

INCH-POUND

RR-C-271D

25 September 1990

SUPERSEDING

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(See 6.7)

FEDERAL SPECIFICATION
CHAINS AND ATTACHMENTS, WELDED
AND WELDLESS

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers welded and weldless chain of commercial quality together with sundry attachments more commonly used with this chain.

1.1.1 Federal specification coverage. Federal specifications do not include all types, grades, classes, and styles of the commodities indicated by the title of the specification, or which are commercially available, but are intended to cover the types, that are suitable for Federal Government requirements.

1.2 Classification.

1.2.1 Chain. Chain types, classes and styles are classified as follows (see 6.2):

Type I - Chain, welded steel.

Class 1 - Alloy chain.

Class 2 - High test chain.

Class 4 - Proof coil chain.

Class 5 - Twist link chain.

Style 1 - Long-link pattern (coil).

Style 2 - Short-link pattern (machine).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4010

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

Type II - Chain, weldless.

- Class 1 - Single-loop pattern.
- Class 2 - Double-loop pattern.
- Class 3 - Sash chain.
- Class 4 - Flat-link chain.
- Class 5 - Bead chain.
- Class 6 - Safety chain.
- Class 7 - Single-jack chain.
- Class 8 - Double-jack chain.
- Class 9 - Ladder chain.
- Class 10 - Register chain.
- Class 11 - Mechanical communication chain.

1.2.2 Attachments. Attachments types, grades and classes are classified as follows (see 6.2):

- Type II - Connecting links.
- Type III - Repair or end lap links.
- Type IV - Shackles.
- Type IVA - Anchor shackles.

Grade A - Regular.

- Class 1 - Round pin.
- Class 2 - Screw pin.
- Class 3 - Safety (bolt and nut).

Grade B - High strength.

- Class 1 - Round pin.
- Class 2 - Screw pin.
- Class 3 - Safety (bolt and nut).

Type IVB - Chain shackles.

Grade A - Regular.

- Class 1 - Round pin.
- Class 2 - Screw pin.
- Class 3 - Safety (bolt and nut).

Grade B - High strength.

- Class 1 - Round pin.
- Class 2 - Screw pin.
- Class 3 - Safety (bolt and nut).

Type V - Hooks.

- Class 1 - Slip hooks with direct eye.
- Class 2 - Grab hooks with direct eye (standard).
- Class 3 - Hoist or sling hooks with direct eye.
- Class 6 - Barrel hooks.

Type VI - Rings.

Type VII - Swivels.

- Class 1 - Chain swivel.
- Class 2 - Eye and eye swivel.
- Class 3 - Jaw and eye swivel.

Type IX - Bead chain fasteners.

Type X - Bead chain couplings.

Type XI - Bead chain insulating coupling.

Type XIII - Pear shaped links.

Type XIV - Connecting links.

Type XV - End links.

1.3 Numerical units.

1.3.1 Metric units. Metric units are used in the following: type I, class I, welded steel alloy chain (see table IIA); type I, class 2, welded steel high test chain (see table IIIA); and type I, class 4, welded steel proof coil chain (see table IVA). Expressing values in metric units has been included for acquisition. When replacement of previously installed chain requires exact measurements, the inch-pound measurements provided in tables II, III, and IV respectively should be used.

1.3.2 Inch-pound system. The weights and measures in the inch-pound system are to be regarded as the standard.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein:

Federal Specifications:

- TT-V-51 - Varnish: Asphalt.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-F-320 - Fiberboard: Corrugated and Solid Sheet Stock (Container Grade) and Cut Shapes.

Federal Standards:

- FED-STD-H28 - Screw Thread Standards for Federal Services.
- FED-STD-123 - Marking for Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and Commercial Item Descriptions as outlined under General Information in the Index of Federal Specifications, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Copies of listed federal and military standards, specifications, Commercial Item Descriptions (CIDs), handbooks and associated documents listed in the Department of Defense Index of Specifications and Standards (DODISS), should be obtained from the DOD Single Stock Point, Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120. Copies of industry association documents should be obtained from the sponsor. Copies of all other listed documents should be obtained from the contracting activity or as directed by the contracting officer.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Specifications:

- MIL-P-116 - Preservation, Methods of.
- MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated.

Military Standards:

- MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking and Waterproofing; with Appropriate Test Methods.
- MIL-STD-2073-1 - DoD Materiel Procedures for Development and Application of Packaging Requirements.

(Copies of military specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A 143 - Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement. (DoD adopted)
- A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware. (DoD adopted)
- A 304 - Standard Specification for Alloy Steel Bars Subject to End-Quench Hardenability Requirements. (DoD adopted)

ASTM (Continued)

- A 322 - Standard Specification for Steel Bars, Alloy, Standard Grades. (DoD adopted)
- A 466 - Standard Specification for Weldless Carbon Steel Chain.
- A 467 - Standard Specification for Machine and Coil Chain.
- A 576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality. (DoD adopted)
- B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel. (DoD adopted)
- B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
- D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. 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 Material.3.1.1 Type I, chain, welded steel.

3.1.1.1 General. The material for type I steel chain shall conform to the chemical composition shown in table I.

TABLE I. Chemical composition.

Element	Maximum amount
	Percent
Carbon	1/ 0.35
Phosphorous	.05
Sulfur	.05
Silicon	.35

1/ Steel with carbon 0.50 (maximum) is permitted for attachments or attachment parts, types II to VII, inclusive, provided the fabrication is done without welding.

3.1.1.2 Type I steel.

3.1.1.2.1 Type I, class 1, alloy chain (type V, class 1, 2, 3, and 6 hooks; type VI, rings; and type XIII, pear shaped links) and type XIV, connecting links. Type I, class 1 material shall be an alloy steel made in accordance with ASTM A 322 or ASTM A 304. Any one of the compositions in accordance with ASTM A 322 or ASTM A 304 that meets the requirements as shown in table I may be used. The chain and attachments shall be heat-treated, as required, to produce the physical requirements as specified in tables II, IIA, XVIII, XIX, XX and XXI.

3.1.1.2.2 Type I, class 2, high-test chain. Type I, class 2 material shall be carbon steel made in accordance with ASTM A 576. Any one of the compositions in accordance with ASTM A 576 that meets the requirements of table I may be used. The chain shall be heat-treated, as required, to produce the physical requirements specified in tables III and IIIA.

3.1.1.2.3 Type I, classes 4 and 5 chain (type II, connecting links; type III, repair or end lap links; and type VII swivels) and type XV, end links. Type I, classes 4 and 5 chain and attachments, material shall be carbon steel made in accordance with ASTM A 576, which meets the requirements shown in table I. The chain and attachments shall be treated, as required by the physical requirements specified in tables IV, IVA, IX, X, XXII, XXIII, and XXIV.

3.1.1.2.4 Type IV, shackles. Type IV, grade A shackles and grade B shackles shall be made of carbon or alloy steel conforming respectively to ASTM A 576 or ASTM A 322. The limitation in the chemical composition shall be as specified in table IA.

TABLE IA. Chemical composition.

Element	Maximum percent
Carbon	0.45
Phosphorous	.04
Sulphur	.045
Silicon	.35

3.1.2 Type II, chain, weldless. Classes 1, 2, 3, 4, 7, 8, 9, and 10 shall be made of steel, bronze, or brass, as specified (see 6.2). Class 6 shall be made of either steel, brass, or aluminum, as specified (see 6.2). Class 11 shall be made of brass.

3.1.3 Recovered materials. The offeror/contractor is encouraged to use recovered materials in accordance with Public Law 94-580 to the maximum extent practicable.

3.2 Methods of fabrication.

3.2.1 Type I, chain, welded. Type I, class 1, alloy steel chain shall be in accordance with ASTM A 322 or ASTM A 304. Other type I steel chain shall be in accordance with ASTM A 576.

3.3 Finish.

3.3.1 General. When specified (see 6.2), the following finishes for chain and attachments are available and may be substituted for those hereinafter specified:

- (a) Self-colored (uncoated).
- (b) Bright finish (uncoated).
- (c) Blacked finish.
- (d) Zinc-coated.

3.3.1.1 Type I, chain, welded. Unless otherwise specified (see 6.2), chain up to 3/4 inch in size with the exception of type I, class 5, shall be provided self-colored. Type I, class 5 shall be provided in bright finish. The 3/4-inch chain size and larger shall be a blacked finish. Blacked finish shall consist of one coat of asphalt varnish in accordance with TT-V-51. The coating shall not be applied until after all required inspections and tests have been completed and it has been ascertained that the chain otherwise conforms to this specification.

3.3.1.2 Type II, chain, weldless. Unless otherwise specified (see 6.2), the chain shall be bright-finished.

3.3.1.3 Attachments. Unless otherwise specified (see 6.2), attachments, except type IV, shackles, type V, class 1, 2, 3, and 6 hooks, and type VII swivels, shall be self-colored. Type IV shackles, type V, class 1, 2, 3, and 6 hooks, and type VII swivels shall be zinc-coated.

3.3.1.4 Zinc coating. Where zinc coating is specified, the coating may be applied by the hot-dip (galvanizing) process, by the electrodeposition process, or by the mechanically deposited coating process at the contractor's option. If the hot-dip process is used, the coating shall be applied in accordance with ASTM A 153, class B3; if the electrodeposition process is used, it shall be in accordance with ASTM B 633, type II, class Fe/Zn 13; and if the mechanically deposited coating process is used, it shall be in accordance with ASTM B 695, type II, class 12. When the electrodeposition process is used, the coating shall be done on screw parts after threading and tapping is completed. When the hot-dip process is used, internal threads may be tapped or retapped after galvanizing. Zinc coating shall be adherent, smooth, and free from injurious lumps, blisters, dross, or flux.

3.3.1.4.1 Where zinc coating of alloy steel is specified, the safeguarding against embrittlement and procedure for detecting embrittlement shall be in accordance with ASTM A 143.

3.4 Detail requirements.

3.4.1 Type I, chain, welded.

3.4.1.1 General. The dimensions, physical requirements, weights, and other detailed data shall be as shown in the respective tables.

3.4.1.1.1 The actual diameter (bar or rod size) of the material in welded chain measured at any point shall be not less than the nominal (trade) size of the chain.

3.4.1.2 Type I, class 1, steel, alloy chain. The alloy chain shall be similar to figure 1 and shall conform to the dimensions and physical requirements shown in tables II or IIA. The figures herein are descriptive, not restrictive, and are not intended to preclude the purchase of chain and attachments otherwise in accordance with this specification.



FIGURE 1. Type I, class 1, welded, steel, alloy chain.

TABLE II. Type I, class 1, welded, steel, alloy chain.

Nominal (trade) size of chain	Maximum inside length of links	Maximum inside width of links	Minimum weight per 100 feet	Safe working load	Proof load	Minimum breaking load
(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	0.975	0.455	72	3,600	7,200	14,400
5/16	1.10	.50	92	4,450	8,900	17,800
3/8	1.333	.650	127	6,400	12,800	25,600
1/2	1.56	.845	226	11,400	22,800	45,600
5/8	1.82	.975	365	17,800	35,600	71,200
3/4	2.08	1.17	520	25,650	51,300	102,600
7/8	2.34	1.30	720	34,900	69,800	139,600
1	2.80	1.43	925	45,600	91,200	182,400
1-1/4	3.705	2.048	1,465	71,250	142,500	285,000

TABLE IIA. Type I, class 1, welded, steel alloy chain.

Nominal chain size (mm)	Max length 100 links (meters)	Inside width min - max (mm)	Safe working load (kg)	Proof test (kilonewtons)	Breaking load minimum (kilonewtons)
7.0	2.24	8.75 - 10.50	1,500	30.8	61.6
8.0	2.79	11.20 - 12.70	2,300	45.0	79.0
10.0	3.20	12.50 - 15.00	3,200	63.0	126.0
13.0	4.16	16.25 - 19.50	5,400	107.0	214.0
16.0	5.12	20.00 - 24.00	8,000	161.0	322.0
20.0	6.40	25.00 - 30.00	12,500	252.0	504.0
22.0	7.04	27.50 - 33.00	15,500	305.0	610.0
26.0	8.32	32.50 - 39.00	21,600	425.0	850.0
32.0	10.24	40.00 - 48.00	32,000	644.0	1,288.0

3.4.1.3 Type I, class 2, steel, high test chain. The high test chain shall be similar to figure 2 and shall conform to the dimensions and physical requirements shown in tables III or IIIA.

FIGURE 2. Type I, class 2, welded steel, high test chain.TABLE III. Type I, class 2, welded steel, high test chain.

Nominal (trade) size of chain (inches)	Actual size of material (bar) (inches)	Maximum inside length of links (inches)	Maximum inside width of links (inches)	Minimum weight per 100 feet (pounds)	Safe working load (pounds)	Proof load (pounds)	Minimum breaking load (pounds)
1/4	9/32	0.863	0.416	77	2,600	4,300	7,750
5/16	11/32	1.056	.50	110	3,900	6,400	11,600
3/8	13/32	1.199	.591	155	5,400	8,900	16,200
1/2	17/32	1.505	.773	264	9,200	15,300	27,600
5/8	21/32	1.95	.955	394	12,300	19,500	36,900
3/4	25/32	2.226	1.17	576	16,800	27,000	50,400

TABLE IIIA. Type I, class 2, welded steel, high test chain.

Nominal chain size (mm)	Max length 100 links (meters)	Inside width minimum (mm)	Safe working load (kg)	Proof test (kilonewtons)	Breaking load minimum (kilonewtons)
5.5	2.48	7.7	520	10.2	20.4
7.0	3.15	9.8	840	16.6	33.1
8.0	3.28	11.2	1,100	21.6	43.2
10.0	3.50	14.0	1,720	33.8	67.6
13.0	4.55	18.2	2,900	57.1	114.2
16.0	5.60	20.0	4,400	86.5	172.9
20.0	7.00	25.0	6,870	135.1	270.2

3.4.1.4 Type I, class 4, steel, proof coil chain. The proof coil chain shall be similar to figure 3 and shall conform to the dimensions and physical requirements shown in tables IV or IVA.

FIGURE 3. Type I, class 4, welded steel, proof coil chain.TABLE IV. Type I, class 4, welded steel, proof coil chain.

Nominal (trade) size of chain	Actual size of material	Nominal inside link dimensions		Length, 100 links, (max)	Weight 100 feet, (max)	Safe working load	Proof load (min)	Breaking load (min)
		Length	Width					
(inch)	(inches)	(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
3/16	7/32	0.95	0.40	99	42	750	1,500	3,000
1/4	9/32	1.00	.50	104	76	1,250	2,500	5,000
5/16	11/32	1.10	.50	114	115	1,900	3,800	7,600
3/8	13/32	1.23	.62	128	166	2,650	5,300	10,600
1/2	17/32	1.50	.81	156	289	4,500	9,000	18,000
5/8	21/32	1.87	1.00	194	425	6,900	13,800	27,600
3/4	25/32	2.12	1.12	220	612	9,750	19,500	39,000
7/8	29/32	2.50	1.37	260	811	11,375	22,750	45,500
1	1-1/32	2.75	1.50	286	1045	13,950	27,900	55,800

TABLE IVA. Type I, class 4, welded steel, proof coil chain.

Nominal chain size (mm)	Max length 100 links (meters)	Inside width minimum (mm)	Safe working load (kg)	Proof test (kilonewtons)	Breaking load minimum (kilonewtons)
5.5	2.48	7.7	360	7.1	14.3
7.0	3.15	9.8	580	11.6	23.1
8.0	3.28	11.2	760	15.1	30.2
10.0	3.50	14.0	1,200	23.6	47.1
13.0	4.55	18.2	2,030	39.8	79.6
16.0	5.60	20.0	3,070	60.3	120.6
20.0	7.00	25.0	4,800	94.2	188.5

3.4.1.5 Type I, class 5, style 1, steel, twist-link chain, (coil) long-link pattern. The long-link chain shall be similar to figure 4 and shall conform to the dimensions and physical requirements as specified in ASTM A 467.



FIGURE 4. Type I, class 4, style 1, welded steel, twist-link (coil) chain, long-link pattern.

3.4.1.6 Type I, class 5, style 2, steel, twist-link (machine) chain, short-link pattern. The short-link chain shall be similar to figure 5 and shall be in accordance with the dimensions and physical requirements as specified in ASTM A 467.



FIGURE 5. Type I, class 5, style 2, welded steel, twist-link (machine) chain, short-link pattern.

3.4.2 Type II, chain, weldless.

3.4.2.1 General. The dimensions, physical requirements, weights, and other detailed data shall be as shown in the respective tables.

3.4.2.2 Class 1, single-loop pattern. The single-loop pattern chain shall be similar to figure 6 and shall be in accordance with ASTM A 466.



FIGURE 6. Type II, class 1, weldless chain, single-loop pattern.

3.4.2.3 Class 2, double-loop pattern. The double-loop pattern chain shall be similar to figure 7 and shall be in accordance with ASTM A 466.



FIGURE 7. Type II, class 2, weldless, double-loop pattern chain.

3.4.2.4 Class 3, sash chain. The sash chain shall be similar to figure 8 and shall be in accordance with ASTM A 466.



FIGURE 8. Type II, class 3, weldless sash chain.

3.4.2.5 Class 4, flat-link chain. The flat-link chain shall be similar to figure 9 and shall be in accordance with the requirements as shown in table V.



FIGURE 9. Type II, class 4, weldless, flat-link chain.

TABLE V. Type II, class 4, weldless, flat-link chain.

Nominal metal thickness	Number of links per foot (approx)	Weight per 100 feet (approx)		Breaking loads (min) 1/		Trade number
		Steel	Brass	Steel	Brass	
(inch)		(pounds)	(pounds)	(pounds)	(pounds)	
0.083	8-1/2	16	17	1,600	1,120	2-0
.065	17	12-1/2	13	990	695	113
.103	9-3/4	35	37	2,190	1,535	210
.125	9	40	42	3,240	2,270	280

1/ Maximum safe working load is 25 percent of breaking loads.

3.4.2.6 Class 5, bead chain. The bead chain shall be similar to figure 10 and shall be in accordance with the requirements as shown in table VI.



FIGURE 10. Type II, class 5, weldless, bead chain.

TABLE VI. Type II, class 5, weldless, bead chain.

Nominal diameter of beads (approx)	Metal thickness (approx)	Number of beads per foot (approx)	Weight per 100 feet (approx)	Breaking loads (min)	Trade number
(inch)	(inch)		(pounds)	(pounds)	
3/32	0.010	102	0.7	15	3
1/8	.014	72	1.5	28	6
3/16	.017	50	2.6	45	10
1/4	.020	40	4.8	90	13
3/8	.034	24	10.8	200	20

3.4.2.7 Class 6, safety chain. The safety chain shall be similar to figure 11 and shall be in accordance with ASTM A 466.

FIGURE 11. Type II, class 6, weldless, safety chain.

3.4.2.8 Class 7, single-jack chain. The single-jack chain shall be similar to figure 12 and shall be in accordance with ASTM A 466.

FIGURE 12. Type II, class 7, weldless, single-jack chain.

3.4.2.9 Class 8, double-jack chain. The double-jack chain shall be similar to figure 13 and shall be in accordance with ASTM A 466.



FIGURE 13. Type II, class 8, weldless, double-jack chain.

3.4.2.10 Class 9, ladder chain. The ladder chain shall be similar to figure 14 and shall be in accordance with the requirements as shown in table VII.



FIGURE 14. Type II, class 9, weldless, ladder chain.

TABLE VII. Type II, class 9, weldless, ladder chain.

Nominal size of chain	Number of links per foot (approx)	Weight per 100 feet (approx)	Breaking loads (min)	
			Steel	Brass or bronze
(inch)		(pounds)	(pounds)	(pounds)
0.036	64	4/5	45	40
.048	42	2-1/2	70	60
.055	34	3-1/2	85	75
.080	25	6	145	130

3.4.2.11 Class 10, register chain. The register chain shall be similar to figure 15 and shall be in accordance with ASTM A 466.



FIGURE 15. Type II, class 10, weldless, register chain.

3.4.2.12 Class 11, mechanical communication chain. The mechanical communication chain shall be similar to figure 16 and shall be in accordance with the requirements as shown in table VIII.



FIGURE 16. Type II, class 11, weldless, mechanical communication chain.

TABLE VIII. Type II, class 11, weldless, mechanical communication chain.

Nominal thickness outside links	Nominal thickness inside links	Width (max)	Pitch between center to center of pins (approx)	Number of links per foot (approx)	Breaking load (min)
(inch)	(inch)	(inch)	(inch)		(pounds)
1/16	1/8	1/4	3/8	32	800

3.4.2.12.1 Each end of the completed chain shall be fitted with a large brass link for the attachment of transmission wires.

3.4.2.12.2 The total length of the finished chain shall be approximately 30 inches.

3.5 Attachments.

3.5.1 Type II connecting links. Connecting links shall be forged from carbon steel as specified in 3.1.1.2.3, shall be similar to figure 17 and shall be in accordance with the dimensions and physical requirements as shown in table IX. The 3/16, 1/4, and 5/16-inch sizes shall have rivets only, no interlocking lugs.

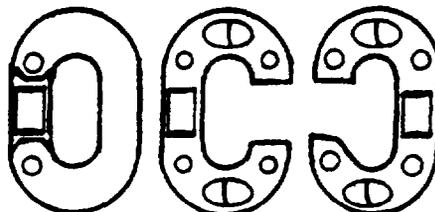


FIGURE 17. Type II connecting links.

TABLE IX. Type II connecting links.

Size	Outside dimensions of links (approx)	Weight per dozen (approx)	Safe working load	Proof load	Breaking loads (min)
(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
3/16	1-1/4 by 3/4	3/8	750	1,500	3,000
1/4	1-1/2 by 1	3/4	1,250	2,500	5,000
5/16	1-11/16 by 1-3/16	1	1,900	3,800	7,600
3/8	2-1/16 by 1-3/8	2	2,650	5,300	10,600
7/16	2-3/8 by 1-1/2	3-1/8	3,625	7,250	14,500
1/2	2-5/8 by 1-3/4	4-1/2	4,500	9,000	18,000
9/16	3 by 1-15/16	6-5/8	5,800	11,600	23,200
5/8	3-5/16 by 2-3/16	9	6,900	13,800	27,600
3/4	3-7/8 by 2-1/2	14-1/2	9,750	19,500	39,000
7/8	4-1/2 by 2-15/16	20-1/4	12,000	24,000	48,000
1	5 by 3-1/4	29	15,500	31,000	62,000
1-1/8	5-5/8 by 3-1/2	40	19,500	39,000	78,000
1-1/4	6-1/8 by 4	53-1/2	24,000	48,000	96,000
1-3/8	6-3/4 by 4-3/4	75	28,750	57,500	115,000
1-1/2	7-1/4 by 5-1/8	103	34,000	68,000	136,000
1-5/8	8 by 5-1/2	131	42,000	84,000	168,000
1-7/8	9 by 6-1/4	216	64,000	128,000	256,000

3.5.2 Type III, repair or end lap links. End lap links shall be formed from carbon steel as specified in 3.1.1.2.3. Links shall be of the end lap type, shall be similar to figure 18, and shall be in accordance with the dimensions and weights as shown in table X.



FIGURE 18. Type III, repair or end lap links.

TABLE X. Type III, repair or end lap links.

Diameter of metal	Length inside	Safe working load	Weight per 100 links (approx)	Breaking load (min)
(inch)	(inches)	(pounds)	(pounds)	(pounds)
3/16	1	225	5	900
7/32	1-1/4	250	5.75	1,000
1/4	1-1/4	325	7.2	1,300
1/4	1-1/2	325	9	1,300
1/4	2	325	10.25	1,300
9/32	1-1/4	375	9.3	1,500
5/16	1-1/2	675	14.5	2,700
5/16	2	625	17	2,500
3/8	1-5/8	1,050	22	4,200
3/8	2	1,000	25	4,000
1/2	2-1/2	1,525	54	6,100

3.5.3 Type IV, shackles.

3.5.3.1 General. Grade A shackles, together with their pins and bolts shall be forged from carbon steel. Grade B shackles together with their pins and bolts shall be forged from alloy steel as specified in 3.1.1.2.4.

3.5.3.1.1 Threads. Screw-pin shackles shall be threaded after fabrication to final size and shape. Threads shall conform to FED-STD-H28 for Unified Coarse (UNC) threads unless the corresponding fine threads are specified (see 6.2).

Threads on zinc-coated or self-colored finished shackles shall be not looser than class 1 fit. The male threads of zinc-coated shackles may be undercut, as necessary, so that after coating they will properly mate (not less than class 1 fit) with the standard size female threads.

3.5.3.1.2 Proof loads. Shackles shall withstand the proof loads shown in table XVII (see 4.4.2.2.1) without developing surface rupture or defects that would interfere with serviceability or prevent disassembly of the pin. After proof loading, screw-pin shackles shall be disassembled by hand after the first turn.

3.5.3.1.3 Breaking loads. Without breaking, shackles shall withstand the breaking loads shown in table XVII (see 4.4.2.2.2).

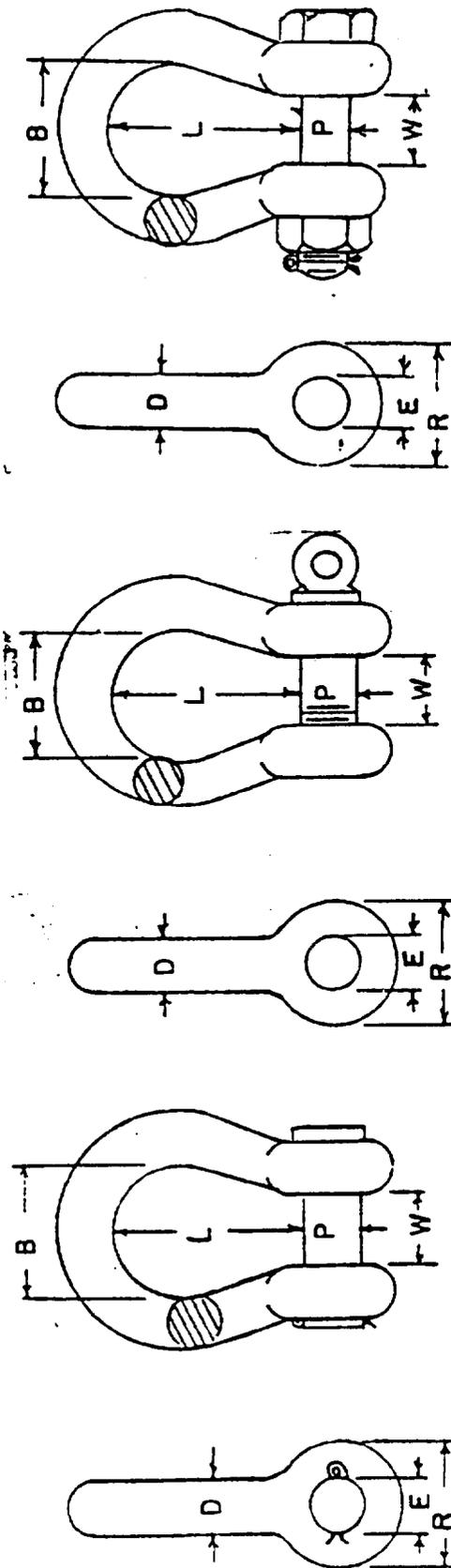
3.5.3.1.4 Safe working load. The recommended safe working loads of shackles covered by this specification are shown in table XVII for information purposes.

3.5.3.1.5 Ductility. Shackles shall be sufficiently ductile so that, when fractured, the fractured member shall show a permanent distortion before breaking. If the pin fractures, it shall show a permanent bend of not less than 20 degrees. If the body fractures, it shall show a permanent mid-shackle set of not less than 15 percent of the original spread between bows.

3.5.3.1.6 Marking. Each shackle body shall be permanently and legibly marked in raised or stamped letters on the side of the shackle bow with the identifying manufacturer's name or trademark, shackle size, and the recommended safe working load. Grade A regular strength shackle pins and bolts shall be unmarked; grade B high strength shackle pins and bolts shall be marked by the raised or stamped letters "HS" on the head. Shackle markings shall be raised or stamped letters or figures of the maximum practical height permitted by the size of the shackle component being marked, but not to exceed 3/4 inch in height by 1/8 inch in relief. Stamping dies shall be of the round bottom, low stress type. Marking location shall not interfere with the serviceability of the shackle assembly.

3.5.3.1.7 Finish. Unless otherwise specified (see 6.2), shackle components shall be zinc coated as specified in 3.3.1.4.

3.5.3.2 Form and dimensions. The form of the respective shackle types and classes shall be similar to that shown on figures 19 and 20 (see 6.2). Dimensions of shackle bodies and component pins and bolts shall conform to the dimensional requirements specified in table XI through XVI.

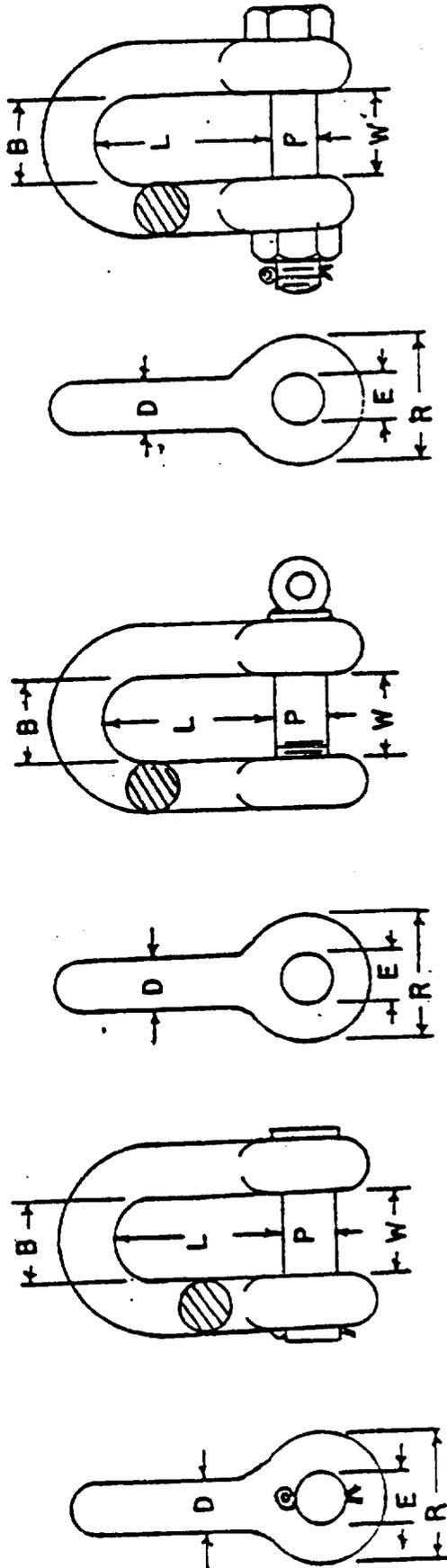


Class 3 safety anchor shackle

Class 2 screw pin anchor shackle

Class 1 round pin anchor shackle

FIGURE 19. Type IVA. anchor shackles.



Class 3 safety chain shackle

Class 2 screw pin chain shackle

Class 1 round pin chain shackle

FIGURE 20. Type IVB chain shackles.

TABLE XI. Type IVA, class 1, round pin anchor shackles.

Size (D) minimum	Diameter pin (P) minimum	Diameter inside eye (E) maximum	Width between eyes (W) nominal tolerance (\pm)		Length inside (L) nominal tolerance (\pm)		Width bow (B) minimum	Diameter outside eye (R) maximum	Weight per 100 shackles (approx)
			(inches)	(inches)	(inches)	(inches)			
3/16	1/4	19/64	3/8	1/16	7/8	1/16	9/16	5/8	5
1/4	5/16	13/32	15/32	1/16	1-1/8	1/16	3/4	7/8	12
5/16	3/8	15/32	17/32	1/16	1-1/4	1/16	13/16	1	18
3/8	7/16	17/32	21/32	1/16	1-7/16	1/8	15/16	1-1/8	30
7/16	1/2	19/32	23/32	1/16	1-11/16	1/8	1-1/16	1-1/4	49
1/2	5/8	23/32	13/16	1/16	1-7/8	1/8	1-3/16	1-3/8	74
9/16	5/8	23/32	7/8	1/16	2-1/8	1/8	1-5/8	1-5/8	92
5/8	3/4	27/32	1-1/16	1/16	2-13/32	1/8	1-1/2	1-7/8	144
3/4	7/8	31/32	1-1/4	1/16	2-27/32	1/4	1-3/4	2-1/8	216
7/8	1	1-3/32	1-7/16	1/16	3-5/16	1/4	2	2-3/8	337
1	1-1/8	1-7/32	1-11/16	1/16	3-3/4	1/4	2-5/16	2-5/8	530
1-1/8	1-1/4	1-11/32	1-13/16	1/16	4-1/4	1/4	2-5/8	2-7/8	700
1-1/4	1-3/8	1-15/32	2-1/32	1/16	4-11/16	1/4	2-7/8	3-1/4	960
1-3/8	1-1/2	1-5/8	2-1/4	1/8	5-1/4	1/4	3-1/4	3-1/2	1,260
1-1/2	1-5/8	1-3/4	2-3/8	1/8	5-3/4	1/4	3-3/8	3-3/4	1,730
1-5/8	1-3/4	1-7/8	2-5/8	1/8	6-1/4	1/4	4	4-1/8	2,200
1-3/4	2	2-5/32	2-7/8	1/8	7	1/4	4-1/2	4-1/2	2,780
2	2-1/4	2-13/32	3-1/4	1/8	7-3/4	1/2	5-1/4	5-1/4	4,110
2-1/4	2-1/2	2-21/32	3-7/8	1/8	9-1/4	1/2	5-1/2	5-3/4	5,600
2-1/2	2-3/4	2-29/32	4-1/8	1/8	10-1/2	1/2	6-3/4	6-1/4	8,350
3	3-1/4	3-13/32	5	1/8	13	3/4	7-3/8	6-3/4	11,900
3-1/2	3-3/4	3-29/32	5-3/4	1/4	15	3/4	9	8-1/2	21,200
4	4-1/4	4-13/32	6-1/2	1/4	17	3/4	10-1/2	9-1/2	30,500

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TABLE XII. Type IVA, class 2, screw pin anchor shackles.

Size (D) minimum	Diameter pin (P) minimum	Diameter unthreaded eye (E) maximum	Width between eyes (W) nominal tolerance (\pm)		Length inside (L) nominal tolerance (\pm)		Width bow (B) minimum	Major diameter threaded eye maximum	Diameter outside eye (R) maximum	Weight per 100 shackles (approx)
			(inches)	(inches)	(inches)	(inches)				
3/16	1/4	5/16	3/8	1/16	7/8	1/16	9/16	9/32	5/8	5
1/4	5/16	13/32	15/32	1/16	1-1/8	1/16	3/4	11/32	7/8	12
5/16	3/8	15/32	17/32	1/16	1-1/4	1/16	13/16	13/32	1	18
3/8	7/16	17/32	21/32	1/16	1-7/16	1/8	15/16	15/32	1-1/8	30
7/16	1/2	19/32	23/32	1/16	1-11/16	1/8	1-1/16	17/32	1-1/4	49
1/2	5/8	23/32	13/16	1/16	1-7/8	1/8	1-3/16	21/32	1-3/8	74
9/16	5/8	23/32	7/8	1/16	2-1/8	1/8	1-5/8	21/32	1-5/8	92
5/8	3/4	27/32	1-1/16	1/16	2-13/32	1/8	1-1/2	25/32	1-7/8	144
3/4	7/8	31/32	1-1/4	1/16	2-27/32	1/4	1-3/4	29/32	2-1/8	216
7/8	1	1-3/32	1-7/16	1/16	3-5/16	1/4	2	1-1/32	2-3/8	337
1	1-1/8	1-7/32	1-11/16	1/16	3-3/4	1/4	2-5/16	1-5/32	2-5/8	530
1-1/8	1-1/4	1-11/32	1-13/16	1/16	4-1/4	1/4	2-5/8	1-19/64	2-7/8	700
1-1/4	1-3/8	1-15/32	2-1/32	1/16	4-11/16	1/4	2-7/8	1-27/64	3-1/4	960
1-3/8	1-1/2	1-5/8	2-1/4	1/8	5-1/4	1/4	3-1/4	1-35/64	3-1/2	1,260
1-1/2	1-5/8	1-3/4	2-3/8	1/8	5-3/4	1/4	3-3/8	1-43/64	3-3/4	1,730
1-5/8	1-3/4	1-7/8	2-5/8	1/8	6-1/4	1/4	4	1-51/64	4-1/8	2,200
1-3/4	2	2-5/32	2-7/8	1/8	7	1/4	4-1/2	2-3/64	4-1/2	2,780
2	2-1/4	2-13/32	3-1/4	1/8	7-3/4	1/2	5-1/4	2-19/64	5-1/4	4,110
2-1/4	2-1/2	2-21/32	3-7/8	1/8	9-1/4	1/2	5-1/2	2-35/64	5-3/4	5,560
2-1/2	2-3/4	2-29/32	4-1/8	1/8	10-1/2	1/2	6-3/4	2-51/64	6-1/4	8,350
3	3-1/4	3-13/32	5	1/8	13	3/4	7-3/8	3-19/64	6-3/4	11,900
3-1/2	3-3/4	3-29/32	5-3/4	1/4	15	3/4	9	3-51/64	8-1/2	21,200
4	4-1/4	4-13/32	6-1/2	1/4	17	3/4	10-1/2	4-19/64	9-1/2	30,500

TABLE XIII. Type IVA, class 3, safety anchor shackles.

Size (D) minimum	Diameter bolt (P) minimum	Diameter inside eye (E) maximum	Width between eyes (W) nominal tolerance (±)		Length inside (L) nominal tolerance (±)		Width bow (B) minimum	Diameter outside eye (R) maximum	Weight per 100 shackles (approx)
			(inches)	(inches)	(inches)	(inches)			
1/2	5/8	23/32	13/16	1/16	1-7/8	1/8	1-3/16	1-3/8	82
5/8	3/4	27/32	1-1/16	1/16	2-13/32	1/8	1-1/2	1-7/8	158
3/4	7/8	31/32	1-1/4	1/16	2-27/32	1/4	1-3/4	2-1/8	280
7/8	1	1-3/32	1-7/16	1/16	3-5/16	1/4	2	2-3/8	395
1	1-1/8	1-7/32	1-11/16	1/16	3-3/4	1/4	2-5/16	2-5/8	560
1-1/8	1-1/4	1-11/32	1-13/16	1/16	4-1/4	1/4	2-5/8	2-7/8	785
1-1/4	1-3/8	1-15/32	2-1/32	1/16	4-11/16	1/4	2-7/8	3-1/4	1,120
1-3/8	1-1/2	1-5/8	2-1/4	1/8	5-1/4	1/4	3-1/4	3-1/2	1,520
1-1/2	1-5/8	1-3/4	2-3/8	1/8	5-3/4	1/4	3-3/8	3-3/4	1,950
1-5/8	1-3/4	1-7/8	2-5/8	1/8	6-1/4	1/4	4	4-1/8	2,410
1-3/4	2	2-5/32	2-7/8	1/8	7	1/4	4-1/2	4-1/2	3,130
2	2-1/4	2-13/32	3-1/4	1/8	7-3/4	1/2	5-1/4	5-1/4	4,630
2-1/4	2-1/2	2-21/32	3-7/8	1/8	9-1/4	1/2	5-1/2	5-3/4	5,650
2-1/2	2-3/4	2-29/32	4-1/8	1/8	10-1/2	1/2	6-3/4	6-1/4	9,400
2-3/4	3	3-5/32	4-1/2	1/8	11-1/4	1/2	7-1/4	6-1/4	11,500
3	3-1/4	3-13/32	5	1/8	13	3/4	7-3/8	6-3/4	14,500
4	4-1/4	4-13/32	6-1/2	1/4	17	3/4	10-1/2	9-1/2	35,800

TABLE XIV. Type IVB, class 1, round pin chain shackles.

Size (D) minimum	Diameter pin (P) minimum	Diameter eyes (E) maximum	Width between eyes (W) nominal tolerance (\pm)		Length inside (L) nominal tolerance (\pm)		Diameter outside eye (R) maximum	Weight per 100 shackles (approx) (pounds)
			(inches)	(inches)	(inches)	(inches)		
3/16	1/4	5/16	3/8	1/16	3/4	1/16	5/8	5
1/4	5/16	13/32	15/32	1/16	7/8	1/16	7/8	11
5/16	3/8	15/32	17/32	1/16	1-1/32	1/16	1	17
3/8	7/16	17/32	21/32	1/16	1-1/4	1/8	1-1/8	28
7/16	1/2	19/32	23/32	1/16	1-7/16	1/8	1-1/4	42
1/2	5/8	23/32	13/16	1/16	1-5/8	1/8	1-3/8	68
9/16	5/8	23/32	7/8	1/16	1-13/16	1/8	1-5/8	88
5/8	3/4	27/32	1-1/16	1/16	2	1/8	1-7/8	121
3/4	7/8	31/32	1-1/4	1/16	2-3/8	1/4	2-1/8	214
7/8	1	1-3/32	1-7/16	1/16	2-13/16	1/4	2-3/8	310
1	1-1/8	1-7/32	1-11/16	1/16	3-3/16	1/4	2-5/8	450
1-1/8	1-1/4	1-11/32	1-13/16	1/16	3-9/16	1/4	2-7/8	660
1-1/4	1-3/8	1-15/32	2-1/32	1/16	3-15/16	1/4	3-1/4	890
1-3/8	1-1/2	1-5/8	2-1/4	1/8	4-7/16	1/4	3-1/2	1,200
1-1/2	1-5/8	1-3/4	2-3/8	1/8	4-7/8	1/4	3-3/4	1,620
1-5/8	1-3/4	1-7/8	2-5/8	1/8	5-1/4	1/4	4-1/8	2,020
1-3/4	2	2-5/32	2-7/8	1/8	5-3/4	1/4	4-1/2	2,500
2	2-1/4	2-13/32	3-1/4	1/8	6-3/4	1/2	5-1/4	3,600
2-1/4	2-1/2	2-21/32	3-7/8	1/8	7-1/8	1/2	5-3/4	5,000
2-1/2	2-3/4	2-29/32	4-1/8	1/8	8	1/2	6-1/4	7,400
3	3-1/4	3-13/32	5	1/8	9	3/4	6-3/4	10,600
3-1/2	3-3/4	3-29/32	5-3/4	1/4	10-1/2	3/4	8-1/2	18,900
4	4-1/4	4-13/32	6-1/2	1/4	12	3/4	9-1/2	27,100

TABLE XV. Type IVB, class 2, screw pin chain shackles.

Size (D) minimum	Diameter pin (P) minimum	Diameter unthreaded eye (E) maximum	Width between eyes (W) nominal tolerance (\pm)		Length inside (L) nominal tolerance (\pm)		Major diameter threaded eye minimum	Diameter outside eye (R) maximum	Weight per 100 shackles (approx)
			(inches)	(inches)	(inches)	(inches)			
3/16	1/4	5/16	3/8	1/16	3/4	1/16	9/32	5/8	5
1/4	5/16	13/32	15/32	1/16	7/8	1/16	11/32	7/8	11
5/16	3/8	15/32	17/32	1/16	1-1/32	1/16	13/32	1	17
3/8	7/16	17/32	21/32	1/16	1-1/4	1/8	15/32	1-1/8	28
7/16	1/2	19/32	23/32	1/16	1-7/16	1/8	17/32	1-1/4	42
1/2	5/8	23/32	13/16	1/16	1-5/8	1/8	21/32	1-3/8	68
9/16	5/8	23/32	7/8	1/16	1-13/16	1/8	21/32	1-5/8	88
5/8	3/4	27/32	1-1/16	1/16	2	1/8	25/32	1-7/8	121
3/4	7/8	31/32	1-1/4	1/16	2-3/8	1/4	29/32	2-1/8	214
7/8	1	1-3/32	1-7/16	1/16	2-13/16	1/4	1-1/32	2-3/8	310
1	1-1/8	1-7/32	1-11/16	1/16	3-3/16	1/4	1-5/32	2-5/8	450
1-1/8	1-1/4	1-11/32	1-13/16	1/16	3-9/16	1/4	1-19/64	2-7/8	660
1-1/4	1-3/8	1-15/32	2-1/32	1/16	3-15/16	1/4	1-27/64	3-1/4	890
1-3/8	1-1/2	1-5/8	2-1/4	1/8	4-7/16	1/4	1-35/64	3-1/2	1,200
1-1/2	1-5/8	1-3/4	2-3/8	1/8	4-7/8	1/4	1-43/64	3-3/4	1,620
1-5/8	1-3/4	1-7/8	2-5/8	1/8	5-1/4	1/4	1-51/64	4-1/8	2,020
1-3/4	2	2-5/32	2-7/8	1/8	5-3/4	1/4	2-3/64	4-1/2	2,500
2	2-1/4	2-13/32	3-1/4	1/8	6-3/4	1/2	2-19/64	5-1/4	3,600
2-1/4	2-1/2	2-21/32	3-7/8	1/8	7-1/8	1/2	2-35/64	5-3/4	5,000
2-1/2	2-3/4	2-29/32	4-1/8	1/8	8	1/2	2-51/64	6-1/4	7,400
3	3-1/4	3-13/32	5	1/8	9	3/4	3-19/64	6-3/4	10,600
3-1/2	3-3/4	3-29/32	5-3/4	1/4	10-1/2	3/4	3-51/64	8-1/2	18,900
4	4-1/4	4-13/32	6-1/2	1/4	12	3/4	4-19/64	9-1/2	27,100

TABLE XVI. Type IVB, class 3, safety chain shackles.

Size (D) minimum	Diameter bolt (P) minimum	Diameter eyes (E) maximum	Width between eyes (W)		Length inside (L)		Diameter outside eye (R) maximum	Weight per 100 shackles (approx)
			nominal	tolerance (\pm)	nominal	tolerance (\pm)		
(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(pounds)
1/2	5/8	23/32	13/16	1/16	1-5/8	1/8	1-3/8	76
5/8	3/4	27/32	1-1/16	1/16	2	1/8	1-7/8	156
3/4	7/8	31/32	1-1/4	1/16	2-3/8	1/4	2-1/8	262
7/8	1	1-3/32	1-7/16	1/16	2-13/16	1/4	2-3/8	365
1	1-1/8	1-7/32	1-11/16	1/16	3-3/16	1/4	2-5/8	535
1-1/8	1-1/4	1-11/32	1-13/16	1/16	3-9/16	1/4	2-7/8	727
1-1/4	1-3/8	1-15/32	2-1/32	1/16	3-15/16	1/4	3-1/4	1,020
1-3/8	1-1/2	1-5/8	2-1/4	1/8	4-7/16	1/4	3-1/2	1,335
1-1/2	1-5/8	1-3/4	2-3/8	1/8	4-7/8	1/4	3-3/4	1,850
1-5/8	1-3/4	1-7/8	2-5/8	1/8	5-1/4	1/4	4-1/8	2,310
1-3/4	2	2-5/32	2-7/8	1/8	5-3/4	1/4	4-1/2	2,850
2	2-1/4	2-13/32	3-1/4	1/8	6-3/4	1/2	5-1/4	4,110
2-1/2	2-3/4	2-29/32	4-1/8	1/8	8	1/2	6-1/4	8,450
3	3-1/4	3-13/32	5	1/8	9	3/4	6-3/4	12,300
3-1/2	3-3/4	3-29/32	5-3/4	1/4	10-1/2	3/4	8-1/2	21,800
4	4-1/4	4-13/32	6-1/2	1/4	12	3/4	9-1/2	31,000

TABLE XVII. Mechanical properties.

Size D (inches)	Recommended safe working load (maximum) (pounds)		Proof load (minimum) (pounds)		Breaking load (minimum) (pounds)	
	Grade A	Grade B	Grade A	Grade B	Grade A	Grade B
3/16	520	900	1,040	2,250	2,600	4,500
1/4	710	2,000	1,420	5,000	3,550	10,000
5/16	1,060	3,120	2,120	7,800	5,300	15,600
3/8	1,590	3,800	3,180	9,500	7,950	19,000
7/16	2,170	5,180	4,340	12,950	10,850	25,900
1/2	2,830	6,500	5,660	16,250	14,150	32,500
9/16	3,580	-----	7,160	-----	17,900	-----
5/8	4,420	10,000	8,840	25,000	22,100	50,000
3/4	6,360	13,800	12,720	34,500	31,800	69,000
7/8	8,650	18,700	17,300	46,750	43,250	93,500
1	11,310	24,400	22,620	61,000	56,550	122,000
1-1/8	13,360	28,600	26,720	71,500	66,800	143,000
1-1/4	16,500	36,000	33,000	90,000	82,500	180,000
1-3/8	19,800	41,400	39,600	103,500	99,800	207,000
1-1/2	23,740	48,800	47,480	122,000	118,700	244,000
1-5/8	27,900	57,400	55,800	143,500	139,500	287,000
1-3/4	32,320	65,000	64,640	162,500	161,600	325,000
2	42,220	85,040	84,440	212,600	211,100	425,200
2-1/4	54,000	-----	108,000	-----	270,000	-----
2-1/2	67,600	121,400	135,200	303,500	338,000	607,000
2-3/4	81,000	-----	162,000	-----	405,000	-----
3	96,200	150,000	192,400	375,000	481,000	750,000
3-1/2	131,100	200,000	262,200	500,000	655,500	1,000,000
4	171,140	260,000	342,280	650,000	855,700	1,300,000

3.5.4 Type V hooks. The hooks shall be forged from alloy steel as specified in 3.1.1.2.1. Class 1, 2, 3, and 6 hooks shall be used with type I alloy chain.

3.5.4.1 Ductility. The class 1, 2, and 3 hooks shall be sufficiently ductile to permit the hook to open to at least twice the original throat gap without fracture.

3.5.4.1.1 Finish. Class 1, 2, and 3 hooks shall be zinc coated as specified in 3.3.1.4.

3.5.4.2 Class 1 slip hook with direct eye. The slip hooks shall have the eye parallel to the hook, shall be similar to figure 21 and shall be in accordance with the physical requirements as shown in table XVIII.



FIGURE 21. Type V, class 1, slip hook with direct eye.

TABLE XVIII. Type V, class 1, slip hook with direct eye.

Nominal size of chain	Weight each (approx)	Safe working load	Proof load	Minimum breaking load
(inch)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	0.4	3,600	7,200	14,400
3/8	1.0	6,400	12,800	25,600
1/2	2.5	11,400	22,800	45,600
5/8	3.1	17,800	35,600	71,200
3/4	6.0	25,650	51,300	102,600

3.5.4.3 Class 2, grab hooks, with direct eye (standard). Grab hooks shall have the eye parallel to the hook, shall be similar to figure 22 and shall be in accordance with the physical requirements as shown in table XIX.



FIGURE 22. Type V, class 2, grab hooks with direct eye (standard).

TABLE XIX. Type V, class 2, grab hooks with direct eye (standard).

Nominal size of chain	Weight each (approx)	Safe working load	Proof load	Minimum breaking load
(inch)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	0.44	3,600	7,200	14,400
3/8	1.1	6,400	12,800	25,600
1/2	2.3	11,400	22,800	45,600
5/8	4.0	17,800	35,600	71,200
3/4	6.1	25,650	51,300	102,600

3.5.4.4 Class 3, hoist or sling hooks with direct eye. The hoist or sling hooks shall have the eye parallel to the hook, shall be similar to figure 23, and shall be in accordance with physical requirements as shown in table XX.



FIGURE 23. Type V, class 3, hoist or sling hook with direct eye.

TABLE XX. Type V, class 3, hoist or sling hook with direct eye.

Nominal size of chain	Weight each (approx)	Safe working load	Proof load	Minimum breaking load
(inch)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	0.7	3,600	7,200	14,400
3/8	1.5	6,400	12,800	25,600
1/2	3.0	11,400	22,800	45,600
5/8	5.1	17,800	35,600	71,200
3/4	8.0	25,650	51,300	102,600
7/8	11.0	34,900	69,800	139,600
1	18.0	45,600	91,200	182,400
1-1/4	33.0	71,250	142,500	285,000

3.5.4.5 Class 6 barrel hooks. Barrel hooks shall be similar to figure 24 and shall be made with a nominal overall length of 5 inches. The hooks shall be proof tested to a proof load of 5,500 pounds (see 4.4.2.3.1).



FIGURE 24. Type V class 6 barrel hooks.

3.5.5 Type VI rings. The rings shall be forged or welded from low alloy steel and shall be in accordance with the chemical requirements as shown in table I. The rings shall be heat treated, be similar to figure 25, and shall be in accordance with the sizes and weights as shown in table XXI.

3.5.5.1 Finish. Rings shall be zinc coated as specified in 3.3.1.4.

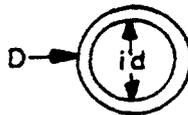


FIGURE 25. Type VI rings.

TABLE XXI. Type VI rings.

Diameter stock D	Inside diameter id	Weight each	Safe working load	Proof load	Breaking load (min)
(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
3/4	4	1.8	6,400	12,800	38,400
7/8	4	2.6	7,200	14,400	43,200
7/8	5-1/2	3.4	5,600	11,200	33,600
1	4	3.5	10,800	21,600	64,800
1-1/8	6	6.5	10,400	20,800	62,400
1-1/4	7	6.8	17,000	34,000	102,000
1-3/8	6	10.38	19,000	38,000	114,000
1-1/2	6	11.7	34,900	69,800	209,400

3.5.6 Type VII. swivels.

3.5.6.1 General. Swivels together with their pins shall be forged from carbon steel as specified in 3.1.1.2.3. Nuts shall be regular hex.

3.5.6.1.1 Finish. Swivels and pins shall be zinc-coated in accordance with 3.3.1.4.

3.5.6.1.2 Proof load. Swivels shall withstand the proof loads in the respective class tables (see 4.4.2.5.1).

3.5.6.1.3 Breaking loads. Swivels shall withstand, without breaking, the breaking loads shown in the respective class tables (see 4.4.2.5.1).

3.5.6.2 Class 1. chain swivels. The chain swivels shall be similar to figure 26 and shall be in accordance with the dimensions and physical requirements as shown in table XXII.

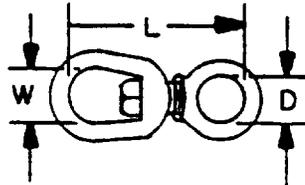


FIGURE 26. Type VII. class 1. chain swivels.

TABLE XXII. Type VII. class 1. chain swivel.

Size	Length (min) L	Width W	Eye dia (min) D	Weight per 100 (min)	Safe working load	Proof load	Breaking load (min)
(inch)	(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	2-1/4	3/4	7/16	13	800	1,600	4,000
5/16	2-23/32	1	1/2	25	1,200	2,400	6,000
3/8	3-7/16	1-1/4	3/4	50	2,200	4,400	11,000
1/2	4-1/4	1-1/2	7/8	100	3,500	7,000	17,500
5/8	5-5/8	1-3/4	1-1/16	175	5,200	10,400	26,000
3/4	5-25/32	2	1-1/4	287	7,100	14,200	35,500

3.5.6.3 Class 2. eye and eye swivels. The eye and eye swivels shall be similar to figure 27 and shall be in accordance with the dimensions and physical requirements as shown in table XXIII.

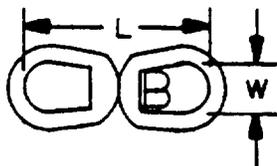


FIGURE 27. Type VII, class 2, eye and eye swivels.

TABLE XXIII. Type VII, class 2, eye and eye swivels.

Size	Length (min) L	Width W	Weight per 100 (min)	Safe working load	Proof load	Breaking load (min)
(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	2-7/8	3/4	17.5	800	1,600	4,000
5/16	3-1/2	1	32.5	1,200	2,400	6,000
3/8	4-1/4	1-1/4	63	2,200	4,400	11,000
1/2	5-7/16	1-1/2	132	3,500	7,000	17,500
5/8	6-9/16	1-3/4	250	5,200	10,400	26,000
3/4	7-3/16	2	375	7,100	14,200	35,500
7/8	8-3/8	2-1/4	600	9,200	18,400	46,000
1	9-5/8	2-1/2	900	11,600	23,200	56,200
1-1/8	10-3/8	2-3/4	1,246	15,000	30,000	75,000
1-1/4	11-1/8	3-1/8	1,637	18,000	36,000	90,000
1-1/2	17-1/8	4	4,906	45,000	90,000	225,000

3.5.6.4 Class 3, jaw and eye swivels. The jaw and eye swivels shall be similar to figure 28 and shall be in accordance with the dimensions and physical requirements as shown in table XXIV.

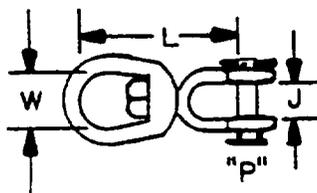


FIGURE 28. Type VII, class 3, jaw and eye swivels.

TABLE XXIV. Type VII, class 3, jaw and eye swivels.

Size	Length (min) L	Width W	Jaw opening (min) J	Pin dia P	Weight per 100 (min)	Safe working load	Proof load	Breaking load (min)
(inches)	(inches)	(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
1/4	2-7/16	3/4	15/32	1/4	21	800	1,600	4,000
5/16	2-13/16	1	1/2	5/16	34	1,200	2,400	6,000
3/8	3-1/2	1-1/4	5/8	3/8	62	2,200	4,400	11,000
1/2	4-1/2	1-1/2	3/4	1/2	125	3,500	7,000	17,500
5/8	5-5/16	1-3/4	15/16	5/8	235	5,200	10,400	26,000
3/4	6-1/16	2	1-1/8	3/4	350	7,100	14,200	35,500
7/8	7	2-1/4	1-3/16	7/8	575	9,200	18,400	46,000
1	8-1/4	2-1/2	1-3/4	1-1/8	950	11,600	23,200	56,200
1-1/8	8-15/16	2-3/4	1-3/4	1-1/8	1,100	15,000	30,000	75,000
1-1/4	9-7/16	3-1/8	2-1/16	1-3/8	1,575	18,000	36,000	90,000
1-1/2	14-3/4	4	2-7/8	2-1/4	5,475	45,000	90,000	225,000

3.5.7 Type IX, bead-chain fasteners (standard couplings with eyelets).

Bead-chain fasteners shall be made of brass, CRES, or steel, shall be similar to figure 29, and shall be in accordance with the dimensions and physical requirements as shown in table XXV.

FIGURE 29. Type IX, bead-chain fasteners.

TABLE XXV. Type IX. bead-chain fasteners.

Trade no.	Size of chain on which used	Length overall (approx)	Diameter of hole in eye (approx)	Weight per 100 couplings (approx)
	(inch)	(inches)	(inch)	(pounds)
6-AD	1/8	13/32	1/8	0.100
10-A	3/16	1/2	1/8	.187
10-AD	3/16	9/16	3/16	.250
13-AN	1/4	11/16	3/16	.312
20-A	3/8	1-1/32	1/4	1.320

3.5.8 Type X. bead-chain couplings. Bead-chain couplings shall be made of brass, CRES, or steel, shall be similar to figure 30, and shall be in accordance with the dimensions and physical requirements as shown in table XXVI.

FIGURE 30. Type X. bead-chain couplings.TABLE XXVI. Type X. bead-chain couplings.

Trade no.	Size of chain on which used	Length overall (approx)	Ring wire size (max)	Weight per 100 couplings (approx)
	(inch)	(inch)	(inch)	(pound)
3-L	3/32	3/8	----	0.0386
6-L	1/8	1/2	----	.085
10-B	3/16	17/32	1/8	.150
13-B	1/4	11/16	9/64	.420

3.5.9 Type XI, bead-chain insulating couplings. Bead-chain insulating couplings shall be as shown on figure 31, and shall be in accordance with the dimensions and physical requirements shown in table XXVII. Couplings shall have a hard fiber body fitted at each end with a metal cap that shall have a hole and slot to receive bead chain. The couplings shall withstand dielectric strength tests (see 4.4.2.6).

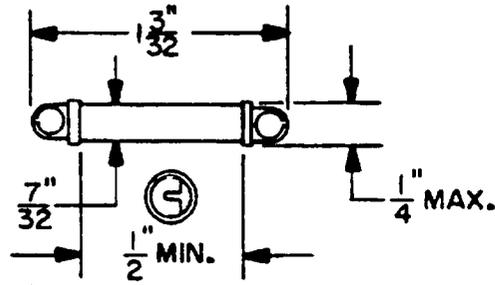


FIGURE 31. Type XI, bead-chain insulating couplings.

TABLE XXVII. Type XI, bead-chain insulating couplings.

Size of chain with which used	Length overall (approx)	Distance between metal ends (min)	Diameter of fiber rod (approx)	Breaking load (min)
(inch)	(inches)	(inch)	(inch)	(pounds)
1/8	1-3/32	1/2	7/32	25

3.5.10 Type XIII, pear shaped links. The pear shaped links shall be forged or welded from low alloy steel and shall be in accordance with chemical requirements shown in table I. The links shall be heat treated, be similar to figure 32, and shall be in accordance with the sizes and weights as shown in table XXVIII.

3.5.10.1 Galvanizing links. Links shall be galvanized as specified in 3.3.1.4.

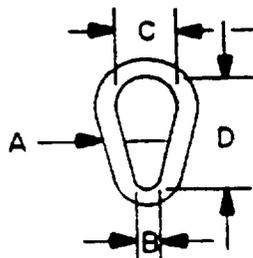


FIGURE 32. Type XIII, pear shaped link.

TABLE XXVIII. Type XIII. pear shaped link.

Nominal diameter A	Inside widths		Inside length D (min)	Safe working load	Proof load	Breaking load (min)	Weight each (approx)
	B (min)	C (min)					
(inches)	(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)	(pounds)
1/2	1	2	3	3,600	7,200	14,400	0.8
5/8	1-1/4	2-1/2	3-3/4	6,250	12,500	25,000	1.4
3/4	1-1/2	2-3/4	4-1/2	9,000	18,000	36,000	2.1
7/8	1-3/4	3	5-1/4	11,400	22,800	45,600	2.8
1	2	3-1/2	6	16,000	32,000	64,000	4.6
1-1/4	2-1/2	4-3/8	7-3/4	25,650	51,300	102,600	9.0
1-3/8	2-3/4	5	8-1/4	30,750	61,500	123,000	11.5
1-1/2	3	5-1/4	10-1/2	34,900	69,800	139,600	15.3

3.5.11 Type XIV. connecting links. Connecting links shall be forged from alloy steel as specified in 3.1.1.2.1, shall be similar to figure 33, and shall be in accordance with the dimensions and physical requirements as shown in table XXIX.

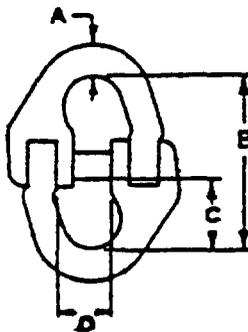
FIGURE 33. Type XIV. connecting links.

TABLE XXIX. Type XIV. connecting links.

Chain size (inches)	Dimensions								Weight each (approx) (pounds)	Safe working load (pounds)	Proof load (pounds)	Breaking load (pounds)
	A		B		C		D					
	min	max	min	max	min	max	min	max				
(inches)	(inches)		(inches)		(inches)		(inches)		(pounds)	(pounds)	(pounds)	(pounds)
1/4	.312	.34	1.81	2.00	.625	.81	.58	.656	.24	4,100	8,200	16,400
5/16	.38	.42	2.13	2.32	.83	.89	.68	.83	.35	5,100	10,200	20,400
3/8	.437	.52	2.406	2.75	.828	1.15	.812	.921	.50	7,100	14,200	28,400
1/2	.58	.64	3.16	3.75	1.20	1.42	1.031	1.312	1.3	13,000	26,000	52,000
5/8	.75	.81	3.906	4.0625	1.50	1.64	1.281	1.593	2.3	20,300	40,600	81,200
3/4	.875	.96	4.62	4.81	1.77	2.02	1.562	1.875	4.0	29,300	58,600	117,200
7/8	1.00	1.13	5.312	5.97	2.031	2.45	1.781	2.281	4.3	39,900	79,800	159,600
1	1.116	1.38	5.75	6.50	2.187	2.75	2.031	2.625	8.4	47,700	95,400	190,800
1-1/4	1.45	1.70	6.937	8.28	2.812	3.61	2.281	3.125	15.5	72,300	144,600	289,200

3.5.12 Type XV end links. End links shall be forged from carbon or alloy steel conforming, respectively, to ASTM A 576 or ASTM A 322, and limitation in the chemical composition shall be as specified in table 1A; the links shall be heat treated, weldless, and similar to figure 34; and the links shall be in accordance with the dimensions and physical requirements as shown in table XXX.

3.5.12.1 Finish. Links shall be zinc coated as specified in 3.3.1.4.

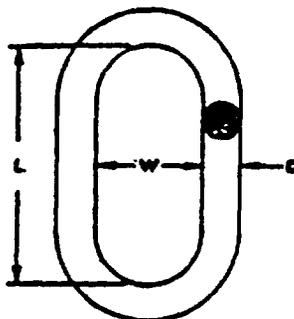


FIGURE 34. Type XV end links.

TABLE XXX. Type XV end links.

Diameter	Inside length	Inside width	Weight each (approx)	Proof load	Breaking load
(inches)	(inches)	(inches)	(pounds)	(pounds)	(pounds)
5/8	3-1/4	1	.95	7,070	14,150
3/4	3-1/2	1-1/8	1.51	11,050	22,100
7/8	5-1/8	2	2.75	15,900	31,800
1	4	1-1/2	3.95	50,000	95,000

3.6 Workmanship. The chain and attachments shall be free from injurious imperfections that may impair appearance or serviceability. The forged and welded chain and attachments shall be free from fins, cracks, flaws, or seams. The screw threads shall be true to form, clean cut, and free from injurious defects.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests as specified in 4.3 and 4.4.

4.2.1 Lot.

4.2.1.1 Type I, chain. For the purpose of inspection, a lot shall consist of 200 feet or fraction thereof of the same type, class, style, and size, unless the chain is in one continuous length of over 200 feet, in which case the lot shall consist of the entire length of chain.

4.2.1.2 Type II, chain. For the purpose of inspection, a lot shall consist of the same type, class, and size offered for delivery at one time.

4.2.1.3 Attachments. For the purpose of inspection, a lot shall consist of not more than 10,000 attachments made from the same material, of the same type and class offered for delivery at one time.

4.2.1.4 Chemical analysis. For the purpose of chemical analysis of type I welded chain and steel attachments, a lot shall consist of chain or attachments made from the same material of the following amount:

Steel-all material made from the same heat. In case heat cannot be identified, a lot shall consist of not more than 2,000 pounds of chain or attachments of the same type, class, and size.

4.2.2 Sampling procedures.

4.2.2.1 Chain.

4.2.2.1.1 Visual and dimensional inspection. A portion of each lot of chain shall be selected for visual and dimensional inspection. If lots comprise more than one length of chain, the sample links shall be selected equally from each lot.

4.2.2.1.2 Type I. A random sampling of links shall be selected from each lot in accordance with table XXXI.

TABLE XXXI. Sampling for visual and dimensional inspection of type I chain.

Links per lot	Number of links to be inspected
Up to 300	30
301 to 500	40
501 to 800	50
801 to 1,300	60
1,301 to 2,000	80
2,001 to 3,000	100
3,001 to 4,500	120
4,501 to 7,000	150

4.2.2.1.3 Type II. A random sampling of links shall be selected from each lot in accordance with table XXXII.

TABLE XXXII. Sampling for visual and dimensional inspection of type II chain.

Links per lot	Number of links to be inspected
Up to 500	25
501 to 1,300	35
1,301 to 8,000	75
8,001 to 22,000	150
22,001 to 60,000	225
60,001 to 120,000	300
120,001 and above	450

4.2.2.1.4 Breaking and elongation test. A specimen not less than 2 feet long, cut from the finished chain, shall be selected from each lot for breaking and elongation test specified in 4.4.1.2 and 4.4.1.3. In the event that the lot of chain exceeds 200 feet in length, a test specimen shall be taken from each length of the chain.

4.2.2.2 Attachments.

4.2.2.2.1 Sampling for examination. A random sample of attachments for examination shall be selected from each lot, except insulated couplings, in accordance with table XXXIII.

4.2.2.2.2 Sampling for proof tests. The random sampling of attachments specified in table XXXIII shall be proof tested as specified in 4.4.2. Samples used for and passing proof test may be reused for the breaking and ductility tests.

4.2.2.2.3 Sampling for breaking and ductility tests. A sample of attachments shall be randomly selected from the proofing samples, for the breaking and ductility tests specified in 4.4.2.

TABLE XXXIII. Sampling for inspection and tests of attachments.

Number of attachments in lot	Number to be selected for inspection and proof test (when proof test is required)	Number to be selected for breaking load and ductility tests
2 to 8	2	2
9 to 15	3	2
16 to 25	5	2
26 to 50	8	2
51 to 90	13	3
91 to 150	20	3
151 to 280	32	3
281 to 500	50	3
501 to 1,200	80	5
1,201 to 3,200	125	5
3,201 to 10,000	200	5

4.2.2.2.4 Type XI, insulating couplings. The number of representative samples shall be selected from each lot as shown in table XXXIV for the dielectric strength test as specified in 4.4.2.6.

TABLE XXXIV. Sampling procedure (type XI, couplings).

Number of couplings in lot	Number of samples to be selected for dielectric strength test
1 to 50	None
51 to 1,000	4
1,001 to 10,000	10

4.2.2.2.5 Chemical analysis. Steel chemistry of material for chain and attachments shall be determined from the certified mill data sheet or by analysis of either bars or from finished chain or attachments. One sample of not less than 2 ounces of drillings or cuttings shall be taken from each lot of chain or attachments and forwarded to a laboratory designated by the contracting activity.

4.3 Examination.

4.3.1 Chain. Each sample of chain selected as specified in 4.2.2.1 shall be examined to determine conformance to this specification regarding dimensions, finish, quality of welds, and other requirements. Chain shall be measured to the inside of the end links after the chain has been proof tested. In determining the length of chain, a load not exceeding 10 percent of the specified proof load shall be applied to take up the slack. In the event no proof load is specified for the chain, the length shall be measured after the slack has been thoroughly taken up.

4.3.1.1 Weight. Each lot of chain shall be weighed.

4.3.2 Attachments. A random sample of attachments as specified in 4.2.2.2.2 shall be examined to determine conformance to this specification regarding dimensions, weights, finish, quality of welds, and other requirements. If attachments are to be zinc coated, surface inspection shall be made before and after coating. Proof and breaking test shall be made after zinc coating.

4.3.3 Rejections.

4.3.3.1 Chain. If the chain fails to meet the requirements as specified in 4.3.1, the chain shall be rejected. Any lot that does not meet the weight specified in tables II, III and IV shall be rejected.

4.3.3.2 Attachments. Sample attachments failing to conform to the requirements specified in 4.3.2 shall be rejected. If any defects are noted in the original sample attachments, additional attachments shall be randomly selected as specified in the original sampling plan and if any defects are noted, the entire lot shall be rejected.

4.4 Tests.

4.4.1 Chain.

4.4.1.1 Order of tests. Breaking and elongation tests shall be conducted before proof tests. If the sample fails the breaking or elongation test, the lot shall be rejected.

4.4.1.2 Breaking test. The test sample shall be properly secured in the testing machine. The sample shall be free from twist. The holding arrangement shall have the stresses bearing on the end links of the test sample the same as on the balance of the links. The chain will be considered to have passed the breaking test if it withstands the specified load for 15 seconds or if it breaks at a load greater than that specified in the respective tables.

4.4.1.3 Elongation test (for type I only). The elongation measurement shall be made on the remains of the breaking-test sample. The gauge length to be measured shall be between 12 and 18 inches as measured to the nearest link. The actual gauge length shall be determined before the breaking test. After the breaking test, the gauge shall be measured to determine the amount of elongation. The elongation shall be not less than 15 percent.

4.4.1.4 Proof test. Chain in each lot shall be proof-tested by subjecting it to the load specified in the applicable table. After proof test, the chain shall be thoroughly inspected. If any links show cold welding, surface rupture, deformation, inferior workmanship, or other defects, the entire lot shall be rejected.

4.4.2 Attachments.

4.4.2.1 Type II. connecting links. The fittings shall be subjected to the loads shown in the applicable tables either singly or in series. These tests shall be as specified in 4.4.1.2 and 4.4.1.4. If any sample link fails the proof or breaking test, the lot shall be rejected. One pair of every ten type II connecting links shall be visually inspected to ensure that all links are interchangeable without applying force. The two halves shall fit concentrically to each other and shall mate (face flush fit), to each other, maintaining rivet-pin to hole alignment. The rivets shall be of sufficient diameter and length to completely fill countersunk holes when peened.

4.4.2.2 Type IV. shackles.

4.4.2.2.1 Proof test. Samples shall be subjected to proof loads shown in table XVII either singly or in series. The diameter of the attachments used in proofing shall be not greater than the pin diameter of the shackle being tested and the application of the proof load shall be at the center of the pin. After releasing the proof load, each shackle shall be examined and disassembled as specified in 3.5.3.1.2.

4.4.2.2.2 Breaking and ductility tests. After proof testing, the required number of samples shall be subjected to the breaking loads shown in table XVII. The diameter of the attachment used in the breaking test shall be not greater than the pin diameter of the shackle being tested; the application of the load shall be at the center of the pin. After breaking, the sample shall be inspected and measured to determine conformance with 3.5.3.1.5.

4.4.2.2.3 Rejections.

4.4.2.2.3.1 If any shackle fails to pass the proof test, all shackles in the lot shall be rejected.

4.4.2.2.3.2 If any shackle fails to pass the breaking or ductility test, the lot shall be rejected.

4.4.2.3 Type V. hooks, classes 1, 2, 3, and 6.

4.4.2.3.1 Proof test. The samples shall be subjected to the proof loads shown in the applicable tables. Hooks shall withstand the proof test without any noticeable permanent opening of the hook at the throat.

4.4.2.3.2 Ductility test. After satisfactorily passing the proof test, the samples for classes 1, 2, and 3 shall be placed in a testing machine and pulled until the throat opening is twice the size, without rupture.

4.4.2.3.3 Rejections.

4.4.2.3.3.1 If any hook fails to pass the proof tests, the lot shall be rejected.

4.4.2.3.3.2 If any hook selected for the ductility test fails to open the required amount, the lot shall be rejected.

4.4.2.4 Type VI. rings. Samples selected in accordance with 4.2.2.2.2 shall be subjected to the proof loads shown in table XXI. Before testing, the inside diameter of the ring shall be measured along the axis to which the load is to be applied. After applying the proof load, the diameter shall be remeasured and the sample shall be considered satisfactory if there is no increase in the diameter. Measurements may be made with dividers, inside calipers, or micrometers or other methods that an accuracy of not less than 0.001 inch per inch diameter may be obtained. Measurements shall be made with an accuracy of not less than 0.001 inch per inch of diameter.

4.4.2.4.1 Rejections. If any ring fails to pass the proof test, all rings of the lot shall be rejected.

4.4.2.5 Type VII. swivels.

4.4.2.5.1 Proof and breaking tests. Samples shall be subjected to the proof and breaking loads shown in tables XXII, XXIII, and XXIV either singly or in series. The swivels shall withstand the proof loads without developing surface rupture or defects that would interfere with serviceability.

4.4.2.5.2 Rejections.

4.4.2.5.2.1 If any swivel fails to pass the proof or breaking load test, all swivels in the lot shall be rejected.

4.4.2.6 Type XI. bead-chain insulating coupling dielectric strength test. Samples selected in accordance with table XXXII shall be tested for dielectric strength. One half the number of samples shall be dried in a desiccator for 24 hours, removed, and immediately subjected to 10,000 volts. The remaining couplings shall be stored for 48 hours in an atmosphere of 35 degrees Celsius (95 degrees Fahrenheit), 90 percent relative humidity, and immediately subjected to 4,000 volts. A tolerance of plus 1 hour and plus or minus 2 percent relative humidity will be permitted. The difference in potential for both samples shall be maintained for 1 minute.

4.4.2.7 Type XIII. pear shaped links.

4.4.2.7.1 Proof test. Samples selected as specified in 4.2.2.2.2 shall be subjected to the proof loads as shown in table XXVIII. Before testing, all dimensions shall be measured and recorded. After applying the test load, the links shall be remeasured and the samples shall be considered satisfactory if there are no dimensional changes.

4.4.2.7.2 Breaking load test. After proof testing, samples selected as specified in 4.2.2.2.3 shall be subjected to the minimum breaking strength as shown in table XXVIII. Samples shall be considered unsatisfactory if any sample link fails to meet the breaking load.

4.4.2.7.3 Rejection.

4.4.2.7.3.1 If any link fails to pass the proof test or fails to pass the minimum breaking strength, the lot shall be rejected.

4.4.2.8 Type XIV connecting links. The connecting links shall be subjected to the loads shown in table XXIX either singly or in series. These tests shall be as specified in 4.4.1.2 and 4.4.1.4. If any sample links fails the proof or breaking test, the lot shall be rejected.

4.4.2.9 Type XV end links.

4.4.2.9.1 Proof test. Samples selected as specified in 4.2.2.2.2 shall be subjected to the proof loads as shown in table XXX. Before testing, all dimensions shall be measured and recorded. After applying the test load, the links shall be remeasured and shall be considered satisfactory if there are no dimensional changes.

4.4.2.9.2 Breaking load test. After proof testing, samples selected as specified in 4.2.2.2.3 shall be subjected to the minimum breaking as shown in table XXX.

4.4.2.9.3 Rejection.

4.4.2.9.3.1 If any sample link fails the proof or breaking test, the lot shall be rejected.

4.5 Inspection of packaging. Sample packs and the inspection of preservation, packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 General.

5.1.1 Navy fire-retardant requirements.

- (a) Treated lumber and plywood. When specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.

Level C - Type I - non-weather resistant.
Category 1 - general use.

- (b) Fiberboard. Unless otherwise specified (see 6.2); fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flamespread index and the specific optic density requirements of PPP-F-320 and amendment thereto.
- (c) Cushioning and wrapping materials. The use of excelsior, newspaper, shredded paper (all types), and similar hygroscopic or nonneutral materials and all types of loose fill materials for packaging applications such as cushioning, fill, stuffing, and dunnage is prohibited. Materials selected for cushioning and wrapping shall have properties (characteristics) for resistance to fire (see 6.3). Cushioning or wrapping materials, as applicable, shall be provided to prevent item and package damage and to prevent free movement of the container contents.

5.2 Preservation. Preservation shall be level A or commercial, as specified (see 6.2).

5.2.1 Level A. Chain and attachments, except black coated and zinc coated, shall be preserved in accordance with method I of MIL-P-116, using type P-1 or P-19 preservative. Black coated or zinc coated chain and attachments shall be preserved in accordance with method III of MIL-P-116.

5.2.1.1 Chain weighing less than 35 pounds per 100 feet and attachments weighing less than 5 pounds each shall be packed in fiberboard boxes conforming to PPP-B-636, class weather resistant. Box closure shall conform to method V as specified in the applicable box specification appendix. The gross weight of the boxes shall not exceed the limitations of the applicable box specification.

5.2.1.2 Chain weighing in excess of 35 pounds per 100 feet and attachments weighing in excess of 5 pounds each shall be bulk packed in containers as specified in 5.3.

5.2.2 Commercial. Chain, and chain and attachments shall be preserved in accordance with ASTM D 3951.

5.3 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2).

5.3.1 General requirements for levels A, B, and C. Containers selected (see 5.3.2) shall be of minimum weight and cube consistent with the protection required, of uniform size, and contain identical quantities.

5.3.2 Levels A, B, and C. Chain and attachments preserved as specified (see 5.2) shall be packed in exterior shipping containers in accordance with MIL-STD-2073-1, table VII of appendix C, for the level of packing specified (see 5.3). Unless otherwise specified (see 6.2), container selection including container options shall be the contractor's option.

5.3.2.1 Closure, gross weight, and waterproofing.

5.3.2.1.1 Closure. Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that weather-resistant fiberboard boxes shall be closed in accordance with method V and reinforced with non-metallic or tape banding and domestic nonweather-resistant fiberboard boxes shall be closed in accordance with method I using pressure sensitive tape.

5.3.2.1.2 Weight. Wood, plywood, and wood cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1, appendix F, or the applicable container specification or appendix thereto.

5.3.2.1.3 Waterproofing. Unless otherwise specified (see 6.2), level A and when specified (see 6.2), level B shipping containers shall be provided with caseliners, linings, wraps, or shrouds in accordance with the waterproofing requirements of MIL-STD-1186.

5.3.3 Commercial. Chain and attachments preserved as specified (see 5.2) shall be packed for shipment in accordance with ASTM D 3951 and herein.

5.3.3.1 Container modification. Shipping containers exceeding 200 pounds gross weight shall be provided with a minimum of two, 3- by 4-inch nominal wood skids laid flat, or a skid- or sill-type base which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage, and storage.

5.4 Palletized unit loads. When specified (see 6.2), containers shall be palletized in accordance with MIL-STD-2073-1, appendix F.

5.5 Marking.

5.5.1 Levels A, B, C, and commercial. In addition to any special marking required (see 6.2), interior (unit) packs, shipping containers and palletized unit loads shall be marked in accordance with MIL-STD-2073-1, appendix F for military agencies and FED-STD-123 for civil agencies and shall include bar codes and applicable packaging acquisition options herein as specified (see 6.2).

6. NOTES

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

6.1 Intended use.

6.1.1 Type I, chain, welded. Type I is steel chain intended for general service. Type I, class 1 is a special analysis alloy steel recommended for hazardous overhead lifting and wherever long life and extremely high tensile strengths are desired. Type I, class 2 is a special analysis steel which is heat treated as required to produce a chain having high tensile strength and resistance to impact loads.

6.1.2 Type II, chain, weldless. Type II, class 2, mechanical communication chain is intended for use in pulleys having a 5/16-inch groove used on a line of signal transmission of mechanical telegraphs.

6.1.3 Type IV, shackles. Shackles in accordance with this specification are intended for general use including rigging. Where stronger shackles are required for special use, refer to grade B high strength. It is general practice to use a shackle one or two sizes larger than the chain that is used with it. The proof loads shown herein indicate the maximum loads which the shackles may be expected to withstand without distortion.

6.1.4 Type XV, end fittings. End fittings in accordance with this specification are intended for use with fueling at sea rigging.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, class, and style of chain and type, grade and class of attachments required (see 1.2.1 and 1.2.2).
- (c) Material required for type II chain (see 3.1.2).
- (d) Finish required, if other than that specified (see 3.3.1 and 3.5.3.1.7).
- (e) If chain is to be other than self-colored (see 3.3.1.1).
- (f) If chain is to be other than bright-finished (see 3.3.1.2).
- (g) If attachments are to be other than self-colored (see 3.3.1.3).
- (h) If fine threads are required for shackles (see 3.5.3.1.1).
- (i) Development of modified or additional preservation, packaging, or packing in support of special requirements will be the responsibility of the activity concerned (see 3.5.3.2).
- (j) Size of chain and attachments required (see applicable tables).
- (k) Level of preservation, packaging, and packing required (see 5.2 and 5.3).
- (l) If single chain lengths exceeding 1000 pounds net weight shall be shipped other than specified (see 5.3).
- (m) Special marking, if required (see 5.5).
- (n) When fire-retardant packaging materials are or are not required (see 5.1.1(a) and (b), as applicable).

- (o) If container selection is not the contractor's option (see 5.3.2).
- (p) When palletization is required (see 5.4).
- (q) Type I welded chain and type II chain should be paid for by the foot.

6.3 Cushioning and wrapping materials (see 5.1.1(c)). Materials having properties for resistance to fire and acceptable for use within unit packs and shipping containers for Navy acquisitions are:

<u>Material</u>	<u>Specification</u>
Paper, Kraft, treated (fire resistant)	A-A-1894
Paper, Kraft, wrapping	UU-P-268, type II, grade C or D
Fiberboard	PPP-F-320, class-domestic/fire retardant
Plastic film, flexible, cellular	PPP-C-795, class 3 - fire retardant
Polystyrene expanded, resilient	PPP-C-850, grade SE
Plastic, open cell, cushioning	PPP-C-1842, type I, style B
Bound fiber	PPP-C-1120, type III or IV, class C
Rubber, latex foam	MIL-R-5001, grade A
Rubber, cellular	MIL-R-6130, grade A
Fibrous glass	MIL-C-17435
Polystyrene foam	MIL-P-19644, type II
Rubber, cellular, synthetic	MIL-R-20092, class 5
Polyurethane foam	MIL-P-26514
Polyurethane foam, flexible, open cell	MIL-F-81334
Foam-in-place packaging materials: General Specification for	MIL-F-83671
Foam, combustion, retardant, for cushioning supply items aboard Navy ships	MIL-F-87090 (SA)

6.4 Deleted types, grades, and classes. The following items have been deleted from RR-C-271 because they are not available commercially:

- Chain: Type I, grade A, class 1 - Wrought-iron (double refined) crane chain.
- Type I, grade B, class 1 - Welded wrought-iron (single refined) long link chain.
- Type I, grade C, class 3 - Welded steel, BBB coil chain, (use type I, grade C, class 4 instead).

Type I, Type III	class 6 - Long link conveyor chain. - Roller chain (see MIL-C-52058 or MIL-C-52223).
Attachments: Type I Type IV	- End links class 1 - Screw pin anchor shackles. class 2 - Screw pin chain shackles. class 3 - Oval pin chain shackles. class 4 - Round pin anchor shackles. class 5 - Round pin chain shackles. class 6 - Bolt type anchor shackle.
Type V	- Barrel hooks (large size only). class 4 - Bale hooks. class 5 - Box hooks. class 7 - Can hooks. class 8 - Stone-hoist hooks. class 9 - Hogshead hooks.
Type VIII Type XII	- Sash attachments. - Type grab links.

6.5 New classes. The classification for type IV, VII, and type XIII attachments have been expanded in this revision as follows:

Type IV	- Shackles.
Type IVA	- Anchor shackles.
grade A	- Regular.
class 1	- Round pin.
class 2	- Screw pin.
class 3	- Safety.
grade B	- High strength.
class 1	- Round pin.
class 2	- Screw pin.
class 3	- Safety.
Type IVB	- Chain shackles.
grade A	- Regular.
class 1	- Round pin.
class 2	- Screw pin.
class 3	- Safety.
grade B	- High strength.
class 1	- Round pin.
class 2	- Screw pin.
class 3	- Safety.
Type VII	- Swivels.
class 1	- Chain swivel.
class 2	- Eye and eye swivel.
class 3	- Jaw and eye swivel.
Type XIII	- Pear shaped links.
Type XIV	- Connecting links.
Type XV	- End links.

6.6 Subject term (key word) listing.

Alloy chain
Breaking and proof loads
Ductility
Hooks
Shackles
Swivels

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

MILITARY INTERESTS:

Custodians

Army - ME
Navy - SH
Air Force - 99

Review Activities

Army - AR, AT, EA, MI
Navy - YD, MC
Air Force - 82
DLA - IS

User Activities

Army - GL, AV
Navy - CG, OS

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS
NASA - JFK

PREPARING ACTIVITY:

Navy - SH
(Project 4010-0181)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (if applicable)	e. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC): Mr. Jack Hall (SEA 56W23)	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON
PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	TPOC: 703-602-1844 8-332-1844
c. ADDRESS (Include Zip Code) Commander Naval Sea Systems Command Department of the Navy (SEA 55Z3) Washington, D.C. 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

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3. DOCUMENT TITLE CHAINS AND ATTACHMENTS, WELDED AND WELDLESS		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		