MERCURY MerCruiser

Service Bulletin

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Diagnostic Supplement for MerCruiser Engines With Emission Control Technology (ECT)

Scope

Worldwide.

Models Affected

All sterndrive and inboard engines with Emissions Control Technology (ECT).

Situation

After a customer has been notified by the warning horn, OBDM light, or a SmartCraft gauge message, the CDS G3 service tool reports "OBDM Fault: Engine Misfire Limit Exceeded" in "Active Faults" and fault 396 in "Freeze Frame Data" buffers. In subsequent testing, however, the technician is often unable to detect a cylinder misfire.

396	**Engine Misfire**	396 - OBDM Fault: Engine Misfire Limit Exceeded

Cause

The fault indicates that the PCM detected excessive cylinder misfire. The PCM can detect cylinder misfire before a technician can detect it. Since the misfiring is not detectable by the technician in most cases, correcting this fault can be very difficult for those unfamiliar with diagnosing emissions-related systems.

The PCM calibrations for ECT engines have several internal diagnostic programs that check for problems. The "Cylinder Misfire Detection" routine is one such program, while another is the "Catalyst Monitor" diagnostic routine. This routine determines if the emissions control system is working correctly. The "Catalyst Monitor" diagnostic routine is a self-test function that activates once per engine run cycle. Upon activation, completion is dependent on the engine operating within specific RPM and load ranges.

NOTE: *The "Cylinder Misfire Detection" program runs continuously, regardless of RPM, load, and fuel control mode.*

Certain active faults prevent the "Catalyst Monitor" diagnostic routine from starting. These faults are related to the following systems:

- ☐ ECT sensor and circuit
- ☐ EMCT sensors and circuit
- ☐ IAT sensor and circuit
- ☐ Fuel injectors and circuits
- ☐ Oxygen sensors and circuits
- ☐ TPS sensor and circuits
- ☐ 12V and 5V electrical systems

Diagnostic Information

This bulletin provides information on the probable causes of the "Cylinder Misfire Limit Exceeded" fault and outlines a diagnostic procedure to efficiently resolve the fault. Cylinder misfire in 4-stroke gasoline engines can be caused by many different engine systems and components. Cylinder misfire is not something new and unique to MerCruiser ECT engines. What is new is the PCM's ability to detect cylinder misfire and set a diagnostic fault.

The actual cause of cylinder misfire can be as varied as the systems and components that make up a complete engine. A technician must remember the basics of engine operation—intake, compression, ignition, and exhaust—when determining the root cause of a misfire fault. Never assume that the PCM09 is the cause of the misfire unless complete and thorough diagnostics prove it defective. Likely causes of misfire can be found in two major areas—engine components and systems. Within these areas, the causes include:

- ☐ Mechanical problems related to valve operation
  - Sticking intake or exhaust valves
  - Crankcase oil level too high, causing oil aeration and hydraulic lifter malfunction
  - Combustion chamber leakage caused by damaged cylinders, pistons, rings, head gaskets, and valves
- ☐ Dirty or damaged fuel injectors, fuel filters, or fuel lines
- ☐ Fuel rail pressure not within specifications
- ☐ Gasoline that does not meet the minimum specifications listed in the MerCruiser Operation, Maintenance, and Warranty manual
- ☐ Degraded, contaminated or otherwise unusable gasoline
- ☐ Electrical system problems
  - Damaged, melted, or corroded harnesses and cables
  - Damaged connectors, terminals and internal splices.
- ☐ Ignition system problems
  - Weak or erratic spark
  - Incorrect or erratic ignition timing
  - Damaged or defective spark plug wires
  - Damaged, defective or incorrect spark plugs
  - Non-resistor spark plugs or spark plug leads installed
- ☐ Product installation, rigging issues, or both
  - Incorrect drive gear ratio
  - Incorrect X-dimension
  - Incorrect application (power-to-weight ratio)
  - Incorrect propeller selection
- ☐ Vibrations or frequencies in the drivetrain
  - Propeller ventilation and cavitation
  - Propeller damage and defective repairs
  - Sterndrives gear failure
  - Bent or twisted propeller shafts
- ☐ Incorrect operation of the engine (Refer to the MerCruiser Operation, Maintenance, and Warranty manual provided with the product.)
- ☐ Incorrect use of the tilt and trim system (Refer to the MerCruiser Operation, Maintenance, and Warranty manual provided with the product.)
- ☐ EMI (electromagnetic interference) or RFI (radio frequency interference)
  - CAN circuit leads routed close to the spark plugs or spark plug wires
  - Non-resistor spark plugs or spark plug leads installed

Related Service Bulletins

- **Service Bulletin 2011-06**: Replacement Distributor Cap on MerCruiser MPI Engines With HVS Ignition Systems (5.0, 5.7 and 6.2 models)

- **Service Bulletin 2011-08**: Crankshaft Position Sensor Connection

Diagnostic Procedure

NOTICE
Catalytic converters can be damaged by an overly rich or lean fuel mixture. Do not disconnect a spark plug lead or a fuel injector while the engine is operating.

If the procedures listed in **Related Service Bulletins** do not correct the misfire fault, proceed as follows:

1. Discuss the correct operation of the boat and engine with the primary operator; review the operation of the trim and tilt system to ensure that the engine is not lugging or overloaded at wide-open-throttle (WOT).
2. Carefully inspect the engine and drive system for:
   - Fluid leaks, impact damage, incorrect rigging or installation
   - Loose components or brackets, or missing fasteners and cotter pins
   - Evidence of overheating
   - Tampering, incorrect repairs, or modifications, especially to the electrical and fuel systems
   - Correct fluid levels and serpentine belt tension

   NOTE: *Do not operate the engine with the crankcase over-filled. Remove excessive oil to prevent hydraulic valve malfunction.*
3. Verify that the battery is fully charged and is of sufficient capacity for the engine being tested. If in doubt, substitute a battery that is known to be good.
4. Check for loose battery cable connections. Check each end of both cables.
   - If any connection is loose, disconnect and inspect it before tightening it.
   - The starter solenoid stud is copper and can be easily deformed. Therefore, the nut on the stud must not be overtightened or the solenoid may fail prematurely.
   - If a block fuse is present on the starter solenoid, verify that the through-bolt is securely tightened.
   - A ground stud must first be securely tightened into the engine block and then the nut tightened to the stud. Studs that are loose in the block will cause erratic operation.
   - If the negative battery cable is not connected to the same engine ground stud as the EFI system ground leads, consider moving the negative battery cable to that ground stud.
5. Verify the safety lanyard tether is securely connected. Also, inspect for a substandard or defective lanyard switch. These often cause an erratic or intermittent voltage supply to the engine.
6. Check all manifold vacuum lines for splits, kinks, proper routing, and connections.
   - Verify that the fuel pressure regulator vent line is connected to the proper fitting and is not kinked, damaged, or disconnected.
   - A PCV valve, if equipped, acts as a calibrated air leak. If an incorrect or malfunctioning PCV valve is present, engine operation will be most affected at lower engine speeds.
   - Check for air leaks in the induction system caused by loose, leaking, or missing throttle body or intake manifold gaskets.
   - Using the G3 service tool, check the IAC% values at idle. If lower than normal, an air leak in the induction system is likely.
   - DTS engines do not use an IAC valve. DTS engines will display lower than the normal TPS% specified values when an air leak is present.
7. Inspect the fuel supply system.
   - Check for loose clamps, blocked vents, kinked lines, incorrect components, or modifications.
   - Check the fuel and vent lines for proper routing, damage, or deterioration.
   - Change the fuel filters at the specified service interval or if contamination is suspected.
8. Use the G3 service tool to scan for "Active Faults" and "Freeze Frame Data."
   - Certain active faults prevent the "Catalyst Monitor" diagnostic routine from activating. Do not attempt to verify proper "Catalyst Monitor" diagnostic routine function if active faults are present.
   - Do not attempt to diagnose or correct the "Cylinder Misfire Limit Exceeded" fault until all other active faults have been repaired and cleared.

- "Freeze Frame Data" buffers contain faults that occurred in the past. Do not forget—faults found in "Freeze Frame Data" buffers are not indications of current problems.
- The "Engine Run Time" stored in each "Freeze Frame Data" buffer is the total engine run time since the fault last occurred. This data will tell you how recently the fault occurred. Faults that have not recently occurred are generally not of concern.

9. Verify the mechanical integrity of the engine by performing a compression test and a cylinder leak-down test on each cylinder. An engine with mechanical defects that cause low compression or excessive cylinder leakage will never produce full power. Do not assume the engine is mechanically sound unless you have proven it. Refer to the appropriate MerCruiser Service Manual for exact test procedures.
10. Remove and inspect the spark plugs.
    a. Verify that the correct spark plugs are installed.
    b. Replace any spark plug that is damaged, worn, or fouled.
        - Check for indications of mechanical damage, cracked insulators, and the correct gap.
        - Look for metal transfer, melted electrodes, or blistering on the insulator from pre-ignition or detonation.
        - Check for carbon build-up or fouling from excessive oil consumption or rich air-to-fuel mixtures.
    c. Install, if not already done, and tighten the spark plugs as specified in the appropriate MerCruiser service manual.
11. Inspect and test the electrical system.
    a. Disconnect and carefully inspect the battery cables from the engine and the battery.
        - Carefully inspect for corrosion, loose terminals, and damage from arcing or overheating. Repair or replace as necessary.
        - Verify that the ground (–) studs are not corroded, damaged, or loose. If they are, remove, clean, reinstall, and securely tighten. Replace if necessary.
        - Remove any wing nuts used on the battery connections and replace them with corrosion-resistant hex nuts.
    b. Reconnect the battery cables and securely tighten the nuts with a wrench.
    c. Verify that all of the connectors are securely attached and locked (if equipped with locks).
    d. Unplug and inspect the three PCM connectors.
        - Refer to the appropriate MerCruiser service manual charts to identify the pins that are used or not used.
        - Ensure that none of the PCM pins are bent and that all of the pins are present that have been identified as being used.
        - Inspect for terminal corrosion, terminal or body damage, and indications of abuse to the pin locking mechanisms.
        - Check for melted, chafed, or other insulation damage. Inspect for evidence of short circuits or other damage that will prevent proper function.
    e. Unplug and inspect the EFI sensors and actuators.
        - Inspect for terminal corrosion, terminal or body damage, and indications of abuse to the pin locking mechanisms.
        - Check for signs of tampering, corrosion, damage to the pin locking mechanisms, melted insulation, and other evidence of short circuits or damage that would prevent proper function.
        - Based on the results of the inspection, further inspection of the harness may be necessary, including wire and connector wiggle tests.

    NOTE: *If there is damage to the external connections, inspect the related internal wire splices for damage.*
12. Check the boat wiring harness and engine wiring harness.
    - On mechanical shift engines:
        i. Isolate the boat harness from the engine using the 14-pin shunt tool or a key switch harness that uses the 14-pin connector.
        ii. Clear the OBDM faults using the CDS G3 tool and test run the boat on open water.
        iii. If the fault does not return, a problem exists in the boat harness or helm harness.
    - On DTS engines:
        i. If available, substitute the boat's helm and 14-pin main CAN harness with a test helm and harness.
        ii. Clear the OBDM faults using the CDS G3 tool and test run the boat on open water.
        iii. If the fault does not return, a problem exists in the boat harness or helm harness.

13. Check the CDS G3 service tool to see if any "Active Tests" ("Electronic Shift Test," "Smart Start Test," or "Electronic Throttle Body Test") are available for the engine you are working on. Perform those that are available to verify each system operates correctly.
14. Inspect and test the ignition system.
    - 4.3, 5.0, 5.7, and 6.2 liter engine models:
        - Verify that the High Voltage Switch (HVS) is indexed properly with the engine at number 1 cylinder TDC. Refer to the appropriate MerCruiser service manual.
        - Inspect the crankshaft reluctor wheel by looking into the bore of the crankshaft position sensor mount. Check for excessive paint buildup on the outer surface of each vane. Use the starter to bump the engine over until each vane has been inspected. Remove all paint buildup that appears to be thicker than a light layer.
    - 3.0 L MPI engine models:
        - Ensure that the crankshaft position sensor air gap is set to 0.64–1.02 mm (0.024–0.040 in.).
        - Inspect the crankshaft reluctor wheel by looking at the outer surface of each vane. Check for excessive paint buildup on the outer surface of each vane. Use the starter to bump the engine over until each vane has been inspected. Remove all paint buildup that appears to be thicker than a light layer.
    - Inspect and test the spark plug wires.
        - Ensure that the spark plug wires and seals are in good physical shape and not cracked, split, or otherwise damaged.
        - Check for correct routing. Keep the spark plug wires as far away as possible from the engine wiring harness.
        - The secondary wires must have the correct resistance to prevent Radio Frequency Interference (RFI) and still deliver full spark. Non-resistor spark plug wires are not acceptable. The resistance for each 30 cm (1 ft.) of wire length must not be more than 8,000 ohms and not less than 2,000 ohms. Replace any wires that are not as specified.
    - Remove the distributor cap (if equipped) and check for signs of moisture, carbon tracking, and damage. Replace if necessary.
15. Inspect and test the fuel system:
    a. Run the engine on a portable fuel tank containing fuel that is known to be clean, fresh, and of the proper octane rating. If the problem is resolved, there is a problem within the boat's fuel system or the fuel in its tank. Check all fuel line barb fittings closely for any hair-line cracks or other damage that may cause an air leak in the fuel delivery system.
        - Test the fuel rail pressure at the engine speed shown in the "Freeze Frame Data" buffer. Refer to the appropriate MerCruiser Service Manual for the pressure specification.
        - Fuel pressure must be within 13.7 kPa (2 PSI) of the specified fuel rail pressure when the manifold vacuum is nearly the same as the barometric pressure.
        - Fuel pressure will decrease whenever the manifold vacuum is less than the barometric pressure. The amount the pressure decreases is in proportion to the difference between the manifold vacuum and barometric pressure.
    b. If the fuel pressure is below specification, refer to **Service Bulletin 99-7** and test the fuel supply system. Perform repairs as needed.
16. Inspect the engine installation:
    a. Inspect the bottom of the hull for obstructions that affect the water flow to the gearcase or water pickup. Common problems are:
        - Incorrectly mounted speedometer pickups, depth transducers, and through-the-hull water pickups
        - Hull damage, such as cracks, distortions, or sub-standard repairs
        - Any object that protrudes into the water near the hull's centerline
    b. Check the position of the anti-ventilation plate. The OEM determined the plate position through the X-dimension and transom cutout.
        - If the anti-ventilation plate is too high, the propeller will ventilate easily causing planing, steering, and handling concerns.
        - If the anti-ventilation plate is too low, the drive will cause excessive drag and high loads on the engine. The boat will perform poorly and the engine will work harder than normal.
    c. Verify the correct drive (or transmission) gear ratio is installed. Incorrect drive ratios can cause excessive torque loads within the power transmission system, leading to premature failure.

d. Check the rigging of the electrical and control cables. Look for installation, routing, or clamping problems. Check for loose brackets and accessories that can vibrate and cause false knock signals. Check for interference problems between the engine system and the boat. Ensure that the control cables are free to operate and are mounted securely.

e. Inspect the exhaust system for evidence of leaks, overheating, and restrictions. Check that the installation meets Mercury specifications.

17. Verify the propeller selection:

a. Run the boat in open water where it is safe to operate at WOT. Trim the boat to achieve the optimal performance. Compare the RPM of the engine to the specifications in the engine's Operation, Maintenance, and Warranty manual or MerCruiser service manual.

NOTE: *The CDS G3 service tool is the most appropriate tool to accurately measure engine RPM.*

b. Best all-around performance is achieved when WOT engine operation occurs near the top of (but within) the WOT RPM operating range designated by MerCruiser for that specific engine. Improperly propping an engine can not only reduce performance, but, can damage the engine.

- If WOT RPM is above the recommended range, the propeller must be changed.
- If WOT RPM is below the recommended range and this engine and hull normally achieve the specified WOT RPM with the installed propeller, you must perform a compression test and cylinder leak-down test.

18. Performing a compression and cylinder leak-down test:

a. Refer to the appropriate MerCruiser Service Manual and perform a compression test at engine cranking speed. Compare the readings to specifications.

b. If compression test results are not within specification, perform a cylinder leak-down test to isolate the problem.

19. Check the calibrations on 5.0, 5.7, or 6.2 liter models:

a. If the "Engine Misfire" fault occurs below 2500 RPM (as shown in the "Freeze Frame Data" buffers), then an updated calibration may help correct it. If the RPM in the freeze frame buffer is above 2500 RPM when the misfire fault occurs, a new calibration will not resolve the problem. Refer to the CDS G3 "Freeze Frame Data" screen capture attached below for an example that qualifies for an updated calibration.

Freeze Frame Data for Module: STBD Engine

STBD Engine - City ID:11(0B) Close

Fault Name	FaultNum	Battvolt	Engspeed	Enginestate	Freq
Engine_Misfire	396	14.12	2024	3	1
None	0	0	0	0	0

49247

b. The CDS G3 help system has a chart listing all of the current PCM ECT calibrations.

- Refer to the chart and check if an updated calibration is available for the engine you are working on.
- If so, the CDS G3 tool can reflash the PCM with the new calibration.

A portion of the CDS G3 help system's chart is shown as an example in the following screen capture.

Proposed Model Description	CALIBRATION IN PCM - Click the arrow below and select the calibration currently in PCM	Is this calibration the latest available	Select Update G3 Reflash Calibration Package Listed Below Cal is latest Reflash **Replace PCM**	Part Number to Order Replacement PCM	PRODUCTION CONTROLLER	CAN BE USED IN CONTROLLER	REFLASH PACKAGE NAME
MCM 5.0L ALPHA ECT FWC	8M2005279	NO	**REPLACE PCM**	8M0049843	902	NONE	
MCM 5.0L ALPHA ECT FWC	8M2014617	NO	8M0060321	8M0049843	903		
MCM 5.0L ALPHA ECT FWC	8M2017077	NO	8M0060321	8M0049843	903		
MCM 5.0L ALPHA ECT FWC	8M2019802	NO	8M0060321	8M0049843	903/904		
MCM 5.0L ALPHA ECT FWC	8M2020285	NO	8M0060321	8M0049843	905		
MCM 5.0L ALPHA ECT FWC	8M2020695	NO	8M0060321	8M0049843	905		
MCM 5.0L ALPHA ECT FWC	8M0060321	YES	8M0060321	8M0049843	905	NOT 902	MCM_50_ALPHA_ECT_FWC_8M0060321

49249

Final Diagnostic Steps

After the cause of the misfire has been corrected, the technician must verify the repair by observing two complete diagnostic cycles of the OBDM "Catalyst Monitor" diagnostic routine self-test.

Two engine run cycles are required to set an OBDM fault. The fault must be present during both run cycles.

- The first time an OBDM fault occurs, the PCM will internally record this event, but there will be no indication to the operator or technician that this has occurred.
- If the same fault occurs during any subsequent engine run cycle, the fault will activate and be visible on the CDS G3 service tool and SmartCraft displays, and the OBDM indicator light will illuminate.

Therefore, if the "Catalyst Monitor" diagnostic routine self-test can complete twice and no faults are displayed on the CDS G3 service tool, the fault can be considered resolved and the boat returned to the customer.

NOTE: *The "Catalyst Monitor" diagnostic routine can be monitored with the CDS G3 service tool, software version 1.3 or higher.*

NOTE: *Certain active faults will prevent the OBDM self-diagnostic routines from initiating. They are active faults related to the following systems: ECT, EMCT, IAT, fuel injectors, oxygen sensors, TPS, and voltage. Correct all "Active Faults" before attempting to verify the OBDM self-diagnostic routines. If the Guardian protection system is active, the OBDM self-diagnostic routines will not initiate.*

The OBDM self-diagnostic routine can be observed on the datastream of the CDS G3 service tool. Software version 1.3 or higher must be used for the following procedure.

After the cause of the cylinder misfire has been corrected, proceed as follows:

1. Erase all faults (active and freeze frame) using the CDS G3 service tool.
   IMPORTANT: Do not perform this procedure using a flushing attachment or in a test tank.
2. Operate the boat in an open body of water at 1500-3000 RPM under normal load.
3. Operate the boat under the conditions specified in step 2, until the OBDM "Catalyst Monitor" diagnostic routine self-test has completed.
   - The test is completed when the data items "Port Catalyst Monitor Raw OSC" and "STBD Catalyst Monitor Raw OSC" display numeric values.
   - ***NOTE:*** *These data items are blank until the self-test has completed.*
4. Turn the ignition switch to the off position.
5. On DTS models—move the remote control handle to the reverse gear, WOT position. This will disable the trim with key-off feature and shut down the PCM.
6. Repeat steps 2–4. The OBDM self-diagnostic routine must be completed twice in order to ensure that no OBDM faults return.
7. Review the data in the CDS G3 "Live Data Display" obtained from the OBDM "Catalyst Monitor" diagnostic routine. The four major data items that must be evaluated at the end of the self-diagnostics are:
   - "PORT Catalyst Monitor Ratio"
   - "PORT Catalyst Monitor Raw OSC" (OSC—Oxygen Storage Capacity)
   - "STBD Catalyst Monitor Ratio"
   - "STBD Catalyst Monitor Raw OSC"

   NOTE: *These data items are shown in the following screen image as an example from an 8.2L engine.*

49250

Four major data items to review

8. Interpret the "Catalyst Monitor Raw OSC" and "Catalyst Monitor Ratio" data from the CDS G3 service tool.

- The lowest passing number for "PORT Catalyst Monitor Raw OSC " or "STBD Catalyst Monitor Raw OSC" is 100 to 330 depending on engine displacement. For 8.2 L engines, for example, the lowest passing number is 330.

Lowest Acceptable Raw OSC	
3.0 L	150 minimum Raw OSC
4.3 L	100 minimum Raw OSC
5.0 – 6.2 L	200 minimum Raw OSC
8.2 L	330 minimum Raw OSC

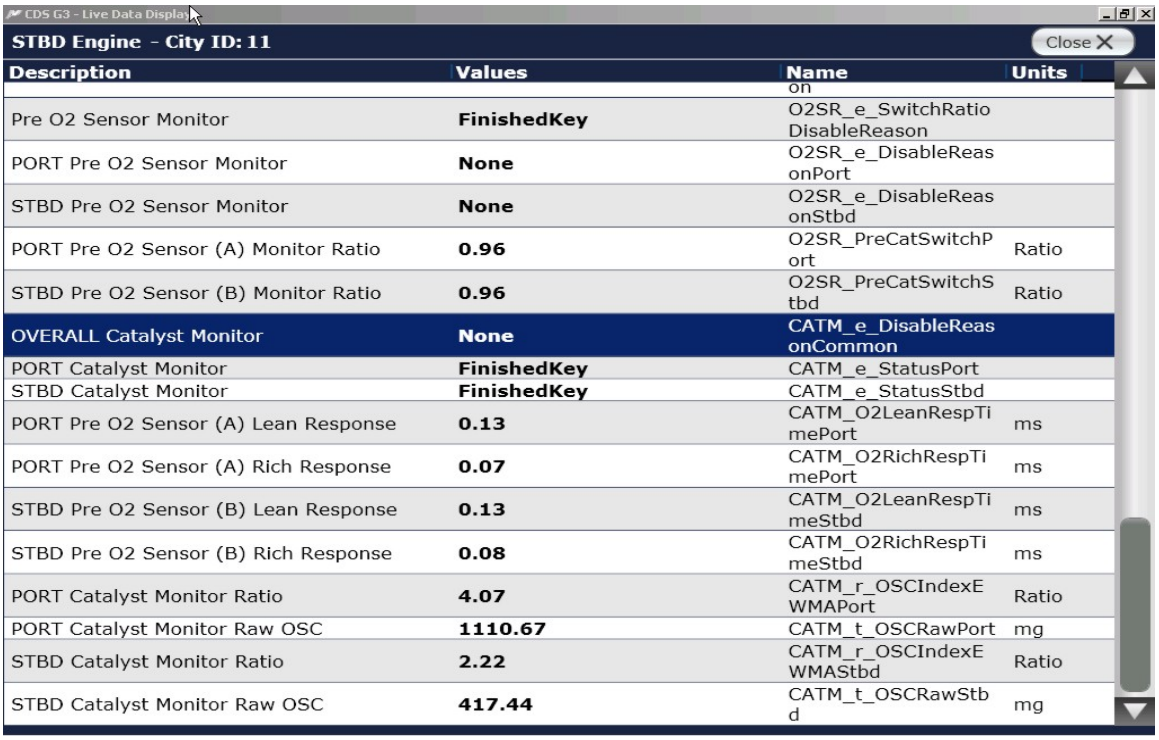
- The minimum catalyst monitor ratio is 1.0 or higher for all displacements.

9. Evaluate the Catalyst Monitor Raw OSC and the Catalyst Monitor Ratio data shown in the G3 screen images.
   - The 8.2L engine used for the example data has a lowest passing Catalyst Monitor Raw OSC value of 330 and a lowest passing Catalyst Monitor Ratio of 1.0.
   - Higher values are acceptable, while lower values indicate the test failed.

   a. Review the "STBD Catalyst Monitor Ratio" and "STBD Catalyst Monitor Raw OSC" values:
      - The "STBD Catalyst Monitor Raw OSC" number is acceptable (above 330), yet is much lower than the port number. This may indicate minor catalyst degradation, but it still has remaining service life.
      - The "STBD Catalyst Monitor Ratio" is also acceptable (above 1.0) and is also lower than the port number. As with the raw OSC number, this indicates minor catalyst degradation, but it still has remaining service life. The number is more than twice the minimum specification.
      - Both data values indicate that the starboard catalytic converter is still performing well above the minimums and should be returned to service.
      - Do not look for matching or equal numbers between port and starboard. They will always differ, even if there is no catalyst degradation. If the numbers meet or exceed the minimum, the catalyst has remaining service life.

   b. Review the "PORT Catalyst Monitor Ratio" and "PORT Catalyst Monitor Raw OSC":
      - The "PORT Catalyst Monitor Raw OSC" number is very good as it is almost 3 times the minimum specification.
      - The "PORT Catalyst Monitor Ratio" is excellent as it is over 4 times the minimum.
      - These readings confirm that the port catalytic converter is in excellent condition and should be returned to service.

- Do not look for matching or equal numbers between port and starboard. They will always differ, even if there is no catalyst degradation. If the numbers meet or exceed the minimum, the catalyst has remaining service life.



Description	Values	Name	Units
		on	
Pre O2 Sensor Monitor	**FinishedKey**	O2SR_e_SwitchRatio DisableReason	
PORT Pre O2 Sensor Monitor	**None**	O2SR_e_DisableReas onPort	
STBD Pre O2 Sensor Monitor	**None**	O2SR_e_DisableReas onStbd	
PORT Pre O2 Sensor (A) Monitor Ratio	**0.96**	O2SR_PreCatSwitchP ort	Ratio
STBD Pre O2 Sensor (B) Monitor Ratio	**0.96**	O2SR_PreCatSwitchS tbd	Ratio
OVERALL Catalyst Monitor	**None**	CATM_e_DisableReas onCommon	
PORT Catalyst Monitor	**FinishedKey**	CATM_e_StatusPort	
STBD Catalyst Monitor	**FinishedKey**	CATM_e_StatusStbd	
PORT Pre O2 Sensor (A) Lean Response	**0.13**	CATM_O2LeanRespTi mePort	ms
PORT Pre O2 Sensor (A) Rich Response	**0.07**	CATM_O2RichRespTi mePort	ms
STBD Pre O2 Sensor (B) Lean Response	**0.13**	CATM_O2LeanRespTi meStbd	ms
STBD Pre O2 Sensor (B) Rich Response	**0.08**	CATM_O2RichRespTi meStbd	ms
PORT Catalyst Monitor Ratio	**4.07**	CATM_r_OSCIndexE WMAPort	Ratio
PORT Catalyst Monitor Raw OSC	**1110.67**	CATM_t_OSCRawPort	mg
STBD Catalyst Monitor Ratio	**2.22**	CATM_r_OSCIndexE WMAStbd	Ratio
STBD Catalyst Monitor Raw OSC	**417.44**	CATM_t_OSCRawStb d	mg

49251

Data items to review

After completing the OBDM self-diagnostic routine twice with no faults indicated on the CDS G3 service tool, the boat can be returned to the customer.