ASME B30.11-2004
(Revision of ASME B30.11-1998)

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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ASME issues written replies to inquirires concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME Web site under the Committee Pages at http://www.asme.org/codes/ 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 III, before rendering decisions on disputed points.

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 October 5, 2004.

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.

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Safety Standards 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

(04)

B30 STANDARD INTRODUCTION

GENERAL

This Standard is one of a series of safety standards on various subjects that have been formulated under the general auspices of the American National Standards Institute. One purpose of the Standard is to serve as a guide to governmental authorities having jurisdiction over subjects within the scope of the Standard. It is expected, however, that the Standard will find a major application in industry, serving as a guide to manufacturers, purchasers, and users of the equipment.

For the convenience of the user, the Standard has been divided into separate volumes.

B30.1 Jacks
B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
B30.3 Construction Tower Cranes
B30.4 Portal, Tower, and Pedestal Cranes
B30.5 Mobile and Locomotive Cranes
B30.6 Derricks
B30.7 Base Mounted Drum Hoists
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
Note: B30.15-1973 has been withdrawn. The revision of B30.15 is included in the latest edition 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
B30.23 Personnel Lifting Systems
B30.24 Container Cranes[1]
B30.25 Scrap and Material Handlers
B30.26 Rigging Hardware[1]
B30.27 Material Placement Systems[1]
B30.28 Balance-Lifting Units[1]

If these standards are 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.

The use of cableways, cranes, derricks, hoists, hooks, jacks, and slings is subject to certain hazards that cannot be met 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 safe operation of the equipment and the handling of the loads. Serious hazards are overloading, dropping or slipping of the load caused by improper hitching or slinging, obstructing the free passage of the load, and using equipment for a purpose for which it was not intended or designed.

The Standards Committee fully realizes the importance of proper design factors, minimum or maximum sizes, and other limiting dimensions 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 depend on many different factors, often varying with the installation and uses. These factors depend on the condition of the equipment or material; the loads; the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums; the type of attachments; the number, size, and arrangement of sheaves or other parts; environmental conditions causing corrosion or wear; and many variables that must be considered in each individual case. The rules given in the Standard must be interpreted accordingly, and judgment must be used in determining their application.

The Standards Committee will be glad to receive criticisms of this Standard's requirements and suggestions

[1] B30.24, B30.26, B30.27, and B30.28 are in the developmental stage.

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for its improvement, especially those based on actual experience in application of the rules.

Suggestions for changes to the Standard should be submitted to the Secretary of the B30 Committee, ASME, Three Park Avenue, New York, NY 10016-5990, and should be in accordance with the following format:

(a) Cite the specific paragraph designation of the pertinent volume.

(b) Indicate the suggested change (addition, deletion, revision, etc.).

(c) Briefly state the reason and/or evidence for the suggested change.

(d) Submit suggested changes to more than one paragraph in the order that the paragraphs appear in the volume.

The B30 Committee will consider each suggested change in a timely manner in accordance with its procedures.

SECTION I: SCOPE OF B30 STANDARD

This Standard applies to the construction, installation, operation, inspection, maintenance, and safe use of lifting equipment used in construction and industrial settings. This includes, but is not limited to: articulating-boom, container, gantry, mobile, pedestal, portal, tower and stacker cranes; balance-lifting units; below-the-hook lifting devices; cableways; derricks; jacks; hoists; hooks; loads suspended from rotorcraft; material placement systems; monorails; rigging hardware; and scrap and material handlers.

This 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 falling within the scope of the following Committees: A10, A17, A90, A92, A120, B20, B56, and B77.

SECTION II: PURPOSE

This Standard is designed to

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

(b) provide direction to owners, employers, supervisors, 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 III: INTERPRETATIONS

Upon request, the B30 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B30 Committee, ASME, Three Park Avenue, New York, NY 10016-5990.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his request utilizing the following format.

Subject: Cite the applicable paragraph number(s) and provide a concise description.

Edition: Cite the applicable edition of the pertinent volume for which the interpretation is being requested.

Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain any proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which could change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an 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.

SECTION IV: NEW AND EXISTING INSTALLATIONS

(a) Effective Date. The effective date of this volume for the purpose of defining new and existing installations shall be 1 year after its date of issuance.

(b) New Installations. 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.

(c) Existing Installations. Inspection, testing, maintenance, and operation of equipment manufactured and facilities constructed prior to the effective date of this volume shall be done, as applicable, in accordance with the requirements of this volume.

It is not the intent of this volume to require retrofitting of existing equipment. However, when an item is being modified, its performance requirement shall be reviewed

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relative to the current volume. If the performance differs substantially, the need to meet the current requirement shall be evaluated by a qualified person selected by the owner (user). Recommended changes shall be made by the owner (user) within 1 year.

SECTION V: MANDATORY AND ADVISORY RULES

Mandatory rules of this Standard are characterized by use of the word *shall*. If a provision is of an advisory nature, it is indicated by use of the word *should* and is a recommendation to be considered, the advisability of which depends on the facts in each situation.

SECTION VI: METRIC CONVERSIONS

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 customary units.

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ASME B30.11-2004
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.11-2004 was approved by the American National Standards Institute on October 5, 2004.

ASME B30.11-2004 includes editorial changes, revisions, and corrections introduced in ASME B30.11-2004, as well as the following changes identified by a margin note, **(04)**.

Page	*Location*	*Change*
viii–x	B30 Standard Introduction	General, Section I, and Section VI revised
9	Section 11-0.3	References updated
11	11-1.3.2(f)	Revised

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

SECTION 11-0.1 SCOPE OF B30.11

Within the general scope defined in Section I of the introduction, ASME B30.11 applies to underhung cranes and monorail systems where load-carrying members, such as end trucks or carriers (trolleys), travel either on the external or internal (see Fig. 9) lower flange of a runway track section, single monorail track, crane bridge girder, or jib boom (see Fig. 1), including all curves, switches, transfer devices, lift and drop sections, and associated equipment. This Volume includes provisions of both power-driven and hand-operated equipment on which the carriers are independently controlled. This equipment is grouped together because of the similarity of construction and because of common considerations which are peculiar to this type of equipment. Systems used for transporting personnel require special considerations and are not included in this Volume. Also excluded from this Volume are conveyor systems, including power and free conveyors.

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. 2).

carrier, floor-operated: a carrier that is controlled by a means suspended from the carrier or crane, or controlled

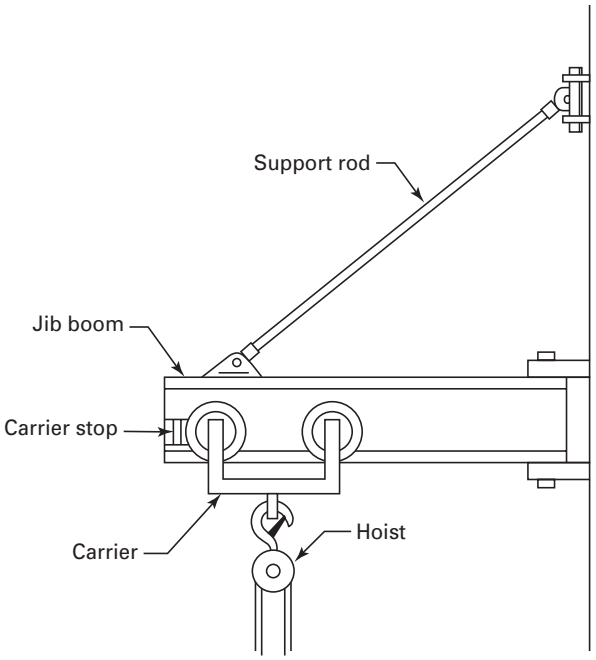


Fig. 1 Wall-Supported Jib Crane

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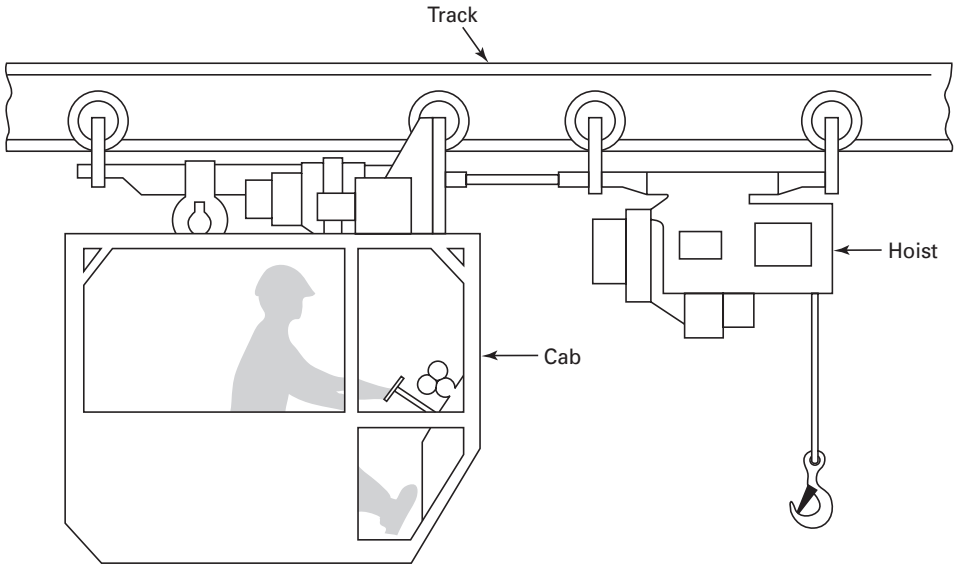


Fig. 2 Cab-Operated Carrier

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.

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. 3).

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. 4).

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. 5).

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

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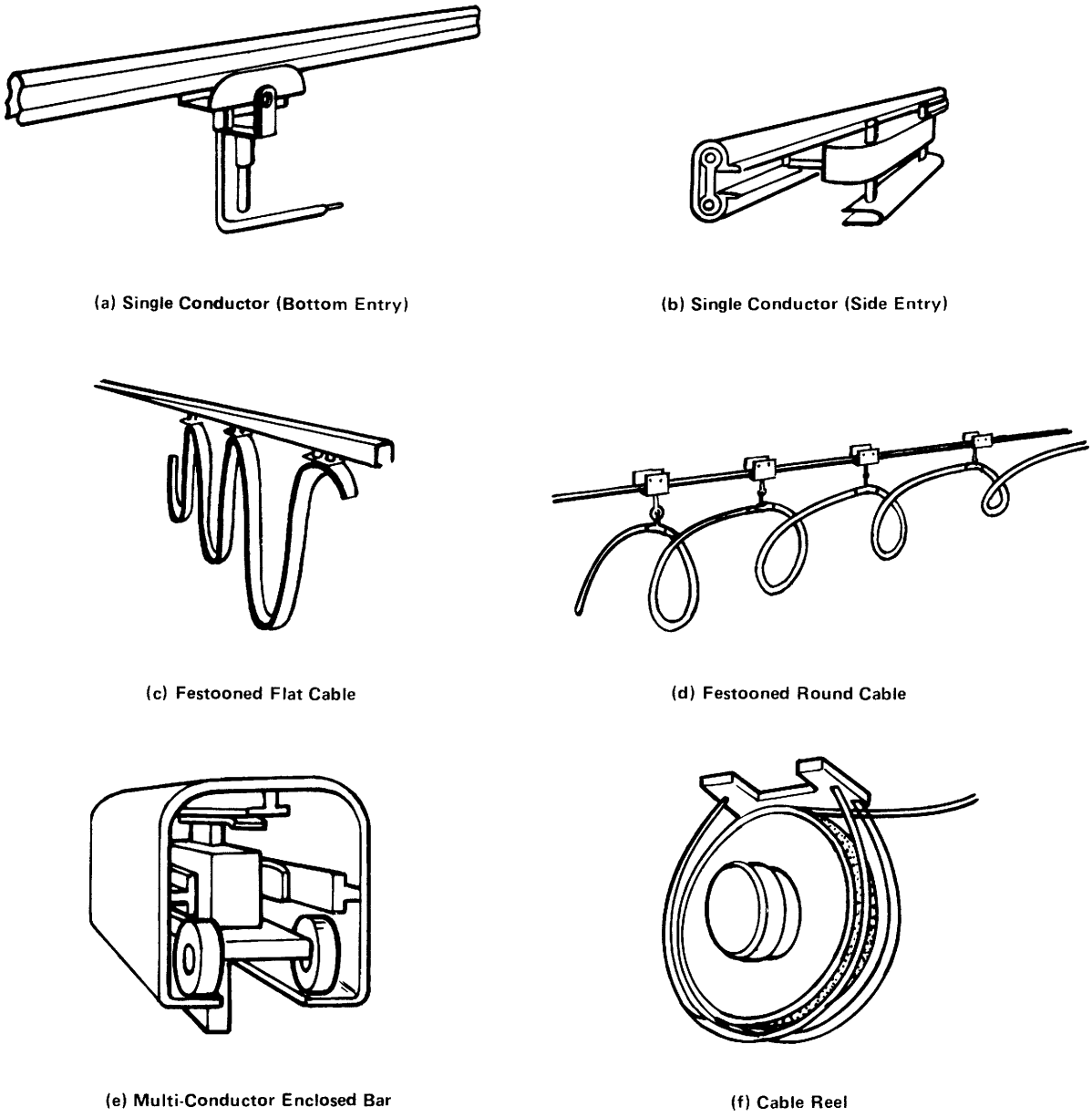


Fig. 3 Examples of Styles of Electrification

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.

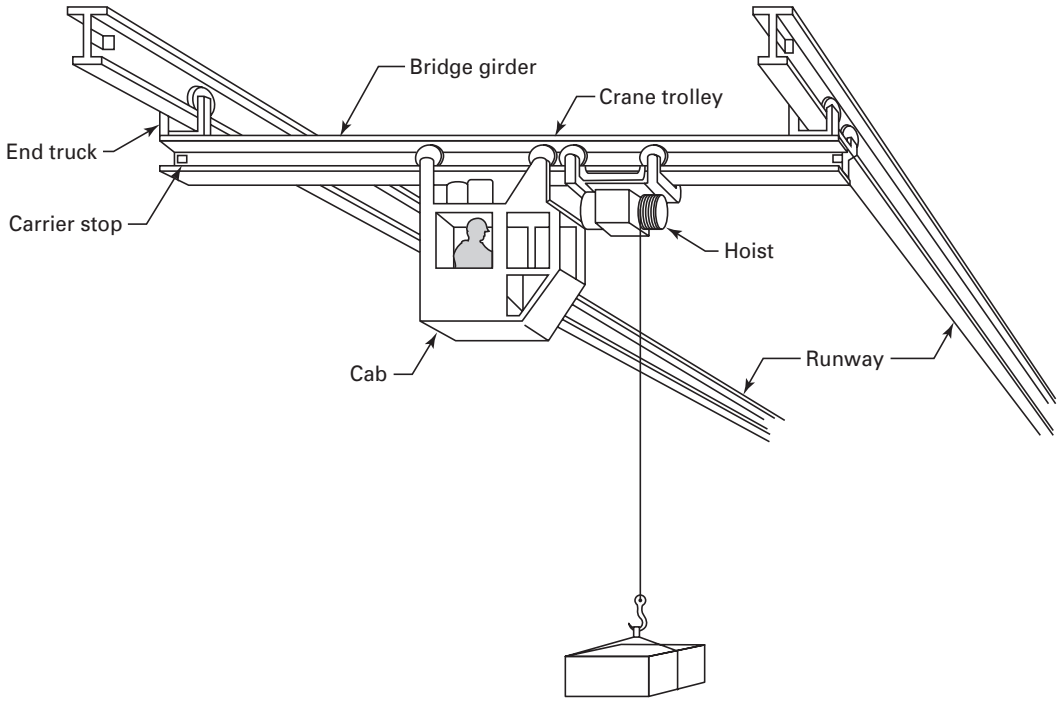
crane, remote-operated: a crane controlled by an operator not in a pulpit nor in the cab attached to the crane, and controlled by any method other than a means suspended from the crane.

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. 6).

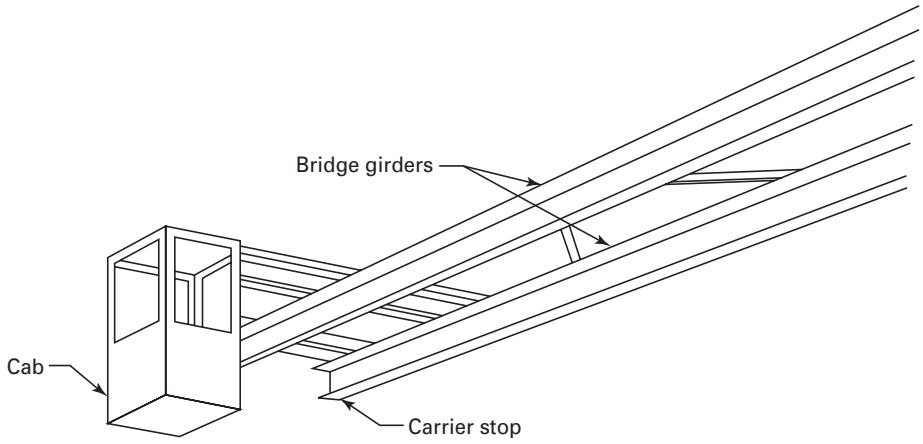
crane, single-girder: a crane having one bridge girder mounted between, and supported from, the end trucks.

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

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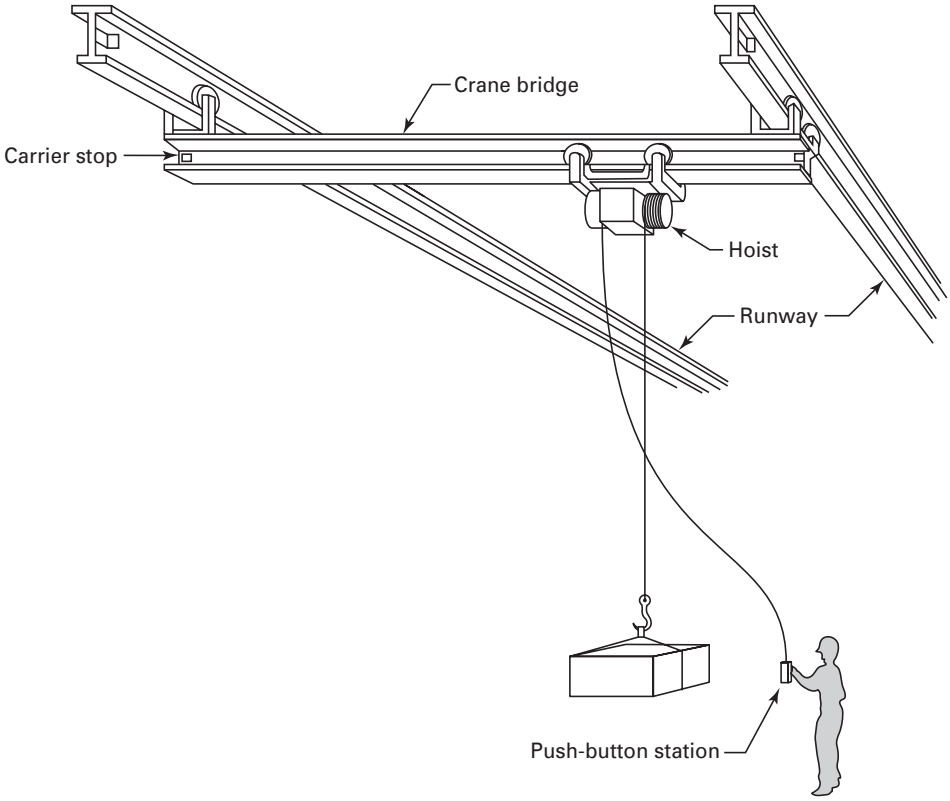
(a) Cab-Operated Crane



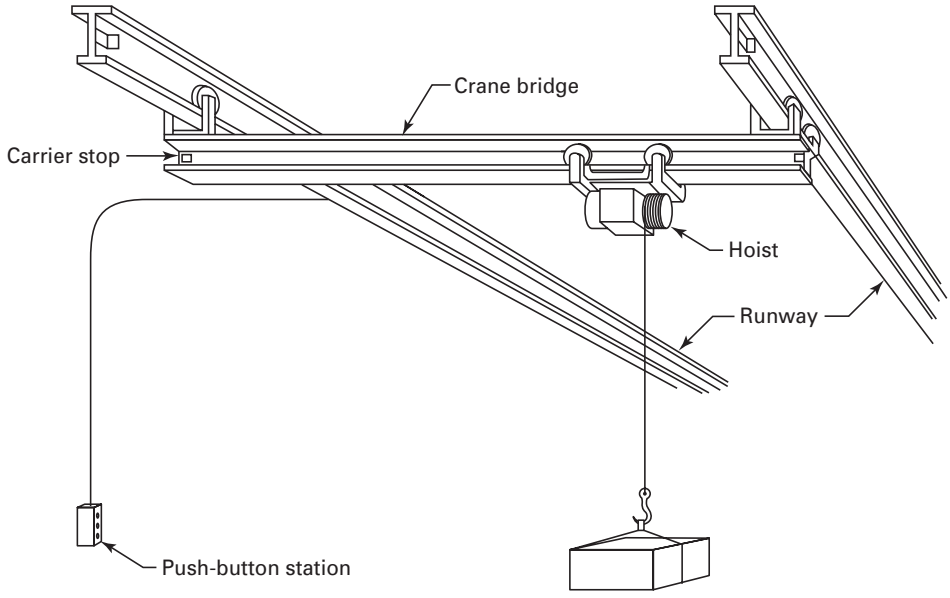
(b) Cab Fixed on Crane

Fig. 4 Cab-Operated Cranes

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(a) Hand-Held Push Button



(b) Wall-Mounted Push Button

Fig. 5 Floor-Operated Cranes

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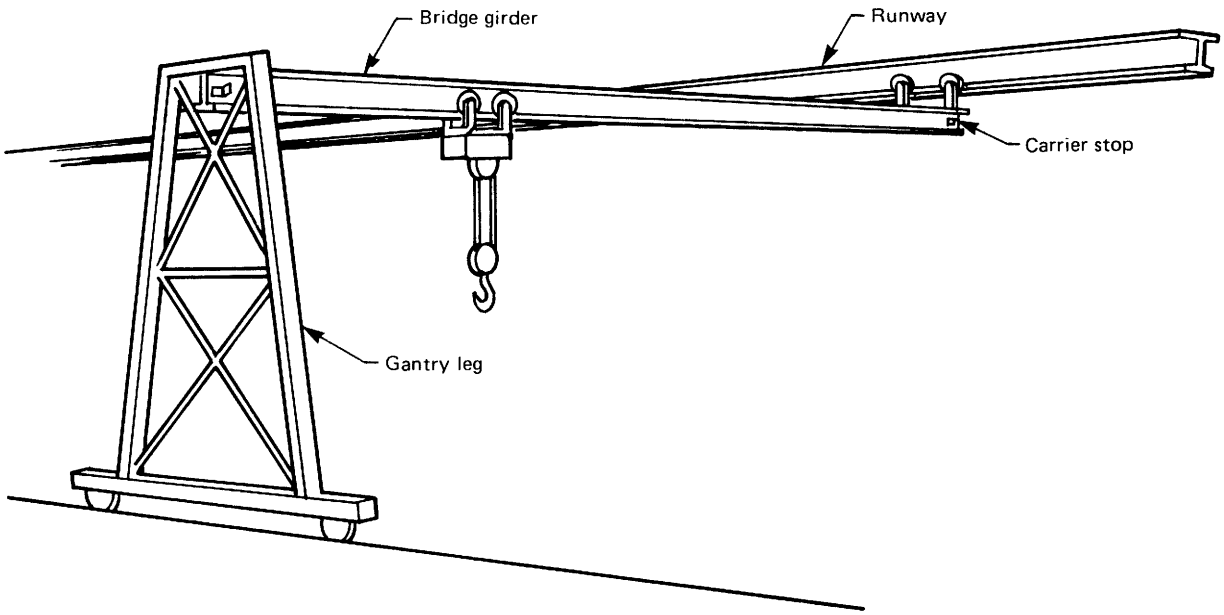


Fig. 6 Semigantry Crane

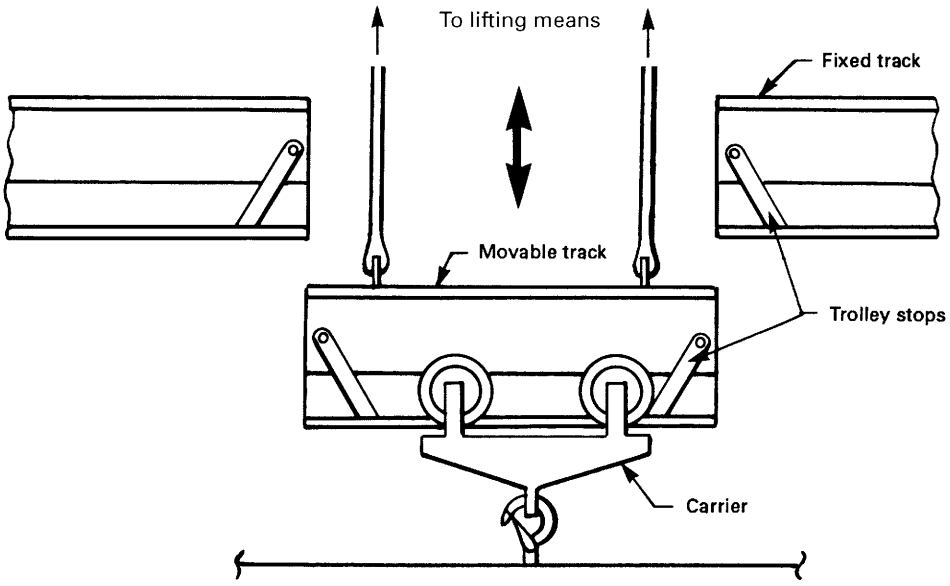


Fig. 7 Drop Section (Lift Section)

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. 7).

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.

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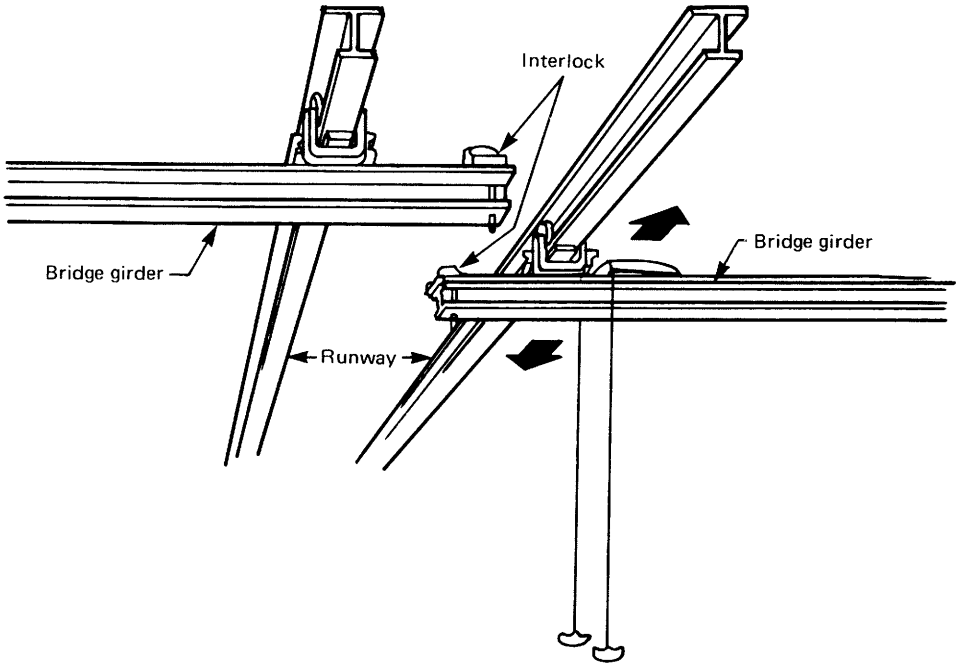


Fig. 8 Interlocking System for Underhung Crane

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. 8).

jib boom: a horizontal cantilever track for supporting the carrier (see Fig. 1).

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.

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 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.

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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.

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.

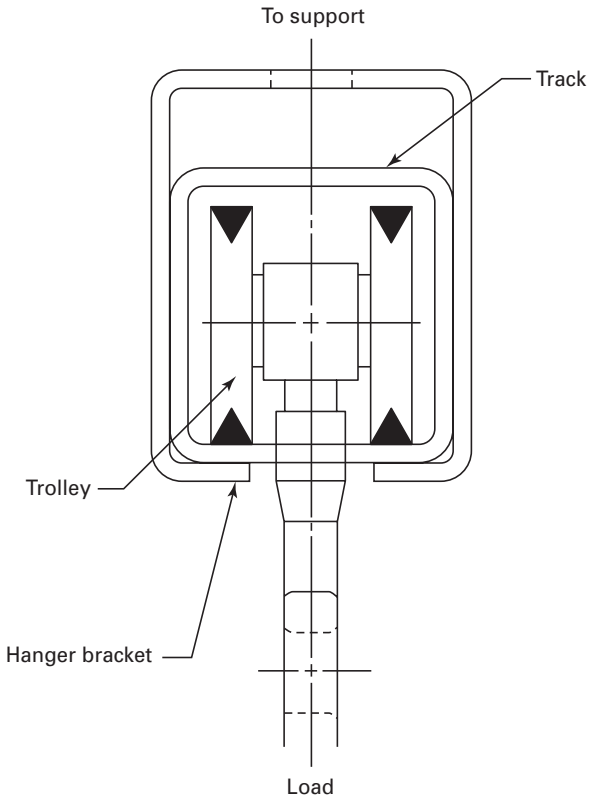


Fig. 9 Example of One Type of Enclosed Track and Support Bracket

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.

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. 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.

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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.

(04) SECTION 11-0.3 REFERENCES

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

The Manual of Steel Construction, 9th ed., 1989

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

Specification for Aluminum Structures (1986)

Publisher: The Aluminum Association, Inc. (AA), 818 Connecticut Avenue, NW, Washington, DC 20006

ANSI A1264.1-1995 (R2002), Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems

ANSI Z26.1-1990, Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036

ANSI A14.3-1992, Safety Requirements for Fixed Ladders[1]

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

[1] May also be obtained from American National Standards Institute, 25 West 43rd Street, New York, NY 10036.

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

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

ANSI Z241.2-1989, Safety Requirements for Melting and Pouring of Metals in the Metalcasting Industry[1]

Publisher: American Foundrymen's Society (AFS), 505 State Street, Des Plaines, IL 60016

ANSI/AWS D1.1-2002. Structural Welding Code-Steel[1]

ANSI/AWS D14.1-85, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment[1]

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

ANSI/NFPA 70-2002, National Electrical Code[1]

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

ASME B30.9-2003, Slings[1]

ASME B30.10-1999, Hooks[1]

ASME B30.16-2003, Overhead Hoists (Underhung)[1]

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

CMAA Specification No. 74-2000, 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

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Chapter 11-1
Construction And Installation

SECTION 11-1.1 MARKINGS

11-1.1.1 Rated Load Markings — Crane

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.

11-1.1.2 Rated Load Markings — Monorails

The rated load of each hoist on a monorail shall be marked in accordance with ASME B30.16. Combined loads on hoists shall not exceed the rated load of the monorail.

11-1.1.3 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.

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

(a) Crane runways, monorails, 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 to 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.

11-1.3.2 Track Supports

(a) Crane runways or monorail tracks shall be fastened to a supporting structure.

(b) All clamps, hanger rods, bolts, or other suspension fittings and supporting structures 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.

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(04) *(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.

11-1.3.3 Cranes

All cranes 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, or ANSI MH27.1, as applicable.

11-1.3.4 Welded Construction

All welding procedures and welding operator qualifications to be used on load-sustaining members of cranes 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.

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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 signalperson.

(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 ANSI A1264.1.

(e) Outdoor cabs should be enclosed. All cab glazing shall be of safety glazing material as defined in ANSI 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/ft^2 (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 ANSI A14.3.

11-1.6.4 Toolbox

If a receptacle is provided for the stowing of tools and oilcans, 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

1-1.7.1 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.

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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 system, 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. 10 and 11.

(4) The arrangement of controllers or master switches should conform to Figs. 10 and 11.

(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. 12.

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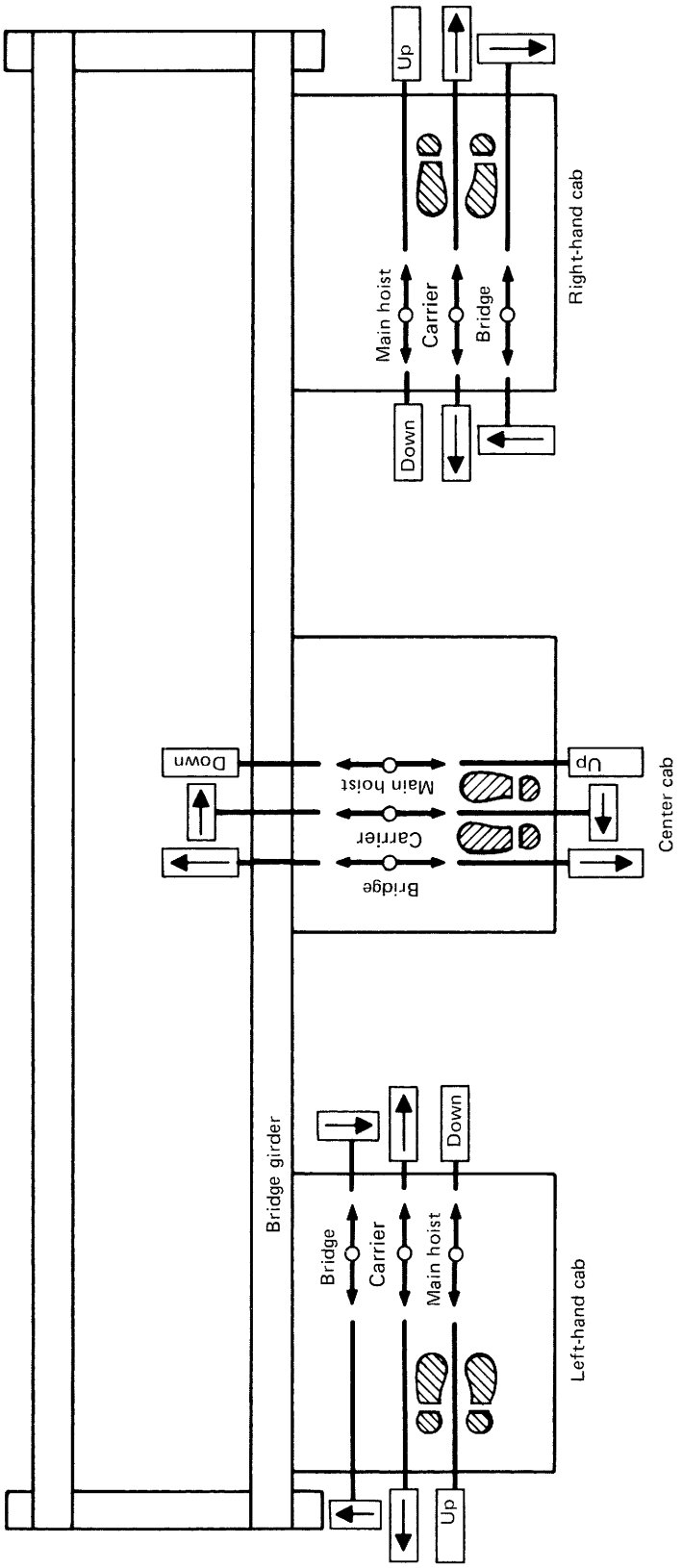


Fig. 10 Recommended Arrangement of Controllers (Three-Motor Crane)

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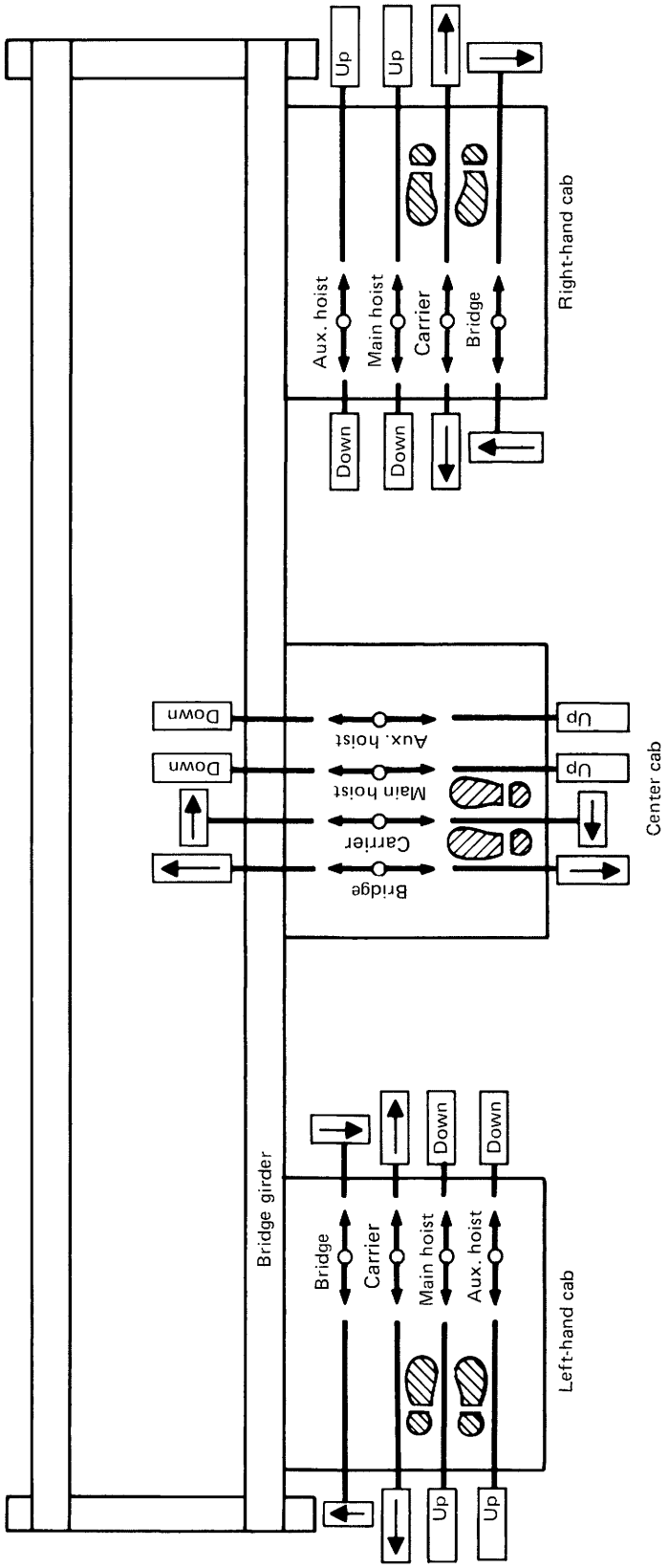
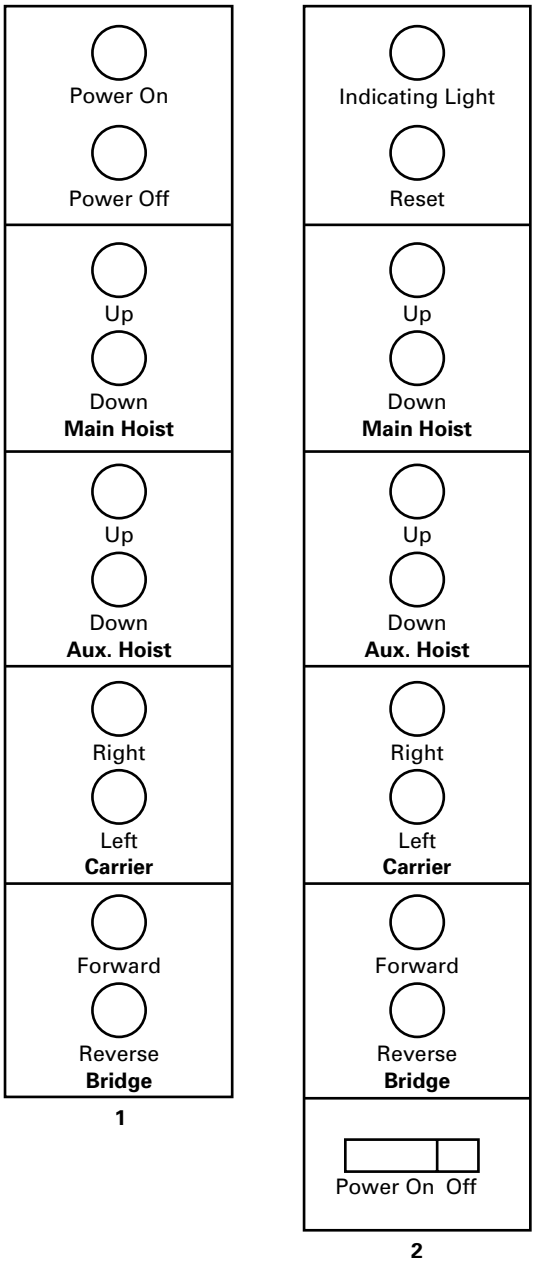


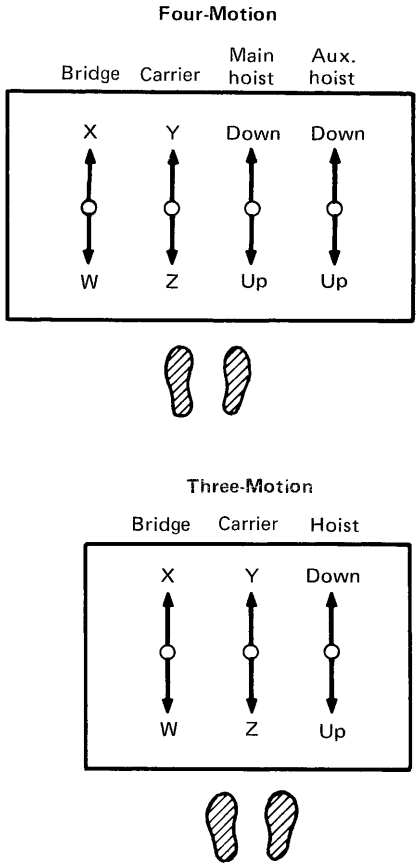
Fig. 11 Recommended Arrangement of Controllers (Four-Motor Crane)

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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. 12 Recommended Arrangement of Controllers (Pendant Push-Button Station 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 opeation. The designation may appear below, above, on, or adjacent to, the button controlling the respective operation.

Fig. 13 Recommended Arrangement of Controllers (Radio Crane Control Transmitter Lever Arrangement)

(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. 13.

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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.

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Chapter 11-2
Inspection, Testing, and Maintenance

SECTION 11-2.1 INSPECTION

11-2.1.1 Inspection Classification

(a) Initial Inspection. Prior to initial use, all new, reinstalled, altered, or modified crane and monorail systems shall be inspected by a designated person to verify compliance with the applicable provisions of this Volume.

(b) Interval Classification. Inspection procedure for crane and monorail systems in regular service shall be divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the equipment and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as frequent and periodic, with respective intervals between inspections as defined below.

(1) Frequent Inspection. Visual examination by the operator or other designated personnel, with records not required, as follows:

(a) normal service — monthly

(b) heavy service — weekly to monthly

(c) severe service — daily to weekly

(2) Periodic Inspection. Visual inspection by an appointed person making records of apparent external conditions to provide the basis for a continuing evaluation, as follows:

(a) normal service, equipment in place — annually

(b) heavy service — as in (a), normal service, unless external conditions indicate that disassembly should be done to permit detailed inspection, semiannually

(c) severe service — as in (b), heavy service, quarterly

11-2.1.2 Frequent Inspection

(a) Frequent inspections shall be performed at intervals defined in para. 11-2.1.1(b)(1) and shall include observations during operation.

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

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

(d) The upper limit device on the hoist shall be checked, without a load on the hook, at the beginning of each work shift. Care shall be exercised. The load block shall be inched into its limit or run in at low speed.

(e) Other items to be checked based on classification of service include the following:

(1) operating mechanisms for proper operation, proper adjustment, and unusual sounds

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

11-2.1.3 Periodic Inspection

(a) Periodic inspections shall be performed at intervals defined in para. 11-2.1.1(b)(2).

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

(c) A qualified person shall examine any deficiencies found during the inspection to determine whether conditions found constitute a hazard, require disassembly for further inspection, or require replacement.

(d) The inspection shall include the items listed in paras. 11-2.1.2(d) and (e).

(e) The equipment shall also be inspected for evidence of the following:

(1) deformed, cracked, or corroded members

(2) loose bolts, nuts, or rivets

(3) cracked or worn sheaves and drums

(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) excessive wear of brake system parts

(6) excessive wear of chain drive sprockets and excessive chain stretch

(7) deterioration of controllers, master switches, contacts, limit devices, and push-button stations, but not limited to these items

(8) excessive wear of drive tires

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

(10) illegibility of function labels

11-2.1.4 Equipment Not in Regular Use

(a) Equipment that has been idle for a period of one month or more, but less than one year, shall be inspected in accordance with para. 11-2.1.2 before being placed into service.

(b) Equipment that has been idle for a period of one year or more shall be inspected in accordance with para. 11-2.1.3 before being placed into service.

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11-2.1.5 Inspection Records

Dated inspection reports or comparable records of critical items such as hoisting machinery, sheaves, hooks, chains, ropes, wheels, and other lifting devices, as required in para. 11-2.1.1(b)(2), shall be maintained. Records should be kept where available to appointed personnel.

SECTION 11-2.2 TESTING

11-2.2.1 Operation Tests

(a) New and reinstalled equipment shall be tested prior to initial use to verify compliance with 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) hoist upper limit of travel device. The trip setting of hoist-limit devices shall be determined by tests with an empty hook comprising a series of runs, each at increasing hook speeds up to the maximum speed unless the hoist has only a single speed. The actuating mechanism of the upper-limit device shall be located or adjusted so that it will trip the device in sufficient time to prevent contact of the load block or load with any part of the carrier or bridge).

(5) trolley-travel-limiting devices.

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

(c) Altered, repaired, and modified cranes and monorails shall be tested. Tests 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.

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.

(b) If a load test is conducted, the load shall be not less than 100% of the rated load of the equipment or more than 125% of the rated load of the equipment, unless otherwise recommended by the manufacturer.

(c) 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.

(d) 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.

(e) 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.

SECTION 11-2.3 MAINTENANCE

11-2.3.1 Preventive Maintenance

(a) A preventive maintenance program should be established and based on the equipment manufacturer's, or a qualified person's, recommendations. Dated records should be kept.

(b) Replacement parts shall be at least equal to the original manufacturer's specifications.

11-2.3.2 Maintenance Procedure

(a) Before adjustments and repairs are started, the following precautions shall be taken, as applicable:

(1) The crane or monorail carrier to be repaired 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) All controllers shall be placed in the off position.

(3) Main power disconnect shall be deenergized and locked, tagged, or flagged in the deenergized position.

(4) Effective markings and barriers shall be utilized where the maintenance work creates a hazardous area on the floor beneath the crane or monorail.

(5) Where other cranes or carriers are in operation on the same runways or monorail track, rail stops or

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other means shall be provided to prevent interference with the idle equipment.

(6) Where temporary protective rail stops are not possible, available, or practical, a signalperson shall be placed at a visual vantage point for observing the approach of an active unit and warning its operator when reaching the limit of safe distance from the idle unit.

(7) Where runways are adjacent to the crane runway of the crane being repaired, and the center runway or center repair platform, or both, become a work area that is not protected by wire mesh or other suitable protection, or if any hazard from the adjacent operations exists, the adjacent runway must also be restricted. When cranes must operate on adjacent runways and through the restricted area, a signalperson shall be provided. All cranes shall come to a full stop prior to entering the restricted area and may then proceed through this area on a signal from the signalperson.

(b) Equipment that cannot be readily moved from its operating location can be inspected and maintained at the site, provided precautions are taken to ensure the safety of the inspecting and maintenance personnel.

(c) Provisions shall be made for trained personnel to test and make adjustments on energized equipment when required.

(d) After adjustments and repairs have been made, the equipment shall not be restored to service until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

11-2.3.3 Adjustments, Repairs, and Replacements

(a) Any condition disclosed by the inspections performed in accordance with the requirements of 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.

11-2.3.4 Lubrication

(a) All moving parts of the monorail or underhung crane 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. 11-2.3.2(a)(1) through (4), unless the cranes or carriers are equipped for automatic or remote lubrication.

SECTION 11-2.4 CHAIN AND ROPE INSPECTION, REPLACEMENT, AND MAINTENANCE

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

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Chapter 11-3
Operation

SECTION 11-3.1 QUALIFICATIONS FOR AND CONDUCT OF OPERATORS

11-3.1.1 Operators of Cranes or Carriers

(a) Equipment shall be operated only by the following personnel:

(1) designated persons

(2) trainees under the direct supervision of a designated person

(3) maintenance and test personnel, when it is necessary in the performance of their duties

(4) inspectors

(b) No one, other than personnel specified in para. 11-3.1.1(a), 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.

11-3.1.2 Qualifications for Operators of Cab-Operated and Pulpit-Operated Cranes or Carriers

(a) Operators shall be required by the employer to pass a written or oral examination, and a practical operating examination, unless they are able to furnish satisfactory evidence of qualifications and experience. Qualification shall be limited to the specific type equipment for which examined.

(b) Operators and operator trainees should have normal depth perception, field of vision, reaction time, manual dexterity, coordination, no tendencies to dizziness or similar undesirable characteristics, and shall meet the following physical qualifications:

(1) have vision of at least 20/30 Snellen in one eye and 20/50 in the other, with or without corrective lenses

(2) be able to distinguish color, regardless of position of colors, if color differentiation is required for operation

(3) have hearing, with or without hearing aid, adequate for a specific operation

(4) have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of the equipment operation

(c) Evidence of physical limitations or emotional instability that could render the operator or operator trainee a hazard to the operator or others, or which in the opinion of the examiner could interfere with the operator's safe performance, may be cause for disqualification. In such cases, specialized clinical or medical judgements and tests may be required.

(d) Evidence that an operator is subject to seizures or loss of physical control shall be reason for disqualification. Specialized medical tests may be required to determine these conditions.

11-3.1.3 Qualifications for Operators of Floor-Operated Cranes or Carriers

Personnel shall be required by the employer to pass a practical operating examination. Qualification shall be limited to the specific type of equipment for which examined.

11-3.1.4 Qualifications for Operators of Remote-Operated or Automatic Cranes or Carriers

The use of remote control or automatic equipment involves such a wide variety of service requirements and conditions that each installation should be carefully analyzed, and the operation reviewed, to determine whether para. 11-3.1.2 or 11-3.1.3 should apply.

11-3.1.5 Conduct of Operators

(a) The operator shall not engage in any practice that will divert attention while actually engaged in operating the equipment.

(b) An operator shall not engage in the operation of the equipment when physically or otherwise unfit.

(c) The operator shall respond to signals from the person who is directing the lift, or an appointed signalperson. When a signalperson is not required as part of the crane operation, the operator is then responsible for the lifts. However, the operator shall obey a stop signal at all times, no matter who gives it.

(d) Each operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall consult with the supervisor before handling the loads.

(e) The operator shall not pick up a load in excess of the rated load appearing on the crane or hoist load block, except during properly authorized tests or properly authorized planned engineered lifts in accordance with para. 11-3.2.4. A hoist overload limiting device shall not be used to measure the maximum load to be lifted.

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(f) Before leaving the cab-operated crane or cab-operated carrier unattended, the operator shall land any attached load, place controllers or master switches in the off position, and open the main line device of the specific crane or carrier.

(g) The operator shall not close the main line disconnect device until certain that no worker is on, or adjacent to, the crane or carrier. If there is a warning sign or lock on the device, the crane or carrier shall not be energized until the sign or lock is removed by the person who placed it thereon or by an authorized person.

(h) Before closing the main line disconnect of cab-operated equipment, the operator shall determine that all controllers are in the off position.

(i) If power goes off during operation of cab-operated equipment, the operator shall immediately place all controllers in the off position. Prior to re-use of the equipment, operating motions shall be checked for proper direction.

(j) The operator shall be familiar with the equipment and its proper care. If adjustments or repairs are necessary, or any defects are known, the operator shall report the same promptly to the appointed person who shall be responsible for the operation and maintenance repairs of the equipment. The operator shall also notify the next operator of any remaining, uncorrected defects upon changing shifts.

(k) Contacts with stops or other cranes or carriers shall be made with caution. The operator shall do so with care for the safety of persons on or below the equipment, and only after making certain that any persons on the other equipment are aware of what is being done.

(l) Before any maintenance work is performed, the requirements of para. 11-2.3.2 shall be met. The operator shall respect the lockout.

(m) All controls of cab-operated equipment shall be tested by the operator before beginning a new shift. If any controls do not operate properly, they shall be adjusted or repaired before operations are begun.

(n) Persons boarding or leaving cab-operated equipment should do so only at authorized locations and designated boarding entrances.

SECTION 11-3.2 HANDLING THE LOAD

11-3.2.1 Load Weight

The equipment shall not be loaded in excess of its rated load except for test purposes as provided in para. 11-2.2.2 or for planned engineered lifts as provided in para. 11-3.2.4.

11-3.2.2 Attaching the Load

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

(b) The load shall be attached to the load block.

(c) Care shall be taken to make certain that the load, sling, attachments, lifting devices, and the load block are clear of all obstacles.

11-3.2.3 Moving the Load

(a) The appointed person directing the lift shall see that the load is well secured and properly balanced and positioned in the sling or lifting device before it is lifted more than a few inches (millimeters).

(b) Before starting to lift, the following conditions should be noted:

(1) Hoist chain or rope shall not be kinked.

(2) Multiple-part lines shall not be twisted around each other.

(3) The load block shall be brought over the load in such a manner as to minimize swinging when the load is lifted.

(4) The chain or rope should be properly seated on the chain sprocket or in the drum groove if there is or has been a slack chain or rope condition.

(c) During lifting, care shall be taken that:

(1) there is no sudden acceleration or deceleration of the moving load

(2) the load does not contact any obstructions

(d) Equipment shall not be used for side pulls except when specifically authorized by a qualified person who has determined that the stability of the equipment is not thereby endangered, and that various parts of the equipment will not be overstressed.

(e) The operator shall not lift, lower, or travel while anyone is on the load or hook.

(f) The operator should avoid carrying loads over people.

(g) 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 short distance and applying the brake(s).

(h) 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.

(i) When two or more pieces of equipment are used to lift a load, one qualified 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.

11-3.2.4 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.

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Limitations and planned requirements shall be applicable, as follows:

(a) Planned engineered lifts shall be limited to powered cranes having a load rating of 5 tons and above.

(b) When planned engineered lifts are made, the load shall not exceed 125% of the equipment load rating.

(c) Planned engineered lifts shall be limited to two occurrences on any crane within any continuous 12-month period, except as provided in para. 11-3.2.4(d). If greater lift frequency is desired, consideration shall be given to rerating or replacing the equipment.

(d) The 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-month 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 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 support shall be inspected, and any deterioration or damage shall be taken into consideration in design calculations for the load to be lifted.

(4) The crane shall be inspected in accordance with para. 11-2.1.3 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 short distance 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. 11-2.1.3 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.

11-3.2.5 Parking the Load

(a) The operator should not leave a suspended load unattended unless specific precautions have been instituted and are in place.

(b) The load block of the hoist should be lifted above head level for storage when the equipment is not in use.

(c) Care shall be exercised when removing a sling from under a landed and blocked load.

11-3.2.6 Hoist Limit Device

The hoist limit device which 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.

SECTION 11-3.3 SIGNALS

11-3.3.1 Standard Signals

Signals to the operator should be in accordance with the standards prescribed in Fig. 14, 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.

11-3.3.2 Hand Signals

When hand signals are used, they should be posted conspicuously and should be as illustrated in Fig. 14.

(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 11-3.4 MISCELLANEOUS

11-3.4.1 Cabs

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

(b) Tools, oilcans, 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.

11-3.4.2 Fire Extinguishers

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

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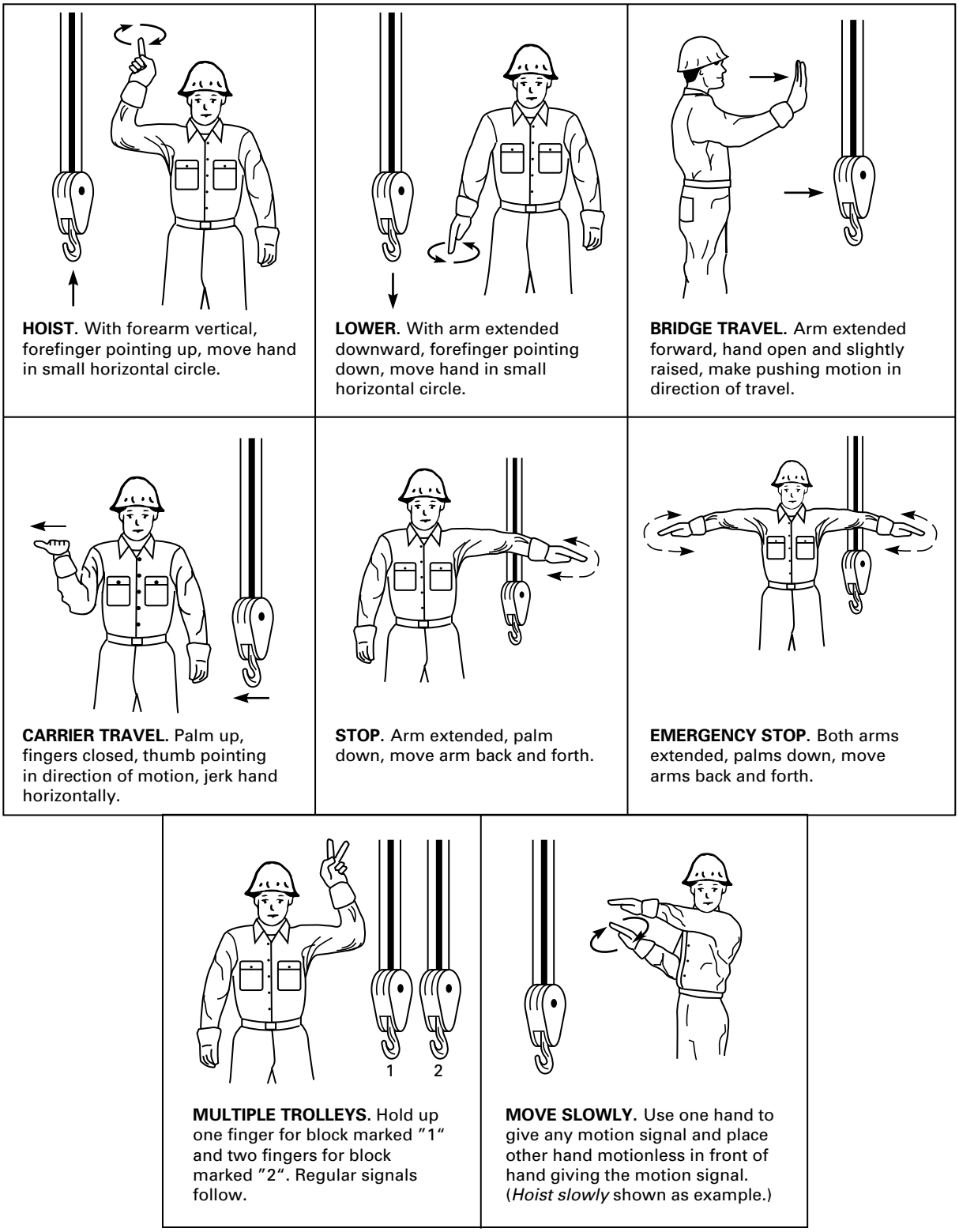


Fig. 14 Standard Hand Signals for Controlling Cab-Operated Monorails and Underhung Cranes

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ASME B30.11-2004 INTERPRETATIONS

Replies to Technical Inquiries
April 1999 through April 2004

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.

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Interpretation: 11-13

Subject: ASME B30.11-1998, Section 11-1.1, Markings

Date Issued: January 19, 2001

Background: Assuming a system is comprised of the following setup: jib crane — 750 lb, trolley — 1,000 lb, hoist — 500 lb

Question (1): How should this unit be marked or rated load?

Reply (1): The crane and the hoist must be marked with their rated load in compliance with ASME B30.11 and ASME B30.16, respectively.

Question (2): May you mark the entire system's rated load with the lowest rated load of any single component?

Reply (2): No. The rated load marking of each component should be retained and protected and not changed to suit a temporary situation. When rated load markings are changed to suit a temporary situation, the original rated load markings can be lost. This might cause the hoisting equipment to be improperly marked or over rated load marked in other subsequent temporary applications. The operator of the hoisting system must be adequately trained to determine the maximum rated load of the system from the rated load markings and make sure the maximum load does not exceed the rated load of the component with the least rated load.

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Interpretation: 11-14

Subject: ASME B30.11-1998, Para. 11-1.2.2, Clearances Between Parallel Cranes

Date Issued: May 30, 2001

Background: Our organization is currently designing a bridge crane system where we desire to have two bridge cranes that overlap each other. Components are to be conveyed through the work center on a common roller conveyer. The bridges are to be positioned such that operators on opposite sides of the common conveyor can access components and return to work stalls. The bridges will be at different elevations having 4 ft of overlap.

The lower bridge offers no intereference with the upper bridge; the potential issue lies in the hoist on the upper bridge. If the hoist on the upper bridge is positioned in the 4 ft of overlap [as shown in Fig. 11-14], the lower bridge could hit the hoist if it travels on the runway. The potential for a collision is minimal since the operator will only enter this zone once every 1½ hr to access another part.

Question: Does the scenario above constitute a clearance issue as defined in para. 11-1.2.2(a)?

Reply: Yes, because no means to prevent collision between the hoist on the higher crane with the lower crane is present.

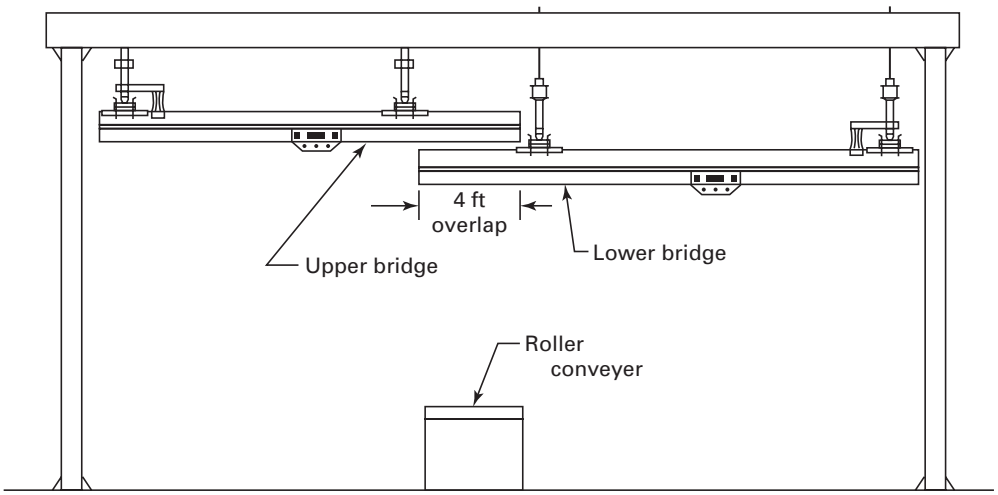


Fig. 11-14 Overlapping Bridge Cranes

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Interpretation: 11-15

Subject: ASME B30.11-1993, Para. 11-1.3.4, Welded Construction

Date Issued: May 30, 2001

Question: Is a load test required for the following example?

A modification to a monorail support structure is being made because of an under-designed connection in the support structure. A welded connection to the top of the monorail beam will be removed and a new connection to the monorail beam will be installed at the same location, but the support structure will need to be changed to provide adequate strength at the support point. Basically, is the Standard considering the weld to the monorail beam and the monorail support structure as part of the monorail load supporting components?

Reply: Paragraph 11-1.3.4 is titled "Welded Construction." Paragraph 11-1.3.5 is titled "Modifications." The Committee believes you are referring to para. 11-1.3.5 "Modifications" for this interpretation. Also, please note that ASME B30.11-1993 has been replaced with ASME B30.11-1998. Since ASME B30.11-1998 became effective on June 29, 1998, our interpretation is based on this volume.

Section 11-2.2(a), Load Test, states the following: "New, reinstalled, altered, repaired and modified equipment should be load tested prior to initial use as determined by a qualified person." The word "should" signifies that the load test is recommended but not mandated. Whether a load test is required should be determined by a qualified person, depending on the facts in the situation.

Interpretation: 11-16

Subject: ASME B30.11-1998

Date Issued: June 8, 2001

Question: When an owner/user of an underhung crane has permanent units in place (bridge, trolley, and hoist) with conflicting capacities (rated loads and markings), may a temporary marking be placed over the permanent markings on the higher rated load units that states the rated load of the lowest rated load unit?

Reply: The ASME B30.11 and ASME B30.16 Standards do not specifically address this situation. However, if the provisions of para. 11-1.3.5, Modifications, are followed, the components of the subject hoisting system could be rerated in conformance with this paragraph to obtain consistent rated capacity markings.

Interpretation: 11-17

Subject: ASME B30.11-1998, Chapter 11-1, Construction and Installation

Date Issued: June 11, 2001

Question: Is fall restraint or means of retaining the bumpers required on B30.11 type cranes?

Reply: Bumpers are not required on the bridge of an underhung crane because the mass and speed of most underhung cranes do not necessitate an energy-absorbing device at the location of contact between the crane bridge and the runway stop or another crane. Therefore, there is no provision for bridge bumpers in ASME B30.11-1998. When bumpers are specified for an underhung crane, the requirements for bumpers found in ASME B30.2 or ASME B30.17 should be followed.

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ASME B30.11-2004

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