

INCH-POUND

MIL-DTL-3903E
27 October 2009
SUPERSEDING
MIL-W-3903D
6 October 1983

DETAIL SPECIFICATION

WIRE ROPE ASSEMBLIES, SINGLE LEG, (SLING TYPE)

Reactivated after 27 October 2009 and may be used for new and existing designs and acquisitions.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers wire rope assemblies, single leg with plain end loops.

1.2 Classification. The wire rope assemblies are of the following types and classes, as specified (see 6.2):

Type I - Hand splice, wire rope, improved plow steel, fiber core
Type II - Mechanical splice, wire rope, improved plow steel, independent wire rope core

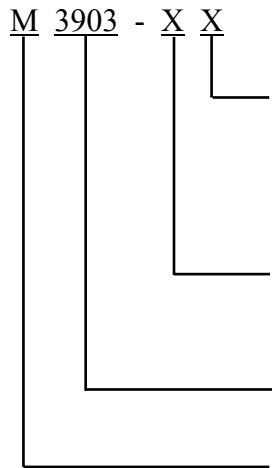
Class 1 - 6 by 19

Class 2 - 6 by 37

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616, or e-mailed to STDZNMGT@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <http://assist.daps.dla.mil/>.

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1.3 Part or identifying number (PIN). The PIN to be used for wire rope assemblies acquired to this specification is created as follows:



Class: A - 1 - Hand splice, wire rope, improved plow steel, fiber core

B - 2 - Mechanical splice, wire rope, improved plow steel, independent wire rope core

Type: 1 - I - Corrosion resistant steel

2 - II - Phosphor bronze

Specification number

Denotes military specification

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 the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards 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.

FEDERAL SPECIFICATION

RR-W-410 - Wire Rope and Strand

COMMERCIAL ITEM DESCRIPTION

A-A-52540 - Fittings, Wire Rope

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-DTL-13220 - Hook, Sliding Choker (for use with Wire Rope)

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DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	- Identification Marking of U.S. Military Property
MIL-STD-889	- Dissimilar Metals

(Copies of these documents are available online at <http://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ Z1.4	- Sampling Procedures and Tables for Inspection by Attributes
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(Copies of this document are available online at <http://www.asq.org/> or from American Society of Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM B 633	- Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
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(Copies of this document are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

SAE INTERNATIONAL

SAE AMS-QQ-P-416	- Plating, Cadmium (Electrodeposited)
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(Copies of this document is available online at <http://www.sae.org/> or from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001)

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 6.2), a sample shall be subjected to first article inspection in accordance with 4.2 and 6.3.

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3.2 Description. Wire rope assemblies (hereinafter called "slings") shall be as shown in figure 1 and specified herein.

3.2.1 Characteristics. Each sling shall be fabricated from one continuous piece of new and unused wire rope with a loop at each end, secured with either a hand or swage splice, as shown in figure 1.

3.3 Material. Materials shall be as specified herein. Materials not definitely specified shall be selected by the contractor and shall be new and unused and subject to all provisions of this document.

3.3.1 Material deterioration and control. The slings shall be fabricated from compatible materials, inherently corrosion and deterioration resistant or treated to provide protection against the various forms of corrosion and deterioration that may be encountered in any of the applicable storage and operating environment to which the item may be exposed.

3.3.1.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protector against galvanic corrosion. Dissimilar metals and methods of protection are defined and detailed in MIL-STD-889.

3.3.1.2 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with components and sub-components, and shall make information available, upon request, to the contracting officer or designated representative.

3.3.2 Wire rope. Wire rope shall conform to RR-W-410, type I for preformed, regular lay, and shall be the size and finish specified in table I.

TABLE I. Wire rope sizes and finish for types I and II slings.

Item	Wire rope diameter	Finish
Types I and II Class 1	3/8 through 1-1/8 inches	Uncoated or galvanized as specified (see 3.7)
Class 2	1-1/4 through 2 inches	Uncoated or galvanized as specified (see 3.7)

3.4 Design.

3.4.1 Type I. Type I slings shall conform to table II and shall consist of one continuous length of steel wire rope as specified in 3.3.2 with hand spliced eye loops on each end as shown in figure 1.

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TABLE II. Strength requirements in tons (2,000 pounds) for type I, classes 1 and 2 slings.

Diameter Inches	RC ¹ (one leg vertical pull)		Proof load		Minimum breaking strength ²		Splice efficiency Percent
	Tons, uncoated	Tons, galvanized	Tons, uncoated	Tons, galvanized	Tons, uncoated	Tons, galvanized	
Class 1:							
3/8	1.1	0.99	2.2	1.98	4.96	4.47	88
1/2	1.8	1.60	3.6	3.20	8.51	7.66	86
5/8	2.8	2.50	5.6	5.00	12.97	11.65	84
3/4	3.9	3.50	7.8	7.00	18.05	16.23	82
7/8	5.1	4.60	10.2	9.20	23.83	21.45	80
1	6.7	6.00	13.4	12.00	30.93	27.84	80
1-1/8	8.4	7.60	16.8	15.20	38.92	35.03	80
Class 2:							
1-1/4	9.8	8.80	19.6	17.60	45.51	40.96	80
1-3/8	12.0	11.00	24.0	22.00	54.83	49.36	80
1-1/2	14.0	13.00	28.0	26.00	65.05	58.54	80
1-5/8	16.0	14.00	32.0	28.00	76.20	68.58	80
1-3/4	19.0	17.00	38.0	34.00	88.06	79.18	80
1-7/8	22.0	20.00	44.0	40.00	100.65	90.58	80
2	25.0	22.00	50.0	44.00	113.95	102.86	80

¹ RC – Rated capacity is the maximum recommended load based on a safety factor of 5.

² Strength requirements computed on the efficiency of the eye splice and the 7-1/2 percent for testing variation.

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3.4.1.1 Seizing. Seizing shall be of strand conforming to RR-W-410, type V, class 1, or wire and shall be iron or annealed steel, as specified (see 6.2). Construction and dimensions shall be as specified in table III. A seizing if strand or wire shall cover the splice and adjacent strands, which were unlaidd during splicing. Seizing shall be tightly wound, each wrap of seizing laying against the preceding wrap, the ends twisted together, and laid against the rope.

TABLE III. Seizing strands size and construction.

Wire rope diameter (Inch)	Seizing strand		Seizing wire minimum diameter (Inch)
	Diameter (Inch)	Construction	
3/8	1/16	1 by 7	0.080
1/2	3/32	1 by 7	0.080
5/8	1/8	1 by 7	0.080
3/4	1/8	1 by 7	0.104
7/8 and larger	5/32	1 by 7	0.104 and larger

3.4.1.2 Hand tucks. Hand-tucked splices shall be made by forming a loop and splicing the dead end into the live end of the rope. Each dead-end strand shall be given one forming tuck and three full tucks around the same strand in the body of the rope. One additional full tuck shall be made when splicing flexible wire ropes such as the 6 by 37 classification. Splices shall be tightly tapped to remove high spots and allow the strands to mesh.

3.4.1.3 Forming tucks. Forming tucks shall be made by prying two adjacent strands apart, inserting a dead-end strand into the opening, and passing the strand under one, two, or three adjacent strands in the body of the rope. The dead-end strand shall be set or locked tightly.

3.4.1.4 Full tucks. Full tucks shall be made by inserting a dead-end strand under a strand in the body of the wire rope and rotating it 360 degrees. The tucked strand shall be set or locked tightly. Each subsequent full turn of the dead-end strand around the live-end strand constitutes an additional full tuck.

3.4.1.5 Setting or locking. Setting or locking of a dead-end strand shall be accomplished by pulling the strand end in under considerable force. At the same time, a marlin spike, inserted in the same opening in the body of the rope, shall be rotated about the axis of the rope back to the start of the splice or to the previous tuck.

3.4.1.6 Tensile strength. Minimum tensile strength shall be as specified in table II.

3.4.2 Type II. Type II slings shall consist of one continuous length of steel wire rope as specified in 3.3.2, table IV, and with mechanically spliced eye loops on each end as shown in figure 1.

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TABLE IV. Strength requirements in tons (2,000 pounds) for type II, classes 1 and 2 slings.

Diameter Inches	RC ¹ (one leg vertical pull)		Proof load		Minimum breaking strength ²		Splice efficiency Percent
	Tons, uncoated	Tons, galvanized	Tons, uncoated	Tons, galvanized	Tons, uncoated	Tons, galvanized	
Class 1:							
3/8	1.2	1.1	2.4	2.2	5.90	5.31	95.0
1/2	2.2	2.0	4.4	4.0	10.35	9.31	95.0
5/8	3.4	3.1	6.8	6.2	16.11	14.50	95.0
3/4	4.9	4.4	9.8	8.8	23.04	20.74	95.0
7/8	6.6	5.9	13.2	11.8	31.14	28.03	95.0
1	8.5	7.6	17.0	15.2	40.41	36.37	95.0
1-1/8	10.0	9.0	20.0	18.0	49.43	44.68	92.5
Class 2:							
1-1/4	12.0	11.0	24.0	22.0	57.84	52.05	92.5
1-3/8	15.0	13.0	30.0	26.0	69.74	62.76	92.5
1-1/2	17.0	16.0	34.0	32.0	82.69	74.42	92.5
1-5/8	20.0	18.0	40.0	36.0	97.12	87.41	92.5
1-3/4	24.0	21.0	48.0	42.0	112.00	100.80	92.5
1-7/8	27.0	24.0	54.0	48.0	127.75	114.97	92.5
2	30.0	27.0	60.0	54.0	144.37	129.94	92.5

¹ RC – Rated capacity is the maximum recommended load based on a safety factor of 5.

² Strength requirements computed on the efficiency of the eye splice and the 5 percent for testing variation.

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3.4.2.1 Mechanical splices. A mechanical splice shall be fabricated by pressing or swaging one or more metal sleeves over the rope junction.

3.4.2.2 Fittings. Swage sleeves shall conform to A-A-52540 or other swage sleeves that conform to the quality assurance provisions of A-A-52540.

3.4.2.3 Strand ends. Spliced strand ends shall be neatly cut. Burning shall not be permitted.

3.4.2.4 Tensile strength. Minimum tensile strength shall be as specified in table IV.

3.5 Choker hooks. When specified (see 6.2), a sliding choker hook shall be fitted between the loops of each sling. Hooks shall be the applicable size for the wire rope and shall conform to MIL-DTL-13220.

3.6 Dimensions. The length of the slings shall be the length from bearing point to bearing point when the loops lay the natural and the length of the loop is approximately twice the width of the loop (see figure 1). The length of the sling and loop shall be as specified in table V (see 6.2). The slings shall not vary from the length specified more than ± 2 diameters of the wire rope used, or ± 0.5 percent of sling lengths, whichever is greater.

3.7 Finish. Types I and II slings shall be finished as specified (see 6.2). When zinc-coated rope is specified, the metal sleeves of type II slings shall be zinc-coated in accordance to ASTM B 633, Fe/Zn 25, type II finish or cadmium plated in accordance with SAE AMS-QQ-P-416, class 1, type II.

3.8 Identification. Identification shall be in accordance with MIL-STD-130. A metal tag shall be securely attached to each sling. Metal tags shall be corrosion resistant, 0.016 inch minimum thick steel, securely fastened adjacent to one of the eye spliced loops by corrosion resistant 0.047 inch minimum diameter wire. The tag shall have the following information etched or punched thereon:

WIRE ROPE ASSEMBLY, SINGLE LEG (SLING TYPE)

NSN _____ Rope dia. _____ Grade _____
 Length of assembly _____
 Loop size _____
 Contract no. _____ Date _____
 Manufacturer _____
 Rated Capacity in short tons (2,000 pounds) _____

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TABLE V. Sling dimensions.

Sling No.	Length of sling	Length of eye	Length of serve	Diameter of wire rope
Dimensions of "A" Slings (see figure 1)				
1	3 ft.	4 in.	8 in.	1/2 in.
2	7 ft.	8 in.	8 in.	1/2 in.
3	20 ft.	10 in.	8 in.	1/2 in.
4	30 ft.	10 in.	8 in.	1/2 in.
5	40 ft.	10 in.	8 in.	1/2 in.
6	50 ft.	10 in.	8 in.	1/2 in.
7	30 ft.	12 in.	10 in.	5/8 in.
8	40 ft.	12 in.	10 in.	5/8 in.
9	50 ft.	12 in.	10 in.	5/8 in.
10	7 ft.	12 in.	12 in.	3/4 in.
11	20 ft.	12 in.	12 in.	3/4 in.
12	30 ft.	12 in.	12 in.	3/4 in.
13	40 ft.	12 in.	12 in.	3/4 in.
14	50 ft.	12 in.	12 in.	3/4 in.
15	20 ft.	13 in.	14 in.	7/8 in.
16	30 ft.	13 in.	14 in.	7/8 in.
17	40 ft.	13 in.	14 in.	7/8 in.
18	50 ft.	13 in.	14 in.	7/8 in.
19	20 ft.	14 in.	16 in.	1 in.
20	30 ft.	14 in.	16 in.	1 in.
21	40 ft.	14 in.	16 in.	1 in.
22	50 ft.	14 in.	16 in.	1 in.
23	20 ft.	18 in.	18 in.	1-1/8 in.
24	50 ft.	18 in.	18 in.	1-1/8 in.
Dimensions of "B" Slings (see figure 1)				
25	12 ft.	8 in.	6 in.	3/8 in.
26	16 ft.	10 in.	6 in.	3/8 in.
27	12 ft.	10 in.	8 in.	1/2 in.
28	20 ft.	12 in.	10 in.	5/8 in.

3.9 Workmanship. The slings shall conform to the quality and grade of product as specified in RR-W-410, and shall be free from imperfections such as protruding strands, sharp edges, burns, burrs, and corrosion.

3.10 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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.

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4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection.

4.2.1 Examination. Two first article slings shall be examined as specified in 4.4.1. Presence of one or more defects shall be cause for rejection of both slings.

4.2.2 Tests. Two first article slings shall be tested as specified in 4.4.2, with one sling undergoing the proof test as specified in 4.4.2.1, and the other sling tested to destruction as specified in 4.4.2.3. Failure of either test shall be cause for rejection.

4.3 Conformance inspection.

4.3.1 Lot. A lot shall consist of all slings of the same type, class, finish, and wire rope diameter at one time for acceptance.

4.3.2 Sampling. Sampling for examination and testing shall be in accordance with ASQ Z1.4, inspection level II, with the Acceptance Quality Limit (AQL) as specified in the contract (see 6.2). For destructive testing, three samples from each lot of 100 or fewer slings produced shall be subjected to the test specified 4.4.2.3.

4.3.3 Examination. Samples selected in accordance with 4.3.2 shall be examined for defects specified in 4.4.1.

4.3.4 Tests. Samples selected in accordance with 4.3.2 shall be tested in accordance with 4.4.2. Failure of either test shall be cause for rejection of the entire lot represented by the sample.

4.4 Inspection procedure.

4.4.1 Examination. Slings shall be examined as specified herein for the following defects:

Major

101. Material not as specified or the materials are not resistant to corrosion or deterioration or treated to be made resistant to corrosion or deterioration for the applicable storage and operating environment.

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102. Dissimilar metals as defined in MIL-STD-889 are not effectively insulated from each other.
103. Finish plan not adequate or the contractor does not have documentation available for identification of material, material finishes, or treatments.
104. One or more wires broken or severed.
105. Wires not completely tucked into splices or swages.
106. Hand splices not as specified.
107. Mechanical splices not as specified.
108. Dimensions not as specified.
109. Workmanship not as specified.

Minor

201. Protruding wire strand ends.
202. Seizing not as specified.
203. Strand ends cut by burning.
204. Identification marking illegible, incomplete, or missing.

4.4.2 Tests.

4.4.2.1 Method of testing. Testing shall be done prior to any seizing when this is specified. The proof and destructive tests shall be a single-leg straight pull method. The slings shall be placed on a tensile testing machine using mandrels having a minimum diameter of four times the diameter of the wire rope used in a uniform rate. Load shall be applied through the movable mandrel at a uniform rate. An alternate test method may be used for heavy duty slings, using a hoist or crane. One terminal of the sling shall be attached to the hook and the other to the test load.

4.4.2.2 Proof load. Slings shall be tested for proof as specified in 4.4.2.1. Slippage of the swage sittings or nonconformance to the applicable minimum proof load specified in tables II or IV shall constitute failure of this test.

4.4.2.3 Ultimate tensile strength. Slings shall be tested as specified in 4.4.2.1 for ultimate tensile strength. Nonconformance to the applicable minimum breaking strength specified in tables II or IV shall constitute failure of this test.

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 slings covered by this specification are intended for use in cargo and material handling operations.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class (see 1.2).
- c. When first article is required for inspection and approval and the number of units required (see 3.1).
- d. Whether seizing should be strand or wire, and of iron or annealed steel (see 3.4.1.1).
- e. When slings should be fitted with choker hooks (see 3.5).
- f. Length of slings (see 3.6).
- g. Wire rope finish required (see 3.7).
- h. AQL (see 4.3.2).
- i. Packaging requirements (see 5.1).

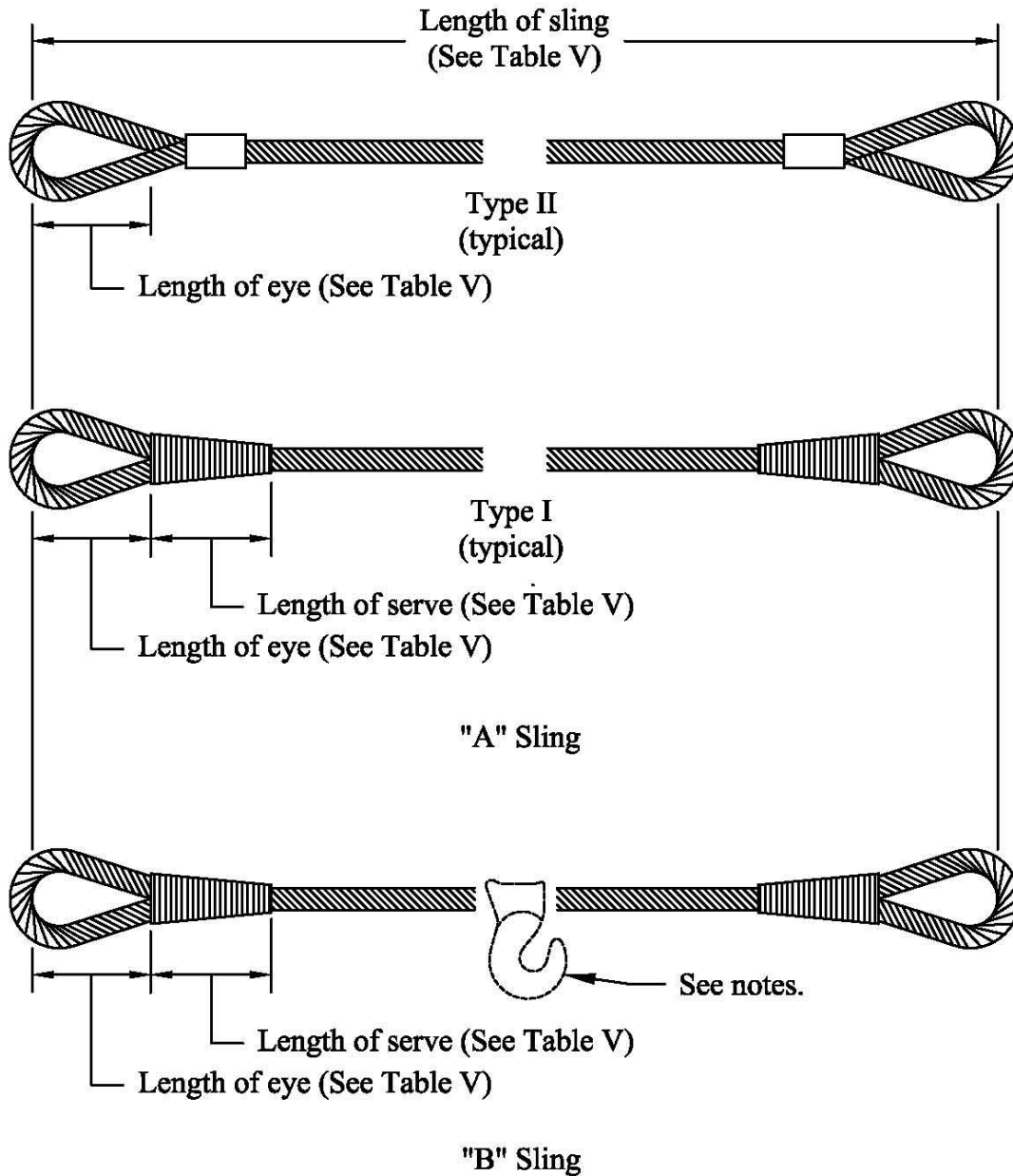
6.3 First article. When a first article inspection is required, the item will be tested and should be a first produced sling. The first article should consist of two or more units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, test, and approval of the first article.

6.4 Subject term (key word) listing.

Cadmium
Hand splice
Mechanical splice
Zinc

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

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**NOTES:**

1. "B" sling is furnished with a choker hook.
2. Hook size shall match up with rope size.

FIGURE 1. Mechanical and hand splices.

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Custodians:

Army - AT
Navy - YD
Air Force - 99
DLA - GS

Preparing Activity:

DLA - GS5

(Project 4010-2009-002)

Review Activities:

Army - MI
Navy - OS, SH
Air Force - 11, 19

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <http://assist.daps.dla.mil/>.