

## High Voltage Composite Reinforced Core (HVCRC) Manufactured by Mercury Cable

### Test Material

The Mercury Cable HVCRC conductor has a core which consists of carbon fiber surrounded by glass fiber. The core is enclosed by two layers of fully annealed trapezoidal aluminum strands. The maximum continuous operating temperature specified by the manufacturer was 150°C. Photographs of the HVCRC conductor and connectors tested are shown in Figure 2-39 and Figure 2-40.



Figure 2-39. Mercury Cable high voltage composite reinforced core (HVCRC) cross-section



Figure 2-40. HVCRC Mercury Cable with AFL Global two-stage compression connector installed

## Conductor Specific Test and Measurement Parameters

1500-amps was applied to the HVCRC conductor-connector system. Within the controlled parameters of the indoor lab, the surface temperature of the HVCRC conductor at 1500-amps was 165°C.

## Results

### Thermal Performance and Line Tension

#### Dead-ends

Figure 2-41 shows the dead-end thermal profiles as well as the tension profile for line 2. The tension on line 2 is shown in orange. The excessive dips in tension were a result of a load cell which had an intermittent connection problem, and not due to an actual loss of line tension. The actual line tension only dropped to about 9,600 lbs, from the initial 10,800 lbs level. Just after the 500 cycle mark the line was re-tensioned, the line was re-tensioned again just before 1,400 cycles were completed.

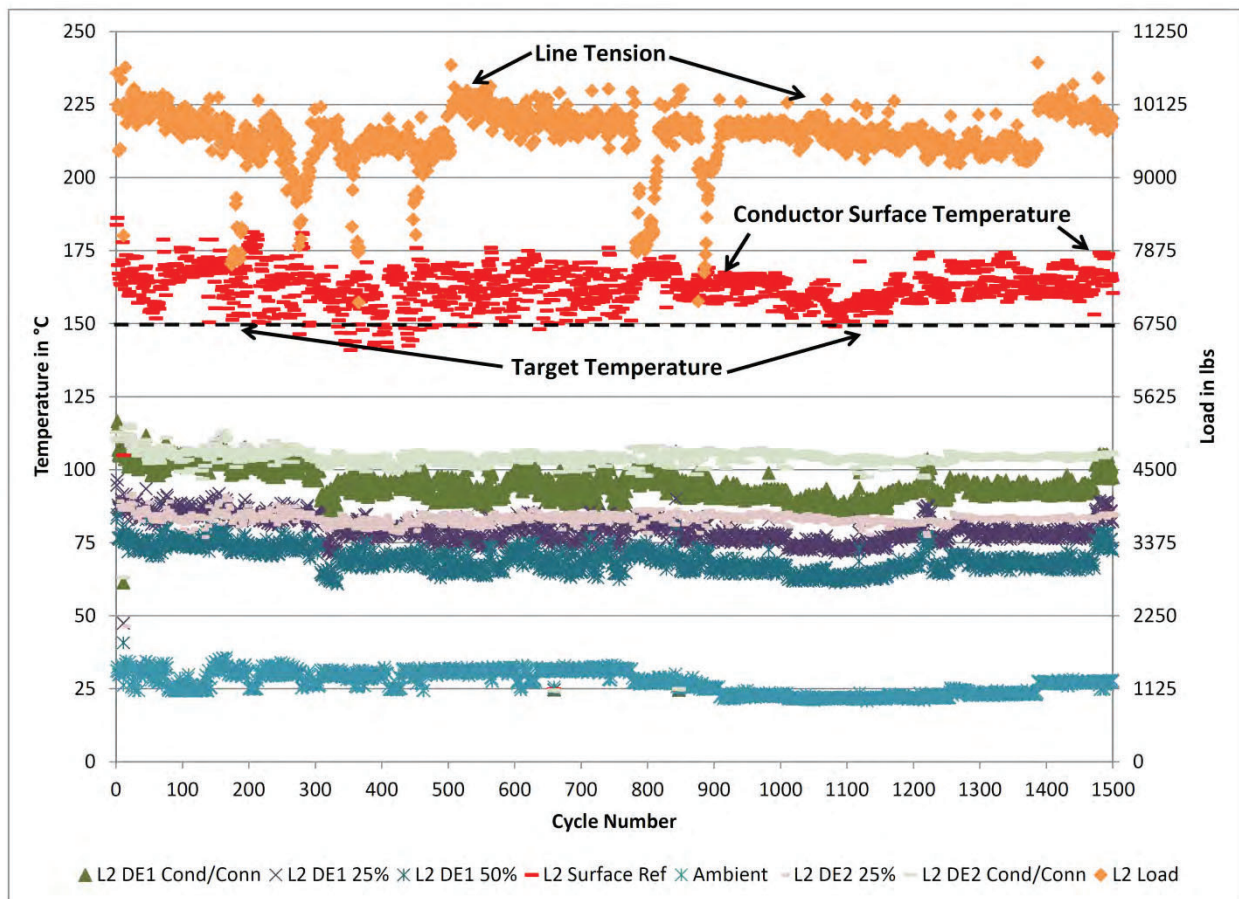


Figure 2-41. HVCRC Dead-end Thermal and Tension Profiles

The HVCRC conductor has a rated operating temperature of 150°C. The HVCRC conductor was evaluated at an average line temperature of approximately 163°C. The test temperature was

approximately 13°C higher than the rated conductor temperature (8.7% above the rated temperature of 150°C). The dead-end temperatures were on average, below 90°C for the 1,500 test cycles completed. There were no excessive temperature excursions noted for the dead-ends.

### Splices

Figure 2-42 shows the splice thermal profiles as well as the tension profile for line 7B. No thermal degradation of the splices were seen.

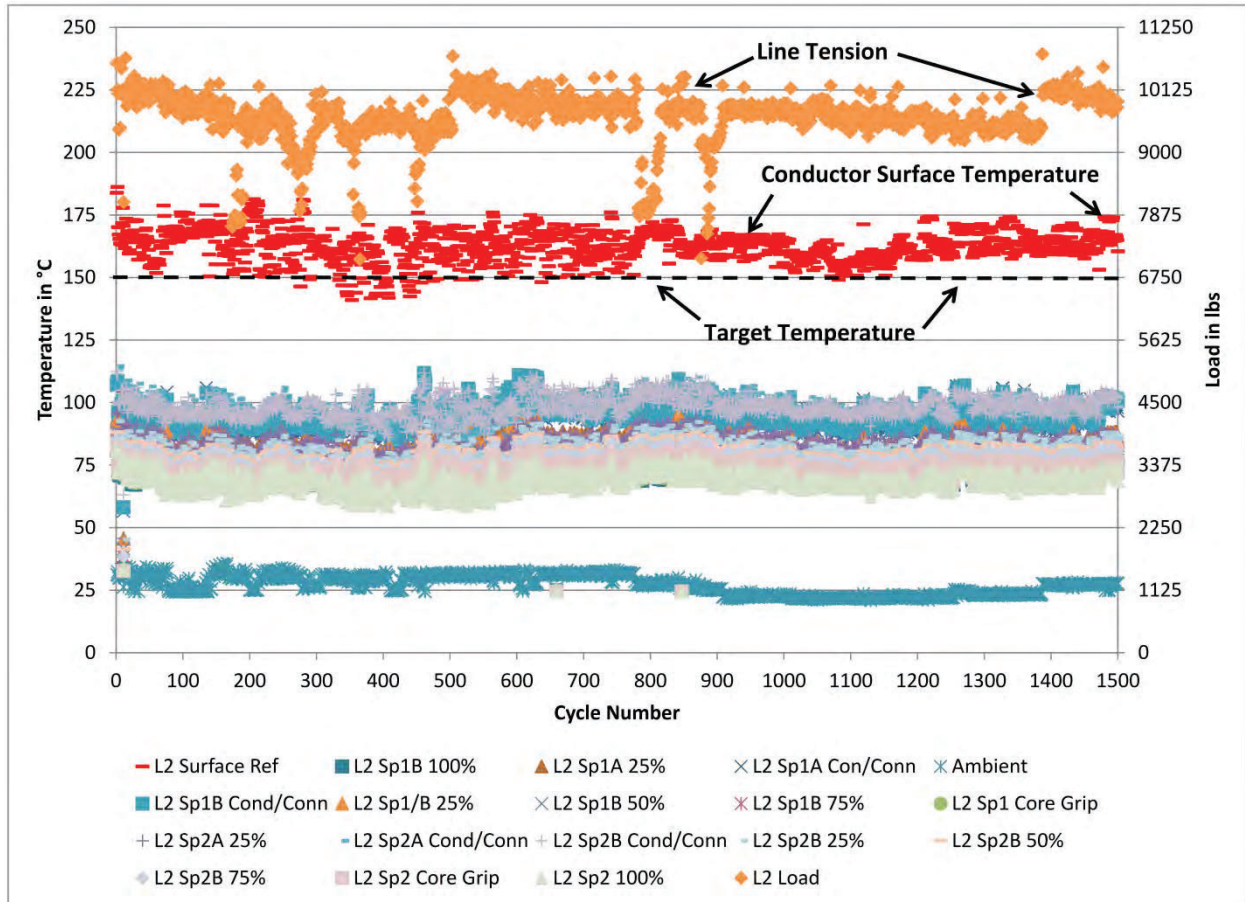


Figure 2-42. HVCRC Splice Thermal and Tension Profiles

### Electrical Performance

Figure 2-43 shows the resistance measurements for the HVCRC connectors. The resistance of all the connectors were generally between 10 – 30 μΩ.

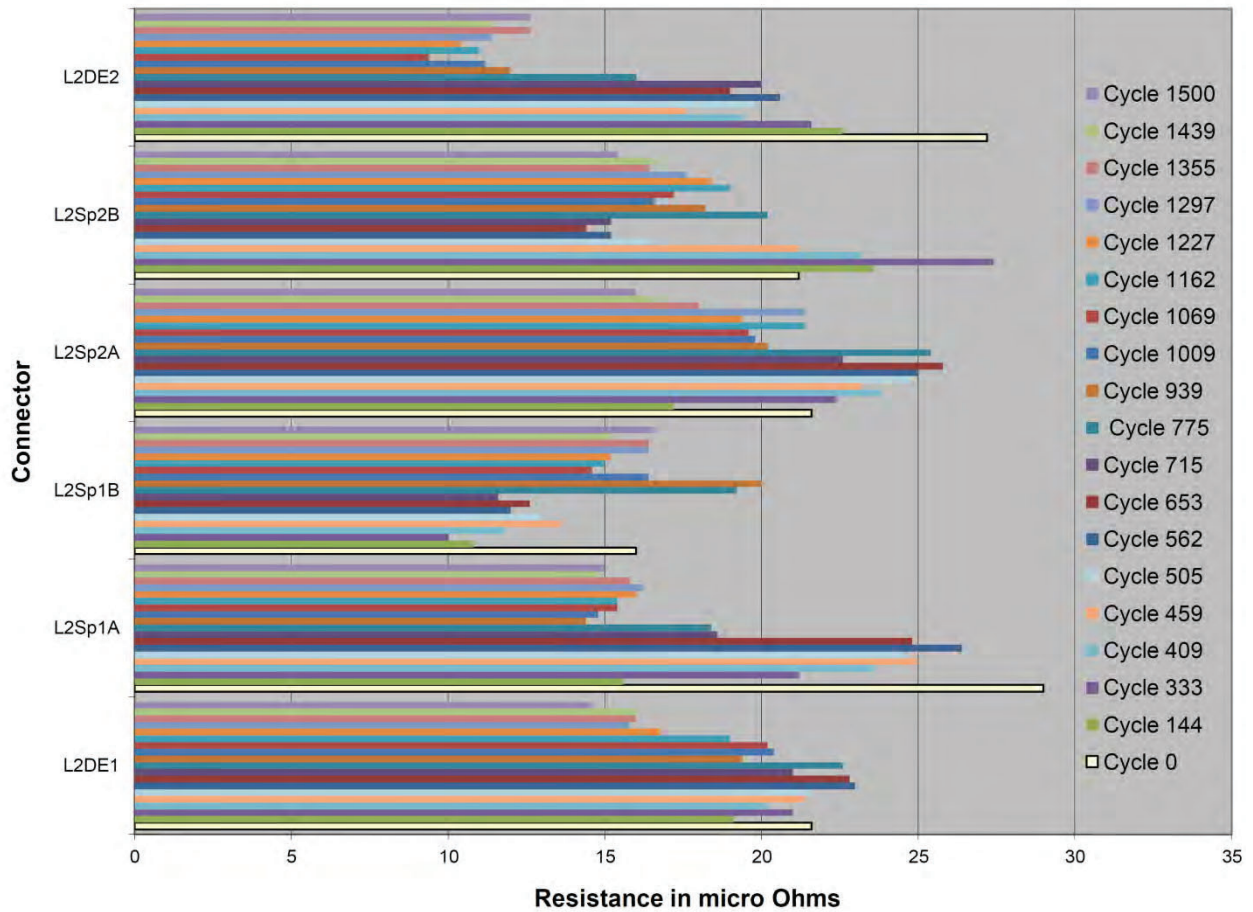


Figure 2-43. HVCRC Line 2 Resistance Measurements

### Mechanical Performance

The conductors rated breaking strength is 43,334 lb. The results of the mechanical tests are shown in Table 2-3.

The test results indicate that only 1 aged sample had a residual strength below 95% of the HVCRC conductor’s rated breaking strength. The other aged connectors had breaking strengths more than 95% of the HVCRC conductor rated strength. Generally, the aged connectors had results which were below those obtained for the new connectors.

Table 2-3. Mercury Cable HVCRC conductor mechanical test results

Sample Tested	Breaking Load (lbs)	%RBS	Maximum Test Temperature in °C	Comments
Aged Dead-end 1	39,486	91.1	90	The conductor broke 280 mm inside of the connector and the core slipped out
Aged Dead-end 2	41,388	95.5	90	The conductor broke about 1.3 m from the mouth of the connector
New Dead-end 1	44,539	102.8	-	The conductor broke 108 mm inside of connector
New Dead-end 2	41.359	95.4	-	Initially slipped 35 mm out of mouth of connector, final break in epoxy resin grip
Aged Splice 1	41,333	95.4	92	Conductor broke 800 mm from North epoxy dead-end
Aged Splice 2	42,519	98.1	90	The conductor broke 950 mm from South epoxy dead-end
New Splice 1	44,540	102.8	-	Conductor broke 140 mm inside North end of connector
New Splice 2	45,352	104.7	-	Conductor broke 90 mm outside of South entrance of connector
Aged Conductor	41,851	96.6	180	The conductor broke 0.3 m from the epoxy resin dead-end.
New Conductor	-	-	-	Sample not available for testing