EMD 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.

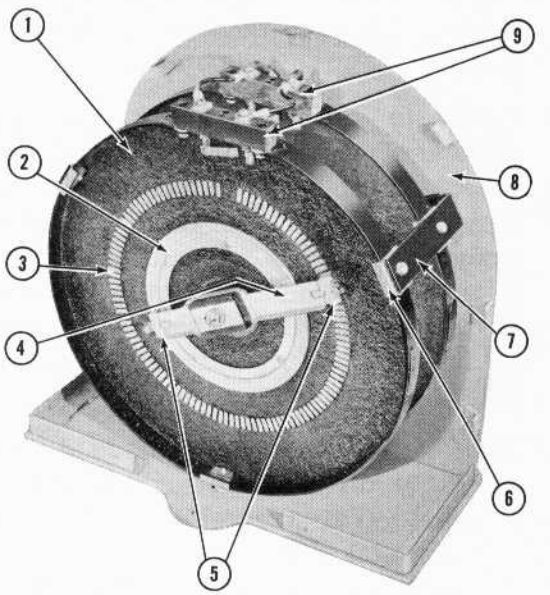
It should be remembered however, that for the load control system to function as intended, the engine governor should have the proper settings and adjustments which vary with the different locomotive models. It is therefore recommended that the 567 Engine Maintenance Manual be consulted for full information on engine governors.

Since this bulletin covers only the face plate rheostat assembly, it is suggested that reference be made to Maintenance Instruction 4504 for details of the vane motor portion of the load regulator. That same bulletin provides a complete description of locomotive load control principles which should be reviewed as they apply as well to the regulator covered in this instruction.

Replacement parts for this load regulator are covered in Parts List No. 4504 "Load Regulators" in the Electro-Motive Master Parts Catalog 90.

MAINTENANCE

The load regulator assembly should be inspected and cleaned at intervals



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

Fig. 1 - Load Regulator Equipped With Rheostat Plates 8179178

outlined in the Scheduled Maintenance Program, Maintenance Instruction 1704. Such periodic attention will insure continued satisfactory operation of this important device. Particular attention should be given the following items:

INSPECTION AND CLEANING

1. Remove cover from regulator assembly.
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

* THIS BULLETIN IS COMPLETELY REVISED AND SUPERSEDES M.I. 630.

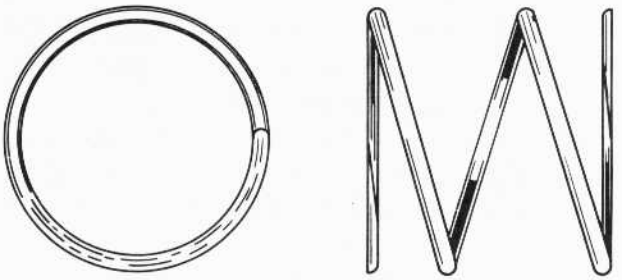
since dirt or grease in such locations may lead to carbon tracking or burning.

3. If necessary, contact buttons and the collector ring surface may be cleaned using hand stone 8149435.

4. Renew copper-graphite button contact shoe when worn 3/32" and silver faced collector ring contact shoe when worn 1/16". New contact shoes measure 1/4" × .500" × 1.093".

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 given in Fig. 2.

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.



Outside Diameter	1-7/64" Max. 1-3/64" Min.
Total Coils	3-1/2
Active Coils	1-1/2
Pressure When Compressed to 11/32"	6 lbs. Max. 5 lbs. Min.
Working Height	7/16" Max.
Solid Height	Not Over 1/4"

Fig. 2 - Contact Pressure Spring

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

Two basic types of face plate rheostat assemblies have been used, each differing from the other to such extent that it is necessary to keep them in matched pairs for proper operation.

The original rheostat having no resistance between the top 1-14 contact buttons was subsequently modified by the installation of external ribbon type resistors for this area. This modified rheostat 8174078 is shown in Fig. 3. Each of the two 0.1 ohm ribbon resistors was connected in series with a rheostat then

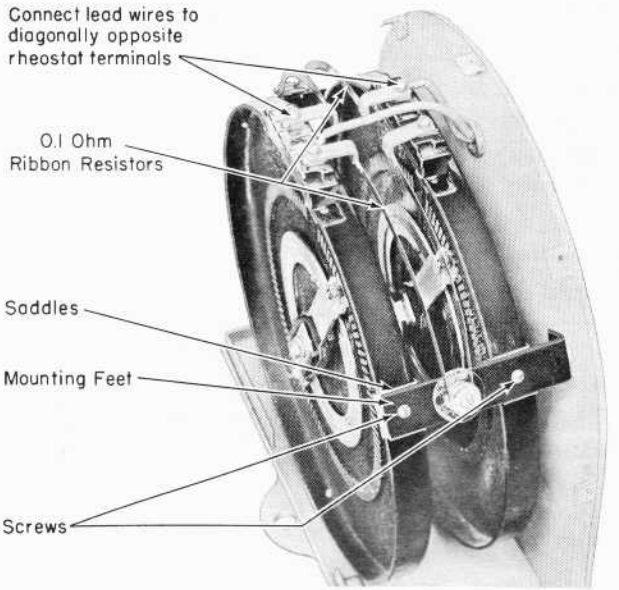


Fig. 3 - Load Regulator Equipped With Rheostat Plates 8174078

both were connected in parallel in the external circuit.

Currently used rheostat 8179178, shown in Fig. 1, features a 0.075 ohm resistance imbedded in the ceramic between the 1-14 contact buttons on each plate. This design eliminates the need for the previously used external ribbon resistors.

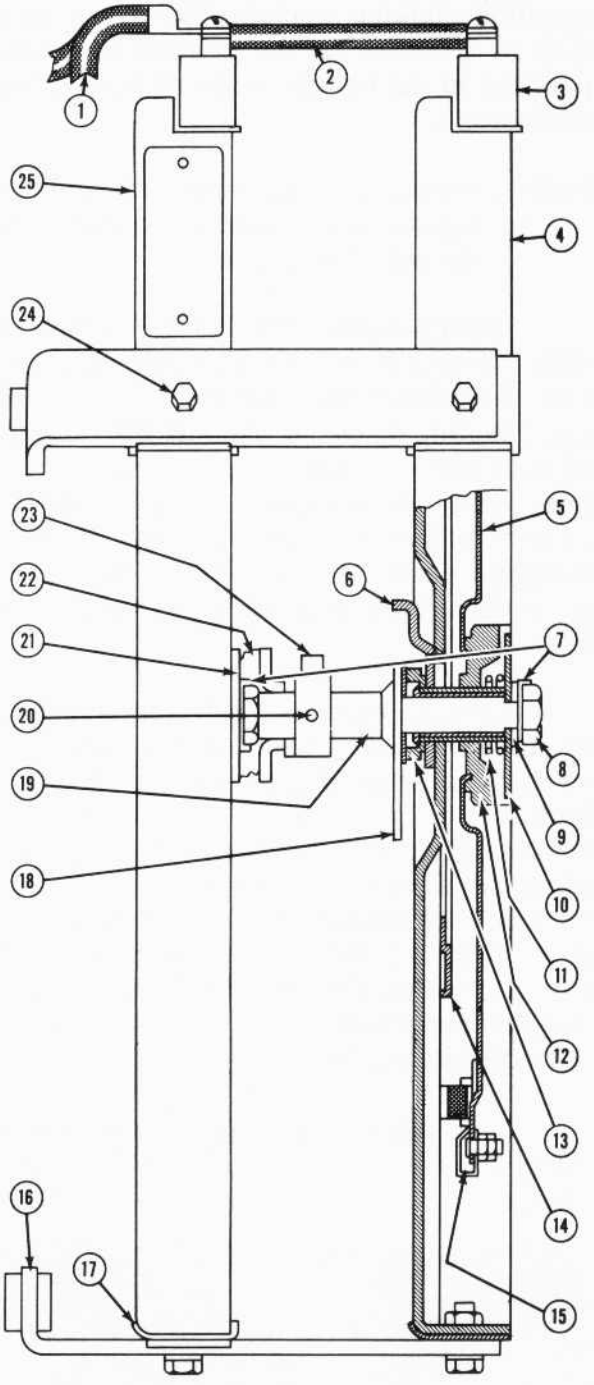
Due to these design differences, it is very important that rheostat plates be kept in matched pairs as mixing them will result in current unbalance and improper operation.

The rheostat plates may be removed by referring to Fig. 4 and following the procedure listed below.

1. Remove the cover from the regulator 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



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

Fig. 4 - Rheostat Assembly

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 103 button, see Fig. 8.

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. 9, 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 spider, when worn, with 8177194, which is made from "bakelite" material.

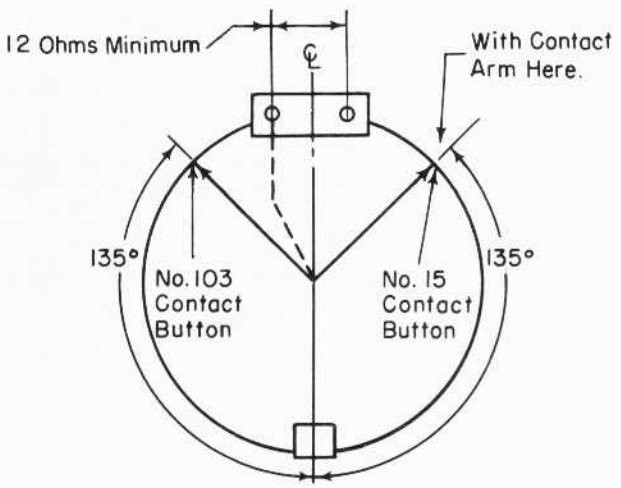
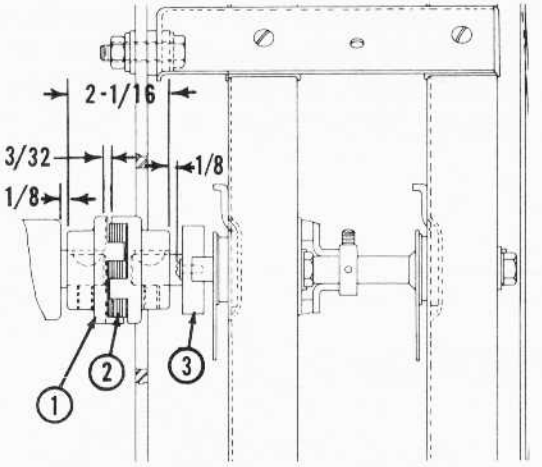


Fig. 8 - Contact Arm Positions



1. Coupling Adjustment
2. Spider
3. Coupling Adapter

Fig. 9 - Coupling Adjustment

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

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.

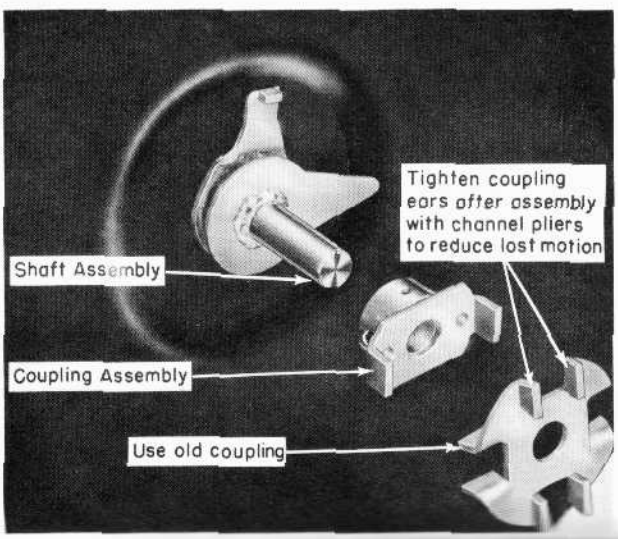
coupling making certain the drive arm (18) is parallel to the contact arm and pointing to the contact shoe on the bottom contacts.

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. 5.

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 exceed one button.*

With a 1/8" drill, drill through coupling and shaft, Fig. 6. 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 453676 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. 7.

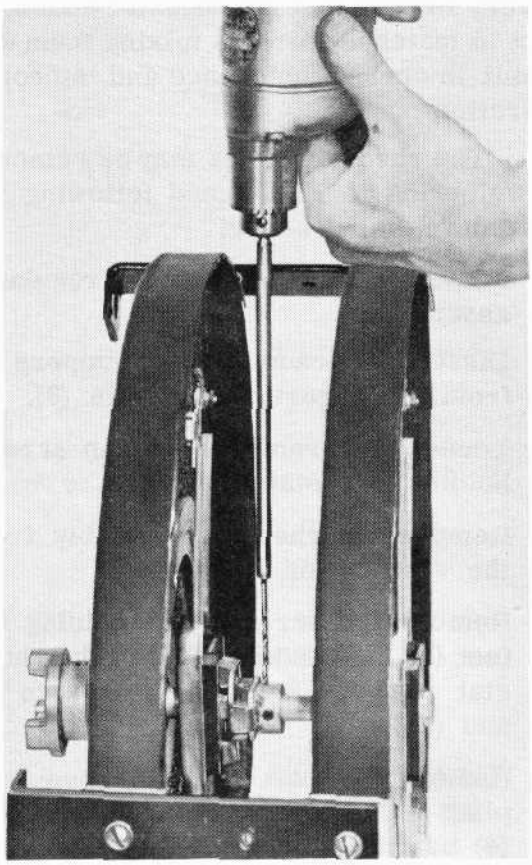
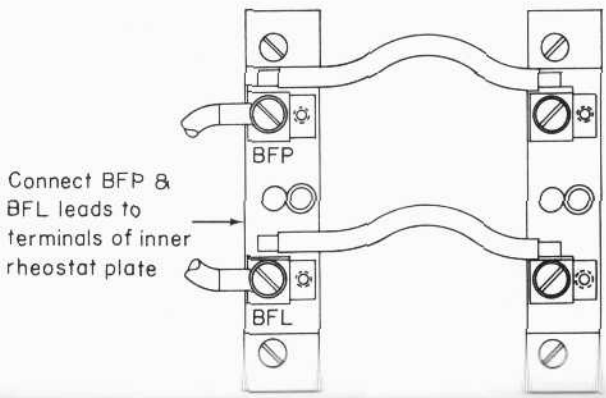


Fig. 6 - Drilling Hub And Shaft



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.

REPLACEMENT PARTS

Refer to Parts List No. 4505 in EMD Master Parts Catalog 90.

SWITCHER TYPE LOCOMOTIVES

Loco. Horsepower	600, 800, 900, 1000, 1200		
Type Generator	D15		
	Step No.	Total OHMS	Amps. at 74V
Gen. Batt. Fld. Res.		1.212	
Field Fixed Res.	0	0.0	
Total External Res.	0	1.212	61.1
	1	1.248	59.4
	2	1.290	57.4
	3	1.332	55.5
	4	1.374	53.9
	5	1.416	52.3
	6	1.466	50.6
	7	1.516	48.9
	8	1.566	47.3
	9	1.613	45.8
	10	1.678	44.1
	11	1.740	42.6
	12	1.802	41.1
	13	1.864	39.7
	14	1.926	38.4
	15	1.988	37.2
	16	2.064	35.8
	17	2.140	34.6
	18	2.216	33.4
	19	2.305	32.1
	20	2.394	30.9
	21	2.496	29.7
	22	2.598	28.7
	23	2.711	27.3
	24	2.824	26.2

Loco. Horsepower	600, 800, 900, 1000, 1200		
Type Generator	D15		
	Step No.	Total OHMS	Amps. at 74V
	25	2.937	25.2
	26	3.065	24.1
	27	3.193	23.2
	28	3.347	22.1
	29	3.501	21.1
	30	3.655	20.3
	31	3.847	19.2
	32	4.039	18.3
	33	4.231	17.5
	34	4.462	16.6
	35	4.693	15.8
	36	4.924	15.0
	37	5.217	14.2
	38	5.510	13.4
	39	5.818	12.7
	40	6.126	12.1
	41	6.526	11.3
	42	6.926	10.7
	43	7.326	10.1
	44	7.866	9.4
	45	8.406	8.8
	46	8.946	8.3
	47	9.676	7.7
	48	10.406	7.1
	49	11.136	6.6
	50	12.156	6.1
	51	13.176	5.6
	52	14.196	5.2

NOTE: Amperes are calculated on basis of 1.212 ohms generator battery field at 75° C. and auxiliary generator voltage of 74 volts. Higher field temperatures will give slightly lower amperes, especially on larger current steps.

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