

Technical Update 25

How to Repair Solenoids for Ford PMGR, Delco PMGR and Delco SD210/260 Starters

In this issue we would like to review the repair of domestic crimp-type solenoids – solenoids that have the solenoid body crimped over the cap to hold the solenoid together. Although crimp-type solenoids have been around for some time on import starters, they are only recently being used on domestic units – specifically Ford PMGR (permanent magnet gear reduction), Delco PMGR and Delco SD210/260 series. In the procedures below we used WAI's crimp-cap tool (WAI #88-723) as an aid in opening and closing the solenoids.

Ford PMGR Solenoids

Repairing the solenoids for Ford units (WAI #66-205) is fairly straightforward, as long as you take a few precautions. Here is the best way we have found to proceed.



Figure 1. Pressing on the plastic plunger tip will destroy it.

Opening the Solenoid

1. Secure the solenoid to a base plate.
 2. Scribe a mark in the solenoid body to indicate the position of the switch terminal.
 3. Place the base plate, with the solenoid mounted, in a press.
 4. Select a round press bar with an open end that fits over the plastic part of the solenoid plunger.
- CAUTION:** Pressing on the plastic tip of the plunger will destroy it! (See Figure 1.)
5. Insert the press bar onto the solenoid plunger and press through the solenoid. This will open the crimp and push the cap and solenoid assembly out of the solenoid body.
 6. Service or replace the solenoid cap and coil as necessary.

Note that some Ford solenoids have a diode molded into the cap that is connected in parallel to the hold-in windings. (See Figures 2 and 3.) This diode clamps the induced voltage that is created in the windings when the solenoid is deactivated.



Figure 2. Some Ford solenoids have a diode molded into the cap.

To test for the presence of this diode while the solenoid is assembled, use a digital-reading diode tester that measures forward voltage drop. Connect one test lead to the switch terminal and the other test lead to ground and note the reading. Reverse the positions of the test leads and note the reading again. If the readings are the same, the diode is not operational. This may be due to a poor ground, a bad diode, or the absence of a diode. On the tester we used, the readings were .792 and .747.

In all cases you can install a solenoid with a diode in place of a solenoid without a diode to provide the ability to clamp spike voltage.

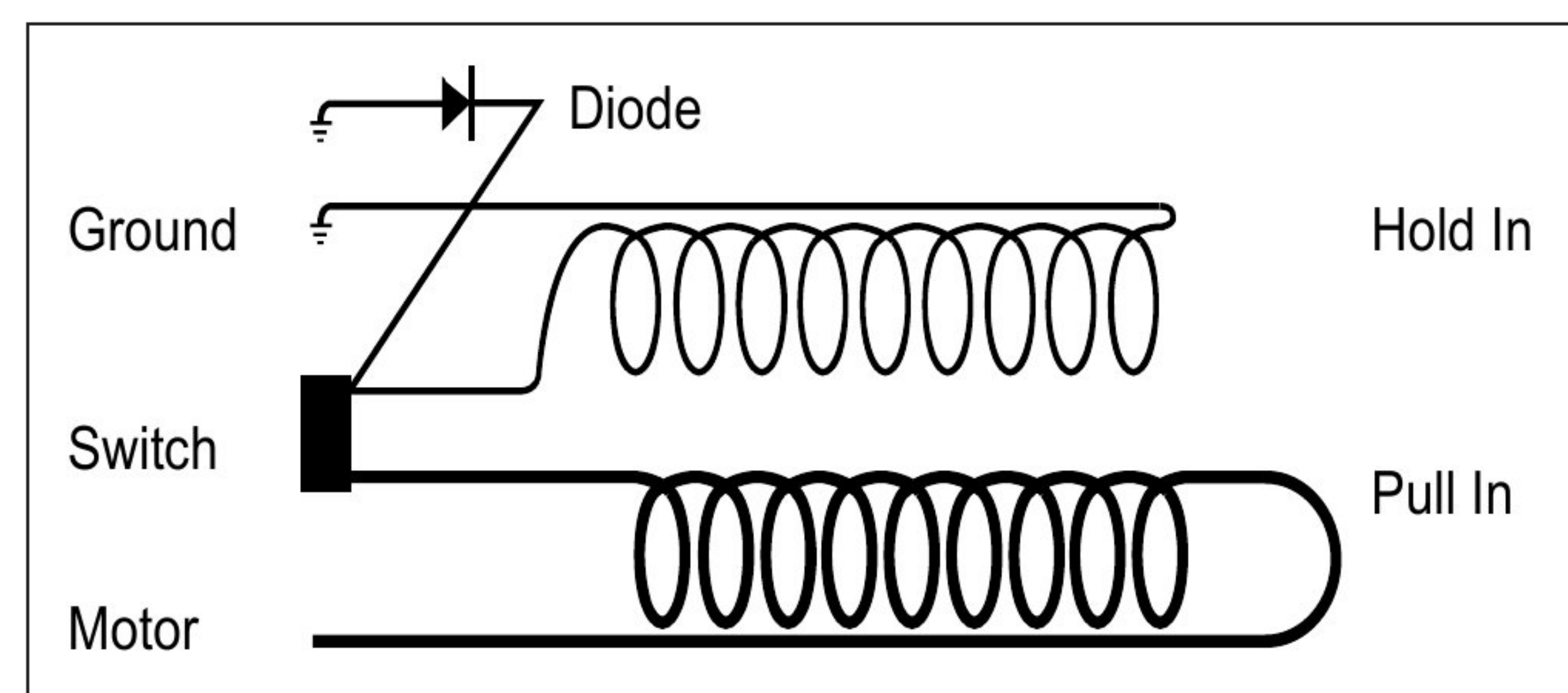


Figure 3. The diode in some Ford solenoids clamps spike voltage.

Closing the Solenoid

First, you will probably want to enlarge the crimp area of the solenoid to make installation of the coil and cap easier. To do this try putting a trailer-hitch ball against the crimp area and giving it a bump with a hammer. Then proceed as follows.

1. Align the switch terminal with the scribe mark on the solenoid body and install the coil assembly and cap. Make sure you have two wires at the switch terminal.
2. Place light pressure on the solenoid cap and peen over the crimp in two places 180 degrees apart. This keeps the cap in place during the crimping operation.
3. Place the solenoid base plate onto the press and place the crimping die over the solenoid. Place the cover over the crimping die and press the assembly.
4. Turn the crimping die over and press the crimp again. This will flatten out and seal the crimp.
5. Solder the two wires at the switch terminal and the one wire at the motor terminal.
6. Test the solenoid.

Delco Solenoids

Delco solenoids (WAI #66-121), on the other hand, are a more challenging project than Ford for several reasons. First, there are no threaded holes for attaching the base plate. Second, the plunger sleeve is flared outward, so the flared end must be removed before the solenoid will come apart. (See Figure 4.) Third, later style solenoids have RTV sealant sealing the coil at the plunger opening. Finally, keep in mind that early solenoids have a round contact disk, whereas later ones have a rectangular contact disk.

Here is how to deal with the quirks of these solenoids.

Opening the Solenoid

1. Cut off the crimped/welded part of the switch and motor terminals. Grind the tip of these terminals to open the hole and release the wires.
2. Using a lathe, cut off the flared end of the plunger sleeve. (See Figure 4.)

3. Secure the solenoid to a base plate. The plate we use has three screws positioned 120 degrees apart, to match the three recesses in the solenoid body. However, these recesses may not exist on some SD210/260 series solenoids. In this case, tighten the three screws into the solenoid body until they dimple the body to a depth of approximately .030" to .050." Make sure you keep the solenoid square with the base plate or it may cause binding during the pressing operation.

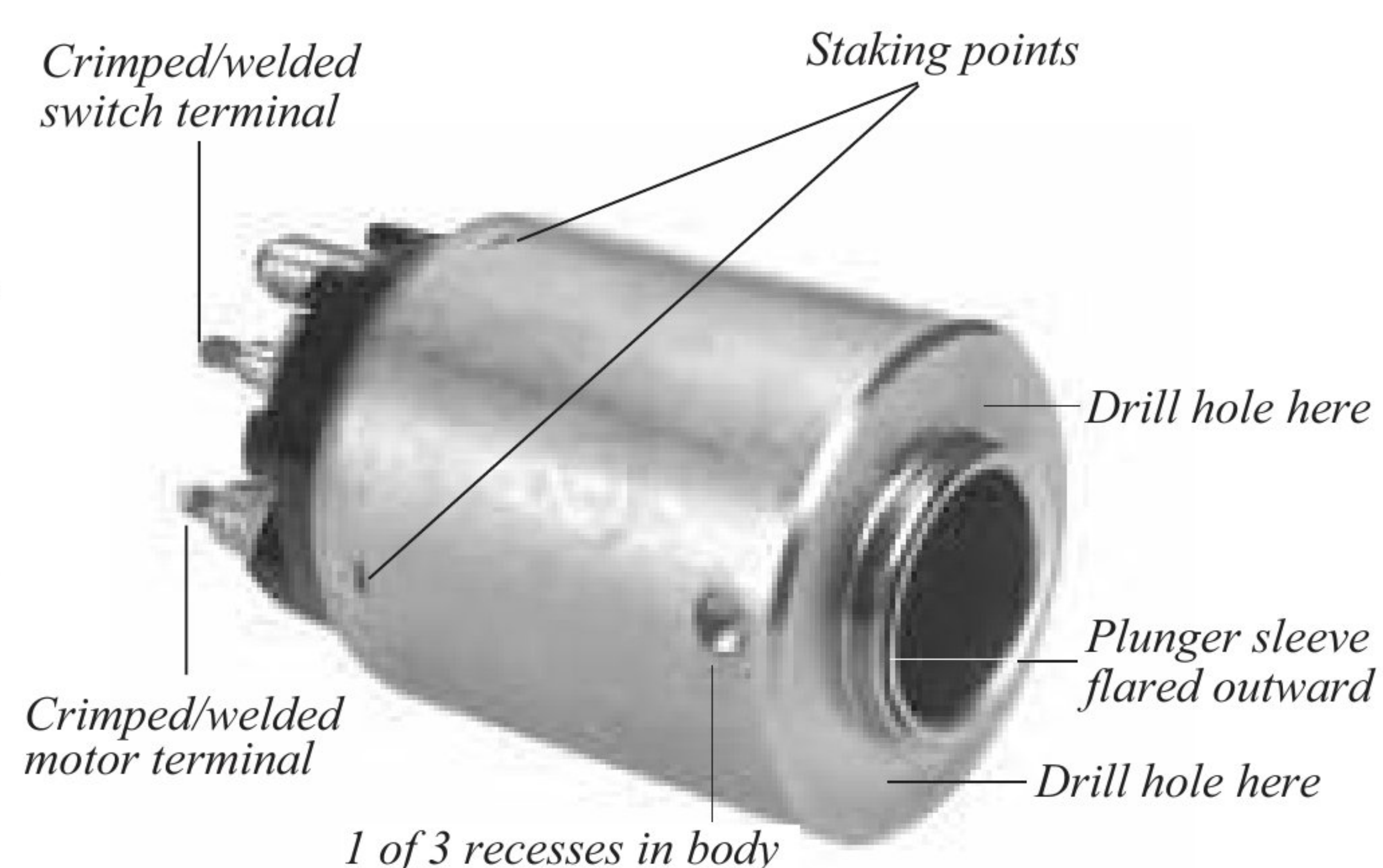


Figure 4. Delco solenoids require a few special procedures.

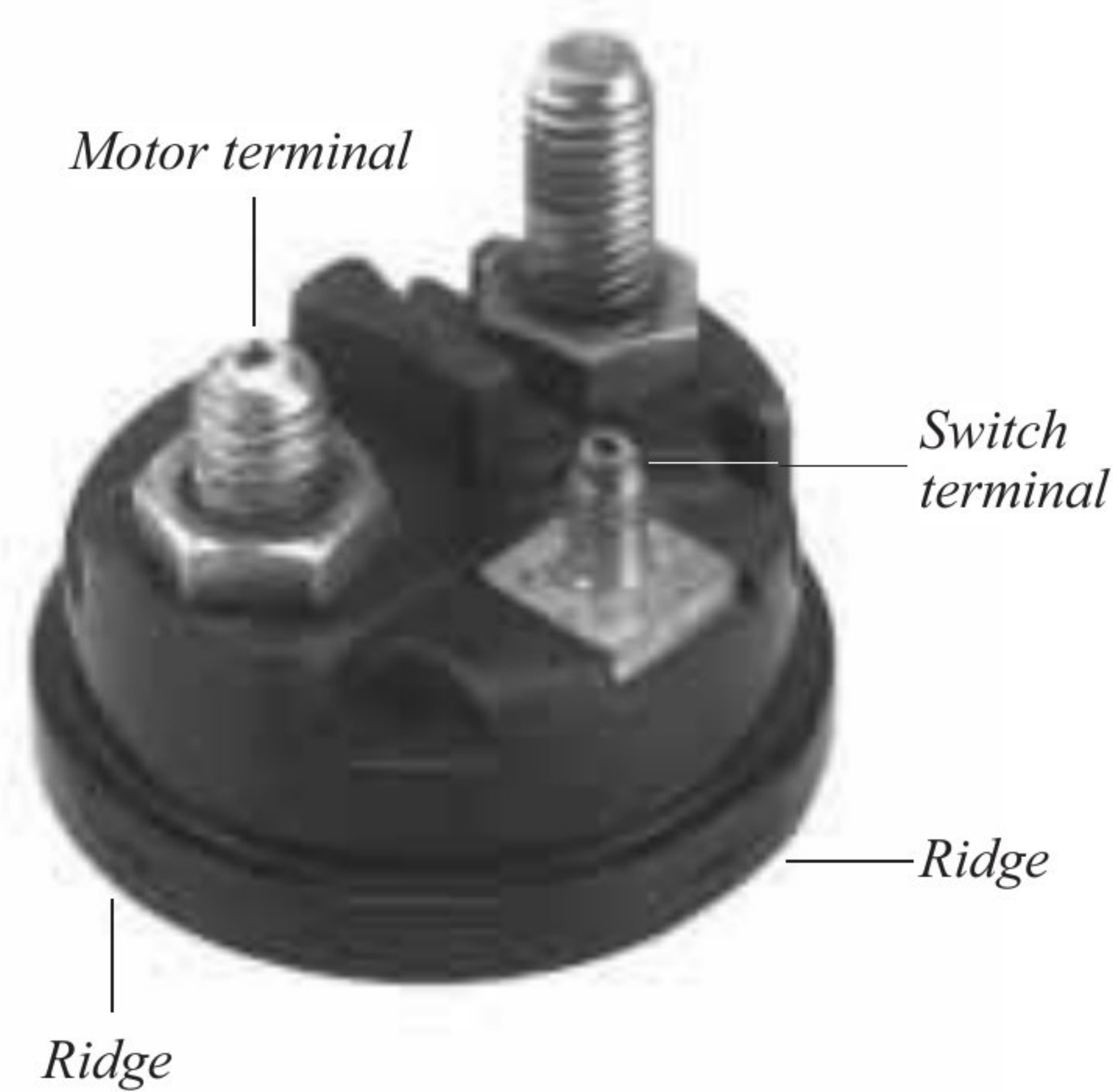


Figure 5. The four ridges in the lip of the OE cap for Delco can be used to gauge .115" when pressing out the cap.

4. Scribe a mark in the solenoid body to indicate the position of the switch terminal.
5. Place the base plate, with the solenoid mounted, in a press.

6. Select a round press bar that fits into the solenoid plunger opening and press until the solenoid cap comes out of the body approximately .115." OE solenoids have a ridge in four places around the lip of the cap that can be used to gauge this distance. (See Figure 5.)
 7. Verify that the wires are loose and rock the cap back and forth until it can be removed from the solenoid.
 8. Remove the gasket.
 9. Using a suitable tool, remove the four staking points that retain the ground plate in the solenoid body. These staking points are visible on the outside of the solenoid body. (See Figure 4.) You can make a tool for doing this by grinding a round punch at an angle.
 10. Cut off the crimped/welded connection where the hold-in winding is attached to the ground plate and remove the ground plate.
 11. Remove the solenoid coil assembly.
- CAUTION:** If the assembly does not come out easily, the solenoid may have the RTV sealant noted above. If you think you've got sealant present, proceed as follows to remove the coil assembly:
- a. Drill two holes 1/4" in diameter and 180 degrees apart to a depth of about .275." (We recommend using a drill press so you can set a stop. That way you will avoid drilling into the coil.) (See Figure 4.)
 - b. With a punch, tap on the plastic bobbin to release the sealant.
12. Service or replace the solenoid cap and coil.

Closing the Solenoid

As with Ford solenoids, you will probably want to enlarge the crimp area slightly using a trailer-hitch ball and hammer. This will make installation of the coil and cap easier.

Also make sure the hold-in winding is long enough to be soldered back to the ground plate. If it isn't, unwrap it one turn and reattach it after the plate and coil assembly have been installed. Then proceed as follows:

1. Install RTV sealant in the bottom of the solenoid body. Then install the coil assembly, making sure you have the two wires for the switch terminal aligned with the scribe mark on the solenoid body.
2. Install the bobbin retaining sleeve (plunger sleeve).
3. Install the ground plate. Make sure the hold-in winding is in a position to be resoldered to the ground plate.
4. Place light pressure on the ground plate and restake the body to retain the ground plate in the proper position.
5. Solder the hold-in winding.
6. Install the gasket and solenoid cap. Make sure you line up the switch terminal with the scribe marks on the solenoid body.
7. As with Ford solenoids, place light pressure on the cap and peen over the crimp in two spots 180 degrees apart to keep the cap in place during crimping.
8. Place the solenoid base plate onto the press and place the crimping die over the solenoid. Place the cover over the crimping die and press the assembly.
9. Turn the crimping die over and press the crimp again to flatten out and seal the crimp.
10. Solder the two wires at the switch terminal and the one wire at the motor terminal.
11. Test the solenoid.
12. If you drilled out the solenoid body to remove the coil, reseal these holes with RTV sealant.
13. Check plunger bore for burrs and make sure plunger moves freely in bore.

WAI Number	Description
66-121	Delco Solenoid
66-205	Ford Solenoid
87-163-93	Delco SD210/260 Catalog
87-210-93	Ford PMGR Catalog
87-241	Delco PMGR Catalog
88-723	Crimp-Cap Tool