

DENSO R4 Starter Installation Guide For:

- International 4700
- International T444E Engine



This guide will assist the technician with the installation of the R4 starter on this particular application.

These installation procedures may vary based on the engine and make, model & year of the vehicle.

Prior to component replacement carefully troubleshoot the starting circuit to identify the true cause of failure.

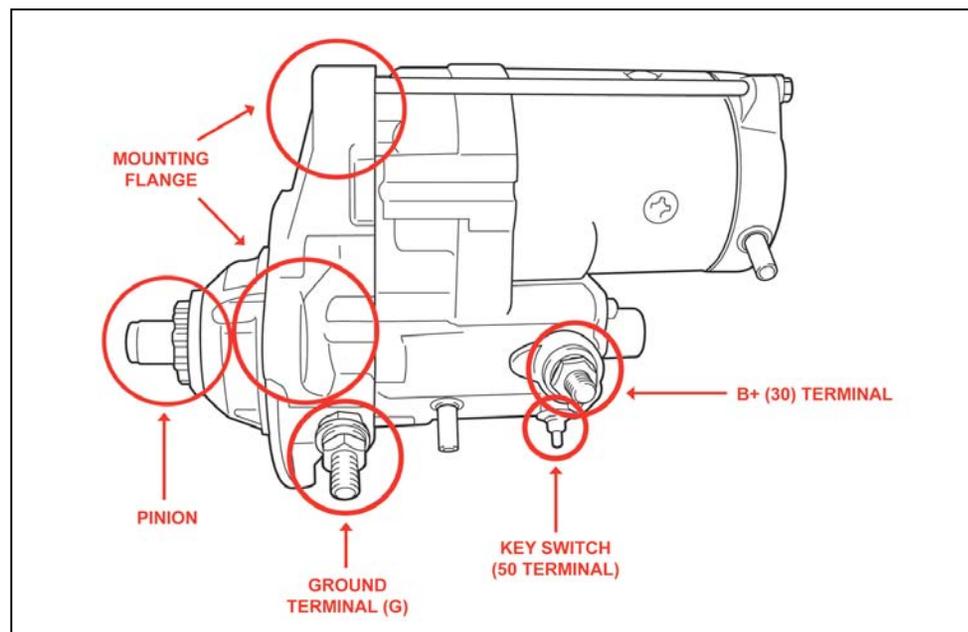
All replaced cables or wiring should match original (OEM) specifications AND when reinstalling bolts and hardware, torque to original specifications.

Starter Preparation

Confirm the correct part number for the particular application.



Visually inspect starter at these critical points.



Proceed to vehicle preparation.

Vehicle Preparation

Locate the vehicle battery compartment and remove the battery cover.



Disconnect and isolate the negative (-) battery cable from the negative (-) battery terminal.



Proceed to starter removal.

Starter Removal

Before disconnecting cables from the original starter, identify and note location for reassembly.

- **Disconnect & remove all cables from the starter**
- **Temporarily group all positive (+) cables together.**
- **Temporarily group all negative (-) cables together.**

Remove the original starter from the vehicle.

Save the original mounting hardware for the DENSO R4 starter installation.

Proceed to inspection.

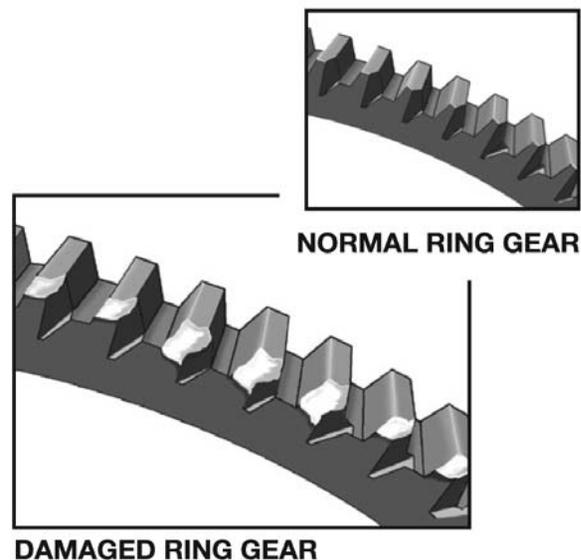
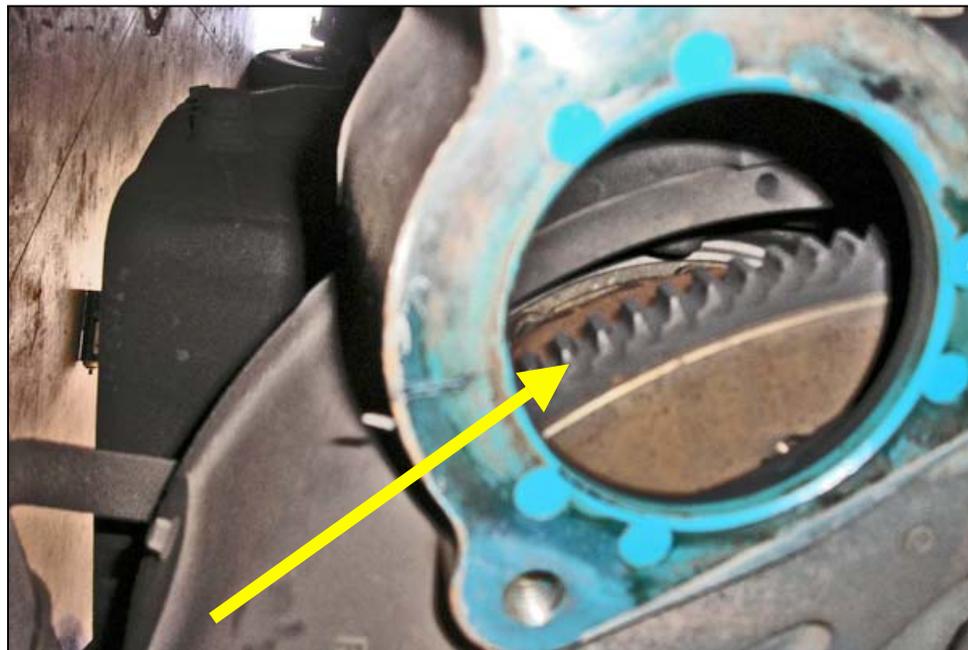


Inspection

Inspect the ring gear for burred or damaged teeth.

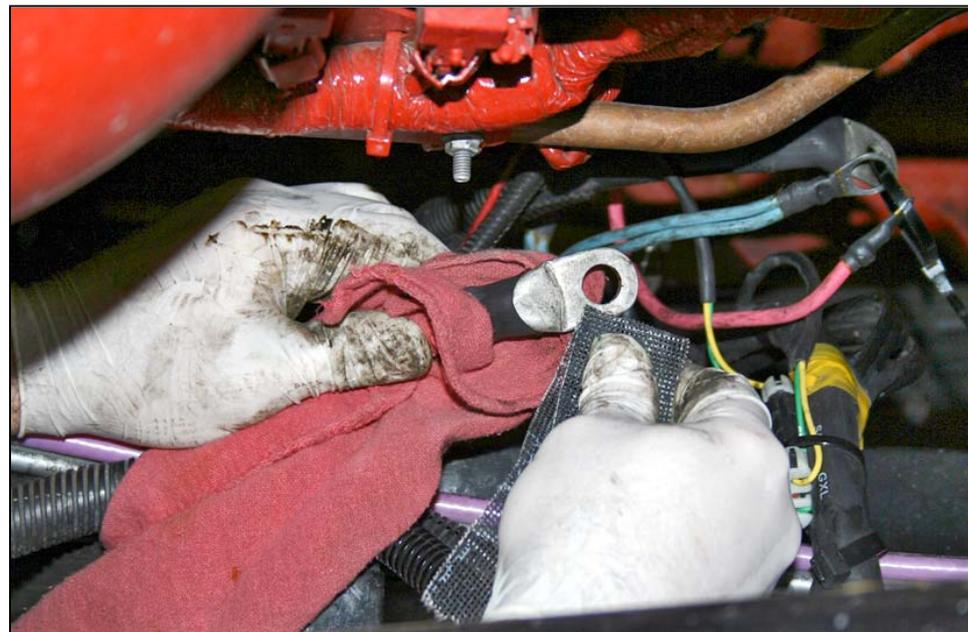
Rotate the flywheel and observe the condition of the entire ring gear.

Replace any ring gear with damaged or worn teeth.



Inspection

Check the condition of all battery cables. If out of specification, clean cable connectors or replace cables.



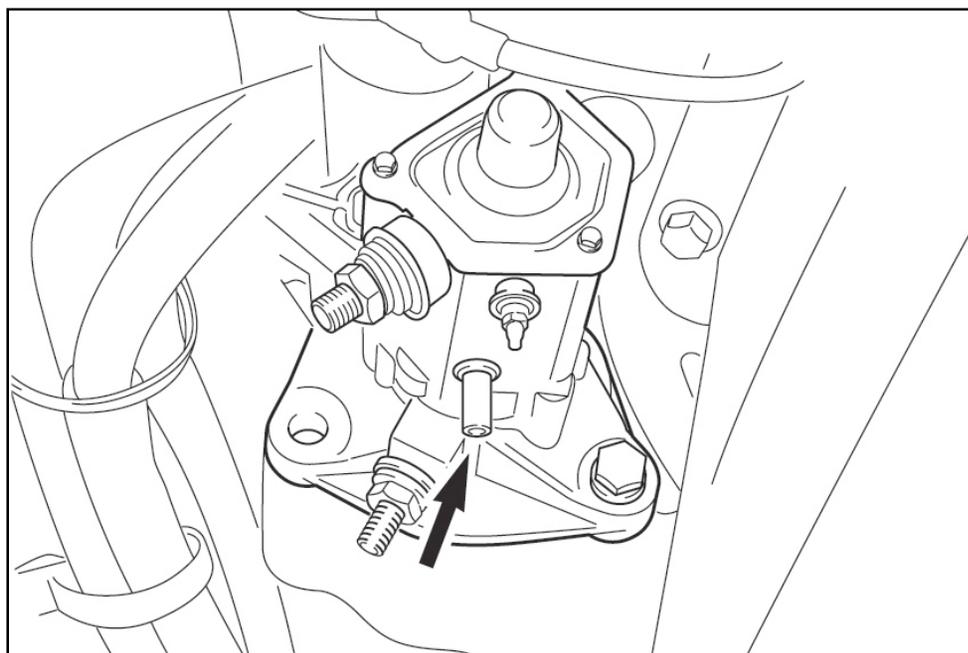
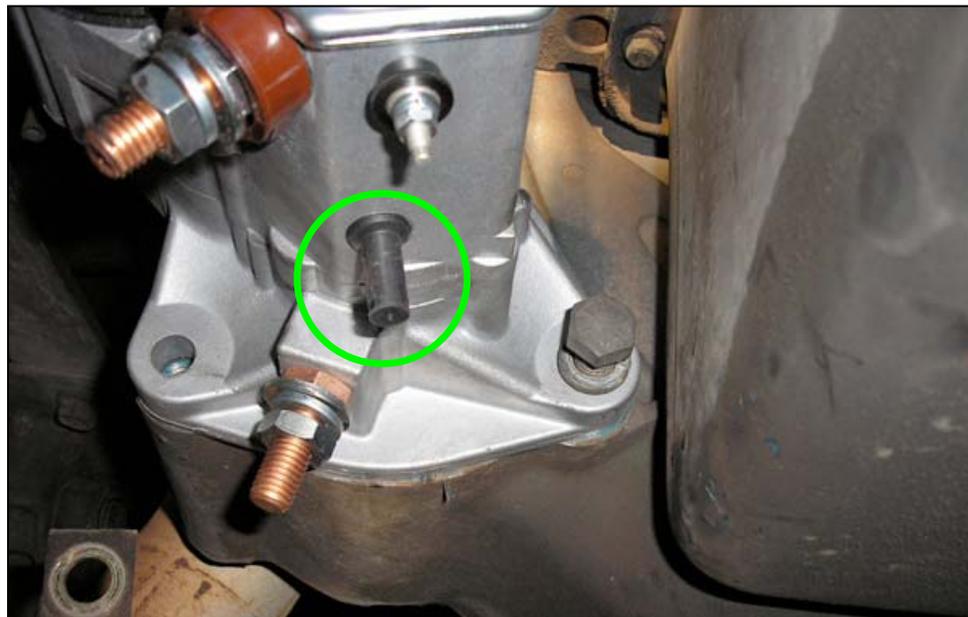
Proceed to starter installation.

Starter Installation

Temporarily support the R4 starter and secure with the original 3 mounting bolts.

- **Ensure the drain tube is in the downward position**

Viewed from bottom of vehicle looking up



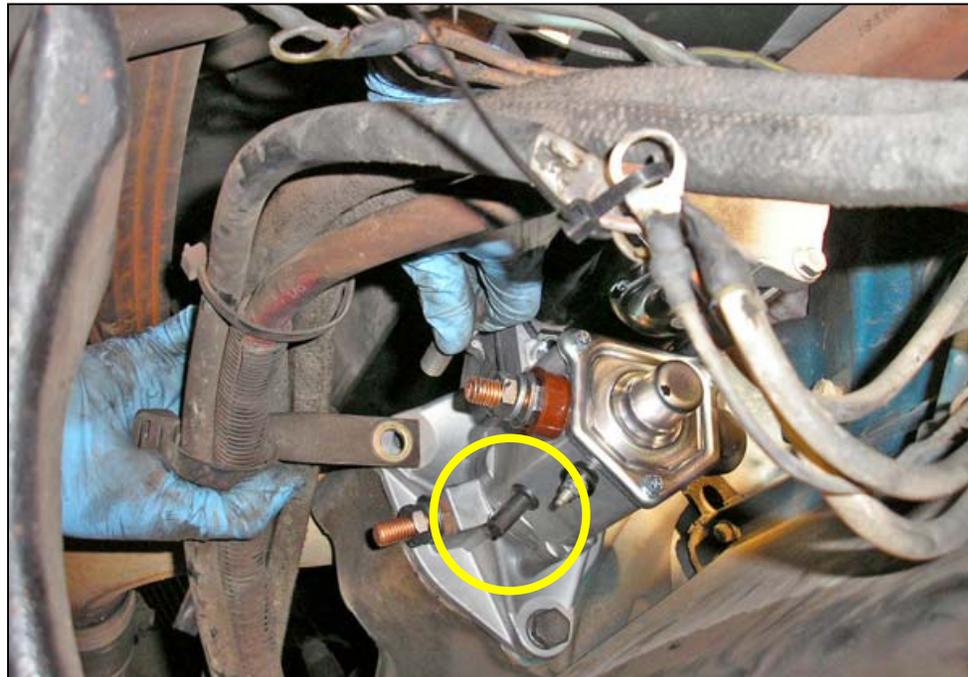
Viewed from bottom of vehicle looking up

Starter Installation

NOTE:

Starter shown from bottom view with drain tube in the downward position.

Viewed from bottom of vehicle



Torque the mounting bolts to the specifications indicated in the International W/T444E 4700 service manual.

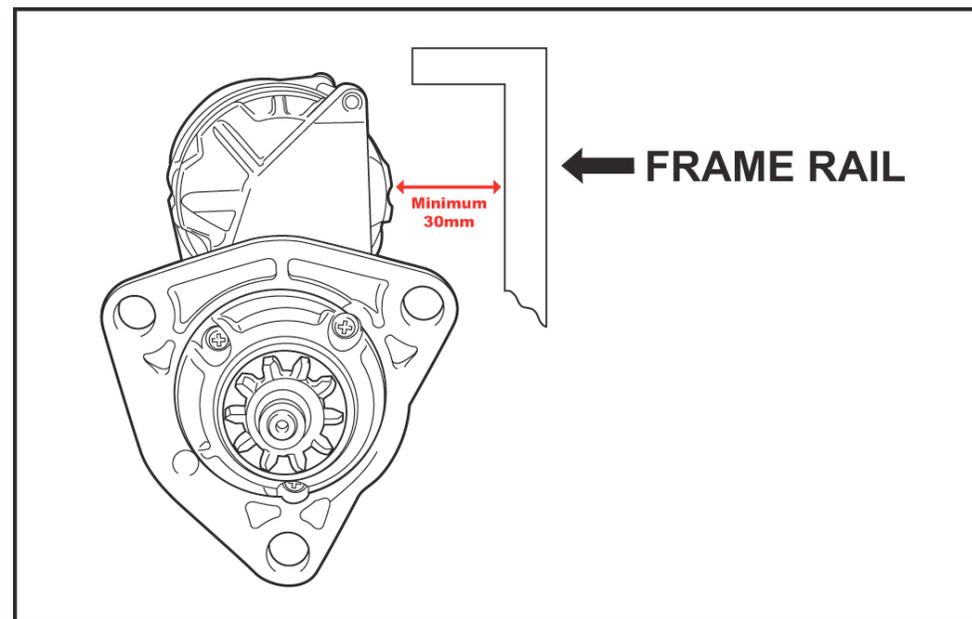
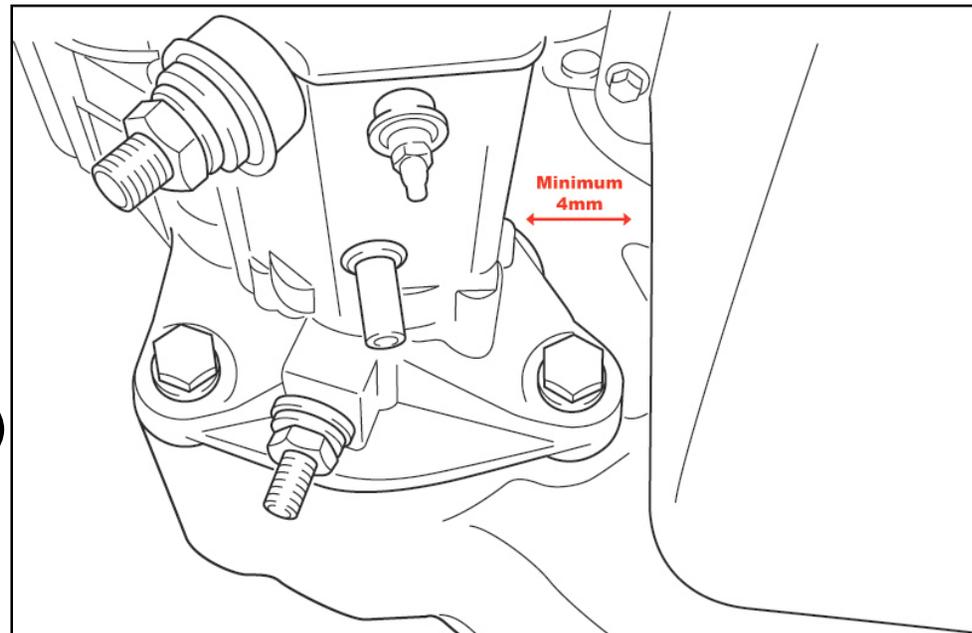
Viewed from bottom of vehicle



Starter Installation

Check for minimum clearances of starter to:

1. Engine Block - **4mm** (.16 inches)
2. Starter to Body - **30mm** (1.2 inches)
3. Heat Source - **15mm** (.60 inches)
(e.g. exhaust manifold)



Proceed to wiring assembly.

Starting Motor Overcrank Protection (OCP) Circuit Bypass (if equipped)

The OCP circuit is an option used on many trucks. It utilizes a thermal switch to open the starter relay ground circuit when excessive starter temperatures are reached due to prolonged cranking of the starter motor. This is commonly called over-cranking.

The information below describes the procedure to bypass the OCP circuit when replacing an OCP equipped starter with a DENSO R4 starter.

The presence of OCP can be identified by looking at the original starter (commutator end view). The OCP terminal comes out of the main wire harness and is plugged into the thermal switch at the rear of the starter. The DENSO R4 kW starter does not require or have an external OCP device. However, it is necessary to complete the relay ground circuit when installing an R4 kW in a vehicle originally equipped with this OCP device. This can be accomplished by installing a jumper plug into the OCP wiring harness connector.

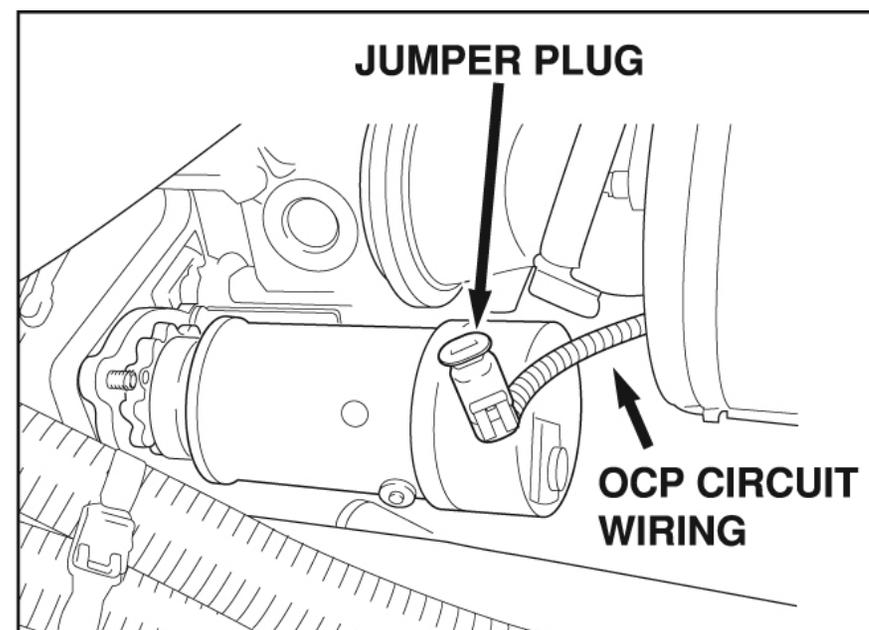
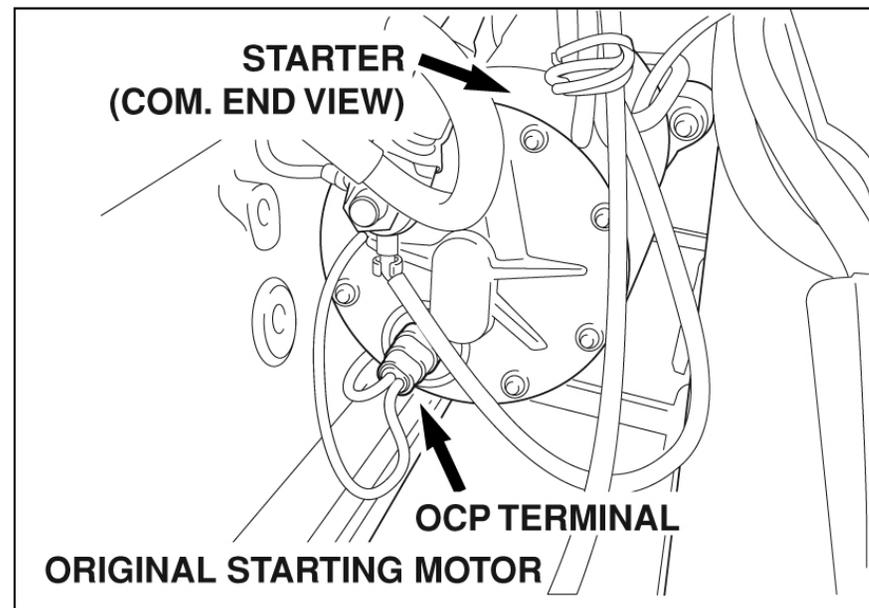
- DENSO OCP Jumper Plug Part #053680-8010

Wiring Assembly

(if equipped with over-crank protection)

Location of over-crank protection terminal in original starter.

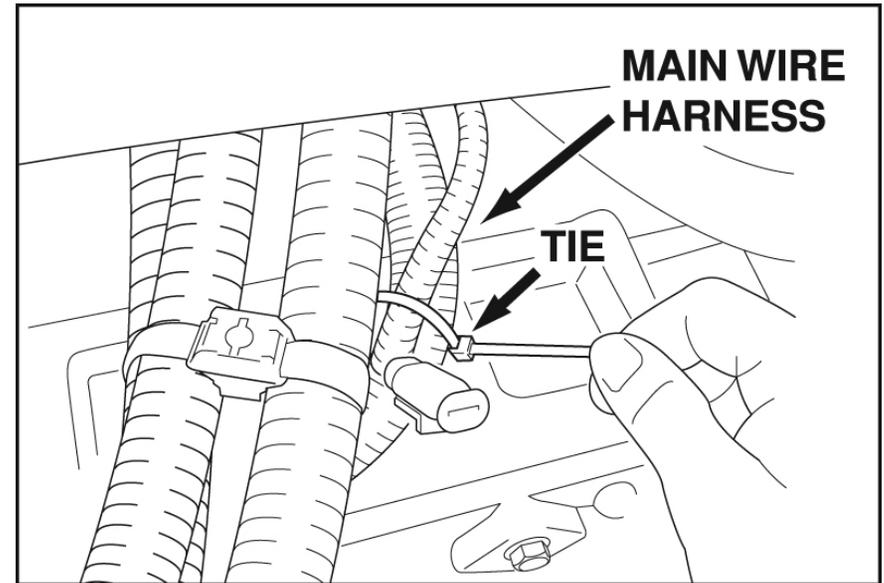
Jumper plug installed in original wire harness.



Wiring Assembly

(if equipped with over-crank protection)

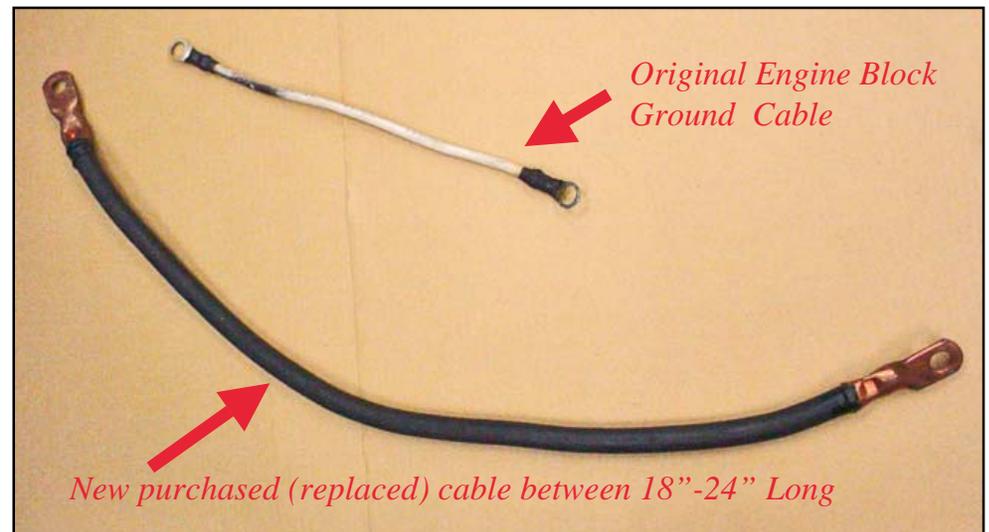
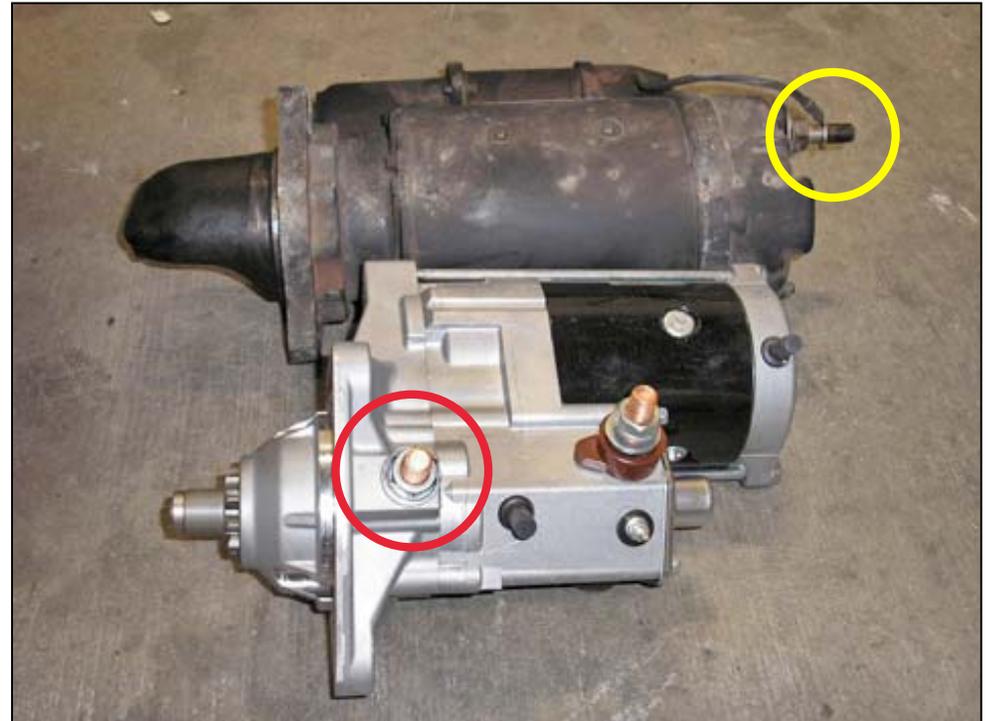
Tie off the OCP terminal and jumper plug to the main wire harness to prevent separation due to vibration.



Wiring Assembly

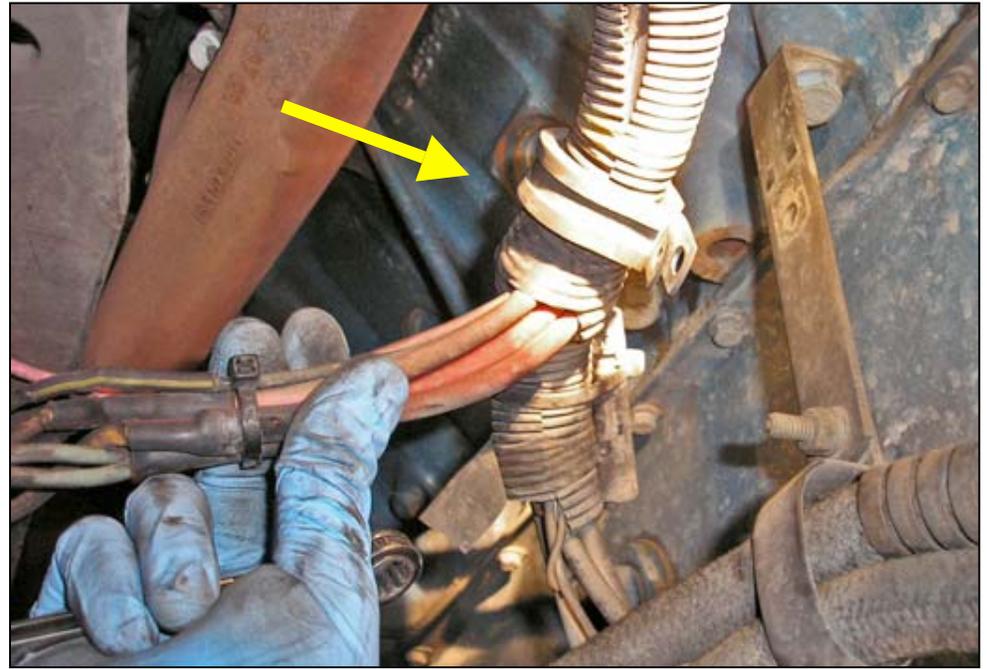
There is a difference in the distances of the ground studs between the two starters. If the length of the engine block GROUND cable does not reach the new R4 starter ground stud, the cable will have to be replaced.

Fabricate or purchase the engine block ground cable. The ground cable should measure 18-24 inches in length from center to center of each eyelet. The gauge of the new cable can be equal to or greater than the original OEM specifications. The cable eyelet diameter must match the original OEM specifications.



Wiring Assembly

Locate and remove the wire harness clamp over the passenger side wheel well. Discard clamp.



Remove the wire harness bracket located at the back of the alternator.



Wiring Assembly

Rotate the clamp with the eyelet pointed up as shown. Secure with the stud nut and tighten to OEM spec.

Make sure no cables make contact with the alternator body. Tie wrap any loose cables to the main wire harness.



Wiring Assembly

Carefully maneuver the cables toward the starter to allow sufficient length for proper connection to the B+ (30) terminal.



Remove the tie holding the battery cable.



Wiring Assembly

Connect all positive (+) cables to the B+ (30) terminal.

Connect the negative (-) battery cable.

Connect all positive (+) cables to the B+ (30) terminal and secure with retaining nut.



Wiring Assembly

Tighten and torque B+ (30) terminal retaining nut to:

**23-30 Nm,
235-306 kgf.cm,
17.0-22.0 lbf.ft.**

Do not over-tighten terminal retaining nut.

Install the new engine block ground cable in place and secure with bolt.



Wiring Assembly

Secure the opposite end of the engine block ground cable to the negative (-) terminal (Terminal G) of the starter.



Secure all ground cables to the negative (-) terminal (Terminal G) with retaining nut.

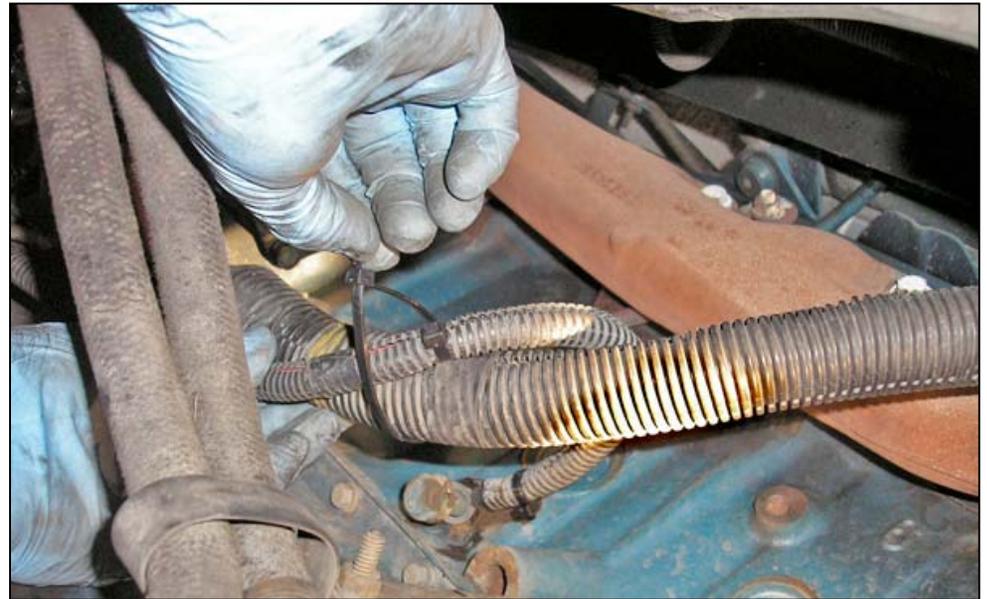


Wiring Assembly

Tighten and torque the Terminal G retaining nut to:

**23-30 Nm,
235-306 kgf.cm,
17.0-22.0 lbf.ft.**

Do not over-tighten terminal retaining nut.



Fasten the engine ground cable to the main wire harness with a cable tie.

Wiring Assembly

Locate the 50 terminal (key switch) stud on the starter.

Attach the key switch wire to the 50 terminal stud.

Tighten and torque the 50 terminal retaining nut to:

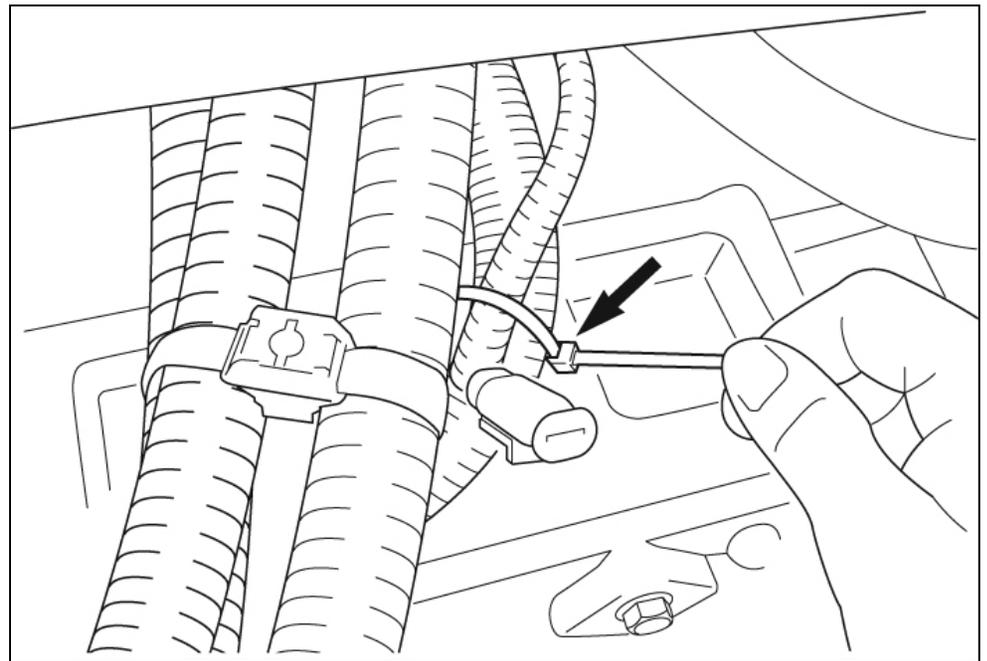
**2.6-4.6 Nm,
26.5-47 kgf.cm,
2.0-3.4 lbf.ft.**

Do not over-tighten terminal retaining nut.



Wiring Assembly

Properly route and re-secure all cable wiring with new cable ties to avoid contact with frame rail and any external heat source.



Proceed to inspection after installation.

Inspection After Installation

Reconnect the battery cables. Torque to OEM specifications.



Check the voltage of all batteries. Each battery should be fully charged.



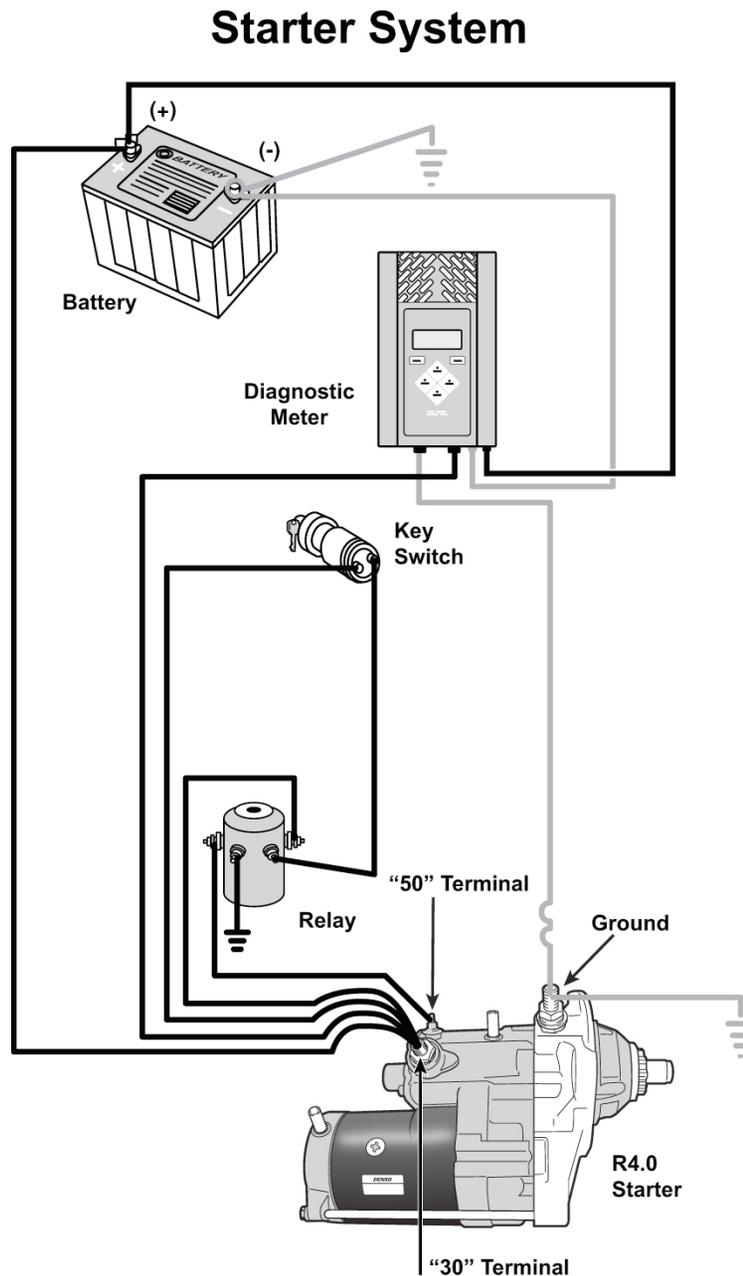
Inspection After Installation

Cable Voltage Loss Test

1. Connect the diagnostic meter as shown in diagram.
2. Run test on the diagnostic meter (main cables).
3. Record voltage loss value indicated on the diagnostic meter.

If total voltage loss exceeds 0.5V @ 500 amps, repair or replace cable.

In accordance with The Maintenance Council RP129 Section 1(B).



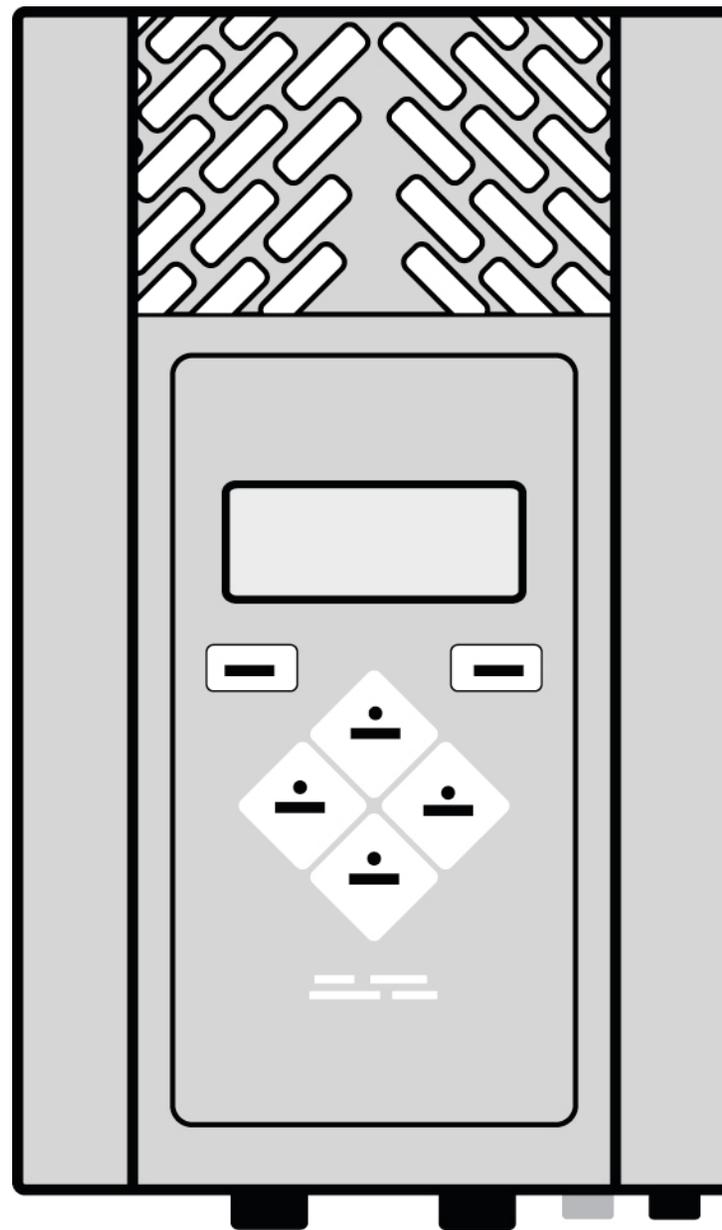
Inspection After Installation

Perform a battery system test. The diagnostic meter will ask for the # of batteries in the system. Enter the # of batteries on the vehicle.

The diagnostic meter will also ask for the rated CCA (cold cranking amps) of ONE battery, and also for the temperature of the batteries. Enter the CCA and temperature of one battery.

The diagnostic meter then will run the test automatically, displaying the test results.

If the system test fails, all batteries must be tested individually.



Inspection After Installation

Replace **ALL** removed vehicle components, such as the battery cover.



Start engine and check for proper operation.





CONGRATULATIONS!

**You have successfully installed the
DENSO R4 Starter.**

**For Additional Assistance or
Technical Support Contact:**

**DENSO Sales California, Inc.
Tech Hotline at 1.800.366.1123**