

# Electrical System

## Section 4A - Starting System

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# Starter Specifications

## Starter

**IMPORTANT:** Do not continuously operate the starter for more than 15 seconds at a time to avoid heat related damage. Before retrying, wait 2 minutes to allow the starter to cool.

Starter	
Identification number	0 001 0EA 1TE
Starter draw (under load)	60 amperes
Battery rating (minimum)	750 CCA, 950 MCA or 180 Ah

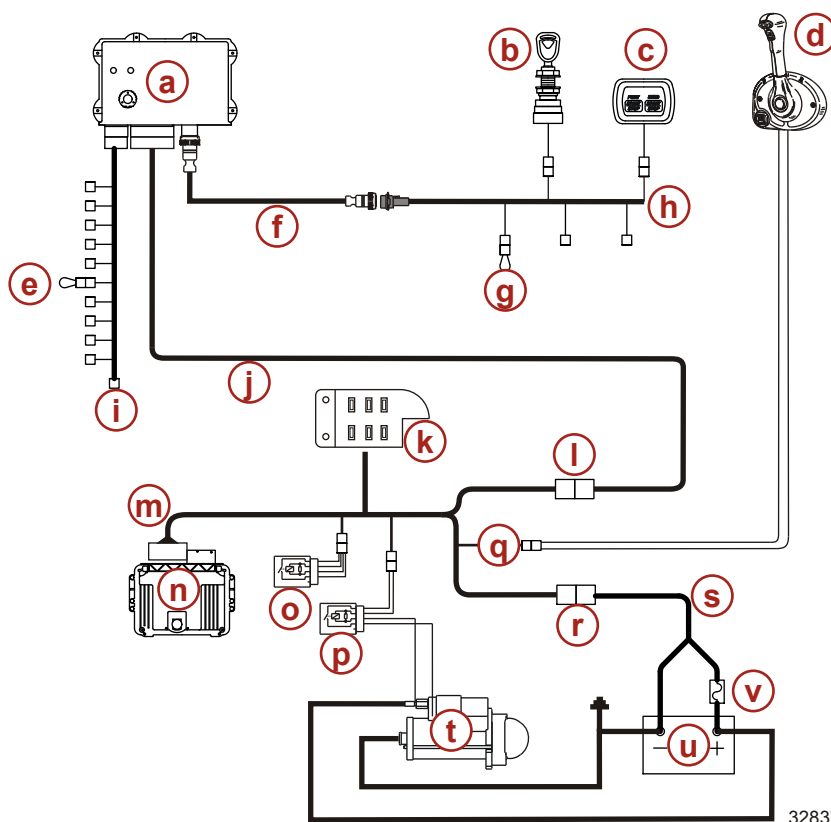
## Lubricant, Sealant, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 25	Liquid Neoprene	Exposed electrical terminals and connections	92- 25711 3
 95	2-4-C Marine Lubricant with Teflon	Starter mounting surfaces and mounting fasteners	92-802859A 1

## Wire Color Code Abbreviations

Wire Color Abbreviations				
BLK	Black		BLU	Blue
BRN	Brown		GRY	Gray
GRN	Green		ORN or ORG	Orange
PNK	Pink		PPL or PUR	Purple
RED	Red		TAN	Tan
WHT	White		YEL	Yellow
LT or LIT	Light		DK or DRK	Dark

# Starting System Components



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- |   |   |
|---|---|
| <b>a</b> - VIP                                  | <b>l</b> - Engine to VIP harness engine connection                |
| <b>b</b> - Key switch                           | <b>m</b> - Engine interface harness "K"                           |
| <b>c</b> - Start stop buttons, if equipped      | <b>n</b> - ECM  |
| <b>d</b> - Remote control neutral safety switch | <b>o</b> - Main relay   |
| <b>e</b> - Halon breakout                       | <b>p</b> - Start relay  |
| <b>f</b> - Station extension harness            | <b>q</b> - Neutral safety switch connection at engine harness "K" |
| <b>g</b> - Halon breakout                       | <b>r</b> - Engine power harness connection                        |
| <b>h</b> - Main station helm harness            | <b>s</b> - Engine power harness                                   |
| <b>i</b> - Vessel sensor harness                | <b>t</b> - Starter  |
| <b>j</b> - Engine to VIP harness                | <b>u</b> - Battery  |
| <b>k</b> - Fuse panel                           | <b>v</b> - 30-amp fuse  |

**IMPORTANT:** The key switch circuit is connected to the halon breakouts in the helm harness and vessel sensor harness before being routed to the engine. If the halon breakout connection is broken, the engine will not start.

## Starter Inspection

### Periodic Inspection

Internal starter components are sealed from contamination when mounted to the drive housing. Periodically inspect external stater components. The starter is electrically grounded by contact with the flywheel housing.

- Inspect the terminals for corrosion and loose connections.

- Inspect the wiring for frayed or worn insulation.
- Ensure that the mounting surfaces under the starter motor and the retaining fasteners are free of paint and corrosion.
- Treat the mounting surfaces under the starter motor and the retaining fasteners with lubricant to prevent corrosion.
- Ensure that the starter retaining bolts are properly tightened.

### Testing Voltage

**IMPORTANT:** A battery voltage or supply voltage below 9.5 volts can cause the starter to overheat. Check the battery voltage to ensure the voltage supplied to the starter is greater than 9.5 volts.

1. Ensure that the battery is fully charged.
2. Connect the voltmeter positive (+) lead to the terminal on the starter solenoid.
3. Connect the voltmeter negative (–) lead to the starter motor case. Ensure that there is good metal contact to prevent a false voltage reading.
4. Crank the engine for 10 seconds and record the voltmeter reading.
5. A reading of 9.5 volts or more verifies the starter motor is getting sufficient voltage.

**NOTE:** If the starter is getting at least 9.5 volts and the engine is not cranking properly, remove the glow plugs, or glow plug hole plugs, and try turning the engine over by hand. If the engine turns over freely by hand, the starter motor could have a problem.

6. A reading below 9.5 volts suggests a voltage loss between the battery and the starter. Refer to Testing Voltage Drop.

### Testing Voltage Drop

1. Ensure that the battery is fully charged.
2. Connect the voltmeter positive (+) lead to the battery positive (+) post.
3. Connect the voltmeter negative (–) lead to the starter solenoid terminal where the positive (+) battery cable connects.

**NOTE:** Connect the voltmeter leads to the battery post, not to the battery cable end.

**IMPORTANT:** Remove one voltmeter lead before the starter motor stops cranking in the following steps to protect the voltmeter from possible damage.

4. Crank the engine and record the voltmeter reading. The reading should not exceed 0.5 volt. A reading over 0.5 volt suggests excessive resistance.
5. Test the negative (–) battery cable by connecting the voltmeter negative (–) lead to the battery negative (–) post.
6. Connect the voltmeter positive (+) lead to the starter motor case. Ensure that there is good contact with metal.
7. Repeat step 4.
8. If either reading was above 0.5 volt, start with the battery cable and work toward the starter checking each connection for resistance.

**NOTE:** Always ensure that paint or corrosion is not causing the high resistance. The mounting surface under the starter motor and the mounting fasteners should be free from paint and corrosion.

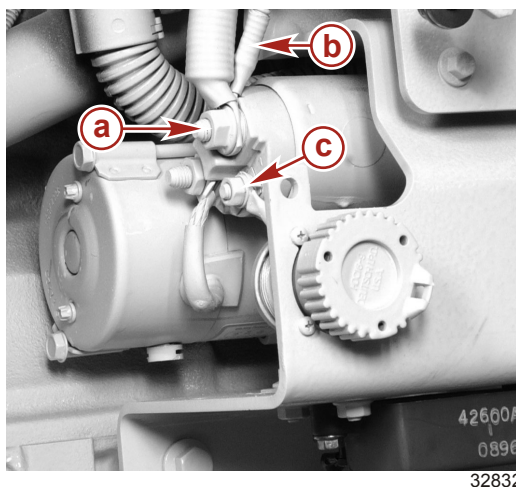
# Starter

## Starter Removal

### ⚠ WARNING

Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

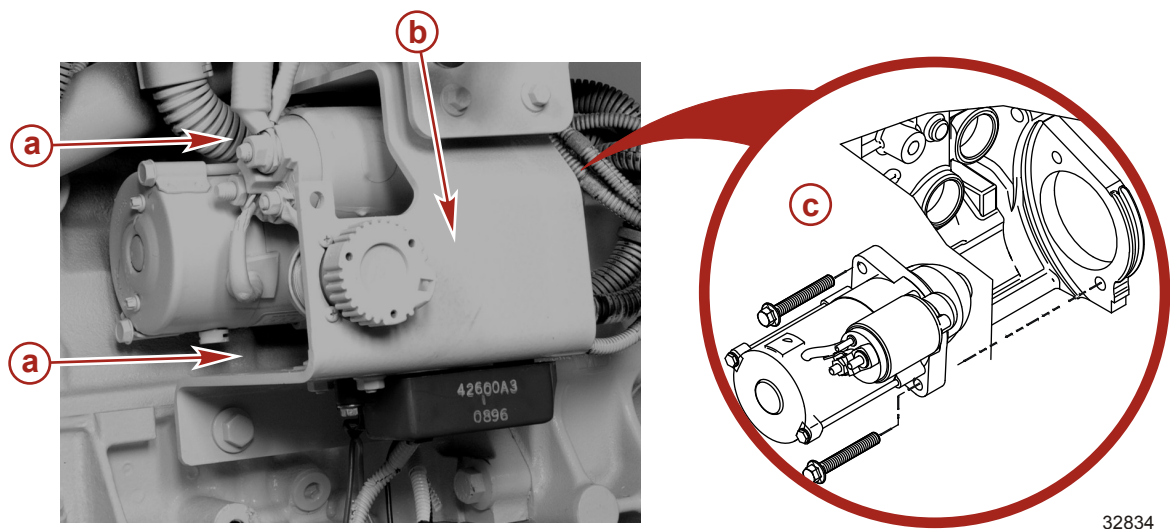
1. Disconnect the battery cables from the battery.
2. Slide the protective rubber boot, if equipped, off of the starter cable ends.
3. Disconnect the positive (+) battery cable and wires from the starter solenoid.



- a** - Positive (+) battery post
- b** - Alternator wire
- c** - Solenoid wire

**NOTE:** The starter mounting screws can be reached with a socket drive and extension inserted along the body of the starter toward the flywheel housing.

4. Remove the upper and lower starter mounting screws.




- a - Access to starter mounting bolts
- b - Bracket
- c - Starter mounting detail

**IMPORTANT:** Do not damage adjacent wiring or relays when removing the starter.

5. Remove the starter from the engine.

Starter Installation

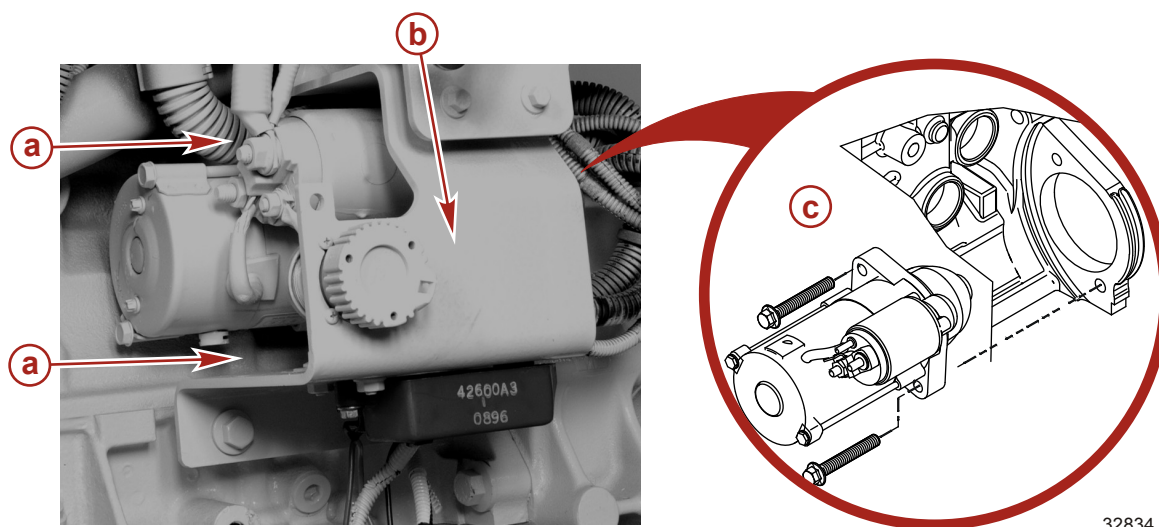
1. Lightly lubricate the starter mounting surfaces and the mounting screws before installation.

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 95	2-4-C Marine Lubricant with Teflon	Starter mounting surfaces and mounting fasteners	92-802859A 1

**IMPORTANT:** Do not damage adjacent wiring or relays when installing the starter.

2. Position the starter on the engine.

3. Install the upper and lower starter mounting screws.



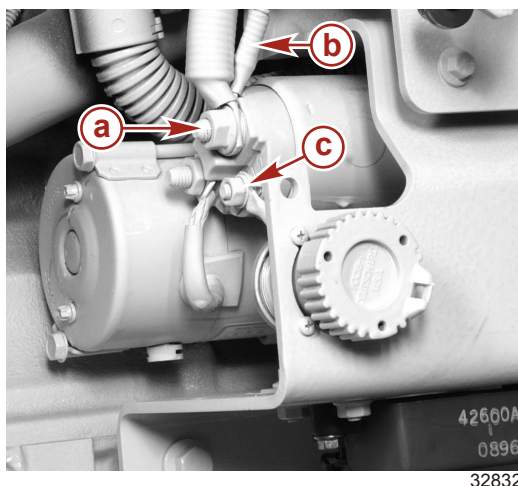
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- a** - Access to starter mounting bolts  
**b** - Bracket  
**c** - Starter mounting detail

4. Torque the starter mounting screws.

Description	Nm	lb-in.	lb-ft
Starter mounting screw	47.1	–	35

5. Connect the positive (+) battery cable and wires to the starter solenoid. Tighten the fasteners securely.




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- a** - Positive (+) battery post  
**b** - Alternator wire  
**c** - Solenoid wire

6. Torque the positive (+) battery cable nut.

Description	Nm	lb-in.	lb-ft
Positive (+) battery cable nut	10.8	96	–

7. Apply sealant to the exposed electrical terminals and connections.

Tube Ref No.	Description	Where Used	Part No.
 25	Liquid Neoprene	Exposed electrical terminals and connections	92- 25711 3

8. Slide the protective rubber boot, if equipped, over the positive (+) terminal connection after the sealant has dried.
9. Connect the battery cables to the battery.