DCA16MR011
NJT
Collision of Train 1614
Hoboken Station
Hoboken, NJ
September 29, 2016

Attachment 12

EPIC II TP1067 Rev H – LIU test plan

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REVISIONS

EWO	LTR	DESCRIPTION	DRAWN BY	DATE	CHECKED	APPROVED
11652	F	Changed highpot voltage from 1200 to 600VDC and ESS chamber cycles from 22 to 7 cycles.	DK	5/17/2004	AH	DK BSC
11987	G	Changed hypot voltage from 600 to 1200VDC and ESS chamber cycles from 7 to 22 cycles. Remove LIU-06 WPN 19304 from procedure. Update steps 7.f.ii, 7.g.i, 7.h.ii, 7.i.i, 7.j.ii, 7.k.i, 7.l to match changes to Adapter Test Box.	JFC	5/23/2004	AH	JFC RJC
12023	H	Correct steps 7j, 7k, 7l.	JFC	7/28/2004	AH	JFC RJC

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES AND INCLUDE FINISHES.
DIM AND TOL PER ASME Y14.5M-1994

MACHINE SURFACES

TOL:

.XX= ±.03 ANG= ± -
XXX = ± .015 FRAC= ±

MATERIAL

FINISH

APPROVALS	DATE
DWN [redacted]	
PROJ. ENG	
PROD ENG	
APPVL	
CAGE CODE	

WABTEC RAILWAY ELECTRONICS

Q.A. TEST PROCEDURE
EPIC-LIU-04 TOP ASSEMBLY FINAL
(WPN 19303)

SIZE	WABTEC PART NO.	DWG NO.	REV
A	19303	TP1067	H

SCALE	DO NOT SCALE DWG	SHEET 1 OF 8

WABTEC RAILWAY ELECTRONICS
Q.A. TEST PROCEDURE
EPIC-LIU-04 TOP ASSEMBLY FINAL WPN 19303
TEST PROCEDURE # 1067 REV. H

Section A. Hi-pot Test

EQUIPMENT:

1. Hi-pot Test Cable FN 339
2. DC Hi-pot Generator Associated Research Model 4045, 3665 or equivalent. Equivalent generator must be able to display voltage of test leads even after test is complete. (Model 3665 is preferred since it discharges capacitors in unit).
3. Test Data Sheet

HI-POT TEST:

1. a. Record Inspector/Date.
   b. Record serial number.
   c. Visual Inspection.
2. Connect the Hi-pot test cable to the UUT.
3. Connect the Hi-pot generator's positive lead to the Hi-pot test cable.
4. Connect the Hi-pot generator's negative lead to the LIU chassis.
5. Test to 1200V DC, <1mA leakage for 10 seconds. Ramp up to target voltage slowly.
6. Ramp voltage down to 0V and confirm 0V reading on display before disconnecting the hi-pot test cable from the UUT.

Section B. Function Test

EQUIPMENT:

1. Final Assy Test Fixture FN 340 with adapter cables RC1,2,3,4,& 5
2. LIU-04 Test Cables FN 335
3. 74Vdc, ≥ 150 mA Power Supply
4. 24Vdc, ≥ 250 mA Power Supply
5. 12Vdc, ≥ 100 mA Power Supply
6. DVM
7. Test Data Sheet

SET-UP:

1. Confirm that all three power supplies are **OFF**.
2. Connect 74Vdc ± 2Vdc power supply to the test box banana jacks.
3. Connect 24Vdc ± 0.5Vdc power supply to the test box banana jacks.
4. Connect 12Vdc ± 0.5Vdc power supply to the test box banana jacks.
5. Remove the adaptor cables from the test box FN 340 and attach the LIU-04 Adapter Cables FN 335.

PROCEDURE:

1. Before connecting the test box to the UUT make sure that all switches are in the **OFF** position on the test box.

2. Connect the test box to the UUT.

   Note: During a test step, if an LED changes state when it is not specifically mentioned that it should do so , this is considered a failure.

3. Turn **ON** the 74Vdc, 24Vdc, and 12Vdc power supplies.

4. Set 74Vdc, 24Vdc, and 12Vdc power switches on the test box to the **ON** position and verify the following:
   a. 74Vdc, 24Vdc, and 12Vdc LEDs are lit. ✓
   b. RLY1-RLY8 "OFF" LEDs are lit. ✓
   c. RLY10 & RLY12 each have 2 "OFF" LEDs lit. ✓
   d. RLY17-RLY21 each have 2 "OFF" LEDs lit. ✓ [redacted]
   e. All other LEDs are not lit. ✓

5. **Check 24VDC is going to UUT by:**
   a. Verifying that the B24 LED on the Adaptor box is lit. ✓

6. **ENERGIZE RLY1- RLY8 AND OBSERVE LEDs:**
   a. Rotate SW1 to position 1 and observe that the
      i. RLY1 "OFF" LED goes out and ✓
      ii. RLY1 "ON" LED lights. ✓
   b. Rotate SW1 to position 2 and observe that the ✓
      i. RLY1 "ON" LED goes out and ✓
      ii. RLY1 "OFF", RLY2 "ON" LED , 21T and 4T LEDs light and Adaptor box 21T LED lights. ✓
   c. Rotate SW1 to position 3 and observe that the ✓
      i. RLY2 "ON", 21T, 4T & RLY3 "OFF" LEDs go out and Adaptor box 21T goes out and ✓
      ii. RLY2 "OFF" & RLY3 "ON" LEDs light. ✓

d. Rotate SW1 to position 4 and observe that the
   i. RLY3 "ON" & RLY4 "OFF" LEDs go out and
   ii. RLY3 "OFF" & RLY4 "ON" LEDs light.
e. Repeat step d for RLY5-RLY8.

7. **ENERGIZE RLY9-RLY16 AND OBSERVE LEDs:**
   a. Confirm that SW11 is in the **OFF** position.
   b. Rotate SW2 to position 9 and observe that the
      i. RLY9 "OFF" & "GND" LEDs light
   c. Rotate SW2 to position 11 and observe that the
      i. RLY9 "OFF" & "GND" LEDs go out and
      ii. RLY11 "OFF" & "GND" LEDs light
   d. Repeat step c for RLY13-RLY16.
   e. Set SW11 to the **ON** position and rotate SW2 to position 9 and observe that the
      i. RLY16 "OFF" & "GND" LEDs go out and
      ii. RLY9 "ON" & "GND" LEDs light and
   f. Rotate SW2 to position 10 and observe that the
      i. (1 of 2) RLY10 "OFF", RLY9 "ON" & "GND" LEDs go out (1 of 2 RLY10 "OFF" LEDs will stay lit) and
      ii. (2) RLY10 "ON" LEDs light and Adaptor Box RLY10 LED lights.
   g. Rotate SW2 to position 11 and observe that the
      i. (2) RLY10 "ON" LEDs go out and Adaptor Box RLY10 LED goes out and
      ii. (2) RLY10 "OFF", RLY11 "ON" & "GND" LEDs light
   h. Rotate SW2 to position 12 and observe that the
      i. (1 of 2) RLY12 "OFF", RLY11 "ON" & "GND" LEDs go out (1 of 2 RLY12 "OFF" LEDs will stay lit) and
      ii. (2) RLY12 "ON" LEDs light and Adaptor Box RLY12 LED lights.
   i. Rotate SW2 to position 13 and observe that the
      i. (2) RLY12 "ON" LEDs go out and Adaptor Box RLY12 LED goes out and
      ii. (2) RLY12 "OFF", RLY13 "ON" & "GND" LEDs light
   j. Rotate SW2 to position 14 and observe that the
      i. RLY13 "ON" & "GND" LEDs go out and
      ii. RLY14 "ON" & "GND" LEDs light and Adaptor Box (2) RLY14 LED lights
   k. Rotate SW2 to position 15 and observe that the
      i. RLY14 "ON" & "GND" LEDs go out and Adaptor Box (2) RLY14 LED goes out and
      ii. RLY15 "ON" & "GND" LEDs light
   l. Rotate SW2 to position 16 and observe that the
      i. RLY15 "ON" & "GND" LEDs go out
      ii. RLY16 "ON" & "GND" LEDs light

8. **ENERGIZE RLY17- RLY21 AND OBSERVE LEDs:**
   a. Rotate SW3 to position 17 and observe that the
      i. (2) RLY17 "OFF" LEDs go out and
      ii. (2) RLY17 "ON" LEDs light
   b. Rotate SW3 to position 18 and observe that the
      i. (2) RLY17 "ON", (2) RLY18 "OFF" LEDs go out and
      ii. (2) RLY18 "ON" LEDs light
   c. Repeat step b for RLY19-RLY21.

9. **OBSERVE LED CONDITIONS FOR BP,BN,13T, AND 4T:**
   a. Rotate SW4 to position BP and observe that the
      i. "BP" and "BN" LEDs light
   b. Rotate SW4 to position 13T and observe that the
      i. "BP" and "BN" LEDs go out and
      ii. "13T" and "4T" LEDs light

10. **OBSERVE LED CONDITIONS FOR L20-L25:**
   a. Rotate SW5 to position L20 and observe that the
      i. "L20" & "L18" LEDs light
   b. Rotate SW5 to position L21 and observe that the
      i. "L20" & "L18" LEDs go out and
      ii. "L21" & "L19" LEDs light
   c. Rotate SW5 to position L9 and observe that the
      i. "L21" & "L19" LEDs go out and
      ii. "L9" & "L11" LEDs light
   d. Rotate SW5 to position L22 and observe that the
      i. "L9" & "L11" LEDs go out and
      ii. "L22" & "L26" LEDs light
   e. Rotate SW5 to position L23 and observe that the
      i. "L22" & "L26" LEDs go out and
      ii. "L23" & "L27" LEDs light
   f. Rotate SW5 to position L24 and observe that the
      i. "L23" & "L27" LEDs go out and
      ii. "L24" & "L28" LEDs light
   g. Rotate SW5 to position L8 and observe that the
      i. "L24" & "L28" LEDs go out and
      ii. "L8" & "L29" LEDs light
   h. Rotate SW5 to position L25 and observe that the
      i. "L8" & "L29" LEDs go out and
      ii. "L25" LED lights and Adaptor Box "L25" LED lights

11. **OBSERVE LED CONDITIONS FOR L14-L17:**
    a. Rotate SW6 to position L14 and observe that the
        i. "L14" LED lights
    b. Rotate SW6 to position L15 and observe that the
        i. "L14" LED goes out and
        ii. "L15" LED lights
    c. Repeat step b for L16 and L17.

Note SW7 is not used during this test.

12. Set 74Vdc, 24Vdc, and 12Vdc power switches on the test box to the **OFF** position and all LEDs on test box will go out.

13. Disconnect the test box from the UUT.

14. **CHECK CHASSIS GROUND:**
    Use DVM to verify continuity (<1ohm) between RC2-E to LIU chassis.

Section C. ESS Test

EQUIPMENT:

1. Temperature Chamber - automatic temperature cycling equipment suitable for the temperature extremes specified herein. The air temperature will be maintained by forced air circulation. The chamber will have sufficient heating and cooling capacity to maintain the specified air temperatures.
2. LIU-04 ESS Test Cable: FN 338.
3. 74Vdc, ≥ 150 mA Power Supply.
4. 24Vdc, ≥ 750 mA Power Supply.
5. DVM
6. Test Data Sheet.

SET UP:

1. Insert the UUT(s) into temperature chamber **and keep the lids wide open during testing.**
2. Connect the LIU ESS test cable(s) FN 338 to UUT's RC1, RC2, RC3, RC4 and RC5 as marked on test cable and UUT.
3. Connect the LIU ESS test cable(s) FN 338 to the 74Vdc ± 2Vdc and 24Vdc ± 0.2Vdc power supplies according to the markings on the test cables' banana plugs.

PROCEDURE:

1. Turn **ON** the 74Vdc and 24Vdc power supplies.
2. Verify that the **RED** LED on the ESS wiring harness is lit.
3. Connect the LIU ESS test cable(s) FN 338 banana plugs marked +DVM and DVMGND to the DVM's positive and negative voltage terminals, respectively. Set the DVM to measure DC Volts.
4. Verify that the DVM reads 2.7Vdc ± 0.1Vdc.
5. Close chamber door and activate File 5 on the chamber. This program will exercise the chamber within following parameters:

Temperature Range	-40°C to +80°C
Ramp Rate - Hot Cycle	7° C per minute
Ramp Rate - Cold Cycle	5° C per minute
Number of cycles	22
Dwell time at temperature extremes	10 minutes min.

6. During the dwell time of one hot cycle and one cold cycle:
   a. Confirm **RED** LED is lit and DVM reads 2.7 ± 0.1Vdc for each UUT.
   b. Turn **OFF** both power supplies at the same time for 5 seconds then turn them back **ON.**
   c. Verify the **RED** LED is lit and DVM reads 2.7 ± 0.1Vdc for each UUT.
7. Repeat steps 3-6 for each UUT.
8. At the completion of the ESS test, repeat steps 6a, 6b and 6c for each UUT.
9. Deactivate the temperature chamber and open the chamber door. Turn the power supplies **OFF**. Disconnect UUT(s) from test cables and remove UUT(s) from chamber.
10. **Repeat section B** - Functional Test after removing the unit(s) from the ESS chamber.

END OF TEST

WABTEC RAILWAY ELECTRONICS
EPIC-LIU-04 TOP ASSEMBLY FINAL WPN 19303
TEST PROCEDURE # 1067 REV. H
TEST DATA SHEET REV. H

DATE: _____ **INSPECTOR:** _____

S/N	REV	Hipot	FUNCTIONAL TEST STEPS									ESS TEST	FUNCTIONAL TEST STEPS								
		P/F	4 P/F	5 P/F	6 P/F	7 P/F	8 P/F	9 P/F	10 P/F	11 P/F	14 P/F	P/F	4 P/F	5 P/F	6 P/F	7 P/F	8 P/F	9 P/F	10 P/F	11 P/F	14 P/F