Terminal Crimp Process Verification Report

<table>
<thead>
<tr>
<th>Thermtrol Report No.:</th>
<th>Tyco_63850-1_18AWG 16/30 Strd_BAOH01_06211</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td>VR Report</td>
</tr>
<tr>
<td>Project Type:</td>
<td>FPA</td>
</tr>
<tr>
<td>Requested By:</td>
<td>Preparing Location: Vietnam</td>
</tr>
<tr>
<td>Prepared By:</td>
<td>Request Date: 27-Feb-11</td>
</tr>
<tr>
<td></td>
<td>Completion Date: 03-Mar-11</td>
</tr>
</tbody>
</table>

| Thermtrol Product:    | Wire Harness Ass'y                        |
| Thermtrol Plant:      | Thermtrol (VSIP) Co., Ltd.                |
| Customer Part #:      | -                                         |
| Terminal Supplier:    | Tyco                                      |
| Terminal Supplier Part #: | 63850-1                    |

| Wire Manufacturer:    | BAOH01                                    |
| Wire Description:     | UL321 Tinned copper                       |
| AWG & Stranding:      | 18AWG 16/30 Strd                          |
| Wire Insulation Range:| 0.118 +/- 0.004 inch                     |
| Crimp Configuration:  | Single crimper                            |
| Conductor Crimp Range:| 20 - 16 AWG                               |
| Insulation Crimp Range:| 0.090 - 0.130 inch Dia.                 |

| Thermtrol Applicator # | AMP-128                          |
| Supplier Applicator #  | 680347-1                         |
| Applicator Serial #    | 640563                           |
| Conductor Punch P/N    | 4-465406-7                       |
| Insulation Punch P/N   | 1-456134-4                       |
| Insulation Anvil P/N   | N/A                              |
| Conductor Anvil P/N    | 4-683452-0                       |
| # Strikes Recorded     | New Tooling                       |

**Conclusions & Results:**

This terminal meets all critical OEM application specifications, quality criteria and Thermtrol guidelines for acceptable crimps based on IPC- A620 and SAE/USCAR-21 specifications and it should be considered as acceptable for use in Customer Products.

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**Customer’s Comments:**

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**Report Prepared By:**

LE VAN CHUNG

**Accepted By:**

Customer Engineering

**Date:**

mm/dd/yy
Observations:
The overall crimp and terminal visual inspection:
Based on visual inspection, classify this crimp as acceptable, process issue, or design issue.

Check Points:  Classification

Terminal mating area is not damaged by the crimping process.  |  Acceptable
Deformation of the terminal from the crimping process is within supplier’s specification. |  Acceptable
Both the Insulation and Conductor are visible in the terminal inspection window.  |  Acceptable
There are no wire strand nicks.  |  Acceptable
The insulation has an even cut with no tearing (jagged edges).  |  Acceptable
Insulation does not extend into the conductor crimp.  |  Acceptable
Bell mouth(s) on conductor crimp meet supplier’s specification.  |  Acceptable
Wire brush is visible, uniform, and evenly distributed.  |  Acceptable
Wire brush does not interfere with the terminal’s mating section. Wire brush meets supplier’s specification.  |  Acceptable
Visual inspection of terminal shows no signs of material cracking as a result of the crimping process.  |  Acceptable

Additional Comments:
Measurement Criteria
1.  Thermtrol Visual Acceptance Criteria for Crimped Terminals
2.  IPC-A-620
3.  SAE/USCAR-21
4.  OEM Application/ Material Specifications and Crimping Guides

<table>
<thead>
<tr>
<th>Category</th>
<th>Measurement</th>
<th>Specification</th>
<th>Meets Criteria?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellmouth Brush End</td>
<td>0.008 inch</td>
<td>0.000 - 0.025 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Bellmouth Entity End</td>
<td>0.016 inch</td>
<td>Visible - 0.025 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Cut off Tab #1 (front)</td>
<td>0.014 inch</td>
<td>0.000 - 0.020 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Cut off Tab #2 (wire end)</td>
<td>0.012 inch</td>
<td>Visible - 0.020 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Brush Length</td>
<td>0.032 inch</td>
<td>Visible - 0.045 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Insulation Inspection Window comments</td>
<td>Thermtrol specifies that in the insulation inspection window, the insulation and conductor lengths should be as close to 50/50 as possible. The insulation length should be at least 20% of the window length, and no more than 75% of the window length.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductor Crimp Seam - comments</td>
<td>The conductor crimp seam is closed and there is no evidence of loose conductor strands visible in the seam.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twist &amp; Roll - comments</td>
<td></td>
<td>There is no evidence of twist, roll, or any other damage to the mating portion of the terminal.</td>
<td></td>
</tr>
</tbody>
</table>
**Terminal Crimp Process Verification Report**

**ThermTrol Report No.:** Tyco_63850-1_18AWG 16/30 Strd_BAOH01_06211

**Project Name:** VR Report

**Project Type:** FPA

**Preparing Location:** Vietnam

**Requested By:** 27-Feb-11

**Prepared By:** TVN

**Request Date:** 27-Feb-11

**Completion Date:** 3-Mar-11

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**Insulation Crimp Cross Section**

- **Height:** 0.1337 inch
- **Width:** 0.1448 inch

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**Observations**

Evaluation based on IPC A-620 sec. 5.1.1

Based on observations, classify this insulation crimp cross section as acceptable, process issue, or design issue.

**Check points**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>Acceptable</td>
</tr>
<tr>
<td>Acceptable</td>
<td>Acceptable</td>
</tr>
<tr>
<td>Acceptable</td>
<td>Acceptable</td>
</tr>
</tbody>
</table>

**Measurements**

- **Height**
  - **Measurement:** 0.1337 inch
  - **Specification:** 0.130 +/- 0.005 inch
  - **Meets Criteria?:** Yes

- **Width**
  - **Measurement:** 0.1448 inch
  - **Specification:** 0.140 +/- 0.010 inch
  - **Meets Criteria?:** Yes

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**Measurement Criteria**

1. IPC-A-620
2. SAE/USCAR-21
3. OEM Application / Specifications and Good Crimping Guides
4. C-4 - 7.4.4

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**Additional Comments:**

- None of the wings penetrate the insulation.
- (This is not allowed by ThermTrol)
- Crimp is symmetrical.
- No insulation extruded between the wing gaps. Wing gap is not greater than 45 degrees.
## Terminal Crimp Process Verification Report

**ThermTrol Report No.:** Tyco_63850-1_18AWG_1630_Stbd_BAOH01_06211  
**Project Name:** VR Report  
**Project Type:** FPA  
**Requested By:**  
**Prepared By:** TVN

### Conductor Crimp Cross Section

**Cross Section Close to Conductor Crimp Center**

<table>
<thead>
<tr>
<th>C/H</th>
<th>C/W</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0949 in</td>
<td>0.0930 inch</td>
<td>0.00103 inch²</td>
</tr>
</tbody>
</table>

**Observations**

- Evaluation based on IPC A-620 sec. 5.1.1
- Based on observations, classify this insulation crimp cross section as acceptable, process issue, or design issue.

**Check Points:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression: No round strands. All strands are deformed.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>The crimp is symmetrical. The distance between wing tips is not greater than the material thickness of the terminal. Strands are evenly distributed.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>No air gaps in the conductor crimp.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>No cracks or breaks in the terminal material (normally linked to excessive extrusion.)</td>
<td>Acceptable</td>
</tr>
<tr>
<td>Wings Locked. No gaps between wings.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>Wing tips do not contact bottom or side of terminal.</td>
<td>Acceptable</td>
</tr>
</tbody>
</table>

**Additional Comments:**

- The crimp is symmetrical. The distance between wing tips is not greater than the material thickness of the terminal.
- Strands are evenly distributed.
- No air gaps in the conductor crimp.
- No cracks or breaks in the terminal material (normally linked to excessive extrusion.)
- Wings Locked. No gaps between wings.
- Wing tips do not contact bottom or side of terminal.

### Center Wire Crimp Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Measurement</th>
<th>Specification</th>
<th>Meets Criteria?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height*</td>
<td>0.0499 inch</td>
<td>0.049 +/- 0.002 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Width*</td>
<td>0.0930 inch</td>
<td>0.090 +/- 0.005 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Pull Test**</td>
<td>43.8967 lbs</td>
<td>&gt; 20 lbs</td>
<td>Yes</td>
</tr>
<tr>
<td>Wire Barrel Flash / Extrusion</td>
<td>Left burr - 0.0026 inch</td>
<td>0.010 inch Max</td>
<td>Yes</td>
</tr>
<tr>
<td>Wire CMA</td>
<td>1600.00</td>
<td>1324.96 - 1900.96</td>
<td>Yes</td>
</tr>
<tr>
<td>Strand Count</td>
<td>16</td>
<td>16</td>
<td>Yes</td>
</tr>
<tr>
<td>Strand Diameter</td>
<td>0.0100 inch</td>
<td>0.0100 inch</td>
<td>Yes</td>
</tr>
<tr>
<td>Crimp Compression*</td>
<td>18.43%</td>
<td>10% &lt;= 30%***</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Measurements are from a 1 piece sample set  
**Measurements are the mean of a 30 piece sample set.  
***For copper wire material only

### Measurement Criteria

1. IPC-A-620  
2. SAE/USCAR-21  
3. OEM Application / Specifications, UL 758 and Good Crimping Guides  
4. C-4 - 7.3.4
Terminal Crimp Process Verification Report

Thermtral Report No.: Tyco_63850-1_18AWG 16/30 Strd_BAOH01_06211

Project Name: FPA Report
Customer: Vietnam
Project Type: VR Report
Preparing Location: TVN
Completion Date: 3-Mar-11

Prepared By: TVN
Request Date: 27-Feb-11
Preparing Location: TVN

Crimp Height Process Capability Study

Sample Mean: X=0.049115
UCL=0.0493224
LCL=0.0489076

Sample Range: R=0.0004292
UCL=0.0008600
LCL=0

Process Capability Sixpack of Crimp Height

Xbar Chart
R Chart

Capability Plot

Normal Prob Plot
AD: 0.589, P: 0.116

Conductor Pull Force Capability Study

Sample Mean: X=43.8967

Sample N: 30
StDev(Between): 0
StDev(Within): 2.15747
StDev(B/W): 2.15747
StDev(Overall): 2.09291

LSL 20
Target *
USL *
Sample Mean 43.8967
B/W Capability
Overall Capability

PPM < LSL 0.00
PPM > USL *
PPM Total 0.00

Observed Performance
PPM < LSL 3.18
PPM > USL *
PPM Total 0.00

Exp. B/W Performance
PPM < LSL 0.00
PPM > USL *
PPM Total 0.00

Exp. Overall Performance
PPM < LSL 0.00
PPM > USL *
PPM Total 0.00

Version: 14.1
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Customer: 

Project Type: FPA  
Preparing Location: Vietnam  
Requested By: 
Request Date: 27-Feb-11  
Prepared By: TVN  
Completion Date: 3-Mar-11

Wire Description: UL 3321 Tinned  
AWG & Stranding: 18AWG 16/30

Wire Insulation Cross Section & Visual Photo

Observations:
The overall wire visual inspection:
Based on visual inspection, classify this wire as acceptable, process issue, or design issue.

Check Points: Classification

- Insulation diameter is within supplier’s specification. Acceptable
- Insulation thickness is within supplier’s specification. Acceptable
- Wire CMA is within supplier’s specification. Acceptable
- Number of strands is within supplier’s specification. Acceptable
- Strand diameter is within supplier’s specification. Acceptable
- Wires strands is tinned/non-tinned as per the specified specification. Acceptable

Additional Comments:

Measurement Criteria
1. Thermtrol Visual Acceptance Criteria
2. Customer prints
3. Customer specifications
4. UL Specifications

Category | Measurement | Specification | Meets Criteria?
--- | --- | --- | ---
Insulation Diameter * | 2.991 mm | 3.0 +/- 0.1 mm | Yes
Insulation Thickness * | 0.871 mm | 0.69 mm Min | Yes
Wire CMA | 1600 | 1324.96 - 1900.96 | Yes
Strand Count | 16 | 16 | Yes
Strand Diameter | 0.0100 inch | 0.0100 inch | Yes
Tinned or Non-Tinned | Tinned | Tinned | Yes
Strip Force (min. and average value of 10 samples) ** | 7.1 lbs Min | 7.5 lbs Average | -

Notes:
1. * Measurements are average of two values as shown in the picture above
2. Wire color in the pictures of wire insulation cross section above may be different from wire color used in crimping studies and actual products, however they are all the same UL style, wire size, strand count, insulation diameter, insulation thickness.
3. ** Strip Force Test Method: 1) Test Sample: Take a 4.5 inch sample with 1.5 inch bare at both ends and 1.5 inches insulated. 2) If the stripability force on two or more of ten specimens tested does not meet the limits of the applicable material specification or if the average stripability force does not meet the limits, the material shall be rejected.
This verification report only shows that the design is centered and the manufacturing process is capable.

By signing below, supplier is certifying to Customer the following:
1) The information and data contained within this report is true and accurate.
2) A day-to-day process control plan is in place that assures parts are produced to a Cpk of 2 or better.
3) This verification report and the supplier's day-to-day process control plan will be included with the FPA submittal to the Customer using division.

Certified By: CAO HUNG SON
Signature
Print Name: CAO HUNG SON
Date: 3-Mar-11
Authorized Supplier Representative
Phone: +84-650-3782873
Email: chson@thermtrol.com