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9.0 SLINGS

9.1 Scope

This Hanford Site Hoisting and Rigging Manual (HSHRM) chapter applies to the fabrication, attachment, use, inspection, and maintenance of slings used for lifting purposes. The proper and safe use of slings is governed by the American Society of Mechanical Engineers (ASME) standards and the Occupational Safety and Health Administration (OSHA) regulations. This section implements required criteria from DOE/RL-92-36, and the following standards: ASME B30.9, Slings, OSHA 29 CFR 1910.184, Slings, and OSHA 29 CFR 1926.251, Rigging Equipment for Material Handling. Slings are used in conjunction with lifting equipment described in other chapters of this HSHRM. This chapter implements the following criteria and the applicable national standards and/or federal specifications that are mandatory per ASME B30.9, Slings as follows:

- Chapter 9-1, Alloy Steel Chain Slings
- Chapter 9-2, Wire Rope Slings
- Chapter 9-3, Metal Mesh Slings
- Chapter 9-4, Synthetic Rope Slings
- Chapter 9-5, Synthetic Webbing Slings
- Chapter 9-6, Polyester Round Slings

Each chapter above includes the following sections:

- Scope
- Training
- Components
- Fabrication and Configurations
- Design Factor
- Rated Load
- Proof Test Requirements
- Sling Identification
- Effects of Environment
- Inspection, Removal and Repair
- Operating Practices
9.2 Accessing Requirements

a. To access ASME standards, choose one of the following options:

- [IHS Engineering Standards, Regulations and Technical Specifications](#). The contractor must have paid for access to the specific standard.
- Purchase standards directly from [ASME](#).

b. To access OSHA standards, go to:

- [OSHA 29 CFR 1910.184, Slings](#)
- [OSHA 29 CFR 1926.251, Rigging Equipment for Material Handling](#)

9.3 Implementation

Contractors shall be compliant to OSHA, ASME, this HSHRM, and manufacturers’ requirements. Users of this Manual are responsible to implement all applicable requirements. If standards conflict, the user shall adhere to the standard containing the most stringent requirements. In most cases, ASME standards provide the most comprehensive information.

Users should contact a Hanford Hoisting Rigging Committee (HHRC) representative or send an [email](#) requesting a formal interpretation. See Appendix C for the process to be followed. Notify the HHRC if any inconsistent standards are identified.

This HSHRM does not intend to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to the requirements within the current HSHRM. The need to meet the current requirements shall be evaluated by a qualified person selected by the owner (user).

9.4 Inconsistent Standards

OSHA 29 CFR 1910.184, *Slings*, Table N-184-4, specifies deductions from capacities shall be taken if a D/d ratio of 20:1 or greater for 6 x 36 and 6 x 19 Improved Plow Steel Grade Wire Rope with an Independent Wire Rope Core (IWRC) is not maintained. ASME B30.9, *Slings*, specifies deductions from capacities shall be taken on a mechanical spliced sling if a D/d ratio of 25:1 or less is obtained for 6 x 36 and 6 x 19 Extra Improved Plow Steel Grade Wire Rope with an IWRC.

Therefore, the requirements of the more restrictive ASME B30.9, *Slings*, shall be followed, but in no case shall wire rope slings be subjected to a D/d ratio of less than 1:1.
9.4.1 D/d Ratio

Figure 9-1: Reduction In Strength Of Wire Rope When Bent Over Sheaves Or Pins Of Various Sizes

When a wire rope is bent around any sheave or other object there is a loss of strength due to this bending action. As the D/d ratio becomes smaller this loss of strength becomes greater and the rope becomes less efficient. This curve relates the efficiency of a rope diameter to different D/d ratios. This curve is based on static loads and applies to 6-strand class 6x19 and 6x37 wire rope.

9.4.1.1 Effects on Wire Rope Slings

The D/d Ratio is the ratio of the diameter around which the sling is bent divided by the body diameter of the sling. Example: A 1/2" diameter wire rope is bent around a 10" diameter pipe; the D/d Ratio is 10" divided by 1/2" = D/d Ratio of 20:1. This ratio has an effect on the rated capacity of slings.

Reference ASME B30.9, Slings, for Sling D/d Ratio (Alloy Steel Chain, Wire Rope, Synthetic Rope)

9.4.2 Temperature Limitations

The working temperature limits listed below shall not be exceeded without the manufacturer’s written approval.

Table 9-1: Temperature Limits By Sling Type

<table>
<thead>
<tr>
<th>Sling Type</th>
<th>Temperature Limit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic Rope Slings</td>
<td>- 40°F to 194°F</td>
<td>ASME B30.9</td>
</tr>
<tr>
<td>Synthetic web and round slings</td>
<td>- 40°F to 194°F</td>
<td>ASME B30.9</td>
</tr>
<tr>
<td>Wire rope slings</td>
<td>Fiber core - 40°F to +180°F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IWRC - 40°F to +400°F</td>
<td>ASME B30.9</td>
</tr>
<tr>
<td>Alloy steel chain slings</td>
<td>- 40°F to +400°F</td>
<td>ASME B30.9</td>
</tr>
</tbody>
</table>
9.5 Hanford Specific Requirements and Practices

9.5.1 Prohibited Sling Applications

Slings with eyes formed by folding back the rope (not a Flemish eye loop) and secured with one or more metal sleeves pressed (not forging) over the wire rope junction are prohibited for lifting service.

9.5.1.1 Pre-Use Inspection

Prior to use, slings shall be inspected and verified that the periodic inspection is current.

9.5.1.2 Sling Identification

Slings used at Hanford shall have permanently affixed and legible identification markings as prescribed by the manufacturer and that indicate the recommended safe working load for the type(s) of hitch (s) used the angle upon which it is based, and the number of legs if more than one.

9.5.2 Inspection and Testing Documentation

9.5.2.1 Proof Testing

All slings shall be proof tested (load tested) prior to initial use by the manufacturer or user. Proof test date shall be marked on the sling. Proof test shall never be less than minimum requirements defined in ASME B30.9, Slings. A tag indicating date of load test may be affixed to the device for filed verification. See example in Figure 9-2.

**Figure 9-2: Example Of A Load Test Tag**
Periodic Inspections

The periodic inspection for all sling types used at Hanford shall be documented by any one of the following methods:

1. Mark a serial number on the sling and maintain inspection records by serial numbers.
2. Institute a comprehensive marking program (such as color coding) to indicate when the next inspection is required.
3. Mark each sling with a tag that indicates when the next periodic inspection is required. This tag becomes the record.

Periodic Inspection Record Tags

A periodic inspection tag (like the example shown in Figure 9-3) is required in addition to the other sling identification requirements for each sling type prescribed by the applicable ASME B30.9, Slings, chapter.

Figure 9-3: Example Of A Periodic Inspection Tag