

## Aluminum Conductor Carbon Fiber Core Supported (ACCS), C<sup>7</sup>-TP, Manufactured by Southwire

### Test Material

This test evaluated the performance of a Suwanee sized Aluminum Conductor Carbon Fiber Core Supported (ACCS), C<sup>7</sup>-TP, conductor. The Southwire ACCS C<sup>7</sup>-TP conductor evaluated was comprised of twenty-two trapezoidal shaped fully annealed aluminum (1350-O) conductive strands around seven carbon fiber composite strands produced by Celanese. The outer diameter of the Southwire ACCS C<sup>7</sup>-TP conductor was 1.108-inches (28.14-mm) with a conductive area of 995-kcmil (504.17-mm<sup>2</sup>). The rated breaking strength of the Southwire ACCS C<sup>7</sup>-TP conductor was 33,500-lbf (149.0-kN).



Figure 2-67. Southwire aluminum conductor carbon fiber core supported (ACCS), C<sup>7</sup>-TP cross-section

### Conductor Specific Test and Measurement Parameters

The test lines were initially tensioned to 25% RBS of the Southwire ACCS C<sup>7</sup>-TP conductor and then re-tensioned to 25% RBS if the line tension dropped below 20% RBS at ambient temperature. The lines were heated to the manufacturer defined maximum continuous

operating temperature of 180°C for two hours and then were passively cooled to near ambient temperature. Resistance measurements were taken every 150-300 cycles.

## Results

Both lines were initially tensioned to 25% of the original breaking strength of the Southwire ACCS C<sup>7</sup>-TP conductor, 8,900 lbs. During the first 600 thermal mechanical cycles, the tension in the line dropped significantly. After 1350 cycles, Line 0 was re-tensioned to 25% RBS of the Southwire ACCS C<sup>7</sup>-TP conductor. After 1400 cycles, Line 1 dropped below 20% RBS of the Southwire ACCS C<sup>7</sup>-TP conductor but was not re-tensioned.

## Thermal Performance

During thermal mechanical cycles all the Line 0 and Line 1 Southwire ACCS C<sup>7</sup>-TP conductors' surface operating temperature stayed well below the conductors' surface operating temperature. The surface temperature of the connectors was measured at 1.5" from the mouth of the connector, at 25% of the connector length form the mouth, and at 50% of the uncrimped portion of the connector. For each of the connectors, the thermocouple 1.5" from the mouth of the connector had the hottest temperatures. This hottest location on each of the connectors stayed below 100°C for the duration of the 1500 thermal mechanical cycles.

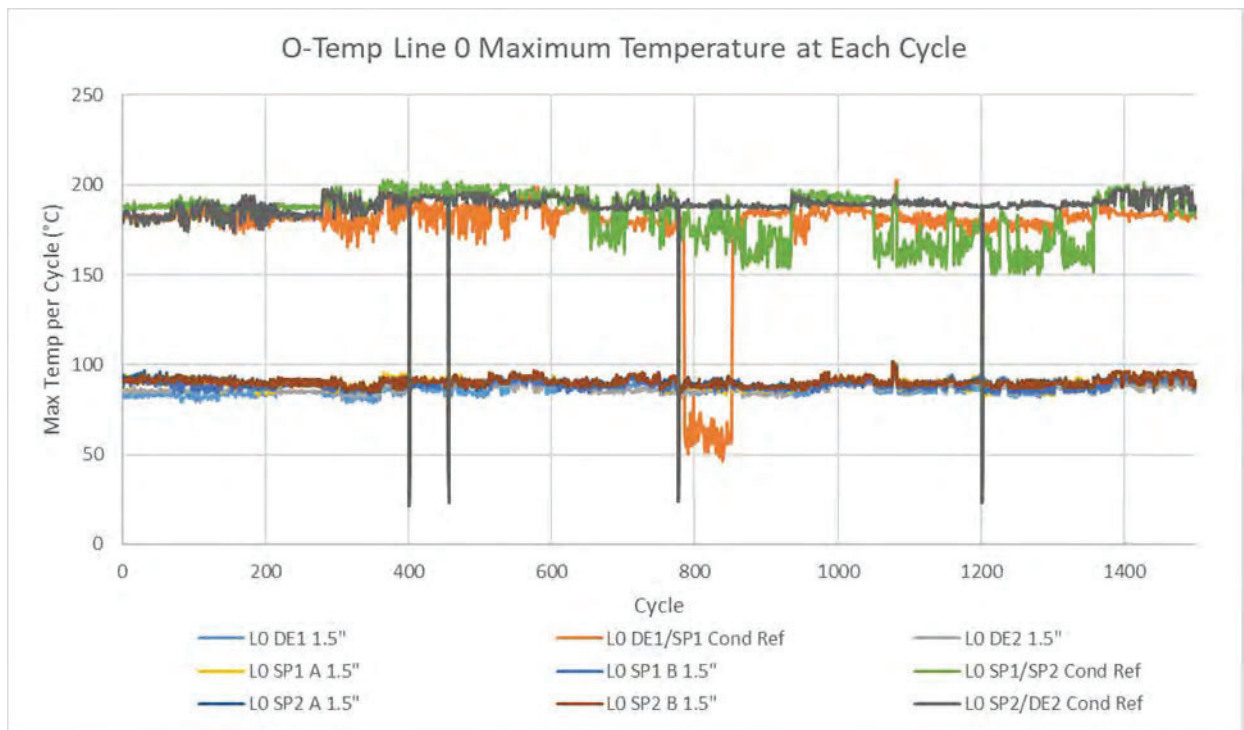


Figure 2-68. ACCS C<sup>7</sup>-TP Line 0 maximum temperature at each cycle

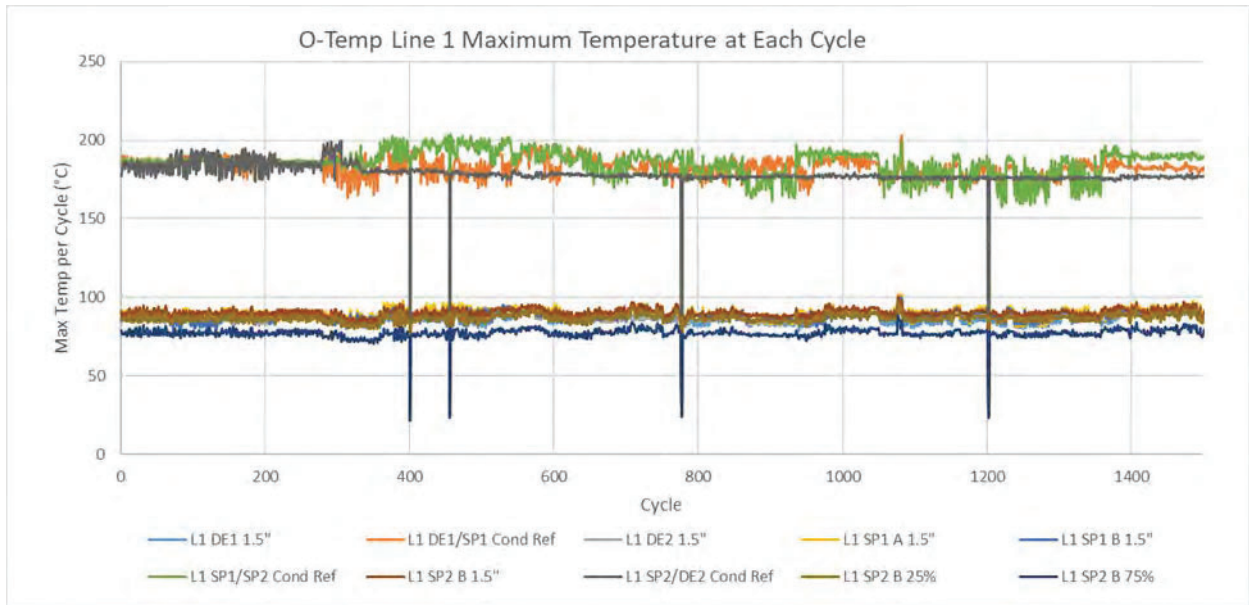


Figure 2-69. ACCS C<sup>7</sup>-TP Line 1 maximum temperature at each cycle

### Electrical Performance

The resistance ratios, the connector resistance over the conductor resistance, for Line 0 and Line 1 stayed below .6, indicating healthy connectors.

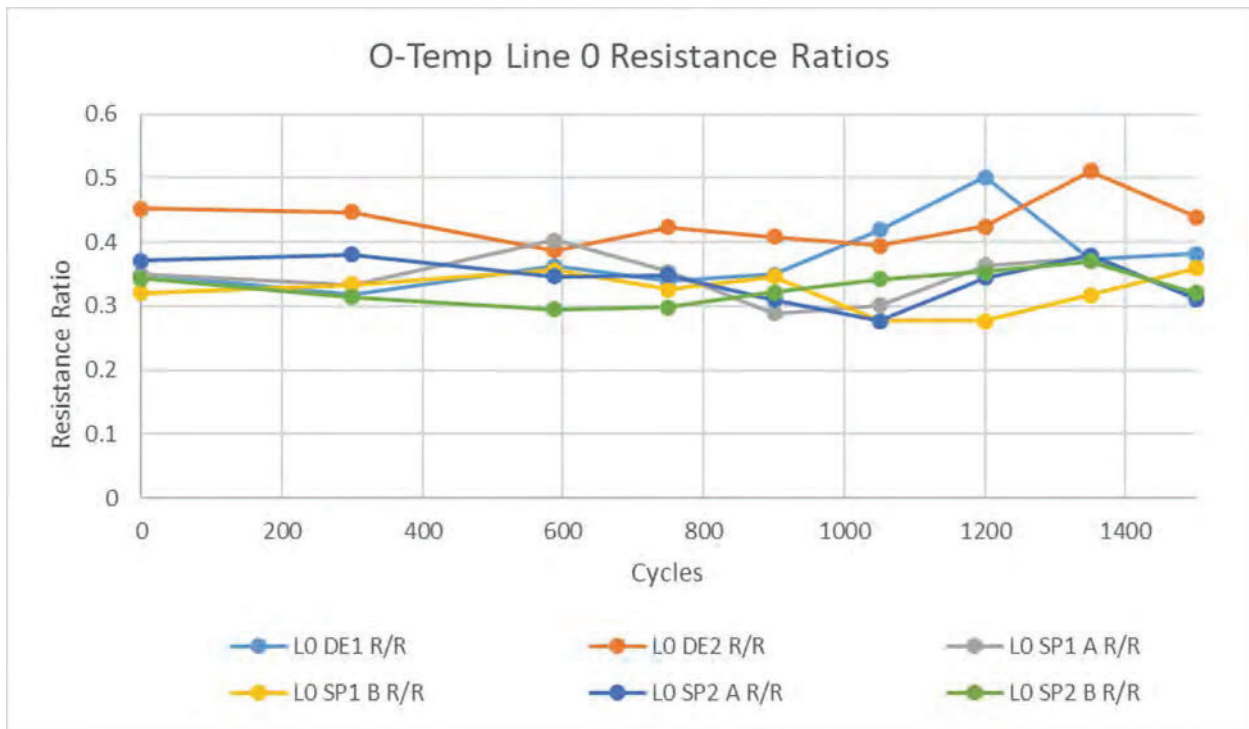


Figure 2-70. ACCS C<sup>7</sup>-TP Line 0 resistance ratios throughout thermal cycling process

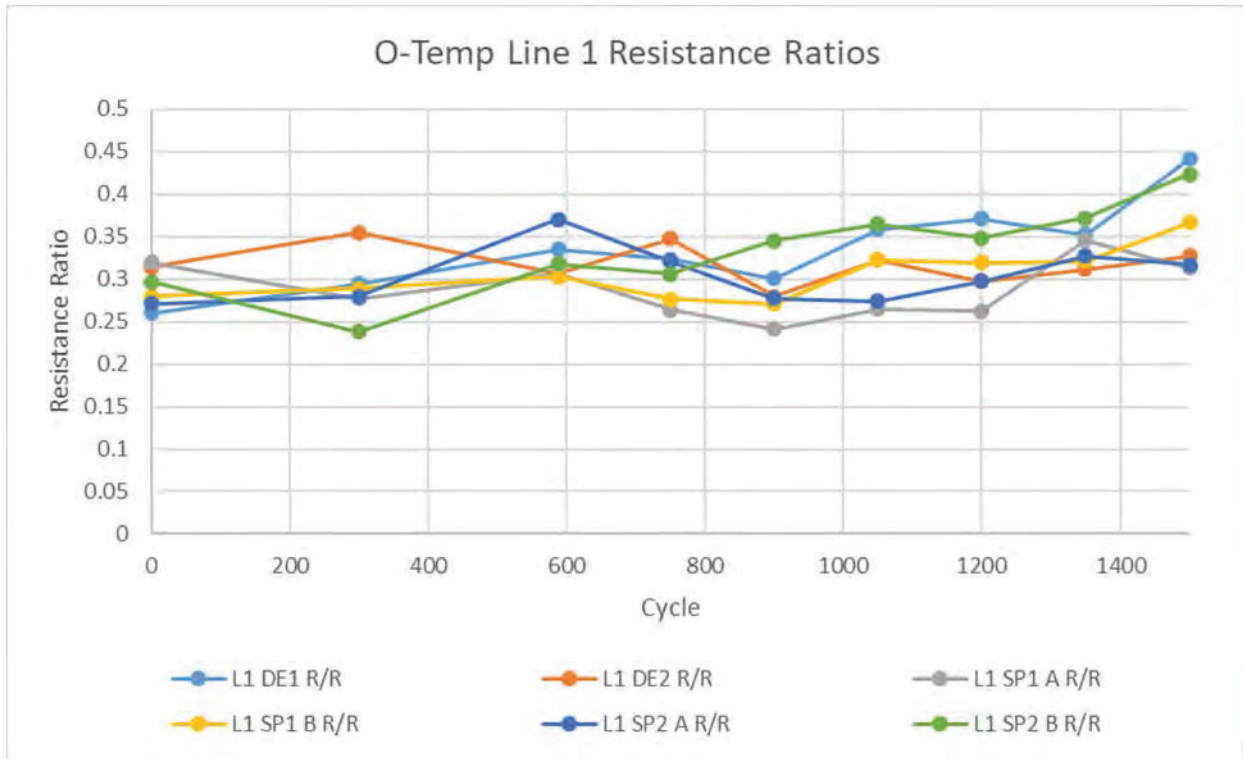


Figure 2-71. ACCS C<sup>7</sup>-TP Line 1 resistance ratios throughout thermal cycling process

### Mechanical Performance

At the beginning of the thermal mechanical evaluating the RBS of the C<sup>7</sup> O-Tempered ACCS conductor/connector systems was 35,600 lbs. During a separate qualification test that EPRI was performing, it was determined that this RBS was not conservative enough for the Southwire ACCS C<sup>7</sup>-TP conductor/connector system, and it was lowered to 33,500 lbs. All the aged Southwire ACCS C<sup>7</sup>-TP conductor/connector samples and one control splice sample failed the original acceptance criteria of 95% RBS of 35,600 lbs (33,820 lbs). With the adjustment of the RBS, only three of the aged splice samples and one control splice sample failed the new acceptance criteria of 31,825 lbs.

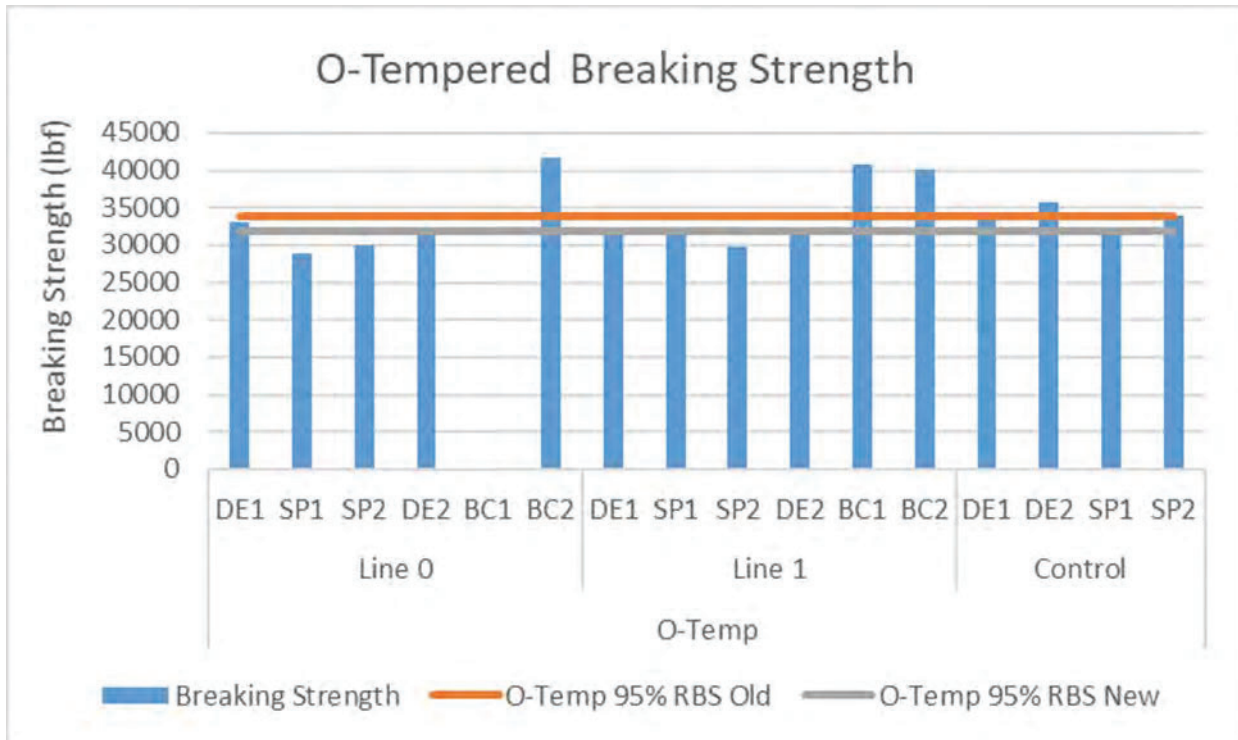


Figure 2-72. ACCS C<sup>7</sup>-TP breaking strength for conductor/connector samples

Table 2-8. Summary of ACCS C<sup>7</sup>-TP breaking strengths

Component	Breaking Strength
Line 0 Deadend1	33120
Line 0 Splice1	28933
Line 0 Splice2	29928
Line 0 Deadend2	32222
Line 0 Bare Conductor1	No Sample
Line 0 Bare Conductor2	41597
Line 1 Deadend1	32153
Line 1 Splice1	32458
Line 1 Splice 2	29705
Line 1 Deadend2	32408
Line 1 Bare Conductor1	40699
Line 1 Bare Conductor2	40105
Control Deadend1	33277

Control Deadend2	35766
Control Splice1	31647
Control Splice2	34004