

INCH-POUND

MIL-DTL-24749B(SH)

28 January 2014

SUPERSEDING

MIL-DTL-24749A(SH)

21 August 1997

DETAIL SPECIFICATION

GROUNDING STRAPS AND BOSSES, ELECTROMAGNETIC

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements and tests for MIL-STD-1310 electrical grounding straps and welding studs, hereafter identified as bond straps and bosses.

1.2 Classification. The bond straps and bosses contained in this specification are classified into the following types, meeting general characteristics as follows (see 6.1 and 6.2):

1.2.1 Bond strap types.

Type I – Corrosion-Resistant Steel (CRES) 316 wire rope with mounting lugs

Type II – Flat CRES 316 strip with mounting holes on each end

Type III – Flat copper strip with mounting holes on each end

Type IV – Flat CRES 316/Nickel 200 braid with mounting lugs

1.2.2 Boss types.

AL – Aluminum/CRES 316L

AL-SGC – Aluminum/CRES 316L stud gun compatible

CR – CRES 316L

CR-SGC – CRES 316L stud gun compatible

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line “Document Comment”. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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1.2.3 Bond strap sizes are as specified in table I, table II, and table III.

TABLE I. Type I bond strap standard sizes.

Standard sizes (see 3.3)		
Standard size code	L (Length)	H (Hole diameter)
A	6.0	$\frac{13}{32}$
B	12.0	$\frac{13}{32}$
C	18.0	$\frac{13}{32}$
NOTES:		
1. Dimensions are in inches.		
2. Length is end-to-end.		
3. Lengths are ± 0.25 inch.		
4. Hole diameter is ± 0.010 inch.		

TABLE II. Type II and III bond strap standard sizes.

Standard sizes (see 3.3)			
Standard size code	L (Length)	W (Width)	H (Hole diameter)
A	3.0	1.0	$\frac{13}{32}$
B	6.0	1.5	$\frac{13}{32}$
C	9.0	2.0	$\frac{13}{32}$
D	12.0	2.5	$\frac{13}{32}$
NOTES:			
1. Dimensions are in inches.			
2. Length is ± 0.25 in hole-to-hole.			
3. Width is ± 0.125 inch.			
4. Hole diameter is ± 0.010 inch.			

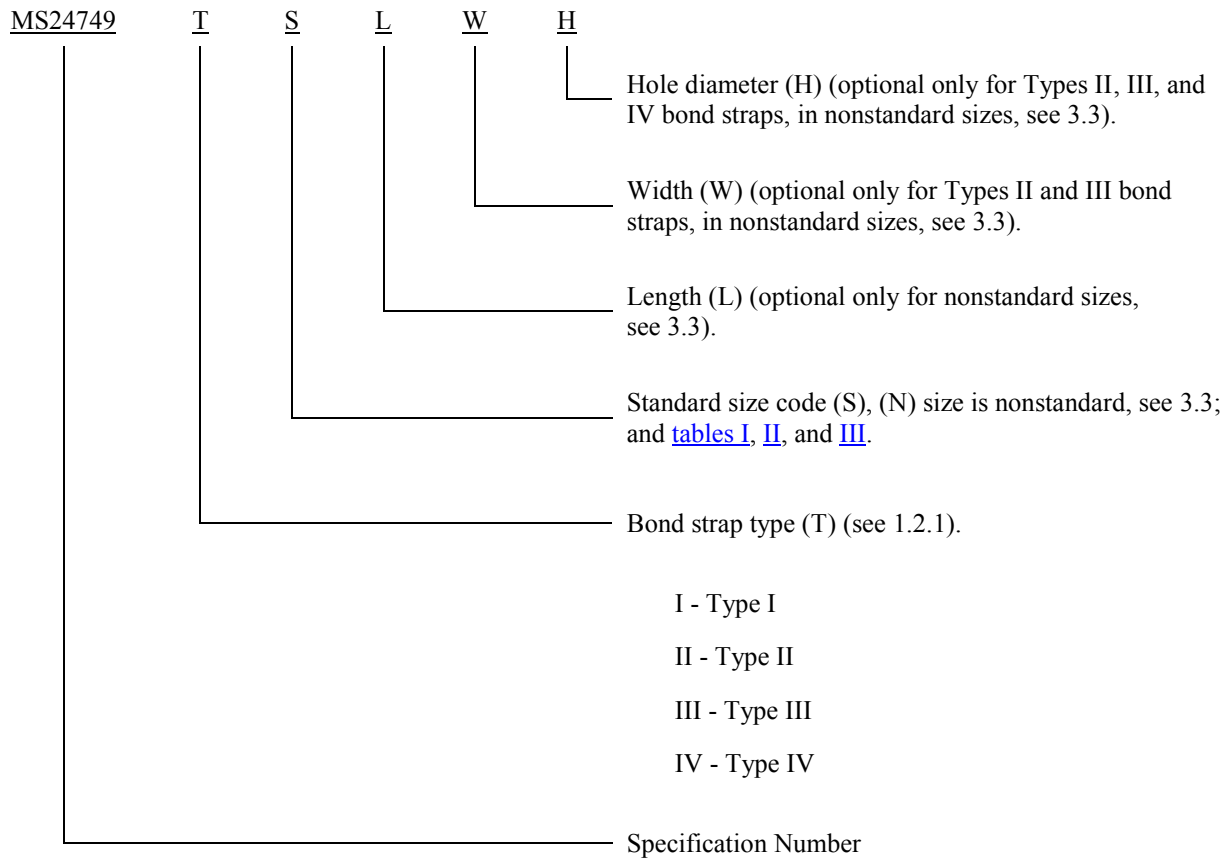
TABLE III. Type IV bond strap standard sizes.

Standard sizes (see 3.3)			
Standard size code	L (Length)	W (Width)	H (Hole diameter)
A	6.0	1.0	$\frac{13}{32}$
B	12.0	1.0	$\frac{13}{32}$
C	18.0	1.0	$\frac{13}{32}$
NOTES:			
1. Dimensions are in inches.			
2. Nominal length is hole-to-hole $\pm 5\%$.			
3. Hole diameter ± 0.010 inch.			
4. Nominal width is $\pm 5\%$.			

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1.3 Part or Identifying Number (PIN). PINs to be used for bond straps acquired to this specification are created as follows (see 6.2):

EXAMPLE: M24749-T-S-L-W-H



EXAMPLE: MS24749-II-B, Type II bond strap, standard size B.

EXAMPLE: MS24749-III-23-5-0.375, Type III bond strap, 23 inches long, 5 inches wide, $\frac{3}{8}$ inch (0.375 inch) hole diameter.

1.3.1 Boss part or identifying number (PIN). PINs to be used for Type I bond strap bosses acquired to this specification are created as follows (see 6.2):

<u>Specification Number</u>	<u>Boss Type</u>
EXAMPLE: MS24749-CR	CRES 316L
EXAMPLE: MS24749-AL-SGC	AL-SGC – Aluminum/CRES 316L stud gun compatible

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification, or recommended for additional information, or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

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2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

COMMERCIAL ITEM DESCRIPTIONS

A-A-59569 - Braid, Wire (Copper, Tin-Coated, Silver-Coated, or Nickel Coated, Tubular or Flat)

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-1222 - Studs, Bolts, Screws and Nuts for Applications where a High Degree of Reliability is Required; General Specification For

MIL-S-24149/3 - Studs, Welding, & Arc Shields (Ferrules); Type V, Class 1, 4, 5, 5A, Corrosion-Resistant Steel, for Direct Energy Arc Welding

MIL-J-24445 - Joint, Bimetallic Bonded, Aluminum to Steel

(Copies of these documents are available online at <http://quicksearch.dla.mil/>.)

DEPARTMENT OF DEFENSE FEDERAL ACQUISITION REGULATION SUPPLEMENT (DFARS)

48 CFR 252.225-7009 - Restriction on Acquisition of Certain Articles Containing Specialty Metals

(Copies of these documents are available online at <http://www.gpo.gov/>.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes

ASTM A342/A342M - Standard Test Methods for Permeability of Feebly Magnetic Materials

ASTM A492 - Standard Specification for Stainless Steel Rope Wire

ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

ASTM B152/B152M - Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar

ASTM B928/B928M - Standard Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments

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ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

(Copies of these documents are available online at www.astm.org.)

SAE INTERNATIONAL

SAE-AMS-QQ-S-763 - Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings

(Copies of this document are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at www.sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the 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.

3. REQUIREMENTS

3.1 First article. When specified (see 6.3), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Materials and components. The materials and components shall conform to applicable specifications, standards, and figures required herein. Items comprised of specialty materials (i.e., CRES 316/316L) shall be DFARS 252.225-7009 compliant.

3.2.1 Type I bond strap. A Type I bond strap shall consist of three components:

- a. One annealed CRES 316, UNS S31600, 1/4-inch diameter stranded wire cable, or wire rope.
- b. Two end lugs formed from CRES 316L, UNS S31600, schedule 40S pipe (see [figure 1](#), detail A).

3.2.1.1 Stranded wire rope. Stranded wire rope shall be 1/4-inch diameter CRES 316, UNS S31600, of 7-by-19 construction (see [figure 1](#), detail B). Wire used to construct the wire rope shall be in accordance with ASTM A492. Wire rope of this construction shall consist of 6 outer strands of 19 wires each laid around a strand core of 19 wires. The 6 outer strands shall each consist of a layer of 6 wires laid around a center wire in a left-hand direction and a layer of 12 wires laid over the 7-wire strand in a left-hand direction. The strand core shall consist of a layer of 6 wires laid around a center wire in a right-hand direction and a layer of 12 wires laid around the 7-wire strand in the right-hand direction. The 6 outer strands shall be laid around the core in a right-hand direction. The length of lay of the inside layer of 6 wires in each of the 6 outer strands and the one strand core shall not exceed 60 percent of the outside layer of 12 wires in each strand. The length of lay of the outside layer of 12 wires in each of the 6 outside strands and the strand core shall not exceed 50 percent of the lay of the finished wire rope. The length of the lay of the finished wire rope shall be not more than 2 inches nor less than 1.5 inches. The finished wire rope shall be annealed. The method of annealing of the wire rope shall be the strand annealing process. There shall be a hydrogen protective atmosphere within the annealing tube to eliminate the chance of oxidization of the surface of the wire rope and premature failure of the grounding strap due to corrosion. Annealing temperature shall be 2,000±50 °F. Through put speed shall be 2.5±0.5 feet per minute. Breaking strength of the fully annealed wire rope shall be between 2,000 and 3,000 pounds. Minimum elongation shall be 30 percent in a 12-inch gauge length. This wire rope shall have no residual martensitic/magnetic properties.

3.2.1.2 Lugs. Lugs shall be made of 0.405-inch outside diameter (O.D.) and 0.269-inch inside diameter (I.D.) CRES 316L, UNS S31603 schedule 40S pipe in accordance with ASTM A312/A312M. The lugs shall be formed from the blank pipe as follows: prepare pipe by cutting 1 1/2-inch length; insert stranded wire cable or wire rope through entire 1 1/2-inch length of pipe; compress the end 3/4 inch of the pipe to 0.20±0.01-inch thickness and ensure that both mounting surfaces of the lug are smooth and flat; burnish the end to remove sharp edges and drill a 13/32±0.001-inch hole in the lug to facilitate a 3/8-inch bolt.

3.2.2 Boss. Bosses used with Type I bond straps shall be 5/8-inch diameter in either of two different types: CRES 316L, UNS S31603 in accordance with SAE-AMS-QQ-S-763; or bimetallic (CRES 316L/Aluminum) in accordance with MIL-J-24445. Dimensions associated with bosses shall be in accordance with [figure 2](#). Bosses shall be either conventional or arc weld studs. Arc weld studs shall be in accordance with MIL-S-24149. Each boss shall contain a CRES 316 bolt (hex cap screw) in accordance with paragraph 3.2.2.2.

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3.2.2.1 Bimetallic boss. The foot of the aluminum boss shall be manufactured from aluminum alloy 5083, 5086, or 5456, in accordance with ASTM B928/B928M. The foot shall be bonded to CRES 316, UNS S31600 to form the Aluminum/CRES boss. An interstitial layer of an appropriate metal may be used to enhance strength and weldability. Acceptable interstitial metals include chromium, tantalum, molybdenum, and titanium.

3.2.2.2 Bolts. Bolts used in conjunction with bosses shall be fabricated from CRES 316, UNS S31600. The bolt for attachment of the Type I bond strap to the boss shall be $\frac{3}{8}$ -16 x $\frac{1}{4}$ inches in accordance with ASTM F593 or MIL-DTL-1222 (see 6.2).

3.2.3 Type II bond strap. Type II bond straps shall be manufactured of annealed CRES 316, UNS S31600 in accordance with ASTM A240/A240M or ASTM A666. Thickness of strap shall be 0.024±0.003 inch.

3.2.4 Type III bond strap. Type III bond straps shall be manufactured of UNS C11000 (Electrolytic Tough Pitch) Temper H00 (cold-rolled) flat copper strip, in accordance with ASTM B152/B152M. Thickness of strap shall be 0.024±0.003 inch.

3.2.5 Type IV bond strap. Type IV bond straps shall consist of three components:

- a. One wire braid strap
- b. Two end terminals

Ensure that both mounting surfaces of the terminals are smooth and flat; and burnish the end to remove sharp edges.

3.2.5.1 Braid. Bond strap braid shall be 50 percent CRES 316 wires and 50 percent Nickel 200 wires of 36 American Wire Gauge (AWG). The braid shall be constructed in accordance with A-A-59569, PIN number 36*1000, using 6 strands of 36AWG Nickel 200 wire and 6 strands of 36AWG CRES 316L stainless steel, woven on a 64 carrier machine with 768 ends to produce an approximately 1-inch wide flat braid strap.

3.2.5.2 End terminal. End terminals shall be annealed, wall welded, or seamless, CRES 316L tube in accordance with ASTM A269. Dimensions shall be 1.18±0.02 inch in length with an O.D. of 0.625 inch and nominal wall thickness of 0.065 inch. The end of the braid shall lay 100 percent inside the tube and the tube shall be flattened to 0.15±0.010 inch onto the braid. Drill or punch $\frac{1}{32}$ inch (0.406) ±0.001-inch hole in each lug to facilitate $\frac{3}{8}$ -inch bolts (for Size Code A-C), or $\frac{1}{32}$ inch (0.282) ±0.001 inch-hole in each lug to facilitate $\frac{1}{4}$ -inch bolts (for Size Code D-F).

3.3 Construction. Bond strap and boss dimensions shall conform to [tables I](#) through [IV](#) and the following:

3.3.1 Type I. Type I bond straps shall conform to paragraph 3.2.1 and [figure 1](#).

3.3.2 Bosses. CRES and bimetallic bosses shall conform to paragraph 3.2.2 and [figure 2](#).

3.3.2.1 Boss bolts. Boss bolts shall conform to paragraph 3.2.2.

3.3.3 Type II. Type II bond straps shall conform to paragraph 3.2.3 and [figure 3](#). The length-to-width ratio shall not exceed 5 to 1.

3.3.4 Type III. Type III bond straps shall conform to paragraph 3.2.4 and [figure 3](#). The length-to-width ratio shall not exceed 5 to 1.

3.3.5 Type IV. Type IV bond straps shall conform to paragraph 3.2.5 and [figure 4](#).

3.3.6 Dimensions. Bond strap dimensions shall be as specified herein. Dimensions are in inches. Unless otherwise specified (see 6.2), strap length shall be of standard sizes as detailed in section 1.2.1.

3.4 Performance requirements.

3.4.1 Visual inspection. When tested as specified in 4.5.1, bond straps shall meet the requirements in 3.2, 3.3, 3.5, and 3.7.

3.4.2 Bond joint strength and uniformity. The bimetallic boss joint shall be tested as specified in MIL-J-24445 and shall meet the requirements for both gas and electric arc weld studs in MIL-J-24445.

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3.4.3 Pull test. When tested as specified in 4.5.3, Type I and IV bond straps shall withstand a load of 300 pounds and be maintained within ± 50 pounds for 3 minutes. Wire rope and braid shall not be pulled from lugs, and no visually observable wire breakage shall occur.

3.4.4 Conformability and flexibility. Type I and IV bond straps shall be tested as specified in 4.5.4. Wire rope and braid shall not be pulled from lugs and shall exhibit no visual evidence of wire breakage.

3.4.5 Electrical resistance. Bond straps shall be tested as specified in 4.5.5. The Type I strap direct current (DC) resistance shall be not greater than 1 milliohm per 1 inch of strap length. The Type IV strap shall be not greater than 0.5 milliohm per 1-inch length.

3.4.6 Permeability. Martensitic/magnetic properties of Type I bond straps shall be verified as specified in 4.5.6. The bond strap wire rope shall have less than 1.002 relative permeability.

3.5 Identification. Type I bond straps shall be marked with the manufacturer's Commercial and Government Entity (CAGE) code. Type II, III, and IV bond straps shall be marked with an identifying legend consisting of the part number (see 6.2 and 6.5) and the manufacturer's CAGE code. Marking shall be permanent by use of metal stamp, indelible ink, or electro-etch with a minimum character height of not less than 0.08 inch.

3.6 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable, or biobased materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.7 Workmanship. Every detail of manufacture shall be in accordance with the best practices for manufacture of bond straps and bosses and the following:

- a. The materials used shall be free from all defects that could adversely affect installation, appearance, or long-term use.
- b. The mounting hole of flat plate straps and lugs of wire rope strap and flat braid straps shall be free from blistering, burrs, cracks, laps, peeling, pitting, sharp edges, slag, and other foreign material which could affect welding or bond strap installation.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.3 and 4.4

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4.3 First article inspection. A first article preliminary inspection shall determine that all samples are acceptable products for testing and that obvious defects are detected prior to the tests. Sample bond straps having any defect that may affect the results of first article testing shall be rejected. First article inspection shall be performed on each type of bond strap or boss when a first article sample is required (see 3.1). This inspection shall include the tests as specified in [table IV](#) and the tests of 4.5.1 through 4.5.6.

TABLE IV. First article inspection and testing.

Inspection/test	Requirement	Test
<u>Type I bond strap</u>		
Visual inspection	3.2.1 3.3 3.5 3.7	4.5.1
Pull test	3.4.3	4.5.3
Conformability and flexibility	3.4.4	4.5.4
Electrical resistance	3.4.5	4.5.5 4.5.6
Permeability	3.4.6	4.5.6
<u>Type I bond strap bosses</u>	3.3.2	4.5.2
<u>Type II, III bond strap</u>		
Visual inspection	3.2.3 3.2.4 3.7	4.5.1
<u>Packaging (all types)</u>	5.1	--
<u>Type IV bond strap</u>		
Visual inspection	3.3.5	4.5.1
Pull test	3.4.3	4.5.3
Conformability and flexibility	3.4.4	4.5.4
Electrical resistance	3.4.5	4.5.5

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4.4 Conformance inspection. Conformance inspection shall include the tests of [table V](#) and [table VI](#) and 4.5.1 through 4.5.5.

TABLE V. Conformance inspection and testing.

Inspection test	Requirement	Test	Defect characteristic ^{1/}
<u>Type I bond strap</u>			
Visual inspection	3.2 3.3.1 3.5 3.7	4.5.1	Major Major Minor Major
Pull test	3.4.3	4.5.3	Major
Electrical resistance	3.4.5	4.5.5	Major
Permeability	3.4.6	4.5.6	Major
<u>Type I bond strap bosses</u>	3.3.2	4.5.2	Major
<u>Type II and III bond strap</u>			
Visual inspection	3.3 3.5 3.7	4.5.1	Major Minor Major
<u>Type IV bond strap</u>			
Visual inspection	3.3.5	4.5.1	Major
Pull test	3.4.3	4.5.3	Major
Conformability and flexibility	3.4.4	4.5.4	Major
Electrical resistance	3.4.5	4.5.5	Major
Packaging (all types)	5.1	--	Minor
NOTE:			
^{1/} See 6.8.			

TABLE VI. Conformance inspection sampling.

Lot size	Major characteristic	Minor characteristic
2 to 8	All	2
9 to 15	All	3
16 to 25	15	3
26 to 50	20	5
51 to 90	20	6
91 to 150	20	7
151 to 280	20	10
281 to 500	47	11
501 to 1,200	47	15
1,201 to 3,200	53	18
3,201 to 10,000	68	22
10,001 to 35,000	77	29
35,001 to 150,000	96	29

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4.4.1 Inspection lot. An inspection lot is defined as items of the same type, size, material, and style produced at the same facility using the same purchased components, production processes and equipment, and being offered for delivery at one time.

4.4.2 Conformance inspection sampling. As a minimum, a sample quantity of completed bond straps shall be randomly selected for inspection and testing in accordance with the sampling plan, [tables V and VI](#), defined herein. Sample size depends on the classification of the defect characteristic as shown in [table V](#). The sample size for each characteristic is shown in [table VI](#). As an example, for a lot size of 75 Type I bond straps use [table VI](#) to determine the number of random samples to be tested for both major and minor defect characteristics. Return to the table V defect characteristic column to determine if the results of a particular test are considered major or minor. If the defect is considered “major”, 20 random samples, as determined from [table VI](#), should be selected for test and inspection. If the defect is considered “minor”, then only 6 random samples, as determined from [table VI](#), need to be selected for test and inspection. If one or more defects are found in any sample, then the entire lot shall be rejected.

4.4.2.1 Test criteria. Conformance testing of Type I bond strap bosses shall be in accordance with 4.5.2.

4.5 Methods of test.

4.5.1 Visual inspection. A visual inspection shall be performed on all samples prior to testing. The inspection shall determine that all samples are acceptable products for testing and that obvious defects are identified prior to the start of tests. The visual inspection shall determine conformance to, but shall not be limited to, the requirements specified in 3.2, 3.3, 3.5, and 3.7. Sample products having defects that may affect the result of testing shall be rejected.

4.5.2 Bimetallic joint.

- a. For every 400 items, or portion thereof, of a bimetallic boss production run, four specimens shall be randomly selected for testing.
- b. Two of the specimens shall be sectioned, polished, etched, and metallographically examined at 100x magnification. Weld Heat Affected Zone (HAZ) shall be uniform across the bond line. The bond shall be uniform and free of any indications of unbonded areas, or inclusions that exceed the acceptance standards of the base metal specifications of ASTM B928/B928M for Aluminum, or SAE-AMS-QQ-S-763 for CRES 316L.
- c. The remaining specimens shall be subjected to the bend test and the as-clad ram tensile test in accordance with MIL-J-24445.
- d. If any specimen fails, the entire lot of 400, or portion thereof, shall be rejected.

4.5.3 Pull test. Type I and IV bond straps shall be placed in a tensile testing configuration with the load distribution from lug to lug. The load shall be 300 pounds and maintained within ± 50 pounds for 3 minutes. The strap shall meet the requirements specified in 3.4.3.

4.5.4 Conformability and flexibility. Type I and Type IV straps shall be placed over a 1-inch diameter pin and subjected to bending the strap 180 degrees back and forth over the pin for fifty cycles. The bending force shall be no greater than 5 pounds. The strap shall meet the requirements specified in 3.4.4.

4.5.5 Electrical resistance. Type I and IV bond straps shall be tested for DC resistance from lug hole to lug hole end. The strap DC resistance shall be no greater than the requirements specified in 3.4.5.

4.5.6 Permeability. Type I bond straps shall be subjected to the test method in ASTM A342/342M. The strap permeability shall be no greater than the requirement specified in 3.4.6.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The bond straps and bosses covered by this specification are intended for, but not limited to, shipboard bonding and grounding applications and as specified for Secure Electrical Information Processing (SEIP) equipment bonding and grounding. Recommended usage should be as follows:

- a. Type I –for bonding items in weather exposed areas where corrosion is a concern.
- b. Type II – for lower impedance bonding items in weather exposed areas where corrosion is a concern.
- c. Type III – for bonding items in non-weather exposed areas.
- d. Type IV – for bonding items in non-weather exposed areas where corrosion is a concern. Also for use below deck across sound dampening devices, grounding or bonding of 1/4-inch stud mounted equipment, or portable electrical equipment that requires grounding or bonding.

- e. AL and AL-SGC Bosses – for attaching Type I straps to aluminum structure.
- f. CR and CR-SGC Bosses – for attaching Type I straps to steel structure.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type of bond strap (see 1.2).
- c. Bond strap part number(s), when applicable (see 1.3).
- d. Boss part number(s) (see 1.3.1).
- e. Quantity of each bolt (see 3.2.2.2).
- f. Whether nonstandard bond strap dimensions are required (see 3.3.6, [figure 3](#), and [figure 4](#)).
- g. Identification (see 3.5).
- h. Packaging requirements (see 5.1).
- i. Preservation (see 6.5).
- j. Quantity of bond straps.
- k. Quantity of each type of boss.
- l. Any special instructions or remarks.

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be first article sample, a first production item, or a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and the disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Sub-contracted material and parts. The packaging requirements of the reference documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into bond straps and bond strap assemblies and lose their separate identity when bond straps and bond strap assemblies are shipped.

6.5 Preservation. Bonding straps of the same type and length, or bosses of the same foot material, in the quantity specified (see 6.2) should be unit-protected in accordance with ASTM D3951.

6.6 Packing. Commercial packing should conform to ASTM D3951.

6.7 Strap information. Information should be furnished with the bond straps and should include the manufacturer's lot number, part number, length, and marking information.

6.8 Definitions.

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6.8.1 Major defect. A defect likely to result in failure or reduce materially the usability of the product for its intended purpose.

6.8.2 Minor defect. A defect not likely to reduce materially the usability of the product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the product.

6.9 Subject term (key word) listing.

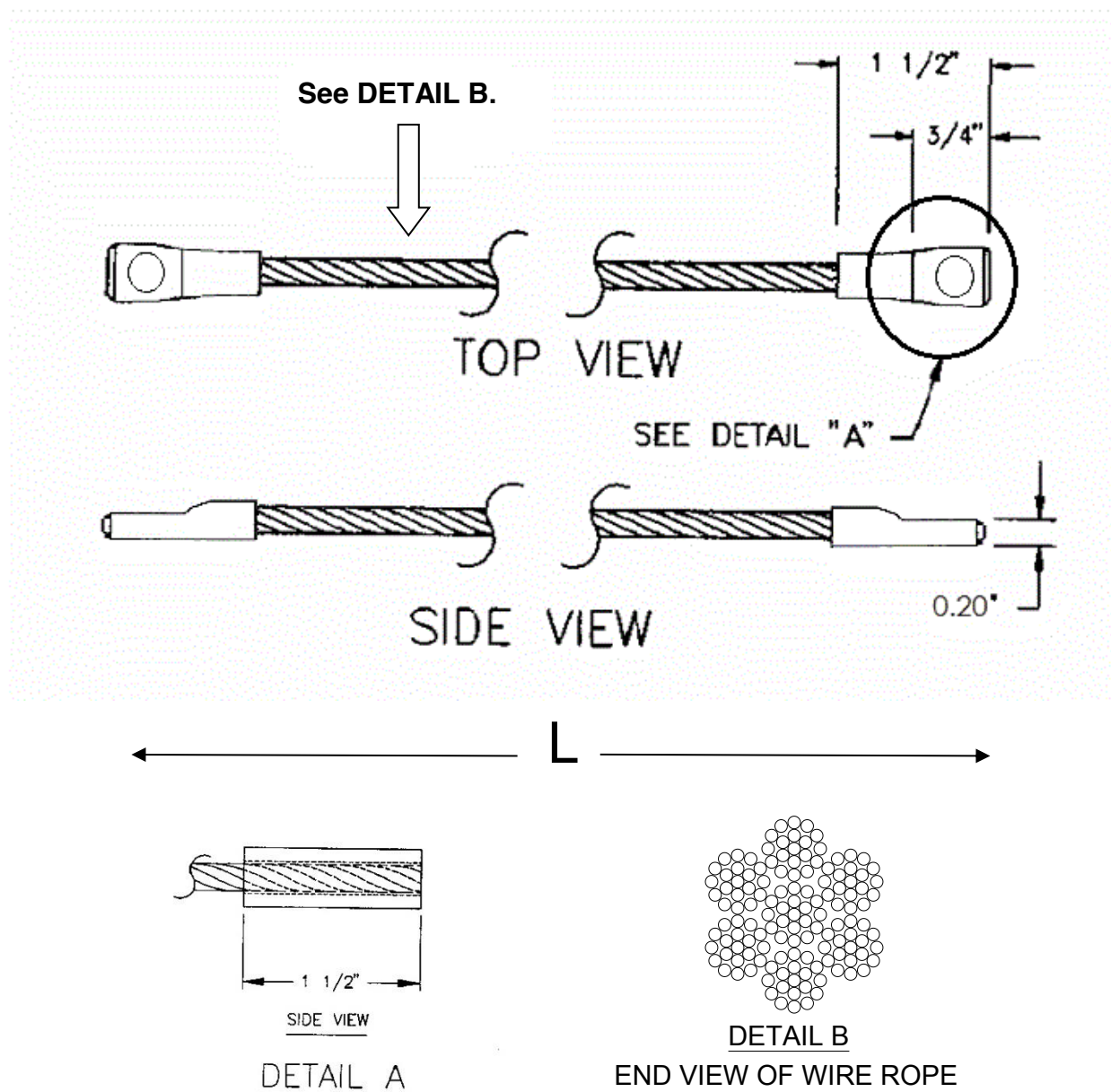
Bond strap

Nut, sleeve

6.10 Workmanship. MIL-HDBK-454, General Guidelines for Electronic Equipment, should be used as a guideline to ensure the use of best practices for manufacturing bond straps.

6.11 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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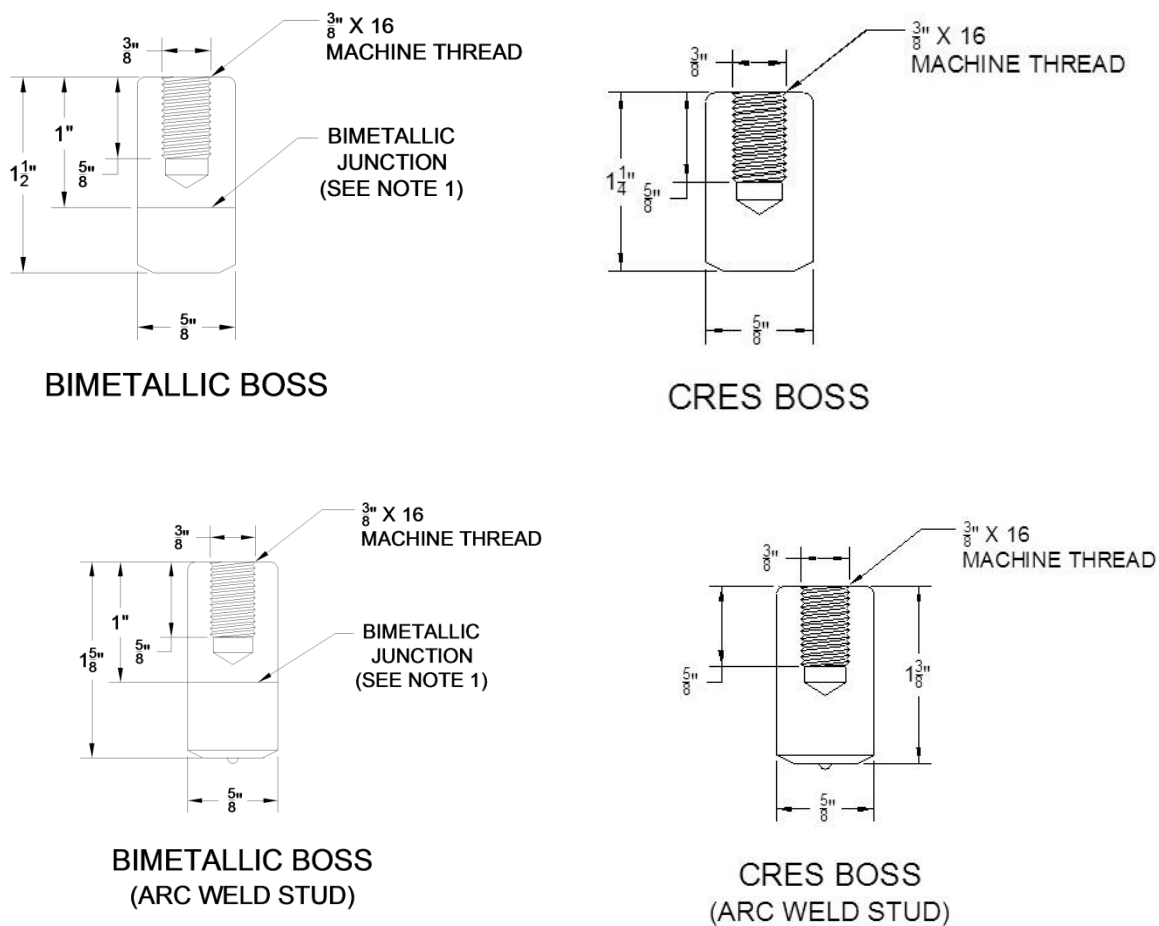


NOTES:

1. Insert stranded wire through entire 1.5-inch length of CRES 316L pipe as shown in detail "A" before compression.
2. Compress the end $\frac{3}{4}$ inch of the pipe to 0.20 ± 0.025 -inch thickness. Ensure both mounting surfaces of the lug are smooth and flat, and burnish the tip.
3. Drill $\frac{13}{32}$ inch (0.406 inch) ± 0.010 -inch hole in each lug to facilitate $\frac{3}{8}$ -inch bolts.
4. All figure dimensions are in inches $\pm \frac{1}{16}$ inch.

FIGURE 1. Type I bond strap.

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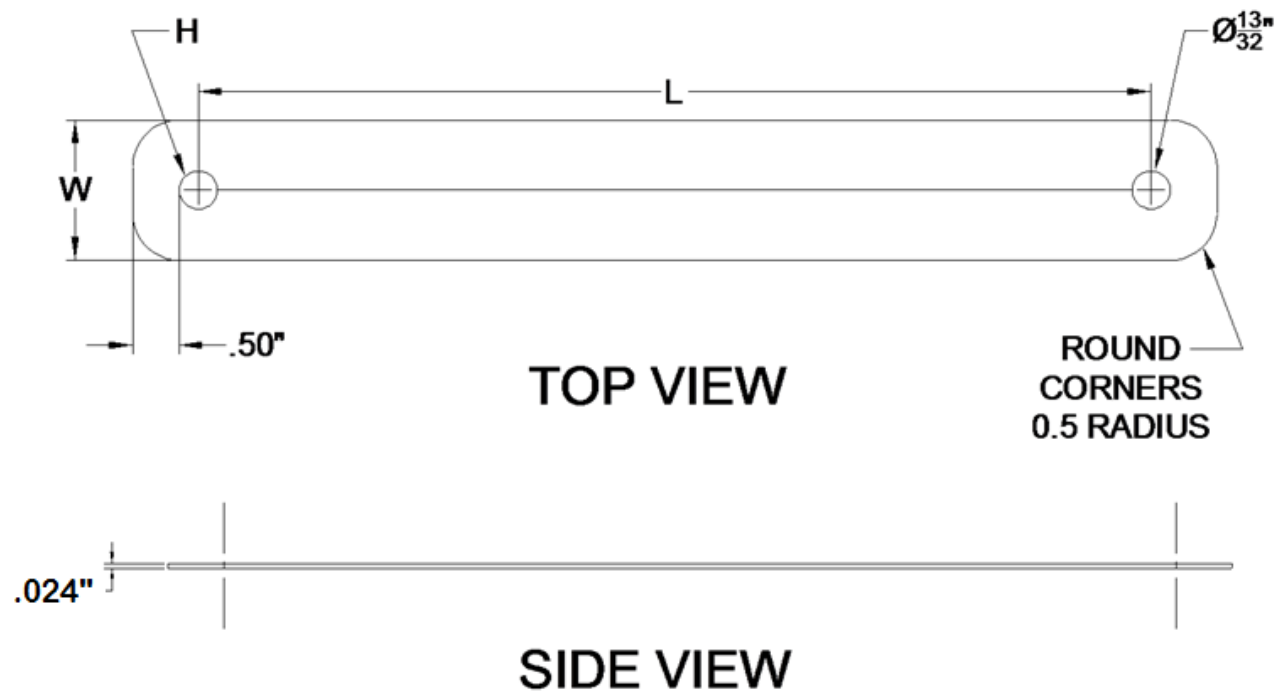


NOTES:

1. Bolt holes shall not penetrate through bond lines of bimetallic transition layer.
2. All dimensions, except machine threads, are in inches $\pm 1/32$ inch.
3. The manufacturer shall be responsible for design of boss weld ends that will provide a sound weld when used with the proper ferrule for arc-welding (see MIL-S-24149/3), or for fillet welding.

FIGURE 2. Bosses.

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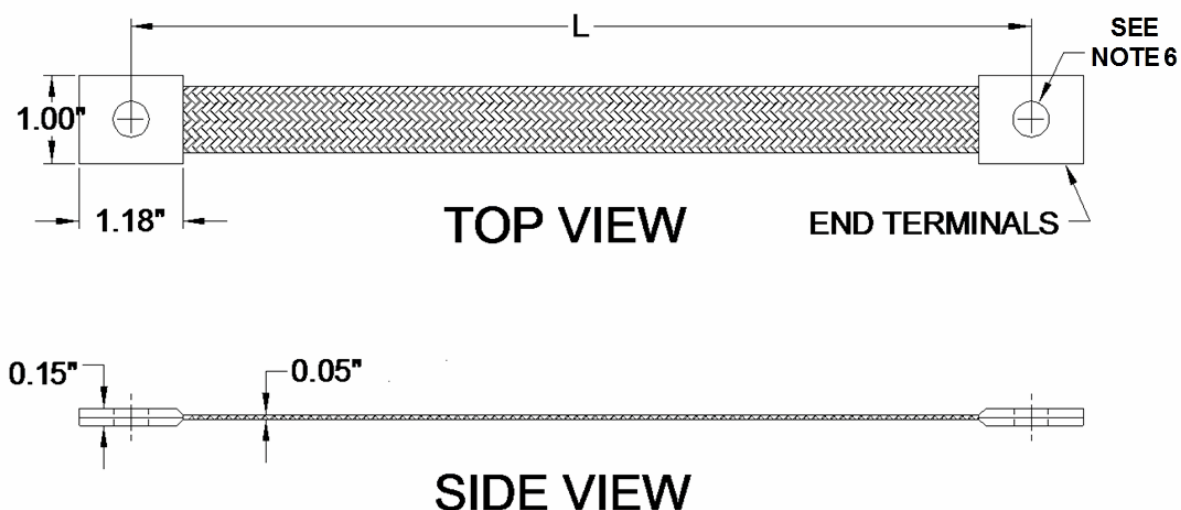


NOTES:

1. Length (L), width (W), and hole diameter (H) may be specified in non-standard sizes (see 1.3 and 6.2).
2. See [table II](#) for Type II and Type III bond strap standard sizes.
3. Unless otherwise noted in sections 3.2.3 or 3.2.4, all dimensions are in inches ± 0.010 inch.

FIGURE 3. Type II and III bond strap fabrication details.

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NOTES:

1. End terminals shall be formed from CRES 316L welded wall tube of 0.625-inch O.D. and wall thickness of 0.065 inch ± 10 percent, as specified in ASTM A269 cut to 1.18 ± 0.02 inch length.
2. The flat end of the braid shall be placed completely into the pipe end.
3. The pipe shall be compressed to 0.15 ± 0.01 inch to hold fast the braid.
4. End terminal width when compressed shall be 1.00 inch ± 5 percent.
5. Length (L) may be specified in nonstandard sizes (see paragraphs 1.3 and 6.2).
6. Drill or punch $\frac{13}{32}$ inch (0.406 ± 0.001 -inch hole in each lug after end terminal installation to facilitate $\frac{3}{8}$ -inch bolts (for Size Code A-C), or $\frac{1}{2}$ inch (0.282 ± 0.001 inch-hole in each lug to facilitate $\frac{1}{4}$ -inch bolts (for Size Code D-F).
7. See [table III](#) for Type IV bond strap standard sizes.

FIGURE 4. Type IV bond strap fabrication details.

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