

ASME B30.11-2010
(Revision of ASME B30.11-2004)

Monorails and Underhung Cranes

**Safety Standard for Cableways, Cranes,
Derricks, Hoists, Hooks, Jacks, and Slings**

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**



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The next edition of this Standard is scheduled for publication in 2015. This Standard will become effective 1 year after the Date of Issuance. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME Web site under the Committee Pages at <http://cstools.asme.org> as they are issued, and will also be published within the next edition of the Standard.

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FOREWORD

This American National Standard, Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, has been developed under the procedures accredited by the American National Standards Institute (formerly the United States of America Standards Institute). This Standard had its beginning in December 1916 when an eight-page Code of Safety Standards for Cranes, prepared by an ASME Committee on the Protection of Industrial Workers, was presented to the annual meeting of the ASME.

Meetings and discussions regarding safety on cranes, derricks, and hoists were held from 1920 to 1925, involving the ASME Safety Code Correlating Committee, the Association of Iron and Steel Electrical Engineers, the American Museum of Safety, the American Engineering Standards Committee (later changed to American Standards Association and subsequently to the USA Standards Institute). Department of Labor — State of New Jersey, Department of Labor and Industry — State of Pennsylvania, and the Locomotive Crane Manufacturers Association. On June 11, 1925, the American Engineering Standards Committee approved the ASME Safety Code Correlating Committee's recommendation and authorized the project with the U.S. Department of the Navy, Bureau of Yards and Docks, and ASME as sponsors.

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the committee organized November 4, 1926, with 57 members representing 29 national organizations. The Safety Code for Cranes, Derricks, and Hoists, ASA B30.2-1943, was created from the eight-page document referred to in the first paragraph. This document was reaffirmed in 1952 and widely accepted as a safety standard.

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Naval Facilities Engineering Command, U.S. Department of the Navy, was reorganized as an American National Standards Committee on January 31, 1962, with 39 members representing 27 national organizations.

The format of the previous code was changed so that separate standards (each complete as to construction and installation; inspection, testing, and maintenance; and operation) will cover the different types of equipment included in the scope of B30.

In 1982, the Committee was reorganized as an Accredited Organization Committee, operating under procedures developed by the ASME and accredited by the American National Standards Institute.

This Standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

In case of practical difficulties, new developments, or unnecessary hardship, the administrative or regulatory authority may grant variances from the literal requirements or permit the use of other devices or methods, but only when it is clearly evident that an equivalent degree of protection is thereby secured. To secure uniform application and interpretation of this Standard, administrative or regulatory authorities are urged to consult the B30 Committee, in accordance with the format described in Section IX, before rendering decisions on disputed points.

In the 2010 edition of this Volume, Chapters 2 and 3 were revised and Maintenance was moved to new Chapter 4.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

This Volume of the Standard, which was approved by the B30 Committee and by ASME, was approved by ANSI and designated as an American National Standard on March 1, 2010.

ASME B30 COMMITTEE

Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

(The following is the roster of the Committee at the time of approval of this Standard.)

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SAFETY STANDARD FOR CABLEWAYS, CRANES, DERRICKS, HOISTS, HOOKS, JACKS, AND SLINGS

(10)

B30 STANDARD INTRODUCTION

SECTION I: SCOPE

The ASME B30 Standard contains provisions that apply to the construction, installation, operation, inspection, testing, maintenance, and use of cranes and other lifting and material-handling related equipment. For the convenience of the reader, the Standard has been divided into separate volumes. Each volume has been written under the direction of the ASME B30 Standards Committee and has successfully completed a consensus approval process under the general auspices of the American National Standards Institute (ANSI).

As of the date of issuance of this Volume, the B30 Standard comprises the following volumes:

B30.1	Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries	B30.23	Personnel Lifting Systems
B30.2	Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)	B30.24	Container Cranes
B30.3	Tower Cranes	B30.25	Scrap and Material Handlers
B30.4	Portal and Pedestal Cranes	B30.26	Rigging Hardware
B30.5	Mobile and Locomotive Cranes	B30.27	Material Placement Systems
B30.6	Derricks	B30.28	Balance Lifting Units ¹
B30.7	Base-Mounted Drum Hoists	B30.29	Self-Erect Tower Cranes ¹
B30.8	Floating Cranes and Floating Derricks		
B30.9	Slings		
B30.10	Hooks		
B30.11	Monorails and Underhung Cranes		
B30.12	Handling Loads Suspended From Rotorcraft		
B30.13	Storage/Retrieval (S/R) Machines and Associated Equipment		
B30.14	Side Boom Tractors		
B30.15	Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)		
B30.16	Overhead Hoists (Underhung)		
B30.17	Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)		
B30.18	Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist)		
B30.19	Cableways		
B30.20	Below-the-Hook Lifting Devices		
B30.21	Manually Lever-Operated Hoists		
B30.22	Articulating Boom Cranes		

SECTION II: SCOPE EXCLUSIONS

The B30 Standard does not apply to track and automotive jacks, railway or automobile wrecking cranes, shipboard cranes, shipboard cargo-handling equipment, well-drilling derricks, skip hoists, mine hoists, truck body hoists, car or barge pullers, conveyors, excavating equipment, or equipment covered under the scope of the following standards: A10, A17, A90, A92, A120, B20, B56, and B77.

SECTION III: PURPOSE

The B30 Standard is intended to

(a) prevent or minimize injury to workers, and otherwise provide for the protection of life, limb, and property by prescribing safety requirements

(b) provide direction to manufacturers, owners, employers, users, and others concerned with, or responsible for, its application

(c) guide governments and other regulatory bodies in the development, promulgation, and enforcement of appropriate safety directives

SECTION IV: USE BY REGULATORY AGENCIES

These Volumes may be adopted in whole or in part for governmental or regulatory use. If adopted for governmental use, the references to other national codes and standards in the specific volumes may be changed to refer to the corresponding regulations of the governmental authorities.

¹ These volumes are currently in the development process.

SECTION V: EFFECTIVE DATE

(a) *Effective Date.* The effective date of this Volume of the B30 Standard shall be 1 yr after its date of issuance. Construction, installation, inspection, testing, maintenance, and operation of equipment manufactured and facilities constructed after the effective date of this Volume shall conform to the mandatory requirements of this Volume.

(b) *Existing Installations.* Equipment manufactured and facilities constructed prior to the effective date of this Volume of the B30 Standard shall be subject to the inspection, testing, maintenance, and operation requirements of this Standard after the effective date.

It is not the intent of this Volume of the B30 Standard to require retrofitting of existing equipment. However, when an item is being modified, its performance requirements shall be reviewed relative to the requirements within the current volume. The need to meet the current requirements shall be evaluated by a qualified person selected by the owner (user). Recommended changes shall be made by the owner (user) within 1 yr.

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

Requirements of this Standard are characterized by use of the word *shall*. Recommendations of this Standard are characterized by the word *should*.

SECTION VII: USE OF MEASUREMENT UNITS

This Standard contains SI (metric) units as well as U.S. Customary units. The values stated in U.S. Customary units are to be regarded as the standard. The SI units are a direct (soft) conversion from the U.S. Customary units.

SECTION VIII: REQUESTS FOR REVISION

The B30 Standards Committee will consider requests for revision of any of the volumes within the B30 Standard. Such requests should be directed to

Secretary, B30 Standards Committee
ASME Codes and Standards
Three Park Avenue
New York, NY 10016-5990

Requests should be in the following format

Volume: Cite the designation and title of the volume.
Edition: Cite the applicable edition of the volume.
Subject: Cite the applicable paragraph number(s) and the relevant heading(s).
Request: Indicate the suggested revision.

Rationale: State the rationale for the suggested revision.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to the requester defining the actions undertaken by the B30 Standards Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

The B30 Standards Committee will render an interpretation of the provisions of the B30 Standard. Such requests should be directed to

Secretary, B30 Standards Committee
ASME Codes and Standards
Three Park Avenue
New York, NY 10016-5990

Requests should be in the following format:

Volume: Cite the designation and title of the volume.
Edition: Cite the applicable edition of the volume.
Subject: Cite the applicable paragraph number(s) and the relevant heading(s).
Question: Phrase the question as a request for an interpretation of a specific provision suitable for general understanding and use, not as a request for approval of a proprietary design or situation. Plans or drawings that explain the question may be submitted to clarify the question. However, they should not contain any proprietary names or information.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for a draft response, which will then be subject to approval by the B30 Standards Committee prior to its formal issuance.

Interpretations to the B30 Standard will be published in the subsequent edition of the respective volume, and will be available online at <http://cstools.asme.org>.

SECTION X: ADDITIONAL GUIDANCE

The equipment covered by the B30 Standard is subject to hazards that cannot be abated by mechanical means, but only by the exercise of intelligence, care, and common sense. It is therefore essential to have personnel involved in the use and operation of equipment who are competent, careful, physically and mentally qualified, and trained in the proper operation of the equipment and the handling of loads. Serious hazards include, but are not limited to, improper or inadequate maintenance, overloading, dropping or slipping of the load,

obstructing the free passage of the load, and using equipment for a purpose for which it was not intended or designed.

The B30 Standards Committee fully realizes the importance of proper design factors, minimum or maximum dimensions, and other limiting criteria of wire rope or chain and their fastenings, sheaves, sprockets, drums, and similar equipment covered by the standard, all of which are closely connected with safety. Sizes, strengths, and similar criteria are dependent on many different factors, often varying with the installation and uses. These factors depend on

- (a) the condition of the equipment or material
- (b) the loads

(c) the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums

(d) the type of attachments

(e) the number, size, and arrangement of sheaves or other parts

(f) environmental conditions causing corrosion or wear

(g) many variables that must be considered in each individual case

The requirements and recommendations provided in the volumes must be interpreted accordingly, and judgment used in determining their application.

ASME B30.11-2010

SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.11-2010 was approved by the American National Standards Institute on March 1, 2010.

ASME B30.11-2010 includes editorial changes, revisions, and corrections introduced in ASME B30.11-2004, as well as the following changes identified by a margin note, **(10)**.

<i>Page</i>	<i>Location</i>	<i>Change</i>
viii–x	B30 Standard Introduction	Revised in its entirety
1	Section 11-0.1	Revised in its entirety
1,6,8	Section 11-0.2	Definitions of <i>crane</i> , <i>underhung</i> ; <i>monorail system</i> ; and <i>support system</i> added
9,10	Section 11-0.3	References updated
11	11-1.1.1	Revised
	11-1.1.2	Revised
	11-1.1.3	Added
	11-1.1.4	Added
	11-1.1.6	Added
	11-1.3.1	Revised
	11-1.3.2	Revised
12	11-1.3.3	Revised
	11-1.3.4	Revised
	Section 11-1.12	Added
15	Section 11-1.13	Added
19	Fig. 11-1.13-1	Added
20	Fig. 11-1.13-2	Added
21–23	Chapter 11-2	Revised in its entirety
24–29	Chapter 11-3	Revised in its entirety
30–32	Chapter 11-4	Added

SPECIAL NOTE:

The interpretations to ASME B30.11 are included in this edition as a separate section for the user's convenience.

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MONORAILS AND UNDERHUNG CRANES

Chapter 11-0 Scope, Definitions, and References

(10) SECTION 11-0.1 SCOPE OF B30.11

Volume B30.11 includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of underhung crane and monorail systems, track sections, and load-carrying members, such as end trucks or carriers (commonly called trolleys) that travel either on the external or internal lower flange of a track section. The track sections include single monorail track, crane bridge girders and jib booms, all curves, switches, transfer devices, and lift and drop sections. Provisions apply to both power-driven and hand-operated equipment in which the carriers are independently controlled. Items within this scope may be referred to as “equipment.”

Provisions for similar equipment used for a special purpose, such as, but not limited to, nonvertical lifting service, lifting a guided load, conveyor systems, including power and free conveyors, and lifting or transporting personnel are not included in this Volume.

(10) SECTION 11-0.2 DEFINITIONS

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to or for the operation of the crane or carrier, such as excessively high or low ambient temperatures, exposure to weather, corrosive fumes, dust- or moisture-laden atmospheres, and hazardous locations.

administrative or regulatory authority: governmental agency or the employer in the absence of governmental jurisdiction.

appointed: appointed by a duly constituted administrative or regulatory authority.

brake: a device, other than a motor, used for retarding or stopping motion by friction or power means.

bridge (crane) girder: crane member on which carriers travel, horizontally mounted between and supported by the end trucks.

bridge (crane) travel: crane movement in a direction parallel to the crane runway.

cab: an operator’s compartment attached to a crane or carrier.

cab, normal: operator’s compartment used for controlling a cab-operated crane or carrier.

cab, skeleton: operator’s compartment used for occasional cab operation of, normally, a floor- or remote-operated crane or carrier.

carrier: (also known as trolley) a unit that travels on the bottom flange of a monorail track, jib boom, or bridge girder to transport a load.

carrier, automatic dispatch: a carrier that, when activated, operates through a preset cycle or cycles.

carrier, cab-operated: a carrier controlled by an operator in a cab attached to the carrier (see Fig. 11-0.2-1).

carrier, floor-operated: a carrier that is controlled by a means suspended from the carrier or crane, or controlled from a wall-mounted station and operated by an operator on the floor or on an independent platform.

carrier, hot molten material: an overhead carrier used for transporting or pouring molten material.

carrier, manually operated: a carrier whose travel mechanism is driven by pulling an endless chain or by manually moving the load.

carrier, power-operated: a carrier whose mechanism is driven by electric, pneumatic, or hydraulic means.

carrier, pulpit-operated: a carrier operated from a fixed operator station not attached to the carrier.

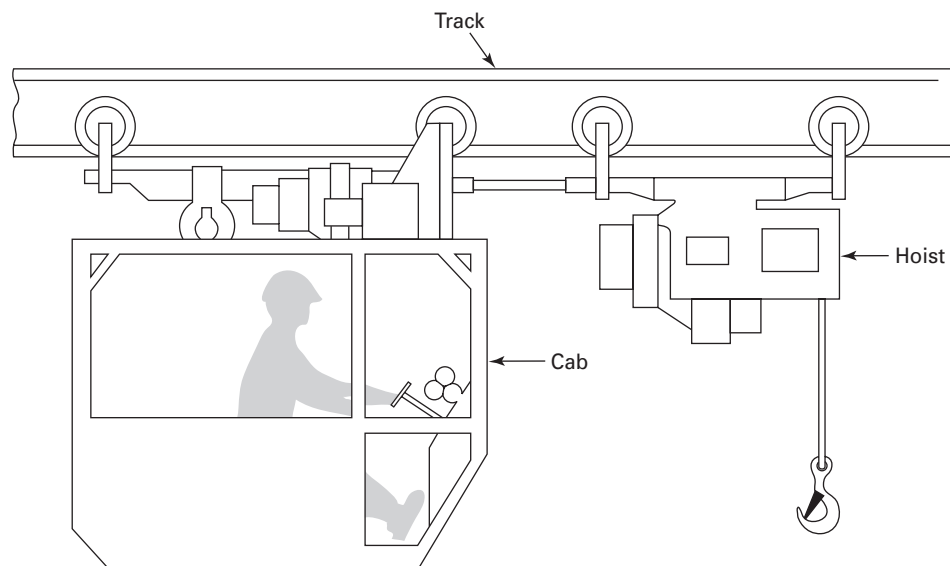
carrier, remote-operated: a carrier that is controlled by any method other than a means suspended from the carrier and operated by an operator not in a pulpit nor in the cab attached to the carrier.

chain, hand: the chain grasped by a person to apply force required for lifting, lowering, or traveling motion.

NOTE: Hand chain properties do not conform to those shown in ASME B30.9.

chain, load: the load-bearing chain in a hoist.

NOTE: Load chain properties do not conform to those shown in ASME B30.9.

Fig. 11-0.2-1 Cab-Operated Carrier

clamp: a type of suspension fitting used to support tracks from an overhead structure which is fastened to the structure by mechanical means rather than by welding or direct bolting.

conductors (electrification): the system by which the moving equipment receives its electrical power (see Fig. 11-0.2-2).

conductors, guarded: bar or wire used to transmit electrical power, guarded to minimize inadvertent contact with the conductor.

conductors, open: bar or wire, not guarded, used to transmit electrical power.

controller: a device or group of devices that govern, in a predetermined manner, the power delivered to the apparatus to which it is connected.

crane: a machine for lifting and lowering a load and moving it horizontally. Cranes, whether fixed or mobile, are driven manually, by power, or by a combination of both.

crane, automatic: a crane that, when activated, operates through a preset cycle or cycles.

crane, cab-operated: a crane controlled by an operator in a cab attached to the bridge or carrier (see Fig. 11-0.2-3).

crane, cantilever gantry: a gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.

crane, double-girder: a crane having two bridge girders mounted between, and supported from, the end trucks.

crane, floor-operated: a crane that is controlled by a means suspended from the crane or carrier, or controlled from a wall-mounted station and operated by an operator on

the floor or on an independent platform (see Fig. 11-0.2-4).

crane, gantry: a crane similar to an overhead crane, except that the bridge for carrying the carrier(s) is rigidly supported on two or more legs running on a fixed rail or other runway.

crane, hot molten material: a crane used for transporting or pouring molten material.

crane, interlocking: a crane with an interlock mechanism on one or both ends, enabling it to be mechanically locked to another crane, fixed transfer section, or spur track for the purpose of transferring a carrier from one to another.

crane, manually operated: a crane whose travel mechanism is driven by pulling an endless chain, or by manually moving the load.

crane, power-operated: a crane whose mechanism is driven by electric, pneumatic, or hydraulic means.

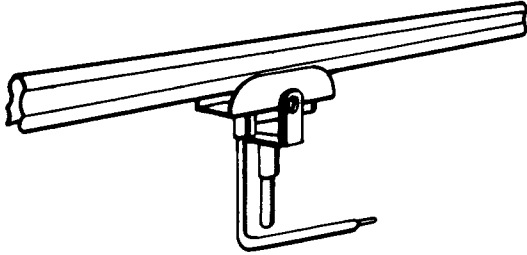
crane, pulpit-operated: a crane operated from a fixed operator station not attached to the crane.

crane, remote-operated: a crane controlled by an operator not in a pulpit nor in the cab attached to the crane, and controlled by any method other than a means suspended from the crane.

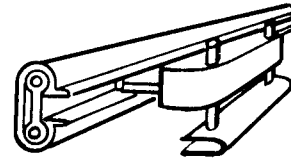
crane, semigantry: a crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail, the other end of the bridge being supported by an end truck suspended from an elevated track (see Fig. 11-0.2-5).

crane, single-girder: a crane having one bridge girder mounted between, and supported from, the end trucks.

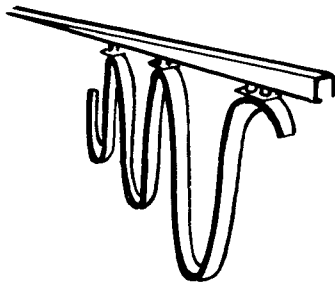
Fig. 11-0.2-2 Examples of Styles of Electrification



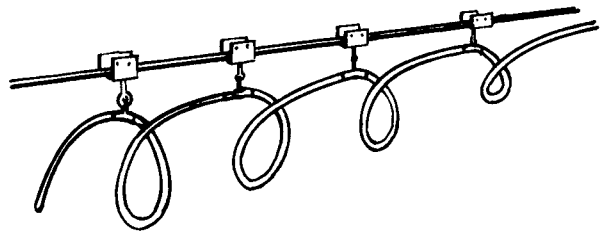
(a) Single Conductor (Bottom Entry)



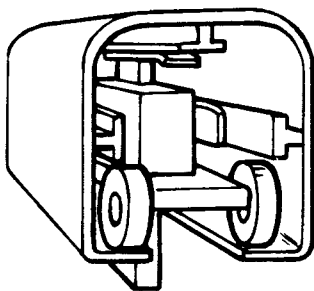
(b) Single Conductor (Side Entry)



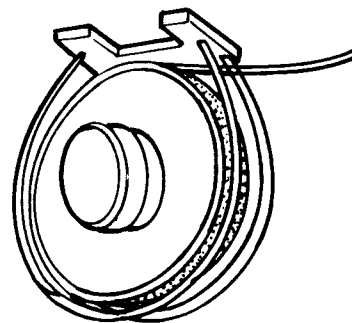
(c) Festooned Flat Cable



(d) Festooned Round Cable

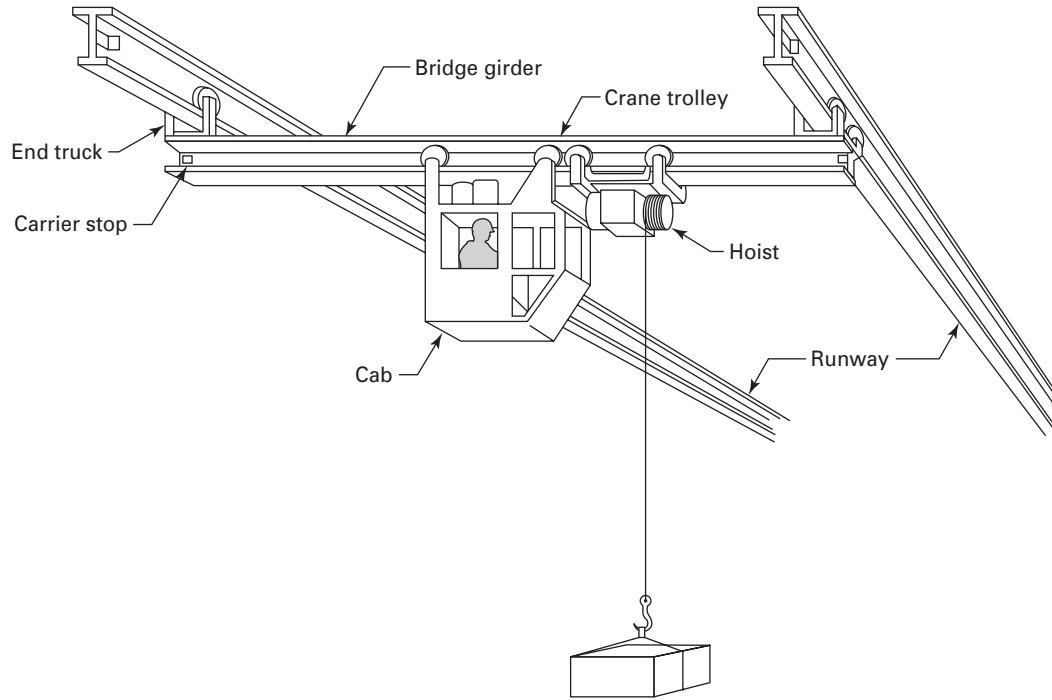


(e) Multi-Conductor Enclosed Bar

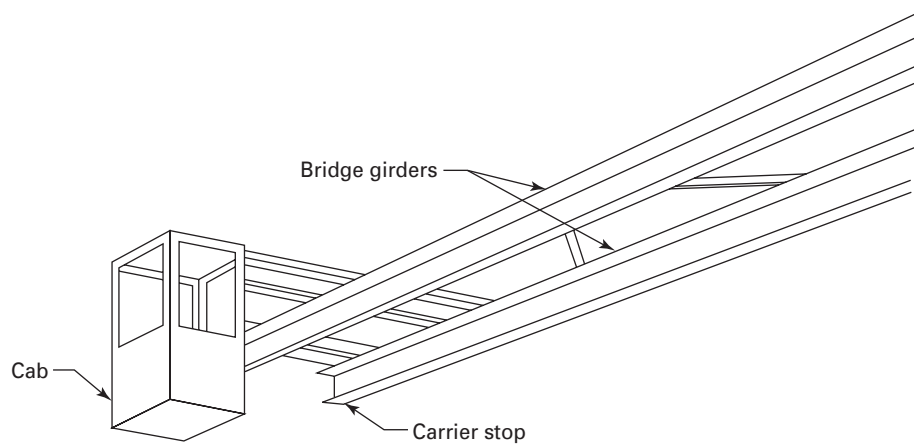


(f) Cable Reel

Fig. 11-0.2-3 Cab-Operated Cranes

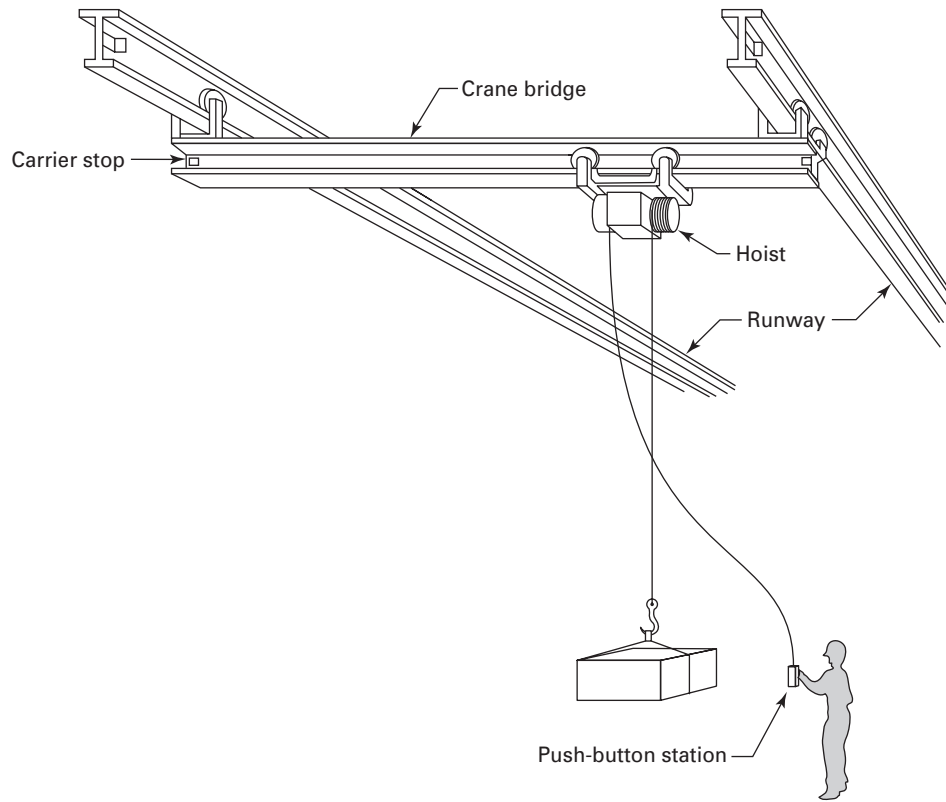


(a) Cab-Operated Crane

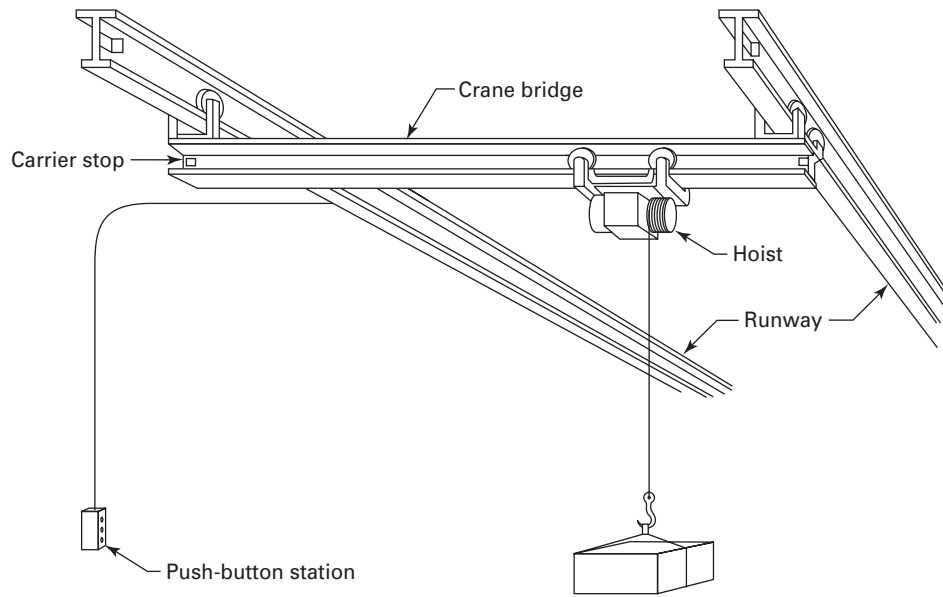


(b) Cab Fixed on Crane

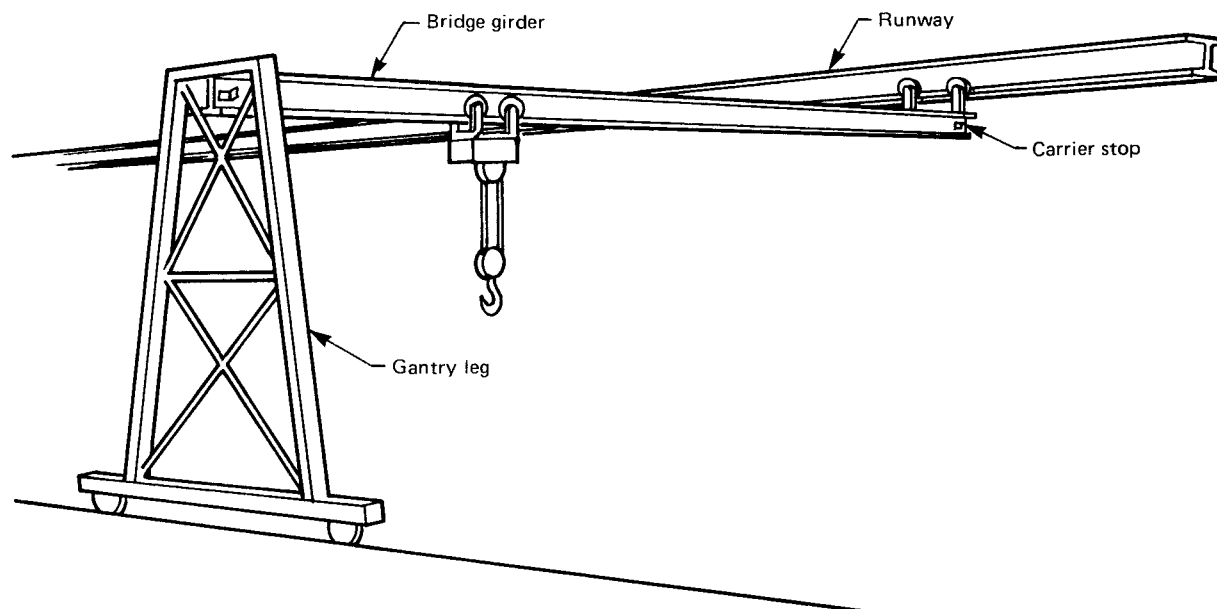
Fig. 11-0.2-4 Floor-Operated Cranes



(a) Hand-Held Push Button



(b) Wall-Mounted Push Button

Fig. 11-0.2-5 Semigantry Crane

crane, underhung: a crane with a single- or multiple-girder movable bridge carrying a movable or fixed hoisting mechanism and traveling on the lower flanges of an overhead runway (see Figs. 11-0.2-3 and 11-0.2-4).

designated person: a person selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

drop section: (also known as lift section) a mechanism that will permit a section of track(s) to be lifted or lowered out of alignment with the stationary track(s) (see Fig. 11-0.2-6).

electric baffle: conductors that are wired to cut off electric power to approaching motor-driven equipment if track switches, drop sections, and other movable track devices are not properly set for passage of equipment.

end truck: an assembly consisting of the frame and wheels which support the crane girder(s) and allow movement along the runway.

fixed transfer section: (also known as crossover) a connecting track with an interlock mechanism on both ends, mounted between two interlocking cranes, used to transfer a carrier from one bridge to the other.

hanger rod: a steel rod which, together with other fittings, is used to suspend the track from the supporting structure.

hoist: a suspended machinery unit that is used for lifting and lowering a freely suspended (unguided) load.

interlocking mechanism: a mechanical device to lock together the adjacent ends of two cranes, or a crane to

a fixed transfer section or spur track, to permit the transfer of carriers from one crane or track to the other (see Fig. 11-0.2-7).

jib boom: a horizontal cantilever track for supporting the carrier (see Fig. 11-0.2-8).

limit device: a device which is operated by some part or motion of power-driven equipment to limit motion.

load bar: a load-carrying member between carriers.

load block: the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoist rope or load chain. This shall include any appurtenances reeved in the hoisting rope or load chain.

master switch: a device that dominates the operation of contactors and auxiliary devices of an enclosed circuit.

monorail: a single run of overhead track on which carriers travel.

monorail system: a machine for lifting and lowering a load and moving it horizontally, suspended from a single track.

normal operating conditions (of cab-operated cranes or carriers): conditions during which a crane or carrier is performing functions within the scope of the original design. Under these conditions, the operator is at the operating control devices and no other person is on the crane or carrier.

normal operating conditions (of floor-operated cranes or carriers): conditions during which a crane or carrier is performing functions within the scope of the original design. Under these conditions, the operator is at the

Fig. 11-0.2-6 Drop Section (Lift Section)

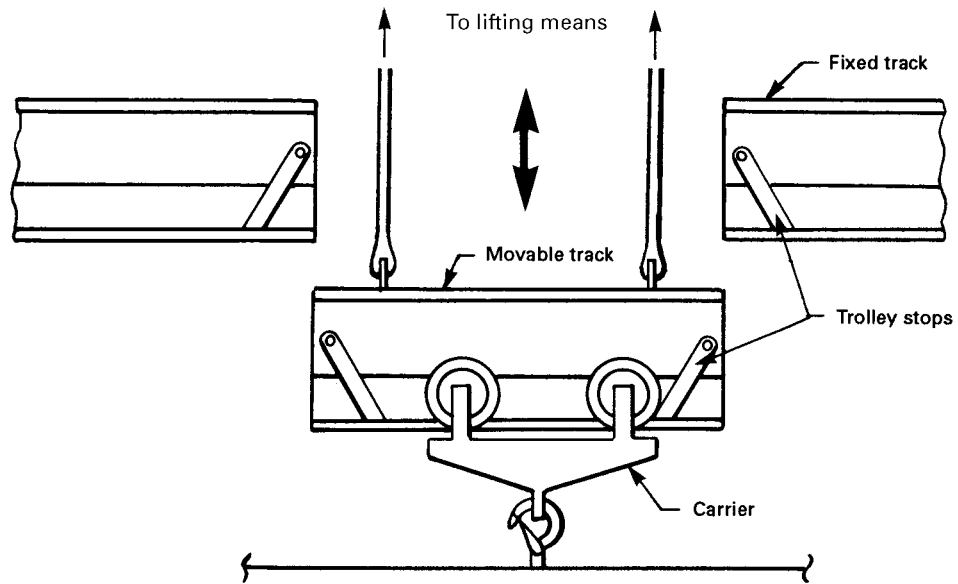


Fig. 11-0.2-7 Interlocking System for Underhung Crane

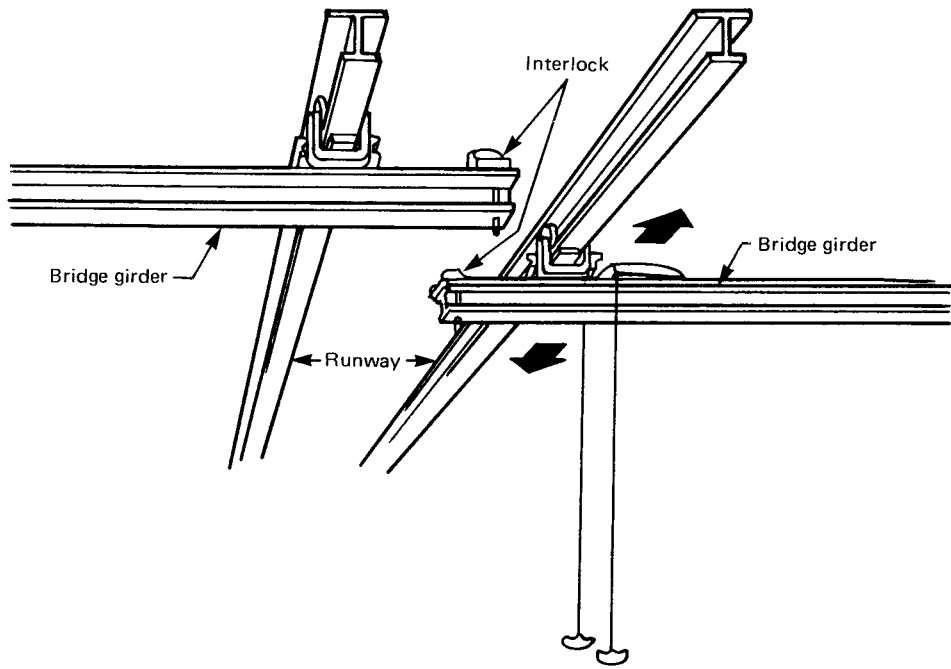
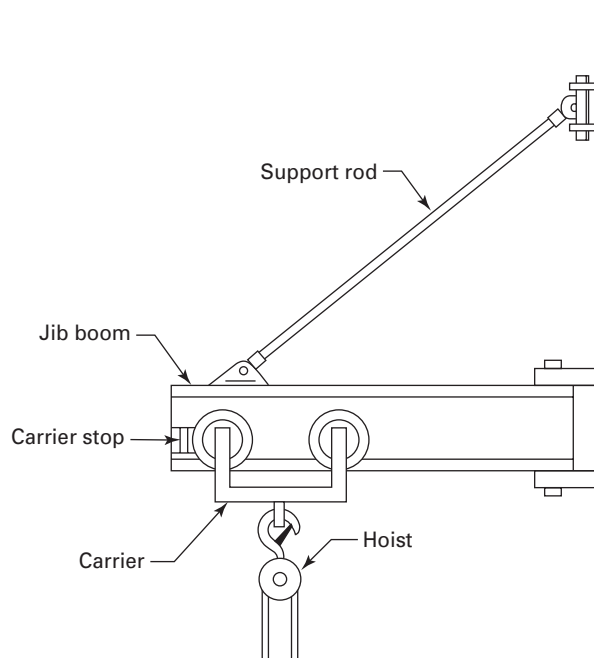


Fig. 11-0.2-8 Wall-Supported Jib Crane

operating control devices that are attached to the crane or carrier but operated with the operator off the crane or carrier, and with no person on the crane or carrier.

normal operating conditions (of remote-operated cranes or carriers): conditions during which a crane or carrier is performing functions within the scope of the original design. Under these conditions, the operator is at the operating control devices that are not attached to any part of the crane or carrier.

normal walking speed: a walking speed assumed to be 150 ft/min (46 m/min).

push-button station: an electrical control device consisting of push-button-operated contacts, in an enclosure used by the operator for control of the powered motions of the crane, carrier, hoist, and other auxiliary equipment.

qualified person: a person who, by possession of a recognized degree in an applicable field, or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

radio controlled: a crane or carrier operated from a radio transmitter located at a point not mechanically attached to the device being controlled.

rated load: the maximum load, designated by the manufacturer or qualified person, for which the crane or monorail system is designed and built.

remote controlled: controlled by a control station located at a point not mechanically attached to the device being controlled.

rope: refers to wire rope unless otherwise specified.

runway: the tracks from which the underhung crane is suspended.

service, heavy: that service which involves operation within the rated load limit which exceeds normal service.

service, normal: that service which involves operation with randomly distributed loads within the rated load limit, or uniform loads of less than 65% of the rated load for not more than 15% of the time for manually operated hoists, and 25% of the time for electric or pneumatic-powered hoists, of a single work shift.

service, severe: that service which involves normal or heavy service with abnormal operating conditions.

shall: the word "shall" indicates that the rule is mandatory and must be followed.

should: the word "should" indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

side pull: the component of the hoist pull acting horizontally when the hoist lines are not operated vertically.

splice: a mechanical device used to join the adjacent ends of track sections.

spur track: a fixed track arranged to interlock with an adjacent crane girder to permit passage of carriers from the spur track to the crane, and vice versa.

standby equipment: equipment that is not in regular service but which is used occasionally or intermittently as required.

stop: a device to limit travel of a carrier or crane and which normally does not have energy-absorbing ability.

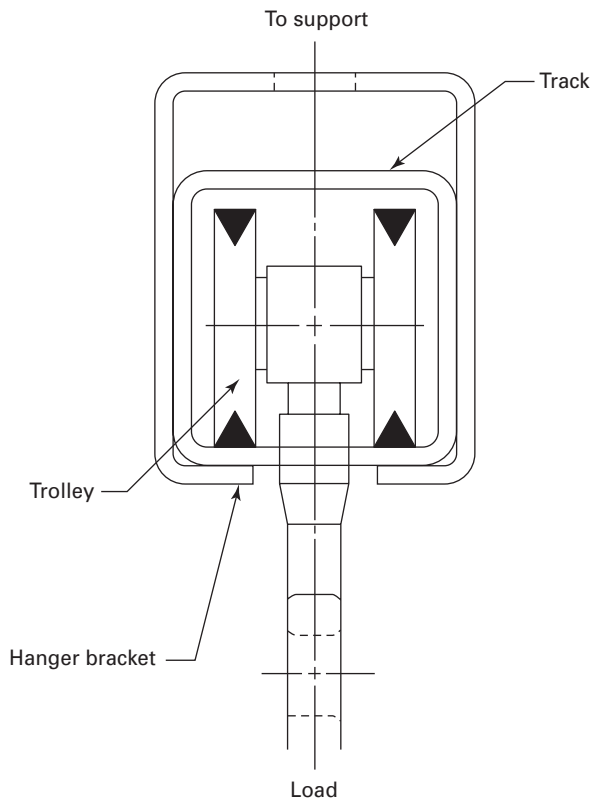
support system: those components whose sole purpose is to suspend or support the crane runway, monorail, jib boom, or other equipment system components. These support system components include, but are not limited to, hanger rods, track hangers, clamps, sway bracing, and fasteners.

switch, cross-track: a track switch containing one straight section of track, pivoted about the center, which can be rotated to align with other crossing tracks to allow passage of the carrier through the junction without changing the direction of the carrier motion.

switch, glide (slider): a track switch with a movable inner frame containing straight or curved sections of track. The inner frame can be moved to align these sections of track with other fixed tracks to permit routing of carriers.

switch, tongue: a track switch containing one straight section of track, pivoted at one end, which can be swung to various positions to connect with fixed tracks for routing of carriers.

Fig. 11-0.2-9 Example of One Type of Enclosed Track and Support Bracket



switch, track: a device with a moving section of track that can be moved to permit passage of a carrier from incoming fixed track(s) to outgoing fixed track(s).

track: the structural member that supports the carrier or crane wheels.

track, enclosed: a structural member, generally in the shape of a rectangular tube, with a continuous slot running lengthwise along the underside that permits end trucks or carriers (trolleys) to travel on the interior bottom flange (see Fig. 11-0.2-9).

track curves: curved sections of monorail track used to change the direction of carrier travel.

track hangers: fittings used to suspend the track from the supporting structure.

track joint: the point at which two sections of track are joined together.

track opener: a section of monorail track arranged to lift or swing out of line to make an opening through which a door may pass.

turntable: a track device with a movable inner frame containing a straight section of track that can be rotated with a loaded carrier on it to align the section of track with other tracks for the transfer of carriers from one track to another.

yoke: a frame on which a pair of load-carrying wheels are mounted.

SECTION 11-0.3 REFERENCES

(10)

The following is a list of publications referenced in this Standard.

AA ADM-1-2005, Aluminum Design Manual

Publisher: Aluminum Association, Inc. (AA), 1525 Wilson Boulevard, Arlington, VA 22209 (www.aluminum.org)

ALI A14.3-2008, Safety Requirements for Fixed Ladders

Publisher: American Ladder Institute (ALI), 401 North Michigan Avenue, Chicago, IL 60611 (www.americanladderinstitute.org)

ANSI/AWS D1.1-2008, Structural Welding Code — Steel

ANSI/AWS D14.1-2005, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment

Publisher: American Welding Society (AWS), 550 NW Le Jeune Road, Miami, FL 33126 (www.aws.org)

ANSI MH27.1-2003, Specifications for Underhung Cranes and Monorail Systems

ANSI MH27.2-2003, Specifications for Enclosed Track Underhung Cranes and Monorail Systems

Publisher: Monorail Manufacturers Association, Inc. (MMA), 8720 Red Oak Boulevard, Suite 201, Charlotte, NC 28217 (www.mhia.org/MMA)

ANSI/NFPA 70-2005, National Electrical Code

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269 (www.nfpa.org)

ASME B30.9-2006, Slings

ASME B30.10-2005, Hooks

ASME B30.16-2007, Overhead Hoists (Underhung)

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASSE A1264.1-2007, Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems

ASSE Z244.1-2003, Control of Hazardous Energy Lockout/Tagout and Alternative Methods

Publisher: American Society of Safety Engineers (ASSE), 1800 East Oakton Street, Des Plaines, IL 60018-2187 (www.asse.org)

ASTM E 2349-2005, Safety Requirements for Melting and Pouring of Metals in the Metalcasting Industry

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428 (www.astm.org)

CMAA Specification No. 74-2004, Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist

Publisher: Crane Manufacturers Association of America, Inc. (CMAA), 8720 Red Oak Boulevard, Charlotte, NC 28217 (www.mhia.org/CMMA)

SAE Z26.1-1996, Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways

Publisher: Society of Automotive Engineers, (SAE), 400 Commonwealth Drive, Warrendale, PA 15096 (www.sae.org)

The Manual of Steel Construction, 13th ed., 2005

Publisher: American Institute of Steel Construction (AISC), One East Wacker Drive, Suite 3100, Chicago, IL 60601 (www.aisc.org)

Chapter 11-1

Construction and Installation

SECTION 11-1.1 MARKINGS

(10) 11-1.1.1 Cranes

The rated load of the crane shall be marked on the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on the hoist or its load block so that the rated load marking shall be legible from the ground or floor. The combined load on all hoists on the crane shall not exceed the rated load of the crane.

(10) 11-1.1.2 Monorails

The rated load of the monorail should be marked on the monorail. If the rated load is marked, it shall be legible from the ground or floor. The combined load on all hoists on the monorail shall not exceed the rated load of the monorail.

(10) 11-1.1.3 Hoists

The rated load of each hoist on a monorail shall be marked in accordance with ASME B30.16.

(10) 11-1.1.4 Trolleys

The rated load, the equipment manufacturer's name, and the model number or serial number shall be marked on each trolley.

11-1.1.5 Warnings

(a) On floor-operated hoists, warnings are to be in accordance with ASME B30.16.

(b) On cab-operated hoists, warnings for hoisting shall be displayed in a readable position in the cab and in accordance with ASME B30.16.

(10) 11-1.1.6 Controls

(a) Each control actuator shall be legibly marked to indicate the function and direction of movement.

(b) In locations or areas where multiple systems are used by nondedicated operators, the arrangement of control markings for function and directions should be the same for all crane and monorail systems in that location or area.

SECTION 11-1.2 CLEARANCES

11-1.2.1 Clearances From Obstructions

In the design of crane or monorail systems, all factors that influence clearances, such as wheel float, truss sag, and bridge or carrier skewing, shall be considered.

11-1.2.2 Clearances Between Parallel Cranes

(a) If the runways of two noninterlocking cranes are parallel and there are no intervening walls or structures, there shall be clearance provided and maintained between the two cranes.

(b) Where two cranes on parallel runways are designed for interlocking transfer of the carrier(s), means shall be provided to maintain clearance between the cranes so that the interlocking ends of the crane girders do not strike each other when passing, and so that the interlocking ends of the crane girders do not strike a fixed interlocking crossover or spur track.

11-1.2.3 Clearances at Curves

Clearances shall be provided at the curves of a monorail system to allow for the swing of the load when negotiating the curve. The amount of this clearance shall be determined by giving due consideration to the size, weight, and speed of the carrier and the radius of the track curve.

SECTION 11-1.3 GENERAL CONSTRUCTION

11-1.3.1 Crane Runways and Monorail Tracks

(10)

(a) Crane runways, monorails, support systems, and supporting structures shall be designed to withstand the loads and forces imposed by the cranes and carriers.

(b) The structure shall be free from detrimental vibrations under normal operating conditions.

(c) Track sections shall be installed with splices that ensure proper alignment of the surface and sides of the load-carrying flange.

(d) Runway tracks shall be spaced to be compatible with the span and design of the crane.

(e) Where curves are required, special design will be necessary.

(f) Where change in elevation of the track is required, special design will be necessary.

(g) Stops shall be provided at the ends of the carrier or crane travel to prevent the carrier or crane from inadvertently coming off the track or contacting an obstruction. Stops shall be provided at open ends of tracks, such as at interlocking crossovers, track spurs, track openers, and track switches. Stops shall resist impact forces of a fully loaded carrier or crane traveling at 50% of the rated full-load speed.

(10) 11-1.3.2 Track Supports

(a) Crane runways or monorail tracks shall be fastened to a supporting structure by means of a support system.

(b) All support system components shall be designed to withstand the loads and forces imposed by the cranes or carriers. Hanger rods shall be installed plumb within the manufacturer's tolerances.

(c) Where multiple hanger rods are used at a suspension point, consideration should be given to the unequal load induced in the rods.

(d) Means shall be provided to restrain the track against damaging lateral and longitudinal movement.

(e) Where the track is suspended from hanger rod assemblies, restraining means shall be provided to prevent the hanger rod nuts from backing off the hanger rods.

(f) All track and track supports built after the issuance of this Volume should conform to the minimum design parameters as specified in ANSI MH27.1, ANSI MH27.2, The Manual of Steel Construction, and the Specification for Aluminum Structures, as applicable.

(10) 11-1.3.3 Cranes and Monorail Systems

All cranes and monorail systems built after the issuance of this Standard should conform to the minimum design parameters as specified in The Manual of Steel Construction, CMAA No. 74, ANSI MH27.1, or ANSI MH27.2, as applicable.

(10) 11-1.3.4 Welded Construction

All welding procedures and welding operator qualifications to be used on load-sustaining members of cranes and monorail systems shall conform to ANSI/AWS D14.1. Where field welding of track supports is done, welding shall be done in accordance with ANSI/AWS D1.1.

11-1.3.5 Modifications

The crane and monorail systems may be modified or rerated, provided such modifications and the supporting structure are analyzed by a qualified person or manufacturer of the equipment. A rerated system or one whose load-supporting components have been modified shall be tested in accordance with Section 11-2.2. The new rated load shall be displayed in accordance with Section 11-1.1.

SECTION 11-1.4 TRACK SWITCHES, TRACK OPENERS, AND INTERLOCKS**11-1.4.1 Track Switches**

(a) All track switches shall be constructed and installed to maintain alignment with incoming and outgoing tracks. Control chains or ropes for hand-operated track switches, push buttons for electrically operated

track switches, and operator-controlled valves for pneumatic or hydraulically operated track switches shall be located within reach of the operator.

(b) Stops shall be provided as an integral part of the switch to protect the end of an incoming track when the switch track is not aligned with the incoming track.

(c) Track switches should not be shifted with a carrier on the movable track. Means shall be provided to prevent a carrier on the movable track from running off the movable track when it is not aligned with an outgoing track.

(d) Means shall be provided to hold the movable frame in a stationary position during passage of carriers through the track switch.

(e) Electric baffles shall be provided on track switches and incoming tracks on systems with cab control, automatic dispatch carriers, or molten material carriers as required in ANSI Z241.2. Baffles shall prevent carrier contact with the end of an incoming track when the switch track is not aligned with the incoming track. Baffles shall also prevent the carrier or load from interfering with a carrier or load on an adjacent track.

11-1.4.2 Track Openers

Stops shall be provided to prevent a crane from running off either of the open ends of the track when the movable section is not in alignment with the track.

11-1.4.3 Interlocks

(a) Interlocking mechanisms for transfer and interlocking cranes shall maintain alignment of the bridge girder(s) with spur tracks, fixed transfer sections, or bridge girder(s) of interlocking cranes operating on adjacent runways to permit the transfer of a carrier from one to the other.

(b) Stops shall be an integral part of the interlock mechanism. When bridge girders and spur tracks or fixed transfer sections are aligned and interlock mechanisms are engaged, stops shall be in the open position to permit transfer of a carrier from one to the other. When bridge girders and spur tracks or fixed transfer sections are not aligned, or interlock mechanisms are disengaged, stops shall be in the closed position and shall prevent carriers from rolling off the end of spur tracks, transfer sections, or bridge girders.

SECTION 11-1.5 VERTICAL DROP OR LIFT SECTIONS**11-1.5.1 Carrier Passage**

Vertical drop or lift sections shall maintain alignment of the fixed tracks and the movable tracks to enable the passage of a carrier.

11-1.5.2 Carrier Run Off Protection

Means shall be provided to prevent a carrier from running off either end of the movable track when the movable track is not in alignment with the fixed tracks.

11-1.5.3 Stops

Stops shall prevent a carrier from running off the open ends of the fixed tracks when the movable track is not in alignment with the fixed tracks.

11-1.5.4 Baffles

Electric baffles shall be provided on fixed and movable tracks on systems with cab-operated carriers, automatic dispatch carriers, or molten material carriers. They shall limit carrier travel when the movable track is not in alignment with the fixed track. They shall also prevent the load from contacting another load on the movable track.

SECTION 11-1.6 CABS, NORMAL OR SKELETON (IF PROVIDED)

11-1.6.1 Cab Location and Internal Arrangement

(a) The general arrangement of the cab and the location of the control and protective equipment should be such that all operating control devices are within reach of the operator when facing the area to be served by the load block, or while facing in the direction of travel of the cab.

(b) The arrangement of the cab should allow the operator to view the load block in all positions. When physical arrangements obscure the operator's view, the operator shall be aided by other means such as, but not limited to, closed circuit TV, mirrors, radio, telephone, or a signal person.

(c) The cab shall be clear of all fixed structures within its area of movement.

(d) The clearance of the cab above the working floor or passageway should not be less than 7 ft (2.1 m), except when operations require dimensions that are less. In this case, precautions shall be taken during the operation of the crane or carrier to keep personnel and other obstructions clear of the low overhead cab.

11-1.6.2 Cab Construction

(a) Where the cab operates on a single track, the cab may be mounted on a separate carrier or can be an integral part of the hoist carrier. On double-girder cranes, the cab shall be rigidly attached to the carrier or the crane to minimize swing.

(b) If an integral outside platform is provided, the door (if provided) shall slide or open outward.

(c) In the absence of an outside platform, the door (if provided) shall slide or open inward and shall be self-closing. It shall be equipped with a latching device.

(d) Guardrails and toeboards shall be in compliance with ASSE A1264.1.

(e) Outdoor cabs should be enclosed. All cab glazing shall be of safety glazing material as defined in SAE Z26.1.

(f) Where a danger from falling objects exists, the cab construction shall offer protection. The protection shall support a minimum static load of 50 lb/ft² (2.4 kPa).

(g) If the cab of a hot molten material crane or carrier is exposed to heat, it shall be provided with the following or equivalent protection:

(1) Where the cab is located near the source of radiant heat, the cab shall be protected by a heat shield located between the cab and heat source.

(2) Cab areas that are subjected to molten metal spatter shall be shielded, or have heat and spatter resistant clear panels or heat screens where required, to provide operator vision and protection.

(3) The floor shall be thermally insulated.

11-1.6.3 Access to Cab

Access to the cab shall be by a fixed ladder, stairs, or platform requiring no step over any gap exceeding 12 in. (305 mm). Fixed ladders shall be in conformance with ALI A14.3.

11-1.6.4 Toolbox

If a receptacle is provided for the stowing of tools and oil cans, it shall be metal and securely fastened in the cab.

11-1.6.5 Fire Extinguisher

A portable fire extinguisher with a basic minimum extinguisher rating of 10 BC shall be installed in the cab.

11-1.6.6 Lighting

Cab lighting, either natural or artificial, shall provide a level of illumination that enables the operator to observe the operating controls.

11-1.6.7 Egress

There should be means of egress from cab-operated cranes or carriers to permit departure under emergency conditions. The means of egress should depend upon the facts of the situation.

SECTION 11-1.7 GUARDS AND LUGS

11-1.7.1 Guards for Moving Parts

(a) Exposed moving parts, such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components that constitute a hazard under normal operating conditions, shall be guarded.

(b) Each guard shall be capable of supporting 200 lb (90 kg), without permanent deformation, unless the guard is located where it is not probable for a person to step on it.

11-1.7.2 Guards for Hoisting Ropes

(a) If it is possible for hoisting ropes to foul or chafe on adjacent parts of the crane under normal operating conditions, guards shall be installed to minimize damage to the rope.

(b) A guard shall be provided to prevent contact between bridge or runway conductors and hoisting ropes, if under normal operating conditions they can come into contact.

11-1.7.3 Lugs

Means shall be provided to limit the drop of a bridge end truck frame in case of wheel, axle, or load bar failure, and shall be located on both sides of the track to provide central loading of the track about the vertical axis if failure occurs.

SECTION 11-1.8 BRAKES

11-1.8.1 Hoisting Brakes

Hoisting brakes shall conform to ASME B30.16.

11-1.8.2 Brakes for Bridge and Carrier Travel (Cab Operated)

(a) Foot-operated brakes shall require an applied force of not more than 70 lb (310 N) to develop rated brake torque.

(b) Brake pedal(s), latches, and levers should allow release without the exertion of greater force than was used in applying the brake.

(c) Foot-operated brakes shall be equipped with a means for positive release when force is released from the pedal.

(d) The foot brake pedals shall be so located that they are convenient to the operator.

(e) Brakes for stopping the motion of the carrier or bridge shall have torque capability to stop the carrier or bridge within a distance in ft (m) equal to 10% of the rated load speed in ft/min (m/min) when traveling at full speed with rated load, and with power off.

(f) All foot brake pedals shall be constructed so that the operator's foot will not readily slip off the pedal.

(g) If parking brakes are provided on the bridge or carrier, they shall not prohibit the use of a drift point in the control circuit.

(h) Brakes shall have the thermal capacity for the frequency of operation required by the service.

11-1.8.3 Brakes for Power-Operated Bridges and Carriers (Floor- and Remote-Operated, Including Skeleton Cab-Operated)

Brakes, if provided, shall meet the requirements of paras. 11-1.8.2(e), (g), and (h).

11-1.8.4 Application of Brakes

(a) On cab-operated cranes with cab on bridge, a bridge brake shall be provided and shall meet the requirements of para. 11-1.8.2.

(b) On cab-operated cranes with cab on carrier, carrier and bridge brakes shall be provided and shall meet the requirements of para. 11-1.8.2.

(c) On cab-operated carriers operating on a monorail, a carrier brake(s) shall be provided and shall meet the requirements of para. 11-1.8.2.

(d) On all floor and remote-operated cranes or carriers, a travel brake(s) is not required, provided that, in case of power failure, the travel motion can be retarded and stopped within the travel distance specified in para. 11-1.8.2(e). If this requirement cannot be complied with, a brake or noncoasting mechanical drive shall be provided and shall meet the requirements of para. 11-1.8.3.

SECTION 11-1.9 ELECTRICAL EQUIPMENT

11-1.9.1 General

(a) Wiring and equipment shall comply with Article 610 of ANSI/NFPA 70.

(b) The control circuit voltage shall not exceed 600 V for AC or DC.

(c) The voltage at pendant push buttons shall not exceed 150 V for AC or 300 V for DC.

(d) Where multiple-conductor cable is used with a suspended push-button station, the station shall be supported so that electrical conductors are protected from strain.

(e) Pendant control stations shall be constructed to prevent electrical shock. The push-button enclosure shall be at ground potential and marked for identification of functions.

11-1.9.2 Equipment

(a) Electrical equipment shall be so located or enclosed that live parts will not be exposed to inadvertent contact under normal operating conditions.

(b) Live parts of electrical equipment shall be protected from direct exposure to grease and oil, and should be protected from dirt and moisture.

(c) Guards for live parts, if provided, shall be so located that they cannot be accidentally deformed so as to make contact with the live parts.

11-1.9.3 Controls

(a) Cab-Operated Controls

(1) Lever-operated manual controllers and master switches shall be provided with an off-position notch or latch. A spring return to the off position is acceptable.

(2) The operating handle for manual controller or master switch shall be located within reach of the operator.

(3) The movement of the handle of each manual controller or master switch should be in the same general direction as the resultant movements of the load, except as shown in Figs. 11-1.9.3-1 and 11-1.9.3-2.

(4) The arrangement of controllers or master switches should conform to Figs. 11-1.9.3-1 and 11-1.9.3-2.

(b) Floor-Operated Controls

(1) For floor-operated cranes or carriers, the controller or controllers, if rope operated, shall automatically return to the off position when released.

(2) Pendant push buttons that control motion shall return to the off position when pressure is released by the operator.

(3) The arrangement of pendant push buttons should conform to Fig. 11-1.9.3-3.

(c) Automatic and Remote Controls

(1) Automatic cranes or carriers shall be so designed that operation of all motions shall be discontinued if the automatic sequence control becomes ineffective. Completion of the last command is permissible if power is available.

(2) Remote-operated cranes or carriers shall function so that if the control signal for any crane or carrier motion becomes ineffective, that crane or carrier motion shall stop. Conversely, signals received from any source other than the operating station (transmitter) shall not result in operation of any motion of the crane or carrier.

(3) The arrangement of radio-controlled crane transmitters should conform to Fig. 11-1.9.3-4.

11-1.9.4 Resistors (if Provided)

(a) Resistor units shall be supported to minimize vibration effect.

(b) Provisions shall be made to prevent broken parts or molten metal from falling upon the operator or from the crane or carrier.

(c) If resistor enclosures are provided, the enclosures shall be installed to prevent the accumulation of combustible matter.

11-1.9.5 Switches

(a) The electrical supply to runway or monorail conductors shall be controlled by a switch or circuit breaker located on a fixed structure, accessible from the floor, with provision for being locked in an open position.

(b) On cab-operated cranes or carriers, a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway or monorail conductors. A means of opening this device shall be located within reach of the operator from the operating position. When the operator opens this switch or circuit breaker, the electric brakes shall set.

(c) On floor- or remote-operated cranes, a disconnect device of the enclosed type shall be provided in the leads from the runway conductors. This device should be mounted on the bridge near the runway collectors. There shall be provisions for locking the device in the open position, unless the crane is the only load on a lockable switch or circuit breaker that is located in the general area of the crane. One of the following types of floor- or remote-operated disconnects shall be provided:

(1) a nonconductive rope attached to the main disconnect device on a floor-operated crane. If this is selected, the rope shall be suspended adjacent to the operating ropes if manual controllers are used, or near the pendant push-button station if magnetic controls are used.

(2) an undervoltage trip for the main circuit breaker, operated by an emergency stop button accessible to the operator.

(3) a main line contactor operated by a switch or push button accessible to the operator.

11-1.9.6 Runway, Monorail, and Bridge Conductors

Runway, monorail, and bridge conductors shall be guarded or located to minimize inadvertent contact with the conductor.

SECTION 11-1.10 HOISTING EQUIPMENT

Manual or powered hoist units used as part of a monorail or underhung crane system shall comply with requirements as stated in ASME B30.16.

SECTION 11-1.11 WARNING DEVICES

On cab- and remote-operated cranes or carriers, an audible or visual warning means shall be provided.

SECTION 11-1.12 INSTALLATION

(10)

The installation of crane and monorail systems shall be in accordance with the equipment manufacturer's recommendations.

SECTION 11-1.13 CARRIERS (TROLLEYS)

(10)

(a) Trolley wheel configuration shall be matched to the rail shape and size (see Fig. 11-1.13-1).

(b) The trolley shall be suitable to operate on the minimum radius and contour of the beam.

(c) Refer to the equipment manufacturer, the operating manual, or other technical information from the manufacturer or a qualified person for suitable equipment application.

(d) Adjust the trolley for proper fit and clearance for the application as referenced in the manual provided with the equipment (see Fig. 11-1.13-2).

Fig. 11-1.9.3-1 Recommended Arrangement of Controllers (Three-Motor Crane)

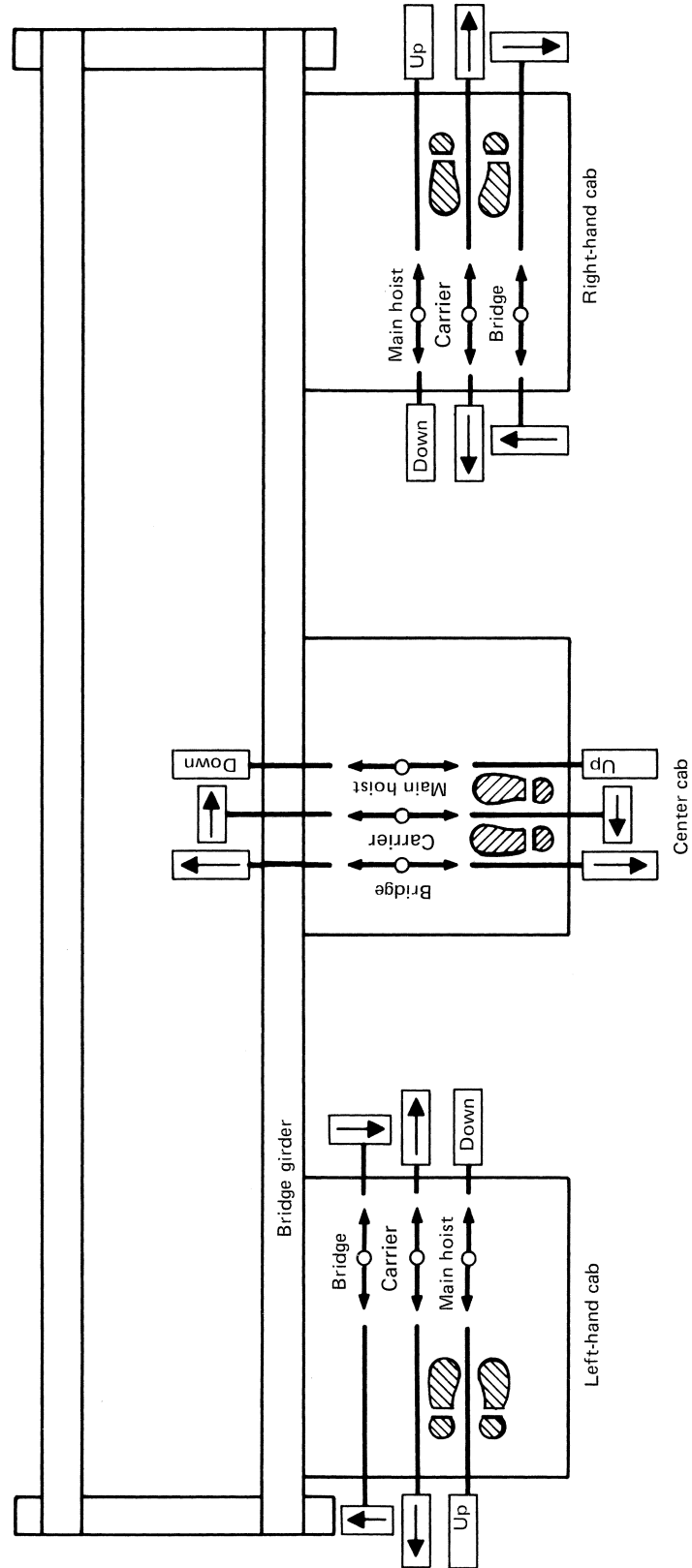


Fig. 11-1.9.3-2 Recommended Arrangement of Controllers (Four-Motor Crane)

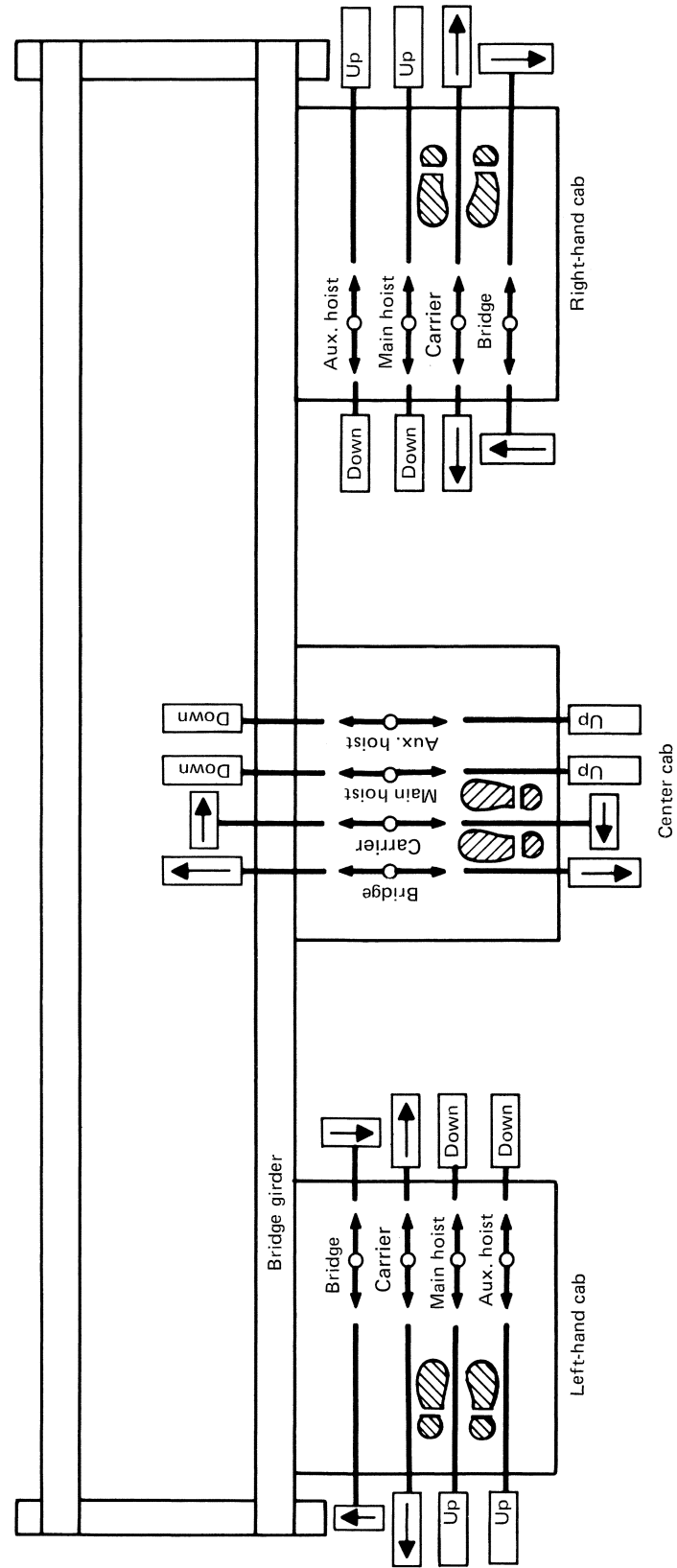


Fig. 11-1.9.3-3 Recommended Arrangement of Controllers (Pendant Push-Button Station Arrangement)

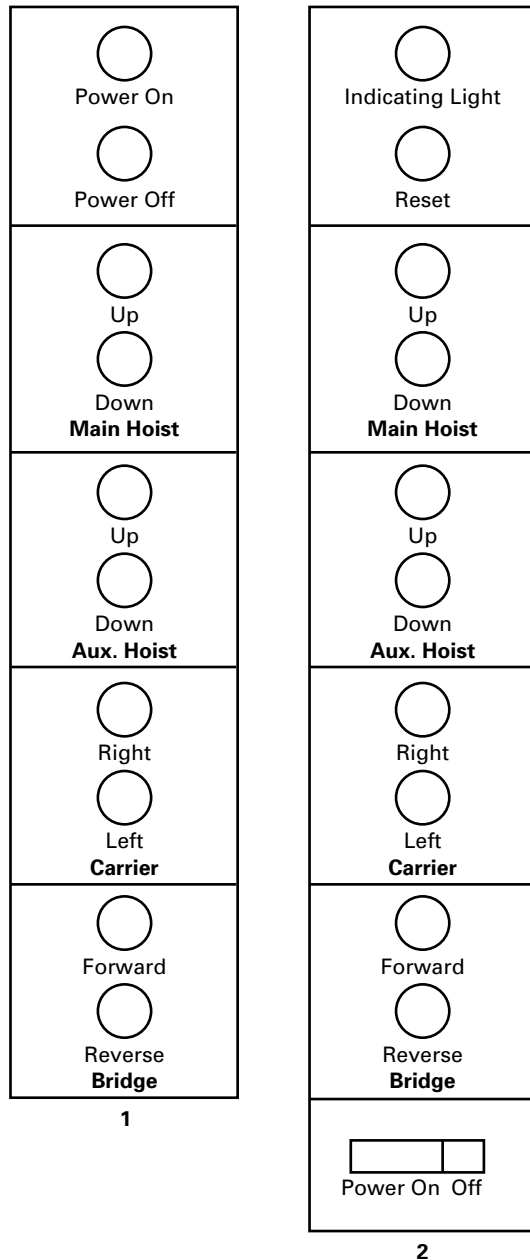
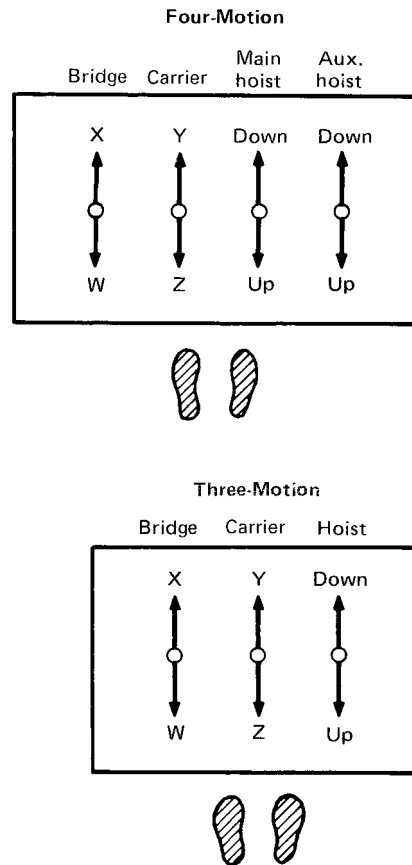


Fig. 11-1.9.3-4 Recommended Arrangement of Controllers (Radio Crane Control Transmitter Lever Arrangement)



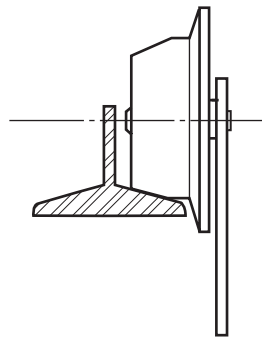
GENERAL NOTE: Markings on the crane, visible from the floor, shall indicate the direction of bridge and carrier travel corresponding to the W, X, Y, and Z designations on the transmitter. The letters used are only intended for the purpose of illustration.

Designations should be selected as appropriate to each operation. The designation may appear below, above, on, or adjacent to, the button controlling the respective operation.

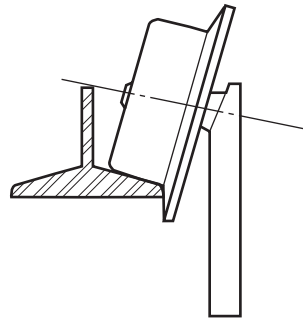
GENERAL NOTE: In each user location, the relative arrangement of units on crane pendant push-button stations should be standardized. In the absence of such standardization, suggested arrangements are shown in arrangements 1 and 2.

Fig. 11-1.13-1 Recommended Trolley Wheel Configurations

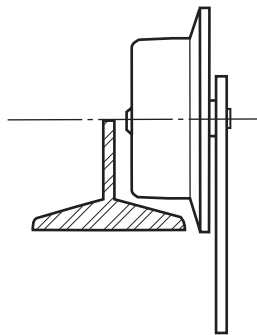
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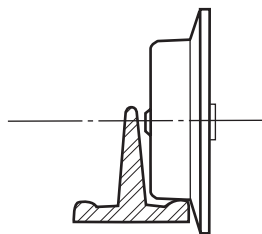
Detail A-I: Beam With Crown Tread Wheel (Preferred)



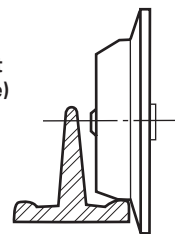
Detail B-I: Beam With Canted Flat Tread Wheel (Acceptable)



Detail C-I: Beam With Flat Tread Wheel (Unacceptable)



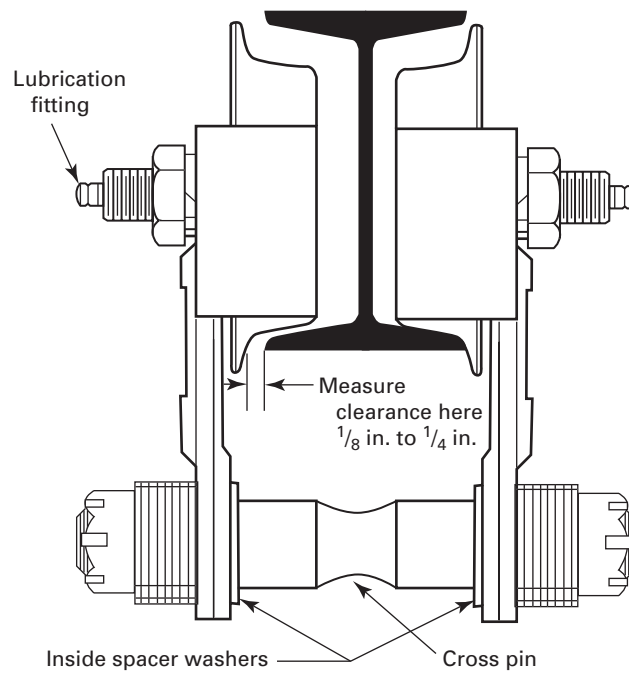
Detail D: Patented Rail With Flat Tread Wheel (Preferred)



Detail E: Patented Rail With Crown Tread Wheel (Acceptable)

(10)

Fig. 11-1.13-2 Recommended Trolley Fit



**Spacer Washer Arrangement
(Minimum Flange Width Shown)**

GENERAL NOTE: To adjust for wider flange widths, use additional washers inside as required, in equal numbers at each side of cross pin.

Chapter 11-2

Inspection and Testing

This Chapter establishes and defines the criteria for determining whether cranes, crane runways, monorail systems, and support systems can be expected to perform as intended.

SECTION 11-2.1 INSPECTION

11-2.1.1 General

(a) There are five types of inspections required, each directed toward a different set of circumstances. They are

- (1) initial inspection
- (2) functional test inspection
- (3) frequent inspection
- (4) periodic inspection
- (5) inspection of equipment not in regular use

(b) In addition, the inspection and testing shall be based on the recommendations in the equipment manufacturer's manual; and, when appropriate, recommendations by a qualified person based upon review of the equipment application and operation.

11-2.1.2 Initial Inspection

(a) An initial inspection is a visual and audible examination of the crane, the runway, monorail systems, and the support system by a designated person.

(b) New, reinstalled, altered, repaired, modified equipment, and supporting structures shall be inspected by a designated person prior to initial use to verify compliance with applicable provisions of Section 11-2.1 of this Volume.

(c) Inspection of altered, repaired, and modified equipment may be limited to the parts of the crane, runway, monorail systems, or support system affected by the alteration, repair, or modification, as determined by a qualified person.

(d) The equipment shall be tested in accordance with Section 11-2.2 in addition to the inspection.

(e) Adjustments, repairs, or replacements necessary to satisfy the requirements of this section shall be made in accordance with para. 11-4.2.4 prior to initial use.

(f) Dated and signed inspection and test records shall be maintained to provide the basis for continuing evaluation. Records should be kept where available to appointed personnel.

11-2.1.3 Functional Test Inspection

(a) A functional test inspection is a visual and audible operational examination of the equipment, and shall be

conducted at the beginning of each shift, or before the equipment is first used during each shift, by the operator or a designated person. In special applications, when the handling of a suspended load is transferred from operator to operator at shift change, the functional test inspection shall be performed when that lift is completed.

(b) As a minimum, the following items shall be inspected during performance of the functional test inspection:

- (1) operational controls
- (2) upper limit device(s) in accordance with ASME B30.16
- (3) chain or wire rope in accordance with ASME B30.16

(c) Adjustments, repairs, or replacements necessary to satisfy requirements shall be made in accordance with para. 11-4.2.4 prior to initial use if the functional test inspection reveals that there are items and conditions that do not comply with the provisions.

(d) Deficiencies discovered during this inspection shall be reported immediately to the supervisor or a designated person.

11-2.1.4 Frequent Inspection

(a) A frequent inspection is a visual and audible examination of the equipment conducted by the operator or a designated person.

(b) Hoist inspection shall be in accordance with ASME B30.16.

(c) Equipment shall be inspected at intervals dependent on the use of the equipment as follows:

- (1) normal service — monthly
- (2) heavy service — weekly to monthly
- (3) severe service — daily to weekly

(d) As a minimum, the following items shall be inspected:

- (1) operating mechanisms for proper operation, proper adjustment, and unusual sounds; such as, but not limited to, squeaking, grinding, grating, etc.
- (2) upper limit device(s) in accordance with ASME B30.16
- (3) tanks, valves, pumps, lines, and other parts of air or hydraulic systems for leakage
- (4) hooks and latches, if used, in accordance with ASME B30.10
- (5) hook attachment and securing means
- (6) warning device(s) for proper operation

(7) chain or wire rope in accordance with ASME B30.16

(8) placement of end stops

(e) A qualified person shall determine whether conditions found during the inspection constitute a hazard and require a more detailed inspection.

(f) Adjustments, repairs, or replacements shall be made, as necessary, in accordance with para. 11-4.2.4.

(g) Deficiencies discovered during this inspection shall be reported immediately to the supervisor or a designated person.

11-2.1.5 Periodic Inspection

(a) A periodic inspection is a visual and audible examination of the equipment conducted by a designated person.

(b) Hoist inspection shall be in accordance with ASME B30.16.

(c) Equipment shall be inspected at intervals dependent on the use of the equipment as follows:

(1) normal service — yearly

(2) heavy service — semiannually

(3) severe service — quarterly

(d) The inspection shall include, but is not limited to, the following items:

(1) deformed, cracked, or corroded members, including hangers and sway braces.

(2) loose or missing fasteners, such as bolts, nuts, pins, or rivets.

(3) cracked or worn sheaves, drums, or chain sprockets.

(4) worn, cracked, or distorted parts such as pins, bearings, wheels, shafts, gears, rollers, locking and clamping devices, bumpers, switch baffles, interlock bolts, and end stops.

(5) hooks and latches, if used, in accordance with ASME B30.10.

(6) hook attachment and securing means.

(7) excessive wear of brake system parts.

(8) excessive wear of chain drive sprockets and excessive chain stretch.

(9) deterioration of motors, controllers, master switches, contacts, limit device(s), and push-button stations.

(10) wind indicators for proper operation.

(11) travel limit devices for proper performance. Each motion shall be inched or operated at low speed into the limit device with no load on the crane.

(12) upper and lower limit device(s) in accordance with ASME B30.16.

(13) warning device(s) for proper operation.

(14) chain or wire rope in accordance with ASME B30.16.

(15) function, instruction, warning and safety information signs, labels, or plates for placement and legibility.

(16) operating mechanisms for proper operation, proper adjustment, and unusual sounds; such as, but not limited to, squeaking, grinding, grating, etc.

(17) tanks, valves, pumps, lines, and other parts of air or hydraulic systems for leakage.

(18) excessive wear of drive tires.

(19) excessive wear or deformation of the lower load-carrying flange of all track sections in the system, both straight and curved.

(20) excessive wear of carrier (trolley) guide and drive wheels.

(21) carrier adjustments and tolerances to manufacturer specifications.

(e) A qualified person shall determine whether conditions found during the inspection require further evaluation or disassembly, or constitute a hazard that requires the equipment to be taken out of service.

(f) Adjustments, repairs, or replacements shall be made, as necessary, in accordance with para. 11-4.2.4.

(g) Dated and signed inspection and test records shall be maintained to provide the basis for continuing evaluation. Records should be kept where available to appointed personnel.

11-2.1.6 Inspection of Cranes and Monorails Not in Regular Use

(a) Equipment that has been idle for a period of 1 mo or more, but less than 1 yr, shall be inspected before being placed into service in accordance with para. 11-2.1.4.

(b) Equipment that has been idle for a period of 1 yr or more shall be inspected before being placed into service in accordance with para. 11-2.1.5.

SECTION 11-2.2 TESTING

11-2.2.1 Operational Tests

(a) New, reinstalled, altered, repaired, and modified cranes and monorail systems shall be tested by a designated person prior to initial use to confirm that the equipment performs in compliance with the provisions of this Volume.

(b) Tests shall include, as applicable, the following functions:

(1) lifting and lowering

NOTE: Refer to ASME B30.16 for hoist test.

(2) carrier travel

(3) bridge travel

(4) upper limit device(s) in accordance with ASME B30.16

(5) travel-limiting devices

(6) locking and safety devices for interlocking mechanisms, track switches, drop sections, and lift sections

(7) indicating devices, if provided

(c) Operational testing of altered, repaired, or modified crane and monorail systems may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.

11-2.2.2 Load Test

(a) New, reinstalled, altered, repaired, and modified equipment should be load tested prior to initial use as determined by a qualified person.

(b) Load testing of altered, repaired, and modified equipment may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.

(c) The replacement of load chain and rope is specifically excluded from this load test; however, an operational test of the hoist shall be made in accordance with ASME B30.16 prior to putting the crane or monorail system back in service.

(d) If a load test is conducted, the load shall be not less than 100% of the rated load of the crane or monorail system or more than 125% of the rated load, unless otherwise recommended by the manufacturer or a qualified person.

(e) If a load test is conducted, the person conducting the load test shall prepare a written report of the load sustained during the test and the operations performed during the test. Reports shall be placed on file.

(f) If a load test is conducted for cranes, operations shall be performed as outlined below or as modified by a qualified person.

(1) Hoist the test load a distance to assure that the load is supported by the crane and held by the hoist brake(s).

NOTE: Refer to ASME B30.16 for hoist test.

(2) Transport the test load by means of the carrier for the full length of the bridge.

(3) Transport the test load by means of the bridge for the full length of the runway in one direction with the carrier as close to the extreme right-hand end of the crane as practical and in the other direction with the carrier as close to the left-hand end of the crane as practical. When cranes operate on more than two runways (multiple-truck cranes), the crane shall also transport the test load the full length of the runway with the carrier positioned at each intermediate end truck.

(4) Lower the test load, stop and hold the load with the brake(s).

(g) If a load test is conducted for monorail systems, operations shall be performed as outlined below or as modified by a qualified person.

(1) Hoist the test load a distance to assure that the load is supported by the equipment and held by the hoist brake(s).

NOTE: Refer to ASME B30.16 for hoist test.

(2) Transport the test load by means of the carrier for the full length of the monorail system.

(3) Lower the test load, and stop and hold the load with the brake(s).

(h) If a load test is conducted for jib crane systems, operations shall be performed as outlined below or as specified by a qualified person.

(1) Hoist the test load a distance to ensure that the load is supported by the equipment and held by the hoist brake(s).

NOTE: Refer to ASME B30.16 for hoist test.

(2) Transport the test load by means of the carrier for the full length of the jib system.

(3) Rotate the jib throughout the full range of travel with the test load applied at the maximum distance from the pivot point.

(4) Lower the test load, stop and hold the load with the brake(s).

(10)

Chapter 11-3

Operator Training and Operation

SECTION 11-3.1 OPERATOR TRAINING

11-3.1.1 Purpose of Operator Training

Operator training shall be provided to promote proficient performance of the operator in conformance with the provisions of this Volume.

11-3.1.2 Operator Training — General

(a) Training shall include those items that apply to the equipment and the particular application of the crane or monorail system. Refer to para. 11-3.1.3 as a guide for sources of training material.

(b) Training programs and their contents shall be based upon, but not limited to

(1) physical characteristics of the workplace.

(2) performance characteristics and complexity of the equipment.

(3) types of load to be handled.

(4) responsibilities of the crane or monorail system operator and other persons involved in the movement of the load. Refer to paras. 11-3.3.2 and 11-3.3.4.

(c) Trainees shall operate equipment under the direct supervision of a designated person.

11-3.1.3 Sources of Training Material

Examples of sources of training material are as follows:

(a) information outlined in the manual provided with the equipment

(b) information available through trade associations

(c) government training resources such as the Department of Labor

(d) organized labor groups

(e) courses, seminars, and literature offered by manufacturers of cranes and monorail systems, consultants, trade schools, continuing education schools, employers, and manufacturers of crane and monorail system component parts

(f) requirements and recommendations found in National Consensus Standards such as this Volume

SECTION 11-3.2 TRAINING FOR PERSONS OTHER THAN CRANE AND MONORAIL SYSTEM OPERATORS

Other persons, such as, but not limited to, maintenance personnel, test personnel, and inspectors, when it is necessary to operate a crane or monorail system

in the performance of their duties, shall be trained in accordance with the training requirements of this Volume for their duties.

SECTION 11-3.3 OPERATION

11-3.3.1 Scope of Crane Operation

The operation of underhung cranes and monorail systems shall be in accordance with the provisions included in this Volume and in manuals furnished by the equipment manufacturer.

The requirements of an operator of a crane or monorail system apply to both dedicated operators, whose primary job is the operation of a crane or monorail system and nondedicated operators who use a crane or monorail system as another tool in performing their job.

11-3.3.2 General Requirements to Be Followed During Equipment Operation

All personnel involved with the crane or monorail system operation shall comply with the following:

(a) equipment lockout/tagout procedures, see Section 11-3.7.

(b) warning or safety signs, labels, plates, or tags.

(c) The crane or monorail system shall not be used to lift, lower, or travel while anyone is on the load or hook.

(d) The hoist chain or rope shall be free from kinks or twists and shall not be wrapped around the load.

(e) A hook latch shall be used when provided.

(f) The hook latch (when provided) shall be closed and shall not be used to support any part of the load.

(g) The load, sling, or lifting device shall be seated in the bowl of the hook.

(h) The hoist chain(s) or rope(s) shall be seated in its chain sprockets or drum and sheave grooves.

(i) Persons shall stay clear of a suspended load.

(j) Caution shall be exercised when using a crane having a lifting magnet, due to hazards of falling metal.

(k) Cranes and monorail systems shall be used to lift loads vertically without side pull except when specifically authorized by the manufacturer(s) or a qualified person for the equipment and a qualified person for the supporting structure who have determined that

(1) the various parts of the equipment, support system, and supporting structure will not be overstressed

(2) the stability of the equipment is not thereby endangered

(3) such side pulls will not cause the hoist rope to be pulled out of the sheave or across drum grooves

(4) such side pulls will not cause damage to the chain hoists

(l) The crane or monorail system shall not be used to lift loads in excess of the rated load of the system except during properly authorized tests or planned engineered lifts in accordance with Section 11-3.4.

NOTE: When multiple hoists, trolleys, bridges, or other devices are installed, the total load shall not exceed the capacity of the system.

(m) A load-limiting device shall not be used to measure the weight of the load.

(n) The hoist rope or chain shall be protected from damaging weld spatter or contaminants.

(o) The harness or belt, when provided, shall be used with the transmitter or the transmitter shall be placed in the location intended for its support.

(p) The safety devices on the transmitter shall not be overridden.

(q) Gloves that interfere with the operation of the controls shall not be worn.

(r) The transmitter shall be stored in a designated and protected location.

(s) The transmitter shall be shut off when a power failure occurs.

(t) When two or more pieces of equipment are used to lift a single load, one designated person shall be in charge of the operation. This person shall analyze the operation and instruct all personnel involved in the proper positioning and rigging of the load and the movements to be made.

(u) The operator shall check the hoist brake(s) at least once each shift if a load approaching the rated load is to be handled. This shall be done by lifting the load a few inches (cm) and applying the brake(s).

(v) The load shall not be lowered below the point where less than two wraps of rope shall remain on each anchorage of the hoisting drum, unless a lower limit device is provided, in which case, no less than one wrap shall remain.

(w) No one, other than the operator, shall enter a crane cab or pulpit, with the exception of persons such as oilers and supervisors whose duties require them to do so, and then only in the performance of their duties and with the knowledge of the operator or other appointed person.

11-3.3.3 Responsibilities of Management (Owners/Users)

Management (owners/users) shall

(a) identify, document, and assign responsibilities of the equipment operator and other persons involved in the movement of the load(s) (see paras. 11-3.3.2 and 11-3.3.4).

(b) provide or verify that persons who will operate the equipment have been trained.

(c) provide a written and practical examination that verifies that the person has acquired the knowledge and skill to operate the specific type of equipment that will be operated. The examinations shall be defined by the owner/user and in accordance with any local, state, and federal provisions that may apply.

(d) issue a certificate, or formal record, that verifies that the person has been trained and has passed the examination required in para. 11-3.3.3(c).

11-3.3.4 Responsibilities of Operators

(a) Lifting and moving the load

(1) three phases of lifting and moving the load shall be addressed

(a) before the lift

(b) during the lift

(c) after the lift

(2) Rigging the load, attaching the load to the hook and other tasks related to moving the load may be performed by persons other than the equipment operator.

(3) Equipment operation may require the use of a signal person or other personnel who have responsibility for directing the lift and move functions and shall be assigned prior to the lift.

(b) Before the lift, operators shall

(1) be familiar with the applicable provisions of the equipment safety standards and the instructions listed in manual(s) provided with the equipment

(2) be familiar with controls, instructions, and warnings located on the lifting equipment

(3) operate the equipment only when physically and otherwise fit

(4) not energize the main switch (equipment disconnect) if a warning sign, lock, or tag is on the device until the sign, lock, or tag is removed by the person who placed it on the device, or by an authorized person

(5) not remove a warning sign, lock, or tag that is on any switch that controls power to the equipment, such as, but not limited to the equipment disconnect, motion disconnect, or runway disconnect, if the sign, lock, or tag was placed on the device by another person

(6) place all controllers in the off position before closing the main line disconnect device

(7) verify that no worker is on or adjacent to the equipment before closing the equipment's main disconnect switch

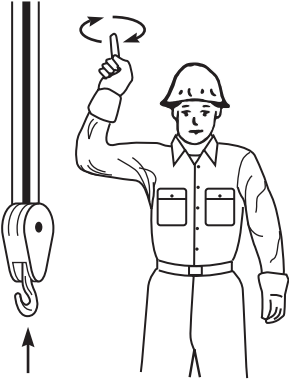
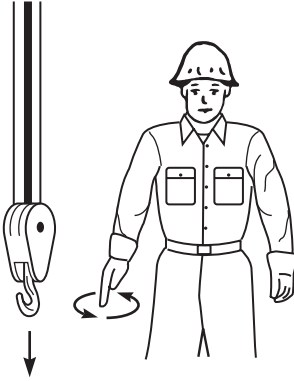
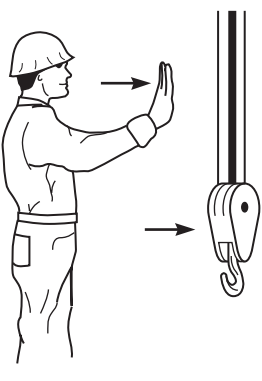
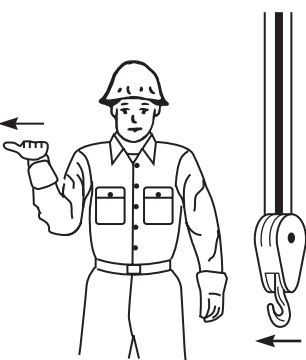
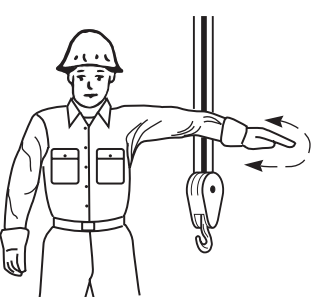
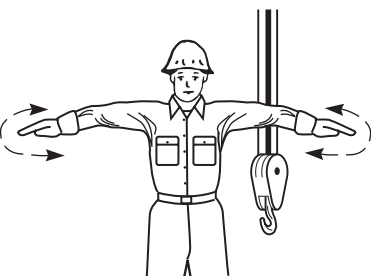
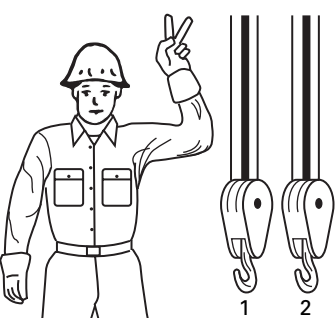
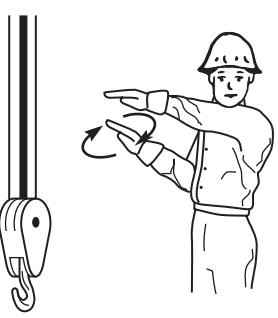
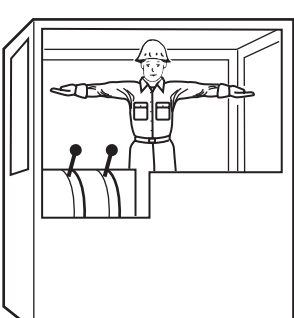
(8) perform a functional test inspection and test in accordance with para. 11-2.1.3

(9) not remove or obscure the warning or safety labels, plates, or tags furnished on the lifting equipment

(10) be familiar with and understand hand signals (see Section 11-3.5 and Fig. 11-3.3.4-1)

(11) verify that the hook, bridge, and carrier travel in the same direction as shown on the controls

Fig. 11-3.3.4-1 Standard Hand Signals for Controlling Cab-Operated Monorail Systems and Underhung Cranes

 <p>HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	 <p>LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.</p>	 <p>BRIDGE TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>
 <p>CARRIER TRAVEL. Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.</p>	 <p>STOP. Arm extended, palm down, move arm back and forth.</p>	 <p>EMERGENCY STOP. Both arms extended, palms down, move arms back and forth.</p>
 <p>MULTIPLE TROLLEYS. Hold up one finger for block marked "1" and two fingers for block marked "2". Regular signals follow.</p>	 <p>MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)</p>	 <p>MAGNET IS DISCONNECTED. Crane operator spreads both hands apart – palms up.</p>

(12) verify that chains or wire ropes are not kinked or twisted or that multiple part chain or wire ropes are not twisted about each other

(13) verify that the hoist chain or wire rope is not wrapped around the load

(14) attach the load to the hook or have the load attached to the hook by means of slings or other lifting devices

(15) verify that the load, sling, or lifting device is seated in the bowl of the hook

(16) use a hook latch when provided

(17) verify that the hook latch (when provided) is closed and not supporting any part of the load

(18) verify that the hoist load chain or rope is seated in the sprockets or drum grooves and in the sheave(s) sprockets or grooves if there is or has been a slack rope condition

(19) board or leave the crane (cab) only at authorized locations and designated boarding entrances

(20) verify that the transmitter selected is the correct transmitter for the crane to be operated

(21) verify that the hoist unit is centered over the load's center of gravity, except when authorized by a qualified person [see para. 11-3.3.2(k)]

(22) verify that the weight of the total load to be lifted does not exceed the rated load of the crane or monorail system, or the rigging [see para. 11-3.3.2(l)]

(23) activate the warning device, when a device is furnished, before starting the bridge or carrier motion of the crane

(e) During the lift, operator's shall

(1) respond to signals from the person directing the lift or a designated signal person.

(2) be responsible for the lift when a signal person is not used.

(3) obey any stop signal regardless of who gives it.

(4) verify multiple part chains or lines are not twisting around each other when the lift is made.

(5) take up slack load chain or rope carefully, lift the load a few inches (cm) to check the hoist operation and verify that the load is secured, balanced, and positioned on the hook and in the sling or lifting device.

(6) minimize swinging the load or load hook.

(7) maintain firm footing when operating lifting equipment.

(8) avoid sudden acceleration and deceleration of the load.

(9) use the crane or monorail system to lift vertically, without side pull, except when specifically authorized by a qualified person [see para. 11-3.3.2(k)].

(10) verify that the load and rigging are free to move and will clear all obstructions.

(11) check the hoist brake(s), if a load approaching the rated load is to be handled, by lifting the load a few inches (cm) and applying the brake(s).

(12) stop the lifting of the load before the upper limit device is engaged. The hoist limit device that controls the upper limit of travel of the load block shall not be used as an operating control in normal operation unless additional means are provided to prevent damage from overtravel.

(13) avoid carrying loads over people.

(14) concentrate on operating the crane and not allow attention to be diverted while operating the equipment.

(15) activate the warning device, when a device is furnished, intermittently during travel of the crane when approaching persons in the path of the load.

(16) avoid exposure of the load chain or rope from damaging elements such as weld spatter or contaminants.

(17) promptly report, to the person responsible for the equipment, any malfunction, unusual performance or sound, or damage of equipment.

(18) contact stops, other cranes, or carriers with caution for the safety of persons on or below the equipment.

(19) place all controllers or master switches in the off position when power is interrupted during operation.

(20) check the controllers for correct direction of motion when power is restored after a power outage.

(21) follow the directions of the designated person in charge of the operation when two or more pieces of equipment are used to lift a single load.

(22) not leave a suspended load unattended unless provisions have been made to provide auxiliary supporting means under the suspended load, or guards or barriers are utilized on the floor to prevent people from entering the area affected by the suspended load.

(23) not lower the load below the point where two wraps of rope remain on each anchorage of the hoisting drum unless a lower-limit device is provided, in which case, no less than one wrap shall remain.

(24) stop the lowering of the load before the lower limit device is engaged, when furnished, and not use it as an operating control in normal operation.

(25) properly secure an outdoor underhung crane when the wind indicating alarm is activated.

(26) use the harness or belt, if provided, for use with the transmitter or place the transmitter in the location intended for its support.

(27) not override safety devices on the transmitter.

(28) not wear gloves that interfere with the operation of the controls.

(29) shut off the transmitter when a power failure occurs.

(30) stop the crane or monorail system functions in a controlled manner when the operator has doubt as to the safety of the crane and monorail system's operations.

Lift operations shall resume only after safety concerns have been addressed.

(f) After the lift, operators shall

(1) lift the load block above the highest moveable obstruction under the equipment when the equipment is not in use

(2) notify the next operator of adjustment, repair, or replacement that needs to be made

(3) properly secure an outdoor underhung crane when the crane is shut down

(4) open the equipment main line disconnect device before leaving the crane cab

(5) place the controllers in the off position before leaving the controls of the equipment

(6) shut off the power to pendant-operated cranes before leaving area

(7) shut off and store transmitter in a designated and protected location

(8) do not use the crane or monorail system to remove slings from under a landed load

SECTION 11-3.4 PLANNED ENGINEERED LIFTS

Lifts in excess of the rated load may be required from time to time on a limited basis for specific purposes such as new construction or major repairs. Every planned engineered lift exceeding the rated load shall be treated as a special and separate event.

Limitations and planned requirements shall be applicable as follows:

(a) Planned engineered lifts shall be limited to powered cranes.

(b) When planned engineered lifts are made, the load shall not exceed 125% of the equipment load rating, except as provided in para. 11-3.4(d).

(c) Planned engineered lifts shall be limited to two occurrences on any crane equipment within any continuous 12-mo period, except as provided in para. 11-3.4(d). If greater lift frequency is desired, consideration shall be given to rerating or replacing the equipment.

(d) The equipment manufacturer or a qualified person shall be consulted if the planned engineered lift exceeds 125% of rated load or if the frequency of planned engineered lifts exceeds two during a continuous 12-mo period.

(e) Each planned engineered lift shall comply with the following requirements:

(1) A written review of the equipment service history shall be prepared, including reference to previous planned engineered lifts, structural repairs, and modifications of original design.

(2) The design of the structural, mechanical, electrical, pneumatic, and hydraulic components of the equipment shall be reviewed by means of applicable calculations for the load to be lifted and approved by the equipment manufacturer or a qualified person

according to accepted crane and monorail system design standards.

(3) The design of the equipment's supporting structure shall be reviewed and approved by a qualified person for conformance to applicable design criteria. The supporting structure shall be inspected, and any deterioration or damage shall be taken into consideration in design calculations for the load to be lifted.

(4) The equipment shall be inspected in accordance with para. 11-2.1.5 just prior to making the lift.

(5) The lift shall be made under controlled conditions under the direction of a designated person in accordance with a previously prepared lift plan. All persons in the area of the equipment shall be alerted that the lift is being made.

(6) The operator shall test the equipment at the planned engineered load by lifting the load a few inches (cm) and setting the brakes. The lift shall only be continued if the brake stops and holds the load. Any failure to hold the load shall be corrected before proceeding with the lift.

(7) The equipment shall be inspected in accordance with para. 11-2.1.5 after the lift is completed and prior to being used for the lifting of any other load.

(8) A record of the planned engineered lift, including calculations, inspections, and all distances moved, shall be placed on file for availability to appointed personnel.

(f) The load test specified in para. 11-2.2.2 is not applicable to planned engineered lift provisions.

SECTION 11-3.5 SIGNALS

11-3.5.1 Standard Signals

Signals to the operator should be in accordance with the standards prescribed in Fig. 11-3.3.4-1, unless voice communication equipment (telephone, radio, or equivalent) is utilized. Signals should be discernible or audible at all times. Some special operations may require additions to, or modifications of, the basic signals.

11-3.5.2 Hand Signals

When hand signals are used, they should be posted conspicuously and should be as illustrated in Fig. 11-3.3-1.

(a) Cranes that are equipped with separately operated carriers present a problem and precautions should be taken to establish ground person-to-crane operating signals.

(b) Crane carriers should be numbered with numerals large enough so they are legible from the floor. Hoist load blocks should have numbers applied on both sides of the block. Carriers should be numbered as follows:

(1) Carrier nearest the crane cab is designated as No. 1.

(2) Carrier away from the crane cab is designated as No. 2.

SECTION 11-3.6 MISCELLANEOUS

11-3.6.1 Cabs

(a) Necessary clothing and personal belongings shall be stored in such a manner as to not interfere with access or operation.

(b) Tools, oil cans, and other necessary articles shall be stored in a toolbox and shall not lie loose in or about the cab.

(c) Materials stored in cabs shall be limited to necessary items.

11-3.6.2 Fire Extinguishers

Operators shall be familiar with the operation and care of fire extinguisher(s) provided.

SECTION 11-3.7 EQUIPMENT LOCKOUT/TAGOUT

11-3.7.2 General

(a) A lockout/tagout policy and procedure shall be developed, documented, and implemented by the owner or user of crane and monorail systems.

(b) The lockout/tagout policy and procedure shall comply with the requirements of ASSE Z244.1.

(c) The policy shall include, but is not be limited to

(1) single-crane runways

(2) multiple-crane runways

(3) monorail systems

(4) cranes on an adjacent runway

(5) runway disconnecting means

(6) crane disconnecting means

(7) work to be done on the crane

(8) work to be done other than on a crane but within the path of a crane where its movement creates a hazard

(10)

Chapter 11-4

Maintenance Training and Maintenance

SECTION 11-4.1 MAINTENANCE TRAINING

11-4.1.1 Purpose of Maintenance Training

Maintenance training shall be provided to promote proficient adjustments, repairs, and replacements on crane and monorail systems that will allow the equipment to perform in accordance with the provisions of this Volume.

11-4.1.2 Crane and Monorail Systems Maintenance Training — General

This Volume of the B30 Standard recognizes that underhung crane and monorail systems are used for many different purposes, handling many different kinds of loads in a variety of workplaces and are maintained in a manner relative to these purposes, kinds of loads, and workplaces. Nevertheless, the requirements for certification as an underhung crane and monorail maintenance person apply to all persons who maintain the mechanical, structural, and electrical components of the equipment.

11-4.1.3 Sources of Training

Examples of sources of maintenance training material are as follows:

- (a) information outlined in the manual(s) provided by the equipment manufacturer
- (b) information available through trade associations
- (c) government training resources such as the Department of Labor
- (d) organized labor groups
- (e) courses, seminars, and literature offered by manufacturers of cranes and monorail systems, consultants, trade schools, continuing education schools, employers, and manufacturers of crane and monorail system component parts
- (f) requirements and recommendations found in National Consensus Standards such as this Volume

11-4.1.4 Responsibilities of Maintenance Persons

Responsibilities of crane and monorail systems maintenance persons shall include, but not be limited to, the following items:

- (a) Read the applicable equipment safety standard referenced and the instructions outlined in the manual(s) provided for the equipment by the equipment manufacturer.

- (b) Board a crane only at authorized locations and designated boarding entrances.

- (c) Do not board a crane without the knowledge of the operator.

- (d) Do not attempt to repair electrical apparatus or to make other major repairs on the equipment unless specific authorization has been received and the power is locked out/tagged out.

- (e) Lower the load block to the ground or otherwise secure the load block before attempting any repairs or adjustments on the lifting equipment that would allow the load block to lower.

- (f) Use replacement parts that are at least equal to the original manufacturer's specifications.

- (g) Become familiar with wire rope replacement criteria.

- (h) Install wire rope clamps correctly. Refer to the manual provided with the equipment.

- (i) Do not use the wire rope, load chain, or hook as a ground for welding.

- (j) Do not touch a live electrode to the wire rope, load chain, or hook.

- (k) Do not attempt to repair a damaged wire rope or load chain.

- (l) Do not remove or obscure the warning or safety labels, plates, or tags furnished on the lifting equipment.

- (m) Replace safety labels, plates, or tags when they are obscured or illegible.

- (n) Replace all protective guards and panels before returning the crane to normal operation.

- (o) Apply lubricant to the wire rope or load chain as recommended by the hoist, wire rope, or chain manufacturer.

SECTION 11-4.2 EQUIPMENT MAINTENANCE

11-4.2.1 General Maintenance

General maintenance should be performed in accordance with the conditions and practices of a particular workplace. Some factors that influence how maintenance is performed are

- (a) whether there are trained and experienced in-house maintenance persons such as mechanics or millwrights and electricians who can perform maintenance work on underhung cranes and monorail systems

- (b) whether an outside crane and monorail service company is contracted to do inspections, perform preventive maintenance, repairs, and replacements

- (c) size of workplace and number of employees
- (d) whether the equipment has sophisticated performance characteristics such as reactor or adjustable frequency controls or basic single-speed or two-speed control systems
- (e) the recommendations in the equipment manufacturer's manual; and, when appropriate, recommendations by a qualified person based upon review of the equipment application and operation

11-4.2.2 Preventive Maintenance

A preventive maintenance program shall be established. The preventive maintenance program should be based on the recommendations in the equipment manufacturer's manual; and, when appropriate, recommendations by a qualified person based upon review of the equipment application and operation. Dated records should be placed on file.

11-4.2.3 Maintenance Procedure

(a) The following precautions shall be taken before performing maintenance on a crane or monorail system:

- (1) The crane or monorail carrier shall be moved to a location where it will cause the least interference with other cranes or carriers on the system and operations in the area.
- (2) If a load is attached to the crane or monorail system, it shall be landed.
- (3) All controllers shall be placed in the off position.
- (4) A lockout/tagout procedure shall be performed (see Section 11-3.7).
- (5) Warning signs and barriers shall be utilized on the floor beneath the equipment where overhead maintenance work creates a hazard.
- (6) Where other cranes or carriers are in operation on the same runways or monorail track, rail stops or other means shall be provided to prevent interference with the idle equipment.
- (7) Where temporary protective rail stops are not possible, available, or practical, a signal person(s) located full-time at a visual vantage point for observing the approach of an active underhung crane or monorail system shall be provided to prohibit contact by the active equipment with the idle equipment; with persons performing maintenance; and with equipment used in performing the maintenance.
- (8) A guard or barrier shall be installed between adjacent runways for the length of any established work area to prevent contact between persons performing maintenance and a crane on the adjacent runway.

(b) The following precautions shall be taken before performing maintenance on a crane runway, monorail, support system, power distribution system, or the areas of the building in the path of travel of the crane bridge or carrier.

(1) A lockout/tagout procedure shall be performed (see Section 11-3.7).

(2) Warning signs and barriers shall be utilized on the floor beneath the area where overhead maintenance work creates a hazard.

(3) If the runway remains energized, stops or a signal person(s), located full-time at a visual vantage point for observing the approach of an active crane(s), shall be provided to prohibit contact by the active crane(s) with the idle crane; with persons performing maintenance; and with equipment used in performing the maintenance.

(4) A guard or barrier shall be installed between adjacent runways for the length of any established work area to prevent contact between persons performing maintenance and a crane on the adjacent runway.

(c) Only designated persons shall work on energized equipment.

(d) After maintenance work is completed and before restoring the crane equipment to normal operation

- (1) equipment guards shall be reinstalled
- (2) safety devices shall be reactivated
- (3) replaced parts and loose material shall be removed
- (4) maintenance equipment, including barriers, shall be removed

11-4.2.4 Adjustments, Repairs, and Replacements

(a) Any condition disclosed by the inspections performed in accordance with Section 11-2.1 that is determined to be a hazard to continued operation shall be corrected by adjustment, repair, or replacement before continuing the use of the equipment.

(b) Adjustments, repairs, and replacements shall be performed by designated personnel.

(c) Components shall be adjusted or repaired as needed. The following are examples:

- (1) hoists as described under "Adjustments and Replacements" in ASME B30.16
- (2) all operating mechanisms
- (3) interlocks, crossovers, track switches, and track openers
- (4) limit devices
- (5) control systems
- (6) brakes

(d) Repairs or replacements shall be made as needed. The following are examples:

- (1) hoists as described under "Adjustments and Replacements" in ASME B30.16
- (2) damaged or worn hooks as described under "Maintenance" in ASME B30.10 (repairs by welding or reshaping are not recommended)
- (3) all critical parts that are cracked, broken, bent, excessively worn, or missing
- (4) pitted or burned electrical contacts in sets only

(5) function labels on pendant control stations and master switches that are illegible

(e) Identification of materials shall be made and appropriate welding procedures shall be followed when making repairs to load-sustaining members by welding.

(f) Dated records should be placed on file.

11-4.2.5 Lubrication

(a) All moving parts of the underhung crane or mono-rail system for which lubrication is specified, including hoist mechanisms and other ropes and chains, should be lubricated regularly. Both manual and remote lubrication systems should be checked for proper delivery of

the lubricant. Care should be taken to follow the manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubricant levels, and types of lubricant to be used.

(b) Cranes or carriers shall be stationary while lubricants are being applied, and protection provided as called for in paras. 11-4.2.3(a)(1) through 11-4.2.3(a)(4), unless the cranes or carriers are equipped for automatic or remote lubrication.

11-4.2.6 Chain and Wire Rope Inspection, Replacement, and Maintenance

Chain and rope inspection, replacement, and maintenance shall be per ASME B30.16.

ASME B30.11 INTERPRETATIONS

Replies to Technical Inquiries May 2004 through August 2009

FOREWORD

This publication includes all of the written replies issued between the indicated dates by the Secretary, speaking for the ASME B30 Standards Committee, Safety Standards for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, to inquiries concerning interpretations of technical aspects of ASME B30.11, Monorails and Underhung Cranes.

These replies are taken verbatim from the original letters except for a few typographical corrections and some minor editorial corrections made for the purpose of improved clarity. In some few instances, a review of the interpretation revealed a need for corrections of a technical nature; in these cases, a corrected interpretation follows immediately after the original reply.

These interpretations were prepared in accordance with the accredited ASME procedures. ASME procedures provide for reconsideration of these interpretations when or if additional information is available that the inquirer believes might affect the interpretation. Furthermore, persons aggrieved by this interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

Interpretation: 11-18

Subject: ASME B30.11-2004

Date Issued: September 26, 2005

Background: The following statement appears in para. 2-1.14.3 of ASME B30.2, para. 11-3.2.3 of ASME B30.11, and para. 16-1.2.6 of ASME B30.16:

“No less than two wraps of rope shall remain on the drum at each anchorage of the hoist(ing) drum when the hook is in its extreme low position unless a lower-limit device is provided, in which case no less than one wrap shall remain.”

Question (1): When the hook is in its “extreme low position,” does this mean that the hook is at its lowest point of travel when all of the rope has been unwound, except for the required wraps?

Reply (1): Yes.

Question (2): When the hook is in its “extreme low position,” does this mean that the hook must be capable of traveling all the way to the ground with no load?

Reply (2): No.

Interpretation: 11-19

Subject: ASME B30.11-1998, Monorails and Underhung Cranes

Date Issued: September 26, 2005

Question (1): Could you provide clarification and opinion to para. 11-3.1.5(a) of ASME B30.11? We need to better understand what "divert attention while engaged in operating the equipment" means.

Reply (1): Commonly used terminology is not specifically defined in B30.11; however, it is the B30.11 Subcommittee's opinion that it is commonly acceptable for crane operators to be engaged in the activities of attaching the load to the hook and handling the load. Oftentimes these activities might require the operator to let go of the pendant and set it aside within easy reach as various tasks are performed by the crane operator during the load handling operation process. Therefore, we do not think activities related to handling the load will divert the attention of the crane operator and compromise safe crane operation.

Question (2): Could you provide clarification for the term "unattended" as described in para. 11-3.2.5(a) of ASME B30.11? Does it mean that the pendant control must be in the operator's possession 100% of the time, or within arm's reach, or within eyeshot?

Reply (2): Since the B30.11 Volume does not cover a definition for "unattended," we refer to B30.16-2003, Overhead Hoists (Underhung) and B30.2-1996, Top Running, Bridge, Single or Multiple Girder, Top Running Trolley Hoist for a clarification of the term "unattended."

ASME B30.16-2003, Section 16-0.2 Definitions, defines "unattended" as follows:

"unattended: a condition in which the operator of a hoist is not at the operating control devices (pendant station or hand chain). If, however, the control devices are within an unobstructed distance of 26 ft (8.0 m) and within sight of the operator, the hoist should be considered attended."

ASME B30.2-1996, Section 2-0.2: Definitions, defines "unattended" as follows:

"unattended: a condition in which the operator of a crane is not at the operating control devices. However, on a floor-operated crane, if the operating control devices are within sight of the operator and within a distance equal to the span of the crane, the crane should be considered attended."

Interpretation: 11-20

Subject: ASME B30.11-2004, Monorails and Underhung Cranes, Section 11-1.1

Date Issued: September 29, 2008

Question (1): Does the monorail beam itself require a capacity marking? If it is required, is it required regardless of the number of hoists or the type of trolley (manual vs. powered)?

Reply (1): No.

Question (2): Is it assumed the monorail beam capacity is that of the hoist when only one hoist is installed on the beam and as such explicit marking of the beam capacity is not required (similar to the requirements set forth in para. 11-1.1.1 for cranes)?

Reply (2): No, the capacity of the beam shall not be assumed.

Question (3): Is the capacity required to be explicitly marked on the beam when two or more hoists are installed on the same monorail beam?

Reply (3): No.

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