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## **Multi-Beam XL and XLE Cable Plug**

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### **1. SCOPE**

#### 1.1. Content

This specification covers performance, tests and quality requirements for the Tyco Electronics Multi-Beam XL and XLE Cable Plugs.

#### 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 3 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

#### 1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 31Jan06. The Qualification Test Report number for this testing is 501-597-1. This documentation is on file at and available from Engineering Practices and Standards (EPS).

### **2. APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

#### 2.1. Tyco Electronics Documents

- 109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)
- 114-13164: Application Specification (Multi-Beam XL\* Cable Plug Assemblies)
- 501-597-1: Qualification Test Report (Multi-Beam XL\* Cable Plug)

#### 2.2. Industry Standard

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

### **3. REQUIREMENTS**

#### 3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

#### 3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Voltage: See Figure 1
- Current: See Figure 2
- Temperature: -20 to 105°C

| Contact Type | Contact Pitch  | Within Primary Circuits | Primary to Secondary Circuits | Primary to Ground Circuits | Within Secondary Circuits |
|--------------|----------------|-------------------------|-------------------------------|----------------------------|---------------------------|
| Signal       | .100 [2.54 mm] | 60*                     | 60*                           | 60*                        | 60*                       |
| Power        | .200 [5.08 mm] | 60*                     | 60*                           | 60*                        | 60*                       |
| Power        | .250 [6.35 mm] | 200                     | NR                            | 200                        | 200                       |
| Power        | .300 [7.62 mm] | 300                     | 150                           | 300                        | 300                       |

Figure 1  
Volts RMS (Safety Extra Low Voltage\* (SELV)) Circuits

| Signal Contacts |                              | Power Contacts         |           |                |                     |                     |                     |
|-----------------|------------------------------|------------------------|-----------|----------------|---------------------|---------------------|---------------------|
| Single Contact  | System (24 contacts, 22 AWG) | Module (Contact Pitch) | Wire Size | Single Contact | 2 Adjacent Contacts | 4 Adjacent Contacts | 8 Adjacent Contacts |
| 5               | 1.5                          | .300                   | 8         | 45             | 37                  | 31                  | -----               |
|                 |                              | .250                   | 10        | 41             | -----               | 27                  | 24                  |
|                 |                              | .250                   | 14        | 28             | -----               | 19                  | 17                  |

Figure 2  
Current (amperes)

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 3. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per EIA-364.

3.5. Test Requirements and Procedures Summary

| Test Description                | Requirement   | Procedure  |
|---------------------------------|---|--|
| Initial examination of product. | Meets requirements of product drawing.  | EIA-364-18.<br>Visual and dimensional (C of C) inspection per product drawing.                               |
| Final examination of product.   | Meets visual requirements.  | EIA-364-18.<br>Visual inspection.  |
| <b>ELECTRICAL</b>               |   |  |
| Low level contact resistance.   | Power contacts:<br>10 milliohms maximum initial.<br>20 milliohms maximum final.<br>Signal contacts:<br>15 milliohms maximum initial.<br>20 milliohms maximum final. | EIA-364-23.<br>Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. |

Figure 3 (continued)

| Test Description                                     | Requirement  | Procedure   |                   |   |  |    |  |    |  |   |
|--|--|---|-------------------|---|--|----|--|----|--|---|
| Contact resistance at rated current, power contacts. | 1.25 milliohms maximum, end of life.<br><table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Wire Size<br/>Current<br/>(AWG)</th> <th>Test<br/>(amperes)</th> </tr> </thead> <tbody> <tr> <td>8</td> <td></td> </tr> <tr> <td>10</td> <td></td> </tr> <tr> <td>14</td> <td></td> </tr> </tbody> </table> | Wire Size<br>Current<br>(AWG)   | Test<br>(amperes) | 8 |  | 10 |  | 14 |  | EIA-364-6.<br>At rated DC test current. |
| Wire Size<br>Current<br>(AWG)                        | Test<br>(amperes)  |   |                   |   |  |    |  |    |  |   |
| 8  |  |   |                   |   |  |    |  |    |  |   |
| 10   |  |   |                   |   |  |    |  |    |  |   |
| 14   |  |   |                   |   |  |    |  |    |  |   |
| Insulation resistance.                               | 500 megohms minimum for signal contacts.<br>1000 megohms minimum for power contacts.   | EIA-364-21.<br>Test between adjacent contacts.  |                   |   |  |    |  |    |  |   |
| Withstanding voltage.                                | 1 minute hold with no breakdown or flashover.  | EIA-364-20, Condition I.<br>1000 volts DC at sea level for signal contacts.<br>2500 volts DC at sea level for power contacts.<br>Test between adjacent contacts.  |                   |   |  |    |  |    |  |   |
| Temperature rise vs current, initial.                | 30°C maximum temperature rise at specified current.  | EIA-364-70, Method 1.<br>Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C.   |                   |   |  |    |  |    |  |   |
| Temperature rise vs current, end of life.            | 30°C average temperature rise at specified current.  |   |                   |   |  |    |  |    |  |   |
| <b>MECHANICAL</b>                                    |  |   |                   |   |  |    |  |    |  |   |
| Vibration, random.                                   | No discontinuities of 1 microsecond or longer duration.<br>See Note.   | EIA-364-28, Test Condition VII, Condition E.<br>Subject mated specimens to 4.90 G's rms between 20-500 Hz. 15 minutes in each of 3 mutually perpendicular planes.   |                   |   |  |    |  |    |  |   |
| Mechanical shock.                                    | No discontinuities of 1 microsecond or longer duration.<br>See Note.   | EIA-364-27, Method A.<br>Subject mated specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. 3 shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. |                   |   |  |    |  |    |  |   |
| Durability.  | See Note.  | EIA-364-9.<br>Mate and unmate specimens for 250 cycles at a maximum rate of 500 cycles per hour.  |                   |   |  |    |  |    |  |   |
| Mating force.  | Average mating force for power contacts shall be less than 28 ounces per contact.<br>Average mating force for signal contacts shall be less than 6 ounces per contact.   | EIA-364-13.<br>Measure force necessary to mate specimens at a maximum rate of .5 inch per minute.   |                   |   |  |    |  |    |  |   |

| Test Description                      | Requirement  | Procedure  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
|---------------------------------------|--|--|--|--|-----------------|---------------|--|------|---|--|----|----|--|----|-----------------|----|--|-----------------|----|--|----|--|----|-----------------|----|--|----|--|----|--|--|----------------|--|--|-----------------|---------------|--|------|----|--|------|----|--|-----|----|--|-----|--|--|---|
| Figure 3 (continued)                  |  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Unmating force.                       | 6 ounce minimum per power contact.<br>.7 ounce minimum per signal contact.   | EIA-364-13.<br>Measure force necessary to unmate specimens at a maximum rate of 1 inch per minute.   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Contact retention, straight pull.     | 30 pounds minimum for power contact.<br>3 pounds minimum for signal contact.   | EIA-364-29.<br>Apply axial load to wire, as crimped to contacts. Signal contact retention shall be qualified fully assembled with clam shells.   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Contact retention, angled pull.       |  | Apply load to single wires at a 45 degree angle in 4 directions from normal exit plane of cable.   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Housing lock strength, straight pull. | 25 pounds minimum.   | EIA-364-98.<br>Apply axial force to mated pair using securely mounted vertical receptacle (self-tapping screw through mounting hole and printed circuit board). Apply force in straight pull in direction normal to plane of cable entrance. |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Housing lock strength, angled pull.   |  | Apply load to wire bundle of mated pair at a 45 degree angle in 4 directions from the normal exit plane of the cable connector with the mated vertical header securely mounted.  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Crimp tensile.                        | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Power Contact</th> <th></th> </tr> <tr> <th style="text-align: center;">Wire Size (AWG)</th> <th style="text-align: center;">Tensile (Lbs)</th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">min)</td> <td style="text-align: center;">8</td> <td></td> </tr> <tr> <td style="text-align: center;">80</td> <td style="text-align: center;">10</td> <td></td> </tr> <tr> <td style="text-align: center;">80</td> <td style="text-align: center;">14 (dual crimp)</td> <td style="text-align: center;">80</td> </tr> <tr> <td></td> <td style="text-align: center;">12 (dual crimp)</td> <td style="text-align: center;">80</td> </tr> <tr> <td></td> <td style="text-align: center;">12</td> <td></td> </tr> <tr> <td style="text-align: center;">70</td> <td style="text-align: center;">16 (dual crimp)</td> <td style="text-align: center;">50</td> </tr> <tr> <td></td> <td style="text-align: center;">14</td> <td></td> </tr> <tr> <td style="text-align: center;">50</td> <td></td> <td></td> </tr> <tr> <th colspan="2" style="text-align: center;">Signal Contact</th> <th></th> </tr> <tr> <th style="text-align: center;">Wire Size (AWG)</th> <th style="text-align: center;">Tensile (Lbs)</th> <th></th> </tr> <tr> <td style="text-align: center;">min)</td> <td style="text-align: center;">22</td> <td></td> </tr> <tr> <td style="text-align: center;">11.0</td> <td style="text-align: center;">24</td> <td></td> </tr> <tr> <td style="text-align: center;">7.0</td> <td style="text-align: center;">26</td> <td></td> </tr> <tr> <td style="text-align: center;">4.0</td> <td></td> <td></td> </tr> </tbody> </table> | Power Contact  |  |  | Wire Size (AWG) | Tensile (Lbs) |  | min) | 8 |  | 80 | 10 |  | 80 | 14 (dual crimp) | 80 |  | 12 (dual crimp) | 80 |  | 12 |  | 70 | 16 (dual crimp) | 50 |  | 14 |  | 50 |  |  | Signal Contact |  |  | Wire Size (AWG) | Tensile (Lbs) |  | min) | 22 |  | 11.0 | 24 |  | 7.0 | 26 |  | 4.0 |  |  | EIA-364-8.<br>Determine crimp tensile at a rate of .5 inch per minute. Clamp contacts as shown in Figure 5. |
| Power Contact                         |  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Wire Size (AWG)                       | Tensile (Lbs)  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| min)                                  | 8  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 80                                    | 10   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 80                                    | 14 (dual crimp)  | 80   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
|                                       | 12 (dual crimp)  | 80   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
|                                       | 12   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 70                                    | 16 (dual crimp)  | 50   |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
|                                       | 14   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 50                                    |  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Signal Contact                        |  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| Wire Size (AWG)                       | Tensile (Lbs)  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| min)                                  | 22   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 11.0                                  | 24   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 7.0                                   | 26   |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |
| 4.0                                   |  |  |  |  |                 |               |  |      |   |  |    |    |  |    |                 |    |  |                 |    |  |    |  |    |                 |    |  |    |  |    |  |  |                |  |  |                 |               |  |      |    |  |      |    |  |     |    |  |     |  |  |   |

| Test Description              | Requirement | Procedure   |
|-------------------------------|-------------|---|
| ENVIRONMENTAL                 |             |   |
| Thermal shock.                | See Note.   | EIA-364-32.<br>Subject mated specimens to 36 cycles between -20 and 105°C.  |
| Figure 3 (continued)          |             |   |
| Humidity-temperature cycling. | See Note.   | EIA-364-31, Method III, Condition B without cold shocks.<br>Subject mated specimens to 10 cycles (10 days) between 25 and 40°C at 80 to 95% RH. |
| Temperature life.             | See Note.   | EIA-364-17, Method A, Test Condition 4.<br>Subject mated specimens to 105°C for 504 hours (21 days).  |
| Mixed flowing gas.            | See Note.   | EIA-364-65, Class IIA (4 gas).<br>Subject mated specimens to environmental Class IIA for 20 days.   |

**NOTE**

...ements, show no physical damage, and meet requirements of additional tests  
Product Qualification and Requalification Test Sequence shown in Figure 4.

Figure 3 (end)

## 3.6. Product Qualification and Requalification Test Sequence

| Test or Examination                                     | Test Group (a)     |     |     |     |          |   |
|---|--------------------|-----|-----|-----|----------|---|
|   | 1                  | 2   | 3   | 4   | 5        | 6 |
|   | Test Sequence (b)1 |     |     |     |          |   |
| Initial examination of product                          | 1                  | 1   | 1   | 1   | 1        | 1 |
| Low level contact resistance, signal and power contacts | 2,5                | 3,7 |     | 2,4 |          |   |
| Low level contact resistance, power contacts only       |                    |     |     |     | 2,6,8,10 |   |
| Contact resistance at rated current, power contacts     |                    |     |     |     | 12       |   |
| Insulation resistance                                   |                    |     | 2,6 |     |          |   |
| Withstanding voltage                                    |                    |     | 3,7 |     |          |   |
| Temperature rise vs current, initial                    |                    |     |     |     | 4        |   |
| Temperature rise vs current, end of life                |                    |     |     |     | 11       |   |
| Vibration, random                                       |                    | 5   |     |     | 9(c)     |   |
| Mechanical shock  |                    | 6   |     |     |          |   |
| Durability  | 3(d)               | 4   |     |     | 3(e)     |   |
| Mating force  |                    | 2   |     |     |          |   |
| Unmating force  |                    | 8   |     |     |          |   |
| Contact retention, straight pull                        |                    |     | 10  |     |          |   |
| Contact retention, angled pull                          |                    |     | 11  |     |          |   |
| Housing lock strength, straight pull                    |                    |     | 8   |     |          |   |
| Housing lock strength, angled pull                      |                    |     | 9   |     |          |   |
| Crimp tensile   |                    |     |     |     |          | 2 |
| Thermal shock   |                    |     | 4   |     |          |   |
| Humidity-temperature cycling                            |                    |     | 5   |     |          |   |
| Temperature life  |                    |     |     | 3   | 7        |   |
| Mixed flowing gas                                       | 4                  |     |     |     | 5        |   |
| Final examination of product                            | 6                  | 9   | 12  | 5   | 13       | 3 |

**NOTE**

Paragraph 4.1.A.  
 Numbers indicate sequence in which tests are performed.  
 Energize at current for 18°C temperature rise.  
 Precondition specimens with 5 durability cycles.  
 Precondition specimens with 50 durability cycles

Figure 4

#### 4. QUALITY ASSURANCE PROVISIONS

##### 4.1. Qualification Testing

###### A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group 1 shall consist of 6 mated pairs (panel mount cable plug to right angle receptacle, with 8 and 14 AWG wires). Test group 2 shall consist of 16 mated pairs (panel mount to right angle receptacle and squeeze-to-release to vertical receptacle, with sampling of all single crimp wire configurations). Test group 3 shall consist of 10 mated pairs (panel mount to right angle receptacle and straight to vertical receptacle, with 8 and 10 AWG wires). Test group 4 shall consist of 5 mated pairs (panel mount to right angle receptacle with 8 and 14 AWG wires). Test group 5 shall consist of a minimum of 11 mated pairs (panel mount to right angle receptacle), 3 specimens with 10 AWG wires, 3 specimens with 14 AWG wires, and 5 specimens with 8 AWG wires. Test group 6 shall consist of 12 contacts per specified wire crimp combinations.

Test collaterals are as follows:

1. Temperature rise printed circuit boards 60-474407 and 60-474408.
2. Low level contact resistance and mechanical board part numbers are 60-474765-1 for vertical receptacles and 60-474765-2 for right angle receptacles.
3. Vibration fixture part numbers are 39-474773-1 and 39-474773-2 for vertical receptacles; and 39-474766-1 and 39-474767-1 for right angle receptacles.

###### B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 4.

##### 4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

##### 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 3. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

##### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

**NOTE**

Unless otherwise specified,  $\pm .005$  or  $\pm 2$  degrees as applicable.  
Material: AISI Type 02 tool steel per Material Specification 100-15.  
Heat: Rockwell C50-55.

Figure 5  
Power Contact Tensile Test Clamp