

14XX Wire Rope - General Requirements

The employer shall ensure that wire rope used on equipment within the scope of this standard is inspected, maintained and replaced in accordance with requirements set forth in Sections 14XX – 14XX. However, where manufacturer [requirements] are more stringent than those specified in these sections, the manufacturer guidelines shall control. [COE]

14XX Wire Rope Inspection

(a) *General Requirements.*

(1) *Action required.* The person or persons conducting a wire rope inspection shall determine whether any wire rope deficiencies exist that affect the safe operation of the equipment. If such a deficiency is located, that person(s) shall:

(i) initially determine whether wire rope replacement is required as specified in Section 14XX, Wire Rope Replacement, and, if so, comply with those provisions; and

(ii) in all other instances, prohibit the use of the wire rope until the deficiency is repaired [unless in the judgment of the person or persons performing the inspection, the wire rope can be safely used in operating the equipment until the end of the work shift. At that point, the wire rope must be repaired prior to the equipment being returned to service.]

(2) *Critical Review Items.* Certain critical items shall be included in each inspection. The extent of the examination shall be limited by the type of inspection being conducted (daily, frequent or periodic). These items are:

(i) rotation resistant wire rope in use;

(ii) wire rope being used for boom hoists [how about others such as luffing hoists and load hoists]; and

(iii) wire rope at flange points, crossover points and repetitive pickup points on drums.

(3) *Inspection Records.* The employer [which employer?] shall keep required records of inspections and wire rope replacement at the project site. Wire rope replacement shall always be documented and reflect the date of replacement, and the size, construction, grade, length and safety factor of any wire rope replacement. The remaining requirements for record keeping vary by the type of inspection as follows:

(i) *Daily*. No records required unless ropes are removed from service.

(ii) *Frequent*. Written records are required and shall reflect, at a minimum, any deficiencies that are required to be considered in a Frequent Inspection. Other deterioration observed shall also be noted, as well as corrective action taken for any deficiency.

(iii) *Periodic*. Written records are required and shall reflect, at a minimum, any deficiencies that are required to be considered in a Periodic Inspection. Other deficiencies observed shall also be noted, as well as corrective action taken for any deficiency.

(4) *Idle Wire Rope*. All wire rope which has been idle for a period of a month or more shall be inspected in accordance with Section 14XX (d) *Periodic Inspections*.

(5) *Visual Inspections*. For the purpose of Sections 14XX - 14XX, visual inspection means an inspection limited to those surfaces of wire rope that are in the open and not otherwise obscured by equipment parts.

(b) *Daily[Pre-shift] Inspections*. Running wire ropes that are in use on equipment in continuous service shall be visually inspected on a daily basis for obvious or gross deficiencies. This inspection shall be limited to wire ropes that are reasonably likely to be in use on the day of the inspection and shall be overseen by an individual who meets the criteria for a competent person [or should this also include qualified person?]. Examples of obvious or gross deficiencies are:

(1) distortion of the rope structure such as kinking, crushing, unstranding, birdcaging, stretching or core protrusion;

(2) wire rope corrosion, particularly at socket and end connections;

(3) broken or cut strands;

(4) numerous visible broken wires per lay length for running ropes, pendants and standing ropes, or per diameters for rotation resistant rope (see Section 14XX, Wire Rope Replacement for additional guidance);

(5) core failure in rotation resistant rope;

(6) reduction of rope diameter [from COE];

(7) electric arc or heat damage; and

(8) corroded, cracked, bent, worn or improperly applied end connections.

(c) *Frequent[Monthly] Inspections.* Frequent Inspections shall be conducted at least on a monthly basis and these inspections shall be overseen by a person or persons who meet the criteria for a competent and qualified person. [These inspections shall be conducted more frequently if based on usage.] A visual inspection for obvious or gross deficiencies of the types listed in 14XX(b)(1) - (7) shall be conducted on the following:

- (1) all running wire rope;
- (2) counterweight wire ropes [from COE]; and
- (3) load trolley wire ropes [from COE].
- (4) [would it be appropriate to list pendant or standing ropes here?]

(d) *Periodic Inspections.*

(1) *Frequency and Oversight.* Periodic Inspections shall be conducted at least annually, and shall be overseen by a person or persons who meet the criteria for a competent and qualified person. The person or persons overseeing the inspection may require inspections more frequently depending upon such factors as the expected rope life, environment, size of lifts, frequency of lifts, and exposure to shock loads [last item from ANSI].

(2) *Review Required.* The inspection shall be complete and thorough, covering the surface of the entire length of the wire rope with particular attention given to those sections of wire rope that are normally hidden during daily and frequent visual inspections. An inspection for obvious or gross damage of the types listed in 14XX(b)(1) - (7) shall be conducted on the following:

- (i) all running wire rope;
- (ii) counterweight wire ropes;
- (iii) load trolley wire ropes;
- (iv) wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited;
- (v) wire rope subject to reverse bends;
- (vi) wire rope passing over outer sheaves;
- (vii) wire rope at or near terminal ends; and
- (viii) all wire standing ropes [this item may be repetitive to those above].

14XX Wire Rope Replacement

(a) *Oversight.* Wire rope that exhibits the deficiencies listed in 14XX(b) shall be immediately removed from service, and replaced prior to the equipment's next use. [However, an exception applies when a person or persons who meet the criteria for both a competent and qualified person determines that such wire rope is sufficiently safe for continued use on the equipment until the end of the work shift, at which point the wire rope must be replaced prior to the equipment being returned to service.] [ANSI standard provides for this discretion – should we?]

(b) *Criteria.* The following deficiencies are cause for wire rope replacement:

(1) *Broken wires:*

(i) in running wire ropes, with six randomly distributed broken wires in one lay or three broken wires in one strand in one lay, where a lay is the length along the rope in which one strand makes a complete revolution around the rope;

(ii) in rotation resistant ropes, with two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in thirty rope diameters; and

(iii) in pendants or standing wire ropes, with more than two broken wires in one lay located in rope beyond end connections and/or more than one broken wire in a lay located at an end connection;

(2) *Diameter reduction due to loss of core support [Note: Mr. Means suggested that we change these numbers – his suggestions are noted in brackets; ANSI/COE are left in main text]:*

(i) reductions of 1/64 in. (.4 mm) for diameters up to and including 5/16 in. (8 mm); [remove inch/mm reference and replace it with 6% of nominal diameter]

(ii) reductions of 1/32 in. (.8 mm) for diameters 3/8 in. (9.5 mm) to and including 1/2 in. (13 mm); [remove inch/mm reference and replace it with 5% of nominal diameter and delete upper limit and replace it with “and larger”]

(iii) 3/64 in. (1.2 mm) for diameters 9/16 in. (14.5 mm) to and including 3/4 in. (19 mm); [delete due to change in (ii)]

(iv) 1/16 in. (1.6 mm) for diameters 7/8 in. (22 mm) to and including 1 1/8 in. (29 mm); [delete due to change in (ii)]

(v) 3/32 in. (2.4 mm) for diameters 1 1/4 in. (32 mm) to and including 1 1/2 in. (38 mm); [delete due to change in (ii)]

(3) One third reduction of diameter due to wear of surface wires; [Mr. Means suggested that this be deleted as it is hard to determine/enforce – however SAE, ANSI, ACCSH and the Rigging Manual have retained it]

(4) Heat damage from any source, including welding, power line contact or lightning; [as elaborated by COE and ACCSH]

(5) Kinking, crushing, birdcaging or other distortion of the wire rope structure; [in ANSI – but is this too vague?]

(6) Wire rope stretch in excess of 6 inches per 100 feet in 6 stranded rope and 10 inches in an 8 stranded rope; [this came from Rigging Manual – include?]

(7) Core Protrusion; and/or

(8) Severe corrosion or rusting in the vicinity of attachments [Rigging Manual, SAE].

(c) *Wire Rope Selection and Disposal.*

(1) Replacement wire rope shall have a strength rating of at least as great as the rope originally provided or recommended by the crane manufacturer. In addition, no deviation from the size, grade or construction of wire rope originally provided or recommended by the crane manufacturer shall be permitted without the prior written approval of the crane manufacturer, wire rope manufacturer or a qualified person.

(2) If, in the opinion of the person or persons who meet the criteria for a competent and qualified person, a deficiency is localized in an operating wire rope, and the section in question and related safety hazard can be eliminated by making a new attachment of wire rope, a partial replacement is permissible rather than replacing the entire rope. [reworded from SAE]

(3) Wire rope removed from service due to deficiencies shall be cut up or plainly marked as unfit for further use.

14XX Wire Rope Maintenance

(a) *General Requirements.*

(1) Maintenance of wire rope, including preventative maintenance and repairs, shall be in accordance with the crane and/or wire rope manufacturer's recommendations.

(2) Maintenance records shall be documented and available at the project site.

(b) *Storage.* Wire ropes shall be stored in coils or on reels, preferably indoors, or if outdoors, covered, and removed from moisture, heat, steam, and direct contact with concrete or ash floors.

(c) *Lubrication.*

(1) Wire ropes shall be properly lubricated at all times, in accordance with the wire rope or crane manufacturer's recommendations. In particular, lubricants shall be compatible with the original lubricant and shall not hinder visual inspection of the wire rope.

(2) Sections of wire rope hidden or obscured during inspections or maintenance, such as areas over sheaves, shall be lubricated as required by the crane or wire rope manufacturer notwithstanding any difficulty of access or absence from view.

(d) *Use.* [the following provisions appear in ANSI; they relate to rigging]

(1) During installation, wire rope shall not be dragged in dirt or otherwise brought in contact with surfaces or objects that may scrape, nick, crush, or create sharp bends in the rope.

(1) *Seizing.* Prior to cutting a wire rope, seizings shall be placed on each side of the point to be cut. The required number of seizings to be placed on each side of the cut follow:

(i) on preformed rope, one seizing on each side;

(ii) on nonpreformed ropes of 7/8 in. (22 mm) diameter or smaller, two seizings on each side; and

(iii) on nonpreformed rope of 1 in. (26 mm) or larger, three seizings on each side. [Mr. Means suggested that due to the disappearance of nonpreformed rope from the market, these numbers should be left off and a qualified person should determine the number of seizings, or alternatively uniformly require three for nonpreformed rope]

(3) The reeling, unreeling and uncoiling of rope shall be performed in accordance with wire rope manufacturer recommendations.

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