

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD

ENGINEERING DEPARTMENT

WORKSHOPS AND RUNNINGSHEDS BRANCH

E.E.C.K.I. (CLYDE) CONTROLLER MAINTENANCE -

ELECTRICAL MECHANIC'S PROCEDURE

ROSTERED DAY-IN SERVICE:

1. Before commencing any work on the controller, the trolley pole must be removed from the overhead wire and placed under the hook, danger tags attached to both trolley ropes and both line breaker control switches placed in the off position. Before removing the wooden cover, rotate the main controller handle through all power notches.
2. Check the controller handle for looseness and tighten the set screw if necessary, first renewing the spring washer. Check the handle for material failure; if the wooden handle is damaged or does not revolve freely, the complete handle must be changed. Check the reverse barrel water cap retaining screw, if loose tighten. Check the reverse key for material failure or spreading of the jaws; if defective, replace.
3. Remove the wooden controller cover and examine the asbestos backing on the inside of the cover and repair or replace if damaged.
4. Check all wiring cables for burning or loose connections on all finger boards and tripping switch. If the connections show signs of burning where they are attached, remove the set screw and clean the contact faces and if necessary resolder the wiring lug to the cable; renew the set screw and washers, then tighten firmly.
5. Check the tripping switch for loose screws or nuts on the operating arm or the insulated finger base, and if necessary tighten, but first replace the spring washer. Replace any worn segment or contact fingers. Check the lift of the contact fingers which should not exceed $\frac{1}{8}$ ". Examine the pull off spring for deformity or worn ends where it is attached; if defective replace.

To test the pull-in operation of the tripping switch, place the main controller handle in the off position, wipe the fingers and contacts clean and free of lubricant, and move the main controller handle smartly to the first notch position; repeat this operation two or three times. If the switch fails to engage remove the main controller handle, water cap, and slacken off the two $\frac{1}{2}$ " bolts on the back of the controller and remove the top cover. Examine the ball race for free rotation. If defective, replace. Check that the rivets in the striking plate are tight; if loose, renew the rivets. If no defect is found with the ball race or striking plate, remove the main arm and file the contact face of the tripping arm. Replace the operating arm and insert a .010" feeler or a tram ticket folded to 4 thicknesses between the tripping arm and the striking plate, replace the main controller handle temporarily, and cut the controller smartly to the 1st notch position; if it still fails to engage repeat the filing operation of the tripping arm and retest. If necessary repeat the above operation until the tripping switch operates satisfactorily, lubricate the fingers and contacts, replace the top cover, water cap, and main controller handle and tighten securely.

6. To test the trip switch for tripping open, cut the 1st power notch and move the handle to the off position; the switch should trip out smartly. Repeat the above operation on the 6th, 7th and 10th notch. If the switch fails to trip renew the pull off spring; if it still fails to trip, remove the main controller handle, water cap, and loosen the two $\frac{1}{2}$ " bolts on the back of the controller and remove the top cover, examine the ball race for free rotation; if defective, replace. Check that the rivets that hold the striking plate are tight; if loose, renew the rivets. If no defect is found with the ball race or striking plate and the tripping arm moves freely, remove the star wheel, wipe clean and use $\frac{1}{8}$ " round file and dress up the worn edges of the appropriate groove in the star wheel. Replace the star wheel and the main controller handle temporarily and retest; if it still fails to trip open repeat the above operation until the switch operates correctly.
 7. Open the arc shield, remove from the controller and place it on the saloon floor. Remove the copper desposits with the end of a flat file and replace any plates that are broken or have a crater burnt in them deeper than $\frac{1}{8}$ ".
 8. Check the auxiliary earth contact lift of the B finger with the controller in the 1st notch position. The height of the finger is altered by bending the mounting stop plate and should be $\frac{1}{8}$ ".
 9. Check the main contact fixed arms for tightness where attached to the blow out coils. If any are loose renew the spring washer before tightening.
 10. Check main fingers for tightness on the mounting bracket; if loose replace the spring washer before tightening.
 11. Check the copper finger shunts for looseness, fraying or fracture. If defective, replace.
 12. Check main fingers for free movement at all pivot points, and that the rollers revolve freely. If defective replace the finger complete.
 13. Check main finger contact set screws for looseness or material failure of the spring washers. If the set screw is loose replace the spring locking washer and tighten securely.
 14. Check main contacts for burns, wear, or not making flat contact on the heel of the contact.
 - (a) All burns and blisters must be smoothed down using an 8" flat bastard file.
 - (b) Contact tips must be changed in pairs when badly ridged or worn to half the original contact thickness, or can't be adjusted to make flat contact on the heel of the contacts.
- Note: The spring locking washer be renewed every time a finger contact is renewed.
15. Main Controller Finger Contact Adjustment:

Check the main finger contacts in the notch position to ensure that flat contact is made on the heel of the contacts; any finger contact that does not meet this requirement must be replaced in pairs.

Check the contact in the notch position for contact pressure between the back of the tips which should be 10 lbs. If this standard cannot be met, the finger pressure spring must be replaced. Where two or more fingers make contact on entering a notch position the fingers must be adjusted to make contact simultaneously; to meet this requirement it may be necessary to change one or more pair of contacts. Special care must be taken in the adjustment of the two trolley fingers between the 5th and 6th notches to ensure that the 4th finger makes contact before the 5th finger breaks contact. If this instruction is not carried out a flashover in the controller will result.

16. Check the reverse fingers and segments for burning or looseness and correct pressure on the segments in the forward and reverse positions. (Note: finger contact pressure should be 4 lbs. at the point of contact). Check the motor cut out levers for free movement and ensure that they lock the reverse barrel correctly in the in and out position and that the motor cut out locking castings are screwed tightly on the finger board.
17. Check all pawl springs for deformity or material failure, check the pawl roller for flats or wear on the roller pin. Replace if worn.
18. Check that the bolts, screws and set screws that retain the top cover, barrel bearing, finger board and main star wheel are tight; if loose renew the spring locking washer (if fitted) and tighten securely.

EVERY 4TH ROSTERED DAY-IN SERVICE:

Oil the top and bottom bearings of the main and reverse barrels, including the pivot point of the main pawl arm and the pivot points and rollers of the main controller fingers with a few drops of armature oil.

Do not over oil - excess oil may damage the insulation.

In addition, the controller must be blown out with compressed air by the Tradesman's Assistant at this service.

EVERY 12TH ROSTERED DAY-IN SERVICE:

Before commencing work on the controller, the trolley pole must be removed from the overhead wire and placed under the hook and danger discs attached to both trolley ropes, and both line breaker control switches must be placed in the off position. Before removing the wooden cover, rotate the controller handle through all power notches. Remove the top controller cover and check the tripping switch for loose set screws or bolts in the moving contacts or base and replace any worn segment. Check the arc shield plates for material failure and ensure that they do not foul the main arm segment.

The fingers must be replaced if either:

- (a) The contact surface has worn so that there is less than $1/16$ " of metal left.
- (b) The copper shunt between the moving and fixed parts of the finger is broken or frayed and arcing has caused the pins to seize.
- (c) The contact surface is burnt.

Note: When a new finger is fitted, check that the finger seats squarely on the segment and adjust if necessary.

Check the lift of the fingers, which should not exceed $\frac{1}{8}$ ". Check tripping switch striking plate for loose rivets. If loose tighten but first renew the copper rivets; examine trip spring guide for wear and see that all cotter pins are intact. Check pull off spring for deformity or worn ends where it is attached: if defective, replace.

Check that the ball race is free to revolve and the grooves in the star wheel are clean; check the stop plate and operating arm for material failure.

To test the pull-in operation of the tripping switch, place the main controller in the off position, wipe the fingers and contacts clean and free from lubricant and insert a .010" feeler (or, if not available, a tram ticket folded to four thicknesses) between the back of the tripping arm and striking plate. Replace the controller handle temporarily and move the controller handle smartly to the first notch position. If the switch fails to engage, the operating arm must be removed and the contact face of the tripping arm filed; replace the operating arm and repeat the above operation until a satisfactory operation is obtained.

To test the switch for tripping open, cut the 1st notch position and move the handle to the off position. The switch should trip out smartly. Repeat the above operation on the 6th, 7th and 10th notches. If the switch fails to trip open, renew the pull off spring; if it still fails to trip open, use $\frac{1}{8}$ " round file to dress up the appropriate groove in the star wheel until the switch operates correctly.

Lubricate all moving parts with a few drops of armature oil and place a small quantity of petroleum jelly on the contact face of the fingers and segment. Replace the top cover and tighten securely.

Replace the controller cover then remove the danger discs from the trolley ropes, after ascertaining that it is safe to do so.
