ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION
SERVICE DEPARTMENT
MAINTENANCE INSTRUCTION

PLATE-TYPE RHEOSTAT LOAD REGULATOR

INTRODUCTION

The plate-type rheostat load regulator, Fig. 1, operates in conjunction with the engine governor to provide an efficient system of locomotive load control. This load control system is designed to maintain the necessary engine speed-fuel ratio to develop a specific predetermined horsepower output for each throttle position. This eliminates engine overloading and underloading and thereby results in efficient locomotive performance.

In order for the load control system to function as intended, the engine governor should have the proper settings and adjustments, which vary with the different locomotive models. It is therefore recommended that the Engine Maintenance and Locomotive Service Manuals be consulted for information on engine governors and load regulator operation.

MAINTENANCE

To ensure continued satisfactory operation, the load regulator assembly should be inspected and cleaned at intervals outlined in the Scheduled Maintenance Program. Particular attention should be given the following items.

INSPECTION AND CLEANING

1. Remove weatherproof cover, Fig. 1, from rheostat assembly, if so equipped, by removing eight retaining screws and lockwashers.

2. Remove rheostat assembly cover, Fig. 2, by removing three retaining screws and lockwashers. A screwdriver may be used to pry cover from rheostat assembly.

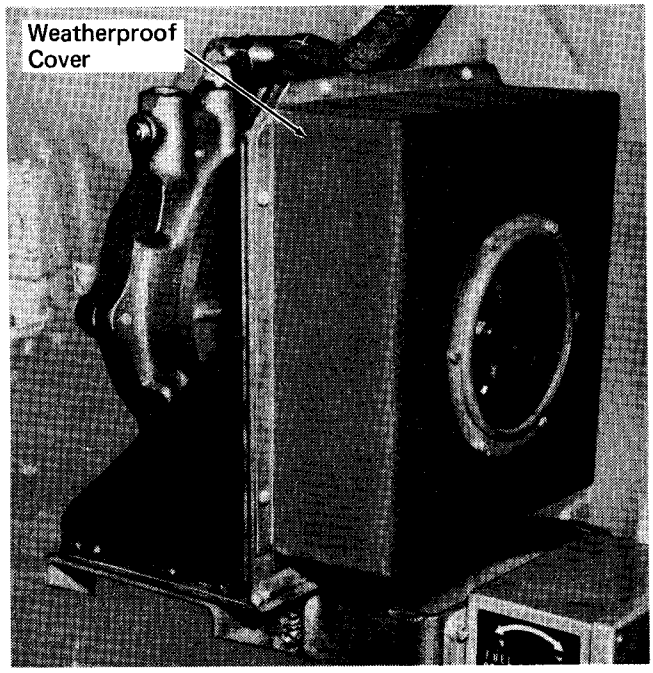

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Fig. 1 – Load Regulator Assembly 8423587 with Weatherproof Cover

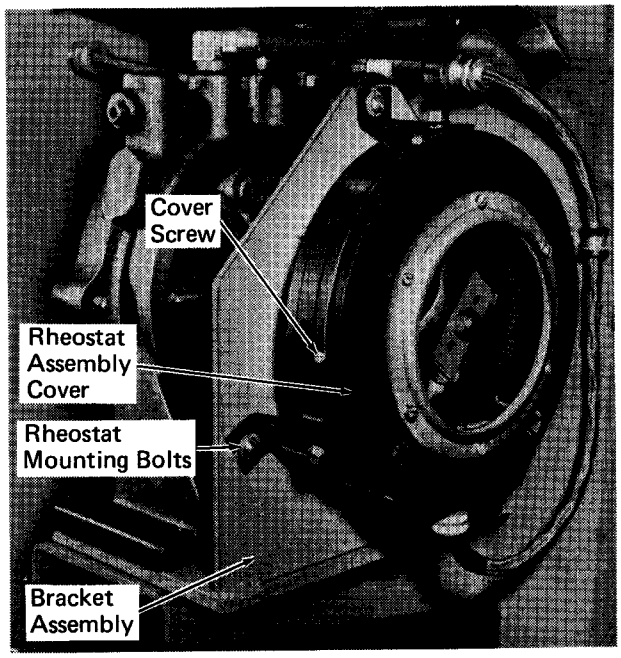

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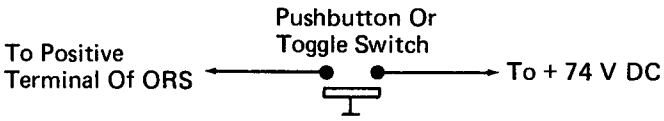
Fig. 2 – Load Regulator Assembly 8453918

NOTE: No attempt should be made to manually turn the vane shaft or contact arm assembly on the rheostat due to the possibility of shearing the drive keys from the drive block. To rotate the vane motor and contact arm, manually raise and lower the load control pilot valve in the governor or alternately energize and de-energize the overriding solenoid ORS by using a jumper wire to apply a positive voltage of 74 volts to the positive terminal of ORS. This causes engine oil pressure to actuate the load regulator as would occur in normal operation.

3. With engine running at idle, manually raise and lower the load control pilot valve in the governor to check contact arm movement from minimum to maximum position. For proper contact, the radial runout between contact button brush and contact buttons should not exceed 1/8".

4. With engine running at idle, check contact arm movement as specified in Step 3 by energizing and de-energizing ORS. ORS may be energized and de-energized by using jumper wire and switch connected as shown in following sketch.



5. Ensure that contact button brush is in firm contact with contact buttons and that slip ring brush is in firm contact with slip ring. Contact pressure is fixed by non-adjustable spring tension. If improper brush contact or a weak spring is suspected, remove spring from contact arm assembly and check against tolerances provided in the Service Data. Refer to Step 6 for removal of contact arm assembly.

6. Remove contact arm assembly as follows: Refer to Fig. 3.

   a. Straighten bent lip of keyed washer to release retaining nut.

   b. Using 5/8" wrench, remove retaining nut.

   c. Note position of contact button brush for proper reassembly, then remove contact arm assembly.

7. Using low pressure air, blow dust and dirt from rheostat assembly. Cleanliness is particularly important in the area between contact buttons. Dirt or grease between contact buttons may lead to carbon tracking or burning. Alcohol or mineral spirits may be used for removing stubborn dirt or grease. If necessary, contact buttons and collector ring surface may be cleaned by using a flexible abrasive. Refer to Service Data for part number of abrasive.

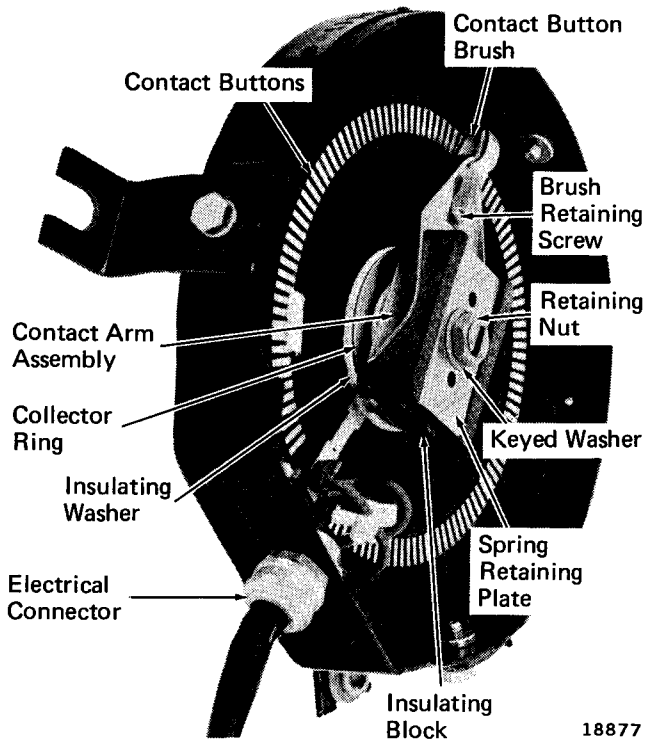


Fig. 3 – Rheostat Assembly with Cover Removed

8. Check all wiring connections to terminals for proper tightness.

9. Check for oil leakage and check connections of lube oil piping to the vane motor.

10. Check the ceramic (vitrohm) face plate rheostat assembly for burning or cracks.

11. Check that rheostat resistance is within the limits specified in the Service Data.

REPLACEMENT OF CONTACT BUTTON BRUSH ASSEMBLY

The contact button brush assembly should be replaced at intervals as specified in the Scheduled Maintenance Program, when the brush is suspected of being defective, or brush wear approaches the limits specified in the Service Data.

1. Remove weatherproof cover from rheostat assembly, Fig. 1.

2. Remove rheostat assembly cover, Fig. 2.

3. Remove contact button brush retaining screw and lockwasher, Fig. 3.

NOTE: The brush may be replaced without removing the contact arm assembly from the rheostat assembly.

4. Remove brush from contact arm assembly, Fig. 4, being careful that the plain washers on the brush drive pin are retrieved. These washers will drop off when the brush is removed from the contact arm assembly.

5. Place the two plain washers on brush guide pin, Fig. 4, and hold them in place.

6. Position new brush so that guide pin aligns with hole in brush, and hold brush against guide pin to keep washers in place. Attach brush spring to contact arm assembly with screw, Fig. 3, and lockwasher. Brush contact with rheostat will retain washers in position.

REPLACEMENT OF SLIP RING BRUSH

The slip ring brush should be replaced at intervals as specified in the Scheduled Maintenance Program, when the brush is suspected of being defective, or brush wear approaches the limits specified in the Service Data.

The slip ring brush is permanently attached to the contact arm assembly, Fig. 4. Therefore, it will be necessary to replace the assembly in order to replace the slip ring brush.

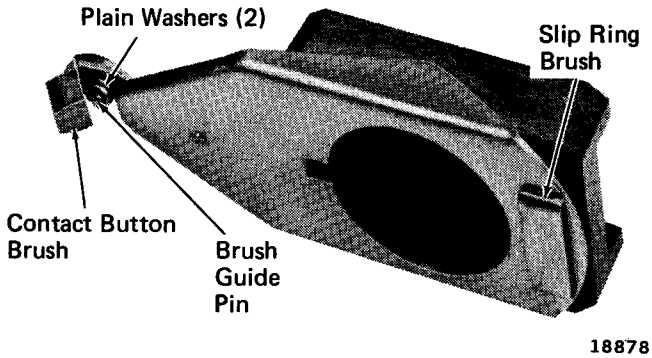


Fig. 4 -- Contact Arm Assembly

REMOVAL AND REPLACEMENT OF RHEOSTAT PLATE

1. If applicable, remove weatherproof cover, Fig. 1, from rheostat assembly by removing eight retaining screws and lockwashers.

2. Remove rheostat assembly cover, Fig. 2, by removing three retaining screws and lockwashers. A screwdriver may be used to pry cover from rheostat assembly.

3. Identify and remove wires from rheostat terminals.

4. Remove three rheostat mounting bolts, Fig. 2, nuts, and washers.

5. Remove rheostat assembly from vane motor.

6. Note position of contact arm assembly and contact arm assembly drive shaft, and remove contact arm assembly and drive shaft as follows: Refer to Fig. 3.

   a. Straighten bent lip of keyed washer to release retaining nut.

   b. Using a 5/8" wrench, remove retaining nut. Remove spring retaining plate, spring, and insulating block.

   c. Remove contact arm assembly from drive shaft, then remove drive shaft from rheostat plate.

7. Check resistance of replacement rheostat plate to ensure that resistance is within the limits specified in the Service Data.

8. Install contact arm assembly drive shaft into rheostat plate in the position noted in Step 6.

9. Install contact arm assembly on drive shaft in the position noted in Step 6.

10. Assemble insulating block, compression spring, spring retaining plate, two keyed washers, and retaining nut on drive shaft. Bend lip of keyed washer to lock retaining nut in place.

11. Mate rheostat coupling, Fig. 5, with the vane motor coupling so that the keyways on the couplings are 180° apart. Ensure that spider is placed between the two couplings.

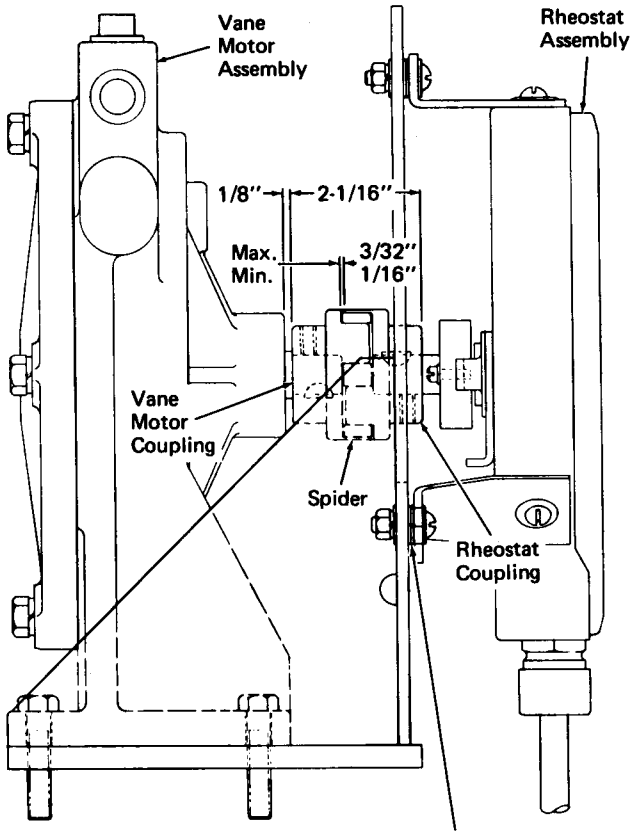


Fig. 5 – Coupling Adjustment

NOTE: When performing Step 12, ensure that rheostat shaft, coupling, and vane motor shaft are aligned. A maximum of two flat washers may be installed under each mounting bracket leg, Fig. 5, if necessary for alignment.

12. Attach rheostat assembly to bracket assembly using three mounting bolts, nuts, plain washers, and lockwashers.

13. Ensure that lube oil piping between governor and regulator vane motor is properly connected.

14. Perform Steps 3, 4, and 5 of "Inspection and Cleaning" procedures to ensure that trailing edge of contact button brush is over the white marker strip at maximum field position and at minimum field position. If necessary, rheostat mounting bolts may be loosened and rheostat turned clockwise or counterclockwise to ensure that contact button brush is over white marker strip at maximum and at minimum field position. Be sure that mounting bolts are tightened after adjustment is made.

15. Using a megohmmeter, check between rheostat terminals and ground. An indication of one megohm or more is satisfactory.

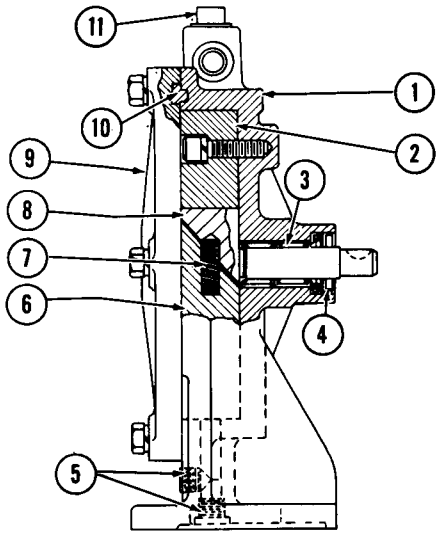
16. Perform high-potential test between rheostat terminals and rheostat case by applying 1200 volts at 60 cycles for one minute.

17. Reconnect wires to rheostat terminals and install rheostat assembly cover and weatherproof cover (if applicable). It may be necessary to cut away the corners from the rheostat mounting feet in order to install the weatherproof cover.

VANE MOTOR DISASSEMBLY, FIG. 6

Disconnect lube oil piping. Remove drain plug to drain oil from vane motor. Remove vane motor assembly from unit and place on workbench for convenience of further disassembly.

Check vane motor shaft end play. It should be not less than .002" or more than .005". Remove the six 3/8" hex-head bolts from vane motor cover. Remove cover and gasket. Discard gasket and apply a new one at assembly. Remove vane, compression spring, and shaft. Handle parts carefully as they are manufactured to close tolerances to minimize oil leakage. Remove plugs and ball check valves.



1. Motor Housing
2. Motor Segment
3. Needle Bearing
4. Oil Seal
5. Pipe Plug - 1/4"
6. Vane
7. Compression Spring
8. Shaft
9. Motor Housing Cover
10. Gasket
11. Governor Connections

Fig. 6 – Vane Motor Assembly

After disassembly, all parts of the vane motor should be thoroughly cleaned and inspected. Parts showing excessive wear or damage should be replaced.

The vane motor may be assembled by reversing the procedure outlined above for disassembly. After assembly, the vane motor should be installed and completely checked for proper performance.

LOAD REGULATOR TIMING

The rate at which the load regulator or contact arm moves when oil flows into the vane motor is very important from the standpoint of load control stability. The load regulator pilot valve is built into the electro-hydraulic and electro-pneumatic governors and it operates within a special ported bushing. The number, size, and location of ports in such bushings automatically controls the rate of oil flow to or from the load regulator and proper timing is ensured.

Several types of bushings are used, depending on locomotive application. Some have four ports and others five ports. Whenever a governor is changed or the load regulator pilot valve and bushing is replaced, care should be exercised to make sure the replacements are identical to those removed. For identification of proper components to be used on various locomotives, consult the EMD Locomotive Replacement Parts Catalog.

SETTING OF ORS AND LOAD CONTROL PILOT VALVE

Refer to the Engine Maintenance Manual for complete information on the settings and adjustments of the ORS, the engine injector rack linkage, and the governor load control pilot valve. These items are all concerned with locomotive power and load control and should be given careful attention.

FLUSHING LOAD REGULATOR

Flushing of load regulators as a routine maintenance practice is unnecessary. They are equipped with ball check valves which allow a constant circulation of oil through the vane motor when the vane is in either extreme of its travel. The load regulator is therefore being flushed during normal operation and will be kept clean in this manner. Any air trapped in the vane motor or piping will similarly be purged as soon as the engine is started and oil circulation begins.

Whenever it becomes necessary to remove the vane motor cover for inspection of interior components, the motor should first be drained. This is easily done by removing the 1/4" pipe plug, Fig. 6, from the drain hole at the bottom center of the vane motor. When replacing the vane motor cover a new cover gasket should be installed as shown in Fig. 6.

SERVICE DATA

SPECIFICATIONS

Load Regulator	8423587	8453918
Vane Motor Assembly	8163954	8163954
Rheostat Assembly	8378256	8356005
Rheostat Resistance	1500 ± .25% at 20°C.	1500 ± 10% at 20°C.
*Trimmer Resistor	As Required	NA

*Resistance value of trimmer resistor will be that value necessary to bring overall resistance to 1500 ohms ± .25%. This value will vary typically between 16 K ohms and 60 K ohms. If the rheostat alone is 1500 ohms ± .25%, no trimmer resistor is required. The trimmer resistor, when applicable, is to be connected between rheostat terminals 1 and 2. A Ward-Leonard metal film METHOHM TYPE WL70 or equivalent trimmer resistor is recommended.

Wear Allowance

- Contact Button Brush . . . . . 3/32"
- Collector Ring Brush . . . . . 1/16"

Spring Specifications

- Free Length -
  - Minimum . . . . . 1"
  - Maximum . . . . . 1-3/16"
- Inside Diameter - Minimum . . . . . 57/64"
- Oustide Diameter - Maximum . . . . . 1-7/64"
- Total Coils 4
- Active Coils 2
- Pressure when compressed to 11/32"
  - Minimum . . . . . 10 lbs.
  - Maximum . . . . . 12 lbs.
- Working Height . . . . . 7/16"
- Solid Height - Maximum . . . . . 17/64"

EQUIPMENT

- Flexible Abrasive 8149435

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