UNITED STATES MARINE CORPS
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FESCR 8105

STUDENT OUTLINE

REPAIR PRESTOLITE MODEL MFY STARTER ASSEMBLY

LEARNING OBJECTIVE:

1. Terminal Learning Objective: Given a Prestolite Model MFY starter assembly, the required common and special tools, test equipment, precision measuring instruments, repair parts, shop supplies, and TM 9-2320-280-34, per information contained in the reference, repair the starter assembly. (8.1.2)

2. Enabling Learning Objectives: Given a Prestolite Model MFY starter assembly, the required common and special tools, test equipment, precision measuring instruments, repair parts, shop supplies, and TM 9-2320-280-34, per information contained in the reference:

a. disassemble the starter, (8.1.2a)

b. inspect the components of the disassembled starter to determine their suitability for reuse, (8.1.2b)

c. test the components of the disassembled starter for serviceability, (8.1.2c)

d. repair or replace the unserviceable components as required, (8.1.2d)

e. assemble the starter from serviceable components, and (8.1.2e)

f. test the starter on an appropriate test bench. (8.1.2f)

OUTLINE

1. NOMENCLATURE AND DESCRIPTION OF THE MAJOR COMPONENTS OF THE STARTER ASSEMBLY

a. The starter assembly consists of six main components that are incorporated in all starters that you will repair. You will also find that their functions are the same.

(1) The solenoid is an electromagnetic switch that opens and closes the circuit between the starter and the battery. It also causes the starter drive to engage and disengage with the flywheel ring gear.

(a) The solenoid contains two windings; the hold-in and pull-in windings. When the vehicle starter switch is actuated, 24 volts are applied to

the "S" terminal of the solenoid. This provides a current path from ground, through the hold-in winding to the 24 volt supply, and a magnetic field is produced around the winding. At the same time, a current path is provided from ground, through the motor, through the pull-in winding to the 24 volt supply.

(b) The magnetism created by each winding adds together to form a strong magnetic field that attracts the plunger into the core. The pull-in winding operates to assist the hold-in winding in pulling the plunger into the core. Once the plunger movement has been completed, much less magnetism is required to hold the plunger in the cranking position. With the solenoid electric contacts now closed, the pull-in winding is shorted and no current flows through it. This design feature reduces current draw from the battery and also reduces heat created in the solenoid.

(2) The starter drive is an overrunning clutch-type drive, that protects the starter motor from being spun too rapidly by the vehicle engine. It consists of rollers that ride between a collar on the pinion gear and outer shell. The outer shell has tapered slots for the rollers so they can either ride freely or wedge tightly between the collar and shell.

(3) The armature assembly is made up of many conductors of heavy copper ribbons that are mounted between iron laminations on an iron shaft. On one end of the armature is the commutator and mounted on the other end is the starter drive.

(4) The commutator is a series of copper bars connected to the armature windings. The bars are insulated from each other and from the armature. The brushes rub against the turning commutator.

(5) The brushes are made from a carbon and graphite mixture and are oblong in shape. The brushes transfer current from the solenoid to the commutator and armature windings.

(6) The starter motor housing incorporates the field windings and the pole shoes. The pole shoes are mounted to the starter motor housing by screws and the field windings are held in the starter motor housing by the pole shoes.

b. These components will be found in all the starters you will come in contact with. Other components will be covered during this lesson as they relate to the starter.

2. PRINCIPLES OF OPERATION FOR THE STARTER ASSEMBLY

a. Function. The starter is mounted to the right or left side of the engine. A starter is a device that converts electrical energy into mechanical energy. In the case of an automotive starter, it takes a portion of the vehicle battery voltage and converts it into mechanical energy to crank the vehicle engine. The starter is considered to be a low voltage, high torque DC motor.

b. Electromagnetic Field. When electrical current flows through a coil of wire (armature windings), a magnetic field is formed around the coil of wire.

The field is much stronger if the coil is wound around an iron core, forming a device called an electromagnet. The field is made up of magnetic lines of force which flow from the north pole to the south pole.

c. When the Starting Switch is Engaged, the Solenoid is Energized. Once the solenoid is energized, the solenoid windings cause the overrunning clutch-type starter drive to engage with the teeth of the flywheel ring gear on the vehicle. Once the starter drive is engaged, the current is then transferred through the brushes, to the commutator, and then the field and armature windings. A magnetic field is then formed around the armature windings and the field windings. The interaction between the magnetic fields surrounding the two coils causes the armature assembly to rotate.

d. Current and Torque. The amount of torque (mechanical energy) produced by the motor is determined by the amount of current flowing through the two coils. As the current increases, the torque increases. As motor speed increases, a voltage is generated in the armature which opposes current flow. Therefore, as motor speed increases, motor current and torque decrease. When the motor is turning slowly, current and torque are high. If the motor is unable to turn, current is extremely high, and one or both windings will burn up very quickly.

3. PROCEDURES REQUIRED TO REPAIR AND TEST THE PRESTOLITE MODEL MFY STARTER ASSEMBLY

a. Disassembly

(1) Find the procedures in TM 9-2320-280-34 for disassembly of the starter assembly. Read the procedures carefully to become familiar with the total task. Then perform the repair steps listed.

(2) Remove the solenoid.

(3) Remove the commutator end head.

(4) Remove the starter motor frame.

(5) Remove the armature and shift lever.

(6) Remove the overrunning clutch.

(7) Remove the brushes.

(8) Disassemble the solenoid.

Have instructor initial.

b. Cleaning

(1) Find the procedures for cleaning the starter components in the technical manual. Read the procedures pertaining to the starter carefully to become familiar with the total task.

(2) Explain to the instructor the procedures for cleaning the components of the disassembled starter.

c. Inspection

(1) Find the procedures for inspecting the components of the disassembled starter in the technical manual. Read the procedures carefully to become familiar with the total task.

(2) Explain to the instructor the procedures for inspecting the components of the disassembled starter.

(a) Inspect the clutch.

(b) Inspect the brushes and springs.

(c) Inspect the bearings.

(d) Inspect the armature and commutator.

(e) Inspect the field housing and windings.

(f) Inspect the core spring, rubber boot and contact disc.

d. Testing

(1) Find the procedures for testing the starter components in the technical manual and your notes. Read the procedures carefully to become familiar with the total task.

(2) Demonstrate to the instructor the procedures for testing the components of the disassembled starter.

(a) Test the field windings for an open.

(b) Test the armature for a ground.

(c) Test the armature for a short.

Have instructor initial.

e. Repair or Replace the Unserviceable Components

f. Assemble the Starter from Serviceable Components

(1) Find the procedures for reassembly in the technical manual. Read the procedures for reassembly carefully to become familiar with the total task.

(2) Assemble the solenoid.

(3) Install the brushes.

(4) Install the overrunning clutch.

(5) Install the armature and shift lever.

(6) Install the armature into the starter motor frame.

(7) Install the commutator end head.

(8) Install the solenoid.

g. Final Adjustments

(1) Find the procedures in the technical manual for the final adjustments on the starter assembly. Read the procedures carefully to become familiar with the total task.

(2) Check and adjust the armature end play.

Have instructor initial.

h. Test the Starter Using the Alternator/Generator/ Regulator/Starter (AGRS) Test Stand.

NOTE: An instructor will be at your test stand to provide you with individual instructions and assistance while you test your starter.

(1) Install the starter on the test stand.

(a) Position the starter on the cradle of the test stand and secure it with the starter clamp.

(b) Connect positive cable 1536 to the starter solenoid positive terminal and into the 24 volt positive socket of the test stand.

(c) Connect negative cable 1537 to the negative post on the starter and into the negative socket of the test stand.

(d) Connect cable 10641529 to the starter solenoid switch terminal and into the 24 volt socket of the test stand.

(2) Check and adjust the pinion clearance.

(a) Make sure the louvers are in the open position and that all five air inlets on the test stand are open.

(b) Turn the test stand main power and the starter power supply main to the ON position.

(c) Turn the starter voltage switch to the 24V position and push button R on the starter timer meter.

NOTE: The test stand has a 30 second timer incorporated in the starter test system to protect the starter solenoid. Once the 30 seconds have elapsed, the test stand will automatically shut down the starter test system for a 2 minute cool down time. This 30 second timer starts when the starter solenoid switch or the starter test switch is placed in the ON position.

(d) Flip the starter solenoid switch to the ON position and, using a feeler gauge, check the pinion clearance and return the switch to the OFF position.

(e) If the pinion clearance is not within specifications listed in the technical manual for the starter, make the required adjustment and recheck the clearance.

(3) Perform the starter free run test.

(a) Using the 12% tap and 2-1/2% tap starter transformer switches, adjust the starter volts to 20 volts.

(b) Using the paint markers provided, paint the end of the armature shaft half white and half black. Then adjust the speed sensor until you have a defined red dot on the white side. Push the starter test button to see if the RPM registers on the starter RPM meter. If they do not register, readjust the sensor and recheck.

(c) Push the starter test button, note the readings displayed on the starter AMPS and starter RPM meter, and release the button. Compare these readings with the specifications for the starter. If all specifications are met, the starter is serviceable. If a low-speed, high-current condition exists, check the armature for excessive arcing, grounds, and shorts; also check for armature drag and faulty bushings. If a low-speed, low-current condition exists, inspect for faulty connections and poor brush contact.

(4) Return all switches to their OFF position.

(5) Remove the starter from the test stand and return all cables to their original location.

Have instructor initial.

STUDENT REFERENCE:

TM 9-2320-280-34