



**NOTE**

All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of  $\pm 0.13$  [ $\pm .005$ ] and angles have a tolerance of  $\pm 2^\circ$ . Figures and illustrations are for identification only and are not drawn to scale.

**1. INTRODUCTION**

This specification covers the requirements for application of COPALUM sealed terminals and splices, which are especially suited for the aerospace industry. These terminals and splices are designed to be terminated to fine stranded aluminum (Al) wire sizes 8.6 to 110.9 mm<sup>2</sup> [8 to 4/0 AWG] and copper (Cu) wire sizes 4.8 to 85.9 mm<sup>2</sup> [10 to 3/0 AWG]. The terminals are available in a variety of ring tongue lengths, shapes, and stud hole sizes. Markings on the terminals and splices indicate the accepted wire sizes and types (Al for aluminum and Cu for copper).

Each sealed terminal and splice has a barrier that helps locate and seal the wire barrel and a funnel lead-in chamfer in the wire barrel that helps guide the wire. A perforated insert in the wire barrel causes a wiping action on the wire during crimping, removing oxides and forming a solid electrical bond between the wire and terminal or splice.

Standard butt splices have a wire barrel at each end and are used for joining aluminum-to-aluminum, aluminum-to-“down size” copper, or copper-to-copper wires. Transitional butt splices have a wire barrel at each end and are used for joining aluminum and copper wires. A blue ring around one wire barrel (which has no perforated insert) indicates the copper wire end of the splice.

All sealed terminals and splices are designed to be crimped with precision dies and a power-assist unit, which perform a unique dry crimp that removes oxides to expose uncontaminated metal surfaces and seals the termination to prevent oxidation.

When corresponding with personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

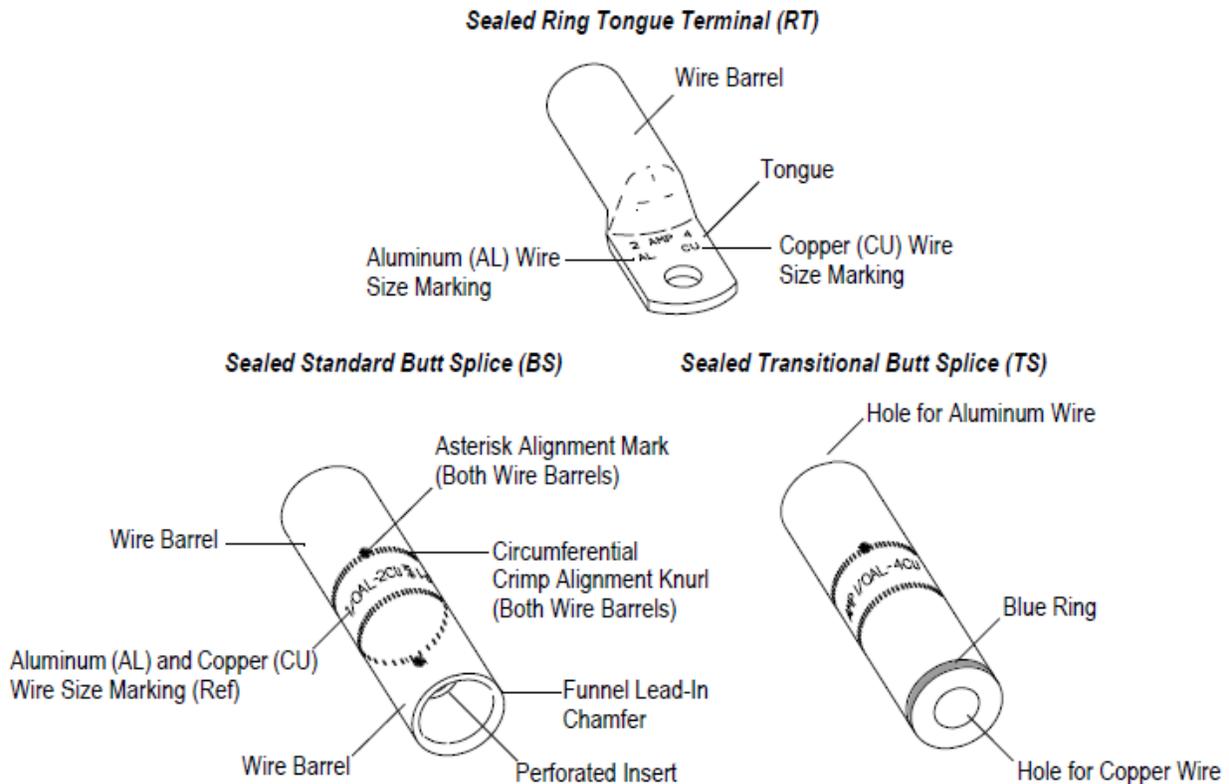


Figure 1

The circumferential crimp alignment knurl and asterisk alignment mark featured on each wire barrel of the splice indicates the direction that the splice should be placed in the dies when crimping the splice.

**NOTE**

*Copper wire has a greater electrical conductivity, density, and weight than aluminum wire of the same size. Because of this differentiation, there is a down size difference from an aluminum to copper wire. Size differences are given in Figure 2.*

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

- Deleted artwork and table information in Figure 6 and added NOTE for clarification.

### 2.2. Customer Assistance

Reference Product Base Part Number 277147 and Product Code 3015 are representative of COPALUM sealed terminals and splices. Use of these numbers will identify the product line and help you to obtain product and tooling information when visiting [www.te.com](http://www.te.com) or calling the number at the bottom of page 1.

### 2.3. Drawings

Customer drawings for product part numbers are available from [www.te.com](http://www.te.com). Information contained in the customer drawing takes priority.

### 2.4. Specifications

Product Specifications (108-series) provide product performance and test results. Product specifications that pertain to this product are:

<a href="#">108-11011</a>	Sealed COPALUM Terminals and Splices, Aluminum Wire
<a href="#">108-11011-1</a>	Sealed COPALUM Terminals and Splices, Copper Wire
<a href="#">108-11011-2</a>	Sealed COPALUM 90-Degree Flag Terminal, Aluminum Wire
<a href="#">108-11011-3</a>	Sealed COPALUM Transitional Butt Splices, Copper and Aluminum Wire

### 2.5. Publications

Publications developed by SAE International available for this product are:

SAE AS70991	Terminals: Lug and Splice, Crimp Style, Aluminum, For Aluminum Aircraft Wire
SAE AS22759	Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy

### 2.6. Instructional Material

Instruction sheets (408-series) provide product assembly instructions or tooling setup and operation procedures and customer manuals (409-series) provide machine setup and operating procedures. Instructional material that pertain to this product are:

<a href="#">408-2281</a>	Crimping Die Assemblies for COPALUM Sealed Terminals and Splices
<a href="#">408-2453</a>	Hydraulic Crimping Head 69066
<a href="#">408-7424</a>	Checking Terminal Crimp Height or Gaging Die Closure
<a href="#">408-8909</a>	Inspection and Servicing Hydraulic Crimping Heads 1752787-1 and 1752877-1
<a href="#">408-8914</a>	Hydraulic Crimping Head 1752787-1
<a href="#">408-8956</a>	Hydraulic Crimping Head 1752877-1
<a href="#">408-9535</a>	Hydraulic Crimping Head 58422-1
<a href="#">409-1950</a>	Heavy-Duty Electric Hydraulic Pumps 69120-1 and 69120-2
<a href="#">409-5860</a>	Hydraulic Hand Pump 314979-1
<a href="#">409-10081</a>	Electric Hydraulic Pumps 1804700-1 and -2

## 3. REQUIREMENTS

### 3.1. Safety

Do not stack product shipping containers so high that the containers buckle or deform.

### 3.2. Storage

#### A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the product material.

#### B. Shelf Life

The product should remain in the shipping containers until ready for use to prevent deformation to components. The product should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

#### C. Chemical Exposure

Do not store product near any chemical listed below as they may cause stress corrosion cracking in the material.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur Nitrites		Tartrates

### 3.3. Wire Selection and Preparation



**DANGER**

To avoid personal injury, DO NOT use larger or smaller aluminum or copper wire sizes than those designated.

The terminal or splice selected will be determined by the wire size and type and wire insulation diameter which is given on the customer drawing of each terminal and splice. For standard butt splices, a cross-reference of wire size marking-to-use is given in Figure 2.

SPLICE WIRE SIZE MARKING	STANDARD BUTT SPLICE USE		
	ALUMINUM-TO-ALUMINUM	COPPER-TO-COPPER	ALUMINUM-TO-DOWN SIZE COPPER
4/0 AL-3/0 CU	4/0 to 4/0	3/0 to 3/0	4/0 to 3/0
3/0 AL-2/0 CU	3/0 to 3/0	2/0 to 2/0	3/0 to 2/0
2/0 AL-1/0 CU	2/0 to 2/0	1/0 to 1/0	2/0 to 1/0
1/0 AL-2 CU	1/0 to 1/0	2 to 2	1/0 to 20
2 AL-4 CU	2 to 2	4 to 4	2 to 4
4 AL-6 CU	4 to 4	6 to 6	4 to 6
6 AL-8 CU	6 to 6	8 to 8	6 to 8
8 AL-10 CU	8 to 8	10 to 10	08 to 10

Figure 2

The strip length for the wire will depend on the number of insulation layers covering the wire. Wire sizes in metric, AWG, and circular mil area (CMA) comparison and the wire strip length is given in Figure 3.

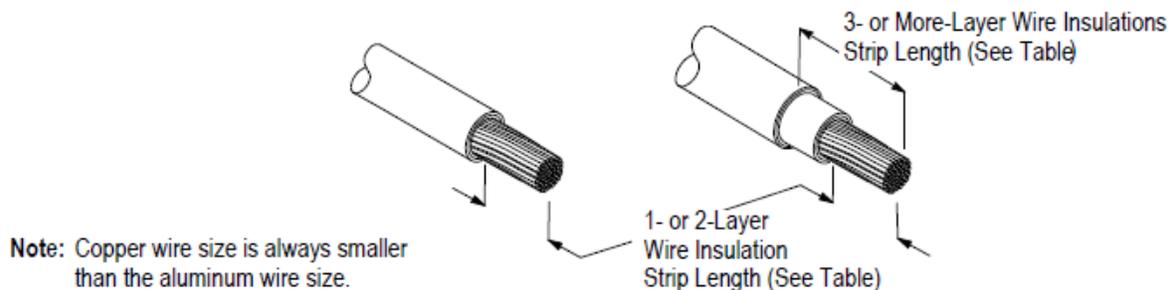


Figure 3 (cont'd)

WIRE SIZE						INSULATION LAYER STRIP LENGTH ( $\pm 1.59$ [1/16])	
ALUMINUM			COPPER			3 OR MORE	1 OR 2
mm <sup>2</sup>	AWG	CMA	mm <sup>2</sup>	AWG	CMA		
8.60	8	16,564	4.80	10	9,354	22.23 [7/8]	11.11 [7/16]
14.60	6	28,280	8.80	8	16,983	22.23 [7/8]	12.70 [1/2]
21.90	4	42,420	13.80	6	26,818	25.40 [1]	17.45 [11/16]
35.00	2	67,872	22.00	4	42,615	31.75 [1 1/4]	19.10 [3/4]
55.50	1/0	107,464	34.30	2	66,500	2.54 [1 9/32]	25.40 [1]
71.30	2/0	138,168	53.90	1/0	104,500	34.93 [1 3/8]	25.40 [1]
87.20	3/0	168,872	68.60	2/0	133,000	34.93 [1 3/8]	25.40 [1]
110.94	4/0	214,928	85.94	3/0	166,500	34.93 [1 3/8]	25.40 [1]

Figure 3 (end)

### 3.4. Crimp Criteria

The terminal or splice must be properly placed in the die assembly to achieve a quality crimp. Placement is described in the instruction sheet for the die assembly.

The crimp applied to the terminal or splice is accomplished in three stages during the crimping cycle: (1) primary, (2) transition, and (3) seal, as shown in Figure 4.

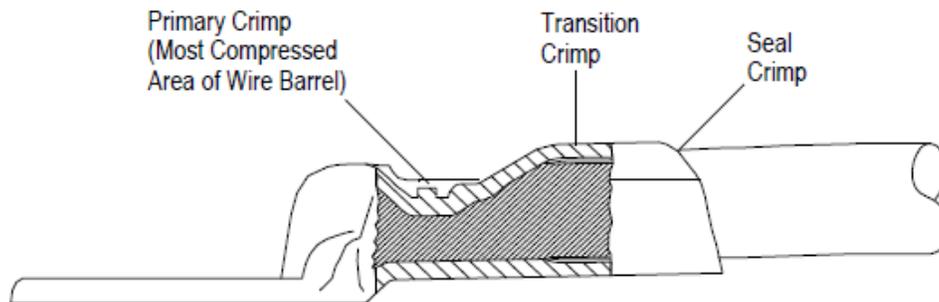


Figure 4

The following information must be used to check that the crimp is properly applied.

#### A. Crimp Inspection Mark

The crimp inspection mark (created by the die assembly) on the terminal or splice can be used as a visual indicator of an acceptable termination, but it does not indicate that the crimp is not acceptable. If the crimp inspection mark is centered in the crimp area and is evenly and distinctly formed, the crimp is considered properly applied; however, if it is not, and (1) the proper terminal or splice and die combination according to the wire size was used (2) the dies fully bottom during the crimping cycle, and (3) the die assembly conforms to a gage inspection, the crimp can be considered acceptable. Refer to Figure 5.



**NOTE**

Gage inspection is described in the instruction sheet for the die assembly.

#### B. Crimp Location

For terminals, the distance between the heel of the terminal and the crimp must be no more than the dimension given in Figure 5.

### C. Straightness

The crimped terminal or splice must be within the degree of straightness provided in Figure 5.

### D. Crimp Flash

Wire barrel flash that results from the crimping process must not exceed the limits provided in Figure 5.

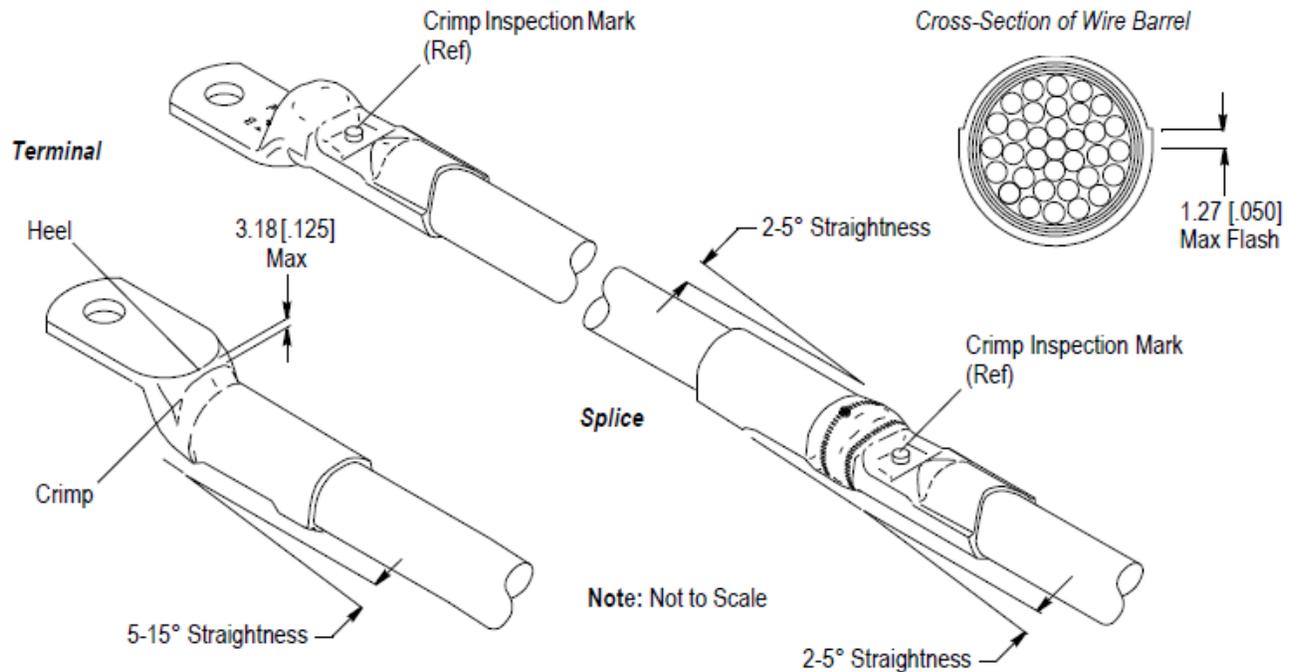


Figure 5

### 3.5. Strain Relief

A properly inserted wire will have a portion of the insulation inside the wire barrel of the terminal or splice. When the terminal or splice is crimped, the end of the wire barrel will form around the insulation to seal and provide strain relief for the terminated wire.

### 3.6. Mounting Hardware

The fasteners used to secure the ring tongue terminals must be in accordance with the user's specification.

### 3.7. Mating and Alignment

The copper tongue terminals should be mated to copper bus bars. They must not be mated to incompatible, dissimilar metals without appropriate interface treatment.

## 4. QUALIFICATION

No outside agency qualifying support was defined at the time of publication of this specification.

## 5. TOOLING

These terminals and splices are designed to be terminated using crimping dies, crimping heads, and hydraulic power units. The die assembly chosen will depend on the wire size and type. See Instruction Sheet 408-2281 for part number to die assembly to crimp head combinations. Catalog 1654519 will provide information for selecting pump and crimping head combinations.

## 6. VISUAL AID

The illustration below shows a typical application of this product. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

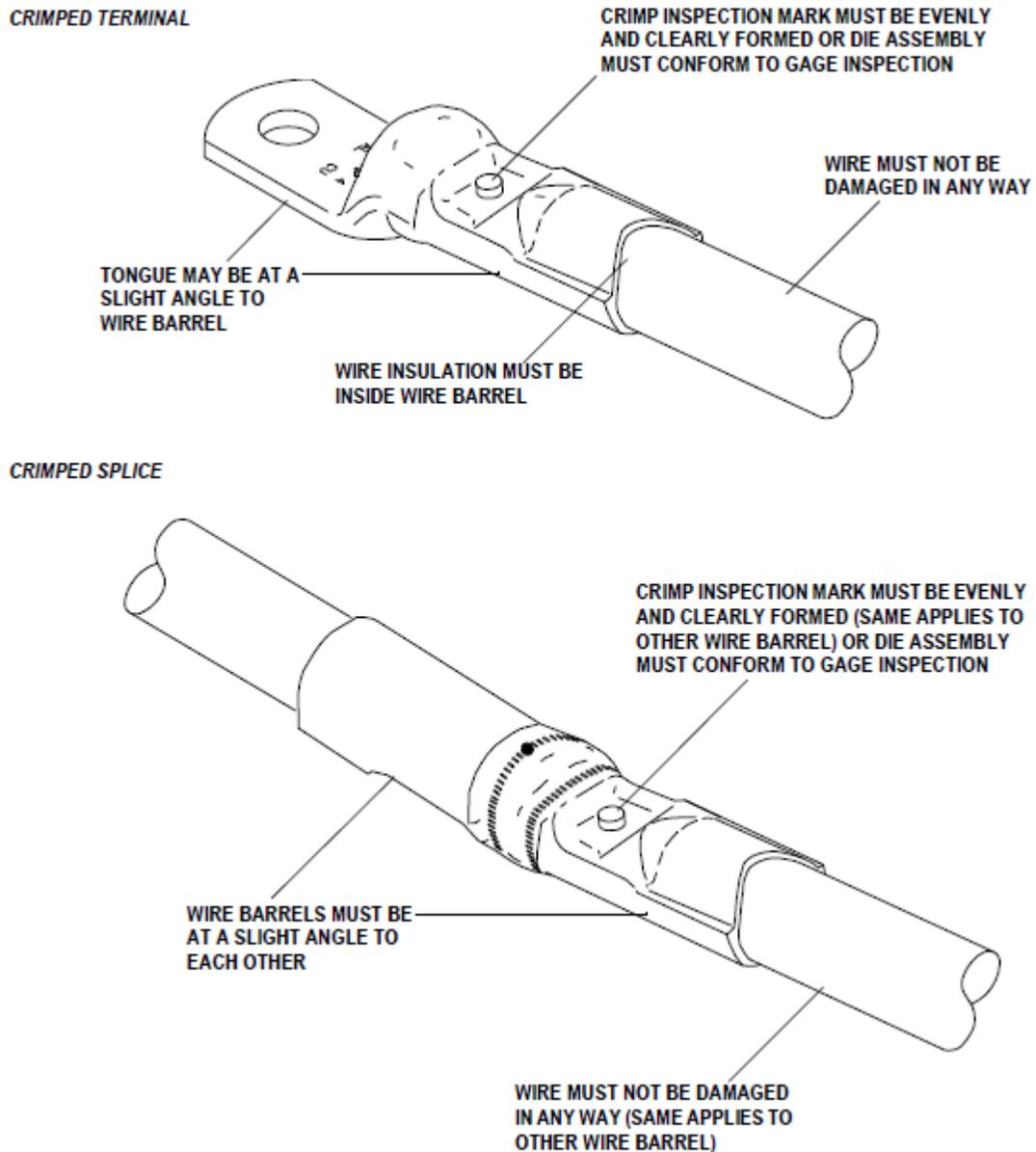


Figure 6. VISUAL AID