

## MAINTENANCE

The work of maintaining equipments and the frequency of inspections necessary, depend greatly on local conditions, which are the real determining factors.

As a general rule, city equipments should be inspected every 500 to 1000 miles and interurban equipments from 1000 to 2000 miles.

## OPERATING TEST

At each inspection the main switch should be opened and with an air pressure of not less than 60 lbs., the PC controller operated from each master controller, with the reverse handle thrown in the forward and reverse positions. This test immediately tells whether the pieces of apparatus are working. The PC controller will "notch up" in 3-1/2 to 4 seconds when properly lubricated and adjusted. This speed will decrease as the main engine piston leathers become dry. When the speed is 6 seconds, the cylinder should be lubricated.

The master controller should be held on points 1 and 2 long enough to insure that the PC controller definitely stops on the corresponding positions. The controller should be advanced a step at a time, the same as during acceleration, by using the "advance" lever on the master controller, or, by repeating the current limit relay by hand. The overload relay should be tripped by hand and reset from the cab.

## INSPECTION

At each inspection the master controller, master control switches, main switch, fuse box and PC controller should be opened, examined, cleaned, adjusted or repaired if needed. The following points should be noted.

### MASTER CONTROLLER:

- (a) Inspect for weak fingers, imperfect contact and loose connections.
- (b) When dirty, clean contacts and apply a small quantity of thin, lubricating oil to the contacts with a piece of cheese cloth.

### CONTROL SWITCHES

- (a) Inspect for poor contact.
- (b) Clean and lubricate when needed.

## MAIN SWITCH AND FUSE BOX:

- (a) Inspect for loose terminals and poor contact.

## PC CONTROLLER

At the first four or five inspections after the equipments are put in service, the cap screws fastening the main cable connections to the contactors, line breaker, reverser and relays should be examined to insure they are tight.

With the PC controller, the line breaker shunts and contactor shunts, contact tips and arc chutes as well as the control and reverse fingers and segments should be given particular attention. Valves and cylinders should be tried for air leaks. Relay contacts should be examined, and such parts as require it, lubricated.

Below is given a detailed description for the maintenance of these parts.

## CONTACTORS AND LINE BREAKER:

- (a) Examine contact tips and tighten screws holding them if loose.
- (b) Renew contact tips when worn halfway through.
- (c) When renewing a contact tip, if the surface against which it rests has become rough or pitted due to poor contact from a loose screw or similar cause, it should be smoothed up or else a new part installed.
- (d) The contact tips of the line breaker and contactors close with a butting and rolling movement, which tends to remove any roughness caused by arcing. If, for any reason, the tips get extremely rough, they should be filed smooth.
- (e) The screws holding the contactor and line breaker shunts should be examined to see that they are tight.
- (f) The contactor and line breaker shunts should be examined for wear and breakage.
- (g) Operate the line breaker by pressing the valve operating pin and note if the line breaker opens quickly. If it is sluggish, the operating cylinder and leather packings should be cleaned and lubricated.
- (h) Examine the arc chute sides. When they are half burned through, they should be replaced by new ones.

## REVERSER

- (a) Inspect for weak fingers, poor contact and loose connections.
- (b) When the contacts are dry or dirty, clean and lubricate with vaseline or lubricating oil.
- (c) Operate the reverser by pressing on the valve pin. If the segments are clean and lubricated and the reverser is slow in operating, the air cylinders and packing leathers should be lubricated.

## CONTROL FINGERS:

- (a) At each inspection, the control fingers on the reverser, line breakers and control drum and their segments should be wiped clean with a piece of cheese-cloth that has been moistened with a thin lubricating oil. This is more essential when the control is operated from low potential (32 volts) than when trolley voltage is used.
- (b) The control fingers when in contact with a segment should have sufficient pressure to make a good contact.
- (c) The fingers should be replaced when worn half way thru, thereby, preventing delays to service from a broken finger.

## OVERLOAD RELAY:

- (a) Clean contacts when dirty.
- (b) Trip the relay and see that the armatures move easily.

## CURRENT LIMIT RELAY:

- (a) Clean contacts when dirty.
- (b) Move armatures by hand and see that they are free and move easily.

## CONTROL DRUM

When segments are replaced on the control drum, they should be located with respect to the control fingers. This is quite necessary, as the circuit, which controls the stopping of the cam shaft for each controller point, is broken by these segments and control fingers.

Where other information is not available, it is suggested that measurements between the control finger and the old segment be made before its removal and used in locating the new segment.

## STAR WHEELS.

The star wheels of the PC controllers, like those in a K controller, locate the controller notches. If the pawl springs are broken or become weak, the controller notches are not as definitely located as they will be when the spring pressure is normal. The pressure of the pawl roller against the star wheel, with the controller in the "off" position, for the PC-5, PC-6, and PC-9 controllers should be between 13 and 25 pounds, and for the PC-10, PC-12 and PC-101 controllers should be between 20 and 30 pounds.

## MAGNET VALVES.

The general construction of the magnet valves used on the reverser line breaker and "on" cylinders is shown on Page 50, while the "off" magnet valve is shown on Page 51.

When the valves are sticky, wash with gasoline or kerosene, also pour a little gasoline thru the magnet core to clean the valve seats. WHEN VALVES ARE REMOVED, EACH MUST BE RETURNED TO ITS OWN SEAT, as each stem is ground to fit its own seat.

Whenever a new valve is installed, or a valve leaks, it must be ground in. After a good seat is obtained, blow out all grinding materials with air and wash with gasoline. When a large number of valves are to be ground in, the cost may be reduced by using special reamers on the valves and valve seats before the valves are ground in.

To grind in the INLET VALVE of the "off" magnet, remove the valve and its seat from the valve case and use the grinding jig - Cat.#1419139 (shown on Page No. 53). The screw threads in the jig form a holder for the valve seat, and the hole in the jig acts as a guide for the inlet valve. A thin paper gasket is used between the inlet valve seat and the valve case; be sure that this is in good condition before replacing the valve seat. The screw-driver - Cat.#189905 may be used for removing and replacing the inlet valve seat.

## MEASURING AIR GAP AND TRAVEL.

The air gap and travel of the magnet valves should be measured once a year. This measurement is made by removing the magnet valve cover and armature. The .020" gauge - Cat. #1420997, is placed around the upper valve stem or plunger and the armature pressed on top of the valve stem. The exhaust valve of the reverser, line breaker and "on" magnet valves should seat (i.e., air should not escape thru the exhaust valve). For the "off" valve, this test should seat the inlet valve (i.e., air should not pass thru the valve). If air passes thru, new valves must be installed.