Product Verification of AMP* Power Series 15, 30 and 45 Connectors

1. PURPOSE

Testing was performed on AMP* Power Series 15, 30 AND 45 connectors to verify their performance when intermated and intermixed with competitive Anderson Powepole product. Connectors were subjected to electrical and force tests per UL 1286 Sec 23 and Sec 33 in a variety of mixed connector groups.

2. SCOPE

This report covers connectors tested under test reports CTLH298-001 and CTLH298-002. Testing was performed by the Engineering Assurance Product Laboratory.

3. TEST SAMPLES

Sample Group	Quantity	Description
CTLH298-001 - UL 1286 Section 23 Temperature Test		
A,B	8 each	2x4 assembly of Tyco housings PN 1445957-3 loaded with Anderson contacts PN 261G1
C,D	8 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Tyco contacts PN 1445962-1
E,F,G	8 each	2x4 assembly of Tyco housings PN 1445957-3 loaded with Tyco contacts PN 1445962-1
H,I,J	8 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Anderson contacts PN 261G1
CTLH298-002 - UL 1286 Section 33 Connector Separation Test		
A,B	8 each	2x4 assembly of Tyco housings PN 1445957-3 loaded with Anderson contacts PN 261G1
C,D	8 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Tyco contacts PN 1445962-1
E,F,G	8 each	2x4 assembly of Tyco housings PN 1445957-3 loaded with Tyco contacts PN 1445962-1
H	8	2x4 assembly of Anderson housings PN 1327G17 loaded with Anderson contacts PN 261G1
J	8	2x4 assembly of Anderson housings PN 1327G17 loaded with Tyco contacts PN 1445962-1
K	4	2x4 assembly of Tyco housings PN 1445957-3 loaded with Tyco contacts PN 1445962-1
L	4	2x4 assembly of Anderson housings PN 1327G17 loaded with Anderson contacts PN 261G1
M,N,O	4 each	2x4 assembly of Tyco housings PN 1445957-3 loaded with Anderson contacts PN 261G1
P,Q,R	4 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Tyco contacts PN 1445962-1
S,T	8 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Anderson contacts PN 261G1
U,V	4 each	2x4 assembly of Anderson housings PN 1327G17 loaded with Anderson contacts PN 261G1

Figure 1

* Trademark
| Indicates change

4. TEST RESULTS

4.1. CTLH298-001 - UL 1286 Section 23 Temperature Test

A. Description

Five mated pairs of connectors were submitted for temperature testing conducted per UL 1286, Clause 23, Fourth Edition, dated October 21, 1999, with revisions through and including July 30, 2004. Test groups are described in Figure 1. All contacts were terminated to 12 AWG wire. All contacts were connected in a series circuit and energized at 20 amperes according to the schedule in Figure 2. Temperature measurements were taken at 16, 40, and 71 hours on the 4 inner contacts of all 8 position housings.

Test Hour	Action Taken
0	Power supply on at 20 amperes
16	Temperature measurements taken after 16 hours energized at 20 amperes
17	Power supply off for 7 hours
24	Power supply on at 20 amperes
40	Temperature measurements taken after 16 hours energized at 20 amperes
41	Power supply off for 7 hours
48	Power supply on at 20 amperes
71	Temperature measurements taken after 23 hours energized at 20 amperes
72	Power supply off, end of test

Figure 2

B. Procedure

The four middle contacts of all 8 position housings were prepared for temperature measurements. 30 AWG thermocouples were welded on the back of the contact just below the contact interface area. Test specimen temperatures were monitored by connecting thermocouple leads to a computer controlled data acquisition system. Ambient temperature was monitored using a thermocouple placed inside a hollow plastic tube positioned approximately 1 inch above the bench top near the test specimens. Wire ends were soldered together and covered with shrink tubing to energize all contacts in a series circuit. Test specimens were placed on a bench top in a temperature rise test room. All contacts were energized at 20 amperes DC and both forward and reverse DC current temperature measurements were taken. Test setup is shown in Figure 3.

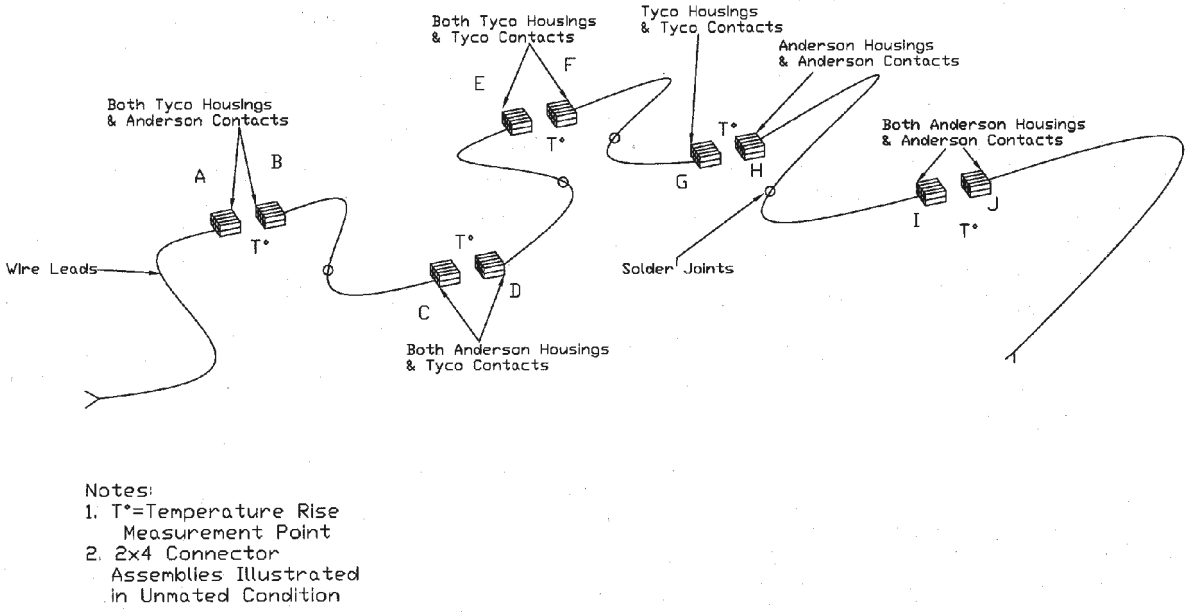

Figure 3

C. Results

All terminations met the requirement that the maximum temperature rise plus 30˚C shall be within the rated temperature range of a material on which the temperature is observed. The UL RTI, Electrical of the Tyco housing material is 130˚C. The maximum temperature rise plus 30˚C, of 64˚C, was observed on Tyco contacts in the Anderson housing.

4.2. CTLH298-002 - UL 1286 Section 33 Mating Unmating Test

A. Description

Power Series Connectors and contacts were submitted for mating connector separation testing as specified by UL 1286 Section 33. Test groups are described in Figure 1. Each test group consisted of one mated, fully loaded, connector pair tested according to the schedule in Figure 4. Conductors were 12 AWG, except for the 2x4 connector pairs which had a 10 AWG pair of contacts in a central housing position.

Order	Description of Test Performed
1	10 mating cycles of fully loaded connectors
2	Separation test, 30 pounds force for 1 minute with separation of connectors
3	Series wire all contacts and energize at 25 amperes for 7 hours on bench top
4	50 mating cycles of fully loaded connectors
5	Separation test, 30 pounds force for 1 minute with separation of connectors
6	Minimum separation test, 3 pounds force for 1 minute, connectors shall not separate

Figure 4

B. Procedure

To prepare specimens for testing, contacts were inserted in housings and PIDG ring tongue terminals were crimped on wire ends. Mating and unmating of connectors was performed by hand. The separation force tests were performed by suspending 1 end of the test assembly from the upper movable crosshead of a tensile testing machine. The lower end of the assembly was attached to a 30 pound dead weight. See Figure 5. The movable crosshead of the tensile machine was raised at a rate of 1 inch per minute until the connectors separated. The maximum tensile force was measured. For the minimum separation force test a 3 pound dead weight was attached to the lower end of the test assembly. The tensile machine was energized raising the crosshead at a rate of 1 inch per minute until the test assembly and the 3 pound dead weight were suspended for a minimum of 1 minute. To apply 125% of the rated current to test specimens, all contacts were connected in a series circuit by joining ring tongue terminals using ¼-20 screws, nuts and washers. The series circuit was energized at 25 amperes for 7 hours on a bench top in a temperature rise test room.

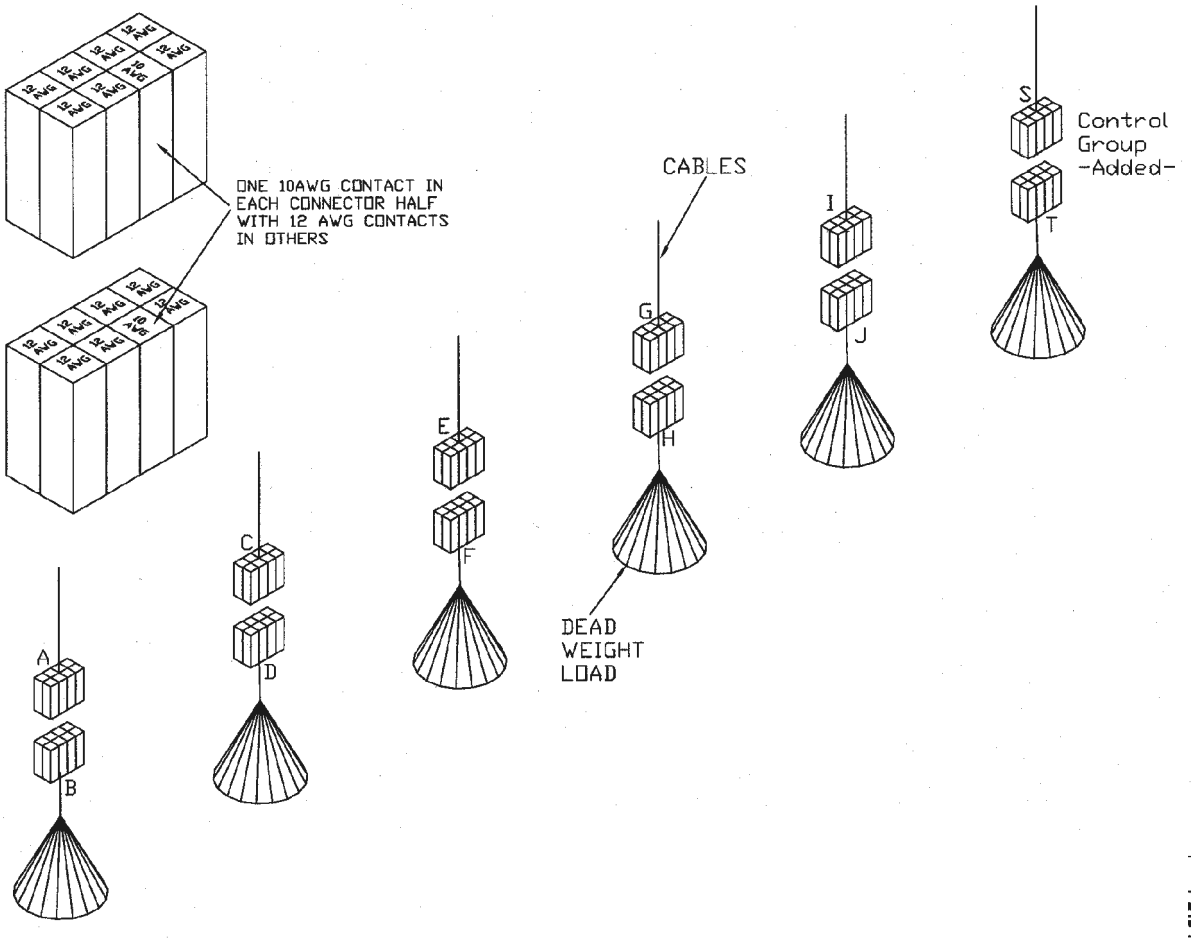

Figure 5

C. Results

All test groups passed the mating connector separation force tests and separated before the 30 pound test weight was suspended by the connectors. All test groups passed the minimum separation force test and the 3 pound weight was suspended by the connectors for longer than the specified hold time of 1 minute. There was no observed damage to the connectors as a result of the testing. The force required to separate connectors for the initial and repeat separation force tests was measured and is summarized in Figure 6.

Requirement	Initial Separation Force (lbs)	Repeat Separation Force (lbs)	Test Group ID
Minimum	5.8	4.6	U-V (2x2 Anderson assembly)
Maximum	29.2	23.3	E-F (2x4 Tyco assembly)
Average	15.0	13.8	

Figure 6