E-15 AND E-12S REVERSE RELAY

TROUBLESHOOTING GUIDE FOR ELEC-TRAK TRACTOR MECHANICS

This troubleshooting guide is provided to enable the Elec-Trak tractor mechanic to rapidly find the cause of burned reverse relay contacts in the E-15 and E-12S. Mechanics should keep this list in their Product Service Manual in the beginning of the Service Bulletin section, along with the Reverse Relay Failure Check List previously received.

TROUBLESHOOTING GUIDE - Find condition under which relay failure occurred.

A. Returning speed control lever to neutral from forward.
   Check #4, 7, 10.

B. Returning speed control lever to neutral from reverse.
   Check #3, 4, 6, 7, 10.

C. Changing direction from forward to reverse.
   Check all steps.

D. Changing direction from reverse to forward.
   Check #1, 2, 3, 4, 6, 7, 10.

E. Impact occurred in forward.
   Check #1 and 2.

   Note: Impact may cause top and center points to burn without any other cause. Replace relay.

F. Impact occurred in reverse.
   Check #3, 4, 6.

G. Applying brake in reverse.
   Check #3, 4, 6.

   Note: If check 3, 4, 6 reveals nothing, take model and serial number and call "Hot Line".
1. Determine if relay contact leaves are abnormally bent. In the de-
energized position (forward operation) the center set of points
should make contact with the top set. In the energized position
(reverse operation) the center set should make contact with the
bottom set. Bending of relay leaves is usually due to mishandling.
Handle relay with care. If leaves are found to be bent, repair by
restoring to original condition or replace relay.

2. Determine if relay travel is restricted. Relay should move up and
donw freely. If it does not, replace it. Relay travel may be re-
stricted by the wiring harness when the upper control panel is closed.
In this case, dress the wiring away from the relay.

3. Determine if there are any loose connections at the reverse relay
coil. A loose connection here will cause intermittent relay opera-
tion. If relay coil loses voltage during reverse operation, the
bottom and center points will draw an arc and burn the points. If
connections are bad, replace terminals.

4. Determine if there are any loose connections on Card #1 or Card #3.*
Especially check positions 7, 8, 9, 12 and 12 on Card #1, and posi-
tions 1 and 7 on Card #3. A loose connection at these positions
will cause intermittent relay operation and intermittent hold cir-
CUItY operation. If hold circuitry is not functioning, relay points
may burn while switching from forward to reverse. If terminals ar
loose, replace only with 60156-3 phosphor bronze Part No. 243A4569P1.
These terminals are not in original parts stock, but are being sent
from the factory for dealer stock. Terminals 60826-1 in original
parts kits should be scrapped.

5. Determine if Card #1 is the latest model. Latest cards are marked
211A3160G1-R6. Cards listed as Part No. 163B9814G1 are also latest
model. If card is not latest model, replace card. Refer to
Product Service Bulletin #12 for part number changes.

6. Determine if reverse switch on the speed control is positively held
actuated in all reverse positions. If switch deactivates in reverse,
the reverse relay will de-energize and draw an arc between the bottom
and center points and burn them. If switch is not held closed, re-
place switch or bend switch lever to correct the problem.

7. Determine if speed control cam overtravels and starts the drive motor
in the right and left neutral positions. To test this, place range
selector in neutral, advance speed control lever to maximum speed
forward and after motor reaches maximum speed, quickly return lever
to neutral. If drive motor continues to run, the cam has overtraveled.
Perform the same procedure from reverse. If the above tests do not
reveal overtravel, place the speed control lever into any forward
speed. Then return the lever to neutral observing which direction

* E-15 only
the cam turns. Once the lever is in neutral, turn the cam manually
in the same direction as observed. If drive motor starts, speed
control is defective. Cam overtravel is usually due to loosening or
wear of speed control mechanism. Repair or replace as required.

8. Determine if drive motor field resistance is approximately 16 ohms.
Use the R x 10 scale on multimeter. Disengage the power disconnect
and remove wires 49 and 10 from the drive motor. Insert each probe
into the field plug and observe reading. If meter shows infinite
resistance (∞), remove plastic plug from motor and check for a poor
internal connection. If meter shows zero resistance, remove plug
and check for shorted internal connections.

9. Determine if field is shorted to armature or case of drive motor.
Test by using resistance scale of multimeter. Insert one probe into
field plug and place one probe on armature stud. Reading should be
infinite ohms (∞). Test field to case in the same fashion; reading
should be the same.

10. Determine if the L contactor sticks closed occasionally as verified
by the drive motor continuing to run with the speed control lever in
neutral. Be sure that this symptom is not produced by overtravel of
cam as described in Step 7. With range selector in neutral, measure
coil voltage at L contactor while motor is still running; if voltage
is present (36 V D.C.), cam has overtraveled. If no voltage is found,
contactor has stuck closed. Replace L contactor if it is sticking.

REVERSE HOLD TEST
(E-15 ONLY)

To be performed only after all other checks are completed and the follow-
ing conditions met:

Range selector in neutral, power disconnect engaged, key "On", foot off
brake, sitting on seat, upper control panel lowered.

1. Advance speed control lever to maximum forward position.

2. Allow motor to attain maximum speed (5 seconds).

3. Quickly return speed control lever to maximum reverse position.

4. Observe relay operation and arc between points.

After Step 3 is completed, approximately one second later the reverse relay
should energize and drive motor should shut off. If motor continues to
run but relay has delay in actuation, Step 3 may not have been performed
quickly. Repeat test. If drive motor continues to run and relay does not delay, replace Card #1. If relay delays and motor shuts off but there is a large arc, check 8 and 9 again. If check 8 and 9 are OK, call "Hot Line" for assistance.

**Arc Description**

A normal arc will make a pinpoint sized mark in the relay point.

An abnormal arc will make a pinhead sized mark in the relay point, with possible carbon splashes.

ATTACH THE COMPLETED REVERSE RELAY FAILURE CHECKLIST UPON SUBMISSION OF THE WARRANTY CLAIM.