

**ASME B30.28-2015**  
(Revision of ASME B30.28-2010)

# Balance Lifting Units

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**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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Two Park Avenue • New York, NY • 10016 USA

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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 (ANSI). 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 at 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 (AESC) [later changed to American Standards Association (ASA), then to the United States of America Standards Institute (USASI), and finally to ANSI], 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, AESC 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. Commencing June 1, 1927, and using the eight-page code published by ASME in 1916 as a basis, the Sectional Committee developed the Safety Code for Cranes, Derricks, and Hoists. The early drafts of this safety code included requirements for jacks, but, due to inputs and comments on those drafts, the Sectional Committee decided in 1938 to make the requirements for jacks a separate code. In January 1943, ASA B30.2-1943 was published addressing a multitude of equipment types, and in August 1943, ASA B30.1-1943 was published just addressing jacks. Both documents were reaffirmed in 1952 and widely accepted as safety standards.

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 Bureau of Yards and Docks (now the Naval Facilities Engineering Command), was reorganized on January 31, 1962, with 39 members representing 27 national organizations. The new committee changed the format of ASA B30.2-1943 so that the multitude of equipment types it addressed could be published in separate volumes that could completely cover the construction, installation, inspection, testing, maintenance, and operation of each type of equipment that was included in the scope of ASA B30.2. This format change resulted in the initial publication of B30.3, B30.5, B30.6, B30.11, and B30.16 being designated as revisions of B30.2, with the remainder of the B30 volumes being published as totally new volumes. ASA changed its name to USASI in 1966 and to ANSI in 1969, which resulted in B30 volumes from 1943 to 1968 being designated as either ASA B30, USAS B30, or ANSI B30, depending on their date of publication.

In 1982, the Committee was reorganized as an Accredited Organization Committee, operating under procedures developed by ASME and accredited by ANSI. This Standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

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

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.

The first edition of this Standard was published in 2010. This 2015 Edition contains technical and editorial revisions, including the addition of responsibilities of personnel, personnel competence, and translations. It was approved by the B30 Standards Committee and by ANSI and designated as an American National Standard on November 20, 2015.

# ASME B30 COMMITTEE

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

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

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

(15)

## B30 STANDARD INTRODUCTION

### SECTION I: SCOPE

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

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

- |        |   |        |                             |
|--------|---|--------|-----------------------------|
| B30.1  | Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries  | B30.23 | Personnel Lifting Systems   |
| B30.2  | Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist) | B30.24 | Container Cranes            |
| B30.3  | Tower Cranes  | B30.25 | Scrap and Material Handlers |
| B30.4  | Portal and Pedestal Cranes  | B30.26 | Rigging Hardware            |
| B30.5  | Mobile and Locomotive Cranes  | B30.27 | Material Placement Systems  |
| B30.6  | Derricks  | B30.28 | Balance Lifting Units       |
| B30.7  | Winches   | B30.29 | Self-Erecting Tower Cranes  |
| B30.8  | Floating Cranes and Floating Derricks   | B30.30 | Ropes <sup>1</sup>          |
| 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<br>(withdrawn in 1982 — requirements found in latest revision of B30.5)       |        |                             |
| B30.16 | Overhead Hoists (Underhung)   |        |                             |
| B30.17 | Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)                       |        |                             |
| B30.18 | Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist) |        |                             |
| B30.19 | Cableways   |        |                             |
| B30.20 | Below-the-Hook Lifting Devices  |        |                             |
| B30.21 | Lever Hoists  |        |                             |
| B30.22 | Articulating Boom Cranes  |        |                             |

### SECTION II: SCOPE EXCLUSIONS

Any exclusion of, or limitations applicable to the equipment, requirements, recommendations, or operations contained in this Standard are established in the affected volume's scope.

### SECTION III: PURPOSE

The B30 Standard is intended to

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

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

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

### SECTION IV: USE BY REGULATORY AGENCIES

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

### SECTION V: EFFECTIVE DATE

(a) *Effective Date.* The effective date of this Volume of the B30 Standard shall be 1 yr after its date of issuance.

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<sup>1</sup> This volume is currently in the development process.

Construction, installation, inspection, testing, maintenance, and operation of equipment manufactured and facilities constructed after the effective date of this Volume shall conform to the mandatory requirements of this Volume.

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

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

## **SECTION VI: REQUIREMENTS AND RECOMMENDATIONS**

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

## **SECTION VII: USE OF MEASUREMENT UNITS**

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

## **SECTION VIII: REQUESTS FOR REVISION**

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

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

Requests should be in the following format:

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

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to

the requester defining the actions undertaken by the B30 Standard Committee.

## **SECTION IX: REQUESTS FOR INTERPRETATION**

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

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

Requests should be in the following format:

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

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

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

## **SECTION X: ADDITIONAL GUIDANCE**

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

The B30 Standard Committee fully realizes the importance of proper design factors, minimum or maximum dimensions, and other limiting criteria of wire rope or chain and their fastenings, sheaves, sprockets, drums, and similar equipment covered by the standard, all of

which are closely connected with safety. Sizes, strengths, and similar criteria are dependent on many different factors, often varying with the installation and uses. These factors depend on

- (a) the condition of the equipment or material
- (b) the loads
- (c) the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums
- (d) the type of attachments

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

(f) environmental conditions causing corrosion or wear

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

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

# ASME B30.28-2015

## SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.28-2015 was approved by the American National Standards Institute on November 20, 2015.

ASME B30.28-2015 includes editorial changes, revisions, and corrections introduced in ASME B30.28-2010, as well as the following changes identified by (15).

<i>Page</i>	<i>Location</i>	<i>Change</i>
viii–x	B30 Standard Introduction	Updated
1, 2	Chapter 28-0	Title revised
	Section 28-0.2	(1) Terms <i>appointed</i> and <i>designated person</i> deleted (2) Terms <i>shall</i> and <i>should</i> added
	Section 28-0.3	Added
	Section 28-0.4	Added
	Section 28-0.5	Updated
6	28-1.3.5	Paragraph 28-1.3.6 deleted
7–9	Section 28-2.1	Revised in its entirety
11, 12	28-3.1.1	Subparagraph (c) revised
	Section 28-3.4	Added

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# BALANCE LIFTING UNITS

## Chapter 28-0

# Scope, Definitions, References, Translations, and Personnel Competence

(15)

### SECTION 28-0.1: SCOPE OF ASME B30.28

Volume B30.28 includes provisions that apply to the marking, construction, installation, inspection, testing, maintenance, and operation of balance lifting units (balancers). Balancers are distinguished by their ability to float the load. This Volume applies to balancers with fixed arm support (Fig. 28-0.1-1) and balancers with overhead flexible lifting medium (Fig. 28-0.1-2). This Volume does not apply to balancers with autonomous operation or balancers used for lifting personnel, as these units require additional considerations, provisions, and features that are not included in this Volume.

### (15) SECTION 28-0.2: DEFINITIONS

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

*balancer:* a balance lifting unit capable of moving loads within the rated capacity and with the capability to float the load.

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

*balancer service, normal:* service that involves operation with loads at or less than 65% of rated load for not more than 50% of the time.

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

*balancer, standby:* balancers that are not in regular service but are used occasionally or intermittently, as required.

*clearance:* the distance from any part of the balancer to the nearest obstruction.

*end effector:* a feature, device, method, or components for connecting the load to a balancer. Also may be referred to as "receiver" or "below the hook lifting devices" (see ASME B30.20).

*exposed:* applies to hazardous objects not guarded or isolated (capable of being contacted inadvertently).

*float the load:* the ability to move the load up or down, without inputs to the operational controls, by applying a force to the load of less than 5% of the load.

*hazardous (classified) locations:* locations where fire or explosion hazards may exist. Locations are classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity is present. Refer to NFPA 70.

*Class I locations:* locations in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

*Class II locations:* locations that are hazardous because of the presence of combustible dust.

*Class III locations:* locations that are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

*lifting medium:* the balancer component that supports and moves the load up and down and determines the type of balancer.

*load:* the total superimposed weight on the balancer including any end effector devices attached to the balancer.

*load, rated:* the maximum load designated by the manufacturer for which the balancer is designed and built.

*manual valves:* a valve for which a manual actuator is the only means of valve actuation.

*normal operating conditions:* conditions during which balancers are performing functions within the scope of the original design.

*overload:* any load greater than the rated load.

*qualified person:* a person who, by possession of a recognized degree 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.

*rope*: refers to wire rope unless otherwise specified.

*safety device*: a feature placed in use for the specific purpose of preventing an unsafe condition and designated as such by the manufacturer.

*shall*: a word indicating a requirement.

*sheave*: a grooved wheel or pulley used with a rope to change the direction and point of application of a pulling force.

*should*: a word indicating a recommendation.

*stop*: a device to limit travel. This device is normally attached to a fixed structure and does not have energy-absorbing ability.

*switch*: a device for making, breaking, or changing the connections in an electric, hydraulic, or pneumatic circuit.

*switch, emergency stop*: a manually actuated switch to disconnect power independently of the regular operating controls.

*unattended*: a condition in which the operator of the balancer is not at the operating control device. However, if the operating control devices are within sight of the operator and within a distance equal to the span of the balancer, the balancer should be considered attended.

### (15) SECTION 28-0.3: TRANSLATIONS OF SAFETY-RELATED INFORMATION AND CONTROL DESIGNATIONS

(a) Translation of non-English documentation into English

(1) The wording of written non-English safety information and manuals regarding use, inspection, and maintenance shall be translated onto English by professional translation industry standards, which include, but are not limited to, the following:

(-a) translation of the complete paragraph message, instead of word by word

(-b) grammatical accuracy

(-c) respectfulness of the source document content without omitting or expanding the text

(-d) accurate translation of the terminology

(-e) reflection of the level of sophistication of the original document

(2) The finished translation shall be verified for compliance with para. 28-0.3(a)(1)(-a) through (a)(1)(-e) by a qualified person having an understanding of the technical content of the subject matter.

(3) Pictograms used to identify controls shall be described in the manuals. The pictograms should comply with ISO 7000, ISO 7296, or another recognized source, if previously defined. The text of the descriptions shall meet the criteria of para. 28-0.3(a)(1) and (a)(2).

(b) Any non-English documentation provided in addition to English shall be translated and reviewed in accordance with the requirements listed in para. 28-0.3(a)(1) and (a)(2).

### SECTION 28-0.4: PERSONNEL COMPETENCE (15)

Persons performing the functions identified in this Volume shall, through education, training, experience, skill, and physical fitness, as necessary, be competent and capable to perform the functions as determined by the employer or employer's representative.

### SECTION 28-0.5: REFERENCES (15)

The following is a list of publications referenced in this Volume:

ANSI/ASSE Z244.1-2003 (R2008), Control of Hazardous Energy — Lockout/Tagout and Alternative Methods  
Publisher: The American Society of Safety Engineers (ASSE), 1800 East Oakton Street, Des Plaines, IL 60018 (www.asse.org)

ANSI Z535.4-2011, Product Safety Signs and Labels  
Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Rosslyn, VA 22209 (www.nema.org)

ASME B30.10-2009, Hooks

ASME B30.20-2013, Below-the-Hook Lifting Devices

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ISO 7000:2012, Graphical symbols for use on equipment — Registered symbols

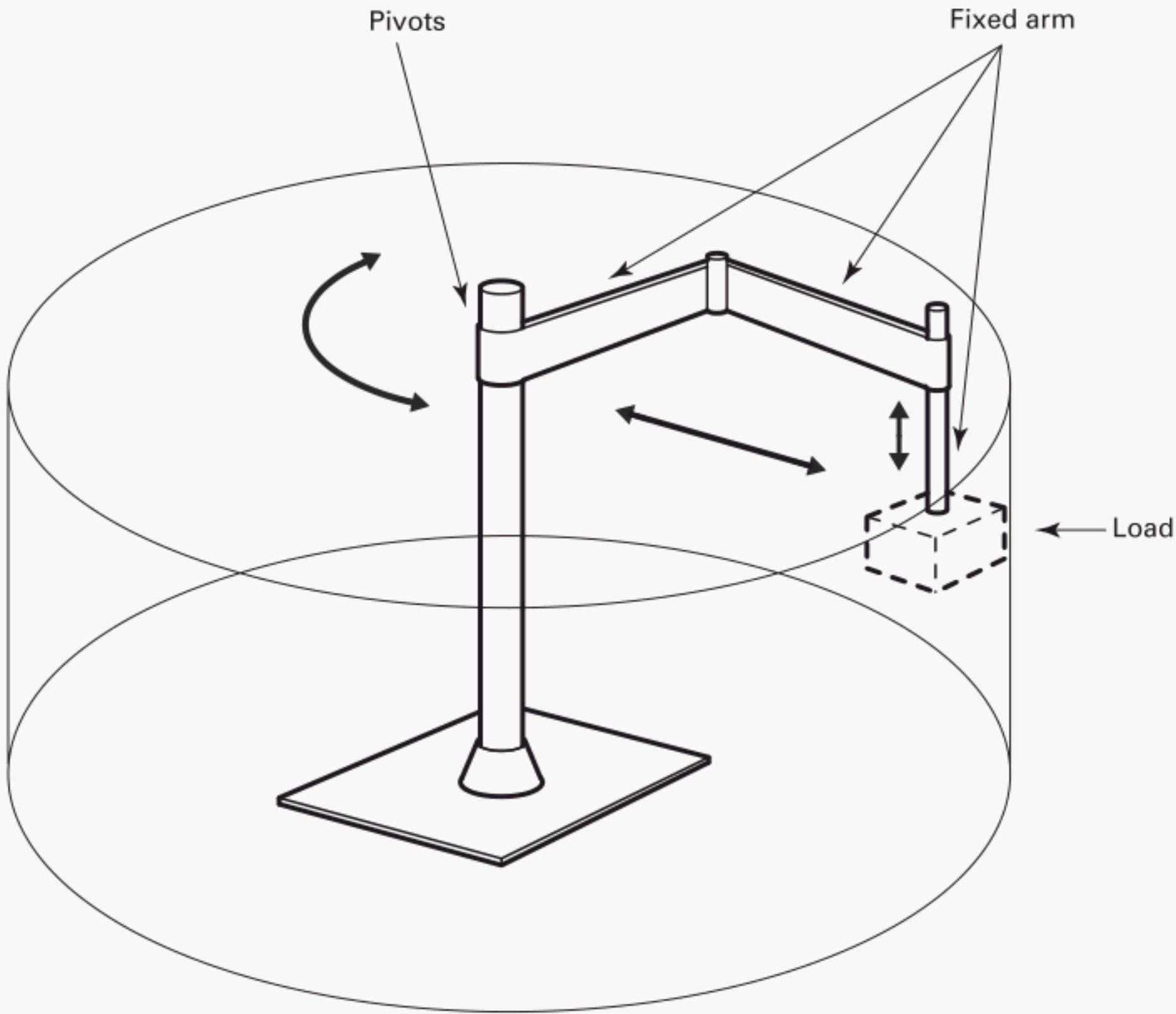
ISO 7296-1:1991, Cranes — Graphical symbols — Part 1: General

Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

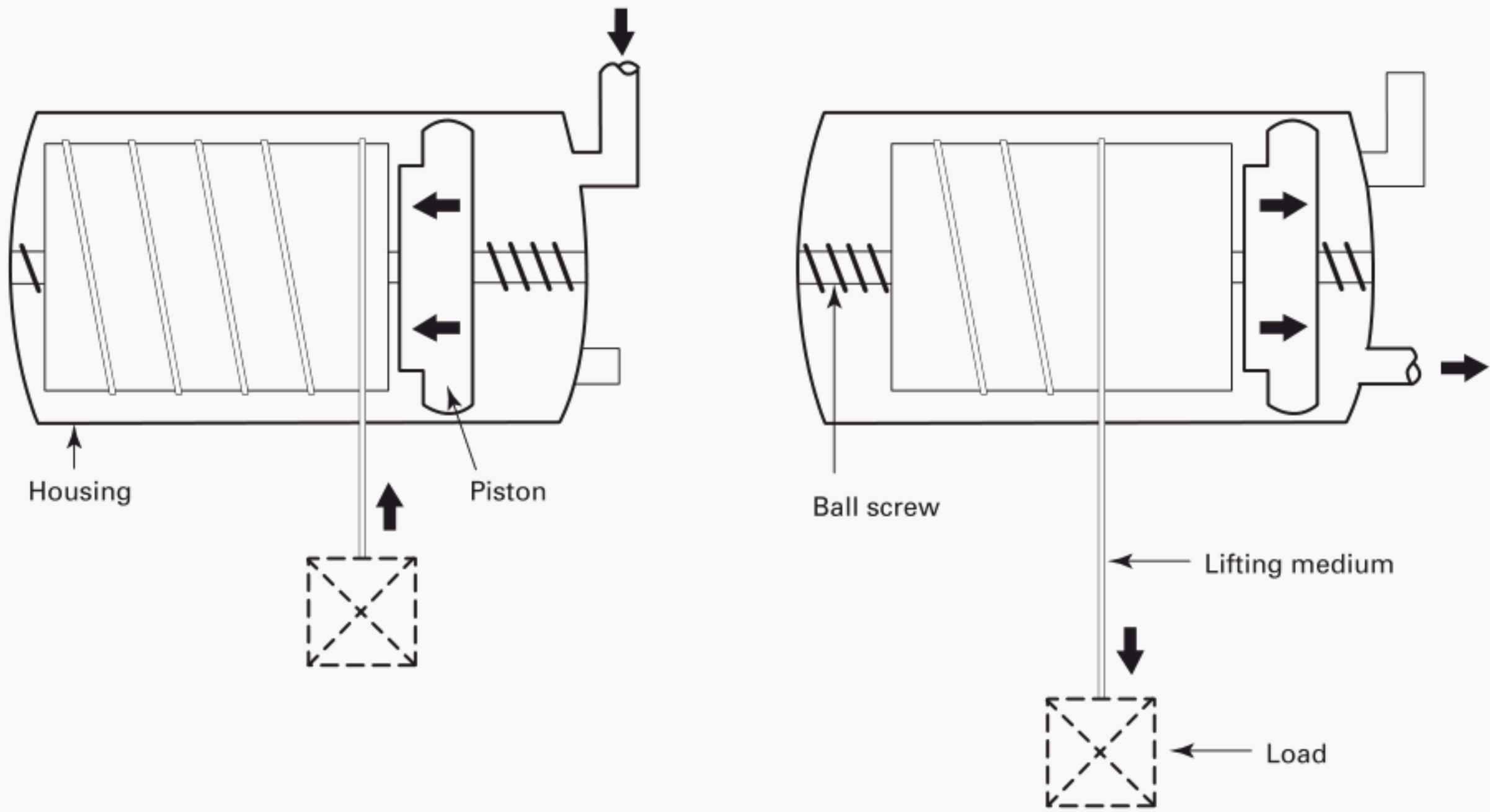
NFPA 70-2014, National Electrical Code

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169 (www.nfpa.org)

**Fig. 28-0.1-1 Fixed Arm**



**Fig. 28-0.1-2 Flexible Lifting Medium**





# Chapter 28-1

## Marking, Construction, and Installation

### SECTION 28-1.1: MARKINGS

#### 28-1.1.1 Rated Load

The rated load of the balancer shall be marked on the unit or its attachment and shall be legible from the operating position.

#### 28-1.1.2 Controls

Control actuators shall be marked to indicate the direction of resultant motion.

#### 28-1.1.3 Identification

The following information shall be legibly marked on a durable identification plate or label on the balancer:

- (a) name of manufacturer
- (b) year of manufacture
- (c) manufacturer's serial number
- (d) type or model number
- (e) maximum rated load
- (f) maximum design working pressure, if applicable
- (g) electrical requirements, if applicable (voltage, frequency, amperage draw)

#### 28-1.1.4 Warnings

(a) Safety signs should be designed according to the relevant requirements of ANSI Z535.4.

(b) Balancers shall have information displayed on the balancer and included in operating manuals concerning operating procedures. This information shall include cautionary language against

- (1) lifting more than the stated rated load
- (2) operating the balancer when the load is not secure or properly attached
- (3) operating the balancer with twisted, kinked, or damaged lifting medium
- (4) operating a damaged or malfunctioning balancer
- (5) lifting people
- (6) lifting loads over people
- (7) removing or obscuring warning or information labels

(c) A label shall be affixed on all electrical control enclosures. The label shall be in compliance with

ANSI Z535.4 and include, but not be limited to, information such as the following:

- (1) Disconnect power and lockout/tagout disconnecting means before removing cover or servicing this equipment.
- (2) Do not operate without cover in place.

### SECTION 28-1.2: CONSTRUCTION

#### 28-1.2.1 Mechanical Design

(a) Balancers shall be designed to withstand all stresses imposed under normal operating conditions while handling loads within the stated rated load capacity.

(b) Load suspension parts shall be designed so that the static stress calculated for rated load shall not exceed 20% of the ultimate tensile strength of the material used.

(c) Power transmission parts shall be designed so that the dynamic stresses calculated for the rated load shall not exceed the endurance limits established by the manufacturer.

(d) Modifications to re-rate or modernize the balancers shall only be as authorized in writing by the original equipment manufacturer or qualified person.

#### 28-1.2.2 Electric Design (Electrically Powered Balancers)

(a) Electrical construction shall comply with relevant sections of Article 610 of NFPA 70.

(b) Electrical components shall be located and enclosed so that energized parts will not be exposed to contact under normal operating conditions.

(c) Electrically powered balancers shall have a power on-off switch mounted on the balancer at or near the power inlet cable.

(d) Electrically powered balancers shall have an emergency stop switch on the operator control.

#### 28-1.2.3 Ropes

(a) Hoisting rope (if used) shall be of a construction as recommended by the balancer manufacturer for the balancer service.

(b) The rated load divided by the number of parts (lines) of rope shall not exceed 20% of the minimum breaking strength of the rope.

(c) Special considerations must be taken when rope may be exposed to environmental conditions under

which the rope could be damaged (e.g., corrosion or weld splatter).

(d) Socketing shall be done in a manner recommended by the rope or fitting manufacturer or a qualified person.

(e) The rope ends shall be attached to the balancer in a manner to prevent disengagement throughout rated hook travel.

(f) Eye splices shall be made in a manner as recommended by the balancer manufacturer or qualified person.

#### **28-1.2.4 Load Chain**

(a) Load chain shall be pitched (calibrated) so as to pass over all sprockets without binding.

(b) The load chain shall be proof tested by the chain or balancer manufacturer, with a load at least equivalent to 1.5 times the balancer's rated load divided by the number of chain parts supporting the load.

#### **28-1.2.5 Hooks**

(a) Hooks, if used, should be articulating or of the swiveling type at the top support of the balancer.

(b) Hooks used at the bottom of the balancer shall be of the swiveling type and shall rotate freely.

(c) Hooks shall be equipped with latches unless use of the latch creates a hazardous condition. When required, a latch shall be provided to bridge the opening of the hook and retain, under slack conditions, lifting devices such as, but not limited to, slings, chains, and eye pads. Refer to ASME B30.10, Hooks.

#### **28-1.2.6 Ergonomics**

Control panels, manual overrides, component access doors, and covers shall be located to provide suitable access.

#### **28-1.2.7 Lubrication**

If lubrication is required, accessible means for lubrication shall be provided and proper instructions documented in the operations manual as to the frequency, type, and location of lubrication to be applied.

#### **28-1.2.8 Controls**

(a) Balancers shall have provisions that will prevent uncontrolled upward movement in the event of a loss of load or failure of the lifting medium.

(b) If there are duplicate controls, they should be interlocked and the same operation shall be performed by each set of control function (e.g., up, down, start, close, open).

(c) The control devices shall return to the neutral position when released.

(d) Manual control valves shall be marked to indicate direction or function of operation.

(e) The control station shall be supported in a manner that will protect the power-source conductors against strain.

(f) Any control station that might present a hazard to the operator if a ground fault occurs shall be grounded.

#### **28-1.2.9 Loss of Power**

Interruption of power to balancers shall not cause a hazardous situation such as loss of control, unintended movement, and unintended direction of travel.

#### **28-1.2.10 Manuals**

The manufacturer shall furnish a manual with each balancer that shall include information on the following:

(a) hazards

(b) warnings that indicate the consequences of not adhering to the warning and methods to avoid the hazards

(c) installation

(d) operation

(e) inspection

(f) testing

(g) lubrication

(h) maintenance

(i) parts

(j) control diagram (may be supplied separately)

### **SECTION 28-1.3: INSTALLATION**

#### **28-1.3.1 Procedure**

(a) Procedure for balancer installation as recommended by the manufacturer shall be followed.

(b) When balancers are suspended from a trolley, monorail, or bridge and the rated capacity of any of these components is different from that of the balancers, the rated load of the system shall be based on the lowest minimum rated load of any individual component within the system.

#### **28-1.3.2 Support**

The supporting structure of the balancers, including trolleys, monorails, crane, or floor supports, shall be designed to withstand the loads and forces imposed by the balancers when operated at their rated load.

#### **28-1.3.3 Location**

(a) Balancers shall be installed in locations that will allow sufficient space for the operator to stay clear of the balancer's load and provide clearances to preclude the operator from being entrapped by the balancer or its load.

(b) Balancers shall not be installed in a hazardous location unless approved by the manufacturer.

#### **28-1.3.4 Installation Inspection**

After installation, an inspection shall be made as defined in para. 28-2.1.3.



**(15) 28-1.3.5 Power Connections**

(a) Electrically powered balancers shall be connected in accordance with the relevant sections of NFPA 70.

(b) Air-powered balancers shall be connected to an air supply providing air at a pressure not exceeding the pressure recommended by the balancer's manufacturer.

(c) Electrical equipment shall be protected from exposure to environmental and physical damage. Fixtures, wiring, and connections used in the installation of the balancers shall be suitable for the location installed.

## Chapter 28-2

# Inspection, Testing, and Maintenance

### (15) SECTION 28-2.1: INSPECTION

#### 28-2.1.1 General

All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard and, if so, what additional steps need to be taken to address the hazard.

#### 28-2.1.2 Inspection Classifications

(a) *Initial Inspection.* Prior to initial use, all new, reinstalled, repaired, or altered balancers shall be inspected to verify compliance with the applicable provisions of this Volume.

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

(1) *Frequent Inspection.* A visual and audible examination for which written records are not required.

(-a) normal service — monthly

(-b) heavy service — weekly to monthly

(-c) severe service — daily to weekly

(2) *Periodic Inspection.* A visual and audible examination with records made of external conditions and deficiencies to provide the basis for a continuing evaluation.

(-a) normal service — yearly

(-b) heavy service — semiannually

(-c) severe service — quarterly

(c) Personnel responsible for the inspection of the balancers shall be familiar with the applicable contents of the manual furnished with the balancers.

#### 28-2.1.3 Frequent Inspection

(a) Frequent inspections shall be performed at intervals defined in para. 28-2.1.2(b)(1) and shall include observations during operation.

(b) The following items shall be inspected:

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

(2) lines, valves, and other parts of air systems for leakage

(3) hooks in accordance with ASME B30.10, Frequent Inspection

(4) hook latches, if used, for proper operation

(5) balancer rope in accordance with para. 28-2.1.5.1(a)

(6) balancer load chain in accordance with para. 28-2.1.6.1(c)

(7) hoses for wear, severe abrasion, and cracking

(8) electrical cables for wear, abrasion, or cracking

(9) general corrosion

(10) fixed arms and pins for visible wear, damage, and missing hardware

(11) rope or load chain reeving for compliance with recommendations of the balancer manufacturer

#### 28-2.1.4 Periodic Inspections

(a) Periodic inspections shall be performed at intervals defined in para. 28-2.1.2(b)(2) and may be performed with the balancer at its normal location, and do not require the balancer to be disassembled.

(b) Covers and other items normally supplied to allow inspection of components should be opened or removed.

(c) The periodic inspection shall include the following items, as applicable:

(1) the items listed in para. 28-2.1.3

(2) fasteners for evidence of loosening

(3) mounting attachments for evidence of missing items

(4) supporting structure or trolley, if used, for evidence of damage or damaging corrosion

(5) hook-retaining nuts or collars and pins used to secure the retaining members for evidence of damage

(6) load sprockets, idler sprockets, drums, and sheaves for evidence of damage and wear

(7) the brake mechanism for proper function [see para. 28-1.2.8(a)]

(8) arms, links, and rotating pivots for proper operation and any deformation

(9) pneumatic lines and fittings for leaks or wear

(-a) leaks at joints between sections

(-b) shaft seal leaks

(-c) unusual noises or vibration

(-d) loss of operating speed

(-e) loss of pressure

(10) pneumatic valves

(-a) cracks in valve housing

(-b) improper return of spool to the neutral position

(-c) leaks at the spools or joints

(-d) sticking spools

(-e) relief valves for correct pressure setting and operation, if applicable

(11) pneumatic cylinders

(-a) drifting of load caused by piston leakage

(-b) rod seal leakage

(-c) leaks at welded joints

(-d) scored, nicked, or dented cylinder rods

(-e) dented case or barrel

(-f) loose or deformed rod eyes or connecting joints and stops

(12) balancers' wire-rope end connections or load chains for evidence of wear, corrosion, cracks, damage, and distortion

(13) operational and safety labels for existence and legibility

(14) electrical apparatus for evidences of pitting or deterioration of controller components

### **28-2.1.5 Rope Inspection and Replacement**

#### **28-2.1.5.1 Rope Inspection**

(a) *General.* All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard and, if so, what additional steps need to be taken to address the hazard.

(b) *Shift Inspection*

(1) All ropes should be visually inspected at the start of each shift. These visual observations should be concerned with discovering gross damage, such as the following, which may be an immediate hazard:

(-a) distortion of the rope such as kinking, crushing, bird caging, main-strand displacement, or core protrusion

(-b) general corrosion

(-c) broken or cut strands

(-d) number, distribution, and type of visible broken wires [See paras. 28-2.1.5.2(b)(1) through (b)(3) for further guidance.]

(2) When such damage is discovered, the rope shall either be removed from service or given an inspection as detailed in para. 28-2.1.5.1(c).

(c) *Periodic Inspection*

(1) The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life.

(2) This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as described below, shall be noted, and determination shall be made as to whether further use of the rope would constitute a hazard.

(-a) points listed in para. 28-2.1.5.1(b)

(-b) reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires

(-c) severely corroded or broken wires at end connections

(-d) severely corroded, cracked, bent, worn, or improperly applied end connections

(3) Special care should be taken when inspecting sections of rapid deterioration, such as the following:

(-a) sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited

(-b) sections of the rope at or near terminal ends where corroded or broken wires may protrude

(-c) sections subject to reverse bends

(-d) sections of rope that are normally hidden during visual inspection, such as parts passing over sheaves

#### **28-2.1.5.2 Rope Replacement**

(a) No precise rules can be given for determination of the exact time for rope replacement, since many variable factors are involved. Once a rope reaches any one of the specified removal criteria, it may be allowed to operate to the end of the work shift, based on the judgment of a qualified person. The rope shall be replaced prior to the equipment being used by the next work shift.

(b) Removal criteria for the rope replacement shall be as follows:

(1) in running ropes, 12 randomly distributed broken wires in six rope diameters or 4 broken wires in one strand in six rope diameters, except as noted in para. 28-2.1.5.2(b)(2)

(2) in rotation-resistant ropes, two randomly distributed broken wires in 6 rope diameters or four randomly distributed broken wires in 30 rope diameters

(3) one outer wire broken at the contact point with the core of the rope, which has worked its way out of the rope structure and protrudes or loops out from the rope structure

(4) kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure

(5) evidence of heat damage from any cause

(6) reductions from nominal diameter greater than 5% of the original manufacturer's installed nominal cable diameter

(c) Broken-wire removal criteria, in this Volume, apply to wire ropes operating on drums regardless of sheave material. The user shall contact the balancer manufacturer or qualified person for additional broken-wire



removal criteria that is required for the manufacturer's product.

(d) Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be replaced. Resocketing shall not be attempted if the resulting rope length will be insufficient for proper operation.

(e) Replacement rope and connections shall have a strength rating at least as great as the original rope and connections furnished by the balancer manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the balancer manufacturer, or a qualified person.

#### **28-2.1.6 Welded Link Chain Inspection and Replacement**

##### **28-2.1.6.1 Welded Link Chain Inspection**

(a) *General.* All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard and, if so, what additional steps need to be taken to address the hazard.

(b) Test the balancer under load in lifting and lowering directions and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.

(c) If the chain binds, jumps, or is noisy, first see that it is clean and properly lubricated. If the trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.

(d) Examine visually for gouges, nicks, weld spatter, corrosion, and distorted links. Slacken the chain and move the adjacent links to one side to inspect for wear at the contact points. If wear is observed or if stretching is suspected, the chain should be measured as outlined in the balancer manufacturer's manual. If instructions are not available, proceed as follows:

(1) Select an unworn, unstretched length of the chain (e.g., at the slack end), suspend the chain vertically under tension, and, using a caliper-type gage, measure the outside length of any convenient number of links approximately 12 in. (305 mm) to 24 in. (610 mm) overall.

(2) Measure the same number of links in the used sections and calculate the percentage increase in length.

##### **28-2.1.6.2 Welded Link Chain Replacement**

(a) If the used chain pitch exceeds the balancer manufacturer's recommended length (or in the absence of such recommendation, if the used chain pitch is  $1\frac{1}{2}\%$  longer than the unused chain), replace the chain. Repairing of load chain is not permitted; the chain shall be replaced.

(b) The existence of gouges, nicks, corrosion, weld spatter, or distorted links is sufficient reason to question chain safety and consider chain replacement. Safety in

this respect depends largely upon the use of good judgment by a designated person in evaluating the degree of deficiency.

(c) Replacement chain shall be the same size, grade, and construction as the original chain furnished by the balancer manufacturer, unless otherwise recommended by the balancer manufacturer or a qualified person due to actual working conditions.

(d) Load chain links that pass over the balancer load sprocket on edge (alternate to those that lie flat in the pockets) shall be installed (if recommended by the balancer manufacturer) with the welds away from the center of the sprocket. This precaution is not required on idler sprockets that change the direction but not the tension in the chain.

(e) The chain shall be installed without any twist between the balancer and an anchored end on either the loaded side or slack side.

(f) When chain is replaced, disassemble and inspect the mating parts (sprockets, guides, stripper) for wear, and replace if necessary.

(g) Discarded load chains shall not be used for slings.

#### **28-2.1.7 Balancers Not in Regular Use**

(a) Balancers that are used infrequently or on standby service, which have been idle for a period of 1 month or more, but less than 1 yr, shall be inspected before being placed in service, in accordance with the requirements listed in para. 28-2.1.3, Frequent Inspection.

(b) Balancers that are used infrequently, which have been idle for a period of 1 yr or more, shall be inspected before being placed in service in accordance with the requirements listed in para. 28-2.1.4, Periodic Inspection.

#### **28-2.1.8 Inspection Records**

(a) Dated inspection reports and records shall be maintained for inspections performed as specified in para. 28-2.1.2(b)(2). Records should be stored where they are available to appointed persons.

(b) A long-range inspection program for rope, chain, or both should be established and should include records on examination of ropes or chains removed from service so a relationship can be established between visual observation and actual condition of the rope or chain.

### **SECTION 28-2.2: TESTING**

#### **28-2.2.1 Manufacturer Testing**

All newly manufactured balancers shall be tested by the manufacturer after final assembly to verify

- (a) proper operation of all safety devices
- (b) proper operation of all controls
- (c) no unusual vibrations or noise
- (d) no fluid leaks
- (e) rated load

**SECTION 28-2.3: MAINTENANCE****28-2.3.1 Preventive Maintenance**

(a) The manufacturer shall provide a recommended preventive maintenance schedule to minimize the possibility of mechanical failures and excessive and unnecessary wear.

(b) A preventive maintenance program based on the balancer manufacturer's recommendations shall be established for balancers in operation. Dated records of maintenance performed shall be maintained.

(c) Under severe conditions, or if excessive wear is noted, scheduled intervals shall be adjusted to prevent breakdowns and excessive wear.

**28-2.3.2 Maintenance Procedures**

(a) Maintenance shall be performed by a designated person.

(b) Maintenance shall be performed in accordance with the manufacturer's recommended procedures and the designated maintenance personnel shall be familiar with the applicable contents of the manual(s) supplied by the manufacturer.

(c) A lockout/tagout policy and procedure shall be developed, documented, and implemented by the owner or user of the balancer lifting system. The lockout/tagout policy and procedure shall comply with the requirements of ANSI/ASSE Z244.1.

(d) The policy shall give consideration to the following areas:

(1) balancer-system power-disconnection means

(2) work to be performed on the balancer

(e) All guards shall be reinstalled, all safety devices reactivated, and maintenance equipment removed after maintenance is performed.

**28-2.3.3 Adjustments and Repairs**

(a) Replacement parts shall meet or exceed the manufacturer's specifications.

(b) Missing or unreadable operational labels and safety signs shall be replaced.

(c) Any hazardous conditions disclosed by the inspection requirements of Section 28-2.1 shall be corrected before operation of the balancer is resumed.

(d) Balancers in which load-suspension parts have been altered, replaced, or repaired shall be tested for proper operation before being returned to service after the maintenance or repair.

**28-2.3.4 Lubrication**

(a) Lubrication should be performed according to the manufacturer's recommendations and procedures.

(b) Delivery of lubricant to intended point shall be verified.

(c) Machinery shall not be in operation while lubricants are being applied, unless equipped for automatic or remote lubrication, or unless the lubrication point specifically requires movement for the lubricating procedure.



## Chapter 28-3 Operation

### SECTION 28-3.1: CONDUCT OF OPERATORS

#### (15) 28-3.1.1 Conduct of Operators

(a) Operators shall operate the balancers in accordance with the manufacturer's recommendations or as directed by a qualified person.

(b) The operator shall not divert attention from the operation of the balancer while operating it.

(c) The operator shall not leave a suspended load unattended unless notice, barricades, and precautions have been provided.

#### 28-3.1.2 Operating Practices

The operator shall be familiar with all equipment, operations, and controls of the balancer. The operator shall have knowledge including, as applicable,

(a) the warnings on the balancer and hazards of balancer operations

(b) the operation instructions portion of the balancers manufacturer's manual

#### 28-3.1.3 Knowledge of Manual Content

Personnel responsible for the supervision or operation of the balancer shall be familiar with the applicable contents of the manual(s) supplied by the manufacturer.

### SECTION 28-3.2: HANDLING THE LOAD

(a) Balancers shall not be loaded in excess of their rated load.

(b) The load shall be firmly supported in the hook, end effector, or receiver at all times during load movement.

(c) The load shall not be moved in any direction at a rate of speed that may cause the load to disengage from its supporting point due to sudden stops or change of direction.

### SECTION 28-3.3: TRAINING

(a) The operator shall be trained in the use and be familiar with all equipment, controls, and operation of the balancer. Training shall include information of the job to be performed.

(b) Training shall include a practical demonstration of proficiency with the same type of balancer.

### SECTION 28-3.4: RESPONSIBILITIES

(15)

While the organizational structure at various facilities may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

*balancer operator*: directly controls the balancer's functions.

*balancer owner*: has custodial control of a balancer by virtue of lease or ownership.

*supervisor*: exercises supervisory control over the work site on which a balancer is being used and over the work that is being performed on that site.

#### 28-3.4.1 Responsibilities of the Balancer Owner

The balancer owner's responsibilities shall include the following:

(a) providing a balancer that meets the requirements of Chapters 28-1 and 28-2 of this Volume, as well as specific job requirements defined by the user

(b) providing a balancer and all necessary components, specified by the manufacturer, that meet the supervisor's requested configuration and capacity

(c) providing all applicable load/capacity chart(s) and diagrams

(d) establishing an inspection, testing, and maintenance program in accordance with Chapter 28-2 and informing the balancer operator of the requirements of this program

(e) ensuring that the inspection, testing, and maintenance programs are followed

(f) complying with the requirements of this Volume, manufacturer's requirements, and those regulations applicable at the work site

(g) ensuring that the balancer is in proper operating condition prior to initial use by verifying that a frequent inspection has been performed as defined in para. 28-2.1.3(a)

(h) verifying that the balancer has the necessary lifting capacity to perform the proposed lifting operations in the planned configuration

(i) ensuring the assigned operator(s) has been notified of adjustments or repairs that have not yet been completed, prior to commencing balancer operations

(j) ensuring that personnel responsible for installation of the balancer are familiar with applicable contents of the manual furnished with the balancer

(k) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards

#### **28-3.4.2 Responsibilities of Supervisor**

The supervisor's responsibilities shall include the following:

(a) ensuring that the balancer meets the requirements of Chapter 28-2 prior to initial usage.

(b) ensuring that conditions that may adversely affect balancer operations are addressed. Such conditions include, but are not limited to, insufficient lighting.

(c) permitting special lifting operations only when equipment and procedures required by this Volume, the balancer manufacturer, or a qualified person are employed. Such operations include, but are not limited to, multiple balancer lifts.

(d) ensuring that balancer maintenance is performed by a designated person.

(e) stopping balancer operations if alerted to an unsafe condition affecting those operations.

(f) ensuring that the preparation of the area needed to support balancer operations has been completed before balancer operations commence.

(g) ensuring that personnel involved in balancer operations understand their responsibilities, assigned duties, and the associated hazards.

(h) addressing safety concerns raised by the operator or other personnel. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be adhered to.)

(i) ensuring precautions are implemented when hazards associated with special lifting operations are present. Such operations include, but are not limited to, multiple balancer lifts.

(j) informing the balancer operator of the weight of loads to be lifted, as well as the lifting, moving, and placing locations for these loads.

(k) obtaining the balancer operator's verification that this weight does not exceed the balancer's rated capacity.

(l) ensuring that the load is properly attached and balanced before it is lifted more than a few inches.

#### **28-3.4.3 Responsibilities of Balancer Operators**

The operator shall be responsible for the following listed items. Whenever the operator has doubt as to the

safety of balancer operations, the operator shall stop the balancer's functions in a controlled manner. Lift operations shall resume only after safety concerns have been addressed.

The operator's responsibilities shall include the following:

(a) knowing what types of site conditions could adversely affect the operation of the balancer

(b) understanding and applying the information contained in the balancer manufacturer's operating manual

(c) understanding the balancer's functions and limitations as well as its particular operating characteristics

(d) knowing the balancer rated capacity and understanding the warning and hazards associated with balancer operation

(e) performing a daily rope inspection as specified in para. 28-2.1.5.1(b)(1)

(f) promptly reporting the need for any adjustments or repairs

(g) following applicable lockout/tagout procedures

(h) not operating the balancer when physically or mentally unfit

(i) ensuring that all controls are in the "OFF" or neutral position and that all personnel are in the clear before energizing the balancer

(j) not engaging in any practice that will divert his attention while actually operating the balancer controls

(k) testing the balancer function controls that will be used and operating the balancer only if those function controls respond properly

(l) operating the balancer's functions, under normal operating conditions, in a smooth and controlled manner

(m) considering all factors known that might affect the balancer capacity and making appropriate adjustments

(n) understanding basic load attachment procedures

(o) if power fails during operations, engaging the emergency stop and returning all controls to the neutral position

(p) under those circumstances requiring a load to be held suspended for a period of time exceeding normal lifting operations, the operator may leave the controls provided that, prior to that time, the supervisor and operator shall establish the requirements for providing notices, barricades, or whatever other precautions may be necessary

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