



MAINTENANCE INSTRUCTION

FACE PLATE TYPE LOAD REGULATOR

GENERAL

The face plate type 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 keep the engine speed-fuel ratio correct so that a predetermined horsepower will be developed for each throttle position. By this means, the engine is prevented from being overloaded or underloaded which results in efficient engine and locomotive performance.

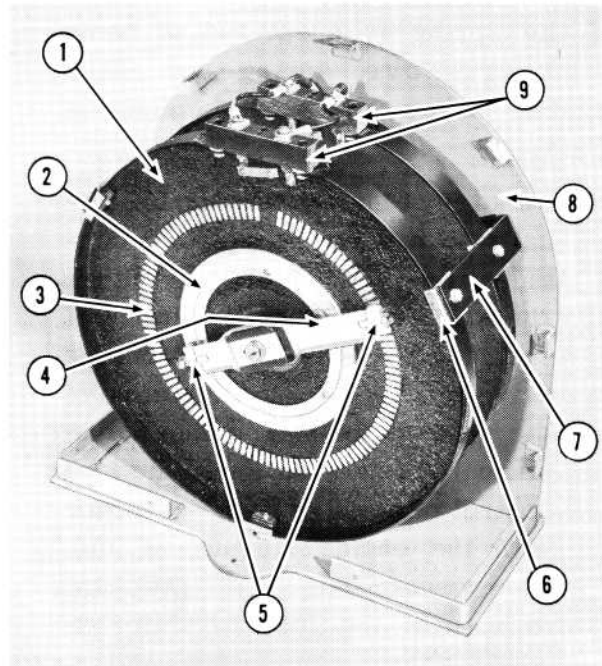
It should be remembered however, that for the load control system to function as intended, the engine governor should have the proper settings and adjustments which vary with the different locomotive models. It is therefore recommended that the Engine Maintenance and Locomotive Service Manuals be consulted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

MAINTENANCE

The load regulator assembly should be inspected and cleaned at intervals outlined in the Scheduled Maintenance Program. Such periodic attention will ensure continued satisfactory operation of this important device. Particular attention should be given the following items:

INSPECTION AND CLEANING

1. Remove cover from regulator assembly.



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|------------------------|----------------------------------|
| 1. Face Plate Rheostat | 5. Contact Shoes ⁷⁴¹⁷ |
| 2. Collector Ring | 6. Saddle |
| 3. Button Contacts | 7. Mounting Foot |
| 4. Contact Arm | 8. Base |
| | 9. Terminal Blocks |

Fig. 1 — Load Regulator

2. Using low pressure air, blow away any accumulations of dust or dirt from rheostat assemblies. Cleanliness is particularly important in the areas between the contact buttons since dirt or grease in such locations may lead to carbon tracking or burning.
3. If necessary, contact buttons and the collector ring surface may be cleaned using a flexible abrasive. See Maintenance Data for part number.
4. Renew copper-graphite button contact shoe and silver faced collector ring

*NOTE: Information contained herein is applicable to equipment being produced as of the date of publication.

contact shoe when worn. See Maintenance Data for wear allowance.

5. Check to see that contact arm and shoe assembly is in firm contact with the collector ring and button contacts. Contact pressure is fixed by spring compression that is not adjustable. Should improper contact be found or if the spring is suspected of being weak, remove spring and check against tolerances in Maintenance Data.

NOTE: No attempt should be made to manually turn the vane shaft or contact arm assemblies on either rheostat due to the possibility of shearing the drive keys from the drive block. To cause rotation of the vane motor and contact arms, manually raise and lower the load control pilot valve in the governor with the engine running at idle. This causes engine oil pressure to actuate the load regulator as would occur in normal operation.

6. Using method outlined in preceding note, check contact arm movement through the full 270° of arm travel. For proper contact, the radial runout between shoe and contacts should not exceed 1/8".

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

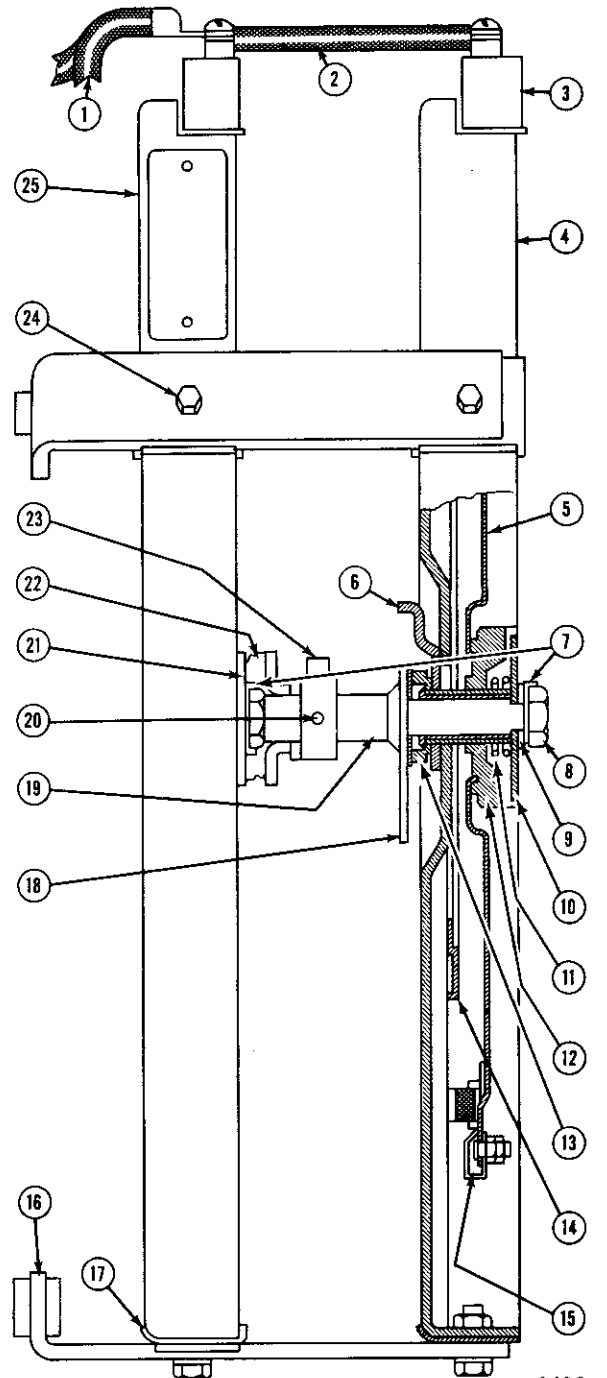
8. Observe for oil leakage and check tightness of lube oil piping connections to vane motor.

9. Check the ceramic (vitrohm) face plate rheostat assemblies for burning or cracks.

REPLACING RHEOSTAT PLATES

The rheostat plates may be removed by referring to Fig. 2 and following the procedure listed below.

1. Remove the cover from the regulator assembly.



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|-------------------------|---------------------------|
| 1. External Leads | 14. Collector Ring |
| 2. Jumpers | 15. Contact Shoe Assembly |
| 3. Terminal Block | 16. Foot |
| 4. Rheostat | 17. Saddle |
| 5. Contact Arm Assembly | 18. Drive Arm |
| 6. Stop | 19. Shaft Assembly |
| 7. Special Keyed Washer | 20. Pin |
| 8. Nut | 21. Short Coupling |
| 9. Keyed Washer | 22. Cross Coupling |
| 10. Drive Arm | 23. Set Screw |
| 11. Spring | 24. Screw |
| 12. Insulating Block | 25. Rheostat |
| 13. Thrust Washer | |

Fig. 2 — Rheostat Assembly

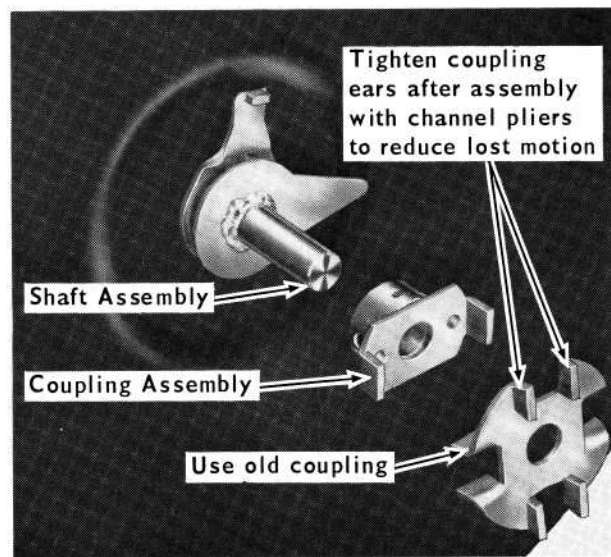
2. Disconnect leads (1) and jumpers (2) from the rheostat terminals (3).
3. Loosen and remove the cap screws holding rheostat assembly to base.
4. Remove the rheostat assembly from the vane motor and base.
5. Remove the screws (24) holding the feet (16) and saddles (17) to the rheostat plates. Separate rheostats (4) and (25).
6. Remove the shaft (19) and cross coupling assembly (22) from the rheostat (4) by removing nut (8). Removing this nut will also release items: (7) keyed washer, (18) drive arm, and (5) contact arm assembly.
7. Remove the cross coupling from the shaft by loosening set screw (23) and driving out locking pin (20).
8. Remove the shaft and coupling assembly from rheostat (25) in the same manner as from rheostat (4).

To reassemble rheostat make certain that all parts reused are in good condition and reassemble parts in the reverse order of disassembly.

When placing the rheostat plates together, align contact arm with the coupling making certain the drive arm (18) is parallel to the contact arm and pointing to the contact shoe on the bottom contacts.

NOTE: When replacing rheostats together, tighten set screw in coupling but do not insert pin.

Install saddle (17) and mounting feet (16), tightening the screws securely. Rotate the contact arm assemblies by turning coupling to check the full 270° travel. Always use coupling when turning the contact arm. Do not apply turning pressure to the contact arm assemblies. Tighten coupling ears, if necessary, with pliers to reduce lost motion in coupling, see Fig. 3.



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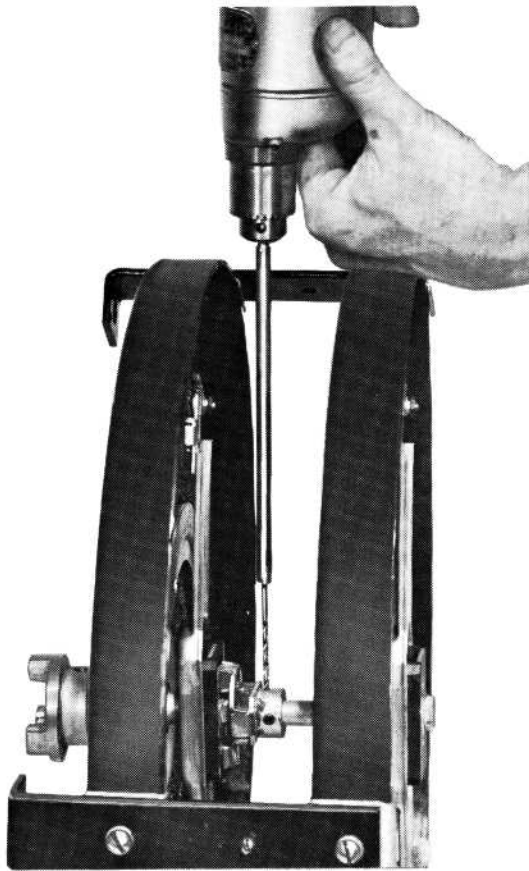
Fig. 3 — Shaft And Coupling

Loosen coupling set screw. Line up both contact arms on the first low resistance step of each rheostat (contact buttons 15, 16, 17, and 18), counterclockwise starting at top button. Tighten coupling set screw. Rotate coupling by hand to check for balanced travel of both face plate contact arms. The lost motion between the two rheostat arms and button displacement between the two plates should not be more than one step out of alignment from contact number 15 to contact number 45 (high current), not more than two steps out of alignment from contact number 45 to contact number 75 and not more than three steps out of alignment from contact number 75 to contact number 102 (minimum current).

With a 1/8" drill, drill through coupling and shaft, Fig. 4. It will be necessary to mount the 1/8" drill in an enlarged shank about 8" long to drill coupling and shaft.

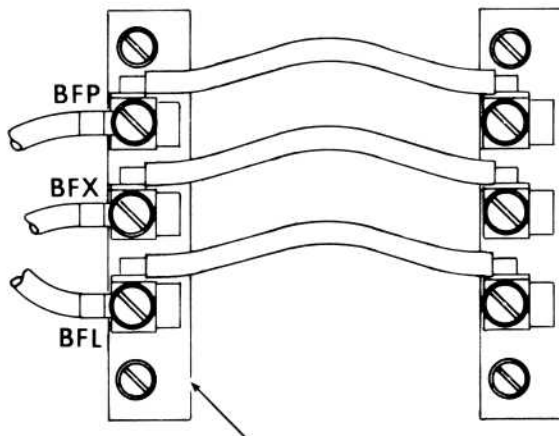
Support shaft and coupling on a block and drive rolled pin in hole drilled. The pin should be driven flush with the surface of the coupling.

Connect external leads and jumper cables as shown in Fig. 5.



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Fig. 4 — Drilling Hub And Shaft



Connect BFP, BFX and BFL leads to terminals of inner rheostat plate

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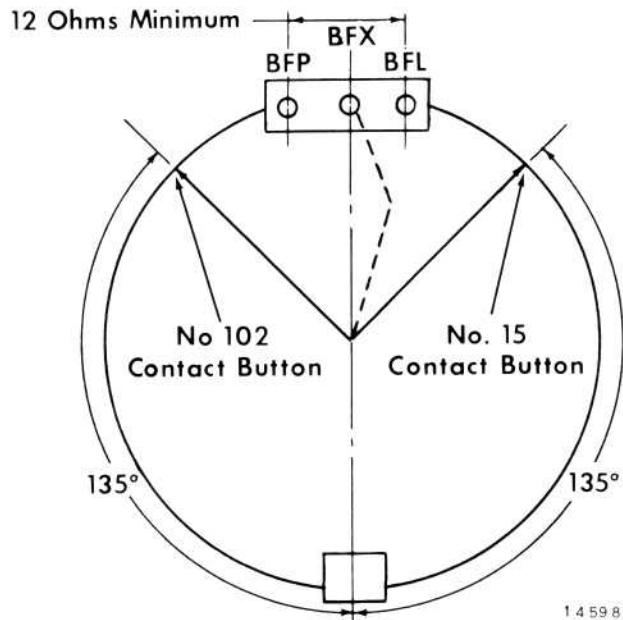
Fig. 5 — Lead And Jumper Connections

COUPLING OF FIELD RHEOSTAT TO VANE MOTOR

Proper meshing of field rheostat coupling to vane motor coupling is essential in timing the contact arms so that the maximum and minimum field positions are

approximately equidistant from the terminal blocks. Improper meshing may shear the drive block due to overtravel of the brush arm contacting the stop on the back of the face plate.

The regulator is in maximum field when the contact arm is contacting the number 15 contact button and in minimum field when in contact with the 102 button, see Fig. 6.



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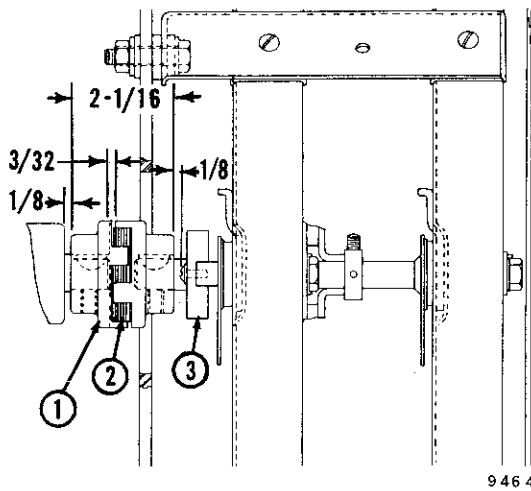
Fig. 6 — Contact Arm Positions

The travel of both arms should be such that at the minimum field position there will be 12 ohms resistance and not greater than 14.5 ohms with both rheostats in parallel.

When assembling the coupling adapter to the rheostat shaft, Fig. 7, place the contact arm on number 14 contact button and position the coupling so the key in the coupling shaft will be pointing down. With the coupling adapter assembled in this position, the full 270° travel of the brush arm will be maintained.

The coupling assembly should always be kept as an assembly, replacing the rubber spider when worn.

Assemble rheostat assembly to vane motor and base making certain insulating material is in place at mounting points.



1. Coupling Adjustment
2. Spider
3. Coupling Adapter

Fig. 7 — Coupling Adjustment

FINAL INSPECTION

After the rheostat plates have been assembled and coupled to the vane motor, the load regulator should be given a final inspection as follows:

1. Connect lube oil piping between governor and load regulator.
2. Check for proper rotation of vane motor and contact arms by starting engine and manually raising and lowering the governor load control pilot valve. This allows engine oil pressure to actuate the load regulator as would occur in normal operation.
3. Check lube oil piping connections for leakage.
4. Check to see that contact shoes are in firm contact with collector ring and button contacts. This may be done while performing Step 2 above.
5. Check all wiring connections to terminals for tightness.
6. Using a megohmmeter, make an electrical check of rheostat assembly insulators to ground. A reading of one (1) megohm or better is satisfactory.

7. If preceding check is satisfactory, apply a high potential check of 800 volts RMS, 60 cycles for 10 seconds, from jumper wire to rheostat case.

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 assured.

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 thus 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 thus 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. 8, 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. 8.

VANE MOTOR DISASSEMBLY

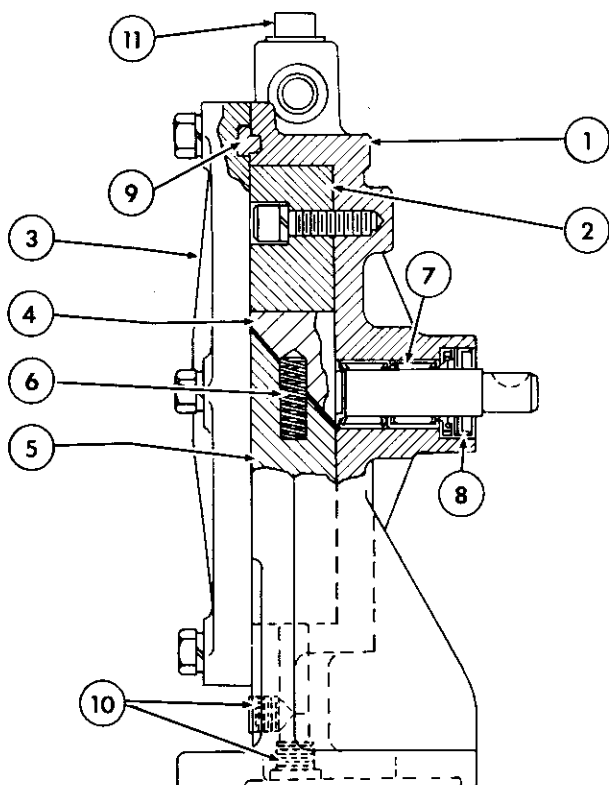
Disconnect lube oil piping. Remove drain plug to drain oil from vane motor. Remove vane motor assembly from unit and place

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 as new one should be applied at reassembly. 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.

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.



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

Fig. 8 — Vane Motor Assembly



MAINTENANCE DATA

Resistance Max. 26 ohms per plate in a 270° travel

Wear Allowance

Button Contact Shoe 3/32"

Collector Ring Contact Shoe 1/16"

New Contact Shoes 1/4" × .500" × 1.093"

Spring Specifications

Free Length 1" Min. - 1-3/16" Max.

Inside Diameter 57/64" Min.

Outside Diameter 1-7/64" Max.

Total Coils 4

Active Coils 2

Pressure When Compressed to 11/32" . . . 12 lbs. Max. - 10 lbs. Min.

Working Height 7/16"

Solid Height Not Over 17/64"

Flexible Abrasive Stone 8149435