BOOM HOIST WIRE ROPE

DONALD L. PELLOW – P.E. PELLOW ENGINEERING SERVICES, INC.





ASME B 30.5 & OSHA 1926 RETIREMENT CRITERIA

- 6 randomly distributed broken wires in one rope lay or 3 broken wires in one strand in one rope lay
- In Rotation-Resistant wire rope, 2 randomly distributed broken wires in six rope diameters or 4 broken wires in thirty rope diameters
- 1 outer broken wire in the valley or at contact point of the core
- Wear of 1/3 of the original diameter of the outer individual wires
- Kinking, crushing, birdcaging or other damage resulting in distortion of the rope structure
- Evidence of heat damage
- Reduction in diameter of more than 5% of nominal diameter
- In standing ropes, more than 2 broken wires in one rope lay beyond the end connection or more than 1 broken wire at the end connection
- Severe corrosion or pitting of wires

LOAD HOISTING DRUM MIN. PITCH DIA. = 18 D/d

TRAVELING BLOCK SHEAVES MIN. PITCH DIA. = 16 D/d















BOOM HOIST DRUM MIN. PITCH DIA. = 15 D/d BOOM HOIST SHEAVES MIN. PITCH DIA. = 15 D/d









WHEN BOOM HOIST WIRE ROPES BREAK

FMC Link-Belt

Austin

1 1211

-in











WHY BOOM HOIST WIRE ROPES BREAK

MORE SEVERE WEAR PATTERNS IN BOOM HOIST WIRE ROPES

- DRUM CRUSHING
- BENDING FATIGUE
- VIBRATION/IMPACT FATIGUE
 - CORROSION
 - SHEAVE DAMAGE

Crawler, Locomotive And Truck Cranes ANSI B 30.5			
Ropes Supporting Rated Load			
Application	Design Factor		
Running Ropes	3.5		
Pendant Lines	3.0		







CROSS OVER









$\mathbf{P} = \frac{\mathbf{2T}}{\mathbf{Dd}}$

P = Unit Radial Pressure - psi
T = Load on Wire Rope - Lbs.
D = Base Diameter of Drum - in.
d = Nominal Diameter of Wire Rope - in.

BENDING FATIGUE TESTS

D/d RATIO	TEST LOAD)LBS.) TEST CYCLES '
15/1	6,373	10,520
15/1	12,746	9,810
15/1	19,119	6,506
18/1	6,373	21,101
18/1	12,746	19,806
18/1	19,119	10,343

WIRE ROPE TESTED - 3/4", 6 X 25 FW, RRL, EIP, IWRC

* WIRE ROPE SAMPLES CYCLED REPEATEDLY OVER STEEL SHEAVES WITH 180 DEGREE CONTACT UNTIL ASME BROKEN WIRE REMOVAL CRITERIA WAS REACHED



TYPICAL WEAR IN SHEAVE













BROKEN IWRC WIRES





































INCREASE IN LAY



DIAMETER REDUCTION

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- Evidence of heat damage
- Reduction in nominal diameter of 5%
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OSHA INSPECTIONS FOR WIRE ROPE

Crane ropes are now required to be inspected under U.S. federal crane rule.

Information came from OSHA Fact Sheet "Subpart CC – Cranes and Derricks in Construction: Wire Rope—Inspection," which can be found at www.osha.gov.

n 2013, OSHA released a fact sheet describing the wire rope inspection requirements of the Cranes and Derricks in Construction rule. These provisions, which took effect Nov. 8, 2010, are intended to assist inspectors and supervisors, and require annual/comprehensive and monthly inspections be documented according to 1926.1412(f)(7) and 1916.1412(e)(3).

According to the rule, rope lubricants that hinder inspection must not be used, and all documents produced under this section must be available during the applicable document retention period to all persons who conduct inspections under this section.

SHIFT INSPECTION

In a shift inspection, a competent person must conduct a visual inspection of the wire rope prior to each shift during which the equipment is used. Shift inspections do not require untwisting wire rope or booming down, but must consist of observation of the wire ropes (running and standing) likely to be in use during the shift for apparent deficiencies.

Where a wire rope is required to be removed from service, either the equipment (as a whole), or the hoist with that wire rope, must be tagged-out until the wire rope is repaired or replaced.

CRITICAL REVIEW ITEMS

Particular attention must be given to:

- Rotation-resistant wire rope in use;
- Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends;
- Wire rope at flange points, crossover points, and repetitive pickup points on drums;
- Wire rope at or near terminal ends; and
- Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

MONTHLY INSPECTION

Each month an inspection must be

Inspection Requirements (OSHA Subpart CC)

Inspection Trigger	Inspection Details	Performed by	Documentation
Each shift	See list below, visual inspection must begin prior to each shift in which the equipment is used	Competent Person	Not required
Monthly	See details below	Competent Person	Required. Must be signed by the person who conducted the inspection and retained for a minimum of three months.
Annual	See details below	Qualified Person	Required. Must be signed by the person who conducted the inspection and retained for a minimum of 12 months.

conducted as stated under "Shift Inspection" above. In addition, monthly inspections require:

- The inspection include any deficiencies that the qualified person who conducts the annual inspection determines must be monitored;
- Wire ropes on equipment must not be used until an inspection under this paragraph demonstrates that no corrective action is required; and
- The inspection must be documented (monthly inspection documentation).

ANNUAL/COMPREHENSIVE INSPECTION

At least every 12 months, wire ropes in use on equipment must be inspected by a qualified person as stated under "Shift Inspection" above. In addition to the criteria for shift inspection, annual inspections require:

- The inspection be complete and thorough, covering the surface of the entire length of the wire ropes, with particular attention given to all of the following:
 - Critical review items in
 - 1926.1413(a)(3);
 - Those sections that are normally hidden during shift and monthly inspections;
 - Wire rope subject to reverse bends; and
 - Wire rope passing over sheaves.

In the event an annual inspection under 1926.1413(c)(2) is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed), or conditions (such as a dense urban setting), such inspections must be conducted as soon as it becomes feasible, but no longer than an additional six months for running ropes and, for standing ropes, at the time of disassembly.

- If a deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question must be prohibited until:
 - The wire rope is replaced (see 1926.1417), or
 - If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining wire rope by splicing is prohibited. If a rope is shortened, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.
- If a deficiency is identified and the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

Additionally:

- The inspection must be documented according to 1926.1412(f)(7);
- Rope lubricants of the type that hinder inspection must not be used; and
 - All documents produced under this section must be available, during the applicable document retention period, to all persons who conduct inspections under this section.

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MONTHLY INSPECTION

Annual See details below Qualified Ferson	retained for a minimum of 12 months.
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BOOM HOIST WIRE ROPES REQUIRE MORE EMPHASIS ON INSPECTION PROCEDURES AND TRAINING