

Circulate to:  Sales Manager  Accounting  Service Manager  Technician  Parts Manager

## 4.5L Information Update

### Models Affected

| Models Covered | Serial Range       |
|----------------|--------------------|
| 4.5L 250 HP    | 2A441953 and above |

### Scope

Worldwide

### Situation

The intention of this bulletin is to make dealers and OEM's aware of the following:

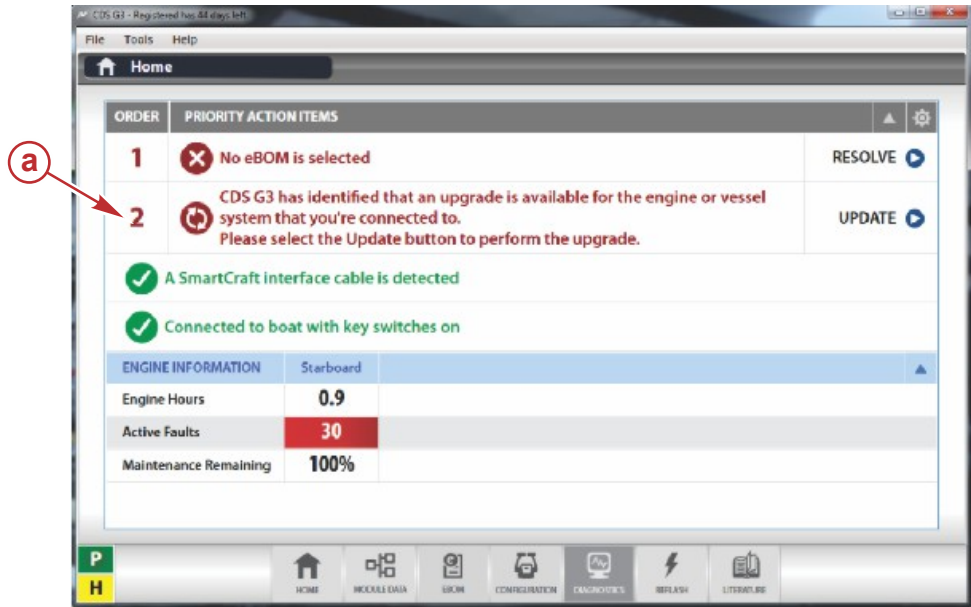
- Calibration update
- New universal fault codes
- Adaptive speed control (ASC)
- Propping using ASC
- Outboard and sterndrive remote control rigging and trim harness connections
- New fuel pressure for MerCruiser
- MerCathode with LED for monitoring status
- New front engine mount with wider bolt pattern and new locking tab
- New digital trim sender
- Analog outputs for gauges provided through PCM 112
  - Mechanical, provided through 14-pin harness
  - DTS, accessory harness required

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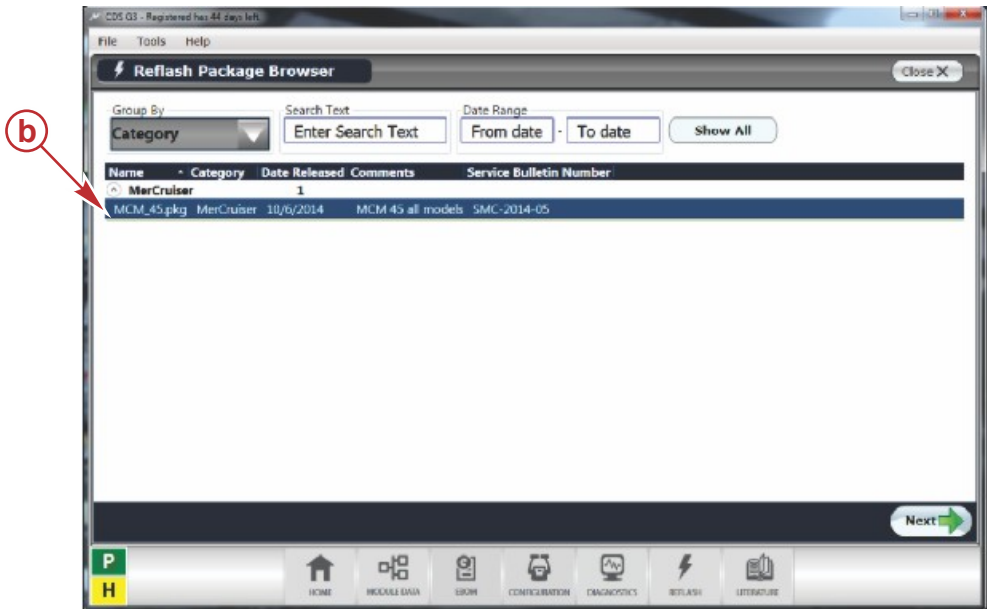
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## Calibration Update

Always update the calibration if an update is available, such as with the 1.6.0 CDS G3 disk release. The CDS G3 will notify the operator that calibration updates are available as shown below.



- a - CDS G3 showing update available
- b - Item that will be updated



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## New Universal Fault Codes

The PCM 112 is the first of Mercury control modules to adopt universal fault codes. These codes will help ensure uniformity in fault reporting in this and future control modules. It will also help ensure that boat operators will receive consistent information and instructions, such as **Service Engine Soon**, **Reduce Engine Speed**, and others in response to specific faults.

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For CDS G3 users this means that instead of seeing a fault such as MAP\_Angle\_RangeLow, the fault will now appear as **402, 25, Manifold pressure sensor 1 (Angle Based Sampling), The input circuit for the sensor is below the valid limit**. Refer to the screenshot below for more examples.

| Fault Code | Type Code | Code Description                  | Type Description  |
|------------|-----------|-----------------------------------|---|
| 1074       | 6         | Mechanical demand sensors A and B | The device, calculation or process detected a fault.                          |
| 311        | 6         | Throttle position sensors A and B | The device, calculation or process detected a fault.                          |
| 3061       | 16        | Fuel pump                         | The ECU has detected a problem when trying to output a signal to this device. |
| 3152       | 16        | Warning horn                      | The ECU has detected a problem when trying to output a signal to this device. |
| 511        | 24        | Intake manifold air temperature   | The input circuit for the sensor is above the valid limit.                    |
| 201        | 16        | Fuel injector circuit 1           | The ECU has detected a problem when trying to output a signal to this device. |
| 202        | 16        | Fuel injector circuit 2           | The ECU has detected a problem when trying to output a signal to this device. |
| 203        | 16        | Fuel injector circuit 3           | The ECU has detected a problem when trying to output a signal to this device. |

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**An active fault list example (actual screen appearance may vary)**

- a** - Fault code (the affected component)
- b** - Type code (how it was affected)
- c** - Code description
- d** - Fault code type description

In the last line of this example, component 203, fuel injector circuit 3, had a fault type 16, meaning that the PCM 112 is unable to output a signal to the device. This could indicate a faulty fuel injector, or in this case, where the same fault is affecting multiple injector and other components, likely indicates a more widespread fault, such as an unplugged harness, issues with a power supply, or some other systemic issue.

There are as many fault codes as there are components on engines that use universal fault codes, and the PCM 112 only uses a small subset of these. There are only 27 fault types, however, only a few of which will be relevant to any single component. Any application specific notes will be included in the diagnostic manual.

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| Universal Failure Type Number | Universal Failure Condition | Description  |
|-------------------------------|-----------------------------|--|
| 0                             | No failure                  | The system has no active faults.   |
| 1                             | Output open circuit         | The output signal to the device from the ECU is an open circuit or has too much resistance.                      |
| 2                             | Output short circuit        | The output signal to the device from the ECU is a short circuit or has too little resistance.                    |
| 3                             | Noisy                       | The signal is unsteady, toggling, or intermittent such that a single value cannot be determined.                 |
| 4                             | Range high                  | The signal received is valid, but is higher than the expected range.   |
| 5                             | Range low                   | The signal received is valid, but is lower than the expected range.  |
| 6                             | Faulted                     | The device, hardware, a calculation, or a process has failed a rationality check or has detected a fault.        |
| 7                             | Dirty                       | The signal following a switch is below the expected value.   |
| 8                             | Leaky                       | The signal following a switch is above the expected value.   |
| 9                             |                             | For future use   |
| 10                            | Rich                        | Too much fuel was detected relative to the amount of air.  |
| 11                            | Lean                        | Too little fuel was detected relative to the amount of air.  |
| 12                            | Disabled                    | Due to conditions present, the device has been disabled.   |
| 13                            | Communication failure       | Communication with the device has been lost.   |
| 14                            | Response                    | The device is not responding properly.   |
| 15                            | Keyup diagnostic failed     | The device has run a key up diagnostic and has detected a problem.   |
| 16                            | Output fault                | The ECU has detected a problem when trying to output a signal to this device.                                    |
| 17                            | Out of range                | The signal or result is outside the expected range, but there is not enough information to indicate high or low. |
| 18                            | Not converged               | The algorithm cannot reach a conclusion.   |
| 19                            | Not performed               | Conditions are such that the test cannot be performed.   |
| 20                            | Overheat                    | A temperature sensor value is higher than normal.  |
| 21                            | Too low                     | Relative to a specified threshold, the value is too low.   |
| 22                            | Too high                    | Relative to a specified threshold, the value is too high.  |
| 23                            | Is active                   | Indicates a particular state or condition.   |
| 24                            | Input high                  | The input circuit for the sensor is above the valid limit.   |
| 25                            | Input low                   | The input circuit for the sensor is below the valid limit.   |
| 26                            | Input open circuit          | The input signal from the device to the ECU is open circuit or has too much resistance.                          |
| 27                            | Input short circuit         | The input signal from the device to the ECU is short circuit or has too little resistance.                       |

For a detailed list, refer to **PCM 112** manual.

## Adaptive Speed Control (ASC)

RPM is controlled by the PCM.

- Load and RPM based
- Maintains RPM of throttle position

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- No RPM loss in turns, currents or wave conditions, or ski load variations

## Adaptive Speed Control (ASC) Propping

**IMPORTANT:** Propping of the boat can be done as normally done with all other MerCruiser products, but to achieve the best optimum propeller selection you can use the propping procedure below with the G3 tool to verify your propeller selection.

A special propping procedure using CDS G3 should be used for optimum propping.

- Install the best guess propeller.
- Run the engine at 100% Demand Linear (demand request by operator) with optimum trim. The Demand (demand request by control software) and Demand Linear with Guardian (demand request by Guardian) should both equal 100%.
- If RPM is less than 4800 but the Demand (demand request by control software), Demand Linear (demand request by operator), and Demand Linear with Guardian (demand request by Guardian) are all 100%, install a smaller pitch propeller.
- If RPM is greater than 5200 even momentarily, and Demand (demand request by control software) and Demand Linear with Guardian (demand request by Guardian) cannot both reach 100%, install a larger pitch propeller. (This means software Demand is pulling back on the throttle to stop from overspeed.)
- If RPM is between 4800 and 5200, the propeller is correct, depending on the customer's preference.

| NAME                       | VALUE         | DESCRIPTION                         |
|----------------------------|---------------|-------------------------------------|
| EngineSerialNumber         | SN000000000   | Engine serial number                |
| J1939_Cal_ID               | 8M0097272     | Calibration part number             |
| SerialNumber               | Serial Number | Engine Control Module serial number |
| RPM                        | 4527 RPM      | Engine speed                        |
| Demand                     | 76.80 %       | Demand request by control software  |
| DemandLinear_with_Guardian | 85.63 %       | Demand request by Guardian          |
| TrimPospercent             | 28.55 %       | Trim Position                       |
| DemandLinear               | 85.63 %       | Demand request by operator          |
| GuardianLatchedPwrLim      | 100.00 %      | Guardian available power            |
| Arb_TPS                    | 36.48 %       | Throttle Position                   |
| LoadPercent                | 75.27 %       | Engine Load                         |
| IdleRPMSetPt_BDR           | 625 RPM       | Engine speed target                 |

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Data values moved in G3 data list for 4.5L optimum propping procedure

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| NAME                       | VALUE    | DESCRIPTION                        |
|----------------------------|----------|------------------------------------|
| RPM                        | 4692 RPM | Engine speed                       |
| Demand                     | 100.00 % | Demand request by control software |
| DemandLinear_with_Guardian | 100.00 % | Demand request by Guardian         |
| TrimPospercent             | 15.97 %  | Trim Position                      |
| DemandLinear               | 100.00 % | Demand request by operator         |
| GuardianLatchedPwrLim      | 100.00 % | Guardian available power           |
| Arb_TPS                    | 75.10 %  | Throttle Position                  |

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**Nonoptimal propping set up, overropped**

- Alpha 21 SS Mirage pitch propeller
- Demand request by control software at 100%
- Demand request by Guardian at 100%
- Trim position percent at 19.35% optimum trim for this boat
- Demand request by operator 100%
- RPM at 4692, indicating that the engine is overropped

| NAME                       | VALUE       | DESCRIPTION                        |
|----------------------------|-------------|------------------------------------|
| RPM                        | 5282 RPM    | Engine speed                       |
| Demand                     | 92.63 %     | Demand request by control software |
| DemandLinear_with_Guardian | 100.00 %    | Demand request by Guardian         |
| TrimPospercent             | 15.97 %     | Trim Position                      |
| DemandLinear               | 100.00 %    | Demand request by operator         |
| GuardianLatchedPwrLim      | 100.00 %    | Guardian available power           |
| Arb_TPS                    | 53.94 %     | Throttle Position                  |
| EngineSerialNumber         | SN000000000 | Engine serial number               |
| J1939_Cal_ID               | 8M0097272   | Calibration part number            |

57317

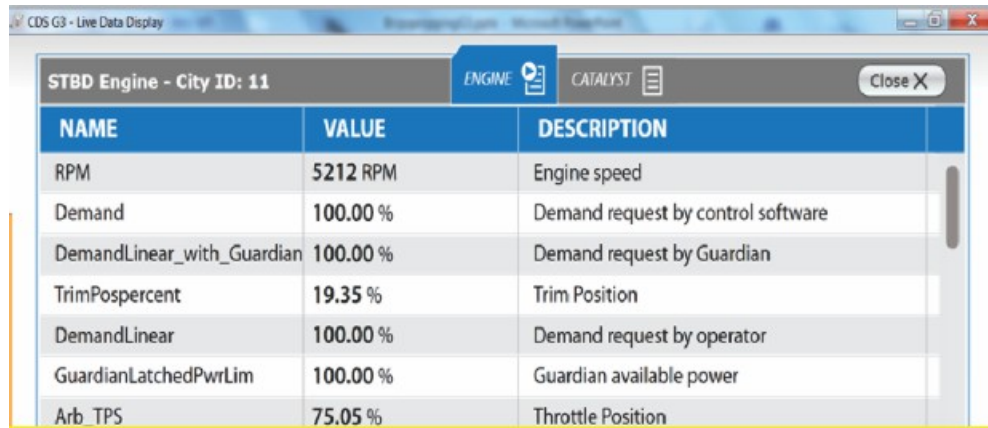
**Nonoptimal propping set up, underropped**

- Alpha 21 SS Mirage pitch propeller
- Demand request by control software at 92.63%
- Demand request by Guardian at 100%
- Trim position percent at 15.97% optimum trim for this boat
- Demand request by operator 100%

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- RPM at 5282, indicating that the engine is underpropped and causing the software to limit the demand and pulling back on the RPMs



| NAME                       | VALUE    | DESCRIPTION                        |
|----------------------------|----------|------------------------------------|
| RPM                        | 5212 RPM | Engine speed                       |
| Demand                     | 100.00 % | Demand request by control software |
| DemandLinear_with_Guardian | 100.00 % | Demand request by Guardian         |
| TrimPospercent             | 19.35 %  | Trim Position                      |
| DemandLinear               | 100.00 % | Demand request by operator         |
| GuardianLatchedPwrLim      | 100.00 % | Guardian available power           |
| Arb_TPS                    | 75.05 %  | Throttle Position                  |

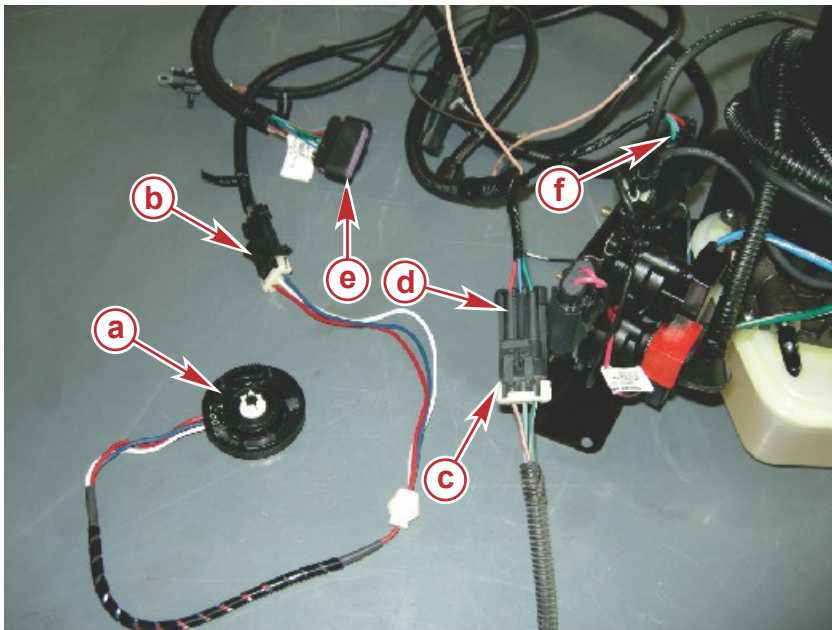
57318

#### Example and the order to set up G3 data for the optimum propping using the parameters shown

- Alpha 19 SS Mirage pitch propeller. Data above would indicate the optimum propping of this boat.
- Demand request by control software at 100%
- Demand request by Guardian at 100%
- Trim position percent at 19.35% optimum trim for this boat
- Demand request by operator 100%
- RPM at 5212 running at optimum speed

## Remote Control Rigging and Trim Harness Connections

A MerCruiser control or an Outboard control may be used for remote controls, but must be wired properly. Connecting the trim pump or the remote control incorrectly will result in trim that is nonfunctional or a trim limit switch that will not limit trim.



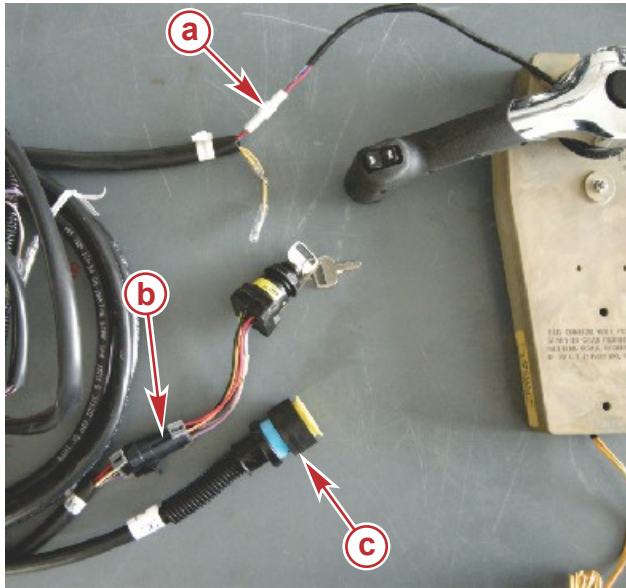
#### MerCruiser control

- a** - Digital trim
- b** - To transom harness
- c** - From remote
- d** - To transom harness
- e** - 16-pin transom harness connection to engine
- f** - Transom harness to trim pump

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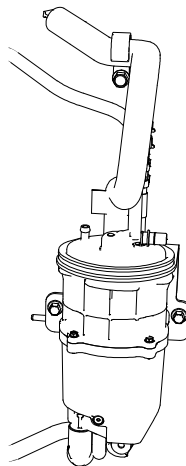
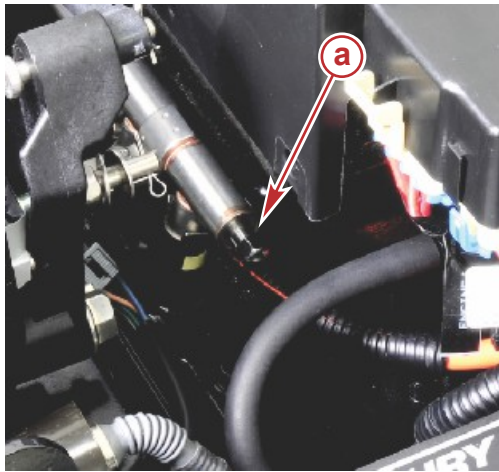
**Outboard control**

- a** - Trim connection
- b** - Key switch
- c** - 14-pin engine harness

57320

**Fuel Pressure for MerCruiser**

New fuel pressure.



**Fuel module**

- a** - Schrader valve

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- Idle 41–45 psi
- Static pressure (engine not running) 49–54 psi

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## MerCathode

The new MerCathode controller now has a LED on it, informing the user of the status of the system.



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## MerCathode LED Codes

| MerCathode LED        | Definition  | Required Action   |
|-----------------------|---|---|
| Solid green           | No fault. The controller is working properly.   | No action is necessary. This is the normal LED indication for a properly functioning MerCathode system.   |
| 2 flashes per second  | There is an open or short in the reference electrode/anode, a high temperature, or a sensed reference electrode voltage in excess of 1.4 V. | The system is not operating correctly. Contact your local Mercury Service dealer for assistance.  |
| 1 flash per 4 seconds | The reference voltage is outside of the normal, expected range: either above 1.04 V or below 0.86 V.  | The system is stabilizing. Monitor it for further change.   |
| LED not on            | There is no power to the controller or both the reference electrode and anode are open.   | <ul style="list-style-type: none"> <li>If the boat is out of the water, no action is necessary.</li> <li>Check the battery voltage; it must be 9 V or higher.</li> <li>Check the 5-amp fuse in the controller wire harness.</li> <li>If further assistance is required, contact your local Mercury Service dealer.</li> </ul> |

**NOTE:** The controller housing is black and the red label identifies output.

## New Front Engine Mount

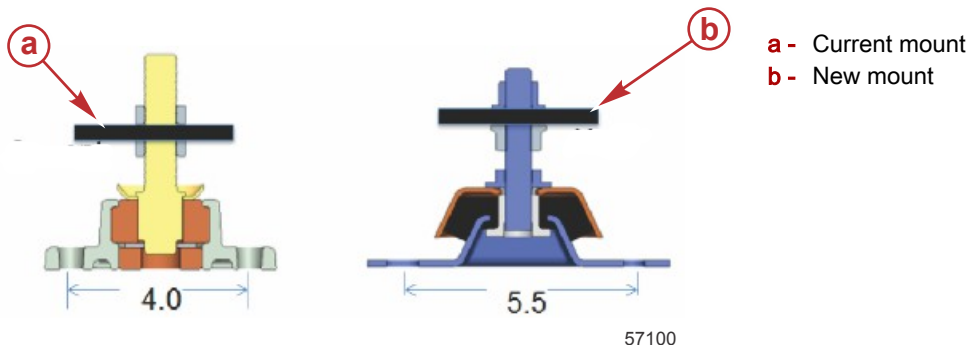
New features for front engine mounts:

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## 4.5L Information Update

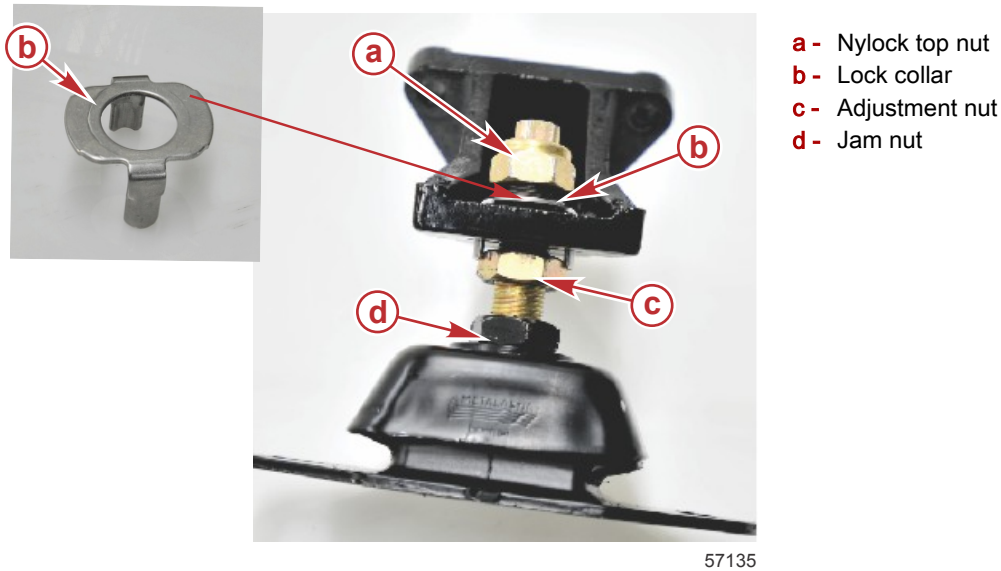
- Larger footprint than current mounts



- Nylock top nut
- New locking method for lower nut

Adjust the mount as follows:

1. The nylock nut must be loosened high enough to disengage the ears of the lock collar.
2. After the lock collar is disengaged, adjust the adjustment nut up or down to get the proper adjustment.  
**NOTE: Do not use the jam nut at any time for adjustment.**
3. When the adjustment is correct, using the adjustment nut, install the lock collar and the nylock top nut.



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## New Digital Trim Sender

The analog trim sender and trim limit switch previously used for Alpha and Bravo non-Smartcraft models are changing to the single digital 3-wire sensor and cover.



57144

The trim limit and trailer limit is set to a factory default but if you need to adjust use the G3 tool to change settings the same as today on Bravo SmartCraft transoms.

## Outputs for Analog Gauges

Mechanical engines (DTM) with shift cable attached to shift plate on the engine. Analog outputs are provided through the PCM and communicated through the 14-pin harness.

Digital engines (DTS), require an accessory harness from the engine analog connector to the gauges at the helm.

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