

## CHANGE RECORD

This page is provided for recording of future changes to this version of P-307.

Change No.	Date	Title or Brief Description	Entered By
1	Aug 2003	Revision to paragraph 14.13.f (deleted knots in wire rope lashing).	09MPF
2	Sep 2003	Revision to paragraph 3.4.1 (biennial load test).	09MPF
3	Apr 2004	Revisions to paragraphs 14.7, 14.7.1.3, 14.7.2.3, 14.7.2.3.1, 14.7.2.3.1.1, 14.7.2.3.1.2, table 14-3, and table 14-4 (wire rope slings, endless slings and sling use criteria).	09MPF

## CHANGE SYNOPSIS FOR CHANGES 1, 2, AND 3

### CHANGE 1

Paragraph 14.13.f Deleted knotting as a method for securing wire rope used for lashing.

### CHANGE 2

Paragraph 3.4.1 Allowed category 3 bridge, wall, and gantry cranes to be included in the biennial load test program.

### CHANGE 3

Paragraph 14.7 Added statements on slings loaded at angles from vertical and potential reductions in sling capacity when used in basket or choker hitches or when the sling body is otherwise bent around an object.

Paragraph 14.7.1.3 Added low temperature requirement for chain slings. Added requirement to reduce chain sling capacities for various choke angles.

Paragraph 14.7.2.3 Explained how object diameter, "D", is derived for objects with non-circular cross sections. Added statement on endless slings used in basket (and similar) hitches.

Paragraphs 14.7.2.3.1, 14.7.2.3.1.1, and 14.7.2.3.1.2 Revised requirements for rating, testing, marking, and usage of wire rope endless slings.

Table 14-3 Added efficiency percentage for a D/d ration of 5:1.

Table 14-4 Revised table and added chain slings.

14.4.2 Pre-use Inspection (Frequent Inspection). Applicable equipment shall be visually inspected by the user prior to each use to verify rated load, marking, inspection status, serial number, and condition. No documentation of pre-use inspection is required.

14.4.3 Periodic Inspection. Periodic documented inspections for covered equipment are specified in table 14-1. Rigging gear used exclusively for lifts of 100 pounds or less and gear with a safety factor of 10 with respect to the yield point of the material are excluded from these periodic inspection requirements.

14.5 Deficiencies. Deficiencies include failure or malfunction of equipment and major or unsafe discrepancies between design drawings and equipment configuration. This does not include normal wear on the equipment. In those instances where a deficiency is detected that has applicability at other Navy activities, the Navy Crane Center shall be notified as soon as practical, but in no case later than five days of the discovery. A summary report of the deficiency, including corrective actions taken or recommended, shall be forwarded to the Navy Crane Center within 21 days. Figure 2-1 shall be used to report the deficiency to the Navy Crane Center.

14.6 Repairs and Alterations. Repairs and alterations to equipment shall be performed in accordance with OEM or activity engineering instructions. The instructions shall require re-inspection (and load test for affected load bearing components) of the repaired or altered equipment. Work documents for repairs affecting load bearing, load control, or operational safety shall be retained for seven years. Other repair work documents shall be retained for one year. Alteration documentation shall be retained for the life of the equipment.

14.7 Slings. Slings shall meet the selection, use, and maintenance criteria of ASME B30.9, with additions and changes as noted below. Loads on slings increase with increasing angles from vertical. Slings shall not be used at angles of less than 30 degrees from horizontal, unless specifically authorized by an engineering work document. In addition, capacity reductions may be required for slings used in basket or choker hitches, or where the body of the sling is bent around a hook, shackle, or other rigging gear. Components in multiple leg sling assemblies shall be sized based on the worst case distribution of loads. For example, slings, shackles, and attachment points in a four leg assembly for a four-point lift shall be sized based on either pair of diagonally opposing legs carrying the entire load, unless the assembly is equipped with devices that automatically adjust for equal distribution of the load such as engineered equalizer plates. Chain hoists may be used for equalizing loads only if used in conjunction with load indicating devices. This requirement for load indicators does not apply to chain hoists used for leveling the load in three-point or two-point lift configurations.

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TABLE 14-2

Minimum Allowable Thickness at Any Point on the Chain Sling Link

<u>Nominal Size of Link</u>	<u>Minimum Allowable Thickness</u>
7/32"	0.189"
9/32"	0.239"
5/16"	0.273"
3/8"	0.342"
1/2"	0.443"
5/8"	0.546"
3/4"	0.687"
7/8"	0.750"
1"	0.887"
1 1/4"	1.091"
1 3/8"	1.187"
1 1/2"	1.261"

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14.7.1 Chain Slings and Fittings

14.7.1.1 Chain Sling Inspection Criteria. For those deficiencies identified below, each link and each attachment shall be examined individually (taking care to expose inner link surfaces). Nicks and cracks in individual links or components shall be removed by grinding. The link or component shall be measured at smallest diameter after grinding.

14.7.1.2 Chain Sling Rejection Criteria. The sling shall be removed from service if inspection reveals any of the following:

- a. Reduction of link size below the values of table 14-2 or as limited by the OEM if more restrictive. For sizes not shown consult the OEM.
- b. Detectable deformation.
- c. Nicks or cracks that cannot be removed by grinding without reducing the thickness below the values in table 14-2.
- d. Knots in any part of the sling.

14.7.1.3 Chain Sling Use Criteria. Chain slings shall be used in accordance with OEM recommendations. Chain slings are recommended for use in abrasive and high temperature environments that may damage other slings. Chain slings shall not be used where their use increases the risk of electrical shock or electrocution, or where damage to equipment may result. For use in temperatures below -40 or above 400 degrees Fahrenheit (F), follow OEM recommendations for rated load reduction. Where a chain sling is used in a choker hitch, the capacity shall be reduced to reflect the efficiency percentages shown in table 14-4.

## 14.7.2 Wire Rope Slings

14.7.2.1 Wire Rope Sling Inspection Criteria. Inspection shall be conducted on the entire length of each sling, including splices, end attachments, and fittings.

14.7.2.2 Wire Rope Sling Rejection Criteria. The sling shall be removed from service if inspection reveals any of the following:

- a. Severe localized abrasion or wear.
- b. Kinked, crushed, or birdcaged sections, or any other damage resulting in distortion of the wire rope structure.
- c. Evidence of heat damage.
- d. End attachments that are cracked or deformed.
- e. Wear in the end attachment socket (excluding the swage area) exceeding 10 percent of the OEM's nominal socket dimensions or 5 percent of the OEM's nominal diameter of the socket pin.
- f. Severe corrosion of the wire rope, fittings, or attachments.
- g. Broken wires:
  - (1) Single part and strand laid wire rope slings: 10 randomly distributed broken wires in one rope lay length, or five broken wires in one strand in one lay length, or two broken wires within one lay length of the end connection.
  - (2) Braided wire rope slings less than eight parts: 20 randomly distributed broken wires in one rope lay length, or one completely broken strand.
  - (3) Braided wire rope slings eight parts or more: 40 randomly distributed broken wires in one rope lay length, or one completely broken strand.
  - (4) Cable laid wire rope slings: 20 randomly distributed broken wires in one rope lay length, or one completely broken strand.
- h. Knots in any part of the sling.

14.7.2.3 Wire Rope Sling Use Criteria. Wire rope slings shall not be used over a pin, shackle, hook, or ring of less than the nominal diameter of the wire rope. If the body of the sling is bent around an object that is greater than 40 times the diameter of the wire rope (e.g., basket hitch), then the total capacity of the sling is equal to two times the sling's single leg lift capacity. If the body of the sling is bent around a pin, hook, or other object that is 40 times the diameter of the sling or less, the total capacity shall be reduced to reflect the efficiency percentages shown in table 14-3. For loads with non-circular cross sections, "D" shall be derived from the minimum bend diameter of the wire rope around the corner of the load. No reduction is required for endless slings that are rated and used based on a D/d efficiency of 50 percent.

Where a wire rope sling is used in a choker hitch, the capacity shall be reduced to reflect the efficiency percentages shown in table 14-4.

Chafing protection shall be used where necessary to protect the load and the sling from damage. In addition, for slings bent around corners, corners shall be rounded (e.g., with pipe sections) to provide a minimum D/d efficiency of 50 percent.

Except for braided slings, wire rope slings shall not be used in single leg vertical hitches, unless a method is used to prevent unlaying of the rope. Wire rope slings shall not be used where their use increases the risk of electrical shock or electrocution, damage to equipment may result, or exposure to temperatures below -40 or above 400 degrees F may occur. (For fiber core slings, the maximum temperature shall be 180 degrees F.)

14.7.2.3.1 Additional Criteria for Wire Rope Endless Slings. To determine the vertical rated load of an endless sling, use the following equation:

$$\text{Rated Load} = \frac{\text{NRS} \times \text{D/d Efficiency} \times 2}{\text{DF}}$$

Where: NRS is the nominal rope strength listed in Federal Spec RR-W-410, the nominal rope strength provided by the wire rope OEM, or the actual breaking strength based on destructive testing of material samples.

D/d Efficiency is taken from table 14-3.

DF is the design factor (5 or greater).

14.7.2.3.1.1 Load Test. The sling shall be tested over a pin with a diameter equal to or greater than the wire rope diameter. The test load shall be 200 percent of the rated load determined from the above equation using the efficiency factor derived from the diameter of the test pin, with a maximum efficiency of 78 percent. For a test pin diameter between the values shown in table 14-3, the efficiency shall be determined from a curve plotted from the D/d values and efficiency percentages shown. The test load and test pin diameter shall be recorded. For slings procured from commercial vendors, the vendor's proof test shall be in accordance with these criteria.

14.7.2.3.1.2 Marking and Usage. Endless slings shall have a marked rated load based on a D/d efficiency of 50 percent and may be used over various pin diameters at loads not exceeding the marked rated load or for a sling that will be used in a specific application over a single pin diameter, the marked rated load shall be the rated load based on a D/d efficiency for that pin diameter; in which case the sling shall be marked to indicate that pin diameter. The load test pin diameter shall be greater than or equal to the specific use pin diameter.

a. If the test pin diameter is greater than the wire rope diameter, the sling may be used at a load higher than the marked rated load with written approval from the activity engineering organization. The allowable load shall be the load derived from the above equation for the intended pin diameter but shall not exceed 50 percent of the test load. Authorization shall be provided for each intended use at a load higher than the marked rated load.

When using wire rope endless slings, ensure the splice is situated at least 10 rope diameters from the load bearing area.

TABLE 14-3  
Efficiency Factors for Various Wire Rope Slings

<u>D/d Ratio</u>	<u>Efficiency Percentage</u>
1:1	50
2:1	65
4:1	75
5:1	78
8:1	83
12:1	87.5
16:1	90
24:1	92.5
40:1	95
over 40:1	100

Where D/d is the ratio of the diameter of the pin, hook, or other object the wire rope is bent around, divided by the diameter of the wire rope sling. Efficiency is expressed as the percentage of the remaining capacity of each leg of the sling. For D/d ratios between the values shown, use the lower efficiency percentage, or alternatively, plot a curve of D/d versus efficiency percentage.

Note: Not applicable to multi-part slings. Contact the wire rope technical board for recommended efficiency factors for these slings. Multi-part slings shall only be used where the D/d efficiency is at least 75 percent. Multi-part slings shall be re-marked at 70 percent of the OEM capacity. Higher capacities may be approved by NCC where destructive testing of sample slings is conducted and documentation is provided to NCC for review.

TABLE 14-4  
Rated Loads For Slings In A Choker Hitch

<u>Choke Angle in Degrees</u> (See Figure 14-1)	<u>Percentage of Vertical Rated Load</u>		
	Chain	Wire Rope & Synthetic Rope	Synthetic Web & Round
121-135	80	75	80*
90 -120	70	65	65
60 - 89	60	55	55
30 - 59	50	46	46
0 - 29	40	36	36

\*or as recommended by OEM if lower