Identification Record

Please record the following information:

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



Reference	Please record the following information:		
	Jetdrive Model Number	Gear Ratio	Unit Serial Number
а		:	
	Hull Identification Number (HIN)		Model and Length
b			/
	Engine Model and Horsepower	Engine Serial Number	
	1		
See Engine Operation,	Exhaust Gas Emissions Certificate Number (Europe Only)		
Maintenance, and Warranty Manual for Location			
	Serial Number Plate		Purchase Date
			/

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

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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!

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 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 don't 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, WARNINGS and CAUTIONS,

accompanied by the International Hazard Symbol A, may be used to alert the installer/ user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **Observe them carefully.**

These safety alerts alone cannot eliminate the hazards that they signal. Strict compliance with these special instructions while performing the service, plus common sense during operation, help prevent major accidents.

WARNING

WARNING—indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

ACAUTION

CAUTION—indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury or property damage. It may also be used to alert against unsafe practices.

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

▲ 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

California Proposition 65 Warning

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

▲ WARNING

Electrical system components on this engine are not 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.

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Section 1 - Warranty

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Warranty Information

Warranty Registration United States And Canada

 You may change your address at any time, including at time of warranty claim, by calling Mercury Marine or sending a letter or fax with your name, old address, new address, and engine serial number to Mercury Marine's warranty registration department. Your dealer can also process this change of information. Mercury Marine Attn: Warranty Registration Department W6250 Pioneer Road P.O. Box 1939

Fond du Lac, WI 54936-1939 920-929-5054 Fax 920-929-5893

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

- 2. To be eligible for warranty coverage, the product must be registered with Mercury Marine. At the time of sale, the dealer should complete the warranty registration and immediately submit it to Mercury Marine via MercNET, E-mail, or mail. Upon receipt of this warranty registration, Mercury Marine will record the registration.
- 3. Upon processing the warranty registration, Mercury Marine will send registration verification by mail to the purchaser of the product. If this registration verification is not received within 30 days, please contact your selling dealer immediately. Warranty coverage is not effective until your product is registered with Mercury Marine.

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/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/dealer's code number, name and address. The distributor/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/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/dealer. If you receive a plastic Warranty Registration Card, you may discard the Purchaser's Copy that you received from the distributor/dealer when you purchased the product. Ask your distributor/dealer if this plastic card program applies to you.

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

5. For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the International Warranty.

Warranty Policies

Recreational Use Limited Warranty

WHAT IS COVERED

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

DURATION OF COVERAGE

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

CONDITIONS THAT MUST BE MET TO OBTAIN WARRANTY COVERAGE

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

WHAT CUMMINS MERCRUISER DIESEL WILL DO

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

HOW TO OBTAIN WARRANTY COVERAGE

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

WHAT IS NOT COVERED

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

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

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

DISCLAIMERS AND LIMITATIONS

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

Warranty Coverage and Exclusion

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

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

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

WARRANTY DOES NOT APPLY TO THE FOLLOWING:

- Minor adjustments or checks, including checking fuel injection pump timing, cleaning fuel injectors, filters, or adjusting belts, controls, and checking lubrication made in connection with normal services.
- Damage caused by neglect, lack of maintenance, accident, abnormal operation, improper installation or service, or freezing temperatures.
- Haul-out, launch, towing charges; removal and/or replacement of boat partitions or material because of boat design for necessary access to the product; all related transportation charges and/or travel time, etc. Reasonable access must be provided to the product for warranty service. Customer must deliver product to an Authorized Dealer.
- Additional service work requested by customer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an Authorized Dealer may be covered only under following circumstances: When performed on emergency basis (providing there are no Authorized Dealers in area who can perform the work required or have no facilities to haul out, etc., and prior factory approval has been given to have the work performed at this facility).
- All incidental and/or consequential damages (storage charges, telephone or rental charges of any type, inconvenience or loss of time or income) are the owner's responsibility.
- Use of other than Quicksilver replacement parts when making warranty repairs.
- Oils, lubricants or fluids changed as a matter of normal maintenance are the customer's responsibility unless loss or contamination of the same is caused by product failure that would be eligible for warranty consideration.
- Participating in or preparing for racing or other competitive activity.
- Engine noise does not necessarily indicate a serious engine problem. If diagnosis indicates a serious internal engine condition which could result in a failure, condition responsible for noise should be corrected under the warranty.
- Lower unit and/or impeller damage caused by striking a submerged object is considered a marine hazard.
- Water entering the engine via the air filter or exhaust system or submersion. Also, water in the starter motor.
- Starter motors and/or armatures or field coil assembly, which are burned, or where lead is thrown out of commutator because of excess cranking.
- Valve or valve seat grinding required because wear.
- Failure of any parts caused by lack of cooling water, which results from starting power package out of water, foreign material blocking inlets or power package being mounted too high.

- Use of fuels and lubricants that are not suitable for use with or on the product. Refer to your Operation, Maintenance, And Warranty Manual.
- Our limited warranty does not apply to any damage to our products caused by the installation or use of parts and accessories that are not manufactured or sold by us. Failures that are not related to the use of those parts or accessories, are covered under warranty, if they otherwise meet the terms of the limited warranty for that product.

Transfer Of Warranty

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

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

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

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

There is no charge for this service.

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

Section 2 - Getting to Know Your Power Package

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Features And Controls

Lanyard Stop Switch

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



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

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

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

- Occupants could be thrown forward due to unexpected loss of forward motion, a
 particular concern for passengers in the front of the boat who could be ejected over the
 bow and possibly struck by the 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 abrupt deceleration of the boat from lanyard stop switch activation. Boat damage and personal injury or death could occur. Never leave the operator's station with the engine operating and in gear.

Instrumentation INSTRUMENTS

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



Reference	Gauge	Function	
а	Speedometer	Indicates boat speed.	
b	Tachometer	Indicates engine revolutions per minute (RPM).	
С	Oil Pressure Gauge	Indicates engine oil pressure.	
d	Battery Meter	Indicates battery voltage.	
е	Coolant Temperature Gauge	Indicates engine operating temperature.	

Getting to Know Your Power Package

Reference Gauge Function					
f	Fuel Gauge	Indicates quantity of fuel in tank.			
g	Hour Meter	Records engine operating time.			

SWITCHES



 c - Engine stop switch—push button (if equipped)

Reference	Switch	Function
a	Key Switch	 —has three positions. 1. "OFF" or (0) - In the "OFF," or 0, position, all electrical circuits are off and engine cannot be started. If the engine is operating the key switch CANNOT be used to stop the engine, except on
		ECM (Electronic Control Module) controlled engines. On all engines except ECM controlled engines, the engine can only be stopped by using the engine stop switch, while the key switch is in the "RUN," or (1) position. No electrical circuit, including the engine stop switch is operational when the key switch is turned to the "OFF," or (0) position.
		NOTE: Do not operate the engine with the key switch in the "OFF" position.
		 "RUN" or (1)—In the "RUN," or 1, position, all electrical circuits, indicator lamps, automatic preheating (if equipped), and all instruments are operational.
		 "START" or (S)—In the "START," or S, position the engine can be started.
		NOTE: Key can only be removed with the key switch in the "OFF" position.

Reference	Switch	Function
b or c	Engine Stop Switch	(Not present on ECM controlled engines)—Is used to stop the engine. This is done by electrically shutting off the fuel delivery system. The switch, toggle or push-button, is either toggled down or pressed in. Engage and hold the stop switch until the engine stops completely. Then, turn the key switch to the "OFF" position.
d	Panel lights and audio test switch	Has three positions; in the normal position all electrical circuits operate in a standard fashion (as described above). With the switch toggled up, the instrumentation lights are all illuminated. When the switch is toggled down the audio warning alarm will sound allowing the operator to perform a test of the audio warning alarm.
е	Bilge Blower Switch	Operates bilge blower

ENGINE MONITORING FEATURES



Engine Warning Lamps

a - Electronic controlled engine

b - Mechanical engine

Reference	Warning Lamp	Function			
с	Charge indicator lamp	Indicates a problem with the charging system if the lamp illuminates while the engine is operating. The lamp will be on when the key switch is in the "RUN position and the engine is not operating. When engi starts, light should go off.			
d	Oil pressure warning lamp	Indicates low engine oil pressure if the lamp illuminates while the engine is running.			
e	Water-in-fuel warning lamp	Indicates water is present in the fuel filter and that the fuel filter requires service.			
f	Coolant temperature warning lamp	Indicates excessive engine coolant temperature if t lamp illuminates while the engine is running.			
g	Check engine warning lamp (Electronically controlled engines only)	(on electronically controlled engines only) - indicates a problem with the engine if the lamp illuminates while the engine is operating. The lamp will be on when the key switch is in the "RUN" position and the engine is not operating. When the engine starts, the light should go off.			

Reference	Warning Lamp	Function			
h	Preheat indicator lamp (If equipped, mechanically controlled engines only)	Indicates when the glow plugs, if equipped, are preheating the combustion chambers. When the engine is cold the timed preheat period begins when the key switch is turned to "RUN." The light stays on until the preheat period is complete. The engine can be started only after the light goes out.			

Remote Controls

Your jet drive has 3 shift positions to provide operation in Forward, Neutral, and Reverse:



Forward (F) - has all the water clearing the reverse bucket for forward thrust and forward boat motion.

Neutral (N) - has the reverse gate covering half the water outlet nozzle to distribute thrust both forward and backward. The drive impeller continues to rotate and the boat may tend to creep in one direction. This is normal for a direct-drive jet-driven boat. Use caution whenever the engine is running.

Reverse (R) - has the reverse gate covering the entire water outlet nozzle to divert the exiting water stream forward to reverse boat motion.

1. After shifting into forward or reverse, advance the throttle lever further to increase speed.

NOTE: Operators must practice the stopping maneuver to become familiar with jet drive handling.

2. To stop the boat normally, gradually reduce speed before shifting to neutral position. Use caution when shifting and turning since some loss of steering control will result. Remember, steering control is dependent on thrust produced.

Power Trim, If Equipped

The optional Power Trim allows the operator to adjust the jet nozzle angle while underway, to provide the ideal boat angle for varying load and water conditions.

For best performance trim the jet unit so that the boat bottom is at a 3–5 degree angle to the water.



Trimming nozzle up can:

- Generally increase top speed.
- Cause boat to accelerate and plane off slower.
- In excess, cause boat porpoising (bouncing).



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Trimming nozzle down can:

- Help the boat accelerate and plane off quicker.
- Generally improve the ride in choppy water.
- In most cases, reduce boat speed.
- If in excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called bow steering or over steering if any turn is attempted or if a significant wave is encountered.



Diesel Engine Electrical System Overload Protection

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

NOTE: In an emergency, when the engine must be operated and the cause for the high current draw cannot be located and corrected, turn "OFF" or disconnect all 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 authorized Cummins MerCruiser Diesel dealer/distributor.

1. **On 1.7L MJ Models:** One 50-amp circuit breaker provides protection for the engine wiring harness and instrumentation power lead. Reset by pushing the reset button in.



a - Bracket

b - Circuit breaker

On 2.8L EJ Models: Two 60-amp circuit breakers provide protection for the engine wiring harness and instrumentation power lead. Reset by pushing the reset button in.



2.8L EJ a - Circuit breaker and electrical box

On 4.2L EJ Models: Two 60-amp circuit breakers provide protection for the engine wiring harness and instrumentation power lead. Reset by pushing the reset button in.



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



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3. The power trim system, if equipped, is protected from overload by a 20-amp in-line fuse on the power trim pump.



4. The Quicksilver Three-Button Power Trim Control Panel, if equipped, is further protected by a 20-amp in-line fuse.



5. The Quicksilver MerCathode system, if equipped, has a 20-amp in-line fuse in the wire which connects to the positive (+) terminal on the controller. If the fuse is blown, the system will not operate, resulting in a loss of corrosion protection.



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 with a continuous horn if one of the following occurs:

- The engine oil pressure is too low.
- The coolant temperature is too hot.

▲ CAUTION

Operation of the engine after the audio warning system alarm has sounded could result in damage to the power package. When the alarm has sounded, do not operate engine except to avoid 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 authorized Cummins MerCruiser Diesel dealer/distributor.

TESTING THE AUDIO WARNING SYSTEM

- 1. Turn the ignition switch to the "RUN" or (1) position; do not start the engine.
- 2. Push the audio test switch toggle lever down and hold.
- 3. Listen for the audio alarm. The alarm will sound if the system is functioning correctly.

Notes:

Section 3 - On The Water

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Before Operating Your MerCruiser Jetdrive

Read this manual carefully. Learn the difference in handling characteristics between a jet-driven boat and a propeller-driven boat including:

- Steering at low power/throttle—Unlike propeller driven boats, the jet-driven boat tends to lose steering control as less water is drawn in and expelled. Increase power/throttle slightly to regain steering.
- Maneuverability—The jetdrive is highly maneuverable at higher speeds; more so than propeller-driven boats. Use caution when turning to prevent spin-outs.
- Steering while in reverse—Unlike sterndrive or outboard driven boats, turning the steering wheel turns the bow of the boat in the same direction, i.e. turning the steering wheel clockwise moves the rear of the boat to port.

If you have any questions, contact your dealer/distributor.

ACAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake. Doing so could damage the seawater pickup pump impeller and jetdrive main seals, thereby causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

Safety and operating information that is practiced along with using good common sense can help prevent personal injury and product damage.

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 Guardapproved, 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.



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.



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 Operating the engine when the boat is moored in a confined space its
 - **b** Mooring close to another boat with its engine operating
- 2. Examples of poor ventilation while a boat is moving:



Basic Boat Operation

Launching And Boat Operation Care

▲ CAUTION

To avoid possible ingestion of water that can damage engine components, do not turn the ignition key off when the engine is above idle speed. When launching your boat from a steep ramp, enter the water slowly. Do not use the lanyard stop switch to shut off the engine above idle speed. When coming off plane, if a large following wave may roll over the boat's transom, apply a short, light burst of throttle to minimize the wave action against the stern of the boat. Do not come off plane quickly and then shut off the engine. Also avoid shifting into referse while on plane.

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

Duty Cycle Rating

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

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

PLEASURE DUTY RATING

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

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



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

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

Operation Chart - Diesel Engines

	-	r	
STARTING PROCEDURE	AFTER STARTING	WHILE UNDERWAY	STOPPING AND SHUT DOWN
Open the engine hatch. Air out the bilge completely.	Observe all the gauges and warning lights to check the condition of engine. If not normal, stop the engine.	Frequently observe all the gauges and indicator lights to monitor the engine condition.	Shift the remote control lever to the neutral position.
Turn the battery switch on, if equipped.	Check for fuel, oil, water, fluid, and exhaust leaks, etc.		Run the engine at idle speed several minutes to allow the turbocharger and the engine to cool.
Turn on and run the engine compartment bilge blower, if equipped, for five minutes.	Check the shift and throttle control operation.		On Mechanical—Engage stop switch and hold, or On Electrical—turn keyswitch "OFF," or 0, until engine completely stops.
Check for leaks—fuel, oil, water, fluid, etc.	Check steering operation.		Remove key with keyswitch in the "Off," or 0, position.
Open the fuel shut off valve, if equipped.			Turn the battery switch to "Off," if equipped.
Open the seacock, if equipped.			Close the fuel shut off valve, if equipped.
Ensure that the mechanical engine stop lever is not engaged (1.7L only).			Close the seacock, if equipped.
Prime the fuel injection system, if necessary.			Flush the seawater cooling circuit, if operating, in a saltwater, brackish, or mineral area. (See Flushing the Seawater System)
Pre-lubricate the turbocharger and engine (1.7L only), if necessary.			
Turn the key switch to "RUN," or 1, and ensure that the lights and indicator lamps come on.			
Turn key switch to "START," or S, after the indicator lamp for the glow plugs (if equipped) ceases. Release the key when engine starts.			
Ensure that the charge indicator and oil pressure indicator lamps cease after engine starts.			
Warm-up the engine at a fast idle RPM for several minutes.			

Starting, Shifting, and Stopping

▲ WARNING

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

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



a - Mechanical engine stop lever

Before Starting the Engine

ACAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake. Doing so could damage the seawater pickup pump impeller and jetdrive main seals, thereby causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

IMPORTANT: Observe the following before starting:

- Provide water to the seawater pickup pump.
- Never operate the starter motor longer than 15 seconds at a time, to avoid overheating the starter motor. If engine does not start, wait one minute to allow the starter motor to cool; then, repeat starting procedure.
- Ensure that the engine crankcase is filled to correct level with the proper grade of oil for the prevailing temperature. Refer to 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 dealer/distributor, or specified in your boat owner's manual.

Starting a Cold Engine

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

1. Place control handle in neutral.

2. If the engine has not been run for a period of time and will not readily start with the standard starting procedure, there is a hand pump/primer located on diesel engines to improve initial fuel supply. Refer to **Maintenance—Fuel System, Priming** and follow the instructions given for diesel engines.

NOTE: The 1.7L and 4.2L may be equipped with optional preheat devices (glow plugs). The preheat devices should operate at temperatures lower than –0° C (32° F). An engine coolant temperature sensor will automatically control activation and duration of preheat cycle.

3. Turn the key switch to "RUN," or 1, position to activate the glow plugs, if equipped. The preheat cycle usually lasts 10 to 15 seconds. Observe the preheat indicator (glow plug) lamp. The lamp should be illuminated when the engine cylinder temperature is too low to sustain combustion. The engine can be started after the preheat indicator lamp goes off.

NOTE: The engine should be started only after the lamp goes off.

IMPORTANT: After starting, the 1.7L MJ key switch should not be returned to the "OFF," or 0, position during engine operation. If the starter key is in the "OFF," or 0, position and the engine is operating, the battery will not be charged, audio warning alarms will not be operational in the event of trouble, and accessories may not operate.

4. Turn key switch to "START," or S, position. Release key when the engine starts. Allow the switch to return to "RUN," or 1, position.

▲ CAUTION

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

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

▲ CAUTION

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

Engine Warm Up

▲ CAUTION

Improper or insufficient engine warm-up can seriously shorten the life of a diesel engine. Ensure that the engine coolant temperature has warmed to within the normal operating range before applying full load.

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

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

- 2. After the engine has reached operating temperature:
 - a. The oil pressure should be within the range listed in the engine specifications chart. Stop the engine if the oil pressure is not within this range.
 - 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 jetdrive 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.
- 3. Locate and correct any problems, or see your Cummins MerCruiser Diesel dealer/ distributor if you are unable to determine the problem.

Starting a Warm Engine

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

Engine Shut Down (Stopping)

1. Place the remote control lever in neutral.

▲ CAUTION

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

- 2. Operate the engine at idle speed for several minutes to allow the turbocharger and engine to cool.
- 3. On mechanical engines, engage the stop switch until the engine stops completely.
- 4. Turn key switch to the "OFF," or O, position.

Freezing Temperature Operation

IMPORTANT: If you operate this boat during periods of freezing temperature, you must take precautions to prevent freeze damage to the power package. Damage caused by freezing is not covered by the Mercury MerCruiser or Cummins MerCruiser Diesel Limited Warranty.

Refer to the STORAGE section for procedures to prepare your boat for cold weather and storage.

Drain Plug and Bilge Pump

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

WHILE YOU ARE CRUISING

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



Always slow down and exercise extreme caution when boating in an area where there might be people in the water.

Whenever a jetdrive boat's engine is operating (even when the gear shift is in neutral), the impeller is rotating. This rotating impeller can cause serious injury. Keep all hands, feet, ropes, and clothing away from the jetdrive intake and exhaust.

WHILE BOAT IS STATIONARY

WARNING

Stop the 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 impeller, a moving boat, a jetdrive, or any solid device rigidly attached to a moving boat.

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

High-Speed And High-Performance Boat Operation

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 **Hi-Performance Boat Operation** booklet (90-849250-R3) from your authorized Cummins MerCruiser Diesel dealer/distributor.

Special Operating Instructions OPERATING ON THE WATER

▲ WARNING

Avoid property damage, personal injury, or death. Directional control is dependent on the water jet thrust. Sudden loss of power caused by factors like running out of gas, quickly backing off the throttle, turning off the ignition switch, or activating the lanyard stop switch, can substantially or completely reduce boat directional control.

WARNING

Avoid property damage, personal injury, or death. Be extremely careful when operating your Jetdrive in weeds, shallow water, or other areas containing debris. Operating at high speeds in areas where the jetdrive could ingest debris may create obstructions, which can cut off or reduce the jet thrust and thereby affect directional control of the boat.

▲ WARNING

Avoid serious injury or death. The Jetdrive impeller rotates whenever the engine is operating. Keep arms, legs, hair, clothing, and loose objects away from the Jetdrive intake to prevent them from being drawn into and wrapping around the impeller shaft. Stay away from the water intake and never insert an object into the water intake or water outlet nozzle when the engine is running.

A boat powered by a jetdrive has substantially different handling characteristics compared to a boat powered by a propeller. Cummins MerCruiser Diesel suggest experimenting in open water at both high and low speeds to get used to the different handling characteristics.

Although jetdrive applications do not pose some of the risks associated with exposed propeller-driven systems, the boat operator must observe the following guidelines:

 The jetdrive ingests water through the bottom water intake and redirects it to the rear for forward thrust. The jetdrive has a steerable nozzle that directs the jet thrust to the right or left. If the engine stops or the water flow is blocked, the lack of jet thrust causes the boat to slow to a stop. Steering is dependent on thrust, so when the water flow is blocked, or the engine stops, steering capability is lost.

▲ CAUTION

If the Jetdrive is tied to a dock, ensure that long ropes are not in the water when starting the engine. Ropes can be drawn into the jet pump intake, causing damage.

- Avoid the use of neutral or reverse when skiing to minimize the chance that the ski rope will be drawn up into the jet pump intake. Turn the engine off when waiting for skiers. Ensure that the ski rope is clear before starting the engine.
- Avoid weedy areas if possible. If these areas are unavoidable, traverse at high speeds to keep the boat on plane until cleared.
- Avoid operating your jetdrive in very shallow water or where there is a noticeable amount of floating debris or weeds, especially when accelerating from idle. Any loose material such as sand, shells, stones, seaweed, grass, etc. can be drawn up by the pump and cause the following problems:
 - Engine overheat
 - Steering loss
 - Blockage
 - Loss of forward or reverse motion
 - Damage to the impeller, wear ring, or stator
 - Objects expelled from the pump at high speeds
- When beaching the boat, idle in forward to reach the beach. Turn the engine off without shifting to neutral. When leaving, push the boat into approximately three feet of water. Start the engine and shift to forward. Avoid the use of neutral and reverse in shallow water.
- When the jetdrive is in neutral, the drive impeller continues to rotate. However, the reverse gate is positioned so that some of the forward thrust is diverted to create reverse thrust. This approximate balancing of forward and reverse thrust will minimize any boat movement. Because the impeller is always rotating and creating thrust when the engine is running, the boat may tend to creep slowly forward or backward. This is normal for a direct-drive, jet-driven boat. The operator should be aware of this and use caution whenever the engine is running.

- The jetdrive is always drawing water into the housing when the engine is running. Do not operate the jet drive with the grate removed from the water intake. Keep your hands, feet, hair, loose clothing, life jackets, and so on, away from the water intake in the bottom of the boat. Never insert an object into the water intake or water outlet nozzle when the engine is running.
- If the jetdrive intake becomes fouled to the point that the boat cannot reach planing speeds, attempt to clear the obstruction as follows:

IMPELLER CLEARING PROCEDURE

WARNING

Avoid injury: A rotating impeller, especially when driven by an operating engine, can cause injury. Before opening the inspection port, ensure that the engine is off, the lanyard switch, if equipped, is in the off position, and the ignition switch is in the off position with the key removed from the switch.

- 1. Turn the engine off.
- 2. Remove both battery cables.
- 3. Loosen the bolts by the inspection cover handle on the inspection cover.

NOTE: The jetdrive has a spring-loaded latch that must be pulled before the inspection cover can be rotated and released. Pull the latch to allow the cover to rotate.

4. Pull the spring-loaded latch while turning the inspection cover handle to release it from the bolts. Remove the cover.



c - Spring loaded latch

9337

- **b** Inspection cover bolts
- 5. Carefully clean the intake as necessary.
- 6. Replace the inspection cover, with the inspection cover tabs under the inspection cover bolts. Ensure that the spring loaded latch is engaged.
- 7. Securely tighten the inspection cover bolts.

▲ CAUTION

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

8. Reconnect the battery cables.

OPERATING IN FREEZING TEMPERATURES

If there is a chance of ice forming on the water, remove the boat from the water. If ice should form at the water level inside the jetdrive, it will block water flow to the engine, causing possible damage.

OPERATING IN SALTWATER OR POLLUTED WATER

Cummins MerCruiser Diesel recommends flushing the internal water passages of the engine with fresh water after each use in salty or polluted water to prevent a build up of deposits from clogging the water passages. Refer to the flushing procedure in the **Maintenance Section**.

Remove the boat and the jetdrive from the water when not in use.

Wash down the exterior and interior of the jetdrive with fresh water after each use. Each month, spray Quicksilver or Mercury Precision Corrosion Guard on external metal surfaces. Do not spray Corrsion Guard on the corrosion control anodes. Coating the anodes with Corrosion Guard will reduce the effectiveness of the anodes.

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.





Jumping Waves And Wakes

▲ 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 a boat comes partially or completely out of the water, certain hazards arise, particularly as the boat reenters the water.

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

There is another, less common hazard from allowing your boat to launch off a wave or wake. If the bow of your boat pitches down far enough while airborne, it may penetrate the water surface upon landing and submarine for an instant. In this situation, the boat could come to an abrupt stop and send the occupants flying forward. The boat could also veer sharply to one side.

Avoid Shallow Water Conditions



Avoid operating your jetdrive in very shallow water or where there is a noticeable amount of floating debris or weeds. Always be in at least three feet of water, especially when accelerating from idle speeds. Any loose material such as sand, shells, stones, seaweed, or grass can be drawn up by the pump and may cause any of the following problems:

- Engine overheating
- Loss of steering
- · Objects expelled from the pump as high-speed projectiles
- Jamming of the pump and pump blockage
- Loss of forward and reverse motion

Stopping The Boat In An Emergency

Your jetdrive powered boat has emergency stopping capability unique to this form of propulsion.

In an emergency, putting the remote control handle into reverse and applying reverse throttle can rapidly slow down your boat and reduce the stopping distance. Keep in mind, however, that such a maneuver may cause occupants in the boat to be thrown forward or even out of the boat.

WARNING

Using the emergency stopping capability of your Jetdrive unit will slow down your boat in an emergency. However, keep in mind that sudden stopping may cause the occupants in the boat to be thrown forward or ejected. This action may result in serious injury or death.

Emergency stopping may cause the bow to submerge and take on a large quantity of water if too much power is applied in reverse. Practice this procedure in a safe area, gradually increasing the throttle in reverse until the bow is just above the waterline.

Selecting Accessories For Your Jetdrive

Genuine Mercury Precision or Quicksilver Accessories have been specifically designed and tested for your Mercury MerCruiser and Cummins MerCruiser Diesel Jetdrive. These accessories are available from Mercury MerCruiser and Cummins MerCruiser Diesel dealers/distributors.

Some accessories not manufactured or sold by Mercury MerCruiser or Cummins MerCruiser Diesel are not designed to be safely used with your Mercury MerCruiser or Cummins MerCruiser Diesel Jetdrive operating system. Acquire and read the installation, operation and maintenance manuals for all your selected accessories.

WARNING

Check with your dealer before installing accessories. The misuse of approved accessories or the use of non-approved accessories can result in product failure, serious injury, or death.

Conditions Affecting Operation

Weight Distribution (Passengers And Gear) Inside The Boat

Shifting weight to the rear (stern):

Generally increases speed

- Causes the bow to bounce in choppy water
- Increases the danger of a following wave splashing into the boat when coming off plane
- At extremes, can cause the boat to "porpoise," a condition where the bow of the boat will bounce up and down similar to a propoise playing in the water. In very extreme cases, the violent pitching can cause damage to the contents of the boat, the operator can be thrown from the controls, or passengers can be thrown from the boat. If porpoising is done in rough water, it is possible for the bow of the boat to get caught in a wave, causing the boat to abruptly stop.

Shifting weight to the front (bow):

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

BOTTOM OF BOAT

To maintain maximum speed, the boat bottom should be:

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

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

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 will affect the performance of your power package. Loss of performance can be caused by:

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

Under normal operating conditions, the engine should achieve its jetdrive-rated RPM, which enhances the overall reliability and durability of the engine.

Getting Started

Engine Break-In

INITIAL BREAK-IN PROCEDURE

It is especially important that the following procedure be used on new diesel engines. This break-in procedure allows the proper seating of the pistons and rings, which greatly reduces the chances for problems.

IMPORTANT: We recommend that the boat not be accelerated quickly 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 one minute to allow the starter motor to cool; then repeat the starting procedure.

1. Refer to the appropriate Operation, Maintenace, and Warranty Manual provided with your power package for proper initial break-in procedure. Allow the engine to fast–idle until it has reached normal operating temperature.

JETDRIVE UNIT 10-HOUR BREAK-IN PERIOD

It is especially important that the following procedure be used on new MerCruiser Jetdrives. This break-in procedure allows the proper seating of drive gears and related components, which greatly reduces the likelihood of problems.

- Avoid full-throttle starts.
- Do not operate at a constant speed for extended periods of time.
- Do not exceed 75% of full throttle during the first 10 hours. During the next 5 hours, operate at intermittent full throttle.

ENGINE 20-HOUR BREAK-IN PERIOD

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

- Do not operate below 1500 RPM for extended periods of time for the first 10 hours. Shift into gear as soon as possible after starting and advance the throttle above 1500 RPM if conditions permit safe operation.
- Do not operate at a constant speed for extended periods.
- Do not exceed 75% throttle during the first 10 hours. During the next 10 hours, occasional operation at full throttle is permissible, with a maximum of 5 minutes at a time.
- Avoid full throttle acceleration from idle speed.
- Do not operate at full throttle until the engine reaches normal operating temperature.
- Frequently check the engine oil level. Add oil as needed. It is normal for oil consumption to be high during the break-in period.
- At the end of 20-Hour break-in period, change the oil and oil filter. Refer to **Specifications** and **Maintenance**. Fill the crankcase with oil of the correct grade and viscosity.

Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-Cycle Diesel Engine Oil	Crankcase	92-877695K1

After Break-In Period

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

- Ensure that the impeller allows the engine to operate at or near the top of the specified Engine Rated RPMs when at full throttle with a normal boat load. Refer to the Cummins MerCruiser Diesel's Marine Performance Curves and Data Sheet at www.cmdmarine.com.
- Operation at 75% of the rated RPM or lower is recommended. Refrain from prolonged operation at WOT RPM.
- Change the oil and oil filter. Refer to **Specifications** and **Maintenance**. Fill the crankcase with oil of the correct grade and viscosity.

Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-cycle Diesel Engine Oil	Crankcase	92-877695K1

End of First Season Checkup

At the end of the first season of operation, contact an authorized Cummins MerCruiser Diesel dealer/distributor to schedule and perform maintenance. If you are in an area where the product is operated 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

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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

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

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

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

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

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

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

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

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

Recommended Fuels

▲ CAUTION

Avoid damage to the fuel system. The use of fuels not recommended by Cummins MerCruiser Diesel may cause hard starting and other troubles such as premature wear of the injection pump plungers and the deposit of carbon residue and other contaminants on the injection nozzles.

Specifications

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.

Anti-Freeze/Coolant

▲ CAUTION

Alcohol or Methanol based antifreeze or plain water, are not recommended for use in the coolant section of the Closed Cooling System at any time.

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 assure 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. Common tap water or softened water contains unwanted minerals which can leave large deposits in the system that restrict the cooling system efficiency. 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.

The coolant, if not premixed, should be mixed before being added to the closed cooling system. Additives and inhibitors introduced into acceptable coolant solutions will form a protective film on internal the passages and provide protection against the internal cooling system erosion.

Do not drain closed cooled section for storage. The closed-cooling section should be kept filled year-round with an acceptable antifreeze/coolant solution to avoid rust forming 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 antifreeze/coolant solution to protect the engine and closed cooling system to the lowest temperature to which they will be exposed.

as this will promote.

NOTE: Generally, we reccommend a 50/50 antifreeze/coolant solution be used except when operating where seawater temperatures are greater than 32 °C (90 °F), you can use a 25/75 (antifreeze/water) solution for improved cooling performance.

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

Some acceptable types of anti-freeze/coolants are listed in the following table. Refer to **Maintenance Schedules** for respective change intervals.

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

Engine Oil

▲ CAUTION

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

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

We strongly recommend the use of:

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

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

Engine Specifications

Description	1.7 MJ	2.8 EJ	4.2 EJ
Engine Type	4 Stroke, 4 Cylinder, Vertical In-Line, 4 Valves Per Cylinder, Dual Overhead Camshaft, Direct Injection, Turbocharged, Aftercooler	4 Stroke, 4 Cylinder, Vertical In-Line, 2 Valves Per Cylinder, Direct Injection, Turbocharged, Aftercooler	4 Stroke, 6 Cylinder, Vertical In-Line, 2 Valves Per Cylinder, Direct Injection, Turbocharged, Aftercooler
Displacement	1.7 liters (103 CID)	2.8 liters (169 CID)	4.2 liters (254 CID)
Firing Order	1 - 3 - 4 - 2	1 - 3 - 4 - 2	1 - 5 - 3 - 6 - 2 - 4
Bore	79 mm (3.11 in.)	94 mm (3.700 in.)	94 mm (3.700 in.)
Stroke	86 mm (3.39 in.)	100 mm (3.937 in.)	100 mm (3.937 in.)
Rated Engine RPM Idle RPM in Neutral	Refer to Cummins MerCruiser Diesel's Marine Performance Curves And Data Sheet (www.cmdmarine.com).		
			70° C (160° F)
Thermostat, Coolant *	95° C (203° F)	80° C (1° F)	96° C (205° F)
Coolant Temperature (Peak)	104° C (219° F)	95° C (203° F)	82° C (180° F) ²
Electrical System	12-volt Negative (–) Ground		
Recommended Battery Rating	515 CCA, 652 mca, or 65 Ah	750 cca, 950 mca, or 180 Ah	750 cca, 950 mca, or 180 Ah

*The 4.2L is equipped with 2 thermostats.

Fluid Specifications ENGINE

IMPORTANT: All capacities are approximate fluid measures.

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

1.7L MJ	Capacity
Total Engine Oil (With Filter) *	41/2 liters (41/4 U.S. quart)
Closed Cooling System	8¾ liters (9¼ U.S. quart)
2.8L EJ	Capacity
Total Engine Oil (With Filter) *	10 liters (8½ U.S. quart)
Closed Cooling System	11 liters (11-2/3 U.S. quart)
4.2L EJ	Capacity
Total Engine Oil (With Filter) *	12 liters (12¾ U.S. quart)
Closed Cooling System	13 liters (13¾ U.S. quart)

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

JETDRIVE

IMPORTANT: All capacities are approximate fluid measures.

NOTE: Oil capacity includes drive lube monitor.

Specifications

All Models	Capacity	Fluid Type	Part Number
DJ10P Gearbox	1.1 liters (1.16 U.S. quart)	High Dorformonoo Coor Lubo	02 00205444
Rear bearing stator hub	370 ml (12.5 U.S. fluid ounces)	High-Performance Gear Lube	92-002004A1

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Section 5 - Maintenance

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Maintenance Section Organization

The **Maintenance Section** of your Diesel Jetdrive Owners Manual has been organized for your convenience into four easy to find and use groups. The groups are arranged:

- Jetdrive and Common Maintenance—Information and maintenance common to all three engines and the jetdrive.
- 1.7L MJ Engine Maintenance—Information and maintenance specific to the 1.7L MJ diesel engine.
- 2.8L EJ Engine Maintenance—Information and maintenance specific to the 2.8L EJ diesel engine.
- 4.2L EJ Engine Maintenance—Information and maintenance specific to the 4.2L EJ diesel engine.

Jetdrive and General Engine Maintenance

Owner/Operator Responsibilities

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

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

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

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

▲ WARNING

Fuel vapors can be present in the engine compartment. Avoid injury or power package damage caused by fuel vapors or explosion. Always ventilate the engine compartment prior to servicing the power package.

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

NOTE: Maintenance points are color-coded for easy identification. See the decal on the engine for identification.

- Blue—Coolant
- Yellow—Engine Oil
- Orange—Fuel
- Black—Gear Lube Oil
- 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. Electronic engine controls and special fuel delivery systems provide greater fuel economy, but also are more complex for the untrained mechanic.

If you prefer to perform your own maintenance, here are some suggestions:

- 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 that 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 them to determine the problem. This will cost you more than taking it to the dealer immediately upon having a problem. A very simple adjustment may be able to correct the problem.
- Do not telephone the dealer, service office or the factory to ask them to diagnose a problem or to request the repair procedure. It is difficult to diagnose a problem over the telephone.

Your authorized Cummins MerCruiser Diesel dealer is there to service your power package. They have qualified factory-trained mechanics.

We reccommend that the dealer does periodic maintenance checks on your power package. Have them winterize it in the fall and service it before the boating season. These steps will reduce the likelihood of any problems occurring during your boating season.

Inspection

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

- Check for loose, damaged or missing parts, hoses, and clamps. Tighten or replace as necessary.
- Check wiring and connectors for damage.
- Remove the inspection port and inspect the impeller. If it is badly nicked, bent or cracked, contact your authorized Cummins MerCruiser Diesel dealer.
- Repair nicks and corrosion damage on the exterior finish of the power package . Contact your authorized Cummins MerCruiser Diesel dealer.

Maintenance Schedule—Jetdrive Models

ROUTINE MAINTENANCE

NOTE: Only perform maintenance which applies to your particular power package.

EACH DAY START

- Check the engine oil (This interval can be extended based on experience).
- Check the coolant level.
- Check the oil level in the jetdrive gear box and in the trim pump (if equipped).
- Check the fluid level of the power shift assist pump.
- Check the water inlets for debris or marine growth. Check the seawater strainer and clean, if necessary.

EACH DAY END

- If operating in salt, brackish or polluted waters, flush the cooling system after each use.
- If operating in freezing temperatures, drain any water from the fuel filter after each use.

WEEKLY

- Inspect the drive unit anodes and replace if they are 50% eroded or more.
- If operating in normal conditions, drain any water from the fuel filter after each use.

EVERY TWO MONTHS OR 50 HOURS (WHICHEVER OCCURS FIRST)

- If operating in saltwater or brackish or polluted water only: treat the power package with Corrosion Guard.
- Check the battery connections and the fluid level.
- Inspect and clean the air filter or air cleaner (depending on the model).
- Ensure that the gauges and the wiring connections are secure. Clean the gauges.

NOTE: If operating in saltwater, interval is reduced to every 25 hours or 30 days whichever occurs first.

SCHEDULED MAINTENANCE

NOTE: Perform only the maintenance tasks which apply to your particular power package. AFTER FIRST 20 HOURS

• Change the engine oil and filter.

AFTER FIRST 50 HOURS

- Check the level and condition of the jetdrive gear box and stator lubricant.
- Check the engine sacrifical anodes and replace if 50% consumed.
- Torque the exhaust riser clamp (1.7L engines only).

EVERY 100 HOURS OR ANNUALLY (WHICHEVER OCCURS FIRST)

- Check the jetdrive-to-engine alignment (must be performed by an authorized Cummins MerCruiser dealer/distributor).
- Touch up paint the power package.
- Change the engine oil and filter.
- Change the jetdrive gearbox oil.
- Change the jetdrive stator housing oil.
- Remove the impeller and lubricate impeller shaft with Quicksilver or Mercury Precision 2-4-C w/Teflon® to prevent the impeller from seizing the shaft.
- Grease the engine coupling.

NOTE: Lubricate the engine coupler every 50 hours if operated at idle for prolonged periods of time.

- Torque the engine mounts.
- Torque the connection of the steering shaft.
- Check the steering system and the remote control for loose, missing or damaged parts. Lubricate the cables and the linkages.
- Check the continuity circuit for loose or damaged connections. Test the MerCathode unit output, if equipped.
- Inspect the condition and the tension of the belts.
- Replace the 2.8L and 4.2L air filters.
- Clean the seawater section of the closed cooling system.
- Clean, inspect and test the pressure cap.
- Check the engine sacrificial anodes and replace if 50% consumed.

EVERY 200 HOURS OR ANNUALLY (WHICHEVER OCCURS FIRST)

- Check cooling system and exhaust system hose clamps for tightness. Inspect both systems for damage or leaks.
- Drain the condensation from the 1.7L aftercooler.
- Clean the seawater section of the closed cooling system.

EVERY 200 HOURS

• Replace the coolant.

EVERY 300 HOURS OR 3 YEARS (WHICHEVER OCCURS FIRST)

- Disassemble and inspect the seawater pump and replace worn components.
- Check the electrical system for loose, damaged, or corroded fasteners.
- Inspect the timing belt and pulleys on the 1.7L.

EVERY 500 HOURS OR 5 YEARS (WHICHEVER OCCURS FIRST)

• Clean the aftercooler core.

EVERY 1000 HOURS OR 5 YEARS

- Replace the timing belt on the 1.7L engine.
- Check the valve clearance on the 1.7L engine.
- Clean the fuel tank.

Maintenance Log

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

Date	Maintenance Performed	Engine Hours

Engine to Jetdrive Alignment

▲ CAUTION

Check or repeat the engine alignment procedure at 100 hours or the first service interval, which ever occurs first.

The engine-to-jetdrive alignment is critical to the logevity of the engine-to-jetdrive coupler. Have the engine-to-jetdrive alignment checked by your authorized Cummins MerCruiser dealer/distributor.

Jetdrive Oil CHECKING

NOTE: Oil level will fluctuate during operation. Check the oil with the engine cold, before starting.

 Check the gear lube oil level. Keep the oil level at or near the "OPERATING RANGE" (full) line in the gear lube monitor. If any water is visible at the bottom of the monitor or appears at the oil fill/drain plug or if the oil appears discolored, contact your authorized Cummins MerCruiser Diesel dealer/distributor immediately. Both conditions may indicate a water leak somewhere in the jetdrive.



Gear lube monitor shown removed from jetdrive transmission for clarity

a - Gear lube monitor cap

<mark>b</mark> - Full line

FILLING

IMPORTANT: If more than 59 ml (2 fl. oz.) of Quicksilver High-Performance Gear Lube is required to fill the monitor, a seal may be leaking. Damage to the jetdrive may occur due to lack of lubrication. Contact your authorized Cummins MerCruiser Diesel dealer/ distributor.

- 1. Remove the gear lube monitor cap.
- 2. Fill to the "OPERATING RANGE" (full) line with specified fluid.

Description	Where Used	Part Number
High-Performance Gear Lube	Gear lube monitor	92-802854A1

3. Replace the gear lube monitor cap.

CHANGING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

Power Shift Assist Pump Fluid CHECKING

- 1. Stop the engine.
- 2. Remove the fill cap and observe the level of the fluid on the attached dipstick.
 - a. Proper fluid level with the engine at normal operating temperature should be between the full hot and full cold marks.
 - b. Proper fluid level with the engine cold should be between the full cold mark and the end of the dipstick.



Typical

- a Fill cap with attached dipstick
- **b** Full hot mark

- c Full cold mark
- d Fluid reservoir

IMPORTANT: If fluid is not visible in the pump, contact your authorized Cummins MerCruiser Diesel dealer/distributor.

FILLING

- 1. Remove the fill cap with integral dipstick and observe the level.
- 2. Add Quicksilver Power Trim and Steering Fluid or Dexron III Automatic Transmission Fluid (ATF) to bring the fluid level up to the proper level.

Tube Ref No.	Description	Where Used	Part No.
114 (0	Power Trim and Steering Fluid	Reservior	92-802880A1

3. Install the fill cap/dipstick.

CHANGING

Power Shift Assist Pump fluid does not require changing for routine maintenance unless it becomes contaminated with water or debris. Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

Rear Stator Housing Oil

▲ CAUTION

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

CHECKING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

FILLING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

CHANGING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

Power Trim Pump Fluid, If Equipped

CHECKING

1. Remove the fill cap from the reservoir.



- 2. Observe the Power Trim And Steering Fluid level. Level must be up to, but not over the bottom of the fill opening on the reservoir.
- 3. Fill as necessary with the specified Power Trim And Steering Fluid.

Tube Ref No.	Description	Where Used	Part No.
114 0	Power Trim and Steering Fluid	Power trim pump	92-802880A1

FILLING

- 1. Remove the fill cap from the reservoir.
- 2. Add Power Trim And Steering Fluid to bring level up to, but not over the bottom of the fill opening on the reservoir.

Tube Ref No.	Description	Where Used	Part No.
114 0	Power Trim and Steering Fluid	Power trim pump	92-802880A1

3. Install the fill cap.

CHANGING

Power Trim And Steering Fluid does not require changing unless it becomes contaminated with water or debris. Contact your authorized Cummins MerCruiser Diesel dealer/ distributor.

Lubrication

STEERING SYSTEM

▲ WARNING

Do not grease steering cable while it is extended. Hydraulic lock could occur and cause loss of steering control.

 If Steering Cable Has Grease Fittings: Turn the steering wheel until the steering cable is fully retracted into the cable housing. Apply approximately three pumps of grease from a typical hand-operated grease gun.

NOTE: If the steering cable does not have a grease fitting, the inner wire of cable cannot be greased.



a - Steering cable grease fitting

	Tube Ref No.	Description	Where Used	Part No.
ſ	95 (0	2-4-C with Teflon	Steering cable	92-802859A1

2. Turn the steering wheel until the steering cable is fully extended. Lightly lubricate the exposed part of the cable.

Tube Ref No.	Description	Where Used	Part No.
34 0	Special Lubricant 101	Steering cable	92-802865A1

3. Lubricate the steering system pivot points.



6626

Extended steering cable and pivot points

Tube Ref No.	Description	Where Used	Part No.
80 (0	SAE Engine Oil 30W	Pivot points	Obtain Locally

4. Remove the steering rod anchor bolt from the tiller. Coat with lubricant and replace. Torque the steering rod anchor bolt.



7388

a - Steering rod anchor bolt

Description	Nm	lb. in.	lb. ft.
Steering rod anchor bolt	35		26

Tube Ref No.	Description	Where Used	Part No.
34 0	Special Lubricant 101	Steering cable	92-802865A1

Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-cycle Diesel Engine Oil	Pivot points	92-877695K1

5. On dual engine boats: Lubricate the tie bar pivot points.

Tube Ref No.	Description	Where Used	Part No.
80 0	SAE Engine Oil 30W	Tie bar pivot points	Obtain Locally

6. Upon first starting the engine, turn the steering wheel several times to starboard and then to port to ensure that the steering system operates properly before getting underway.

REVERSE BUCKET CABLE

1. Extend the stainless end guide of the cable and coat it with lubricant. Move it back and forth to allow an even distribution of the lubricant.



6626

Tube Ref No.	Description	Where Used	Part No.
95 (0	2-4-C Marine Lubricant with Teflon	Reverse bucket cable and end guide	92-802859A1

- 2. Move the remote control until the reverse bucket actuator cable is fully extended. Lightly lubricate the exposed part of cable.
- 3. Lubricate the pivot points of the reverse bucket actuator .



- a Cable connecting clevis
- **b** Actuator knee joint

- c Barrel pivot bolt
- Tube Ref No.DescriptionWhere UsedPart No.80 0SAE Engine Oil 30WReverse bucket actuator cable
and pivot pointsObtain Locally
- 4. On dual engine boats: Lubricate the tie bar pivot points.

Tube Ref No.	Description	Where Used	Part No.
80 (0	SAE Engine Oil 30W	Tie bar pivot points	Obtain Locally

Battery

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

WARNING

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 ENGINE

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 <u>unless a battery isolator is used.</u>

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.

Corrosion Protection EXTERNAL COMPONENTS

Whenever two or more dissimilar metals (like those found on the drive unit) 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 the power package components that are exposed to water. Refer to the Marine Corrosion Protection Guide (90-88181301).



Port anodes shown, starboard similar

- a Intake body (2)
- **b** Discharge nozzle (2)

IMPORTANT: Replace sacrificial anodes if eroded 50 percent or more.

MerCathode System (if equipped): System should be tested to ensure adequate output. The test should be performed where boat is moored, using Quicksilver Reference Electrode and Test Meter. Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

c - Reverse bucket (2)

In addition to the corrosion protection devices, the following steps should be taken to inhibit corrosion:

- 1. Paint your power package. Refer to Painting The Power Package.
- 2. Spray the power package components on the inside of the boat annually with Corrosion Guard to protect the finish from dulling and corrosion. You may also spray the external power package components.
- 3. Lubricate all lubrication points, especially steering system and remote control linkages, should be kept well lubricated.
- 4. Flush the cooling system periodically, preferably after each use.

PAINTING THE POWER PACKAGE

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

1. **Painting Boat Hull or Boat Transom:** You may apply anti-fouling paint to the boat hull and boat transom, but you must observe the following:

IMPORTANT: Do not paint anodes or MerCathode System reference electrode and anodes, if equipped, as this will render them ineffective as galvanic corrosion inhibitors. IMPORTANT: If anti-fouling protection is required for the boat hull or transom, you may use copper-based paints, if not prohibited by law. If you use copper-based anti-fouling paints, observe the following:

 Avoid any electrical interconnection between the Cummins MerCruiser Diesel Product, anodic blocks, or MerCathode system (if equipped), and the paint by allowing a minimum of 40 mm (1-1/2 in.) unpainted area on the transom of the boat around these items.



2. **Painting Jetdrive or Transom Assembly:** Jetdrive and transom assembly should be painted with a good quality marine paint or an anti-fouling paint that does not contain copper, or any other material that could conduct electrical current. Do not paint drain holes, anodes, the MerCathode system (if equipped), and items specified by the boat manufacturer.

Water Pickup Options

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







Typical Through The Transom Pickup

Cleaning The Seawater Strainer, If Equipped

1. Visually inspect seawater strainer through the glass top.

▲ 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.

▲ CAUTION

Do not overtighten cover screws. Overtightening the cover screws may cause the cover to warp and allow water to leak into the boat, thereby causing the boat to sink or causing engine and property damage.

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



f - O-ring

Seawater Pump Impeller

Seawater pump impeller and impeller splines should be inspected for wear or damage at scheduled maintenance interval or whenever insufficient seawater flow is suspected (if operating temperature exceeds normal range). This maintenance should be performed by an authorized Cummins MerCruiser Diesel dealer/distributor.

1.7L MJ Engine Maintenance

Engine Oil

▲ CAUTION

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

CHECKING

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



a - Dipstick

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

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



4. Install the oil dipstick.

FILLING

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



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

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

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

3. Install the oil fill cap.

CHANGING OIL AND FILTER

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

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

- 1. Start the engine and allow it to warm up to normal operating temperature.
- 2. Stop the engine and allow some time for the oil to drain into the oil pan (approximately five minutes).
- 3. Remove the dipstick.

4. Install the crankcase oil pump. Push the adapter onto the dipstick tube and attach the pump.



- a Dipstick tube
 b Quicksilver Hose/Oil Pump Adapter (32-863642)
- C Quicksilver Crankcase Oil Pump (802889A1)

▲ CAUTION

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

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



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

Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-Cycle Diesel Engine Oil	Oil filter O-rings	92-877695K1

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

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

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

- 14. Remove the oil fill cap and refill the engine with new oil. Refer to Filling.
- 15. Add specified oil to bring level up to, but not over, maximum oil level mark "MAX" on dipstick.



^{16.} Install oil fill cap.

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

17. Pre-lubricate the turbocharger and engine.

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

- a. Hold the stop switch engaged while you simultaneously turn the key switch to "START," or S position for 15 seconds. This will rotate the starter motor and the engine oil pump.
- b. During this process the engine will not run because no fuel is injected. If the engine starts, turn off immediately.
- c. Allow the starter motor to cool down for one minute.
- 18. Repeat step 17 one more time then proceed to step 19.
- 19. Start and operate the engine for five minutes and wait for about five minutes.
- 20. Remove the oil dipstick. Wipe the dipstick clean and reinstall it into the dipstick tube.

A CAUTION

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

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

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

22. Start the engine and check for leaks.

Engine Coolant CHECKING

ACAUTION

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly. Only then should you push the cap downward and turn it for removal.

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

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



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

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



- a Coolant recovery bottle c "ADD" mark b - "FULL" mark
- 7. Add the specified coolant as necessary. Refer to Filling

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

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

Inspect the coolant recovery system for leaks.

Inspect the pressure cap gaskets for damage and replace if necessary.



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

FILLING

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

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

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

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

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

CHANGING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

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.

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

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

1. Remove the boat from the water, if possible, or turn on the bilge pump, if the boat is in the water.

▲ CAUTION

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

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

▲ CAUTION

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

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



a - Drain plug

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



a - Drain plug

6. While draining, repeatedly clean out the drain holes using a stiff piece of wire. Do this until the entire system is drained.

7. On models equipped with a seawater strainer: remove the hose at the seawater strainer and drain the hose completely. Drain and empty the seawater strainer. Reconnect the hose and tighten the hose clamps securely. Install the washer and drain plug.



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

Tube Ref No.	Description	Where Used	Part No.
19 (0	Perfect Seal	Drain plugs	92-34227-1

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

FLUSHING THE SEAWATER SYSTEM

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

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

ACAUTION

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.

ACAUTION

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

1. If flushing the engine with the boat in the water:

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



- D Seawater miet nose
- b. Using an appropriate adapter, connect the flushing hose from a water tap to the seawater inlet hose on the seawater pickup pump inlet.



c. Proceed to Step 3.

▲ CAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake, as damage to the seawater pickup pump impeller and jetdrive main seals could occur, causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

2. If flushing the engine with the boat out of the water: supply water to the engine and the intake of the jetdrive, ensuring that water is making contact with the ceramic drive seals. This cooling water is necessary to avoid damage to the ceramic seal whenever the engine is running.

▲ WARNING

This jetdrive has an internal rotating impeller that could cause injury if contact is made with hands, clothing, or tools. To avoid injury, keep hands and clothing away from the inlet or outlet of the jetdrive, regardless of whether the boat is in the water. Secure tools and loose items to avoid being struck by projectiles as a result of contact with the rotating impeller, and to prevent damage to the impeller.

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



- b. Supply water to the intake of the jetdrive, ensuring water is making contact with the ceramic drive seals. This cooling water is necessary to prevent damage to the ceramic seal whenever the engine is running.
- c. Proceed to Step 3.
- 3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.

ACAUTION

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

4. Place the remote control in neutral, idle speed position and start the engine.

ACAUTION

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

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

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



b - Seawater inlet pump hose

ACAUTION

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

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

Air Cleaner

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

CLEANING

- 1. Remove any debris present at openings.
- 2. Ensure that the air cleaner is mounted (clamped) securely at all times.



REPLACEMENT

Replace the assembly if it is cracked or damaged.

Aftercooler Condensation

On the 1.7L MJ, the condensation must be drained from the aftercooler periodically. Refer to **Maintenance Schedules** for interval.

1. Remove the small condensate drain plug from the aftercooler.



- **a** Condensate drain plug
- 2. Drain the liquid that may have condensed in the aftercooler during operation.
- 3. Apply sealer to the threads of the condensate drain plug and install after the aftercooler has drained.

Tube Ref No.	Description	Where Used	Part No.
19 0	Perfect Seal	Drain plug	92-34227-1

4. Tighten the condensate drain plug securely.

Water Separating Fuel Filter

WARNING

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

▲ 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.

ACAUTION

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

▲ CAUTION

If water enters the fuel injection system, take the unit to an authorized Cummins MerCruiser Diesel dealer/distributor immediately to prevent corrosion and rusting of the injectors and other components.

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

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

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

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

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

DRAINING

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

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

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

- 1. Install a short piece of hose to help direct the water and fuel from the water separating fuel filter.
- 2. Place a small container at the end of the drain hose beneath the drain cap on the filter.
- 3. Open the drain cap by turning the cap counterclockwise (as viewed from the bottom of the filter) approximately five turns.



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



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

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

REPLACING

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

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



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



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



Typical mounting bracket and filter

a - Filter sealing surface

b - Sealing ring

Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-Cycle Diesel Engine Oil	O-rings	92-877695K1

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

FILLING

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

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

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



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

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



3. Tighten the bleed screw.

Fuel System PRIMING

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

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



2. Attempt to start the engine.

PURGING AIR

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

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



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



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



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

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

FUEL TANK CLEANING AND FLUSHING

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

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

Engine Lubrication THROTTLE CABLE

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



Tube Ref No.	Description	Where Used	Part No.
121 (0	15W40 4-Cycle Diesel Engine Oil	Pivot points, guide contact surfaces	92-877695K1

ENGINE COUPLER

1. Lubricate the engine coupler splines through the grease fittings on the coupler by applying approximately 8 - 10 pumps of grease from a typical hand-operated grease gun.

NOTE: If the boat is operated at idle for prolonged periods of time, coupler should be lubricated every 50 hours.



a - Engine coupler grease fitting (not visible)

Tube Ref No.	Description	Where Used	Part No.
91 (0	Engine Coupler Spline Grease	Engine coupler	92-802869A1

18373

Rear Engine Mount

NOTE: Refer to the Operation, Maintenance, and Warranty Manual provided with the power package for front engine mount information.

1. Torque the rear engine mount bolts.



a - Rear engine mount bolts

Description	Nm	lb. in.	lb. ft.
Rear engine mount bolts	51		38

Corrosion Protection

Whenever two or more dissimilar metals (like 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 authorized Cummins MerCruiser Diesel dealer/distributor for additional information.

INTERNAL CORROSION PROTECTION COMPONENTS

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

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

Sacrificial anode locations:

• Front and rear of the heat exchanger.





 d - Anode plug and sacrificial anode assembly

REMOVAL

1. Allow the engine to cool.

▲ CAUTION

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

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

INSPECTION

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

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

- 1. Replace the anode assembly when deteriorated 50%.
 - Length when new-32 mm (1-1/4 in.)
 - Diameter when new–15 mm (5/8 in.)

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

2. Discard the sealing washer.



INSTALLATION

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



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



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

Drive Belts

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

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



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

CHECKING SERPENTINE BELT

1. The various components are:



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

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

- Fraying
- Glazed surfaces



Replace the belt if necessary.

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



Power shift assist pump, bracket, and belt shown removed for clarity only

a - Automatic tensioner

CHECKING POWER SHIFT ASSIST PUMP BELT

- 1. Inspect the power shift assist pump belt for proper tension and for the following:
 - Excessive wear
 - Cracks
 - Fraying
 - Glazed surfaces
- 2. Check the tension of the power shift assist pump belt by depressing upper strand of power shift assist belt with light thumb pressure (approximately 5 kgf [11 lbf.], at the point shown.) The belt should move no more than 5 mm (3/16 inches) either way. Adjust or replace the belt if necessary.



- a Power shift assist pump belt tension check point
- **b** Power shift assist pump

c - Seawater pump and drive pulley for power shift assist pump

2.8L EJ Engine Maintenance

Engine Oil

▲ CAUTION

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

CHECKING

▲ CAUTION

Avoid possible injury or damage to the crankcase oil dipstick and 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. If it becomes necessary 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 as follows.



FILLING

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



Shown without engine cover

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.

2.8L EJ	Capacity Liters (U.S. qts)	Fluid Type
Engine Oil (With Filter)	8.9 liter (9.4 U.S. quart)	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

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

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

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

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



Typical engine and oil drain hose, all similar

c - Crankcase oil pump

Тооі	Part Number
Crankcase oil pump	802889Q1, or equivalent

- 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.

a - Threaded fitting

b - Oil drain hose

- 9. 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.



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

Tube Ref No.	Description	Where Used	Part No.
121 (0	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 sound.

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.

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. Refer to 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.

Engine Coolant

ACAUTION

Avoid serious injury from burns. Do not remove the coolant cap when the engine is hot. Coolant may discharge violently.

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.



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



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 authorized Cummins MerCruiser Diesel dealer/distributor.
- d. Refer to **Filling** and add the specified coolant as necessary.

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 is low in the coolant expansion tank, add 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.



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

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

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

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

Drain the power package before flushing or prior to cold weather, freezing temperatures, seasonal storage or extended storage.

1. Remove the boat from the water, if possible, or turn on the bilge pump, if the boat is in the water.

ACAUTION

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

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

▲ CAUTION

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

▲ CAUTION

Avoid damage to the heat exchanger and subsequent possible engine damage. Remove all water from the heat exchanger sections. Failure to do so could cause corrosion or freeze damage to the water passage tubes of the heat exchanger. 4. Remove the drain plug, or fitting if equipped, from the aft end cover of the power shift fluid cooler.



NOTE: In the following steps, it may be necessary to lower or bend the hoses to allow water to drain completely.

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



7. Repeatedly clean out the drain holes using a stiff piece of wire. Do this until the entire system is drained.



8. On models equipped with a seawater strainer: remove the hose at the seawater strainer and drain the hose completely. Drain and empty the seawater strainer. Reconnect the hose and tighten the hose clamps securely. Install the washer and drain plug.



9. Coat the threads of the drain plugs with sealant and install after the seawater section of the cooling system has been drained completely. Tighten the plug securely.

Tube Ref No.	Description	Where Used	Part No.
19 0	Perfect Seal	Drain plugs	92-34227-1

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

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

FLUSHING THE SEAWATER SYSTEM

Flushing is needed only for salty, brackish, mineral laden or polluted water applications. Flushing is recommended after each outing for best results. **NOTE:** The closed cooling section of the cooling system that contains coolant does not need to be flushed. Coolant is changed at specified intervals. Refer to **Maintenance Schedules.**

▲ 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.

▲ CAUTION

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

- 1. If flushing the engine with the boat in the water:
 - a. Close the seacock, if equipped, or disconnect and plug the seawater inlet hose.



a - Seacockb - Seawater inlet hose



b. Connect the flushing hose from a water tap to the seawater pump inlet hose connected to the seawater pump inlet using an appropriate adapter.



c. Proceed to Step 3.

▲ CAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake. Doing so could damage the seawater pickup pump impeller and jetdrive main seals, thereby causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

2. If boat is out of the water: supply water to the intake of the jetdrive, ensuring water is making contact with the ceramic drive seals. This cooling water is necessary to avoid damage to the ceramic seal whenever the engine is running.

▲ WARNING

This jetdrive has an internal rotating impeller that could cause injury if contact is made with hands, clothing, or tools. To avoid injury, keep hands and clothing away from the inlet or outlet of the jetdrive, regardless of whether the boat is in the water. Secure tools and loose items to avoid being struck by projectiles as a result of contact with the rotating impeller, and to prevent damage to the impeller.

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



- b. Supply water to the intake of the jetdrive, ensuring water is making contact with the ceramic drive seals. This cooling water is necessary to avoid damage to the ceramic seal whenever the engine is running.
- c. Proceed to Step 3.
- 3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.



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

4. Place the remote control in neutral, idle speed position and start the engine.

▲ CAUTION

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

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

▲ CAUTION

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

Air Filter CLEANING

1. Remove the nut, hardware, bracket and cover, if equipped, attached to the air filter. Do not remove air filter bracket from engine.



2. Carefully remove the air filter element from the air filter bracket mounted on the turbocharger inlet. Do not remove the air filter bracket from the engine.



Shown removed from engine for clarity only

a - Air filter element

b - Air filter bracket

A CAUTION

Avoid potential fire hazards and injury or damage to the polyester foam element. Do not clean the foam element in petroleum-based solvents or cleaners.

- 3. Wash the air cleaner element in warm water and detergent until clean.
- 4. Allow the foam element to completely dry before use.

IMPORTANT: No treatment (such as partial oil saturation) is required or recommended on the air cleaner foam element prior to use. Use the element clean and dry for proper filtration.

5. Install the air cleaner element onto the air cleaner bracket.

IMPORTANT: To prevent unfiltered air from entering the engine be certain that all of the air intake screen is covered by the foam element when installed.

6. Install the cover, bracket, hardware and nut, if equipped, to the air cleaner. Tighten the nut securely.

REPLACEMENT

Replace the air cleaner element if it is deteriorated or torn. Refer to **Maintenance Schedules** for replacement interval under normal conditions.

Water Separating Fuel Filter

WARNING

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

▲ 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.

ACAUTION

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

▲ CAUTION

If water enters the fuel injection system, take the unit to an authorized Cummins MerCruiser Diesel dealer/distributor immediately to prevent corrosion and rusting of the injectors and other components.

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

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

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

DRAINING

The 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.



- 3. Drain until the fuel is clear in appearance.
- 4. Close the drain cap by turning clockwise. Tighten securely.
- 5. Refer to Filling and fill the fuel filter.

REPLACING

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

1. Twist the locking ring by hand. Remove the water separating fuel filter and sealing ring from the mounting bracket. Do not use a filter wrench.



- **b** Water separating fuel filter
- 2. Remove and retain the drain cap.
- 3. Discard the used filter as defined by local authorities.
- 4. Install the retained drain cap and O-ring on the new filter.
5. Lubricate the sealing ring on the new filter.



Tube Ref No.	Description	Where Used	Part No.
80 0	SAE Engine Oil 30W	Water separating fuel filter sealing ring	Obtain Locally

- 6. Clean the filter sealing surface on the mounting bracket.
- 7. Align the filter to the bracket. Twist the locking ring by hand to secure the filter to the bracket. Do not use a filter wrench.
- 8. Ensure the drain cap is securely tightened.



- 9. Connect the WIF wires, if equipped.
- 10. Refer to Filling. Fill the fuel filter.
- 11. Check the filter and drain cap for fuel leaks.
- 12. Start and operate the engine. Check the filter connection for fuel leaks. If leaks exist, recheck filter installation. If leaks continue, stop engine immediately and contact your authorized Cummins MerCruiser dealer/distributor.

FILLING

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

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

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

1. Loosen the bleed screw on the fuel filter bracket.



- a Bleed screw
- 2. Move the plunger on the hand pump/primer up and down repeatedly, until an air free stream of fuel flows from the bleed screw. The filter is full when this occurs.



3. Tighten the bleed screw.

Fuel System PRIMING

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

- 1. Move the hand pump/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. Refer to 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.

Engine Lubrication THROTTLE CABLE

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

a - Pivot points

b - Guide contact surfaces

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

ENGINE COUPLER

1. Lubricate the engine coupler splines through the grease fittings on the coupler by applying approximately 8-10 pumps of grease from a typical hand-operated grease gun.

NOTE: If the boat is operated at idle for prolonged periods of time, the coupler should be lubricated every 50 hours.



a - Engine coupler grease fitting

90-866351050 NOVEMBER 2005

	Tube Ref No.	Description	Where Used	Part No.
ſ	91 (0	Engine Coupler Spline Grease	Engine coupler	92-802869A1

Rear Engine Mount

NOTE: Refer to the Operation, Maintenance, and Warranty Manual provided with the power package for front engine mount information.

1. Torque the rear engine mount bolts.



a - Rear engine mount bolts

Description	Nm	lb. in.	lb. ft.
Rear engine mount bolts	51		38

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Corrosion Protection

Whenever two or more dissimilar metals (like 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 authorized Cummins MerCruiser Diesel dealer/distributor for additional information.

INTERNAL CORROSION PROTECTION COMPONENTS

Anodes have been installed as part of the aftercooler system, which serves as a sacrificial anode to protect the engine from corrosion.

This sacrificial anode is installed in the seawater circuit to help avoid electrolytic corrosion caused by seawater.

Sacrificial anode location:

Top of the aftercooler end cover.

•



b - Anode plug and sacrificial anode

REMOVAL

1. Allow the engine to cool.

ACAUTION

18256

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

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

INSPECTION

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

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

1. Replace anode assembly when deteriorated 50%.

- Length When New— 19 mm (3/4 in.)
- Diameter When New©—16 mm (5/8 in.)

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

2. Discard the sealing washer.



INSTALLATION

- 1. Install the new sealing washer.
- 2. Install the anode plug with sacrificial anode and washer into heat exchanger or aftercooler end cover. Tighten securely.



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



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

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

Drive Belts

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

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

WARNING

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

CHECKING SERPENTINE BELT

1. The various components are:



Typical, power shift assist pump and belt shown removed for clarity only

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

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

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

- Fraying •
- Glazed surfaces
- Proper tension



- 3. Check operation of the automatic tensioner and associated components.
 - a. Position a suitable tool in the square tool opening and move (rotate) tensioner pulley in direction of arrow.
 - b. Release and allow to glide back slowly.

c. Tensioner must return to its initial position.



CHECKING POWER SHIFT ASSIST PUMP BELT

- 1. Inspect the power shift assist pump belt for proper tension and for the following:
 - Excessive wear
 - Cracks
 - Fraying
 - Glazed surfaces
- 2. Check the tension by depressing the upper strand of the power shift assist belt, with light thumb pressure (approximately 5 kgf [11 lbf.]), at point shown. The belt should move no more than 5 mm (3/16 inches) either way. Adjust or replace the belt if necessary.



a - Power shift assist pump belt tension check point

4.2L EJ Engine Maintenance

Engine Oil

▲ CAUTION

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

CHECKING

▲ CAUTION

Avoid possible injury or damage to the crankcase oil dipstick and 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. If it becomes necessary 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. Oil must be between the marks on the dipstick. If necessary, add oil as follows.



FILLING

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



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

4.2L EJ	Capacity liters (U.S. qts.)	Fluid Type
Engine Oil (With Filter)	12 liter (12-3/4 U.S. Quart)	4-Cycle 25W40 Marine Engine Oil

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

3. Reinstall the oil fill cap.

CHANGING OIL AND FILTER

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

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

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

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



b - Oil drain hose

Tool	Part number
Crankcase oil pump	Quicksilver Part Number 802889Q1

ACAUTION

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

- 5. Pump the oil out of the crankcase into a drain pan.
- 6. When the crankcase is empty, remove the crankcase oil pump and install the crankcase oil drain hose fitting. Tighten securely.
- 7. Remove and discard the oil filter and sealing ring.
- 8. Contain and dispose of the oil or oil waste as directed by local authorities.
- 9. Apply lubricant to the sealing ring on the new filter and install the filter. Hand tighten only, do not use a filter wrench.



a - Oil filter

10. Remove the oil fill cap and refill the engine with new oil. Refer to Filling.

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

- 11. Install the oil fill cap.
- 12. Start the engine and check for leaks.

Engine Coolant

WARNING

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

CHECKING

- 1. Allow the engine to cool.
- 2. Remove the pressure cap from the heat exchanger and observe the coolant level.



3. The coolant level in the heat exchanger should be at the bottom of the fill neck. If coolant is low refer to **Filling.**

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

- 4. Install the pressure cap. Tighten until it contacts locking tabs on the fill neck.
- 5. With the engine at normal operating temperature, check the coolant level in the coolant recovery bottle.

6. If coolant level is low, refer to Filling.



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



- a Gaskets
- c. The pressure cap maintains pressure on the coolant tank. It may not be holding pressure properly. Contact your authorized Cummins MerCruiser Diesel dealer/ distributor to have the cap tested .
- 8. 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 heat exchanger and observe the coolant level.



- a Pressure cap
- 3. If the coolant is low in the heat exchanger, add specified coolant as necessary to bring the level up to the bottom of the fill neck.

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

- 4. Install the pressure cap. Tighten until it contacts locking tabs on the fill neck.
- 5. Remove the fill cap from the coolant recovery bottle.
- 6. Fill to the "FULL" mark with the specified coolant.

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

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

CHANGING

Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

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

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

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

1. Remove the boat from the water, if possible, or turn on the bilge pump, if the boat is in the water.

▲ CAUTION

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

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

ACAUTION

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

4. Remove the end covers from both port and starboard ends of the upper and lower sections of the heat exchanger tank.



4.2L MJ heat exchanger tanks

a - Upper end cover

b - Lower end cover

- 5. Drain the heat exchanger tank completely.
- 6. Sponge-out, soak-up, or use compressed air to remove any water that remains in the bottom part of each section, until all water passage tubes are completely free of standing water.

NOTE: In the following steps, it may be necessary to lower or bend the hoses to allow water to drain completely.

7. Disconnect the seawater outlet hose at the aft end of the power steering cooler. Lower the hose and drain completely.



a - Seawater outlet hose

8. Remove the drain plug from the aft end cover of the aftercooler.



Typical

- a Drain plug
- 9. Remove the seawater pump outlet hose from the top of the seawater pump. Drain the hose.



- a Seawater pump outlet hose
- 10. Repeatedly clean out the drain holes using a stiff piece of wire. Do this until the entire seawater system is drained.

11. On models equipped with a seawater strainer: remove the hose at the seawater strainer and drain the hose completely. Drain and empty the seawater strainer. Reconnect the hose and tighten the hose clamps securely. Install the washer and drain plug.



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

Tube Ref No.	Description	Where Used	Part No.
19 0	Perfect Seal	Drain plugs	92-34227-1

- 13. Reconnect the hoses. Tighten the hose clamps securely.
- 14. Replace the end cover gaskets and seals if worn or deteriorated. Install all four end cover assemblies on the heat exchanger.
- 15. Torque the end covers on the upper and lower heat exchanger sections.

Description	Nm	lb. in.	lb. ft.
Upper heater exchanger end covers	14 - 15	120 - 132	
Lower heat exchanger end covers	11 - 14	108 - 120	

FLUSHING THE SEAWATER SYSTEM

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

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



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.

▲ CAUTION

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

1. If flushing the engine with the boat in the water:

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



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



c. Proceed to Step 3.

ACAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake. Doing so could damage the seawater pickup pump impeller and jetdrive main seals, thereby causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

2. If flushing the engine witht the boat out of the water: supply water to the engine and the intake of the jetdrive, ensuring water is making contact with the ceramic drive seals. This cooling water is necessary to avoid damage to the ceramic seal whenever the engine is running.

▲ WARNING

This jetdrive has an internal rotating impeller that could cause injury if contact is made with hands, clothing, or tools. To avoid injury, keep hands and clothing away from the inlet or outlet of the jetdrive, regardless of whether the boat is in the water. Secure tools and loose items to avoid being struck by projectiles as a result of contact with the rotating impeller, and to prevent damage to the impeller.

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



- b. Supply water to the intake of the jetdrive, ensuring water is making contact with the ceramic drive seals. This cooling water is necessary to prevent damage to the ceramic seal whenever the engine is running.
- c. Proceed to Step 3.
- 3. Partially open the water tap to about 1/2 maximum. Do not use full water pressure.

ACAUTION

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

4. Place the remote control in neutral, idle speed position and start the engine.

ACAUTION

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

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

▲ CAUTION

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

Air Filter CLEANING

1. Remove the nut, hardware, bracket and cover, if equipped, attached to the air filter. Do not remove air filter bracket from engine.



a - Bracket c - Cover b - Nut <image><image>

2. Carefully remove the air filter element from the air filter bracket mounted on the turbocharger inlet. Do not remove the air filter bracket from the engine.

Shown removed from engine for clarity only

a - Air filter element

b - Air filter bracket

▲ CAUTION

Avoid potential fire hazards and injury or damage to the polyester foam element. Do not clean the foam element in petroleum-based solvents or cleaners.

- 3. Wash the air cleaner element in warm water and detergent until clean.
- 4. Allow the foam element to completely dry before use.

IMPORTANT: No treatment (such as partial oil saturation) is required or recommended on the air cleaner foam element prior to use. Use the element clean and dry for proper filtration.

5. Install the air cleaner element onto the air cleaner bracket.

IMPORTANT: To prevent unfiltered air from entering the engine be certain that all of the air intake screen is covered by the foam element when installed.

6. Install the cover, bracket, hardware and nut, if equipped, to the air cleaner. Tighten the nut securely.

REPLACEMENT

Replace the air cleaner element if it is deteriorated or torn. Refer to **Maintenance Schedules** for replacement interval under normal conditions.

Water Separating Fuel Filter

▲ WARNING

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

▲ 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

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

▲ CAUTION

If water enters the fuel injection system, take the unit to an authorized Cummins MerCruiser Diesel dealer/distributor immediately to prevent corrosion and rusting of the injectors and other components.

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

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

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

DRAINING

The 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.



- 3. Drain until the fuel is clear in appearance.
- 4. Close the drain cap by turning clockwise. Tighten securely.
- 5. Refer to **Filling** and fill the fuel filter.

REPLACING

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

1. Twist the locking ring by hand. Remove the water separating fuel filter and sealing ring from the mounting bracket. Do not use a filter wrench.



- **b** Water separating fuel filter
- 2. Remove and retain the drain cap.
- 3. Discard the used filter as defined by local authorities.
- 4. Install the retained drain cap and O-ring on the new filter.

5. Lubricate the sealing ring on the new filter.



Tube Ref No.	Description	Where Used	Part No.
80 0	SAE Engine Oil 30W	Water separating fuel filter sealing ring	Obtain Locally

- 6. Clean the filter sealing surface on the mounting bracket.
- 7. Align the filter to the bracket. Twist the locking ring by hand to secure the filter to the bracket. Do not use a filter wrench.
- 8. Ensure the drain cap is securely tightened.



- 9. Connect the WIF wires, if equipped.
- 10. Refer to Filling. Fill the fuel filter.
- 11. Check the filter and drain cap for fuel leaks.
- 12. Start and operate the engine. Check the filter connection for fuel leaks. If leaks exist, recheck filter installation. If leaks continue, stop engine immediately and contact your authorized Cummins MerCruiser dealer/distributor.

FILLING

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

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

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

1. Loosen the bleed screw on the fuel filter bracket.





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



3. Tighten the bleed screw.

Fuel System PRIMING

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

- 1. Move the hand pump/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. Refer to 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.

Engine Lubrication THROTTLE CABLE

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



b - Guide contact surfaces

Tube Ref No.	Description	Where Used	Part No.
80	SAE Engine Oil 30W	Pivot points, guide contact surfaces	Obtain Locally

ENGINE COUPLER

1. Lubricate the engine coupler splines through the grease fittings on the coupler by applying approximately 8 - 10 pumps of grease from a typical hand-operated grease gun.

NOTE: If the boat is operated at idle for prolonged periods of time, the coupler should be lubricated every 50 hours.



a - Engine coupler grease fitting

	Tube Ref No.	Description	Where Used	Part No.
ſ	91 (0	Engine Coupler Spline Grease	Engine coupler grease fittings	92-802869A1

18013

Rear Engine Mount

NOTE: Refer to the Operation, Maintenance, and Warranty Manual provided with the power package for front engine mount information.

1. Torque the rear engine mount bolts.



18958

a - Rear engine mount bolts

Description	Nm	lb. in.	lb. ft.
Rear engine mount bolts	51		38

Corrosion Protection

Whenever two or more dissimilar metals (like 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 authorized Cummins MerCruiser Diesel dealer/distributor for additional information.

INTERNAL CORROSION PROTECTION COMPONENTS

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

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

Sacrificial anode locations:

• Starboard, aft-side of the heat exchanger.

•

Top of the intercooler end cover.



a - Heat Exchangerb - Intercooler End Cover



c - Anode Plug And Sacrificial Anode

REMOVAL

1. Allow the engine to cool.

ACAUTION

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

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

INSPECTION

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

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

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

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

2. Discard the sealing washer.



INSTALLATION

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



- b Sealing washer
- 3. Unplug and connect the seawater inlet hose, or open the seacock if equipped.



- 4. Ensure that the engine is supplied with sufficient cooling water.
- 5. Start the engine and check for leaks.

Drive Belts

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

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

IMPORTANT: On models with dual-row pulleys and dual belts always inspect both belts. Never renew just one of the two belts driving the alternator and engine water circulating pump. Always replace both belts as a pair, preferably as a matched pair.

▲ WARNING

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

ALTERNATOR DRIVE BELT AND ENGINE WATER CIRCULATING PUMP BELT OR BELTS

- 1. Inspect drive belt, or belts, for excessive wear or damage.
- 2. Check belt tension by depressing upper strand of belt, with moderate hand pressure, at point shown. Belt should move no more than 5 mm (3/16 in.) either way.



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CHECKING POWER SHIFT ASSIST PUMP BELT

- 1. Inspect the power shift assist pump belt for proper tension and for the following:
 - Excessive wear
 - Cracks
 - Fraying
 - Glazed surfaces
- 2. Check the tension by depressing the upper strand of the power shift assist belt, with light thumb pressure (approximately 5 kgf [11 lbf.]), at point shown. The belt should move no more than 5 mm (3/16 inches) either way. Adjust or replace the belt if necessary.



6

Section 6 - Storage

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Cold Weather (Freezing Temperature) Storage	

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

IMPORTANT: Cummins MerCruiser Diesel strongly recommends that this service should be performed by an authorized Cummins MerCruiser Diesel dealer/distributor. Damage caused by freezing is not covered by the Cummins MerCruiser Diesel Limited Warranty.

▲ CAUTION

Avoid damage to the cooling system and engine. Water trapped in the seawater section of the cooling system can cause corrosion damage or freeze damage. Ensure that the seawater section of the cooling system is drained immediately after operation and before storing in any location that may experience freezing temperatures.

Consider a boat to be "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 protect the power package from freeze damage, corrosion damage, or both types of damage during storage.

Freeze damage can be caused 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.

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

Preparing Your Power Package For Storage

IMPORTANT: If the boat has already been removed from the water, before starting the engine a source of water must be supplied to the water intake (inlet) openings. Follow all warnings and flushing attachment procedures stated in Section 5–Flushing The Seawater System.

▲ CAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake, as damage to the seawater pickup pump impeller and jetdrive main seals could occur, causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

- 1. If the boat is out of the water, make sure to supply water to both the engine and jetdrive intakes. Jetdrive seals will be damaged if the jetdrive is allowed to run without cooling water being supplied to the seals.
- 2. Start the engine and operate at idle until it reaches normal operating temperature.
- 3. Stop the engine.
- 4. Change the engine oil and oil filter.
- 5. Start the engine and operate for about 2–3 minutes. Check for oil leaks.
- 6. Flush the seawater cooling system. Refer to **Section 5—Flushing** procedure shown earlier in this manual.
- 7. Check the jetdrive oil; contact your authorized Cummins MerCruiser Diesel dealer/ distributor if water is present or the oil has 100 or more hours of operating time.

WARNING

To avoid serious injury or death, remove battery cables before opening the inspection port.

8. Remove both battery cables.

WARNING

Avoid injury: A rotating impeller, especially when driven by an operating engine, can cause injury. Before opening the inspection port, ensure that the engine is off, the lanyard switch, if equipped, is in the off position, and the ignition switch is in the off position with the key removed from the switch.

9. Remove the inspection cover and ensure that the impeller area is clean and clear of foreign debris. Refer to **Section 3—Impeller Clearing Procedure** for details.



- a Inspection cover handleb Inspection cover bolts
- c Spring-loaded latch

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Cold Weather (Freezing Temperature) Storage

1. Read all the precautions and perform all the procedures found in **Section 5–Draining The Seawater System** and drain the seawater section of the cooling system.

▲ CAUTION

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

- 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. Fill the seawater cooling system with a mixture of propylene glycol antifreeze and tap water for additional assurance against freezing and corrosion. Refer to **Seasonal Storage Instructions** in this section.

Seasonal Storage

- 1. Read all precautions and perform all procedures found in **Preparing Your Power Package For Storage**.
- 2. Read all precautions and perform all procedures found in **Section 5–Draining The Seawater System** and drain the seawater section of the cooling system.

IMPORTANT: Cummins MerCruiser Diesel recommends that propylene glycol antifreeze be used 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. For 1.7L MJ Engines:

- a. Fill a container with approximately 5.6 liters (6 U.S. quarts) of propylene glycol antifreeze and tap water mixed to the manufacturer's recommendation to protect the engine to the lowest temperature to which it will be exposed during the cold weather or extended storage.
- b. Remove the anode plug from front cover of heat exchanger.



a - Anode plug

- c. Using a suitable funnel, slowly pour the propylene glycol antifreeze mixture through the anode plug opening and into the seawater system until the system is full.
- d. Install the anode plug. Tighten securely.
- 4. For 2.8L EJ and 4.2L EJ Engines:
 - a. Fill a container with approximately 5.6 liters (6 U.S. quarts) of propylene glycol antifreeze and tap water mixed to the manufacturer's recommendation to protect the engine to the lowest temperature to which it will be exposed during cold weather or extended storage.

b. Disconnect the seawater inlet hose from the connector fitting. Temporarily connect an appropriate length piece of hose to the connector fitting using an adapter, if required, and place the other end of the hose into the container of propylene glycol antifreeze and tap water.



Typical-4.2L EJ Shown, 2.8L EJ similar

a - Inlet hose

b - Connector fitting

 C - Container of propylene glycol antifreeze and tap water

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

- c. Run engine until the propylene glycol antifreeze is drawn into the engine.
- d. Stop the engine.
- e. Connect the seawater inlet hose to the seawater inlet hose connector fitting.
- 5. Clean the engine.
- 6. Coat the engine with Quicksilver Corrosion Guard or equivalent corrosion inhibiting oil.
- Your Mercury MerCruiser or Cummins MerCruiser Diesel dealer/distributor should now perform all checks, inspections, lubrication and fluid changes outlined in Section 5– Maintenance Schedules.

Battery

Follow the battery manufacturer's instructions for storage.

Power Package Recommissioning

NOTICE	
Refer to Cold Weather Or Extended Storage precautions, before proceeding.	

- 1. Ensure that all the cooling system hoses are in good condition, connected properly, and the hose clamps are tight.
- 2. Verify that all the drain valves and the drain plugs are installed and tight.
- 3. Inspect all the drive belts.
- 4. Perform all the lubrication and maintenance specified for completion Annually in the **Maintenance Schedule**, except items that were performed at the time of the engine layup.
- 5. Lubricate the jetdrive to engine coupling
- 6. Fill the fuel tanks with fresh fuel. Old fuel should not be used. Check the fuel lines and connections for leaks and general condition.
- 7. Replace the fuel filter.
- 8. Check the jetdrive to engine alignment. Refer to an authorized Cummins MerCruiser Diesel dealer/distributor.

▲ CAUTION

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

- 9. 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.
- 10. Coat the terminals with a battery terminal anti-corrosion spray to help retard corrosion.
- 11. Perform all the checks on the **Operation Chart** in the **Starting Procedure** column. Refer to **SECTION 3**.

▲ CAUTION

Do not operate the engine without water flowing through the seawater pickup pump and the jetdrive intake. Doing so could damage the seawater pickup pump impeller and jetdrive main seals, thereby causing subsequent overheating damage to the engine or seal damage to the jetdrive unit, or both.

12. Supply cooling water to the water inlet openings.

IMPORTANT: On the 1.7L MJ Diesel Only: After not having been operated for two months or longer, it is necessary to pre-lubricate the 1.7L MJ Diesel engines and the turbocharger. To do this, hold the stop switch engaged while, simultaneously, turning the key switch to the "START," or S, position for 15 seconds. This will rotate the starter motor, engine, and oil pump. During this process the engine will not run because no fuel is injected. Allow the starter motor to cool down for one minute and repeat the above described process. To avoid overheating the starter motor, do not engage starter motor for more than 15 seconds each time.

- 13. Pre-lubricate the 1.7L MJ engine and turbocharger, if applicable. Refer to above **Important** information.
- 14. Start the engine and closely observe instrumentation. Ensure that all systems are functioning correctly.
- 15. Carefully inspect the engine for fuel, oil, fluid, water and exhaust leaks.
- 16. Inspect the steering system, shift and throttle control for proper operation.

Storage

Notes:

Section 7 - Troubleshooting

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Diagnosing Electronically Controlled Fuel System Problems

Your authorized Cummins MerCruiser Diesel dealer/distributor 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.

Starter Motor Will Not Crank Engine, Or Cranks Slow

Possible Cause	Remedy
Battery switch turned off.	Turn the battery switch on.
Remote control not in neutral position.	Position remote control lever in neutral.
Open circuit breaker or blown fuse.	Check and reset the circuit breaker or replace the fuse.
Loose or dirty electrical connections or damaged wiring.	Check all electrical connections and wires (especially the battery cables). Clean and tighten any faulty connections.
The battery is bad.	Test the battery and replace if it is bad.
Clogged or damaged jetdrive.	Clear the intake; repair the impeller; see an authorized Cummins MerCruiser Diesel dealer/ distributor.

Engine Will Not Start, Or Is Hard To Start

Possible Cause	Remedy
The lanyard stop switch is activated.	Check the lanyard stop switch.
Improper starting procedure.	Read and use the starting procedure.
The fuel tank is empty or the fuel shut off valve is closed.	Fill the fuel tank or open the fuel shut off valve.
The throttle is not operating properly.	Check the throttle for freedom of movement.
The electrical stop-circuit is faulty .	Have an authorized Cummins MerCruiser Diesel dealer/distributor service the electrical stop circuit.
Fuel filters are clogged.	Replace the fuel filters.
Fuel is stale or contaminated.	Drain the fuel tank. Fill the fuel tank with fresh fuel.
Fuel line or tank vent line is kinked or clogged.	Replace any kinked lines or blow out clogged lines with compressed air to remove obstruction.
Air in the fuel injection system.	Purge the fuel injection system.
Faulty wire connections.	Check the wire connections.
Glow-plugs or glow-plug system inoperative, if so equipped.	Test, and repair or replace components as needed.
An injector/injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Injection timing is incorrect.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Jet drive clogged or damaged.	Clear the intake; repair the impeller, see an authorized Cummins MerCruiser Diesel dealer/ distributor.
Electronic fuel system faulty.	Have the electronic fuel system checked by an authorized Cummins MerCruiser Diesel Dealer/ Distributor.

Engine Runs Rough, Misses or Backfires

Possible Cause	Remedy
Throttle is not operating properly.	Check the throttle linkages for binding or obstructions. Have the throttle inspected by an authorized Cummins MerCruiser Diesel dealer/ distributor.
Idle speed is too low.	Check the idle speed and have it adjusted by an authorized Cummins MerCruiser Diesel dealer/ distributor, if necessary.
Clogged fuel or air filters.	Replace filters.
Fuel is stale or contaminated.	If contaminated, drain the 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 the fuel injection system.	Purge fuel injection system.
Injector/injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Injection pump governor malfunction, if equipped.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Electronic fuel system fault.	Have the electronic fuel system checked by an authorized Cummins MerCruiser dealer/distributor.

Poor Performance

Possible Cause	Remedy
Throttle is not fully opening.	Inspect throttle cable and linkages for operation.
Impeller is damaged.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Excessive bilge water.	Drain and check for cause of entry.
Boat is overloaded or the load is improperly distributed.	Reduce load or redistribute load more evenly.
Boat bottom is fouled or damaged.	Clean or repair as necessary.
Air is in the fuel injection system.	Purge fuel injection system.
Fuel or air filters are clogged.	Replace filters.
Fuel is leaking from overflow valve.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Valve clearance adjustment is incorrect.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Injection pump governor spring deteriorated.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Fuel injection amount uneven between cylinders.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Cylinder compression pressure leakage.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Electronic fuel system fault.	Have the electronic fuel system checked by an authorized Cummins MerCruiser Dealer/Distributor.

Excessive Engine Temperature

Possible Cause	Remedy
Water inlet or seacock closed.	Open water inlet or seacock.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups or sea strainer obstructed.	Remove obstruction.
Thermostat faulty.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Coolant level low in closed cooling section.	Check for cause of low coolant level and repair. Fill system with proper coolant solution.
Heat exchanger cores plugged with foreign material.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Loss of pressure in closed cooling section.	Check for leaks. Clean, inspect and test pressure cap.
Faulty seawater pickup pump.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
Seawater discharge restricted or plugged.	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.
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
I harmostat taulity	Have inspected by an authorized Cummins MerCruiser Diesel dealer/distributor.

Turbocharger—Noisy Or Rough Operation

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

Turbocharger—White Smoke

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

Low Engine Oil Pressure

Possible Cause	Remedy
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).
Faulty senders.	Have system checked by an authorized Cummins MerCruiser Diesel dealer/distributor.
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 serpentine belt and/or check automatic tensioner.
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 shift or throttle linkages.	Remove obstruction.
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see an authorized Cummins MerCruiser Diesel dealer/distributor immediately.
Shift or throttle cable kinked.	Straighten cable or have an authorized Cummins MerCruiser Diesel dealer/distributor replace cable if damaged beyond repair.
Improper shift cable adjustment.	Have adjustment checked by an authorized Cummins MerCruiser Diesel dealer/distributor.
Reverse bucket power assist pump not working properly.	Have the pump checked by an authorized Cummins MerCruiser Diesel dealer/distributor.

Steering Wheel Turns Hard Or Jerky

Possible Cause	Remedy	
Insufficient lubrication on steering components.	Lubricate steering components.	
Loose or missing steering fasteners or parts.	Check all parts and fasteners. If any are loose or missing, see an authorized Cummins MerCruiser Diesel dealer/distributor.	

Reverse Gate Moves Hard or Jerky

Possible Cause	Remedy		
Low power shift assist pump fluid level.	Check for leak. Refill system with fluid.		
Drive belt loose or in poor condition.	Replace and/or adjust.		
Insufficient lubrication on reverse gate components.	Lubricate.		
Loose or missing reverse gate fasteners or parts.	Check all parts and fasteners if any are loose or missing, see an authorized Cummins MerCruiser Diesel dealer/distributor.		
Contaminated power shift assist fluid.	See an authorized Cummins MerCruiser Diesel dealer/distributor.		

Power Trim Does Not Operate (Motor Does Not Operate)

Possible Cause	Remedy	
Blown fuse.	Replace fuse.	
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connection. Repair or replace wiring.	

Power Trim Does Not Operate (Motor Operates But Drive Unit Does Not Move)

Possible Cause	Remedy	
Trim pump oil level low.	Fill pump with oil.	
Power trim operation binding.	Check for obstruction.	

Section 8 - Customer Assistance Information

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Outside The United States and Canada

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/distributors in the recovery of stolen motors.

Attention Required After Submersion

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

Replacement Service Parts

▲ WARNING

Electrical, ignition and fuel system components on Cummins MerCruiser Diesel Engines and Jetdrives are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion. Use of replacement electrical or fuel system components that do not comply to these rules and regulations could result in a fire or explosion hazard and should be avoided. When servicing the electrical and fuel systems, it is extremely important that all components be properly installed and tightened. Otherwise, an opening in an electrical component could permit sparks to ignite fuel vapors from fuel system leaks.

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

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

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

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 should he 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 dealer/distributor. If additional assistance is required, take these steps:

- 1. Talk with the dealership's sales manager or service manager. If this has already been done, then contact the owner of the dealership.
- 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.

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	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 sub payment to	omit the following order form with D:	ı	Mercury Marine Attn: Publications W6250 West Pior P.O. Box 1939 Fond du Lac, WI	neer Road	
Ship To: (F	Please copy this form and print o	r type–T	his is your shippin	g label)	
Name					
Address					
City, State,	, Province				
ZIP or post	tal code				
Country					
Quantity	Item	Stock	Number	Price	Total
					-
					-
	Total Due				