

# DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

## DIRECTOR'S OFFICE

### GENERAL INDUSTRY SAFETY STANDARDS

(By authority conferred on the director of the department of licensing and regulatory affairs by sections 16 and 21 of 1974 PA 154 and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4, and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

#### PART 20. UNDERHUNG CRANES AND MONORAIL SYSTEMS

##### **R 408.12001 Scope.**

Rule 2001. This part applies to power-driven cranes, classified as underhung, single-leg gantry, and jib, operating on the bottom flange of a track section and to single-track monorail systems. This part does not include monorail systems used only to transport personnel or to monorail-type conveyor systems commonly referred to as overhead trolley conveyors or power and free trolley conveyors. This part does not apply to a crane with a manually moved type bridge or trolley.

History: 1990 AACCS.

##### **R 408.12002 Adoption of standards by reference.**

Rule 2002. (1) The American Society of Mechanical Engineers (ASME) Standard ASME B30.11 "Monorail Systems and Underhung Cranes," 1993 edition, is adopted by reference in these rules and is available from IHS Global, 15 Inverness Way East, Englewood, Colorado, 80112, USA, telephone number: 1-800-854-7179 or via the internet at website: <http://global.ihs.com>; at a cost as of the time of adoption of these rules of \$60.00.

(2) The standard adopted in subrule (1) of this rule is also available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143.

(3) Copies of the standard adopted in subrule (1) of this rule may be obtained from the publisher or may also be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

(4) The following Michigan occupational safety and health standards are referenced in these rules. Up to 5 copies of these standards may be obtained at no charge from the Michigan Department of licensing and regulatory affairs, MIOSHA standards section, 7150 Harris Drive, P.O. Box 30643, Lansing, MI, 48909-8143 or via the internet at website: [www.michigan.gov/mioshastandards](http://www.michigan.gov/mioshastandards). For quantities greater than 5, the cost, at the time of adoption of these rules, is 4 cents per page.

(a) General Industry Safety Standard Part 1 “General Provisions,” R 408.10001 to R 408.10098.

(b) General Industry Safety Standard Part 2 “Floor and Wall Openings, Stairways, and Skylights,” R 408.10201 to R 408.10241.

(c) General Industry Safety Standard Part 33 “Personal Protective Equipment,” R 408.13301 to R 408.13398.

R 408.12003 Definitions; A to F.

Rule 2003. (1) "Automatic crane or monorail system" means equipment which, when activated, operates through a preset cycle.

(2) "Cab" means an operator compartment located on a bridge or trolley of a crane or monorail system.

(3) "Controller" means a device that controls the motion of a crane or monorail system.

(4) "Crane" means any type of crane covered by the scope of this part.

(5) "Floor-operated" means a crane or monorail system which is controlled by an operator from a floor or independent platform.

History: 1990 AACCS; 2013 AACCS.

#### **R 408.12004 Definitions; H to M.**

Rule 2004. (1) "Hooker" means an employee who attaches the load to the hook.

(2) "Hot metal crane" means a crane or monorail system which transports molten metal.

(3) "Jib crane" means a crane with a horizontal arm (jib) designed to rotate around a vertical member.

(4) "Modified" means a change in design or rating.

(5) "Monorail system" means an overhead track from which hoisting equipment travels to transport loads and includes curves, switches, transfer devices, drop sections, hangers, and related equipment.

History: 1990 AACCS.

#### **R 408.12005 Definitions; P to U.**

Rule 2005. (1) "Preformed" means to permanently shape wires and strands before fabrication into wire rope.

(2) "Pulpit" means an operator compartment located at a fixed position remote from the crane or monorail equipment.

(3) "Safety factor" means the ratio of the breaking strength of a material to the maximum designed stress.

(4) "Seizing" means to bind the end of a wire rope with a soft annealed iron wire.

(5) "Side pull" means to pull a load with a hoist, chain, or cable other than vertically.

(6) "Single-leg gantry crane" means a crane similar to an underhung crane, except that the bridge for carrying the trolley is rigidly supported on one end by a vertical leg mounted on an end truck.

(7) "Swaged socket" means a fitting into which wire rope is inserted and attached by cold forming.

(8) "Underhung crane" means a crane with a traveling bridge which is suspended under its runway track system. A hoist trolley may be underhung or top running.

History: 1990 AACCS.

## **CONSTRUCTION, INSTALLATION, AND TESTING**

### **R 408.12011 Underhung cranes and monorail systems; adoption of standards by reference.**

Rule 2011. An underhung crane or monorail system installed, or that portion modified, after November 5, 1997, shall be in compliance with the requirements of ASME B30.11 "Monorail Systems and Underhung Cranes," 1993 edition, as adopted in R 408.12002.

History: 1990 AACCS; 1997 AACCS.; 2013 AACCS.

### **R 408.12012 Cranes and hoists or lifting devices of monorail systems; marking of rated capacity.**

Rule 2012. (1) The rated capacity of a crane shall be legibly marked on the crane. If the crane has more than one hoisting unit, each hoist shall be legibly marked with its rated capacity.

(2) Each hoist or lifting device of a monorail system shall be legibly marked with its rated capacity.

History: 1990 AACCS.

### **R 408.12013 Safety factor for hoisting cables; wire rope.**

Rule 2013. (1) The designed safety factor for the hoisting cable on a hot metal crane shall be not less than 8 and on any other crane or monorail system shall be not less than 5.

(2) Wire rope, with an independent wire rope core, shall be used on all molten metal applications and in an area where the environmental atmosphere will cause deterioration of a hemp center.

History: 1990 AACCS.

### **R 408.12014 Single-leg gantry crane; positive mechanical restraint.**

Rule 2014. A single-leg gantry crane used out-of-doors shall be provided with a positive mechanical restraint to secure the crane against wind movement while parked.

If clamps act on the rail heads, beads or weld flash on the rail heads shall be ground off.

History: 1990 AACCS.

#### **R 408.12015 Controls.**

Rule 2015. (1) Rope controls shall be marked for a floor-operated crane or monorail system to show the direction of travel.

(2) A pendant, radio, cab, or pulpit control station shall be equipped with a positive stop device, colored red, to disconnect all motors.

(3) The controller in a cab or pulpit shall be legibly marked to indicate function and direction.

(4) When the controller of a pendant or radio-controlled type crane is released from the "on" position, the controller shall automatically return to the "off" position.

(5) A transmitter for a radio-controlled crane or a monorail system shall be stored in a locked cabinet or a supervised storage area when not in use.

(6) A crane or monorail system shall be provided with an operable overtravel limit device in the hoisting direction. The device shall be adjusted so that it is tripped under all conditions to prevent contact of the hook or block with the hoist or trolley frame.

(7) A crane or monorail system which is not equipped with a spring-return controller or momentary contact push button shall be provided with a device which disconnects all motors from the line on failure of power and which does not permit restarting until the controller handle is brought to the "off" position or until a reset switch or button is operated.

(8) The pendant push-button enclosure shall be grounded and legibly marked for identification of functions.

History: 1990 AACCS.

#### **R 408.12016 Access, clearances, and barriers.**

Rule 2016. (1) Safe access shall be provided to a cab operated crane by a fixed ladder, stairway, or walkway.

(2) Conductors of the open type which are mounted on the crane runway, bridge, or monorail beams or overhead shall be located or guarded so that an operator at the normal operator's position or persons entering or leaving the cab or crane footwalk could not, under normal conditions, come into contact with them.

(3) A catwalk on a crane shall have a standard barrier as prescribed in General Industry Safety Standard Part 2 "Floor and Wall Openings, Stairways, and Skylights," as referenced in R 408.12002. A floor opening in a crane platform, if equipped with a hinged cover, need not be equipped with a standard barrier. The cover shall be kept closed, except when an employee is entering or leaving the opening.

(4) Safe clearance shall be provided between fixed objects and the monorail system where there is employee exposure.

History: 1990 AACS; 2013 AACS.

**R 408.12017 Hoisting brakes; equipment handling molten metal.**

Rule 2017. (1) Each independent hoisting unit on a crane or monorail hoisting equipment handling molten metal shall be equipped with not less than 2 holding brakes.

(2) A single brake is permitted where a hot metal monorail hoist is equipped with physical stops limiting ladle travel.

History: 1990 AACS.

**R 408.12018 Attaching hoisting units.**

Rule 2018. Unless the hoisting unit is lug or deck-mounted or an integral part of the trolley, the unit shall be attached to the trolley by a clevis or safety hook.

History: 1990 AACS.

**R 408.12019 Trolley and bridge stops.**

Rule 2019. (1) Stops shall be provided at ends of travel of the trolley or bridge.

(2) Stops shall be provided at open ends other than the ends of runs. These may occur at track switches, interlocking cranes, track opener, lift-out section, turntables, and drop, lift, or transfer sections. Such stops shall meet the same safety requirements as the end stop.

(3) Stops shall be provided to resist forces of impact of a crane or trolley carrying its rated load at 40% of the rated speed.

History: 1990 AACS.

## **OPERATORS AND OPERATIONS**

**R 408.12021 Operator selection; cab-operated or pulpit-operated equipment.**

Rule 2021. (1) An employer shall be able to demonstrate that an employee is trained and qualified to operate the equipment prior to authorizing the employee to operate the equipment. A permit system may be used to comply with this rule.

(2) An employee assigned to operate cab-operated or pulpit-operated equipment shall meet the minimum requirements stated in this rule and shall be retested at least once every 3 years or more often when there is reason to doubt safe operating ability.

History: 1990 AACS; 2013 AACS.

**R 408.12022 Operator training.**

Rule 2022. An employer shall train a prospective operator before assignment as an operator of a crane or monorail system. Training shall include all of the following:

(a) Capabilities of equipment and attachments.

- (b) Purpose, use, and limitation of controls.
- (c) How to make daily visual inspections.
- (d) Practice in operating assigned equipment through its functions necessary to perform the required jobs.
- (e) A review of applicable state standards.

History: 1990 AACCS.

**R 408.12023 Operator testing; cab-operated or pulpit-operated equipment.**

Rule 2023. An employer shall test the knowledge and ability of an employee before authorizing the employee to operate a crane or cab-operated or pulpit-operated monorail equipment. The test shall determine all of the following with respect to the employee:

- (a) Operating ability.
- (b) Knowledge of equipment.
- (c) Knowledge of daily checks.
- (d) Knowledge of the use of fire extinguishers.

History: 1990 AACCS.

**R 408.12024 Limitations on use of a cab-operated crane or monorail equipment.**

Rule 2024. (1) An employer shall limit the use of a cab-operated crane or monorail equipment to the following:

- (a) An employee who has been trained and qualified to operate the type of crane or monorail equipment to which the employee is assigned.
- (b) A learner under the direct supervision of a qualified person.
- (c) Its maximum rated capacity.
- (d) Maintenance personnel, during performance of their duties, who have been trained and qualified to operate that type of equipment.

(2) An employer shall establish and implement a safe method, applicable to authorized employees, for boarding and leaving a cab-operated crane or monorail equipment.

- (3) An unauthorized employee shall not enter a cab or pulpit.

History: 1990 AACCS.

**R 408.12025 Reporting defects in crane or monorail equipment.**

Rule 2025. (1) An operator shall report any safety defects in a crane or monorail equipment to the operator's supervisor.

(2) A crane or monorail system in need of repair shall have a warning or "out of order" sign placed at the operator control station if the crane or monorail system is to be left unattended.

History: 1990 AACCS.

**R 408.12026 Personal protective equipment.**

Rule 2026. For personal protective equipment requirements, see General Industry Safety Standard Part 33 "Personal Protective Equipment," as referenced in R 408.12002.

History: 1990 AACCS; 2013 AACCS.

**R 408.12031 Operation of equipment; instructions.**

Rule 2031. (1) An operator, when starting on duty, shall comply with the following provisions:

(a) Not close the main switch, disconnect, or emergency contactor until the operator checks to see if anyone is on the crane or monorail system.

(b) Not close the main switch if a warning sign is on the crane or monorail system, hook, or main switch.

(c) Function test the controls and brake or brakes.

(2) When a load approaches the rated load, the operator shall test the hoisting brake or brakes by raising the load a few inches and applying the brake or brakes.

(3) A hoisting limit switch on equipment or hoisting means shall not be used as an operating control unless the equipment is also equipped with a backup limit switch.

(4) A load shall not be lowered below a point where less than 2 full wraps of wire rope remain on the hoisting drum.

(5) When there is doubt concerning the safety of equipment, an operator shall stop the crane or monorail equipment and report the condition creating this doubt to the operator's supervisor.

(6) Before leaving a cab-operated crane or monorail equipment with powered trolley and hoist unattended, an operator shall land any attached load, place the controllers in the "off" position, and open the main switch or disconnect switch. Before closing a main switch or disconnect on a cab-operated crane or monorail system, the operator shall make sure all controllers are in the "off" position.

(7) An operator of a floor-controlled crane or monorail equipment shall land any attached load before leaving the crane.

(8) An operator leaving an outdoor crane shall secure it as prescribed in R 408.12014.

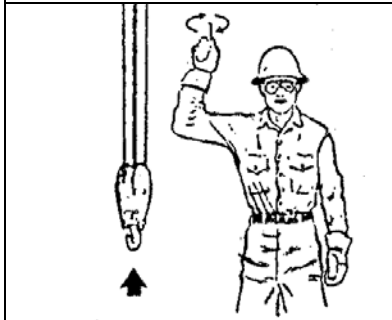
History: 1990 AACCS.

**R 408.12032 Signals; table 1.**

Rule 2032. (1) An operator shall respond to a signal only from the employee directing a lift. However, the operator shall obey an emergency stop signal from any employee at all times. The signals given an operator shall conform to table 1. When 2 or more cranes are used to lift a load, a designated employee shall give all signals.

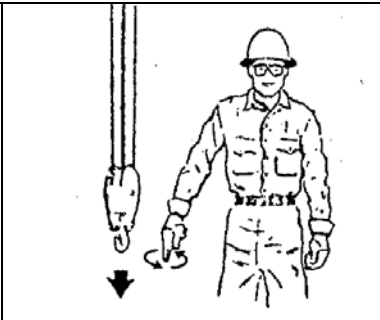
(2) Table 1 reads as follows:

**Table 1**



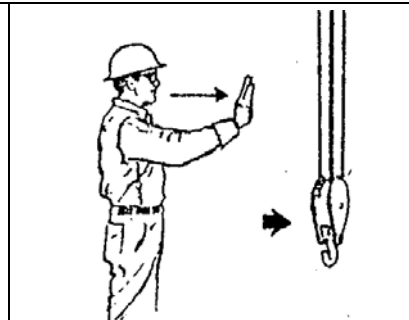
**HOIST.**

With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



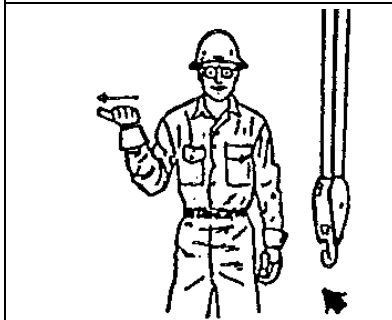
**LOWER.**

With arm extended downward, forefinger pointing down, move hand in small horizontal circles.



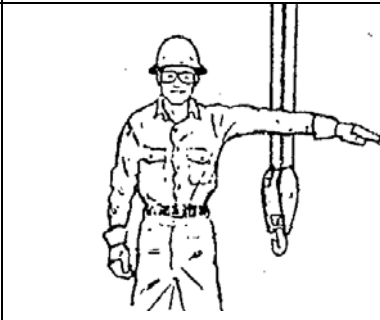
**BRIDGE TRAVEL.**

Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



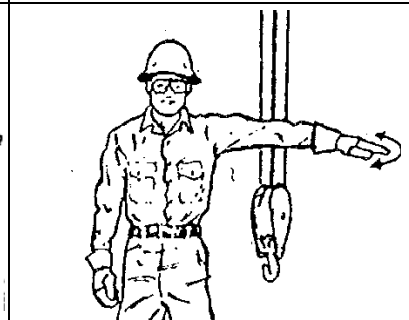
**TROLLEY TRAVEL.**

Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.



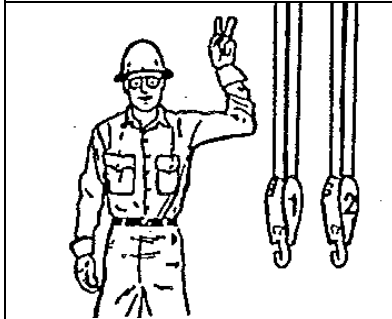
**STOP.**

Arm Extended, palm down, hold position rigidly.



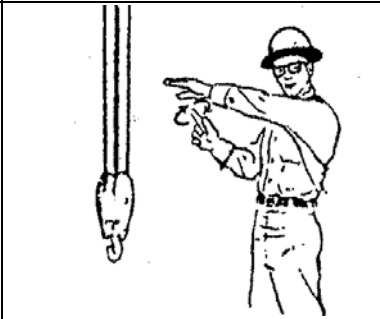
**EMERGENCY STOP.**

Arm extended, palm down, move hand rapidly right and left.



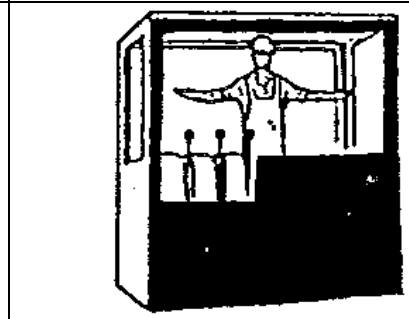
**MULTIPLE TROLLEYS.**

Hold up one finger for



**MOVE SLOWLY.**

Use one hand to give any motion signal and



**MAGNET IS DISCONNECTED.**

Crane operator spreads



<b>Table 1</b>		
block marked “1” and two fingers for block marked “2”, Regular signals follow.	place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)	both hands apart – palms up.

History: 1990 AACCS.

**R 408.12033 Lifting.**

Rule 2033. (1) An operator of a crane or monorail system shall not carry a load over an employee.

(2) An employee shall not place his or her body under a load supported only by a crane or monorail system.

(3) A crane or monorail system shall not be used to make a side pull, except where it has been specifically established by a qualified person that such a side pull and possible consequent load swing will not endanger employees or result in equipment deterioration creating a potential hazard.

(4) Compressed gas containers shall be lifted only by a cradle or enclosed platform.

(5) The rated capacity of a crane or monorail system shall not be exceeded, except as required for test purposes.

(6) When attaching or moving a load, the operator or hooker shall insure that all of the following provisions are complied with:

(a) The hoisting rope or chain is free of kinks or twists and not wrapped around the load.

(b) The load is attached to the load block hook by means of a sling or other approved device.

(c) The sling and load will clear all obstacles or obstructions.

(d) The load is balanced and secured before lifting the load more than a few inches.

(e) That multiple lines are not twisted around each other.

(f) The hook is brought over the load in a manner to prevent swinging.

(g) Load line slack is gradually removed and there is no sudden acceleration or deceleration of the moving load.

History: 1990 AACCS.

**R 408.12034 Warning device; wind-indicating device.**

Rule 2034. (1) A crane or monorail equipment, except a pendant or rope-controlled crane or monorail equipment where the operator and other employees in the area of the load can see all load movements, shall be equipped with a warning device, such as a flashing light, horn, bell, or siren. An operator shall use a warning device before starting and intermittently while traveling in an occupied area.

(2) A wind-indicating device shall be provided on an outdoor storage gantry-type crane which gives a visual or audible alarm to the operator at a predetermined wind velocity. When the warning is given, the crane shall be secured as prescribed in R 408.12014.

History: 1990 AACCS.

**R 408.12035 Storing tools and other necessary articles; fire extinguisher.**

Rule 2035. (1) Tools and other necessary articles shall be stored in a secured container and not allowed to be loose in the cab or on the crane.

(2) On cab-operated equipment, a class "C" or multi-purpose fire extinguisher shall be provided and maintained in a location accessible to the crane operator.

History: 1990 AACCS.

## **INSPECTION AND MAINTENANCE**

**R 408.12041 Shift inspections.**

Rule 2041. At the beginning of each shift during which a crane or monorail system is used, a daily visual inspection shall be made in accordance with table 2. The visual inspection shall be limited to that which can be made from a catwalk or other safe observation point.

History: 1990 AACCS.

**R 408.12042 Monthly to yearly inspections; records; table 2.**

Rule 2042. (1) Monthly-to-quarterly and yearly inspections shall be made in accordance with table 2. Where supported by a documented record, monthly-to-quarterly inspections may be scheduled less frequently but not longer than semiannually. Before use, a crane or monorail system used in a corrosive atmosphere which has been idle for more than 1 month shall be inspected for all items specified in table 2. Where conditions of extreme duty cycle, heat, and corrosive or climatic extremes exist, more frequent inspections shall be conducted before use.

(2) Records of all monthly-to-quarterly and yearly inspections shall be kept for not less than 2 years.

(3) Table 2 reads as follows:

**TABLE 2 - MINIMUM INSPECTION SCHEDULE**

<b>ITEM</b>	<b>DAILY</b>	<b>MONTHLY TO QUARTERLY</b>	<b>YEARLY OR MORE OFTEN</b>
Operating Mechanisms	Visual for function	Check for wear, distortion and fractures	
Limit Switches	Visual & operational for function	Check for adjustment and wear	
Air Systems	Visual for leaks	Visual for leaks	
Hydraulic Systems	Visual for leaks	Visual for leaks and abrasions	
Hooks*	Visual For deformation and cracks		
Chains	Visual For wear, elongations and twist	Measure for wear and elongation	
Wire Rope**	Visual for wear, elongations and twist	Measure for wear	
Slings	Visual For wear, broken wire, kinks	Measure for wear	
Rope Reeving	Visual for proper seating in drum and sheave grooves	Visual for proper seating in drum and sheave grooves	
Chain Drive Sprockets			Check for wear
Drive Chain		Check for stretch	
Brake System ***	Functional test	Check for adjustment and wear	
Sheaves			Check For wear and cracks
Drums			Check For wear and cracks
Fasteners		Check for tightness	
Electrical Apparatus		Check electrical components for function, loose connections & deterioration	
Lock and Clamp Mooring Devices		Visual for function and wear	Check for wear, distortion and fractures
Cab		Check hangers and fasteners	

**TABLE 2 - MINIMUM INSPECTION SCHEDULE**

ITEM	DAILY	MONTHLY TO QUARTERLY	YEARLY OR MORE OFTEN
Load, Wind and Other Indicators		Accuracy	
Power Plants		Performance and safety requirements	
End Stops on Bridge	Visual to ensure they are in place		Check bolts for tightness and wear

\*See rule 2045

\*\*See rule 2044

\*\*\*See rule 2031(1)(c)

History: 1990 AACS.

**R 408.12043 Maintenance of equipment: correction of unsafe condition; precautions; returning equipment to normal operation; removing dirt and debris.**

Rule 2043. (1) An employer shall maintain a crane, monorail system, and their accessories in a condition that does not endanger an operator or other employee.

(2) Before adjustments or repairs are commenced on a crane or monorail system, all of the following precautions shall be taken:

(a) A crane shall be repaired in a location where it causes the least interference with other moving equipment on the track or rails and operations in the area.

(b) Controllers shall be placed in the “off” position.

(c) Where an employee is working at or near a disabled crane and there is a parallel runway on that side, or where a section of track or runway is being repaired or replaced, and a hazard exists to the employee, the requirements of subrule (3) of this rule apply.

(d) The power to the crane or monorail system shall be locked out in accordance with R 408.10132 of General Industry Safety Standard Part 1 “General Rules,” as referenced in R 408.12002.

(3) Where any other crane or monorail systems uses the same runway, a protective device shall be used to prevent interference with the idle crane or monorail systems undergoing repairs. Where the protective device is impractical, a signalman shall be placed at a visual vantage point to warn the operator of the active crane or monorail system when it reaches the limit of safe distance from the idle crane.

(4) A crane or monorail equipment that has been adjusted or repaired shall not be returned to normal operation until all guards have been replaced, locks removed, safety devices reactivated, and the maintenance equipment removed.

(5) An accumulation of dirt or debris on a crane or monorail equipment that may create a hazardous condition shall be removed.

History: 1990 AACS; 2013 AACS.

**R 408.12044 Wire rope.**

Rule 2044. (1) A wire rope used on a crane or monorail equipment shall be replaced if any of the following conditions exist:

(a) Within a segment of 8 diameters in length, the total number of broken wires exceeds 10% of the total number of wires.

(b) The wire rope has been kinked, crushed, or bird-caged or has sustained any other damage which distorts the wire rope structure.

(c) The wire rope shows heat or corrosive damage.

(2) If wire rope is discarded from a crane or monorail equipment because of a condition specified in subrule (1) of this rule, the damaged portion shall not be used for a sling.

(3) Wire rope for a crane or monorail equipment that has been clipped or spliced to form an eye shall be equipped with a thimble or equivalent.

(4) An end fitting shall be a clamp, swage socket, or a zinc, or equivalent poured socket. Before cutting wire rope, seizings shall be placed as follows:

(a) One seizing on each side of the cut on a preformed wire rope.

(b) Two seizings on each side of 7/8-inch size or smaller nonpreformed wire rope.

(c) Three seizings on each side of 1-inch or larger size nonpreformed wire rope.

History: 1990 AACCS.

**R 408.12045 Hooks.**

Rule 2045. (1) A crane or monorail equipment hook shall be discarded for any of the following reasons:

(a) The throat opening is more than 15% larger than the manufactured size.

(b) The hook has more than a 10-degree twist from a vertical centerline drawn through the hook socket.

(c) The hook is cracked.

(2) A discarded hook shall not be repaired or rebuilt and placed back in service.

History: 1990 AACCS.