NIPPONDENSO DIRECT DRIVE

Courier
Subaru
All Models
Toyota

DESCRIPTION

The Nippondenso starter has four pole pieces and four sets of field coils. Four commutator brushes are installed; two are grounded, and two are insulated and are connected to the ends of field coils. Field coil is connected with armature coil through brushes and commutator segments in series. Starter clutch is engaged to armature shaft with helical splines. The turning of the pinion is due to these helical splines which result in a smooth engagement of pinion and flywheel.

APPLICATION

Model	Part No.
Courier	①D77Z
Subaru	
Man. Trans.	2970
Auto. Trans. (Calif.)	4210
Auto. Trans. (Fed.)	4721
Toyota	
2F Engine	60041, 60061
3K-C Engine	24022
20R Engine	
Federal	36050
Calif.	33020

① – Ford part number.

TESTING

PERFORMANCE TESTS

No Load Test – With starter on bench, and using a fully charged 12-volt battery, make connections as shown. The starter should rotate smoothly. See specification chart for RPM, voltage, and current draw.

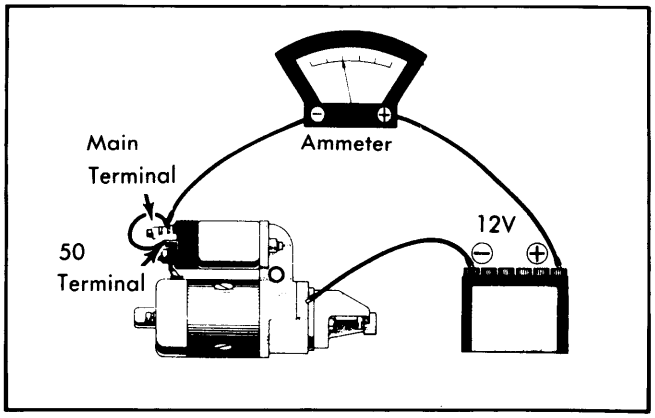

Fig. 1 Circuit for No Load Test

Lock Test – To perform lock test follow instructions and procedures outlined in instruction manual furnished with tester. With starter locked in test stand, and voltage adjusted to specified figure, ammeter reading and starter torque should be within limits (see specifications).

OVERHAUL

DISASSEMBLY

1) Disconnect field coil wire from starter solenoid main terminal and remove the two solenoid attaching bolts. Remove solenoid by moving it up and down to unhook unit from drive lever.

2) Remove bearing cover and pull out armature shaft lock plate, washer, seal and spring.

3) Remove through bolts, commutator end frame, brush holder and yoke.

4) Remove drive lever set bolt, rubber piece, plate, armature and drive lever from housing.

5) Remove pinion stop collar from armature shaft end, and remove starter clutch.

STARTER PERFORMANCE SPECIFICATIONS

Model	No Load Test ①		Lock Test		
	Amps.	RPM	Amps.	Volts	Torque
D77Z	below 50	over 5000	.....	.....	.....
2970	below 50	over 5000	below 600	7.7	over 9.4 ft.lbs.
4210	below 50	over 5000	below 600	7.7	over 9.4 ft.lbs.
4721	below 60	over 5000	below 600	7.0	over 13.0 ft.lbs.
60041	below 50	over 5000	.....	.....	.....
60061	below 50	over 5000	.....	.....	.....
33020	below 50	over 5000	.....	.....	.....
36050	below 50	over 5000	.....	.....	.....

① – At 11 volts on Subaru and Courier; 11.5 volts on Toyota.

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PARTS REPLACEMENT & TESTING

Armature – Check armature for open, shorted or grounded circuits. Inspect armature shaft for bend; if bend is excessive replace armature. **NOTE** – *Do not attempt to straighten a bent shaft.* Inspect armature shaft to bushing clearance. If clearance exceeds .008", replace bushing.

Commutator – If condition warrants, carefully polish commutator with a strip of fine glass paper. If surface is scored, rough or burnt, dress with lathe just enough to remove defective area. If out-of-round exceeds .012", commutator must be turned. After turning, out-of-round must not exceed .004". Check mica depth and file off mica if depth is less than .008". Correct depth is .020-.032".

Brushes & Springs – 1) Check brush holder insulation. Connect one lead of ammeter to brush holder positive side and other lead to negative side of brush holder. If tester needle moves, the brush holder is shorted due to defective insulator. Replace brush holder.

2) Check brush length and if less than .39" (Toyota 3K-C engines), .51" (Toyota 2F engines) or .47" (all others), replace brushes. Be sure brushes move freely in holders and if movement is sluggish, clean brushes and holders.

3) Check brush spring tension and if less than 21 ozs. replace springs. New brush springs should have a tension of 37-48 ozs.

Starter Solenoid – Test pull-in motion of solenoid by connecting test leads to the "50" terminal and the main "F" terminal. Apply 8 volts. Plunger should be pulled in. If switch does not pull in, it is defective. Disconnect the "F" terminal lead only. If plunger remains pulled in, then switch is satisfactory. Test plunger returning movement by connecting the battery positive lead to the "F" terminal and the negative lead to the switch body. Depress plunger by hand and release it. If plunger returns to its original position with 12 volts, switch is satisfactory.

Field Coils – Check field coils for open circuit using a circuit tester. Connect one test prod to field coil lead and the other prod to soldered portion of brush lead. If meter does not register, field coil is open. Repair or replace as necessary. Check field for ground by connecting one test prod to field coil and other lead to starter housing. If meter registers, coil is

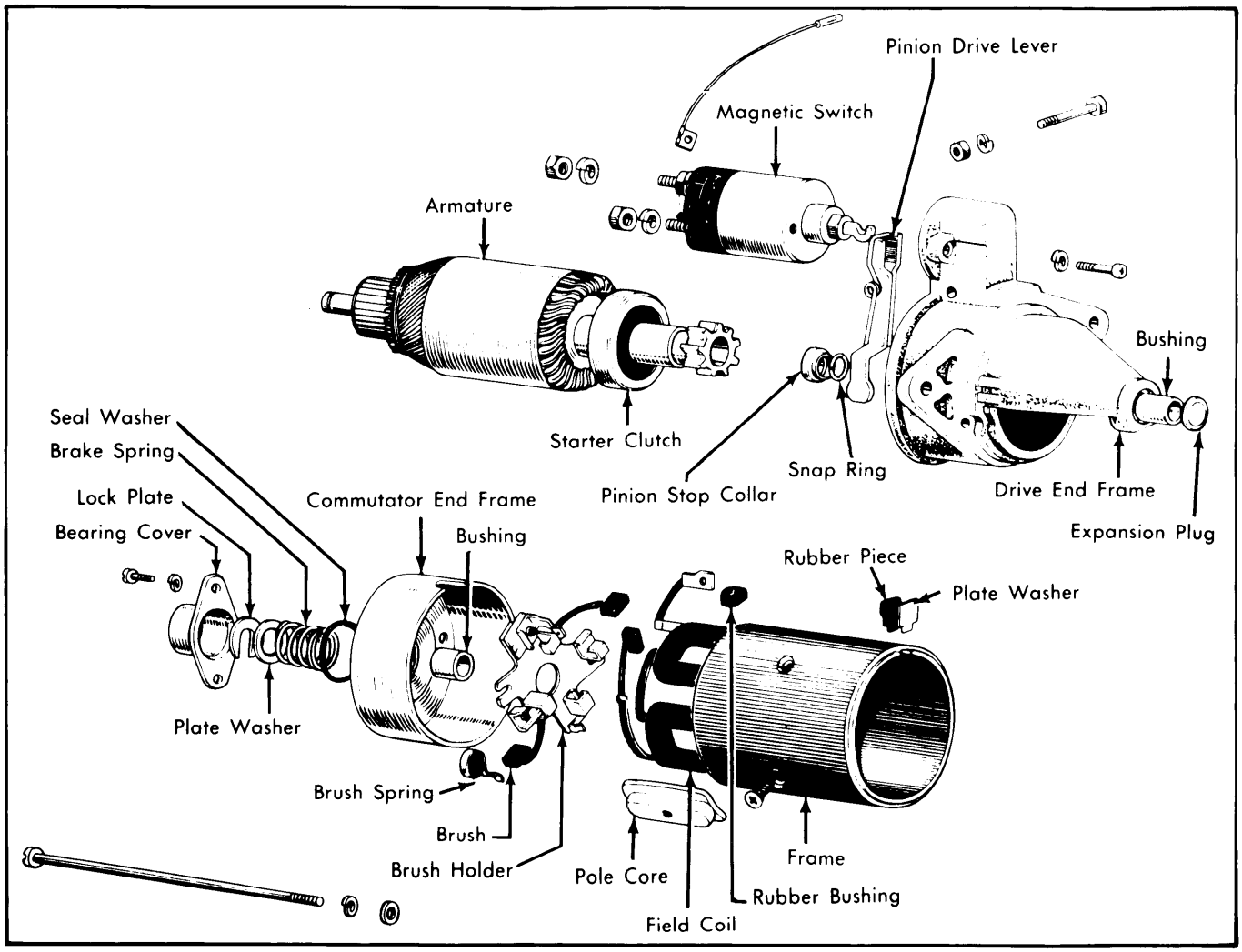

Fig. 2 Disassembled View of Starter Motor

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grounded. Remove field coil and repair or replace as necessary.

REASSEMBLY

Clean all parts and coat the sliding surface of armature shaft splines, starter clutch bushing, drive lever and moving stud with multipurpose grease. Reassemble in the reverse order of disassembly while noting the following: After completing reassembly, operate starter under a no load condition and check clearance between pinion gear and pinion stop collar. If clearance is not within specifications, adjust length of solenoid plunger shaft. Standard length of shaft is 1.34". To increase clearance, lengthen plunger. To decrease clearance, shorten plunger length.

Pinion Gear Clearance

Application	Clearance
Ford Courier	.080-.160"
Subaru	.004-.160"
Toyota	.040-.160"