



# AEROSPACE RECOMMENDED PRACTICE

ARP5614

Issued

2014-08

## Guidelines for Harness Critical Clamp Locator Marker Installation on Electrical Cable Assemblies

### RATIONALE

This SAE Aerospace Recommended Practice (ARP) provides information to the user community on the use of Harness Critical Clamp Locator Markers where there is an installation requirement to reduce electrical wiring and harness movement, provide slack in critical locations and maintain adequate clearance and separation from aircraft equipment and structure. In addition, the Harness Critical Marker alerts the wiring installer and service personnel that harnesses in the area need special attention.

#### 1. SCOPE

This ARP specifies the recommended methods of marking electrical wiring and harnesses to aid in the positioning/routing of electrical wiring, harnesses and cable assemblies.

##### 1.1 Purpose

The purpose of this ARP is to provide guidance on accepted methods for marking electrical wiring and harnesses when control of routing is required for structural clearance, use of service loops, and/or harness movement during ground/flight operations.

##### 1.2 General

Primary support of aircraft wiring is provided by metal cushion clamps (such as AS21919 or AS23190) and spaced at intervals not to exceed 24 inches. Harness Critical Clamp Locator Markers are used to install the harness in the metal cushioned clamps in specific locations.

In areas of minimum clearance and separation aircraft requiring Harness Critical Clamp Locator Markers, electrical wiring and harnesses may require additional support and protection to prevent chafing, mechanical strain that could lead to arcing and/or damage/breakage to control cables, from associated moving equipment and structure. Preventing interference between electrical wiring, harnesses and equipment that slide or travel by design (shock and vibration mounted equipment or equipment required to be moved (slide) without being disconnected) is also required. Standard practice methods to prevent chafing are required in addition to primary support not in lieu of primary support.

In addition to being supported in areas of minimum clearances and separation requiring Harness Critical Clamp Locator Markers, electrical wiring and cable assemblies must also be protected. Shielded or metal braid harnesses may require protective non-metallic covering in the event of loosening or failure of the primary support.

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## 2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

AS4373	Test Methods for Insulated Electric Wire
AS5942	Marking of Electrical Insulating Materials
AS50881	Wiring, Aerospace Vehicle
AMS-DTL-23053/4	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Dual-Wall, Outer Wall Crosslinked
AMS-DTL-23053/5	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked
AMS-DTL-23053/18	Insulation Sleeving, Electrical, Heat Shrinkable, Modified Fluoropolymer, Crosslinked

### 2.2 Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-HDBK-522	Guidelines for Inspection of Aircraft Electrical Wiring Interconnect Systems
A-A-3165	Lacquer, Gloss, For Aircraft Use

### 2.3 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, [www.faa.gov](http://www.faa.gov).

AC 25.1701-1	Certification of Electrical Wiring Interconnection Systems on Transport Category Airplanes
AC 43.13-1	Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair

## 3. REQUIREMENTS

### 3.1 Protection and Support

Aircraft wiring should be supported to prevent chafing, mechanical strain or work hardening, arcing or overheating, interference between wiring and other components and movement in high vibration areas. Guidance for proper aircraft wiring and harness support can be found in AS50881, MIL-HDBK-522, and FAA AC 25 series and 43.13.

### 3.2 Harness Critical Clamp Locator Marker Location

Electrical wiring and harnesses should be permanently marked when there is an installation requirement to control the electrical wiring and cable assembly movement or slack in critical locations, and maintain specified adequate clearance and separation from equipment and structure. Harness Critical Clamp Locator Markers may be one to two inches wide. Color and location should be specified by the design organization and approved by the procuring activity. When the clamp is installed over the marker, the marker should be visible on both sides of the clamp, thus ensuring the required harness location in relation to the clamp. When required, clamp locator markers, as a minimum, should be placed at each harness endpoint (i.e., last clamp prior to termination) and at the mid-point harness clamp locations. Additional Harness Critical Clamp Locator Markers should be added as necessary, for areas in close proximity to fluid carrying lines, tubes, hoses, moving parts and components. For harnesses that flex/move or connect with moving components or surfaces that flex/move, Harness Critical Clamp Locator Markers should be located at the last clamp point prior to area of harness movement. When required at harness breakouts, Harness Critical Clamp Locator Markers should be located at the clamp position closest to the breakout point except for breakouts that occur within 18 inches of a previously established Harness Critical Clamp Locator Marker location. A harness with extra length for removal and maintenance of equipment maybe required. The service loop length depends on the needs of the equipment and the length is controlled by the use of Harness Critical Clamp Locator Marker.

### 3.3 Materials

#### 3.3.1 Protected Harnesses

A variety of types of marking methods can be used for marking electrical cable assemblies prior to installation. Note that these markings are permanent and if an error is made in Harness Critical Clamp Locator Marker location additional maintenance or replacement of harness overbraid, tape wrap, etc., may be required.

##### 3.3.1.1 Lacquer

A-A-3165 or equivalent applied by brush or spray preceded by masking to limit area coverage. Remove masking after lacquer has dried.

##### 3.3.1.2 Marker Pen

OPCO Marker or equivalent.

#### 3.3.2 Open/Protected Harnesses

##### 3.3.2.1 Heat Shrink

AMS-DTL-23053/5 (Class 1 or 3) or /18 are recommended in lieu of AMS-DTL-23053/4 for open harness application. The maximum temperature ratings of AMS-DTL-23053/4 (Class 2 or 3), /5 (Class 1 or 3) and /18 (Class 2 and 3) are 110 °C, 125/135 °C and 150 °C, respectively. In addition, cross-linked fluoropolymer heat shrink or equivalent is also suitable and has a maximum temperature rating of 225 °C. AMS-DTL-23053 heat shrink with hot-melt adhesive of a contrasting color may be used as a Harness Critical Clamp Locator Marker. AMS-DTL-23053/4 heat shrink is not recommended on an open harness or under a clamp. The adhesive of the AMS-DTL-23053/4 heat shrink may flow throughout the open harness, and result in damage to the harness during repair of individual wire and stiffening of the harness, preventing a smooth radius under the clamp.

### 3.3.2.2 Tape/Wrap Around Marker

The following tape/wrap around markers are considered suitable for use as Harness Critical Clamp Locator Markers:

- a. Polyvinyl fluoride - Maximum temperature rating 130 °C.
- b. Cross-linked polyolefin - Maximum temperature rating 175 °C.
- c. Top coated polyvinyl fluoride - Maximum temperature rating 135 °C.
- d. Polyurethane - Maximum temperature rating 121 °C.
- e. Polyimide - Maximum temperature rating 180 °C.

### 3.3.3 Material Selection

When selecting heat shrink or tape/wrap markers for a particular application, maximum operating temperature, AS5942 marking requirements and AS4373 (Test Method 711) durability and legibility testing should be considered. In addition, adhesive material used in the heat shrink or tape/wrap markers should be considered in regards its minimum/maximum operating temperature, adhesion to the harness to prevent movement of the marker, stiffening of the harness and penetration of the adhesive material into the harness which may affect maintenance or repair of the harness.

### 3.4 Maintenance

Periodic maintenance inspections of the visibility and legibility and cleanliness of Harness Critical Clamp Locator Markers should be performed. These inspections should be scheduled as part of already required wiring inspections or other required maintenance inspections to avoid a separate standalone inspection. On aircraft undergoing maintenance, marker placement outside the clamp may be required to eliminate localized chafing since every aircraft wiring installation has unique aspects. Adjustments to the Harness Critical Clamp Locator Marker locations must be approved by the aircraft cognizant engineering authority. Care needs to be taken to ensure overall wire harness installation requirements are not compromised when adjusting the Harness Critical Clamp Locator Marker position in relation to the clamp location.

## 4. NOTES

### 4.1 Definitions

#### 4.1.1 Chafing

Chafing is the repeated relative motion between electrical wiring and harnesses or between a wiring system component and structure, equipment or moving mechanical parts. This repeated relative movement may result in a rubbing action that causes degradation of the wiring insulation and cause mechanical or electrical failure during the aerospace vehicles specified service life. Caution care and attention to detail during the installation of electrical wiring and cable assemblies should be taken to prevent chafing.

#### 4.1.2 Clamp

Primary support of wiring shall be provided by metal cushion clamps and plastic clamps in accordance with AS23190, AS21919, spaced at intervals not to exceed 24 inches. AS23190/4 is the preferred wiring support clamp.

#### 4.1.3 Harness

An assembly of any number of wires, electrical/optical cables and/or groups and their terminations which is designed and fabricated so as to allow for installation and removal as a unit. A harness may be an open harness or a protected harness.