

Declaration of Conformance—Cummins MerCruiser Diesel

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

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

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

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

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

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

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

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

 Jim Kahlenbeck

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

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

Identification Record

Please record the following information:

Engine Model and Horsepower		Engine Serial Number
Transom Assembly Serial Number (Sterndrive)	Gear Ratio	Sterndrive Unit Serial Number
Transmission Model (Inboard)	Gear Ratio	Transmission Serial Number
Propeller Number	Pitch	Diameter
Hull Identification Number (HIN)		Purchase Date
Boat Manufacturer	Boat Model	Length
Exhaust Gas Emissions Certification Number		

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

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

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

Mercury, Mercury Marine, MerCruiser, Mercury MerCruiser, Mercury Racing, Mercury Precision Parts, Mercury Propellers, Mariner, Quicksilver, #1 On The Water, Alpha, Bravo, Pro Max, OptiMax, Sport-Jet, K-Planes, MerCathode, RideGuide, SmartCraft, Zero Effort, M with Waves logo, Mercury with Waves logo, and SmartCraft logo are all registered trademarks of Brunswick Corporation. Mercury Product Protection logo is a registered service mark of Brunswick Corporation.

Welcome

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

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

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

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

Cummins MerCruiser Diesel

Warranty Message

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

Read This Manual Thoroughly

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

Notice

Throughout this publication, and on your power package, dangers, warnings, cautions, and notices, accompanied by the International Hazard Symbol , may be used to alert the installer and user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. These safety alerts follow ANSI standard Z535.6-2006 for product safety information in product manuals, instructions, and other collateral materials. **Observe them carefully.**

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

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

WARNING

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

 **WARNING**

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

TABLE OF CONTENTS

Section 1 - Warranty

Warranty Information.....	2	Warranty Policies.....	3
Warranty Registration—United States and Canada.....	2	High Output Recreational Use Worldwide Limited Warranty.....	3
Warranty Registration—Outside the United States and Canada.....	2	Transfer Of Warranty.....	6

Section 2 - Getting to Know Your Power Package

Identification.....	8	Engine Monitoring Features.....	13
Serial Number Decal.....	8	Audio Warning System.....	13
Engine Dataplate.....	8	System Tachometer or Speedometer.....	14
Emissions Information.....	9	Features and Controls.....	15
Exhaust Gas Emissions Certificate.....	9	Lanyard Stop Switch.....	15
Owner Responsibility.....	10	Remote Controls.....	16
ZF Marine Transmissions.....	10	Panel Mount Features.....	16
Technodrive Transmissions.....	10	Console Mount Features.....	17
Instrumentation.....	10	Engine Electrical System Overload Protection.....	17
VesselView.....	10	Vessel Integration Panel (VIP) Overload Protection.....	19
Digital Gauges.....	11		
Instruments—Inboard Models.....	12		
Switches.....	12		

Section 3 - On The Water

Safe Boating Suggestions.....	22	Protecting People In The Water.....	29
Be Alert To Carbon Monoxide Poisoning.....	23	While You Are Cruising.....	29
Good Ventilation.....	23	While Boat Is Stationary.....	30
Poor Ventilation.....	24	High-Speed and High-Performance.....	30
Basic Boat Operation.....	24	Passenger Safety In Pontoon Boats And Deck Boats.....	30
Launching and Boat Operation Care.....	24	Boats Having An Open Front Deck.....	30
Duty Cycle Rating.....	24	Boats With Front-Mounted, Raised Pedestal Fishing Seats.....	30
High Output (HO) Rating.....	25	Wave And Wake Jumping.....	31
Operation Chart.....	25	Impact With Underwater Hazards.....	31
Starting, Shifting, and Stopping.....	25	Conditions Affecting Operation.....	32
Before Starting the Engine.....	26	Weight Distribution (Passengers and Gear) Inside the Boat.....	32
Starting a Cold Engine.....	26	Bottom of Boat.....	32
Engine Warm Up.....	27	Elevation and Climate.....	33
Starting a Warm Engine.....	27	Propeller Selection.....	33
Shifting.....	27	Getting Started.....	34
Engine Shut Down (Stopping).....	28	Initial Break-In Procedure.....	34
Freezing Temperature and Cold Weather Operation.....	28		
Trolling Valve Operation on Technodrive Transmissions.....	29		
Drain Plug and Bilge Pump.....	29		

Engine Break-In.....	34	After the 20-Hour Break-In Period.....	34
20-Hour Break-In Period.....	34	End of First Season Checkup.....	35

Section 4 - Specifications

Fuel Requirements.....	38	Fluid Specifications.....	41
Recommended Fuels.....	38	Engine.....	41
Diesel Fuel In Cold Weather.....	39	QSD 2.8.....	41
Coolant (Antifreeze).....	39	QSD 4.2.....	42
Engine Oil.....	40	Transmission.....	42
Engine Specifications.....	41	Approved Paints.....	42

Section 5 - Maintenance

Owner and Operator Responsibilities.....	44	Checking.....	60
Dealer Responsibilities.....	44	Filling.....	61
Maintenance.....	44	Changing.....	61
Do-It-Yourself Maintenance Suggestions.....	45	2.8 Air Filter.....	61
Inspection.....	45	Removal.....	61
Maintenance Schedule—Inboard Models.....	46	Inspection.....	62
Routine Maintenance.....	46	Installation.....	62
Each Day Start.....	46	4.2 Air Filter.....	62
Each Day End.....	46	Removal.....	62
Weekly.....	46	Inspection.....	63
Every Two Months.....	46	Installation.....	64
Scheduled Maintenance.....	47	Water-Separating Fuel Filter.....	65
After First 25 hours and not to Exceed 30		Draining.....	65
Hours.....	47	Replacing.....	66
Annually.....	47	Filling.....	69
Every 100 Hours or Annually (Whichever		Fuel System.....	71
Occurs First).....	47	Priming.....	71
Every 2 Years.....	47	Filling (Bleeding).....	71
Every 500 Hours or 5 years (Whichever		Fuel Tank Cleaning and Flushing.....	71
Occurs First).....	47	Seawater System.....	71
Every 1000 Hours or 5 years (Whichever		Draining the Seawater System.....	71
Occurs First).....	47	Checking the Seawater Pickups.....	74
According To OEM.....	47	Cleaning the Seawater Strainer, if	
Maintenance Log.....	47	Equipped.....	74
Engine Oil.....	49	Flushing the Seawater System—Inboard	
Checking.....	49	Models.....	75
Filling.....	49	With the Boat out of the Water.....	75
Changing Oil and Filter.....	50	With the Boat in the Water.....	76
ZF Marine Transmission Fluid.....	53	Engine Seawater Pump Inspection.....	78
Checking.....	53	Replacing the Engine Coolant in the Closed Cooling	
Filling.....	53	System.....	78
Changing.....	54	Draining the Closed Cooling System.....	78
Technodrive Transmission Fluid.....	56	Filling the Closed Cooling System.....	80
Checking.....	56	Corrosion Protection.....	81
Filling.....	57	General Information.....	81
Changing.....	57		
Engine Coolant.....	60		

Engine Corrosion Protection Components.....	81	Drive Belts.....	85
Removal.....	81	Drive Belt.....	85
Cleaning and Inspection.....	82	Serpentine Belt.....	86
Installation.....	83	Inspection.....	86
Antifouling Paint.....	84	Replacement.....	87
Lubrication.....	85	Battery.....	88
Throttle Cable.....	85	Battery Precautions for Multiple Engines.....	88
Shift Cable.....	85		

Section 6 - Storage

Cold Weather (Freezing Temperature), Seasonal Storage, and Extended Storage.....	90	Seasonal Storage Instructions.....	91
Cold Weather (Freezing Temperature) Storage.....	91	Extended Storage Instructions.....	93
Preparing Your Power Package for Seasonal or Extended Storage.....	91	Battery.....	93
		Recommissioning.....	93

Section 7 - Troubleshooting

Diagnosing Electronically Controlled Fuel System Problems.....	96	Excessive Engine Temperature.....	97
Troubleshooting Charts.....	96	Insufficient Engine Temperature.....	97
Starter Motor Will Not Crank Engine, or Cranks Slow.....	96	Low Engine Oil Pressure.....	97
Engine Will Not Start, or Is Hard to Start.....	96	Battery Will Not Charge.....	98
Engine Runs Rough, Misses, or Backfires.....	96	Remote Control Operates Hard, Binds, Has Excessive Free-play, or Makes Unusual Sounds.....	98
Poor Performance.....	97		

Section 8 - Customer Assistance Information

Owner Service Assistance.....	100	Muut kielet.....	102
Local Repair Service.....	100	Autres langues.....	102
Service Away From Home.....	100	Andere Sprachen.....	102
Stolen Power Package.....	100	Altre lingue.....	102
Attention Required After Submersion.....	100	Andre språk.....	102
Replacement Service Parts.....	100	Outros Idiomas.....	102
Parts and Accessories Inquiries.....	101	Otros idiomas.....	102
Resolving a Problem.....	101	Andra språk.....	103
Customer Service Literature.....	101	Allej glþssej.....	103
English Language.....	101	Ordering Literature.....	103
Other Languages.....	101	United States and Canada.....	103
Andre sprog.....	102	Outside The United States and Canada.....	103
Andere talen.....	102		

Section 1 - Warranty

1

Table of Contents

Warranty Information.....	2	Warranty Policies.....	3
Warranty Registration—United States and Canada.....	2	High Output Recreational Use Worldwide Limited Warranty.....	3
Warranty Registration—Outside the United States and Canada.....	2	Transfer Of Warranty.....	6

Warranty Information

Warranty Registration—United States and Canada

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

NOTE: Registration lists must be maintained by the factory and dealer on marine products sold in the United States, should a safety recall notification under the Federal Boat Safety Act be required.

8. You may change your address at any time, including at time of warranty claim, by calling Mercury MerCruiser or sending a letter or fax with you name, old address, new address, and engine serial number to Mercury MerCruiser's warranty registration department. Your dealer can also process this change of information.

United States customers or dealers may contact:

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

Canadian customers or dealers may contact:

Mercury Marine Canada Limited
2395 Meadowpine Blvd.
Mississauga, On.
Canada, L5N 7W6
Fax 1-800-663-8334

Warranty Registration—Outside the United States and Canada

1. It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the distributor or Marine Power Service Center responsible for administering the warranty registration and claim program for your area.
2. The Warranty Registration Card identifies your name and address, product model and serial numbers, date of sale, type of use and the selling distributor's and dealer's code number, name and address. The distributor or dealer also certifies that you are the original purchaser and user of the product.

3. A copy of the Warranty Registration Card, designated as the Purchaser's Copy, MUST be given to you immediately after the card has been completely filled out by the selling distributor or dealer. This card represents your factory registration identification, and should be retained by you for future use when required. Should you ever require warranty service on this product, your dealer may ask you for the Warranty Registration Card to verify date of purchase and to use the information on the card to prepare the warranty claim forms.
4. In some countries, the Marine Power Service Center will issue you a permanent (plastic) Warranty Registration Card within 30 days after receiving the Factory Copy of the Warranty Registration Card from your distributor or dealer. If you receive a plastic Warranty Registration Card, you may discard the Purchaser's Copy that you received from the distributor or dealer when you purchased the product. Ask your distributor or dealer if this plastic card program applies to you.
5. For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the International Warranty. See Table of Contents.

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

Warranty Policies

High Output Recreational Use Worldwide Limited Warranty

WHAT IS COVERED

Products Included in this Coverage

QSD 2.0L ES—EI—EJ

QSD 2.8L ES—EI—EJ

QSD 4.2L ES—EI—EJ

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

Duration of Coverage

This Limited Warranty provides coverage for two (2) years from the date the product is first sold to a recreational use retail purchaser, the date on which the product is first put into service, or when the Product has been operated for 50 hours, whichever occurs first. High Output Rating is for use in variable load applications where full power is limited to one (1) hour out of every eight (8) hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM for engines rated at 3000 RPM or less, and at or below 400 RPM of the maximum rated RPM for engines rated at greater than 3000 RPM. This rating is for pleasure (non-revenue generating) applications that operate 500 hours or less per year. Commercial use of the product voids the warranty. Commercial use is defined as any work-related 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.

Conditions That Must Be Met to Obtain Warranty Coverage

Section 1 - Warranty

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, & Warranty Manual must be timely performed in order to obtain warranty coverage. Cummins MerCruiser Diesel reserves the right to make any warranty coverage contingent upon proof of proper maintenance.

What Cummins MerCruiser Diesel Will Do

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

When on-site warranty repairs are necessary, Cummins MerCruiser Diesel will pay reasonable travel expenses for mechanics. Cummins MerCruiser Diesel will pay for reasonable labor costs for the engine and drive removal and reinstallation when necessary to repair a Warrantable Failure.

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 to a Cummins MerCruiser Diesel Authorized Repair Facility to service the product. 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 the following:

- Routine maintenance items
- Minor adjustments or checks, including checking fuel injection pump timing, cleaning fuel injectors, checking filters, adjusting belts or controls, and checking lubrication made in connection with normal services
- Oils, lubricants, or fluids unless loss or contamination of the same is caused by product failure that would be eligible for warranty consideration.
- Normal wear and tear
- Correction of an engine noise, unless diagnosis indicates the condition responsible for the noise is a serious internal engine condition that could result in a failure
- Valve or valve seat grinding because of wear
- Damage caused by abuse, abnormal use, neglect, accident, submersion, improper service, freezing temperatures, alteration, or removal of parts
- Damage caused by use of a propeller or gear ratio that does not allow the engine to run at its maximum rated RPM (see the Operation, Maintenance & Warranty Manual)
- Operation of the product in a manner inconsistent with the recommended operation and duty cycle section of the Operation, Maintenance & Warranty Manual
- Damage to the sterndrive lower unit or propeller caused by striking a marine hazard, such as a submerged object
- Improper installation (proper installation specifications and techniques are set forth in the installation instructions for the product)
- Additional service work requested by the customer other than that necessary to satisfy the warranty obligation
- Damage to the Cummins MerCruiser Diesel product caused by the use of an accessory or part that was not manufactured or sold by Cummins MerCruiser Diesel or Mercury Marine
- Jet pump impellers and liners
- Operation with fuels, oils, or lubricants that are not suitable for use with the product (see the Operation, Maintenance & Warranty Manual)
- Damage caused by water entering the engine through the air filter or exhaust system
- Damage as a result of water in the starter motor
- Starter motors, armatures, or field coil assemblies, that are burned, or where lead is thrown out of the commutator because of excessive cranking
- Damage to the product from insufficient cooling water caused by blockage of the cooling system or water inlets
- Damage caused by running the engine out of water
- Damage resulting from mounting the power package too high on the transom
- Damage as a result of operating the boat with the engine over trimmed
- Damage caused by engines that do not reach maximum rated RPM because of vessel overloading
- Labor performed by other than Cummins MerCruiser Diesel except when prior factory approval has been given to have the work performed at that facility and when performed on an emergency basis, providing there are no Authorized Repair Facilities in the area that can perform the work required or have no facilities to haul out, tow, and so on
- Expenses related to haul-out, launch, or towing
- Removal or replacement of boat partitions or other material in order to gain access to the product
- Expenses related to delivering the product to a Cummins MerCruiser Diesel Authorized Dealer when reasonable access is not provided to the product for warranty service
- Expenses related to 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

Use of the product for racing or other competitive activity, or operating with a racing-type lower unit at any time, even by a previous owner of the product, voids the 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.

Transfer Of Warranty

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

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

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

In Canada mail to:
Mercury Marine Canada Limited
2395 Meadowpine Blvd.
Mississauga, On.
Canada, L5N 7W6
Fax 1-800-663-8334

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

There is no charge for this service.

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

Section 2 - Getting to Know Your Power Package

Table of Contents

Identification.....	8	Engine Monitoring Features.....	13
Serial Number Decal.....	8	Audio Warning System	13
Engine Dataplate.....	8	System Tachometer or Speedometer	14
Emissions Information.....	9	Features and Controls.....	15
Exhaust Gas Emissions Certificate	9	Lanyard Stop Switch.....	15
Owner Responsibility	10	Remote Controls.....	16
ZF Marine Transmissions.....	10	Panel Mount Features	16
Technodrive Transmissions.....	10	Console Mount Features	17
Instrumentation.....	10	Engine Electrical System Overload Protection	
VesselView.....	10	17
Digital Gauges.....	11	Vessel Integration Panel (VIP) Overload	
Instruments—Inboard Models.....	12	Protection.....	19
Switches.....	12		



Identification

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

Serial Number Decal

The serial number decal is located on top of the engine on the aft end of the intercooler.



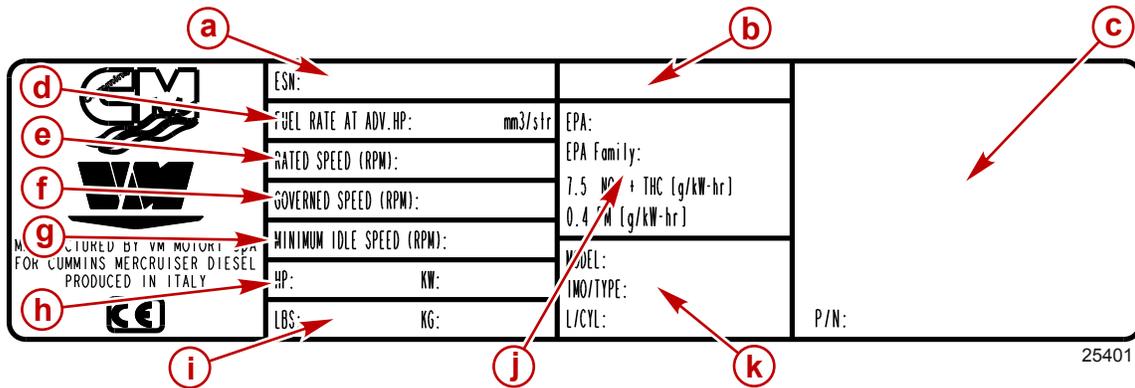
2.8 shown, 4.2 similar

a - Serial numbers and maintenance color codes decal

Engine Dataplate

A tamper-resistant engine data plate is affixed to the engine at the time of manufacture by Cummins MerCruiser Diesel. It contains important exhaust gas emissions information. Please note that the engine data plate will not affect the fit, function, or performance of the engine and neither boatbuilders nor dealers may remove the engine data plate or the engine component it is affixed to before sale. If modifications are necessary or the engine data plate is damaged contact Cummins MerCruiser Diesel about the availability of a replacement.

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



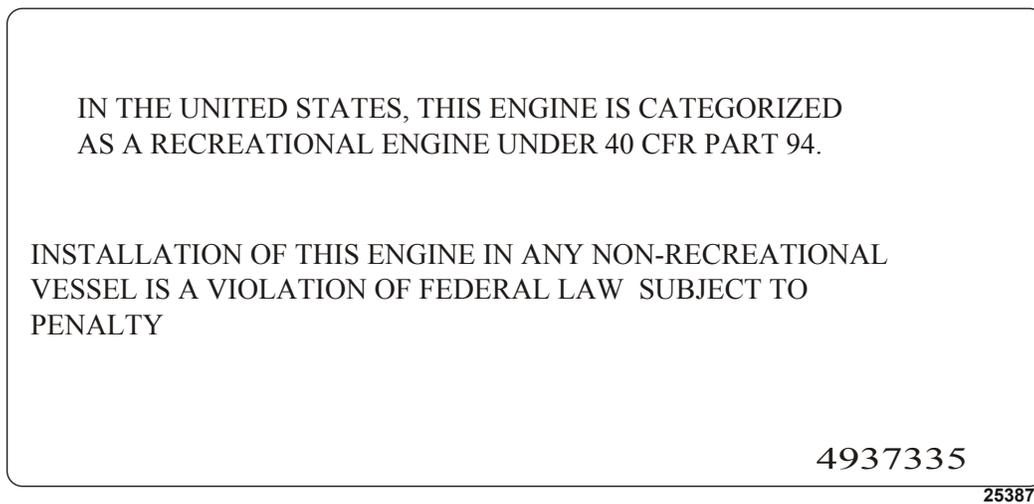
Typical engine dataplate

- a - Engine serial number
- b - Cummins MerCruiser Diesel model information
- c - Emissions certification information
- d - Fuel rate
- e - Rated operation engine speed
- f - Governed engine speed
- g - Minimum idle speed
- h - Engine power rating
- i - Engine weight
- j - Emissions data
- k - Manufacturer model number, IMO type, liters per cylinder

Emissions Information

EXHAUST GAS EMISSIONS CERTIFICATE

A tamper-resistant exhaust gas emission label is affixed to the engine's integrated exhaust manifold and expansion tank assembly at the time of manufacture by Cummins MerCruiser Diesel. Please note that the exhaust gas emissions certification will not affect the fit, function, or performance of the engine. Neither boatbuilders nor dealers may remove the exhaust gas emission label or the part it is affixed to before sale. If modifications require the removal or cause damage to the exhaust gas emission label, contact Cummins MerCruiser Diesel about the availability of a replacement before proceeding.



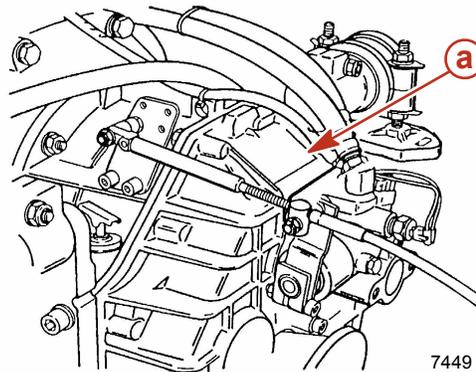
Exhaust gas emission label

OWNER RESPONSIBILITY

Neither the owner nor operator is to modify the engine in any manner that would alter the horsepower or allow exhaust gas emission levels to exceed their predetermined factory specifications.

ZF Marine Transmissions

On the ZF Marine 63A 8° Down Angle and 63IV V-Drive Transmissions, the transmission identification plate indicates gear ratio, serial number, and model.

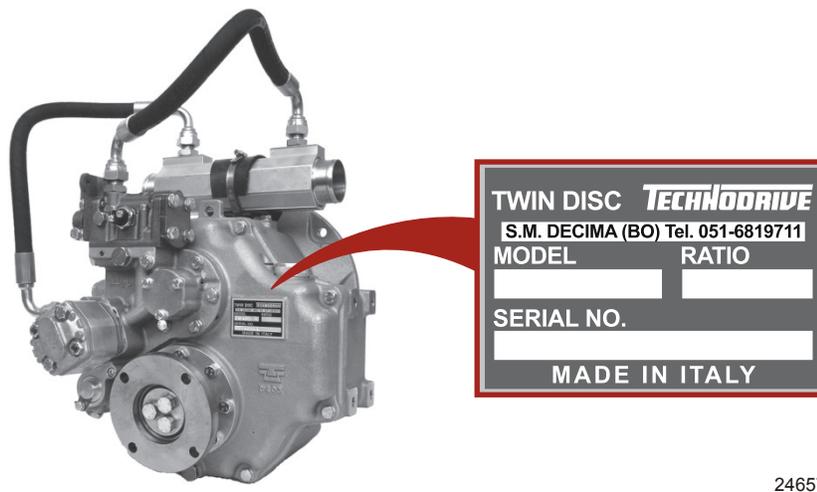


Typical ZF Marine down angle transmission show (V-drive similar)

a - Transmission identification plate

Technodrive Transmissions

On the Technodrive TM 485-A, the transmission identification plate indicates gear ratio, serial number, and model.



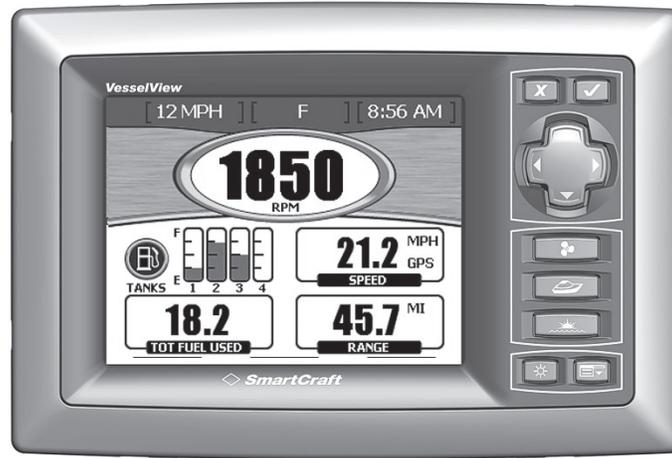
Typical Technodrive transmission shown

Instrumentation

VesselView

Your power package may come equipped with the following system viewer.

Your power package may be connected to a SmartCraft VesselView display. This display provides a single, easy-to-use source for real-time information about a variety of vessel systems. The interactive VesselView display continuously monitors and reports information about speed and performance, trim angle, water temperature and depth, and other operating data. When VesselView detects a problem with any connected system, it displays an alarm message to signal the problem to the boat operator.



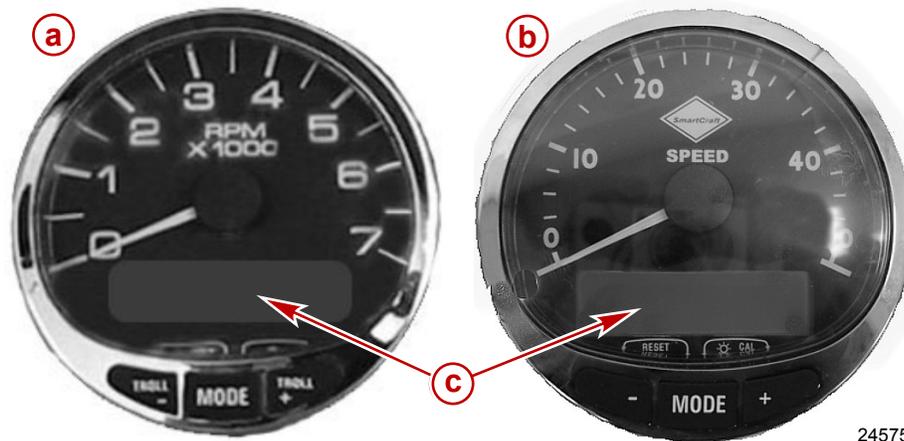
24797

Typical VesselView application

VesselView may also be connected to other vessel systems, such as GPS, generators, and cabin environmental controls. This comprehensive vessel integration allows the operator to monitor and control a wide range of vessel systems from a single, convenient display.

Digital Gauges

A Cummins MerCruiser Diesel SmartCraft instrument package may be provided with this product. A few of the functions the instrument package will display are engine RPM, coolant temperature, oil pressure, battery voltage, fuel consumption, and engine operating hours.



24575

Typical SmartCraft gauges

- a - Tachometer
- b - Speedometer

- c - LCD system view display

Section 2 - Getting to Know Your Power Package

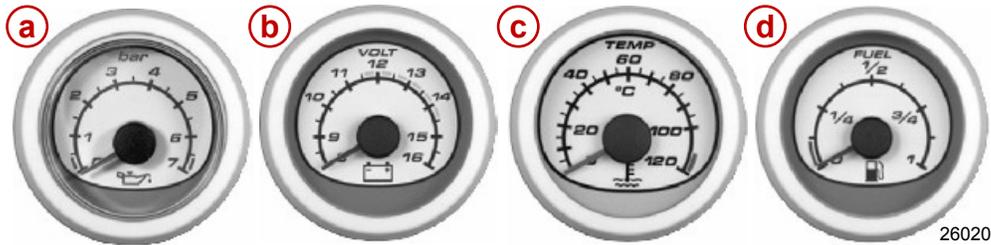
The SmartCraft instrument package will also aid in identifying the fault codes associated with the sounding of the engine audio warning system. The SmartCraft instrument package will display critical engine alarm data and relate other potential problem areas on its LCD display.

Refer to the manual with your gauge package for the warning functions monitored and basic operation of the SmartCraft Instrument package.

Instruments—Inboard Models

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

The following types of gauges may be included with your power package.



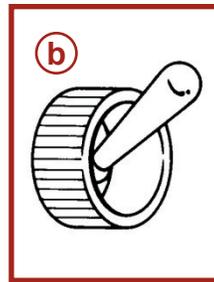
Typical gauges

Reference	Gauge	Function
a	Oil pressure gauge	Indicates engine oil pressure.
b	Battery meter	Indicates battery voltage.
c	Coolant temperature gauge	Indicates engine operating temperature.
d	Fuel gauge	Indicates quantity of fuel in tank.

Switches



a - Key switch



b - Bilge blower switch (if equipped)

24735

Reference	Switch	Function
a	Key switch	<p>Has four positions.</p> <ol style="list-style-type: none"> "OFF." In the "OFF" position, all electrical circuits are off and the engine cannot be started. The engine is stopped when the key switch is turned to the "OFF" position. "ACC." In the "ACC" position, any accessory connections to the electrical circuits can be operated. The engine will not operate with the key switch in the "ACC" position. "ON." In the "ON" position, all electrical circuits and instruments are operational. "START." In the "START" position the engine can be started. <p>NOTE: The key can only be removed with the key switch in the "OFF" position.</p>
b	Bilge blower switch (if equipped)	Operates the bilge blower, if equipped

Engine Monitoring Features

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 from damage. It is designed to warn the operator that a problem has occurred.

The audio warning system will sound if the Engine Control Module (ECM) detects a malfunction. Your power package may be equipped with one of the following system views that can be used to indicate the fault codes.

- System Tachometer or Speedometer

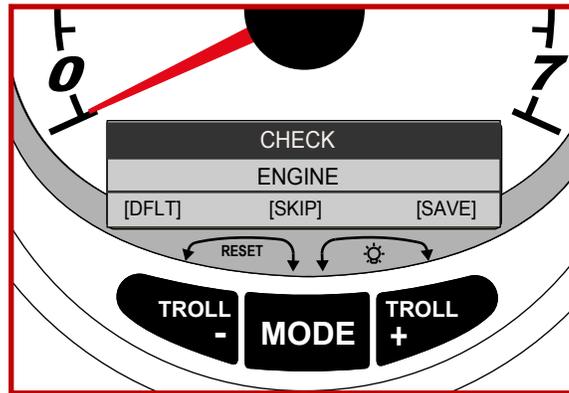
NOTICE

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

If the alarm sounds, stop the engine immediately if you are not in a hazardous situation. Investigate the cause and correct it, if possible. If you cannot determine the cause, consult your Cummins MerCruiser Diesel Authorized Repair Facility.

SYSTEM TACHOMETER OR SPEEDOMETER

The LCD on the system tachometer, if equipped, displays active fault codes. To indicate an active fault code is present the following screen appears on the tachometer display.



25991

Typical system tachometer fault code display

After pressing the "MODE" button, a blinking "AL" also appears in the upper right hand corner of each menu on the digital display screen to signify an active fault. A major fault is also accompanied by the audio warning system.

To view the active faults, you must press the "MODE" button until you reach the total engine hours screen. In the event of an active fault code, the total engine hours is only displayed for 30 seconds after key-on. After this 30-second period, the digital display screen outputs the active fault codes in 3-second intervals in place of the total engine hour value.

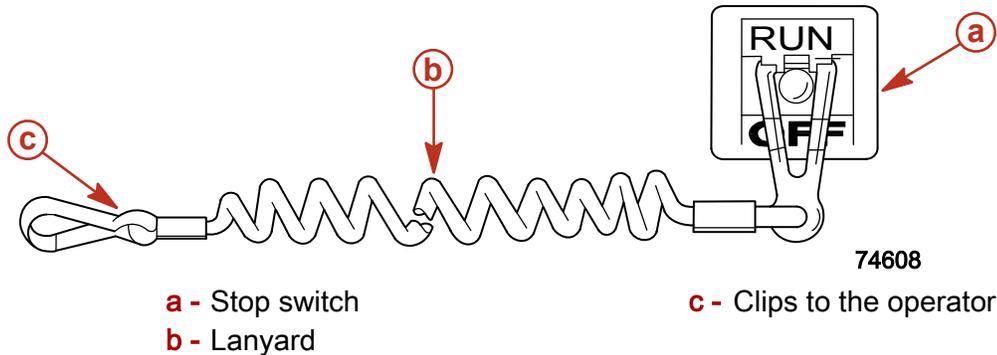
The following is a list of faults displayed by the Smart Tach that also activates the audio warning system.

Smart Tach Display	Warning Indication
"LOW OIL PRESS"	The oil pressure has dropped below the critical engine protection limit
"OVERHEAT"	The engine coolant temperature has risen above the engine protection limit.
"WATER IN FUEL"	Water has been detected in the fuel filter housing.
"FAULT THROTTLE"	There is a fault in the throttle sensor.
"FAULT BATTERY"	The ECM battery voltage is out of range.
"CHECK ENGINE"	The "CHECK ENGINE" code corresponds to a number of different engine related faults. Refer to your Cummins MerCruiser Diesel Authorized Repair Facility.

Features and Controls

Lanyard Stop Switch

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



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

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

Accidental ejections can also occur from:

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

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

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

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

⚠ WARNING

Should the operator fall out of the boat, the possibility of serious injury or death from being run over by the boat can be greatly reduced by stopping the engine immediately. Always properly connect both ends of the stop switch lanyard to the stop switch and the operator.

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

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

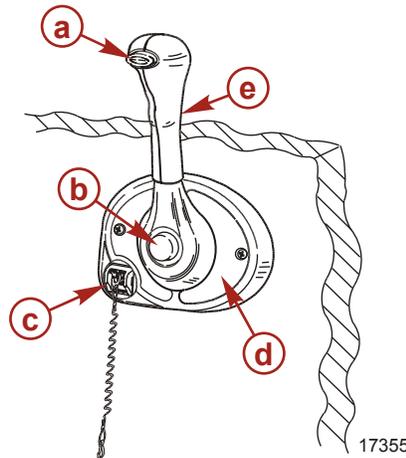
⚠ WARNING

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

Remote Controls

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

PANEL MOUNT FEATURES



- a** - Neutral lock button
- b** - Throttle-only button
- c** - Lanyard stop switch

- d** - Control handle tension adjustment screw
- e** - Control handle

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

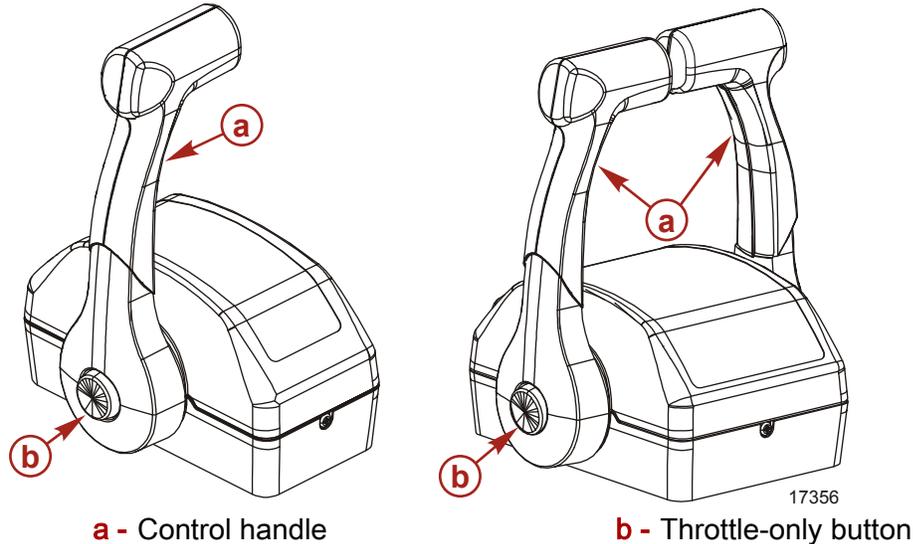
Throttle-only button. Allows engine throttle advancement without shifting the engine. This is done by disengaging the shift mechanism from the control handle. The throttle-only button can be depressed only when the remote control handle is in the neutral position, and should only be used to assist in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

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

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

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

CONSOLE MOUNT FEATURES



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

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

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

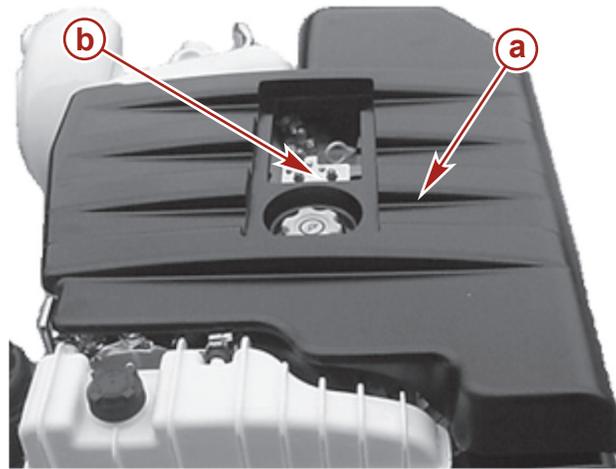
Engine Electrical System Overload Protection

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

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

Section 2 - Getting to Know Your Power Package

Circuit breakers provide protection for the engine electrical system as indicated. The circuit breaker panel is located beneath a small access panel in the engine cover on top of the engine.



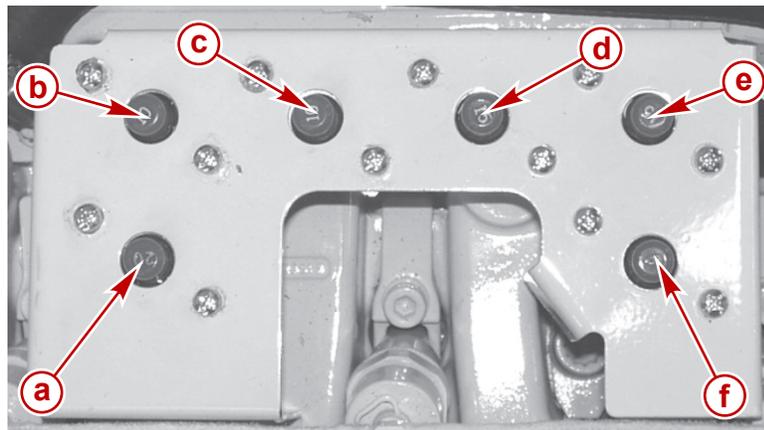
24727

Typical engine cover with access panel

a - Engine cover

b - Circuit breakers

After finding and correcting the cause of the overload, reset the circuit breaker by pressing the reset button.



23245

Circuit breakers

Reference	Circuit breaker rating	Protection	Location on fuse panel
a	20-amp	Key unswitched power to helm	Lower left
b	10-amp	Switched power to ECM	Upper left
c	10-amp	Key switch to ECM	Middle left
d	15-amp	Switched power to ECM	Middle right
e	15-amp	ECM switched power to SIM	Upper right
f	5-amp	Power—diagnostic connector	Lower right

Vessel Integration Panel (VIP) Overload Protection

The Vessel Integration Panel (VIP) contains 2 circuit breakers that help protect the engine harness, vessel sensor harness, and helm harness.



Vessel Integration Panel (VIP) circuit breakers

Reference	Circuit breaker rating	Protection	Location on fuse panel
a	5-amp	VIP Diagnostic	Left
b	10-amp	Helm	Right

Notes:

Section 3 - On The Water

Table of Contents

Safe Boating Suggestions.....	22	While You Are Cruising	29
Be Alert To Carbon Monoxide Poisoning.....	23	While Boat Is Stationary	30
Good Ventilation	23	High-Speed and High-Performance.....	30
Poor Ventilation	24	Passenger Safety In Pontoon Boats And Deck	
Basic Boat Operation.....	24	Boats.....	30
Launching and Boat Operation Care	24	Boats Having An Open Front Deck	30
Duty Cycle Rating	24	Boats With Front-Mounted, Raised Pedestal	
High Output (HO) Rating	25	Fishing Seats	30
Operation Chart.....	25	Wave And Wake Jumping.....	31
Starting, Shifting, and Stopping.....	25	Impact With Underwater Hazards.....	31
Before Starting the Engine.....	26	Conditions Affecting Operation.....	32
Starting a Cold Engine.....	26	Weight Distribution (Passengers and Gear)	
Engine Warm Up.....	27	Inside the Boat.....	32
Starting a Warm Engine	27	Bottom of Boat.....	32
Shifting.....	27	Elevation and Climate.....	33
Engine Shut Down (Stopping).....	28	Propeller Selection.....	33
Freezing Temperature and Cold Weather Operation		Getting Started.....	34
.....	28	Initial Break-In Procedure.....	34
Trolling Valve Operation on Technodrive		Engine Break-In.....	34
Transmissions.....	29	20-Hour Break-In Period	34
Drain Plug and Bilge Pump.....	29	After the 20-Hour Break-In Period	34
Protecting People In The Water.....	29	End of First Season Checkup.....	35

Safe Boating Suggestions

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

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

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

- **Perform safety checks and required maintenance.** Follow a regular schedule and ensure that all repairs are properly made.
- **Check safety equipment on board.** Here are some suggestions of the types of safety equipment to carry when boating:
 - Approved fire extinguishers
 - Paddle or oar
 - Signal devices: flashlight, rockets or flares, flag, and whistle or horn
 - Transistor radio
 - Tools necessary for minor repairs
 - First aid kit and instructions
 - Anchor and extra anchor line
 - Waterproof storage containers
 - Manual bilge pump and extra drain plugs
 - Spare operating equipment, batteries, bulbs, and fuses
 - Drinking water
 - Compass and map or chart of the area
- **Watch for signs of weather change and avoid foul weather and rough-sea boating.**
- **Tell someone where you are going and when you expect to return.**
- **Passenger boarding.** Stop the engine whenever passengers are boarding, unloading, or are near the back (stern) of the boat. Shifting the drive unit into neutral is not sufficient.
- **Use personal flotation devices.** Federal law requires that there be a U. S. Coast Guard–approved, wearable-type life jacket (personal flotation device), correctly sized and readily accessible for every person aboard, plus a throwable cushion or ring. We strongly advise that everyone wear a life jacket at all times while in the boat.
- **Prepare other boat operators.** Instruct at least one person aboard in the basics of starting and operating the engine and handling the boat in case the driver becomes disabled or falls overboard.
- **Do not overload your boat.** Most boats are rated and certified for maximum load (weight) capacities (refer to your boat capacity plate). Know your boat's operating and loading limitations. Know if your boat will float if full of water. When in doubt, contact your authorized Cummins MerCruiser Diesel dealer/distributor or the boat manufacturer.

- **Ensure that everyone in the boat is properly seated.** Do not allow anyone to sit or ride on any part of the boat that was not intended for such use. This includes the backs of seats, gunwales, transom, bow, decks, raised fishing seats, and any rotating fishing seat; anywhere that sudden unexpected acceleration, sudden stopping, unexpected loss of boat control or sudden boat movement could cause a person to be thrown overboard or into the boat. Ensure that all passengers have a proper seat and are in it before any boat movement.
- **Never be under the influence of alcohol or drugs while boating (it is the law).** Alcohol or drugs impairs your judgment and greatly reduce your ability to react quickly.
- **Know your boating area and avoid hazardous locations.**
- **Be alert.** The operator of the boat is responsible by law to maintain a proper lookout by sight and hearing. The operator must have an unobstructed view particularly to the front. No passengers, load, or fishing seats should block the operator's view when operating the boat above idle or planing transition speed. Watch out for others, keep your eyes on the the water, and be aware of your wake.
- **Never drive your boat directly behind a water skier in case the skier falls.** As an example, your boat traveling at 40 km/h (25 MPH) will overtake a fallen skier who was 61 m (200 ft.) in front of you in five seconds.
- **Watch fallen skiers.** When using your boat for water skiing or similar activities, always keep a fallen or down skier on the operator's side of the boat while returning to attend to the skier. The operator should always have the down skier in sight and never back up to the skier or anyone in the water.
- **Report accidents.** Boat operators are required by law to file a Boating Accident Report with their state boating law enforcement agency when their boat is involved in certain boating accidents. A boating accident must be reported if 1) there is loss of life or probable loss of life, 2) there is personal injury requiring medical treatment beyond first aid, 3) there is damage to boats or other property where the damage value exceeds US \$500.00 or 4) there is complete loss of the boat. Seek further assistance from local law enforcement.

Be Alert To Carbon Monoxide Poisoning

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

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

WARNING

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.

Good Ventilation

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

1. Example of desired air flow through the boat.



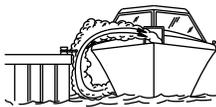
mc79553-1

Poor Ventilation

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

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

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



(a)

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



(b)

b - Mooring close to another boat with its engine operating

mc79554-1

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



(a)

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



(b)

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

mc79556-1

Basic Boat Operation

Launching and Boat Operation Care

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

Duty Cycle Rating

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

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

HIGH OUTPUT (HO) RATING

High Output Rating is for use in variable load applications where full power is limited to one (1) hour out of every eight (8) hours of operation. Also, reduced power operations must be at or below 200 RPM of the maximum rated RPM for engines rated at 3000 RPM or less, and at or below 400 RPM of the maximum rated RPM for engines rated at greater than 3000 RPM. This rating is for pleasure (non-revenue generating) applications that operate 500 hours or less per year.

Operation Chart

Starting Procedure	After Starting	While Underway	Stopping and Shut Down
Open the engine hatch. Air out the bilge completely.	Observe all gauges and the system viewer to check the condition of the engine. If not normal, stop the engine.	Frequently observe all gauges and the system viewer to monitor engine condition.	Shift the remote control lever to the neutral position.
Turn the battery switch on, if equipped.	Check for fuel, oil, water, fluid, and exhaust leaks, etc.	Listen for the audio alarm.	Run the engine at idle-RPM for several minutes to allow the turbocharger and engine to cool.
Turn on and run the engine compartment bilge blower, if equipped, for 5 minutes.	Check shift and throttle control operation.		Turn the key switch to "OFF" position.
Check for leaks: fuel, oil, water, fluid, etc.	Check steering operation.		Turn the battery switch off, if equipped.
Open the fuel shut-off valve, if equipped.			Close the fuel shut-off valve, if equipped.
Open the seacock, if equipped.			Close the seacock, if equipped.
Prime the fuel injection system, if necessary.			Flush the seawater cooling circuit, if operating in saltwater, brackish water, or polluted water.
Turn the key switch to "START" position. Release the key when the engine starts.			
Warm-up the engine at a fast idle-RPM for several minutes.			

Starting, Shifting, and Stopping

WARNING

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

CAUTION

Avoid exposure to irritants. Before servicing engine components, ventilate the engine compartment to remove any fuel vapors.

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 the engine does not start, wait one minute to allow the starter motor to cool; then, repeat the starting procedure.
- Ensure that the engine crankcase is filled to the correct level with the proper grade of oil for the prevailing temperature. See Specifications—Engine Oil.
- Ensure that all electrical connections are secure.
- Check all items listed in the Maintenance Schedules and Operation Chart.
- Perform any other necessary checks as indicated by your Cummins MerCruiser Diesel Authorized Repair Facility or specified in your boat owner's manual.

Starting a Cold Engine

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

1. Turn on and run the engine compartment bilge blower (if equipped) for 5 minutes. Or, open the engine hatch to air out the bilge before attempting to start the engine.
2. Place the control handle in neutral.
3. If the engine has not been run for a period of time and will not readily start with the standard starting procedure, use the hand pump and primer plunger located on the fuel filter header. Move the primer plunger up and down four or five strokes. Attempt to start the engine following the normal procedure.

⚠ CAUTION

Do not attempt to engage the starter while the engine is running because doing so will damage the starter pinion and ring gear.

4. Turn the key switch to the "START" position. Release the key and allow the switch to return to the "ON" position once the engine starts.

⚠ CAUTION

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

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

5. Ensure that all instrumentation is functioning properly and indicating normal readings.

Engine Warm Up

NOTICE

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

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

NOTE: Engine warm-up time during cold weather can be reduced by operating the vessel at a reduced engine speed. Begin normal vessel operation when systems reach operating temperatures.

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

Starting a Warm Engine

1. Turn on and run the engine compartment bilge blower (if equipped) for 5 minutes. Or, open the engine hatch to air out the bilge before attempting to start the engine.
2. Place the remote control handle in neutral.
3. Turn the key switch to "START" position and release the key when the engine starts.
4. Ensure that all the instrumentation is functioning properly and indicates normal readings.

Shifting

⚠ CAUTION

Never shift the transmission when the engine is above idle RPM. Shifting at RPM above idle will damage the transmission.

1. To shift the unit, ensure that the remote control throttle lever is in NEUTRAL. Move the remote control shift lever forward to shift to FORWARD gear or backward to shift to REVERSE. After shifting the transmission, advance the throttle to the desired setting.
2. Once underway, engine oil pressure should be within the range listed in **Engine Specifications** at maximum RPM, or wide-open-throttle. Stop the engine if oil pressure is not within this range. Locate and correct the problem, or see your Cummins MerCruiser Diesel Authorized Repair Facility if you are unable to determine the problem.

Engine Shut Down (Stopping)

1. Place the remote control lever in neutral.

NOTICE

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

2. Operate the engine at idle speed for several minutes to allow the turbocharger and engine to cool.
3. Turn the key switch to the "OFF" position.

Freezing Temperature and Cold Weather Operation

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

NOTICE

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

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

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

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

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

Trolling Valve Operation on Technodrive Transmissions

The trolling valve is a device that slows the propeller speed below the normal speed attained with the engine at idle. Trolling mode range allows the propeller speed to vary from a few RPM to 70% of the propeller RPM in normal operating mode.

⚠ CAUTION

Never shift the transmission when the engine is above idle RPM. Shifting at RPM above idle will damage the transmission.

⚠ CAUTION

Avoid injury or damage to the boat. When the power package is in trolling mode, helm control during maneuvering and docking is limited and unstable. Disengage from trolling mode before attempting any precise maneuvers or docking.

NOTICE

Excessive engine RPMs in trolling mode may overheat transmission fluid and damage the transmission or engine. Never operate the engine above 1100 RPM when the trolling mode feature is engaged.

Refer to the appropriate Technodrive operating manual for trolling valve operation instructions.

Never operate the engine above 1100 RPM to prevent serious transmission damage while operating in trolling mode.

Drain Plug and Bilge Pump

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

Protecting People In The Water

WHILE YOU ARE CRUISING

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



21604

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

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

WHILE BOAT IS STATIONARY

⚠ WARNING

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 moving gearcase, or any solid device rigidly attached to a moving boat or gearcase.

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

High-Speed and High-Performance

If your boat is considered a high-speed or high-performance boat with which you are unfamiliar, we recommend that you never operate it at its high-speed capability without first requesting an initial orientation and demonstration ride with your dealer or an operator experienced with your boat. For additional information, refer to the **Hi-Performance Boat Operation** booklet (90-849250-R03) from your Cummins MerCruiser Diesel Authorized Repair Facility.

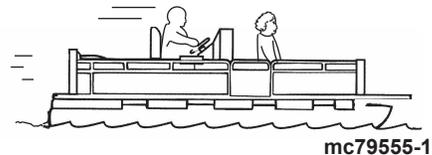
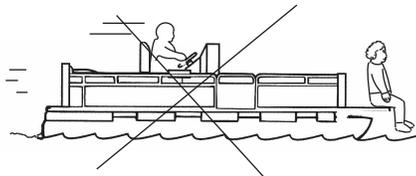
Passenger Safety In Pontoon Boats And Deck Boats

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

BOATS HAVING AN OPEN FRONT DECK

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

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



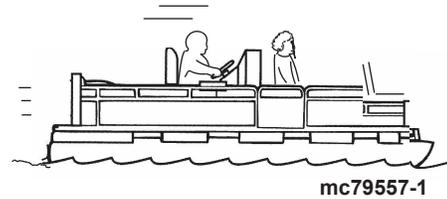
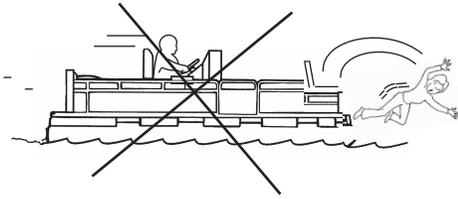
⚠ WARNING

Avoid serious injury or death from falling over the front end of a pontoon or deck boat and being run over. Stay back from the front end of the deck and remain seated while the boat is in motion.

BOATS WITH FRONT-MOUNTED, RAISED PEDESTAL FISHING SEATS

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

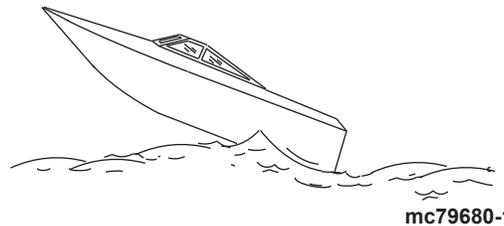
Any unexpected, sudden reduction in boat speed could result in the elevated passenger falling over the front of the boat.



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 any boat hand hold.

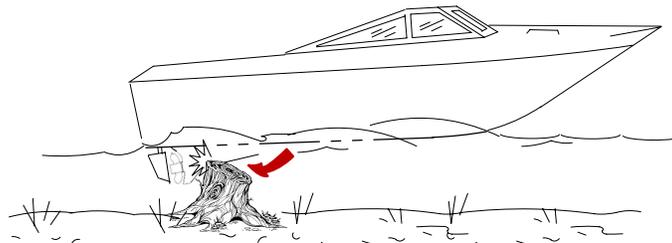


Operating recreational boats over waves and wakes is a natural part of boating. However, when this activity is done with enough speed to force the boat hull partially or completely out of the water, certain hazards arise, particularly when the boat re-enters the water.

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.

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

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

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

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

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

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

⚠ WARNING

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

Conditions Affecting Operation

Weight Distribution (Passengers and Gear) Inside the Boat

Shifting weight to rear (stern):

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

Shifting weight to front (bow):

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

Bottom of Boat

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

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

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

Elevation and Climate

NOTE: Engines equipped with an Engine Control Module (ECM) reduce the effects of changes in elevation and climate by automatically adjusting fuel flow for weather conditions and elevation. ECM controlled engines, however, do not compensate for increased loading or hull conditions.

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

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

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

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

Propeller Selection

⚠ 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 or valve damage, regardless of whether the engine is operated at WOT. Conversely, using a propeller that allows the engine to operate above the specified Rated Engine RPM can increase fuel consumption and wear and will not allow the engine to produce its rated horsepower.

The boat manufacturer and the selling dealer are responsible for equipping the power package with the correct propellers.

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

NOTE: Use an accurate service tachometer to verify RPM.

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

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

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

- Warmer weather and greater humidity cause an RPM loss (not as significant on these models).
- Operating in a higher elevation causes an RPM loss (not as significant on these models).
- Operating with a damaged propeller or dirty boat bottom causes an RPM loss.
- Operating with increased load (additional passengers, pulling skiers).

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

Getting Started

Initial Break-In Procedure

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

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

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

1. See the appropriate **Starting, Shifting, and Stopping** section and start the engine.
2. Operate the engine at a fast idle until it has reached normal operating temperature.
3. Operate the engine in gear for 3 minutes at each of the following RPM: 1200 RPM, 2400 RPM and 3000 RPM.
4. Operate the engine in gear for 3 minutes at each of the following RPM: 1500 RPM, 2800 RPM and 3400 RPM.
5. Operate the engine in gear for 3 minutes at each of the following RPM: 1800 RPM, 3000 RPM and maximum rated full throttle RPM.

Engine Break-In

20-HOUR BREAK-IN PERIOD

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

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

AFTER THE 20-HOUR BREAK-IN PERIOD

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

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

End of First Season Checkup

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

Notes:

Section 4 - Specifications

Table of Contents

Fuel Requirements.....	38	Fluid Specifications.....	41
Recommended Fuels.....	38	Engine.....	41
Diesel Fuel In Cold Weather.....	39	QSD 2.8	41
Coolant (Antifreeze).....	39	QSD 4.2	42
Engine Oil.....	40	Transmission.....	42
Engine Specifications.....	41	Approved Paints.....	42

Fuel Requirements

⚠ WARNING

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

⚠ WARNING

FIRE AND EXPLOSION HAZARD: Fuel leakage from any part of the fuel system can be a fire and explosion hazard which can cause serious bodily injury or death. Careful periodic inspection of entire fuel system is mandatory, particularly after storage. All fuel components should be inspected for leakage, softening, hardening, swelling or corrosion. Any sign of leakage or deterioration requires replacement before further engine operation.

⚠ WARNING

This engine requires diesel fuel. Mixing gasoline, gasohol, or alcohol and diesel fuel is highly flammable and produces a significant risk to the user. Never mix gasoline, gasohol, or alcohol with diesel fuel.

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

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

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

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

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

On engines that use high sulphur content diesel fuel, this will greatly increase:

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

Recommended Fuels

NOTICE

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

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

Diesel Fuel In Cold Weather

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

Coolant (Antifreeze)

NOTICE

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

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

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

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

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

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

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

Section 4 - Specifications

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

Engine Oil

NOTICE

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

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

We strongly recommend the use of:

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

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

Other recommended oils:

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

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

Engine Specifications

Description	Specifications	
	QSD 2.8	QSD 4.2
Engine type	In-line 4 cylinder diesel	In-line 6 cylinder diesel
Displacement	2.8 liter (169 cu. in.)	4.2 liter (256 cu. in.)
Firing order	1 - 3 - 4 - 2	1 - 5 - 3 - 6 - 2 - 4
Bore	94 mm (3.700 in.)	
Stroke	100 mm (3.937 in.)	
Rated engine RPM (see Conditions Affecting Operation—Propeller Selection for additional information)	Refer to CMD's Marine Performance Curves And Data Sheet (www.Cummins.com)	
Idle RPM in neutral (engine at normal operating temperature)	700	600
Oil pressure @ idle	2.4 bar [240 kPa] (35 PSI)	2.1 bar [210 kPa] (30 PSI)
Oil pressure @ 3800 RPM	6.2 bar [620 kPa] (87 PSI)	6.6 bar [660 kPa] (93 PSI)
Thermostat (water)	83° C (181° F)	89° C (192° F)
Thermostat (oil)	95° C (203° F)	87° C (187° F)
Coolant temperature	80–85° C (176–185° F)	
Electrical system	12-volt negative (-) ground	
Alternator rating	1540W, 14V, 110 A	
Recommended battery rating	750 CCA, 950 MCA, or 180 Ahm	

Fluid Specifications

IMPORTANT: All capacities are approximate fluid measures.

Engine

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

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

QSD 2.8

All models	Capacity Liters (U.S. qts)	Fluid Type	Part Number
Engine oil (with filter)	8.9 (9.4)	15W40 4-cycle Diesel Engine Oil	92-877695K1
Closed cooling system	11 (11.6)	Marine Engine Coolant (Only available in Europe)	92-813054A2
		Fleetguard Compleat with DCA4 Fleetguard Part Number: CC2825 Container size: 3-3/4 liters, 1 U.S. gallon	Obtain locally

QSD 4.2

All models	Capacity Liters (U.S. qts)	Fluid Type	Part Number
Engine oil (with filter)	13.8 (14.6)	15W40 4-cycle Diesel Engine Oil	92-877695K1
Closed cooling system	17.25 (18.2)	Marine Engine Coolant (Only available in Europe)	92-813054A2
		Fleetguard Compleat with DCA4 Fleetguard Part Number: CC2825 Container size:3-3/4 liters, 1 U.S. gallon	Obtain locally

Transmission

NOTE: Capacities are for the transmission only and do not include the fluid cooler or fluid cooler hose capacities.

Model	Capacity liters (US qt)	Fluid type	Part Number
ZF Marine 63A	4 (4.2)	Dexron III Automatic Transmission Fluid or Equivalent	Obtain Locally
ZF Marine 63IV	4.4 (4.6)		
Technodrive 485-A	2.6 (2.5)	SAE 20W - 40 or SAE 15W - 40 engine oil	

Approved Paints

Description	Part Number
Marine Cloud White (CMD part number: 40918660)	Obtain locally
Mercury Light Gray Primer	92-80287852
Mercury Phantom Black	92-802878Q1

Section 5 - Maintenance

Table of Contents

Owner and Operator Responsibilities.....	44	4.2 Air Filter.....	62
Dealer Responsibilities.....	44	Removal.....	62
Maintenance.....	44	Inspection.....	63
Do-It-Yourself Maintenance Suggestions.....	45	Installation.....	64
Inspection.....	45	Water-Separating Fuel Filter.....	65
Maintenance Schedule—Inboard Models.....	46	Draining.....	65
Routine Maintenance.....	46	Replacing.....	66
Each Day Start.....	46	Filling.....	69
Each Day End.....	46	Fuel System.....	71
Weekly.....	46	Priming.....	71
Every Two Months.....	46	Filling (Bleeding).....	71
Scheduled Maintenance.....	47	Fuel Tank Cleaning and Flushing.....	71
After First 25 hours and not to Exceed 30		Seawater System.....	71
Hours.....	47	Draining the Seawater System.....	71
Annually.....	47	Checking the Seawater Pickups.....	74
Every 100 Hours or Annually (Whichever		Cleaning the Seawater Strainer, if Equipped	
Occurs First).....	47	74
Every 2 Years.....	47	Flushing the Seawater System—Inboard	
Every 500 Hours or 5 years (Whichever		Models.....	75
Occurs First).....	47	With the Boat out of the Water.....	75
Every 1000 Hours or 5 years (Whichever		With the Boat in the Water.....	76
Occurs First).....	47	Engine Seawater Pump Inspection.....	78
According To OEM.....	47	Replacing the Engine Coolant in the Closed Cooling	
Maintenance Log.....	47	System.....	78
Engine Oil.....	49	Draining the Closed Cooling System.....	78
Checking.....	49	Filling the Closed Cooling System.....	80
Filling.....	49	Corrosion Protection.....	81
Changing Oil and Filter.....	50	General Information.....	81
ZF Marine Transmission Fluid.....	53	Engine Corrosion Protection Components....	81
Checking.....	53	Removal.....	81
Filling.....	53	Cleaning and Inspection.....	82
Changing.....	54	Installation.....	83
Technodrive Transmission Fluid.....	56	Antifouling Paint.....	84
Checking.....	56	Lubrication.....	85
Filling.....	57	Throttle Cable.....	85
Changing.....	57	Shift Cable.....	85
Engine Coolant.....	60	Drive Belts.....	85
Checking.....	60	Drive Belt.....	85
Filling.....	61	Serpentine Belt.....	86
Changing.....	61	Inspection.....	86
2.8 Air Filter.....	61	Replacement.....	87
Removal.....	61	Battery.....	88
Inspection.....	62	Battery Precautions for Multiple Engines.....	88
Installation.....	62		

Owner and Operator Responsibilities

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

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

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

Dealer Responsibilities

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

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

Maintenance

WARNING

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

CAUTION

Avoid exposure to irritants. Before servicing engine components, ventilate the engine compartment to remove any fuel vapors.

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

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

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

Do-It-Yourself Maintenance Suggestions

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

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

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

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

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

Inspection

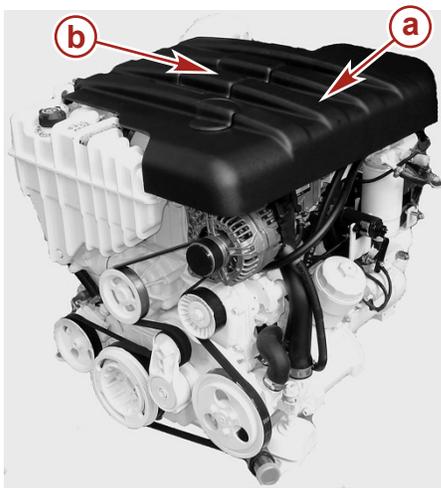
Inspect your power package often and at regular intervals to help maintain its top operating performance and correct potential problems before they occur. The entire power package should be checked carefully, including all accessible engine parts.

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

It may be necessary to remove the engine cover during some maintenance inspections and procedures. To remove the engine cover:

NOTE: *The engine cover contains an access panel which can be used to access the engine circuit breakers and the oil fill cap and dipstick without removing the entire engine cover.*

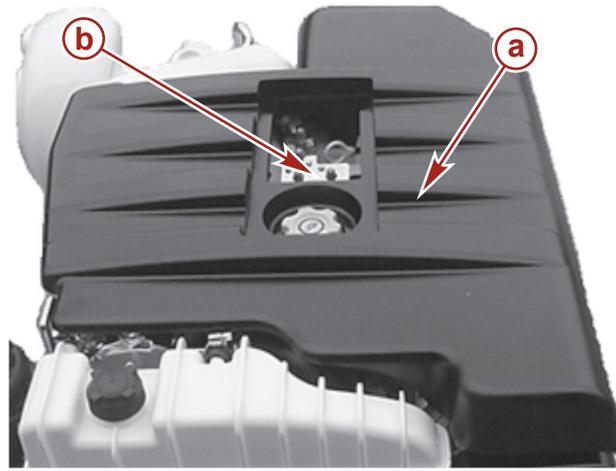
1. Lift and detach the engine cover from the mounts.



24522

Typical engine cover

a - Engine cover



24727

Engine cover with access panel showing

b - Engine cover access panel location

2. Set the engine cover over the mounts and press the cover down in the mount areas to reattach the engine cover.

Maintenance Schedule—Inboard Models

Routine Maintenance

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

EACH DAY START

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

EACH DAY END

- If operating in saltwater, brackish water, or polluted water, flush the seawater cooling system after each use.
- Drain any water from the primary fuel filter after each use (Drain any water from both fuel filters if operating in freezing temperatures).

WEEKLY

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

EVERY TWO MONTHS

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

Scheduled Maintenance

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

AFTER FIRST 25 HOURS AND NOT TO EXCEED 30 HOURS

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

ANNUALLY

- Touch up the power package with paint and spray with Corrosion Guard.

EVERY 100 HOURS OR ANNUALLY (WHICHEVER OCCURS FIRST)

- Change the engine oil and filter.
- Change the transmission fluid.
- Replace the fuel filters.
- Check the steering system and the remote control for loose, missing, or damaged parts. Lubricate the cables and linkages.
- Torque the engine mounts.
- Check the electrical system for loose, damaged, or corroded fasteners.
- Inspect the condition and tension of the belts.
- Inspect the cooling system and the exhaust system for damage or leaks. Check both systems hose clamps for tightness.
- Disassemble and inspect the seawater pump and replace worn components.
- 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 air filter.

EVERY 2 YEARS

- Replace the engine coolant.

EVERY 500 HOURS OR 5 YEARS (WHICHEVER OCCURS FIRST)

- Clean the aftercooler core.

EVERY 1000 HOURS OR 5 YEARS (WHICHEVER OCCURS FIRST)

- Clean the fuel tank.

ACCORDING TO OEM

- Check the engine-to-propeller shaft alignment.

Maintenance Log

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

Engine Oil

NOTICE

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

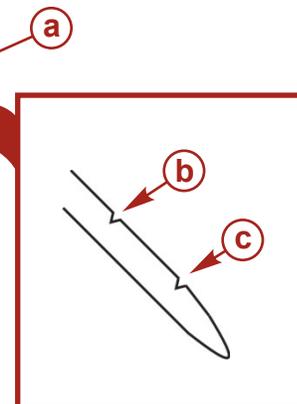
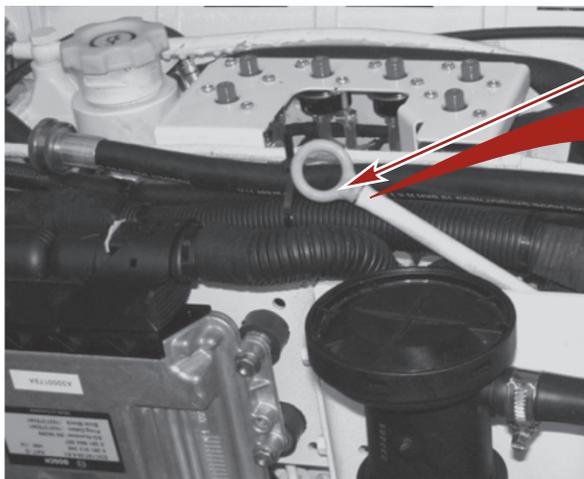
Checking

IMPORTANT: Engine crankcase oil must be checked at intervals specified in Maintenance Schedules. It is normal for an engine to use a certain amount of oil in the process of lubricating and cooling the engine. The amount of oil consumed depends greatly upon engine speed, with consumption being highest at wide open throttle and decreasing substantially as engine speed is reduced.

NOTICE

With the engine running, the crankshaft journals or rod journals may strike and break the dipstick, resulting in damage to internal engine components. Do not remove the oil dipstick when the engine is running. Stop the engine completely before removing or inserting the dipstick.

1. To check the engine oil level during operation, stop the engine and allow five minutes for the oil to drain into the pan.
2. Remove the dipstick. Wipe clean and reinstall into the dipstick tube.
3. Remove the dipstick and observe the oil level. The oil level must be between the marks on the dipstick. If necessary, add oil. See **Filling**.



23196

Typical

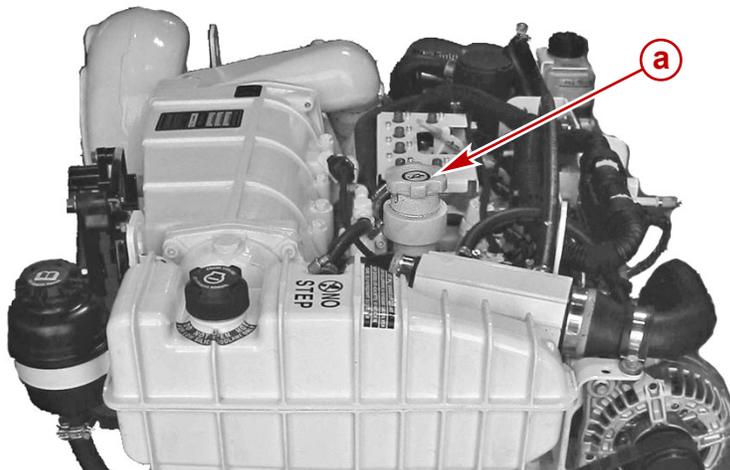
a - Dipstick
b - Maximum mark

c - Minimum mark

Filling

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



23244

Typical

a - Oil fill cap

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

2.8	Capacity Liters (U.S. qts)	Fluid Type
Engine Oil (With Filter)	8.9 liter (9.4 U.S. qts)	4-Cycle 15W40 Marine Engine Oil

4.2	Capacity Liters (U.S. qts)	Fluid Type
Engine Oil (With Filter)	13.8 liter (14.6 U.S. qts)	4-Cycle 15W40 Marine Engine Oil

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

3. Install the oil fill cap.

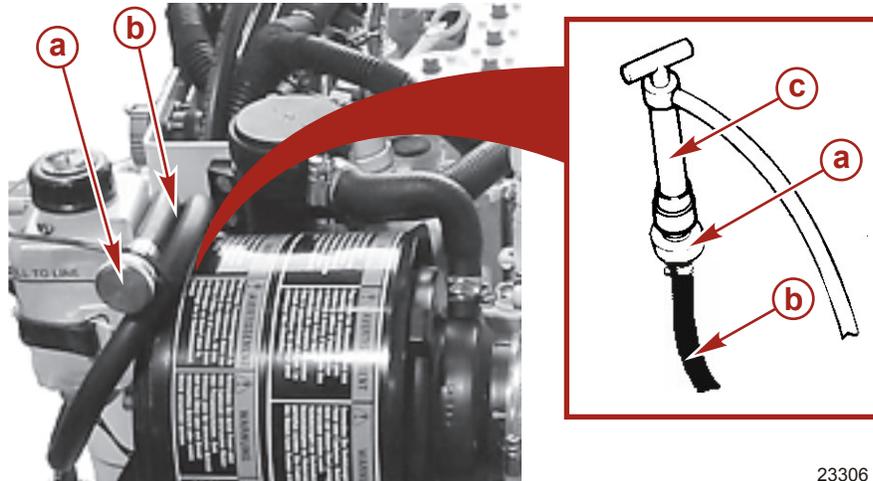
Changing Oil and Filter

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

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

1. Start the engine and allow it to warm up to normal operating temperature.
2. Stop the engine and allow some time for the oil to drain into the oil pan (approximately five minutes).
3. Remove the fitting from the end of crankcase oil drain hose.

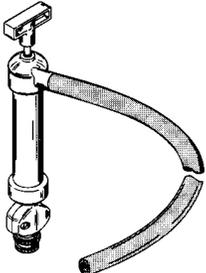
4. Install the crankcase oil pump (order separately) onto the threaded fitting of the oil drain hose.



Typical

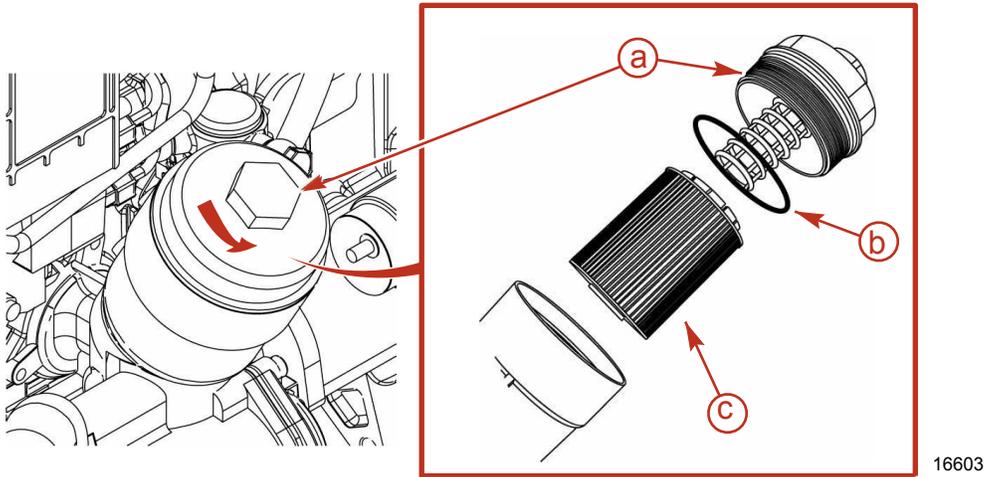
- a - Threaded fitting
- b - Oil drain hose

- c - Crankcase oil pump

Crankcase oil pump	91-90265A 5
 <p>11591</p>	<p>Aids in the removal of engine oil without draining the crankcase.</p>

5. Pump the oil out of the crankcase into the drain pan.
6. Contain and dispose of the oil or oil waste as directed by local authorities.
7. Remove the crankcase oil pump and install the crankcase oil drain hose fitting when the crankcase is empty. Tighten securely.
8. Install the oil dipstick.
9. Place a suitable container under the oil filter housing to contain any oil leakage that may occur. Use an appropriate socket to loosen the oil filter top piece.
10. Remove the top piece and cartridge type oil filter.

11. Disconnect and discard the old filter element. Discard the old O-ring from the top piece.



Typical

a - Top piece
b - O-ring

c - Filter element

12. Install the new O-ring. Apply lubricant to the O-ring.

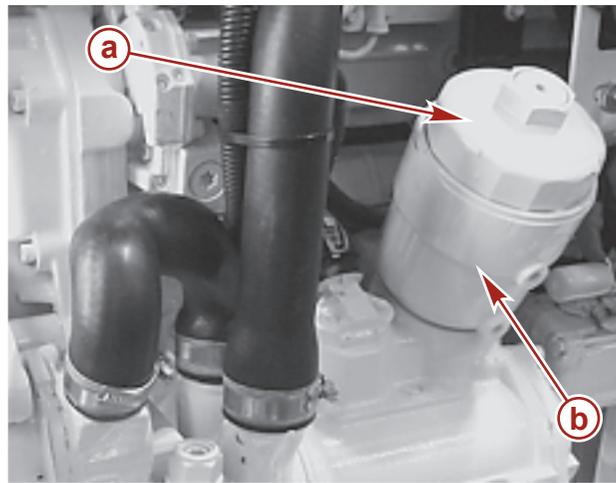
Tube Ref No.	Description	Where Used	Part No.
 121	15W40 4-cycle Diesel Engine Oil	Oil filter O-rings	92-877695K1

13. Push the filter element onto the top piece until it is locked. Listen for a click.

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

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

15. Turn the oil filter top piece until the sealing surface contacts the housing. Torque the top piece using an appropriate socket.



a - Top piece

b - Oil filter housing

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

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

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

17. Start the engine and check for leaks.

ZF Marine Transmission Fluid

Checking

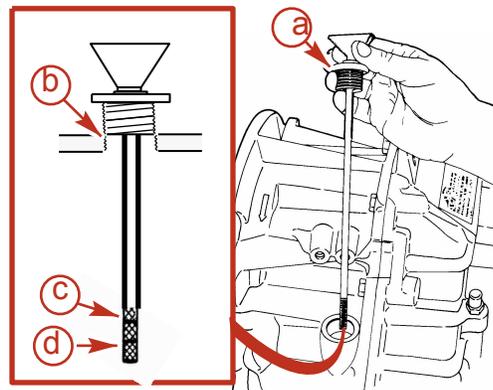
1. Remove the dipstick.

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

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

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

3. If the fluid level is below the minimum mark on the dipstick, add transmission fluid. See **Filling**.



16604

a - Dipstick
b - Threaded hole

c - Maximum fluid level
d - Minimum fluid level

IMPORTANT: To accurately check the fluid level, operate the engine at 1500 RPM for 2 minutes immediately before 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 the fluid level is low, add transmission fluid to bring the level up to the maximum mark on the dipstick. See **Filling**.

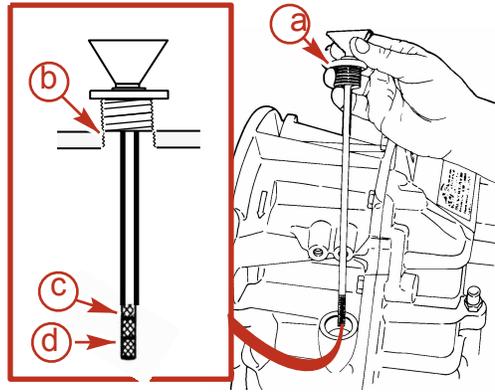
NOTE: If the transmission fluid level was extremely low, see your local Cummins MerCruiser Diesel Authorized Repair Facility.

7. Install the dipstick.

Filling

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

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



16604

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

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

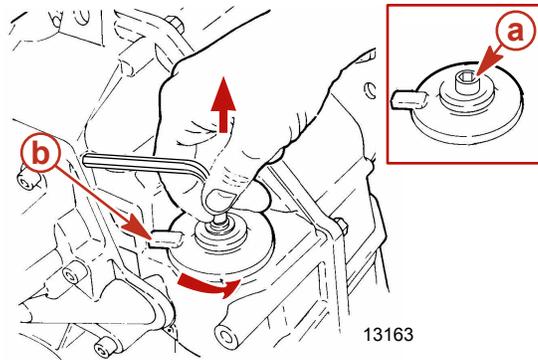
NOTE: Capacities are for the transmission only and do not include the fluid cooler or fluid cooler hose capacities.

Model	Capacity	Fluid type	Part Number
ZF Marine 63A	4 liters (4.2 US qt)	Dexron III Automatic Transmission Fluid or Equivalent	Obtain locally
ZF Marine 63IV	4.4 liters (4.6 US qt)		

2. Install the dipstick.
3. Check the fluid level. See **Checking**.

Changing

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

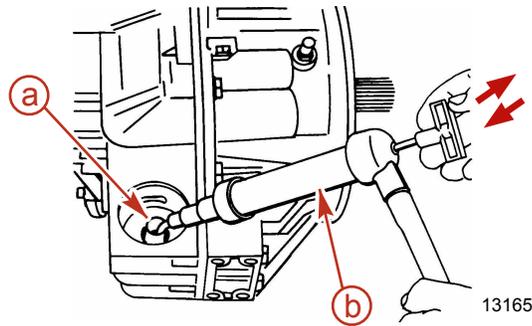


13163

- a - Assembly nut
- b - Fluid filter assembly

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

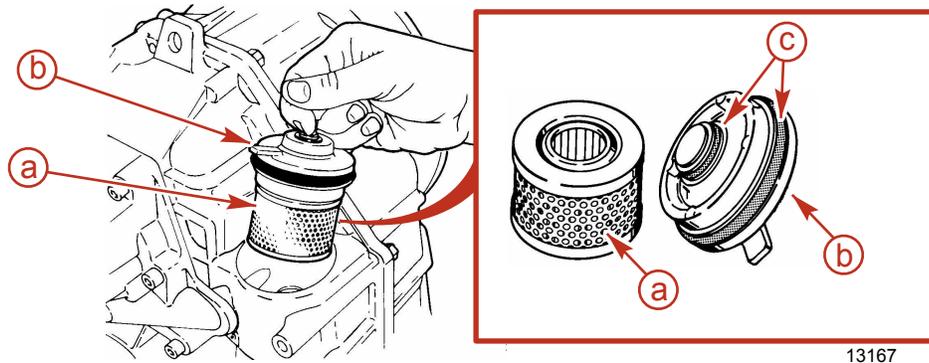
- Pump the fluid from the housing into a suitable container. Dispose of the fluid properly.



a - Suction pipe

b - Suction pump

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



a - Filter element

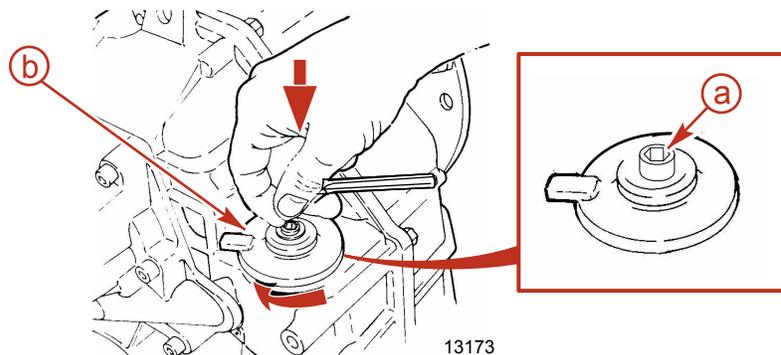
b - Cover

c - O-rings

NOTICE

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

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



a - Assembly nut

b - Fluid filter assembly

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

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

Technodrive Transmission Fluid

Checking

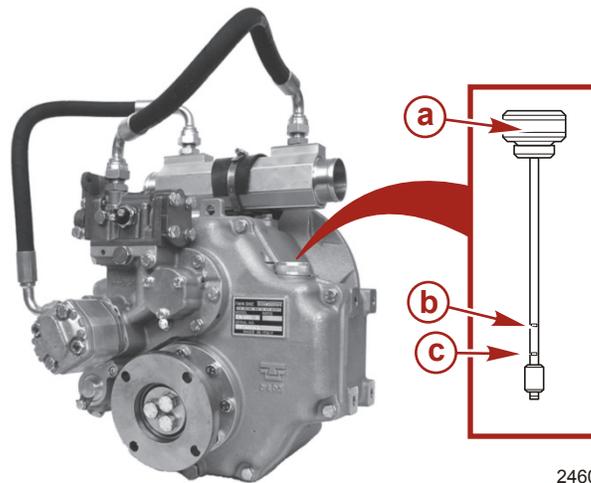
1. Remove the dipstick.

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

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

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

3. If the fluid level is below the minimum mark on the dipstick, add transmission fluid. See **Filling**.



a - Dipstick

b - Maximum fluid level

c - Minimum fluid level

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

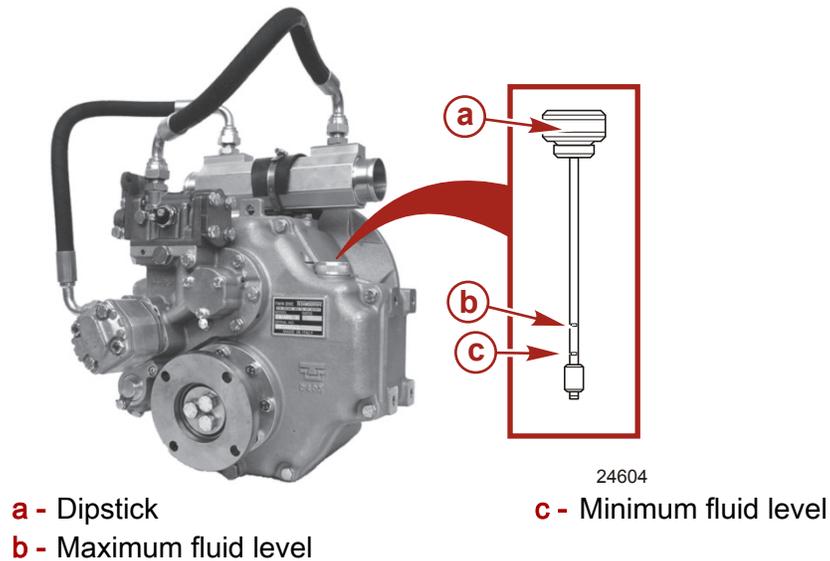
4. Start the engine and operate at 1500 RPM for 2 minutes to fill all the hydraulic circuits.
5. Stop the engine and quickly check the fluid level with the dipstick resting on the top of the threaded hole.
6. If the fluid level is low, add transmission fluid to bring the level up to the maximum mark on the dipstick. See **Filling**.

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

7. Install the dipstick.

Filling

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



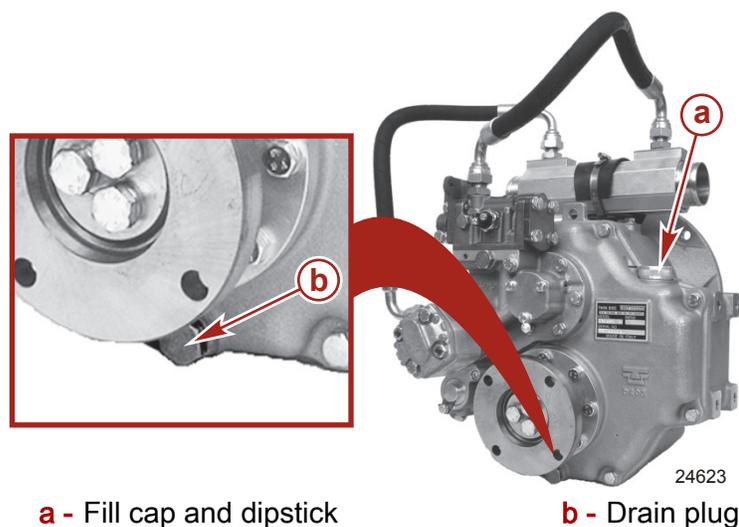
NOTE: Always use the dipstick to determine the quantity of oil or fluid required.

Model	Capacity	Fluid type	Part Number
Technodrive 485A	2.6 liters (2 ½ US qt)	SAE 20W - 40 or SAE 15W - 40 engine oil	Obtain Locally

2. Install the dipstick.
3. Check the fluid level. See **Checking**.

Changing

1. Remove the fill cap and dipstick.
2. Remove the transmission fluid drain plug and drain the transmission into a suitable container.



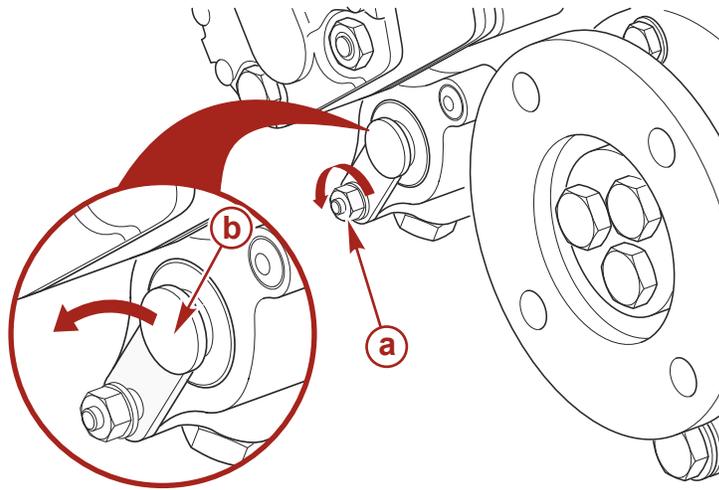
3. Contain and dispose of the oil or oil waste as directed by local authorities.
4. Reinstall the transmission fluid drain plug.

5. Torque the drain plug.

Description	Nm	lb. in.	lb. ft.
Transmission fluid drain plug	17		12.5

6. Clean the exterior of the transmission around the fluid filter assembly.

7. Loosen the assembly nut then rotate the securing tab in the direction shown.

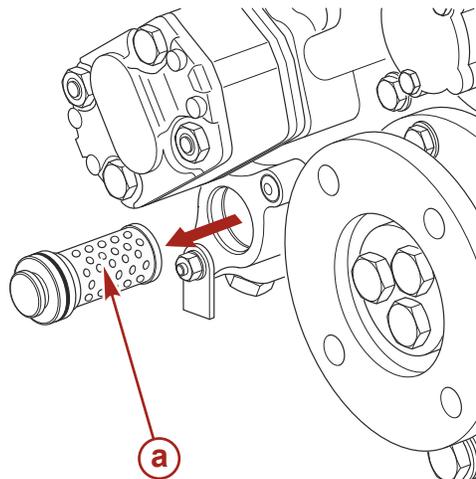


a - Assembly nut

b - Securing tab

24608

8. Remove the filter element.



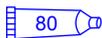
a - Filter element

24618

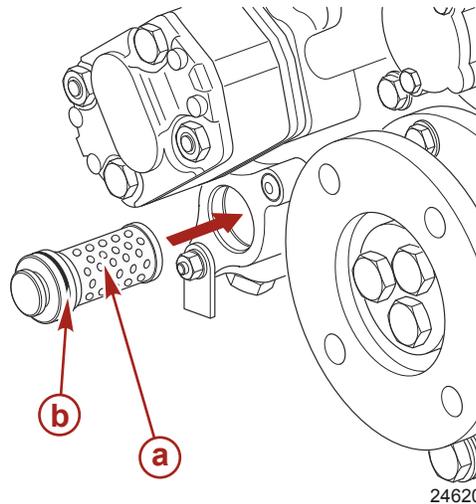
9. Clean the filter element using the cleaning solvent.

Tube Ref No.	Description	Where Used	Part No.
	Cleaning solvent	Transmission filter element	Obtain Locally

10. Lubricate the O-rings.

Tube Ref No.	Description	Where Used	Part No.
	SAE Engine Oil 30W	Transmission filter element O-ring	Obtain Locally

11. Reinstall the filter element.



a - Filter element

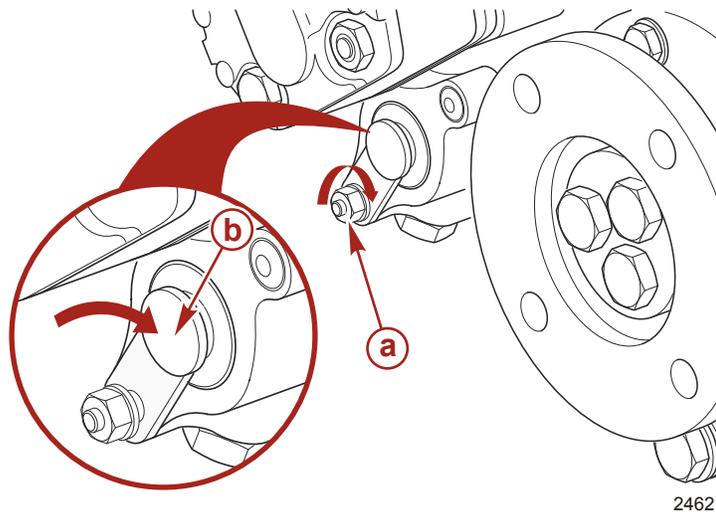
b - O-ring

NOTICE

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

12. Replace the securing tab over the filter assembly by turning it clockwise.

13. Tighten the assembly nut. Torque the nut.



a - Assembly nut

b - Securing tab

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

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

Engine Coolant

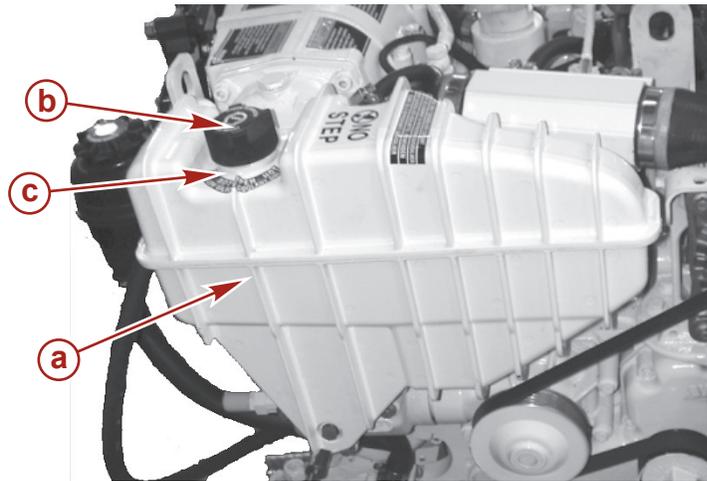
⚠ CAUTION

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

Checking

IMPORTANT: Check the engine coolant before starting the engine.

1. Allow the engine to cool.
2. Remove the pressure cap from the coolant expansion tank.
3. The coolant level in the coolant expansion tank should be within 25 mm (1 in.) of the bottom of the filler neck or between the upper and lower marks, if marked.



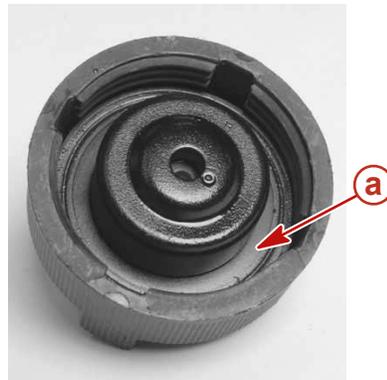
23247

Typical

a - Coolant expansion tank
b - Pressure cap

c - Bottom of fill neck

4. If the coolant level is low:
 - a. Inspect the coolant recovery system for leaks.
 - b. Inspect the gasket in the pressure cap for damage and replace if necessary.



14142

a - Gasket

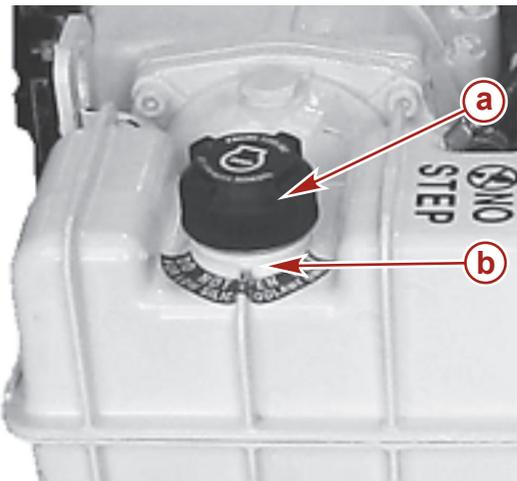
- c. The pressure cap maintains pressure on the cooling system and may not be holding pressure properly. To have the cap tested, contact your Cummins MerCruiser Diesel Authorized Repair Facility.
- d. Add the specified coolant as necessary. See **Filling**.

IMPORTANT: When installing the pressure cap, be sure to tighten it securely to prevent coolant loss.

5. If the coolant level is correct, install the pressure cap and tighten securely.

Filling

1. Allow the engine to cool.
2. Remove the pressure cap from the coolant expansion tank.
3. If the coolant level is low in the coolant expansion tank, add the specified coolant as necessary to bring the level to within 25 mm (1 in.) of the bottom of the fill neck or between the upper and lower marks, if marked.



23248

a - Pressure cap

b - Bottom of fill neck

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

IMPORTANT: When installing the pressure cap, be sure to tighten it securely to prevent coolant loss.

4. Install the pressure cap. Tighten securely.

Changing

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

2.8 Air Filter

Removal

1. Remove the retaining nut off of the air filter cover.
2. Remove the air filter cover.

NOTE: It is not necessary to remove the air filter bracket mounted on the turbocharger inlet.

3. Remove the air filter cartridge from the air filter bracket mounted on the turbocharger inlet.



Shown removed from the engine for clarity only

a - Air filter cartridge

b - Air filter bracket

Inspection

1. The air filter cannot be cleaned. Replace the air filter if it is dirty or contaminated.
2. Replace the air filter if the foam element is deteriorated or torn.
3. Replace the air filter at the recommended interval. See **Maintenance Schedules** for the replacement interval under normal conditions.

Installation

IMPORTANT: Treatment such as partial oil saturation is not required and is not recommended on the foam element before use. The foam element must be clean and dry for proper filtration.

1. Install the air filter cartridge onto the air filter bracket.
2. Install the air filter cover and retaining nut.
3. Torque the retaining nut.

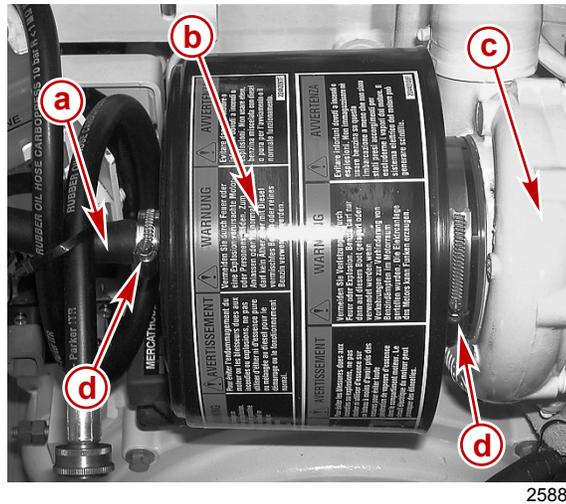
Description	Nm	lb. in.	lb. ft.
Air filter cover retaining nut	10.8	95	

4.2 Air Filter

Removal

1. Loosen the clamp and remove the oil separator vent hose.

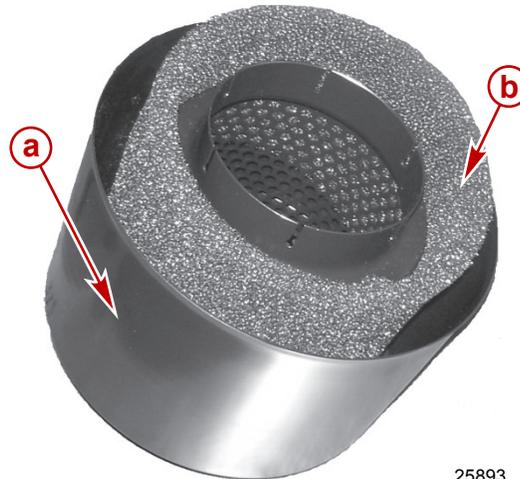
- Loosen the clamp and remove the air filter housing from the turbocharger inlet.



25881

- a - Oil separator vent hose
 b - Air filter housing
 c - Turbocharger
 d - Clamp

- Remove the air filter element from the air filter housing



25893

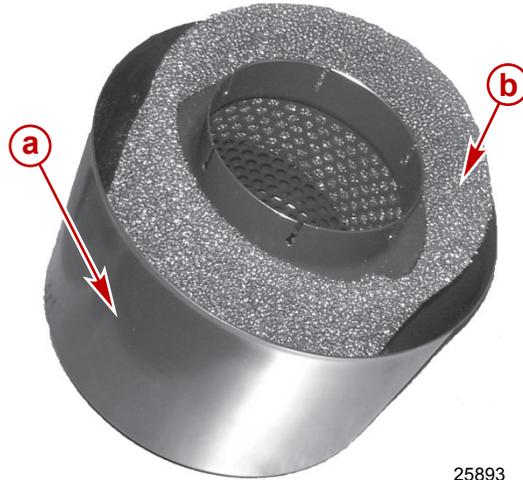
- a - Air filter housing
 b - Air filter element

Inspection

- The air filter cannot be cleaned. Replace the air filter if it is dirty or contaminated.
- Replace the air filter if the foam element is deteriorated or torn.
- Replace the air filter at the recommended interval. See **Maintenance Schedules** for the replacement interval under normal conditions.

Installation

- Slide the filter element into the air filter housing. Ensure that the element is seated fully into the air filter housing.



a - Air filter housing

25893

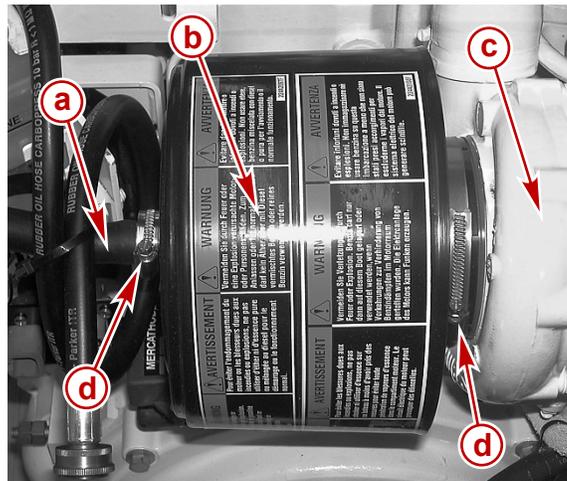
b - Air filter element

NOTE: The warning labels on the air filter housing must be visible after the air filter housing is installed.

- Install the air filter housing on to the turbocharger inlet.
- Torque the air filter housing clamp.

Description	Nm	lb. in.	lb. ft.
Air filter housing clamp	3.4–6.8	30–60	

- Install the oil separator vent hose. Tighten the oil separator vent hose clamp securely.



25881

a - Oil separator vent hose

b - Air filter housing

c - Turbocharger

d - Clamp

Water-Separating Fuel Filter

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

Water entering the fuel injection system will cause corrosion and rusting of the injectors and other components, disabling the fuel injection system. Check daily for water in the water-separating fuel filter before starting. Take the unit to a Cummins MerCruiser Diesel Authorized Repair Facility immediately if water enters the fuel injection system.

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

The operator may be alerted that the WIF sensor has detected water in the fuel, depending upon the boat instrumentation package and if equipped:

- A fault code may be displayed on a system viewer.
- The audio warning system may sound.

See **Features and Controls**.

Drain or replace the remote mounted primary filter (such as a Racor® filter) at specified intervals, or whenever water is detected in the engine-mounted fuel filter.

Draining

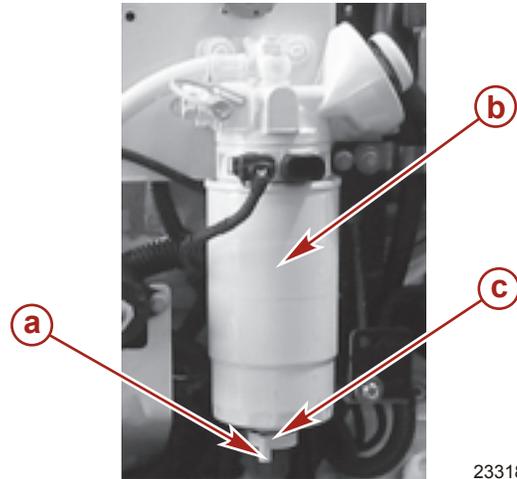
The engine-mounted water-separating fuel filter can be drained of water and small dirt particles by opening the drain cap on the bottom of the filter.

NOTE: To ensure complete draining in warm weather, drain the filter 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 the fuel filter to catch contaminated fuel or water. Dispose of properly.

1. Place a container under the drain cap on the filter.

2. Open the drain by turning the drain cap counterclockwise (as viewed from the bottom of the filter) until fuel starts draining. Do not remove the drain cap.



Typical water-separating fuel filter

- a** - WIF sensor wire connection **c** - Drain cap
b - Filter

3. Drain until the fuel is clear in appearance.
4. Close the drain cap by turning clockwise. Tighten securely.
5. Fill the fuel filter. See **Filling**.

Replacing

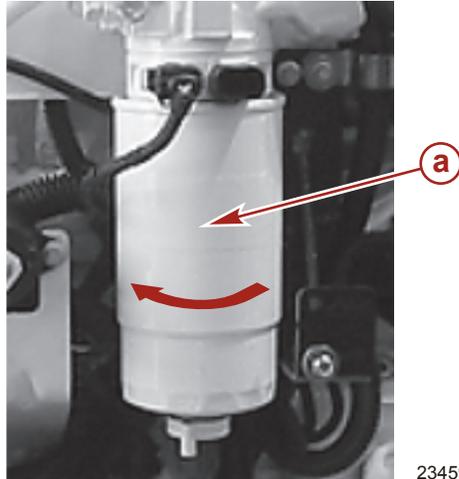
⚠ WARNING

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

IMPORTANT: The element cannot be cleaned and reused. It must be replaced.

1. Disconnect both battery cables from the battery.
2. Disconnect the WIF sensor wires, if equipped.

3. Remove the water-separating fuel filter and sealing ring from the mounting bracket. Do not use a filter wrench.

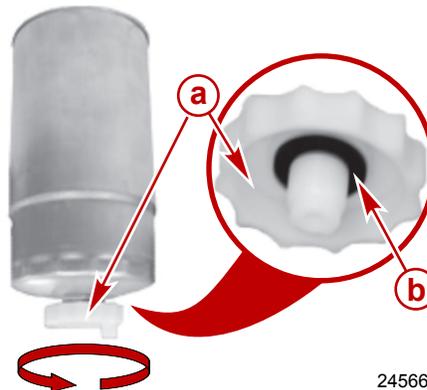


Typical

a - Water-separating fuel filter

NOTE: It may be necessary to keep the existing drain cap and use it on the new filter. Be sure to replace the O-ring on the drain cap.

4. Remove the drain cap and O-ring seal from the bottom of the existing fuel filter. Note the position of the O-ring seal.



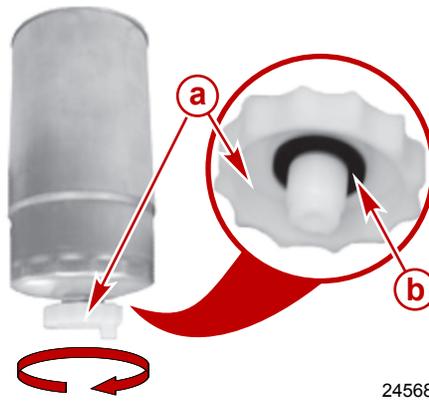
Typical

a - Drain cap

b - O-ring seal

5. Discard the used filter and O-ring seal as defined by local authorities.

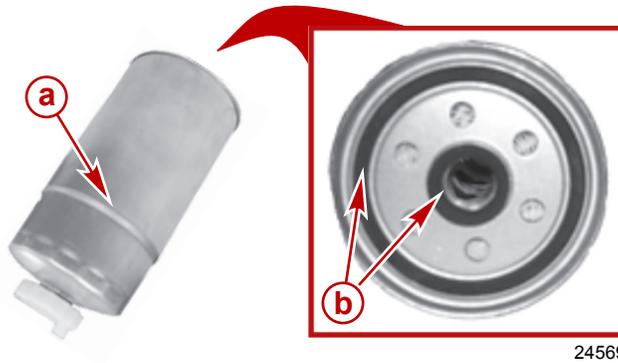
6. Install the O-ring and drain cap on the new water-separating fuel filter.



a - Drain cap

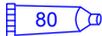
b - O-ring seal

7. Lubricate the fuel filter seals.

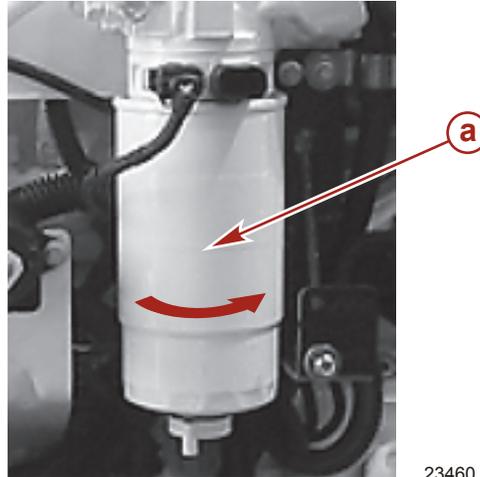


a - Water-separating fuel filter

b - Seals

Tube Ref No.	Description	Where Used	Part No.
 80	SAE Engine Oil 30W	Water-separating fuel filter sealing ring	Obtain Locally

8. Align the filter to the bracket. Twist the filter by hand to secure the filter to the bracket. Do not use a filter wrench.



23460

Typical

a - Water-separating fuel filter

9. Ensure that the drain cap is securely tightened.
10. Connect the WIF sensor wires, if equipped.
11. Fill the water-separating fuel filter with fuel. See **Filling**.
12. Check the filter and drain cap for fuel leaks.
13. Connect the battery cables.
14. Start and operate the engine. Check the filter connection for fuel leaks. If leaks exist, recheck filter installation. If leaks continue, stop the engine immediately and contact your Cummins MerCruiser Diesel Authorized Repair Facility.

Filling

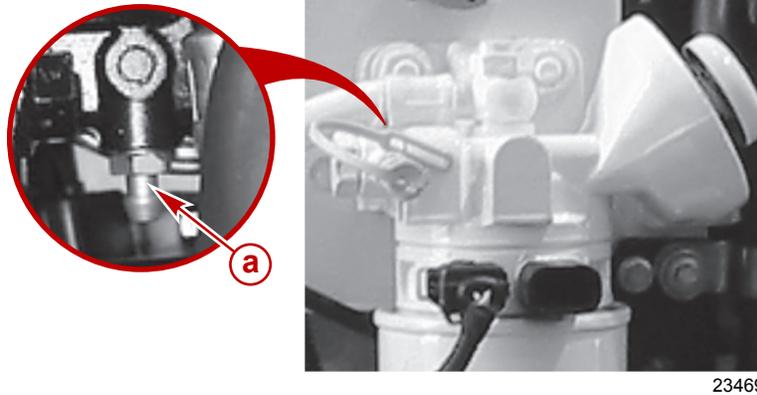
A type of hand pump and primer plunger is located on the fuel filter bracket and is used to

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

IMPORTANT: Only fill the fuel filter with the hand pump and primer plunger to ensure that unfiltered fuel does not get into the fuel system.

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

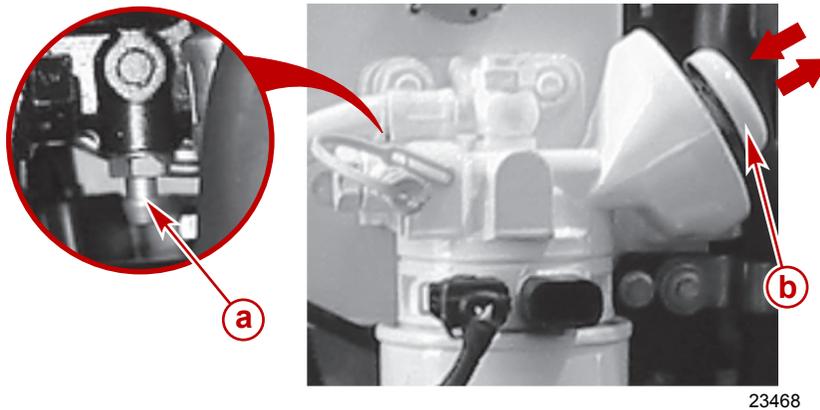
1. Loosen the air vent (bleed) screw on the fuel filter bracket.



Typical

a - Air vent screw

2. Move the primer plunger up and down repeatedly. The filter is full when an air-free stream of fuel flows from the air vent screw.

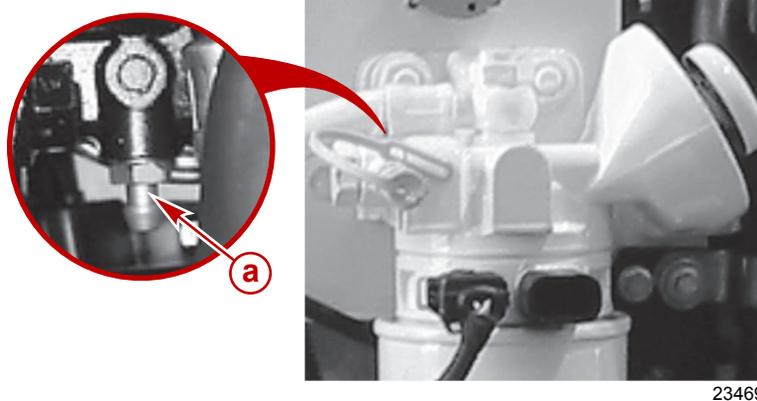


Typical

a - Air vent screw

b - Primer plunger

3. Securely tighten the air vent screw.



Typical

a - Air vent screw

Fuel System

Priming

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

1. Move the hand pump and primer plunger up and down several times as previously outlined.
2. Attempt to start the engine.

Filling (Bleeding)

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

1. See **Water Separating Fuel Filter - Filling** and fill the fuel filter.
2. Check the filter and drain cap for fuel leaks. Ensure that the bleed screw on the fuel filter bracket is closed.

Fuel Tank Cleaning and Flushing

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

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

Seawater System

Draining the Seawater System

⚠ CAUTION

Excess water in the bilge can damage the engine or cause the boat to sink. When the drain system is open, excess water can enter the bilge. Do not operate the engine with the drain system open.

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

Drain the seawater system of the power package before cold weather (freezing temperature), seasonal storage, or extended storage.

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

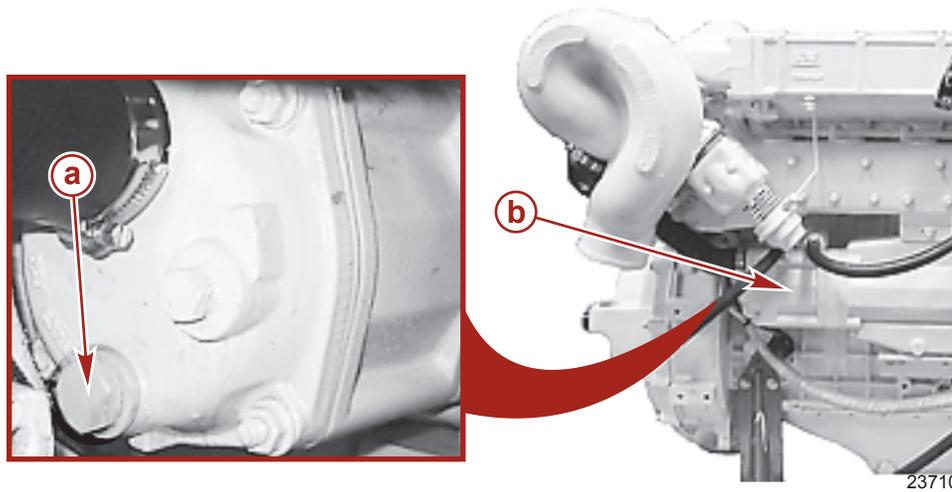
⚠ CAUTION

Excess water in the bilge can damage the engine or cause the boat to sink. Ensure that the boat is out of the water, the seacock is closed (if equipped) or the seawater inlet hose is disconnected and plugged on both ends, and the bilge pump is operating before beginning the draining procedure.

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

NOTE: The anode assembly on the back of the fluid cooler can be used as a drain plug.

4. Remove the drain plug from the aft end cover of the fluid cooler.

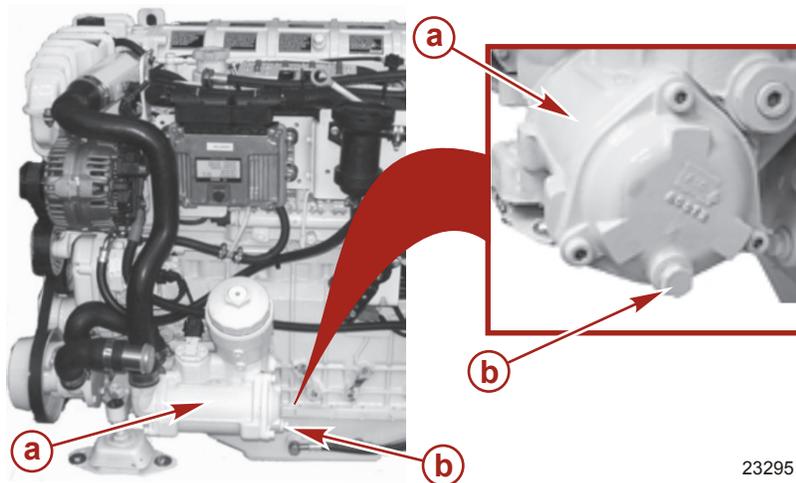


Typical engine

a - Anode assembly drain plug

b - Fluid cooler

5. Remove the drain plug, or fitting (if equipped), from the aft end cover of the engine oil cooler.



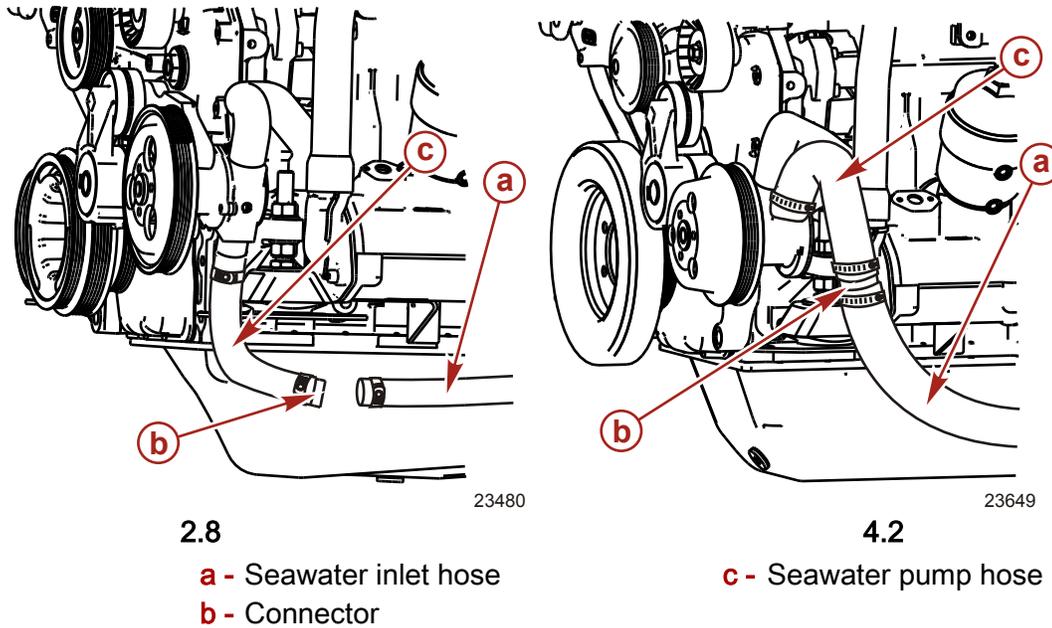
Typical engine

a - Engine oil cooler

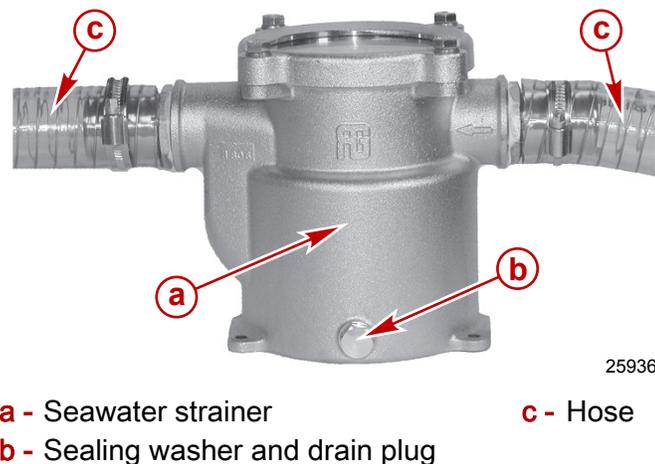
b - Drain plug, or fitting if equipped

NOTE: In the following steps, the hoses may require lowering or bending to allow seawater to drain completely.

- Disconnect the seawater inlet hose from the connector on the seawater pump hose and drain.



- Repeatedly clean out the drain holes using a stiff piece of wire until the seawater section is completely drained.
- On models equipped with a seawater strainer**, remove the hose at the seawater strainer and drain the hose completely. Drain and empty the seawater strainer. Reconnect the hose and tighten the hose clamps securely. Install the sealing washer and drain plug.



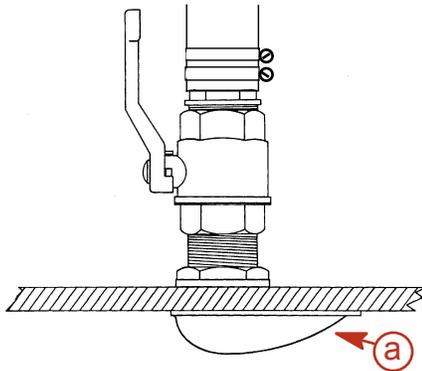
- After the seawater has completely drained, apply sealant to the threads of the drain plugs or fittings (if equipped). Install and tighten the drain plugs or fittings securely.

Tube Ref No.	Description	Where Used	Part No.
 19	Perfect Seal	Drain plug or fitting threads	92-34227-1

- Reconnect the hoses. Tighten the hose clamps securely.

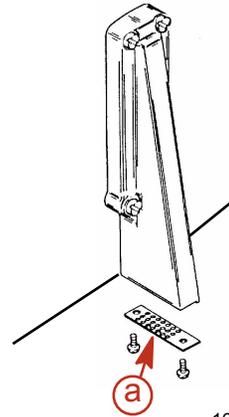
Checking the Seawater Pickups

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



Typical through-hull seawater pickup

a - Water inlet holes



Typical through-transom seawater pickup

Cleaning the Seawater Strainer, if Equipped

⚠ CAUTION

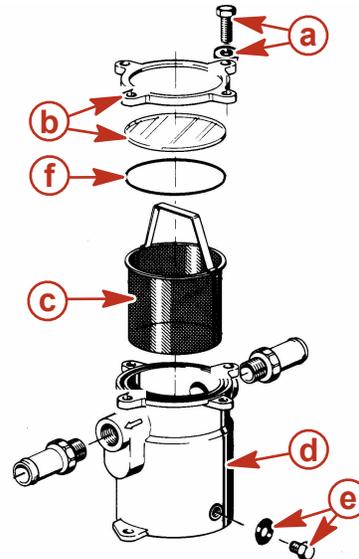
When cleaning the seawater strainer, close the seacock, if equipped. If the boat is not equipped with a seacock, remove and plug the seawater inlet hose to prevent siphoning, which would allow seawater to flow from the drain holes or removed hoses.

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

⚠ CAUTION

Seawater leaking from the seawater strainer could cause excess water in the bilge. Excess water in the bilge can damage the engine or cause the boat to sink. Do not overtighten the cover screws or the cover will warp and leak seawater into the bilge.

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



12863

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

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

Flushing the Seawater System—Inboard Models

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

WITH THE BOAT OUT OF THE WATER

⚠ CAUTION

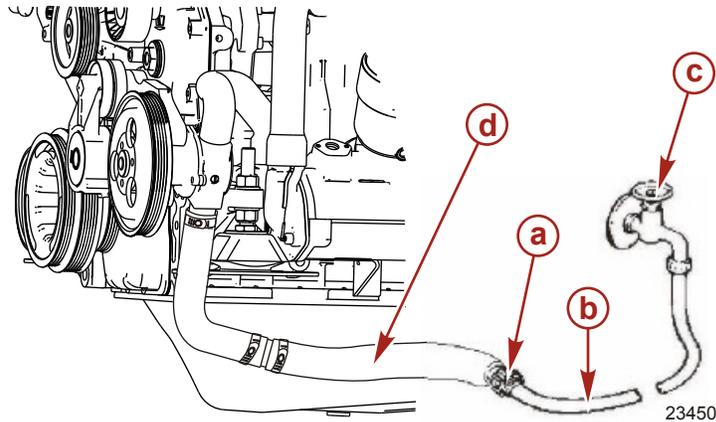
Do not operate the engine without water being supplied to the seawater pickup pump. An insufficient supply of seawater may damage the impeller. Subsequent overheating could damage the engine itself.

⚠ WARNING

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

1. Remove the propeller. Refer to the boat manufacturer's instructions.
2. Disconnect the seawater inlet hose from the seawater pickup pump connection.

- Using a suitable adapter, connect a flushing hose from a water tap to the seawater inlet hose connected to the seawater pump inlet.



2.8 shown, 4.2 similar

- a - Adapter
- b - Flushing hose
- c - Water tap
- d - Seawater inlet hose

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

CAUTION

Avoid engine damage from overheating. If the engine is operated above 1500 RPM during flushing, suction created by the seawater pickup pump may collapse the flushing water hose causing the engine to overheat.

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

CAUTION

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

- Observe the water temperature gauge to ensure that the engine is operating in the normal range.
- Stop the engine.
- Shut off the water tap.
- Remove the adapter from the seawater pump inlet hose connection.
- Reconnect the seawater inlet hose. Tighten the hose clamps securely.

WITH THE BOAT IN THE WATER

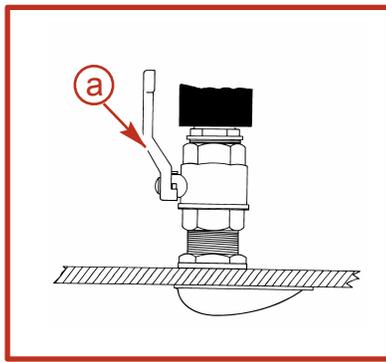
CAUTION

Do not operate the engine without water being supplied to the seawater pickup pump. An insufficient supply of seawater may damage the impeller. Subsequent overheating could damage the engine itself.

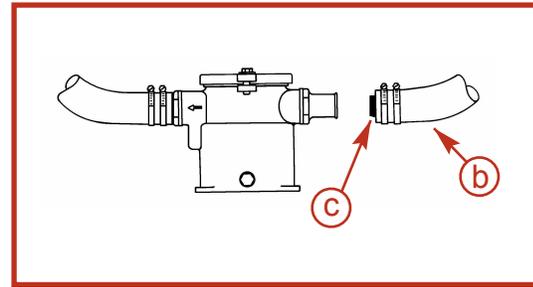
CAUTION

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

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



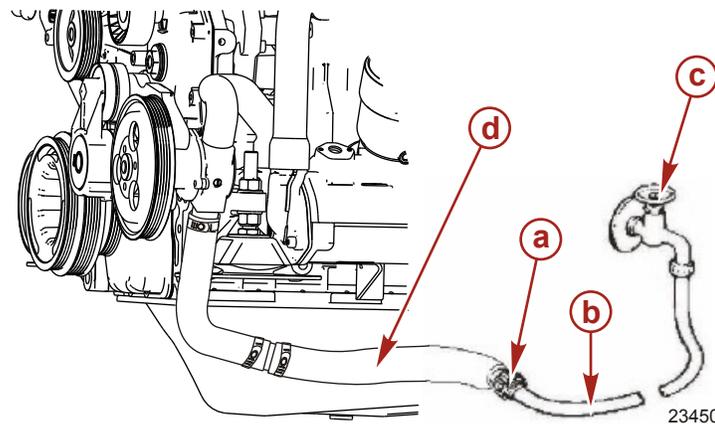
a - Seacock
b - Seawater inlet hose



13171

c - Plug

2. Using a suitable adapter, connect a flushing hose from a water tap to the seawater inlet hose connected to the seawater pump inlet.



2.8 shown, 4.2 similar

a - Adapter
b - Flushing hose
c - Water tap
d - Seawater inlet hose

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

⚠ CAUTION

Avoid engine damage from overheating. If the engine is operated above 1500 RPM during flushing, suction created by the seawater pickup pump may collapse the flushing water hose causing the engine to overheat.

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

⚠ CAUTION

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

6. Observe the water temperature gauge to ensure that the engine is operating in the normal range.
7. Stop the engine.

8. Shut off the water tap.
9. Remove the adapter from the seawater pump inlet hose connection.
10. To prevent water from siphoning into the boat or engine, do not open the seacock or reconnect the water inlet hose at this time.
11. Place an appropriate tag on the key switch stating that the seacock must be opened or the seawater inlet hose must be reconnected before operating the engine.

Engine Seawater Pump Inspection

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

Remove and inspect the engine seawater pump at the interval specified in the **Maintenance Schedule**. See your Cummins MerCruiser Diesel Authorized Repair Facility.

Replacing the Engine Coolant in the Closed Cooling System

Draining the Closed Cooling System

NOTICE

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

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

IMPORTANT: Observe the following points.

- Ensure that the engine is as level as possible to promote complete draining of the cooling system.
- The closed cooling section must be filled year-round with the required coolant. If the engine will be exposed to freezing temperatures, ensure that the closed cooling section is filled with a solution of ethylene glycol antifreeze and water properly mixed to protect the engine to the lowest temperature to which it will be exposed.
- Do not use propylene glycol antifreeze in the closed-cooling section of the engine.

⚠ CAUTION

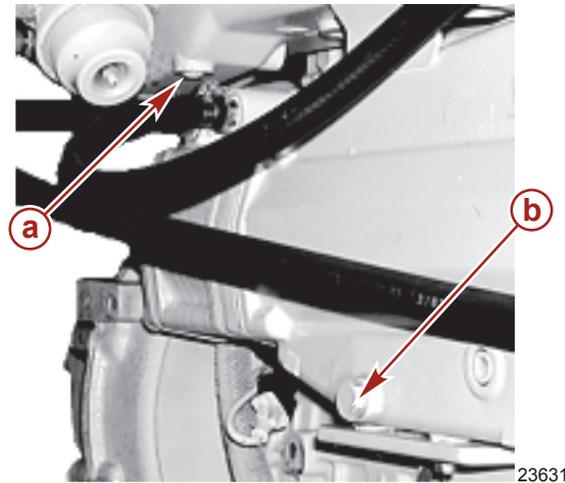
A sudden loss of pressure could cause hot coolant to boil and discharge violently causing serious injury from burns. Allow the engine to cool down before removing the coolant pressure cap.

1. Allow the engine to cool.
2. Remove the pressure cap from the expansion tank and coolant reservoir.

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

3. Remove the intake and exhaust manifold drain plug.

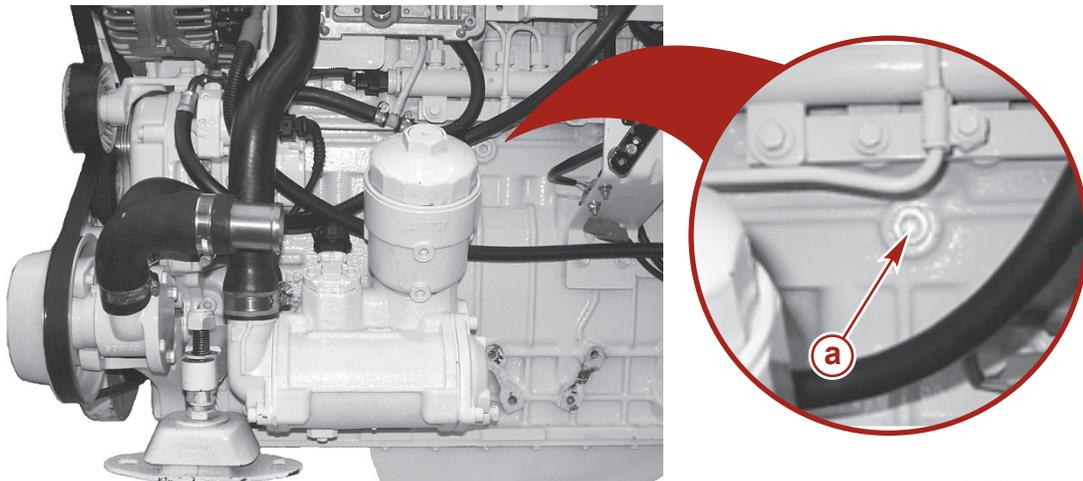
- Remove the heat exchanger drain plug.



4.2 shown, 2.8 similar

- a** - Intake and exhaust manifold drain plug **b** - Fluid cooler drain plug

- Open the engine block drain plug.



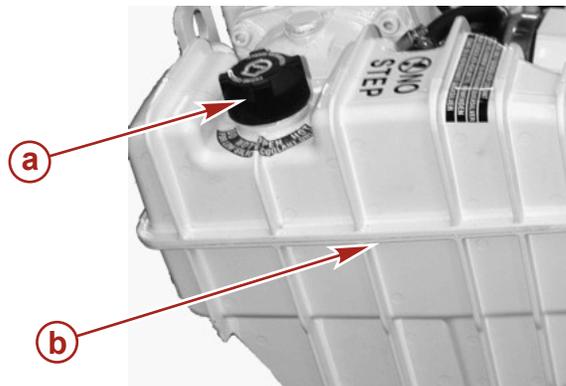
4.2 shown, 2.8 similar

- a** - Engine block drain plug

- After the coolant has drained completely, install the intake and exhaust manifold drain plug, the heat exchanger drain plug, and the engine block drain plug. Tighten all drain plugs securely.
- If required, clean the closed cooling system. See your local Cummins MerCruiser Diesel Authorized Repair Facility.
- Fill the system with the specified coolant. See **Filling the Closed Cooling System**.

Filling the Closed Cooling System

1. Remove the pressure cap.



23302

a - Pressure cap

b - Coolant expansion tank

IMPORTANT: Use only the specified coolant.

2. If the coolant is being replaced or the level is low, slowly add the specified coolant to the level indicated in the table.

Coolant level in expansion tank	
All models	Within 25 mm (1 in.) of the bottom of the filler neck, or between the upper and lower marks, if marked

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

⚠ 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.

3. Ensure that the seawater pickup pump is supplied cooling water.
4. Do not install the pressure cap. Start and operate the engine at fast idle (1500–1800 RPM). Add coolant if necessary to maintain the coolant at the level specified previously.

IMPORTANT: When installing the pressure cap, be sure to tighten it securely to avoid coolant loss.

5. Install the pressure cap after the engine has reached normal operating temperature (with the thermostat fully open) and the coolant level remains constant.
6. Test the engine operation. Observe the temperature gauge and check the engine for coolant leaks. If the temperature gauge indicates the presence of excessive temperature or coolant is leaking, stop the engine immediately and inspect for the cause.
7. After the first operation, allow the engine to cool.
8. Remove the pressure cap and add the specified coolant to the level indicated in the table.

Coolant level in expansion tank	
All models	Within 25 mm (1 in.) of the bottom of the filler neck, or between the upper and lower marks, if marked

- Install and securely tighten the pressure cap.

Corrosion Protection

General Information

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

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

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

Engine Corrosion Protection Components

This engine is equipped with a sacrificial anode located on top of the aftercooler end cover to assist in protecting the engine and the seawater cooling system from corrosion. It also contains a second sacrificial anode assembly on the stern end of the fluid cooler.

REMOVAL

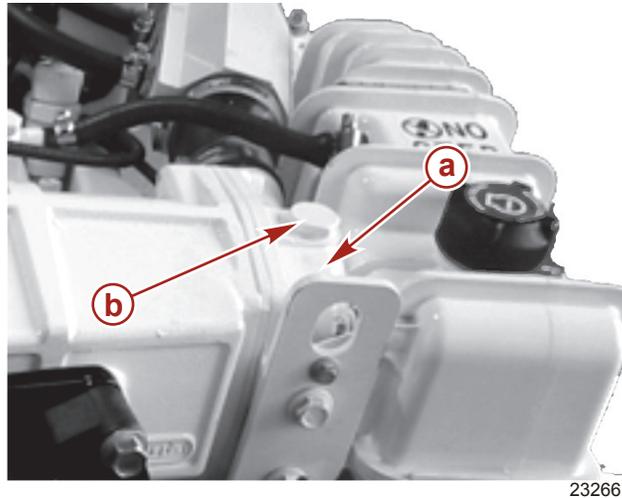
- Allow the engine to cool.

NOTICE

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

- With the engine off, close the seacock, if equipped, or remove and plug the seawater inlet hose.
- Drain the seawater system. See **Draining the Seawater System** .

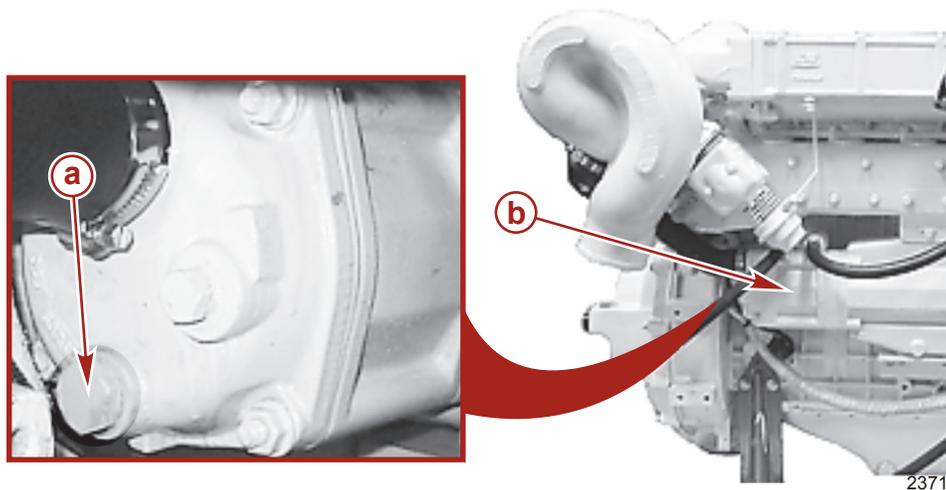
4. Remove the anode assembly (anode plug and the sacrificial anode) from the top of the aftercooler end cover.



a - Aftercooler end cover

b - Anode assembly

5. Remove the anode assembly (anode plug and the sacrificial anode) from the aft end of the fluid cooler.



Typical engine

a - Anode assembly

b - Fluid cooler

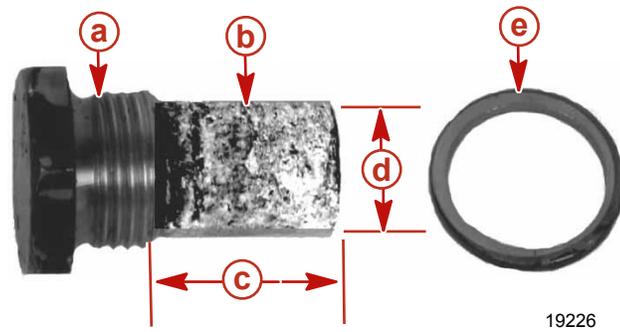
CLEANING AND INSPECTION

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

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

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

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



Anode assembly

- a - Anode plug
- b - Sacrificial anode
- c - Length

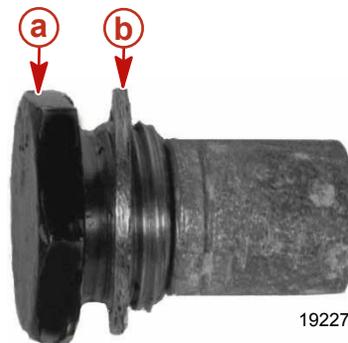
- d - Diameter
- e - Sealing washer

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

3. Discard the sealing washer.

INSTALLATION

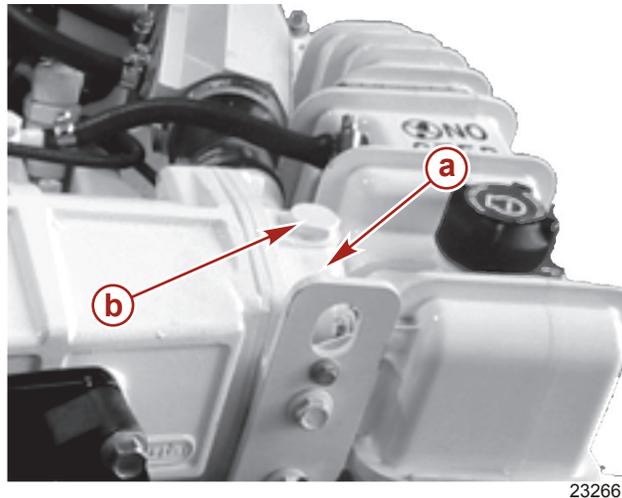
1. Install a new sealing washer on the anode assembly (anode plug with the sacrificial anode).



- a - Anode assembly

- b - Sealing washer

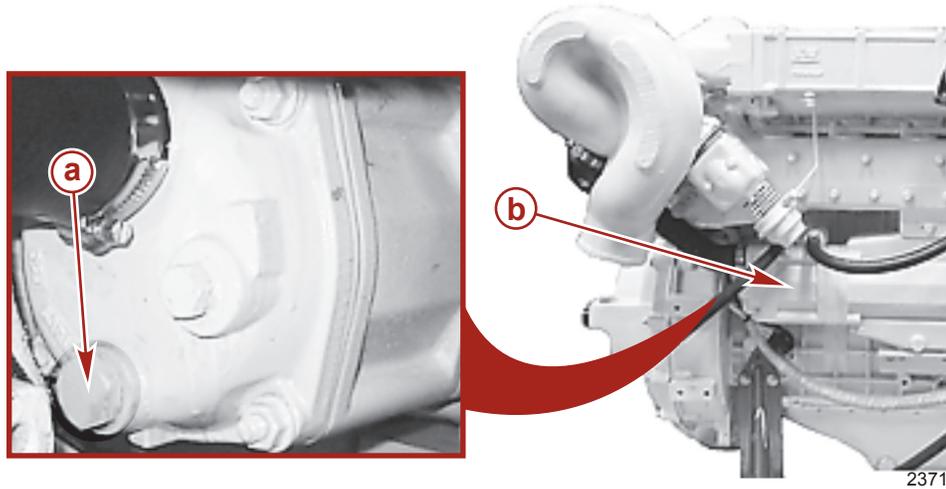
2. Install the anode assembly and washer into the aftercooler end cover. Tighten securely.



a - Aftercooler end cover

b - Anode assembly

3. Install the anode assembly and washer into the aft end of the fluid cooler. Tighten securely.



Typical engine

a - Anode assembly

b - Fluid cooler

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

⚠ CAUTION

Avoid damaging the seawater pickup pump impeller. Do not operate the engine without supplying cooling water to the Seawater pickup pump.

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

Antifouling Paint

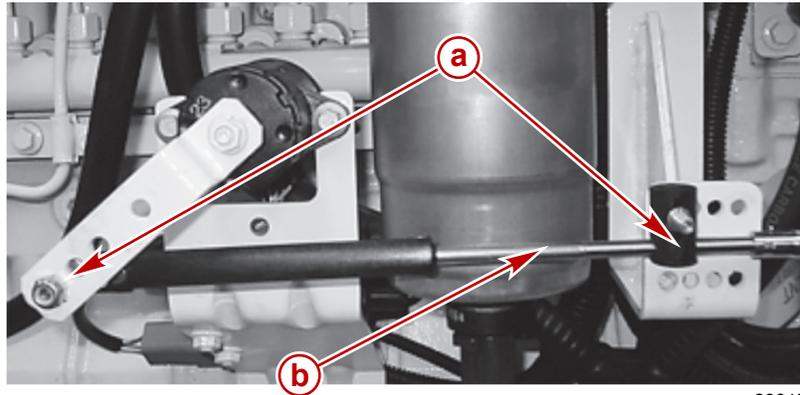
IMPORTANT: Corrosion damage that results from the improper application of anti-fouling paint is not covered by the limited warranty.

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

Lubrication

Throttle Cable

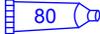
1. Lubricate the pivot points and guide contact surfaces.



23643

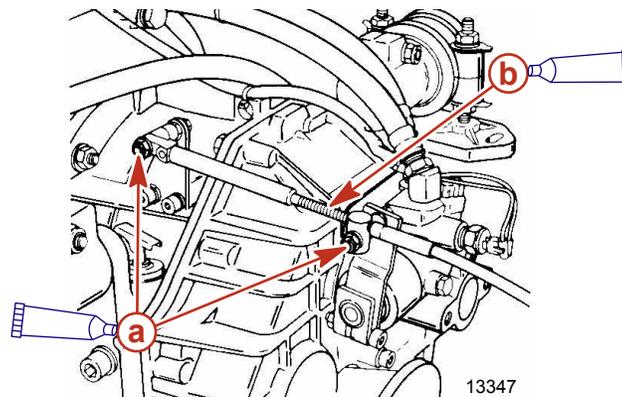
a - Pivot points

b - Guide contact surfaces

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

Shift Cable

1. Lubricate the pivot points and guide contact surfaces.

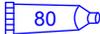


13347

Typical inboard model shift cable and transmission linkage

a - Pivot points

b - Guide contact surface

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

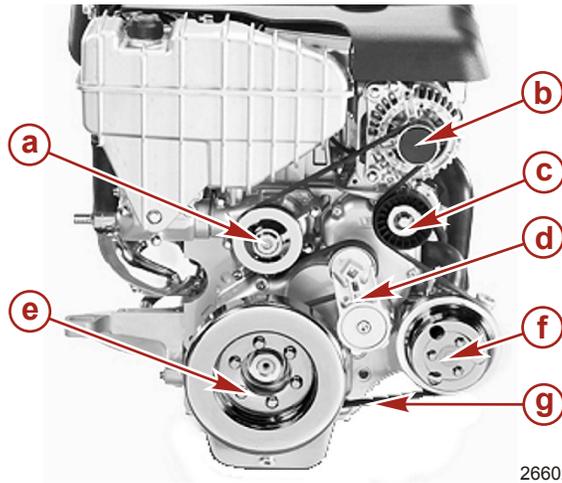
Drive Belts

Drive Belt

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

⚠ WARNING

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



4.2 inboard shown, 2.8 similar

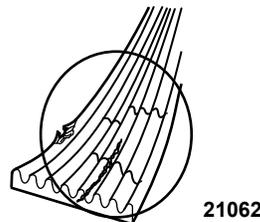
- | | |
|--|---------------------------------|
| a - Water circulating pump pulley | e - Crankshaft pulley |
| b - Alternator pulley | f - Seawater pump pulley |
| c - Idler | g - Serpentine belt |
| d - Automatic Tensioner | |

Serpentine Belt INSPECTION

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

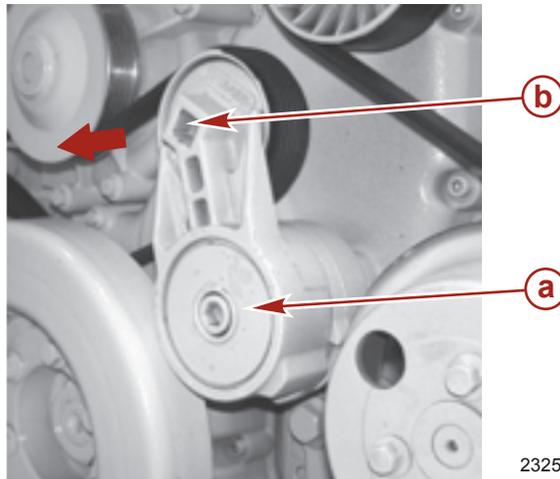
NOTE: *Minor, transverse cracks (across the belt width) may be acceptable. Longitudinal cracks (in the direction of belt length) that join transverse cracks are not acceptable.*

- Fraying
- Glazed surfaces



2. Check the operation of the automatic tensioner and associated components.
 - a. Position a suitable tool in the automatic tensioner release slot.

- b. Rotate the automatic tensioner in the direction of the arrow.



a - Automatic tensioner

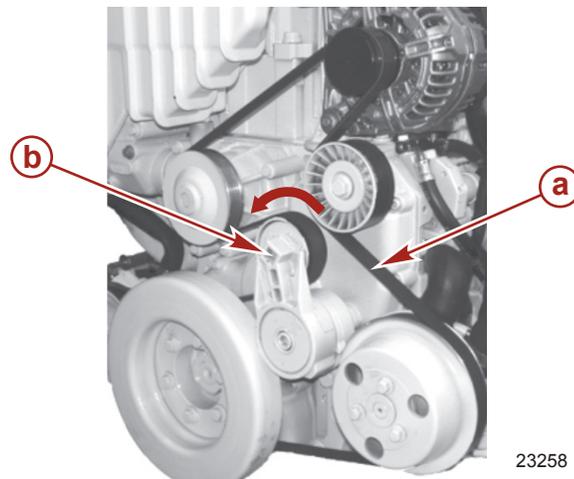
b - Release slot

- c. Release the automatic tensioner and allow it to glide back slowly.
 d. The automatic tensioner must return to the initial position and hold tension on the serpentine belt.

REPLACEMENT

IMPORTANT: If a belt is to be reused, it should be installed in the same direction of rotation as when first used.

1. Position a suitable tool in the automatic tensioner release slot.
2. Rotate the automatic tensioner in the direction of the arrow to remove the tension on the serpentine belt.



a - Serpentine belt

b - Release slot

3. Remove the serpentine belt.
4. Replace the serpentine belt.
5. Carefully release the automatic tensioner with the breaker bar, ensuring that the belt stays positioned properly.

Battery

Refer to the 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.

Battery Precautions for Multiple Engines

Alternators: Alternators are designed to charge a single battery that supplies electrical power to the individual engine on which the alternator is mounted. Connect only one battery to one alternator. Do not connect two batteries to the same alternator unless a battery isolator is used.

Engine Control Module (ECM): The ECM requires a stable voltage source. During multiple engine operation, an onboard electrical device may cause a sudden drain of voltage at the engine's battery. The voltage may go below the ECM's minimum required voltage. Also, the alternator on the other engine may now start charging. This could cause a voltage spike in the engine's electrical system.

In either case, the ECM could shut off. When the voltage returns to the range that the ECM requires, the ECM will reset itself. The engine will now run normally. This ECM shut down usually happens so fast that the engine just appears to have an ignition miss.

Batteries: Boats with multi-engine Electronic Control power packages require each engine be connected to its own battery, ensuring that the engine's Electronic Control Module (ECM) has a stable voltage source.

Battery Switches: Battery switches should always be positioned so that each engine is operating off of its own battery. Do not operate engines with switches in both or all position. In an emergency, another engine's battery can be used to start an engine with a dead battery.

Battery Isolators: Isolators can be used to charge an auxiliary battery used for powering accessories in the boat. They should not be used to charge the battery of another engine in the boat unless the type of isolator is specifically designed for this purpose.

Generators: The generator's battery should be considered another engine's battery.

Section 6 - Storage

Table of Contents

Cold Weather (Freezing Temperature), Seasonal Storage, and Extended Storage.....	90	Seasonal Storage Instructions.....	91
Cold Weather (Freezing Temperature) Storage	91	Extended Storage Instructions.....	93
Preparing Your Power Package for Seasonal or Extended Storage.....	91	Battery.....	93
		Recommissioning.....	93

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

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

NOTICE

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

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

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

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

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

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

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

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

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

Cold Weather (Freezing Temperature) Storage

NOTICE

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

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

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

Preparing Your Power Package for Seasonal or Extended Storage

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

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

Seasonal Storage Instructions

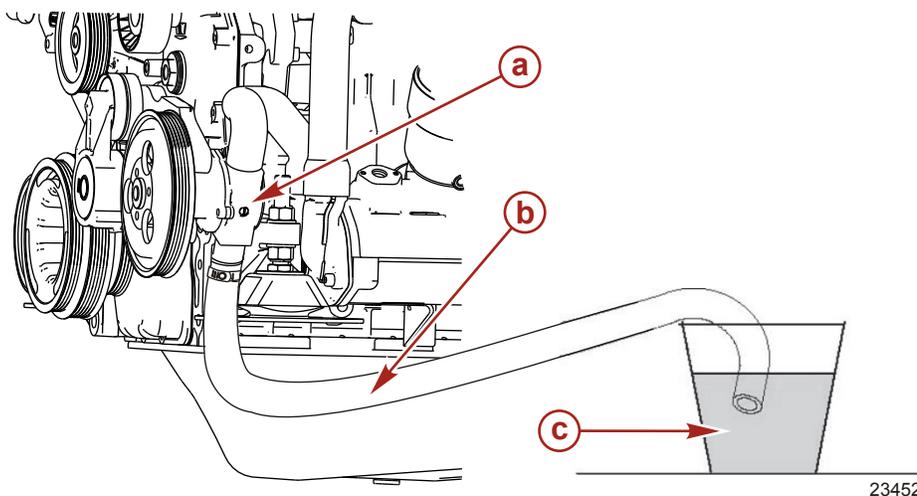
1. Read all precautions and perform all procedures found in **Preparing Your Power Package for Seasonal or Extended Storage**.
2. Read all precautions and perform all procedures found in **Draining the Seawater System** and drain the seawater section of the cooling system.

NOTICE

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

IMPORTANT: Cummins MerCruiser Diesel recommends the use of propylene glycol antifreeze in the seawater section of the cooling system for cold weather (freezing temperature), seasonal storage, or extended storage. Make sure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Be certain to follow the propylene glycol manufacturer's recommendations.

3. Fill a container with approximately 5.6 liters (6 U.S. quarts) of propylene glycol antifreeze and tap water mixed to manufacturer's recommendation to protect the engine to the lowest temperature to which it will be exposed during cold weather or extended storage.
4. Disconnect the seawater inlet hose from the seawater pump. Using an adapter, temporarily connect an appropriate length piece of hose to seawater pump and place the other end of the hose into the container of propylene glycol antifreeze and tap water.



Typical

a - Seawater pump
b - Temporary hose

c - Container of propylene glycol antifreeze and tap water

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

5. Start the engine and operate at idle speed until the antifreeze mixture has been pumped into the engine seawater cooling system.
6. Stop the engine.
7. Remove the temporary hose from the seawater pump.
8. Clean the outside of the engine and repaint any areas required with primer and spray paint. After the paint has dried, coat the engine with the specified corrosion inhibiting oil or equivalent.

Description	Where Used	Part Number
Corrosion Guard	Outside of engine	92-802878-55
Light gray primer		92-802878-52
Marine Cloud White paint (CMD part number: 4918660)		Obtain locally

9. Your Cummins MerCruiser Diesel Authorized Repair Facility should now perform all checks, inspections, lubrications, and fluid changes outlined in **Maintenance Schedules**.

NOTICE

The universal joint bellows may develop a set when stored in a raised or up position, causing the bellows to fail when returned to service and allowing water to enter the boat. Store the sterndrive in the full down position.

10. On Sterndrive models, place the sterndrive in the full down (in) position.
11. Follow the battery manufacturer's instructions for storage and store the battery.

Extended Storage Instructions

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

1. Read all precautions and perform all procedures found in **Preparing Your Power Package for Seasonal or Extended Storage**.
2. Read all precautions and perform all procedures found in **Draining the Seawater System**.
3. Read all precautions and perform all procedures found in **Seasonal Storage Instructions**.

IMPORTANT: The seawater pump impeller material can be damaged by prolonged exposure to direct sunlight.

4. Remove the seawater pump impeller and store away from direct sunlight. Refer to a Cummins MerCruiser Diesel Authorized Repair Facility for additional information and service.
5. Place a caution tag at the instrument panel and in the engine compartment stating that the seawater pump is out and not to operate the engine.

Battery

Follow the battery manufacturer's instructions for storage.

Recommissioning

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

1. On engines that were prepared for extended storage, refer to a Cummins MerCruiser Diesel Authorized Repair Facility and have the seawater pump impeller installed, if it was removed for storage.
2. On engines that were prepared for cold weather (freezing temperature), seasonal, or extended storage, see **Draining the Seawater System** and drain the propylene glycol into a suitable container. Dispose of the propylene glycol in accordance with federal, state, and local laws and guidelines.

3. Ensure that all cooling system hoses are in good condition, connected properly, and clamped tightly. Verify that all drain valves and drain plugs are installed and tight.
4. Inspect all drive belts.
5. Perform all lubrication and maintenance specified for completion according to **Annually** in **Maintenance Schedules**, except items that were performed at time of engine layup.
6. Fill the fuel tanks with fresh diesel fuel. Do not use old fuel. Check the general condition of the fuel lines and inspect the connections for leaks.
7. Replace the water-separating fuel filter or filters (some engines may have more than one).

 **CAUTION**

Reversing the battery cables or connection order will damage the electrical system. When installing the battery, be sure to connect the positive (+) battery cable to the positive (+) battery terminal first, and the negative (-) battery cable to the negative (-) battery terminal second.

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

 **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.

10. Supply cooling water to the water inlet openings.
11. Start the engine and closely observe instrumentation. Ensure that all systems are functioning correctly.
12. Carefully inspect the engine for fuel, oil, fluid, water, and exhaust leaks.
13. Check the steering system, shift, and throttle control for proper operation.

Section 7 - Troubleshooting

Table of Contents

Diagnosing Electronically Controlled Fuel System Problems.....	96	Excessive Engine Temperature.....	97
Troubleshooting Charts.....	96	Insufficient Engine Temperature.....	97
Starter Motor Will Not Crank Engine, or Cranks Slow.....	96	Low Engine Oil Pressure.....	97
Engine Will Not Start, or Is Hard to Start.....	96	Battery Will Not Charge.....	98
Engine Runs Rough, Misses, or Backfires....	96	Remote Control Operates Hard, Binds, Has Excessive Free-play, or Makes Unusual Sounds	98
Poor Performance.....	97		

Diagnosing Electronically Controlled Fuel System Problems

Your Cummins MerCruiser Diesel Authorized Repair Facility has the proper service tools for diagnosing problems on electronically controlled fuel systems. The Engine Control Module (ECM) on these engines has the ability to detect some problems with the system when they occur, and store a trouble code in the ECM's memory. This code can then be read later by a service technician using a special diagnostic tool.

Troubleshooting Charts

Starter Motor Will Not Crank Engine, or Cranks Slow

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

Engine Will Not Start, or Is Hard to Start

Possible Cause	Remedy
Lanyard stop switch activated.	Check lanyard stop switch.
Improper starting procedure.	Read starting procedure.
Empty fuel tank or fuel shut-off valve closed.	Fill tank or open valve.
Throttle not operating properly.	Check the throttle for freedom of movement.
Faulty electrical stop-circuit.	Have a Cummins MerCruiser Diesel Authorized Repair Facility service the electrical stop circuit.
Clogged fuel filters.	Replace fuel filters.
Stale or contaminated fuel.	Drain tank. Fill with fresh fuel.
Fuel line or tank vent line kinked or clogged.	Replace kinked lines or blow out the lines with compressed air to remove obstruction.
Air in fuel injection system.	Purge fuel injection system.
Faulty wire connections.	Check wire connections.
Electronic fuel system fault.	Have the electronic fuel system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.

Engine Runs Rough, Misses, or Backfires

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

Possible Cause	Remedy
Electronic fuel system faulty.	Have electronic system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.

Poor Performance

Possible Cause	Remedy
Throttle not fully open.	Inspect throttle cable and linkages for proper operation.
Damaged or improper propeller.	Replace propeller. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Excessive bilge water.	Drain and check for cause of entry.
Boat overloaded or improperly distributed.	Reduce load or redistribute more evenly.
Boat bottom fouled or damaged.	Clean or repair as necessary.
Electronic fuel system fault.	Have electronic fuel system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.

Excessive Engine Temperature

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

Insufficient Engine Temperature

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

Low Engine Oil Pressure

Possible Cause	Remedy
Faulty senders.	Have system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Insufficient oil in crankcase.	Check and add oil.
Excessive oil in crankcase (causing it to become aerated).	Check and remove required amount of oil. Check for cause of excessive oil (improper filling).

Possible Cause	Remedy
Diluted or improper viscosity oil.	Change oil and oil filter, using correct grade and viscosity oil. Determine cause for dilution (excessive idling).

Battery Will Not Charge

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

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

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

Section 8 - Customer Assistance Information

Table of Contents

Owner Service Assistance.....	100	Muut kielet	102
Local Repair Service	100	Autres langues	102
Service Away From Home	100	Andere Sprachen	102
Stolen Power Package	100	Altre lingue	102
Attention Required After Submersion	100	Andre språk	102
Replacement Service Parts	100	Outros Idiomas	102
Parts and Accessories Inquiries	101	Otros idiomas	102
Resolving a Problem	101	Andra språk	103
Customer Service Literature.....	101	Allej gļpssej	103
English Language	101	Ordering Literature.....	103
Other Languages	101	United States and Canada	103
Andre sprog	102	Outside The United States and Canada	103
Andere talen	102		

Owner Service Assistance

Local Repair Service

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

Service Away From Home

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

Stolen Power Package

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

Attention Required After Submersion

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

Replacement Service Parts

WARNING

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

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

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

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

Parts and Accessories Inquiries

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

Resolving a Problem

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

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

The service office will need the following information:

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

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

Customer Service Literature

English Language

English language publications are available from:

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

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

When ordering be sure to:

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

Other Languages

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

Andre sprog

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

Andere talen

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

Muut kielet

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

Autres langues

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

Andere Sprachen

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

Altre lingue

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

Andre språk

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

Outros Idiomas

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

Otros idiomas

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

Andra språk

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

Allej glþssej

Gia na apoktþsete Ýna Egxeirþdio Leitourgþaj kai Suntþrhshj se Üllh glþssa, epikoinwnþste me to plhsiÝstero DieqnÝj KÝntro SÝrbij thj Mercury Marine þ thj Marine Power gia plhroforþej. To pakÝto isxyoj saj sunodeýetai apü Ýnan katÜlogo ariqmþn paragelþaj gia Üllej glþssej.

Ordering Literature

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

Model		Serial Number	
Horsepower		Year	

United States and Canada

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

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

Outside The United States and Canada

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

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

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

Section 8 - Customer Assistance Information

Quantity	Item	Stock Number	Price	Total
			.	.
			.	.
	Total Due		.	.