Hoisting and Rigging: Pre-use Inspection Criteria for Below-the-Hook Lifting Devices, Slings, and Rigging Hardware and Accessories

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1 Purpose

The purpose of these requirements is to ensure the listed equipment is properly inspected before each use by the lift operator.

2 Scope

These pre-use inspection criteria pertain to inspections done by operators only. For detailed criteria for the initial and periodic inspections conducted by a qualified inspector, see Department of Energy Standard 1090, "Hoisting and Rigging" (DOE-STD-1090-2007).

Note *The following criteria do not include operational requirements, proof testing, care, or information on maintenance or storage. For that level of detail, consult the appropriate sections in DOE-STD-1090-2007.*

3 Applicability

These requirements apply to lift operators.

4 Requirements

4.1 Below-the-Hook Lifting Devices

The following requirements apply to below-the-hook lifting devices such as spreader bars, lifting yokes, lifting baskets and lift fixtures.

4.1.1 Structural and Mechanical Lifting Devices

- The rated capacity of each lifting device must be marked on the main structure where it is visible and legible.
- If the lifting device comprises several items, each detachable from the assembly, each lifting device must be marked with its rated capacity.

- At a minimum, a nameplate, name tag, or other permanent marker must be affixed displaying the following data:
  - Manufacturer or contractor's name if fabricated on-site
  - Lifting device weight, if over 100 lbs
  - Serial number (if available)
  - Rated capacity
  - Proof of inspection label by hoist and rigging inspector
- A re-rated lifting device must be relabeled with the new rated capacity.
- Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device must be marked with an identification number, and its documentation must describe both its rated capacity and weight.

4.1.2 Vacuum Lifting Devices

- The rated capacity, maximum width and length, and minimum thickness of load must be marked on the main structure where it is visible and legible.
- Individual pads or groups of pads, controlled by shutoff valves, must be marked with the rated capacity of each pad or group of pads.
- At a minimum, a nameplate, name tag, or other permanent marker must be affixed to each lifter displaying the following data:
  - Manufacturer's name
  - Model number or unit identification
  - Weight of lifting-device
  - Electric power (when applicable)
  - Pressure and volume of compressed air (when applicable)
  - Rated capacity
  - Proof of inspection label by hoist and rigging inspector
- Manual shutoff valves on individual pads or groups of pads must be marked to show operating position.
- Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device must be marked with an identification number, and its documentation must contain both its rated capacity and weight.
- A label or labels must be affixed to each vacuum lifting device in a readable position that displays the word WARNING or other legend designed to bring the label to the attention of the operator. The label must also contain information cautioning against
  - Exceeding the rated capacity or lifting loads not specified in the manufacturer's instruction manual
  - Operating a damaged or malfunctioning unit or a unit with missing parts
  - Operating when vacuum indicators show insufficient vacuum
  - Operating the unit when vacuum pads are not spaced for equal loading
  - Incorrect positioning of the lifting device on the load

  - Lifting people
  - Moving loads above people
  - Removing/obscuring warning labels
  - Operating the lifting device when the rated capacity, lifting-device weight, or
  - Safety markings are missing (except in cases where the device cannot, for security or other reasons, be marked).
  - Making alterations or modifications to the lifting device.
  - Lifting loads higher than necessary and leaving suspended loads unattended.
- A label must be affixed to each unit that directs the user to consult the manufacturer's manual if the size or shape of the unit prohibits the inclusion of the above markings.

4.1.3 Magnets (close-proximity-operated)

- At a minimum, a nameplate, name tag, or other permanent marker must be affixed to each lifting magnet, and must display
  - Manufacturer's name, or if the magnet has been repaired or modified, the name and address of the repairer/modifier
  - Model or unit identification
  - Weight
  - Duty cycle, if applicable
  - Cold current
  - Rated capacity
  - Proof of inspection label by hoist and rigging inspector
- In addition, battery-powered and external-powered lifting electromagnets and electrically controlled permanent-magnet lifting magnets must be marked with
  - The voltage of the battery or primary power supply
  - The cold current or watts at 68 degrees F (20 degrees C) and rated voltage
- Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device must be marked with an identification number, and its documentation must contain both its rated capacity and weight.
- A label or labels must be affixed to each lifting magnet in a readable position that displays the word CAUTION or other legend designed to bring the label to the attention of the operator. The label must also contain information cautioning against
  - Operating when the battery capacity is inadequate
  - For externally powered electromagnets: exceeding magnet duty cycle and disconnecting the magnet with the power on
  - On electrically controlled permanent magnets: operating if the internal control function indicator, where applicable, does not indicate a complete cycle
  - On manually controlled permanent magnets: operating with the control handle not fully in the LIFT position

4.2 Rigging Hooks

- **Marking.** The manufacturer's identification must be forged, cast, or die-stamped on a low-stress and non-wearing area of the hook.
- **Inspecting.** The operator or other designated person must visually inspect hooks daily or prior to first use, or if the hook is not in regular service for
  - Cracks, nicks, gouges
  - Deformation
  - Damage from chemicals
  - Damage, engagement, or malfunction of latch (if provided)
  - Evidence of heat damage
  - Wear
  - Hook attachment and securing means

  If any of these conditions are found, remove the hook from service and contact the equipment custodian.

4.3 Slings

4.3.1 Wire Rope Sling

- **Marking.** Wire-rope slings must be marked with the following information:
  1. Name of trademark of manufacturer
  2. Work load limit (WLL)
  3. Diameter or size
  4. Purchase order or serial number
  5. Inspection due date labeled by the hoist and rigging inspector.

Note *Marking requirements 1, 2, and 3 are ASME B30.9 requirements effective January 2001. Sling identification must be maintained by the user so as to be legible during the life of the sling. (Stenciling or stamping on the swages of a sling is not recommended.).*

Note *Slings may be marked with serial number or other identifying number that can be used to determine capacity in situations where it becomes impossible to mark the sling as described above due to security classification of the loads to be lifted or for other valid reasons approved by the responsible manager.*

- **Fabricating.** Wire rope purchased to fabricate slings must be made in the United States by a member of Wire Rope Technical Board (except stainless steel). Stainless steel wire rope must be made in the United States and must be 302 or 304 grade stainless steel.
- **Inspecting.** Wire-rope sling users must visually inspect all slings each day they are used or prior to use if the sling has not been in regular service (records are not required). Users must carefully note any deterioration that could result in an appreciable loss of original strength and determine whether further use of the sling would constitute a safety hazard. Slings must be immediately removed from service if any of the following conditions are present:
  - Missing or illegible sling identification

- Ten randomly distributed broken wires in one rope lay or five broken wires in one strand in one rope lay
- Wear or scraping of one-third the original diameter of the outside individual wire
- Kinking, crushing, bird caging or any other damage resulting in distortion of the rope structure
- Evidence of heat damage
- End attachments that are cracked, deformed, or worn
- Corrosion of the rope or end attachments

4.3.2 Metal-mesh Slings

- **Inspecting.** Metal-mesh slings must be visually inspected before each use. Metal-mesh slings must be removed from service if any of the following defects are present:
  - A broken weld or brazed joint along the sling edge
  - A broken wire in any part of the mesh
  - Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion
  - Lack of flexibility due to distortion of the mesh
  - Distortion of the female handle so the depth of the slot is increased by more than 10 percent
  - Distortion of either end fitting so the width of the eye opening is decreased by more than 10 percent
  - A 15 percent reduction of the original cross-sectional area of metal at any point around a handle eye
  - Any distortion or twisting of either end fitting out of its plane
  - Cracked end fitting
  - Evidence of heat damage

4.3.3 Synthetic-web Slings

- **Marking.** Each sling must be marked with
  - Manufacturer's name or trademark
  - Manufacturer's code or stock number
  - Type of synthetic web material
  - Rated loads for the type of hitches used

Note *Hand written or ink embossed markings are not acceptable. Sling tags must be indelibly marked and the lettering must not wear off with use. The markings must remain legible for the life of the sling.*

- **Inspecting.** Synthetic-web slings must be visually inspected before each use. Slings must be removed from service if any of the following defects are visible:
  - Acid or caustic burns
  - Melting or charring of any part of the surface
  - Snags, punctures, tears, or cuts
  - Broken or worn stitches

- Wear or elongation exceeding the amount recommended by the manufacturer
- Distortion of fittings
- Knots in any part
- Missing or illegible sling identification

4.3.4 Synthetic Roundslings

- **Marking.** Each polyester roundsling must be permanently marked or labeled showing
  - Name or trademark of manufacturer
  - Manufacturer's code or stock number
  - Rated capacities for the three basic hitches (vertical, choker, vertical basket)
  - Core fiber type – if cover(s) is of a different fiber type, both fiber types must be identified
  - Length (reach) – bearing point to bearing point
  - Each manufacturer must internally identify their product with name or trademark for traceability
- Inspecting. Synthetic roundslings must be visually inspected before each use. Slings must be removed from service if any of the following defects are visible:
  - Missing or illegible sling identification
  - Acid or caustic burns
  - Melting or charring of any part of the surface
  - Snags, punctures, tears, cuts or abrasive wear that expose the core yarns
  - Broken or worn stitches in the cover which exposes the core yarns
  - Wear or elongation exceeding the amount recommended by the manufacturer
  - Stretched, cracked, worn, pitted or distortion of fittings
  - Knots in any part

4.3.5 Alloy Steel-chain Slings

The following applies to slings made from grade 80 and 100 alloy chain manufactured and tested in accordance with National Association of Chain Manufacturers welded steel chain specifications – 1990. If chain other than this is used, it must be used in accordance with the recommendations of the chain manufacturer.

- **Marking.** Wire-rope slings must be marked with the following:
  - Size
  - Manufacturer's grade
  - Rated load and angle on which the rating is based.
  - Reach
  - Numbers of legs
  - Sling manufacturer
  - Inspection due date label by hoist and rigging inspector
- This information may be stenciled or stamped on a metal tag or tags affixed to the sling.

- Where slings have more than one leg, ensure that the tag is affixed to the master link.
- Ensure that the working load does not exceed the rated capacity of the sling.
- **Inspecting.** Steel-chain sling users must visually inspect all slings before they are used as follows:
  - Conduct a link-by-link inspection for the following defects: nicks, cracks, gouges, wear, bent links, stretched links, shearing of links, cracks in any section of link, scores, abrasions, heat damage, rust, corrosion or markings tending to weaken the links. Reject damaged items.
  - Check steel-chain slings for uneven lengths when sling legs are hanging free
  - Check rings and hooks for bends, distortion, cracks in weld areas, corrosion, and scores, heat damage, or markings tending to weaken the links. Reject damaged items.
  - Perform inspection on an individual-link basis. If any link does not hinge freely with the adjoining link, remove the assembly from service.
  - Remove from service assemblies with deformed master links or coupling links.
  - Remove from service assemblies if hooks have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.
  - Do not straighten deformed hooks or other attachments on the job. Assemblies with such defects must be reconditioned by the manufacturer or discarded.
  - Remove from service assemblies with cracked hooks or other end attachments; assemblies with such defects must be reconditioned or repaired prior to return to service.
  - Do no use homemade links, makeshift fasteners formed from bolts, rods, and the like, or other nonstandard attachments. Reject if discovered.
  - Do not use makeshift or field-fabricated hooks on steel-chain slings. Reject if discovered.

4.3.6 Shackles

- **Marking.** Each shackle body must be permanently and legible marked in raised letters by the manufacturer. Raised or stamped letters on the side of the bow must be used to show:
  - Manufacturer's name or trademark
  - Size
  - Rated capacity, recommended safe working load
- Grade A shackles (regular strength), together with their pins and bolts must be forged from carbon steel
- Grade B shackles (high strength) together with their pins and bolts must be forged from alloy steel
- Shackle pins must fit freely (without binding), and seat properly

4.4 Rigging Hardware and Accessories

4.4.1 Eyebolts

- **Marking.**
  - Carbon steel eyebolts must have the manufacturer's name or identification trademark forged in raised characters on the surface of the eyebolt.

  - Alloy steel eyebolts must have the symbol “A” (denoting alloy steel) and the manufacturer’s name or identification mark forged in raised characters on the surface of the eyebolt.

- Eyebolts used for hoisting must be fabricated from forged carbon or alloy steel.
- Carefully inspect each eyebolt before use
- Visually inspect the hole to ensure that there has been no deformation
- Check the condition of the threads in the hole to ensure that the eyebolt will secure and the shoulder can be brought down snug
- Ensure that the shank of the eyebolt is not undercut and is smoothly radiused into the plane of the shoulder or the contour of the ring for non-shouldered eyebolts
- Destroy eyebolts that are cracked, bent, or have damaged threads

4.4.2 Turnbuckles

Turnbuckles may be used in sling systems provided that they are engineered, designed, and approved as a part of the sling system. Approved turnbuckles must be marked and identified for use with the sling set for which they were designed and must be load-tested as part of the sling set.

- **Marking.** Manufacturer’s name or trademark and turnbuckle size must be permanently marked on the turnbuckle body.
- Eyebolts must be fabricated from forged alloy steel.
- Eyebolts must be provided with a jam nut of a type that does not depend upon deformation of the threads for security.
- Turnbuckles must be inspected for damage before each use. Damaged threads, jamb nuts, or bent frame members make the unit unsuitable for use.

4.4.3 Links and Rings

Links and rings are usually designed and manufactured as a part of the lifting hardware for a specific purpose, such as the peak link on multiple-leg slings. However, the rings and links may also be found on the load-attachment end of slings.

- **Marking.** Rings or links should be marked by the manufacturer with the manufacturer’s name or trademark and ring or link size.
- Rings must be forged or welded from low alloy steel.
- Welded rings or links must be subjected to a nondestructive weld test (NDT) and the results must be documented. (NDT is not required for forged rings or links.)

4.4.4 Swivel Hoist Rings

- **Marking.** Swivel hoist rings must have the manufacturer’s name or trademark, working load limit (WLL), and recommended torque value permanently marked (forged, stamped, or inscribed) by the manufacturer on the swivel hoist ring. Permanently attached metal tag bearing the same information may also be used.
- Check that swivel hoist rings for hoisting are be fabricated from forged carbon or alloy steel
- Inspect permanently installed hoist rings before each use to ensure free movement of bail and swivel
- Inspect swivel hoist rings thoroughly each before use
- Inspect the hole to ensure that there has been no deformation

- Check the condition of the threads in the hole to ensure that the hoist ring will secure and the bushing can be brought down for a snug fit
- Destroy hoist rings that are cracked, bent, have damaged threads, or do not operate freely

4.4.5 Wire Rope Clips (Clamps)

- **Marking.** Wire rope clips must be permanently and legibly marked with the size and manufacturer's identifying mark.