

Interlocking Test Procedures

Begin interlocking test with the Master Controller in the following condition:

- a. Main handle at FSB
- b. Reverser switch at NEUtral.
- c. Transfer switch at LAY-UP or STANDBY.
- d. Key removed.

Proceed in the following sequence:

1. Verify that the reverser switch is locked in neutral, and that the main handle is locked at FSB.
2. Insert key into the transfer switch and verify the key is removable in the LAY-UP, and STANDBY positions and turn to OPERATE position. Key should not be removable in the OPERATE position.
3. Rotate reverser switch to ForWarD. Verify that transfer switch is locked at the OPERATE position. Rotate reverser switch to REVERSE position. Verify that transfer switch is locked at the OPERATE position.
4. Verify that when in REVERSE and ForWarD switch positions, the main handle can be moved out of the FSB position.
5. Move the Master Controller to any power position. Rapidly force main handle to the EMERGENCY position. Handle should stop at EMERGENCY with clearance to stop permissible providing none of the cam switches that were open or closed at the EMERGENCY position operate with the main handle forced against the stop.
6. Verify that reverser switch is locked at all main handle positions (including EMERGENCY and FSTR) except FSB.
7. Place main handle at FSB. Verify that reverser switch can be moved to all positions.
8. Verify that main handle can be moved smoothly through entire operating range (FSB to PMAX) with reverser switch at any position other than NEUtral. Verify that COAST, FSTR, and EMER are detented positions.
9. Verify that "RB5" does not break contact while main handle is locked. Move handle back and forth to verify continuity through range of motion. "BF - BH"

**C. OPERATION**

Check for the following:

- a. Smooth operation of dead-man device components.
- b. Rotation of detent arm roller.
- c. Alignment at each operating position of main handle.
- d. Free action of interlocking components, roller arm and plunger.

**10.0 ELECTRICAL TESTING**

**A. CONTINUITY AND SWITCH OPERATION**

.25 ohm limit for all switch closures.

Check operation of transfer switch, reverser switch, and dead-man switch at each position.

Connect test fixture to Master Controller.

Check all switch operation for each main handle position as described below:

**NOTES:**

- 1) *When connecting DMM to the Test fixture, make special note of upper or lower case of the test point on the test fixture.*
- 2) *Set the DMM to Ohms for all switch tests.*
- 3) *For the following tests that refer to a chart, see dwg 5D79135G01 Sheet 58*

**RB1 Test**

*Testing of RB1, M55, and M56:*

- 1) Connect the DMM to "K" & "L" on the test fixture.
- 2) Verify switch RB1 operates as shown in RB1 chart.

**RB2, DM1, & TS8 Test**

*Testing of RB2, TS8, M32, M58, & M59:*

- 1) Set Reverser switch to FWD.
- 2) Connect the DMM to "T" & "U" on the test fixture.
- 3) Verify closed contacts.

*Testing of RB2, DM1, M57, M59, & M78:*

- 4) Connect the DMM to "T" & "Y". With dead-man handle turned to the right, verify switch RB2 operates as shown in RB2 chart.

- 5) Verify that releasing the handle opens the contacts.

*Testing of RB2, DM1, RS1, M46, M47, M57, & M59:*

- 6) Connect the DMM to "T" & "BC". With dead-man handle turned to the right, verify switch RB2 operates as shown in RB2 chart.
- 7) Set handle to FSB.
- 8) Verify open-circuit when dead-man handle is released.
- 9) Set Reverser to NEU, DMM should show open-circuit with dead-man handle turned to the right.
- 10) Set Reverser to REV, DMM should show open-circuit with dead-man handle turned to the right in all handle positions.

*Testing of M32, M33, & TS8:*

- 11) Connect the DMM set for Ohms to "AK" & "U".
- 12) Set reverser switch to NEU.
- 13) Set the Transfer switch to Lay Up.
- 14) Verify DMM shows contacts are closed.
- 15) Set the Transfer switch to Stand By.
- 16) Verify DMM shows contacts are closed.
- 17) Set the Transfer switch to Operate.
- 18) Verify DMM shows contacts are open.

**RB3, TS6, & RS2 Test**

*Testing of RB3, TS6, M61, M62, and M24:*

- 1) Set reverser switch to FWD.
- 2) Connect the DMM set for Ohms to "C" & "AH". Verify contacts closed. (Close ALL THE TIME)

*Testing of RB3, DM2, M60, M76:*

- 3) Connect the DMM to "C" & "AB". With handle turned to the right, verify switch RB3 operates as shown in RB3 chart.
- 4) Verify circuit opens when dead-man handle is released anywhere outside of EMER position.

*Testing of RB3, RS2, M50, M52, M60, M62:*

- 5) Set Reverser to REV.
- 6) Connect the DMM to "C" & "BC". With dead-man handle turned to the right, verify switch RB3 operates as shown in RB3 chart.
- 7) Verify circuit opens when dead-man handle is released anywhere outside of EMER position.

*Testing of RB3, DM2, RS2, M50, M52, M60, M61, M62:*

- 8) Connect the DMM to "B" & "C".
- 9) Set Reverser to FWD.

- 10) With dead-man handle turned to the right, verify switch RB3 operates as shown in RB3 chart.
- 11) Verify circuit opens when dead-man handle is released anywhere outside of EMER position.
- 12) Set handle to FSB.
- 13) Set Reverser to NEU.
- 14) Verify open circuit.
- 15) Connect DMM to "B" & "y".
- 16) Set Reverser to REV.
- 17) Verify closed circuit.
- 18) Set Reverser to NEU.
- 19) Verify open circuit.
- 20) Set Reverser to FWD
- 21) Verify open circuit.

*Testing of RB3, DM2, TS6, M23, M50, M60, M61, M62:*

- 22) Connect the DMM set for Ohms to "C" & "w".
- 23) Set reverser switch to NEU.
- 24) Verify contacts are closed for Lay Up and Standby, and open in Operate.

*Testing of DM2, RS2, M46, M50, & M76:*

- 25) Connect the DMM to "AB" & "BC". Set the reverser switch to REVERSE and verify less than .25 Ohms.
- 26) Verify that the contacts are open when reverser is in NEUTRAL, and FORWARD.

**RB4 Test:**

*Testing of RB4, M63, & M64:*

- 1) Connect the DMM to "J" & "H" on the test fixture.
- 2) Verify switch RB4 operates as shown in RB4 chart.

**RB5 Test:**

*Testing of RB5, M65, & M66:*

- 1) Connect the DMM to "BF" & "BH" on the test fixture.
- 2) Verify switch RB5 operates as shown in RB5 chart.

**FB1 Test:**

*Testing of FB1, TS8, M34, M71, M72:*

- 1) Set the handle/switches to FSB, NEU, & Lay-up. ✓
- 2) Connect the DMM set for "Ohms" to "F" & "y" on the test fixture.
- 3) Verify contacts closed for Lay Up, and Standby, and open for Operate.

*Testing of FB1, TS8, RS2, M54, M71, M72, & M53:*

- 4) Move the DMM plug from "y" to "BD".
- 5) Set the transfer switch to "OPERATE".

MOVE ONLY y  
LEAVE OTHER LEAD ON F

F & BD

- 6) Set the Reverser switch to "FWD". Verify switch FB1 operates as shown in FB1 chart.
- 7) Set the Reverser switch to "REV". Verify switch FB1 operates as shown in FB1 chart.
- 8) Set the handle to "NEU", and verify contacts are open.

**FB2 Test:**

*Testing of FB2, DM1, M75, M79, M80:*

- 1) Connect the DMM set for "Ohms" to "A" & "AA" on the test fixture. Verify switch FB2 operates as shown in FB2 chart.

*Testing of FB2, DM1, RS3, M77, M79, M80, M81:*

- 2) Move the DMM plug from "AA" to "u".
- 3) Set the Reverser switch to "FWD".
- 4) With the handle released in EMER, verify the contacts are closed, and that they open when the handle is turned.
- 5) Set the handle to FSB, and the reverser switch to "REV". With the handle released in EMER, verify the contacts are closed, and that they open when the handle is turned.
- 6) Set the reverser to "NEU", and verify contacts are open.

**FB4 Test:**

*Testing of FB4, M73, & M74:*

- 1) Connect the DMM set for "Ohms" to "M" & "N" on the test fixture.
- 2) Set reverser to REV
- 3) Verify switch FB4 operates as shown in FB4 chart.

**LOCK OUT SOLENOID**

- 1) Set the Reverser to FWD
- 2) Set the Transfer switch to Operate.
- 3) Set the handle to Min.
- 4) Set the DC power supply for 24 Volts, and connect it to "AR" & "AS".
- 5) Verify that the handle moves freely.
- 6) Set the handle to FSB.
- 7) Set the Reverser to NEU.
- 8) Set the Transfer Switch to "Stand By".
- 9) Verify that all controls are now "Locked out".
- 10) Shut down & remove power supply.

**Reverser & Transfer switch tests:**

Connect DMM as described in table below, and verify switch contacts at each setting.

<u>DMM Connections:</u>	<u>REVERSER SWITCH SETTINGS:</u>		
	<u>FWD</u>	<u>NEU</u>	<u>REV</u>
AX & AY	OPEN	OPEN	CLOSED
AX & AW	CLOSED	OPEN	OPEN
BA & AZ	CLOSED	OPEN	CLOSED
AT & AU	OPEN	CLOSED	OPEN

*Handwritten notes:*  
CLOSED  
OPEN  
CLOSED  
OPEN  
CLOSED  
OPEN

DMM Connections:

TRANSFER SWITCH SETTINGS:

	<u>Lay Up</u>	<u>Stand By</u>	<u>Operate</u>
AL & AM	OPEN	CLOSED	CLOSED
AN & AP	OPEN	CLOSED	CLOSED
V & W	OPEN	CLOSED	CLOSED
X & Y	OPEN	CLOSED	CLOSED
a & b	OPEN	OPEN	CLOSED
c & d	OPEN	CLOSED	CLOSED
c & f	CLOSED	OPEN	OPEN
h & i	CLOSED	CLOSED	OPEN
i & Z	OPEN	OPEN	CLOSED
j & k	CLOSED	CLOSED	OPEN
m & n	OPEN	CLOSED	OPEN
n & p	OPEN	OPEN	CLOSED
BJ & BK	OPEN	CLOSED	CLOSED
AJ & AD	OPEN	CLOSED	CLOSED
AE & AF	OPEN	CLOSED	CLOSED
E & AE	CLOSED	OPEN	OPEN
P & R	CLOSED	CLOSED	OPEN
P & S	OPEN	OPEN	CLOSED
AV & BE	OPEN	OPEN	CLOSED

**C. POTENTIOMETER ADJUSTMENT**

The following are reference resistances: Pin 2 to 3

2  
3  
9  
r

Handle Position	Resistance (ohms)
EMER	294.68
FSTR	294.68
FSB	294.68
BMIN	819.49
COAST	895.26
PMIN	971.03
PMAX	1495.84

1. Setup potentiometer circuit as indicated below. The DC power supply should be connected from pin 3 to the end of the resistor connected to pin 1.
2. Set DC power supply to 7.5 VDC +/- 0.0375.
3. Move main handle to full service brake (FSB) position. The direction switch should be put into the neutral position to ensure the full service brake position.
4. Adjust potentiometer for 6.435 VDC +/- 0.0515. (Set the pot below 6.3 VDC and move up toward the 6.435 VDC setting to make sure that you are not in the shorted region).
5. Verify the voltages at each position per the table below.
6. Note that there are no detents between BMIN-FSB and PMIN-PMAX. Verify that the voltage varies smoothly and linearly throughout these ranges.

SIGNAL NAME (HANDLE POSITION)	DC VOLTAGE W/SERIES 609 Ω
EMER	6.435 ± 0.0515 V
FSTR	6.435 ± 0.0515 V
FSB	6.435 ± 0.0515 V
BMIN	4.571 ± 0.0777 V
COAST	4.305 ± .1334 V
PMIN	4.039 ± .1333 V
PMAX	2.175 ± .1088 V

7. Move the main handle to the Coast position. Verify the voltage on pin location 2 is the same as pin location 4.

**D. LED test of RB2 + RB3 switches**

1. Set supply to ~~2.1~~ 1.8 vdc. Connect LED test fixture leads to supply as labeled.
2. Connect test leads to "T", "y", "C", "AB" as labeled.
3. Check RB2 per pg 8 of 15 "RB2, DM1 + TS8 test" Step 4, if LED blinks see Sta



TEST FIXT.

1. Setup potentiometer circuit as indicated below. The DC power supply should be connected from pin 3 to the end of the resistor connected to pin 1.
2. Set DC power supply to 7.5 VDC +/- 0.0375.
3. Move main handle to full service brake (FSB) position. The direction switch should be put into the neutral position to ensure the full service brake position.
4. Adjust potentiometer for 6.435 VDC +/- 0.0515. (Set the pot below 6.3 VDC and move up toward the 6.435 VDC setting to make sure that you are not in the shorted region).
5. Verify the voltages at each position per the table below.
6. Note that there are no detents between BMIN-FSB and PMIN-PMAX. Verify that the voltage varies smoothly and linearly throughout these ranges.

SIGNAL NAME (HANDLE POSITION)	DC VOLTAGE W/SERIES 609 Ω	
EMER	6.435 ± 0.0515 V	6.4865 ~ 6.2665
FSTR	6.435 ± 0.0515 V	6.4865 ~ 6.2665
FSB	6.435 ± 0.0515 V	6.4865 ~ 6.2665
BMIN	4.571 ± 0.0777 V	4.6487 ~ 4.4933
COAST	4.305 ± .1334 V	4.4324 ~ 4.1716
PMIN	4.039 ± .1333 V	4.1723 ~ 3.9057
PMAX	2.175 ± .1088 V	2.2838 ~ 2.0662

7. Move the main handle to the Coast position. Verify the voltage on pin location 2 is the same as pin location 4.

D. LED test of RB2 + RB3 switches

1. Set supply to <sup>1.8</sup>2 vdc. Connect LED test fixture leads to supply as labeled.
2. Connect test leads to "T", "y", "C", "AB" as labeled.
3. Check RB2 per pg 8 of 15 "RB2, DM1 + TS8 test" Step 4, if LED blinks see Step 5.
4. Check RB3 per pg 9 of 15 "RB3, TS6 + RS2 test" Step 4, if LED blinks see Step 5.
5. If LED blinks the RB switch needs shimming or the Cam needs to be reprofiled to prevent contact with the switch.

Note: If Shimming doesn't work and Cam is NOT touching, then switch is vibration sensitive!