ASME B30.22-2023
(Revision of ASME B30.22-2016)

Articulating Boom Cranes

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

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME B30.22-2023
(Revision of ASME B30.22-2016)

Articulating Boom Cranes

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

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: June 19, 2023

The next edition of this Standard is scheduled for publication in 2028. This will become effective 1 year after the Date of Issuance.

This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The standards committee that approved the code or standard was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code or standard was made available for public review and comment, which provided an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity. ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor does ASME assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representatives or persons affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

ASME accepts responsibility for only those interpretations of this document issued in accordance with the established ASME procedures and policies, which precludes the issuance of interpretations by individuals.

The endnotes and preamble in this document (if any) are part of this American National Standard.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

CONTENTS

Foreword v
Committee Roster vii
Correspondence With the B30 Committee ix
B30 Standard Introduction x
Summary of Changes xii

Chapter 22-0 **Scope, Definitions, Personnel Competence, Translations, and References** 1
Section 22-0.1 Scope of B30.22 1
Section 22-0.2 Definitions 1
Section 22-0.3 Legend for Figures 22-0.3-1 Through 22-0.3-4 9
Section 22-0.4 Nomenclature for Articulating Cranes 14
Section 22-0.5 Personnel Competence 14
Section 22-0.6 Translations 14
Section 22-0.7 References 14
Chapter 22-1 **Construction and Characteristics** 16
Section 22-1.1 Load Ratings 16
Section 22-1.2 Boom Lift, Boom Telescoping, and Load Hoist Mechanisms 19
Section 22-1.3 Swing Mechanism 19
Section 22-1.4 Crane Transport 19
Section 22-1.5 Ropes, Rope-Lifting Components, and Reeving Accessories 20
Section 22-1.6 Controls 20
Section 22-1.7 Installation 20
Section 22-1.8 Construction 20
Section 22-1.9 Operating Manual 22
Chapter 22-2 **Inspection, Testing, and Maintenance** 23
Section 22-2.1 Inspection 23
Section 22-2.2 Testing 24
Section 22-2.3 Maintenance 25
Chapter 22-3 **Operation** 27
Section 22-3.1 Qualifications and Responsibilities 27
Section 22-3.2 Operating Practices 31
Section 22-3.3 Signals 32
Section 22-3.4 Operation in the Vicinity of Electric Power Lines 33
Section 22-3.5 Miscellaneous 40

Figures

22-0.2.1-1 Commercial Truck-Mounted With Ground Control 2
22-0.2.1-2 Commercial Truck-Mounted With Top Seat Control 3
22-0.2.1-3 Commercial Truck-Rear-Mounted With Remote Control 4

22-0.2.1-4 Crawler-Mounted 4
22-0.2.1-5 Stationary Installation 5
22-0.2.1-6 Railcar Installation 5
22-0.2.1-7 Trailer-Mounted 5
22-0.2.1-8 Traveling Base-Mounted on Trailer 6
22-0.2.1-9 Off-Road Vehicle 6
22-0.3-1 Definitions of Specifications for Articulating Cranes 10
22-0.3-2 Hook Approach 13
22-0.3-3 Elevation Below Horizontal 13
22-0.3-4 Elevation Above Horizontal 13
22-0.4-1 Nomenclature for Articulating Cranes 15
22-1.1.3-1 Work Areas 17
22-3.3.4-1 Standard Hand Signals 34
22-3.4.1-1 Flowchart to Assist in Determination of the Applicable Subsection for Operation in the Vicinity of Power Lines 36
22-3.4.1-2 Specified Clearance Around an Energized Power Line 37
22-3.4.1-3 Specified Clearance Around an Energized Electric Power Line That Shall Be Maintained When the Crane Is in Travel or Transit 38
22-3.4.1-4 Electric Power Line Support Structures 38

Table

22-3.4.1-1 Specified Clearance for Operation in the Vicinity of Energized Electric Power Lines 39

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 the American Society of Mechanical Engineers (ASME) Committee on the Protection of Industrial Workers, was presented at the annual meeting of 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, the 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 was organized on 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 addressing only 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 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 B30.22 was issued in 1987, and new editions were published in 1993, 2000, 2005, and 2010. The 2010 edition incorporated the addition of responsibilities, hand signals, and more comprehensive information on operation near electric power lines.

The 2016 edition contained revisions to all chapters. The most notable changes included installation requirements, clarification of testing, lift director responsibilities, and setup and operating practices.

This 2023 edition adds references to ASME B30.30 and updates the definitions and figures.

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 May 19, 2023.

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.)

STANDARDS COMMITTEE OFFICERS

T. L. Blanton, *Chair*
E. D. Fidler, *Vice Chair*
S. D. Wood, *Vice Chair*
K. Peterson, *Secretary*

STANDARDS COMMITTEE PERSONNEL

N. E. Andrew, Neil E. Andrew and Associates, LLC
B. B. Bacon, Tennessee Valley Authority
T. L. Blanton, Ogr Consulting Services, LLC
P. A. Boeckman, The Crosby Group, LLC
J. Burkey, Consultant
J. A. Danielson, The Boeing Co.
D. Decker, Becket, LLC
L. D. DeMark, Equipment Training Solutions, LLC
D. W. Eckstine, Eckstine and Associates
E. D. Fidler, Grove U.S., LLC
M. Gardiner, ICC Forensics, LLC
J. A. Gilbert, Associated Wire Rope Fabricators
D. Henninger, Bridon Bekaert
G. B. Hetherston, Hetherston Consulting, LLC
M. M. Jaxtheimer, Navy Crane Center
P. R. Juhren, Morrow Equipment Co., LLC
T. W. Klein, Wireco Worldgroup
R. M. Kohner, Consultant
A. J. Lusi, Jr., Lumark Consulting, LLP
T. C. Mackey, WRPS Hanford
J. Mihlbauer, Jr., All Ship and Cargo Surveys, Ltd.
R. M. Parnell, Industrial Training International
J. T. Perkins, All Material Handling
K. Peterson, The American Society of Mechanical Engineers
B. Pickett, Systems Engineering and Forensic Services
J. A. Pilgrim, Manitowoc Cranes
S. K. Rammelsberg, McDermott
K. Rask, NationsBuilders Insurance Services, Inc.
K. Reynolds, Shell Exploration and Production
J. E. Richardson, Navy Crane Center
J. W. Rowland III, Consultant
A. R. Ruud, Atkinson Construction
L. K. Shapiro, Howard I. Shapiro and Associates
T. Sicklesteel, National Commission for the Certification of Crane Operators
D. W. Smith, J. E. Spear Consulting, LP
W. J. Smith, Jr., NationsBuilders Insurance Services, Inc.
R. S. Stemp, Lampson International, LLC
R. G. Strain, Advanced Crane Technologies, LLC
J. Sturm, Sturm Corp.
D. Sullivan, IUOE Local 542 JATC
P. D. Sweeney, Riverside Engineering
C. Warren, Webber, LLC
J. D. Wiethorn, International Crane and Construction Safety Solutions, LLC
S. D. Wood, Terex Corp.
D. Boyle, *Alternate,* The Crosby Group
B. M. Casey, *Alternate,* Electric Boat Corp.
M. Chaudanson, *Alternate,* Howard I. Shapiro and Associates
W. C. Dickinson, Jr., *Alternate,* Crane Industry Services, LLC
D. Duerr, *Alternate,* 2DM Associates, Inc.
M. Eckstine, *Alternate,* Safelift, LLC
S. R. Fletcher, *Alternate,* Cowles, Murphy, Glover, and Associates
D. Frerking, *Alternate,* XCMG American Research Corp.
T. Gordon, *Alternate,* IUOE Local 14 Training Fund
J. B. Greenwood, *Alternate,* Navy Crane Center
D. F. Jordan, *Alternate,* American International Crane Bureau
K. Kennedy, *Alternate,* Navy Crane Center
R. Marcotte, *Alternate,* Bruce Power
L. D. Means, *Alternate,* Means Engineering and Consulting
W. J. Merrill, *Alternate,* Merrill Safety Solutions, LLC
G. D. Miller, *Alternate,* Manitowoc Cranes
D. A. Moore, *Alternate,* Unified Engineering
L. S. Olver, *Alternate,* Kolo Holdings, Inc.
J. M. Randall, *Alternate,* McDermott
G. M. Ray, *Alternate,* Tennessee Valley Authority
M. Riggs, *Alternate,* Riggsafe Solutions, Inc.
J. R. Schober, *Alternate,* American Bridge Co.
J. Schoppert, *Alternate,* NBIS Claims and Risk Management, Inc.
C. H. Smith, *Alternate,* Morrow Equipment Co., LLC
J. E. Spear, *Alternate,* J. E. Spear Consulting, LP
J. A. Stewart, *Alternate,* Stewart Safety Consulting
A. Thompson, *Alternate,* Wireco Worldgroup
W. Tubbs, *Alternate,* Craneology, Inc.
P. A. Vallejos, *Alternate,* Hanford Mission Integration Solutions
J. J. VanEgeren, *Alternate,* Manitowoc Cranes
M. Zerba, *Alternate,* Lampson International, LLC

HONORARY MEMBERS

J. W. Downs, Jr., Downs Crane and Hoist Co., Inc.
J. L. Franks, Consultant
C. W. Ireland, National Oilwell Varco
R. W. Parry, Parry, Parry, and Glen
J. C. Ryan, Boh Bros. Construction Co., LLC
D. N. Wolff, Consultant

B30.22 SUBCOMMITTEE PERSONNEL

K. Reynolds, *Chair,* Shell Exploration and Production
T. Gordon, IUOE Local 14 Training Fund
J. C. Hendry, Aveda Transportation and Energy Services
M. M. Jaxtheimer, Navy Crane Center
A. J. Lusi, Jr., Lumark Consulting, LLP
J. Parnell, Consultant
P. Quick, Affiliated Engineering Laboratories
M. Schroeder, Stellar Industries
W. Timm, Palfinger North America
P. A. Vallejos, Hanford Mission Integration Solutions

B30 INTEREST REVIEW GROUP

O. Akinboboye, Ropetech Engineering Services, Ltd.
P. Clark, Lifting Gear Hire Corp.
B. Dobbs, LEEA
J. Edmundson, Konecranes Nuclear Equipment and Services, LLC
M. Eggenberger, Bay, Ltd.
D. Ferland, F&M MAFCO
A. Gomes Rocha, Industrial Training International
J. Groce, WireCo WorldGroup
N. C. Hargreaves, Hargreaves Consulting, LLC
J. Hui, School of Civil Engineering, People's Republic of China
A. C. Mattoli, Prowinch, LLC
T. McCullough, Consultant
D. Modzeleski, Dematic Corp.
C. Neth, Siefert Associates, LLC
A. Payne, Bureau of Safety and Environmental Enforcement

B30 REGULATORY AUTHORITY COUNCIL

C. N. Stribling, Jr., *Chair,* Kentucky Labor Cabinet
K. Peterson, *Secretary,* The American Society of Mechanical Engineers
R. D. Jackson, U.S. Department of Labor
D. E. Latham, State of Maryland DLLR
M. J. Nelmida, State of California, Occupational Safety and Health Standards Board
T. Taylor, North Carolina Department of Labor
N. Reynolds, *Alternate,* Maryland Occupational Safety and Health (MOSH)

CORRESPONDENCE WITH THE B30 COMMITTEE (23)

General. ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Standard should be sent to the staff secretary noted on the committee's web page, accessible at https://go.asme.org/B30committee.

Revisions and Errata. The committee processes revisions to this Standard on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases. The committee does not issue cases for this Standard.

Interpretations. Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued only in response to a request submitted through the online Interpretation Submittal Form at https://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers can track the status of their requests at https://go.asme.org/Interpretations.

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.

Interpretations are published in the ASME Interpretations Database at https://go.asme.org/Interpretations as they are issued.

Committee Meetings. The B30 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/B30committee.

(23)

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 Standards Committee and has successfully completed a consensus approval process under the general auspices of the American National Standards Institute (ANSI).

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

B30.1 Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries

B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

B30.3 Tower Cranes

B30.4 Portal and Pedestal Cranes

B30.5 Mobile and Locomotive Cranes

B30.6 Derricks

B30.7 Winches

B30.8 Floating Cranes and Floating Derricks

B30.9 Slings

B30.10 Hooks

B30.11 Monorails and Underhung Cranes (withdrawn 2018 — requirements found in latest revision of B30.17)

B30.12 Handling Loads Suspended From Rotorcraft

B30.13 Storage/Retrieval (S/R) Machines and Associated Equipment

B30.14 Side Boom Tractors

B30.15 Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)

B30.16 Overhead Underhung and Stationary Hoists

B30.17 Cranes and Monorails (With Underhung Trolley or Bridge)

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

B30.23 Personnel Lifting Systems

B30.24 Container Cranes

B30.25 Scrap and Material Handlers

B30.26 Rigging Hardware

B30.27 Material Placement Systems

B30.28 Balance Lifting Units

B30.29 Self-Erecting Tower Cranes

B30.30 Ropes

B30.31 Self-Propelled, Towed, or Remote-Controlled Hydraulic Platform Transporters[1]

B30.32 Unmanned Aircraft Systems (UAS) Used in Inspection, Testing, Maintenance, and Load-Handling Operations

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.

[1] This volume is currently in the development process.

SECTION V: EFFECTIVE DATE

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

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

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

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

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

SECTION VII: USE OF MEASUREMENT UNITS

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

SECTION VIII: ADDITIONAL GUIDANCE

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

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

(a) the condition of the equipment or material

(b) the loads

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

(d) the type of attachments

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

(f) environmental conditions causing corrosion or wear

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

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

ASME B30.22-2023
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.22-2023 was approved by the American National Standards Institute on May 19, 2023.

ASME B30.22-2023 includes the following changes identified by a margin note, **(23)**.

Page	*Location*	*Change*
ix	Correspondence With the B30 Committee	Added
x	B30 Standard Introduction	Updated
1	22-0.2.2	(1) Definitions of *accessory*, *anti-two-block device*, *axle*, *cab*, *drum*, *operational aid*, *outer boom cylinder*, *outer boom pivot*, *rope*, *sheave*, *stabilizer*, *structural competence*, *swivel*, *telescoping boom*, *transit*, and *travel* revised (2) Definitions of *administrative or regulatory authority*; *axle (tandem)*; *cab, station, or top seat*; *crane rating*; *crossover points*; *dynamic loads*; *electrically insulated*; *flange point*; *load block, lower*; *load block, upper*; *model designation*; *remote*; *rotation resistant rope*; *running rope*; and *weight of crane* deleted (3) Definitions of *cab, station, or top seat control*; *lower load block*; *original language(s)*; *remote control*; and *upper load block* added (4) The following terms revised: *boom extensions, manual or hydraulic (one or more)* to *boom extensions, manual or hydraulic*; *controls, ground or floor* to *ground or floor control*; *load hoist mechanism* to *load hoist*; and *load radius* to *radius (load)*
14	Section 22-0.6	Revised in its entirety
14	Section 22-0.7	Updated
19	22-1.2.3	(1) Subparagraphs (b)(2) and (b)(3) revised (2) Note deleted
20	Section 22-1.5	Revised in its entirety
21	22-1.8.7	Subparagraph (f) added
23	Chapter 22-2	(1) Paragraph 22-2.3.5 added (2) Section 22-2.4 deleted
28	22-3.1.3	Definition of *signalperson* added
29	22-3.1.3.2.2	Subparagraph (g) revised
30	22-3.1.3.3.1	Subparagraph (q) revised
31	22-3.1.3.3.3	Added
31	22-3.2.3	Subparagraph (a) revised
33	Section 22-3.4	Revised in its entirety
33	Section 22-3.5	Added

Chapter 22-0
Scope, Definitions, Personnel Competence, Translations, and References

SECTION 22-0.1: SCOPE OF B30.22

The scope includes cranes of the types described in para. 22-0.2.1 that are articulated by hydraulic cylinders and powered by internal combustion engines or electric motors and that are mounted on a mobile chassis or stationary installation. Articulating cranes equipped with a load hoist mechanism to broaden their versatility are covered by this Volume.

Some basic machine types within this scope are convertible for excavating work and other uses not considered to be lifting service. The requirements of this Volume are applicable only to such machines when used as lifting cranes. When cranes within the scope of this Volume are used for service other than lifting service, the manufacturer or (when not available from the manufacturer) a qualified person shall establish the ratings, operating limitations, maintenance, testing, and inspection requirements that apply during that use.

Exemptions from this Volume include

(a) units with a maximum rated capacity of 2,000 lb (907 kg) or less

(b) units with booms constructed of nonconductive-type materials

(c) units equipped with or designed primarily for personnel baskets, platforms, ladders, etc.

(d) units when equipped with nonlifting attachments

(e) units while used in forestry and logging applications

(f) telescoping boom cranes that do not articulate (covered under ASME B30.5)

(g) scrap and material handlers as defined in ASME B30.25

SECTION 22-0.2: DEFINITIONS

22-0.2.1 Mounting of Articulating Boom Cranes

commercial truck-mounted: a crane, consisting of a rotating mast, mainframe or base, boom, and one or more operator's stations, such as ground controls (see Figure 22-0.2.1-1), top seat controls (see Figure 22-0.2.1-2), or remote controls (see Figure 22-0.2.1-3), mounted on a frame attached to a commercial truck chassis, with or without a payload capability, whose power source may power the crane. The function is to lift, lower, and swing loads at various radii.

crawler-mounted: a crane, consisting of a rotating mast, mainframe or base, operator's station(s), and boom, mounted on crawler treads for travel. It may be equipped with a single control station or have separate stations for driving and operating. Its function is to lift, lower, and swing loads at various radii (see Figure 22-0.2.1-4).

stationary: a crane, consisting of a rotating mast, mainframe or base, and boom, mounted on a stationary structure. The function is to lift, lower, and swing loads at various radii from a fixed center of rotation (see Figure 22-0.2.1-5).

trailer- or railcar-mounted: a crane, consisting of a rotating mast, mainframe or base, and boom, mounted on a trailer or railcar. The function is to lift, lower, and swing loads at various radii (see Figures 22-0.2.1-6 and 22-0.2.1-7).

traveling base-mounted: a crane, consisting of a rotating mast, boom, mainframe or base, and one or more operator's stations, mounted on a traveling base. The function is to lift, lower, and swing loads at various radii (see Figure 22-0.2.1-8).

wheel-mounted: a crane, consisting of a rotating mast, mainframe or base, operator's station(s), and boom, mounted on commercial truck vehicle, a trailer, or an off-road vehicle equipped with axles and rubber-tired wheels. It may be equipped with a single control station or have separate stations for driving and operating. Its function is to lift, lower, and swing loads at various radii (see Figures 22-0.2.1-1 through 22-0.2.1-3 and Figures 22-0.2.1-7 through 22-0.2.1-9).

22-0.2.2 General Definitions (23)

accessory: a secondary part or assembly of parts that contributes to the overall function and usefulness of the equipment.

Figure 22-0.2.1-1
Commercial Truck-Mounted With Ground Control

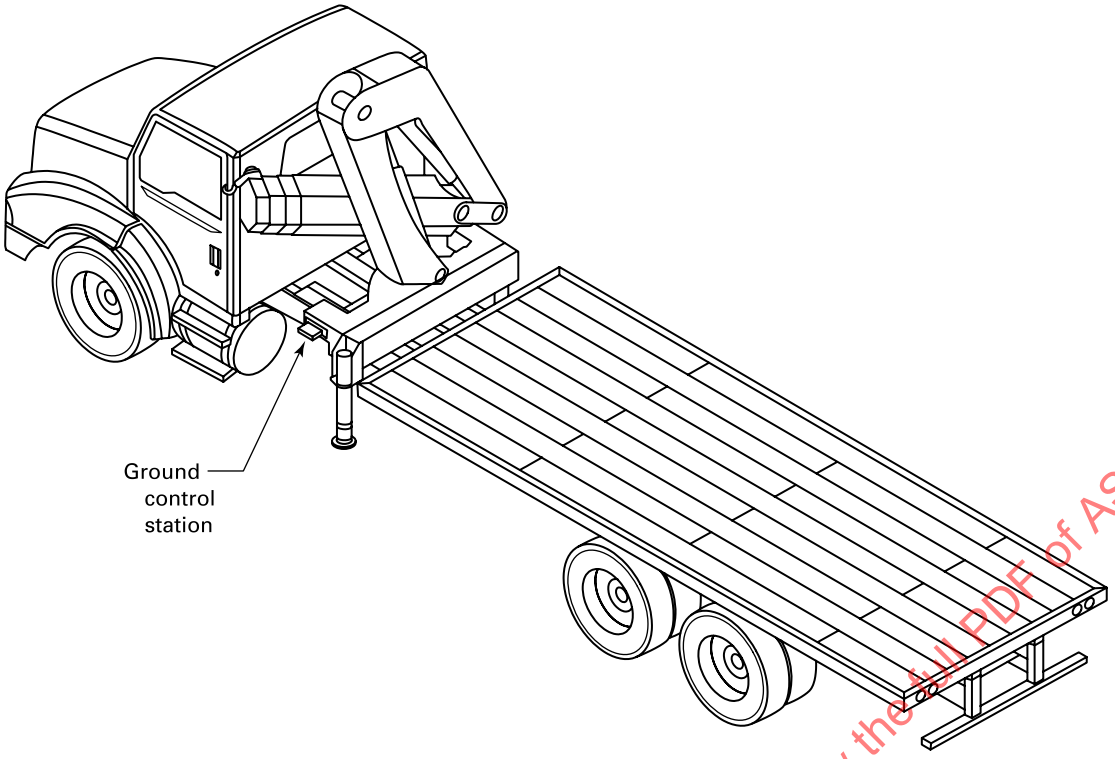


Figure 22-0.2.1-2
Commercial Truck-Mounted With Top Seat Control

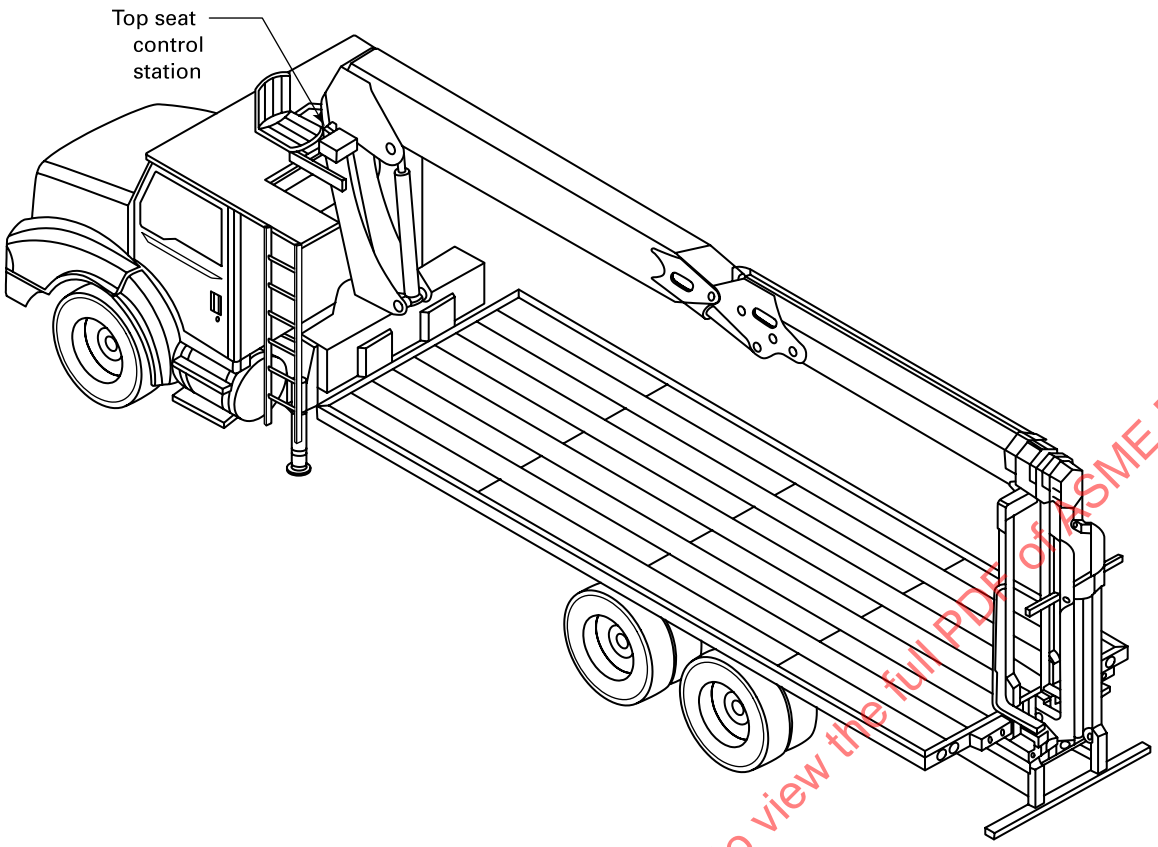


Figure 22-0.2.1-3
Commercial Truck-Rear-Mounted With Remote Control

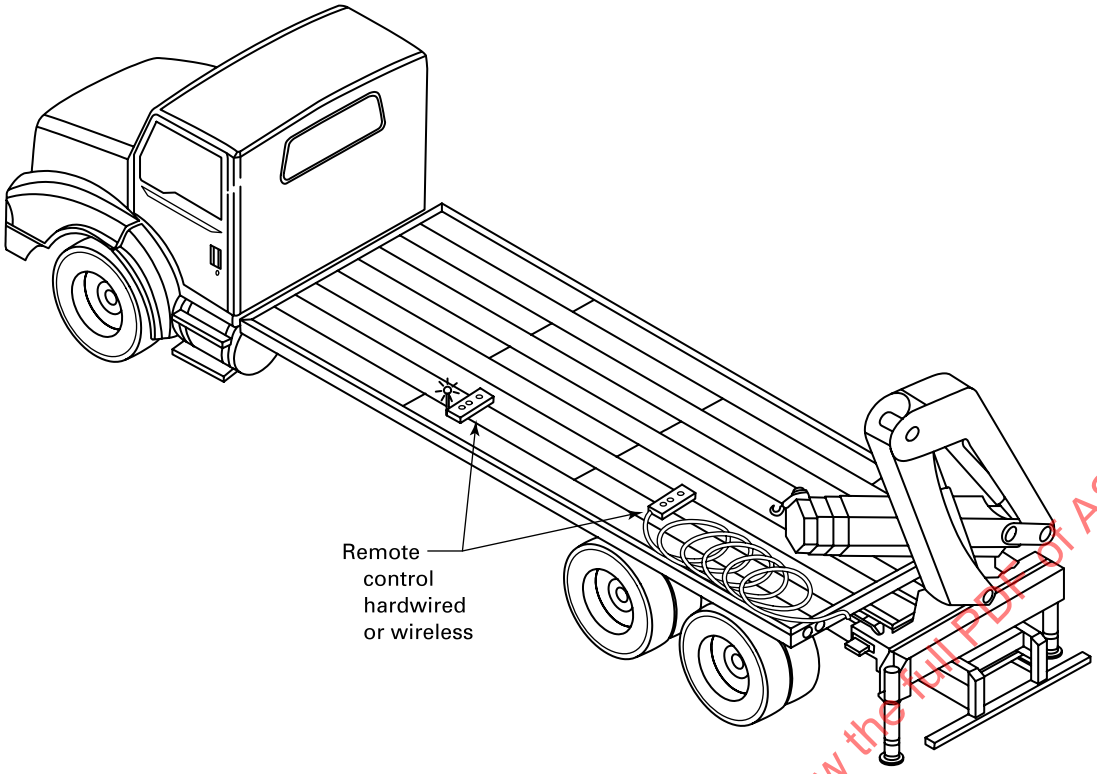


Figure 22-0.2.1-4
Crawler-Mounted

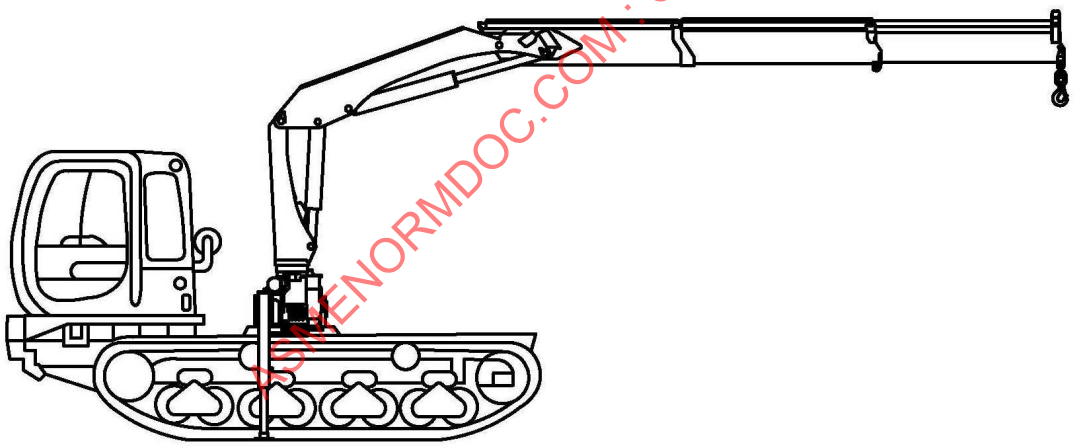


Figure 22-0.2.1-5
Stationary Installation

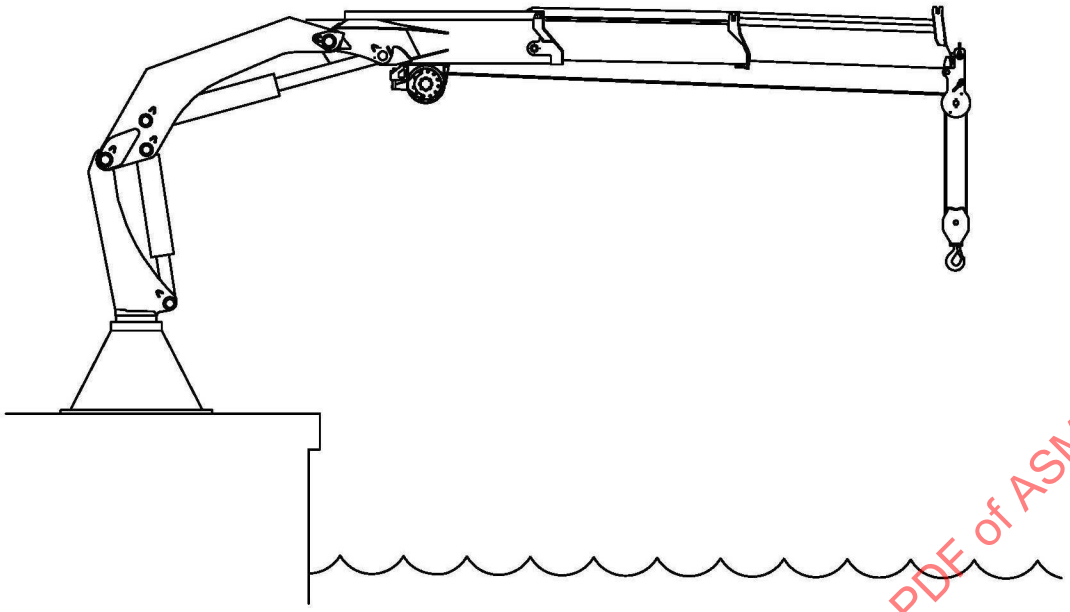


Figure 22-0.2.1-6
Railcar Installation

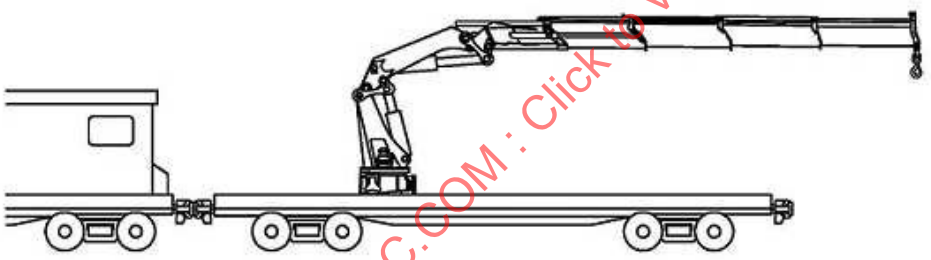


Figure 22-0.2.1-7
Trailer-Mounted

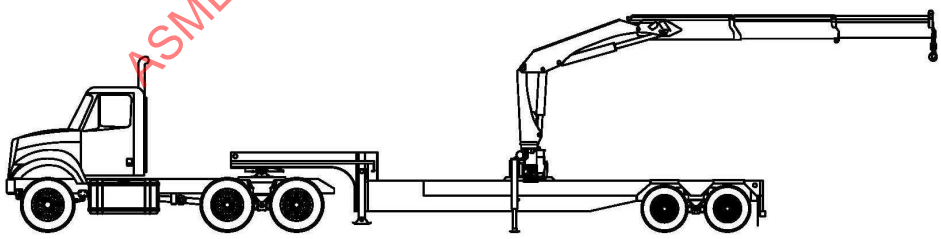


Figure 22-0.2.1-8
Traveling Base-Mounted on Trailer

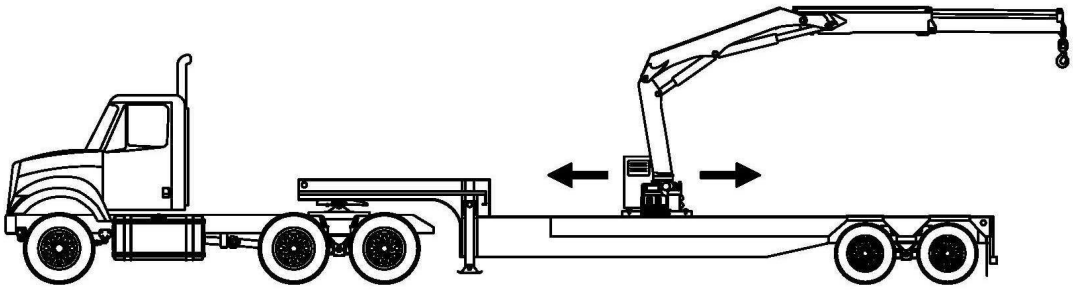
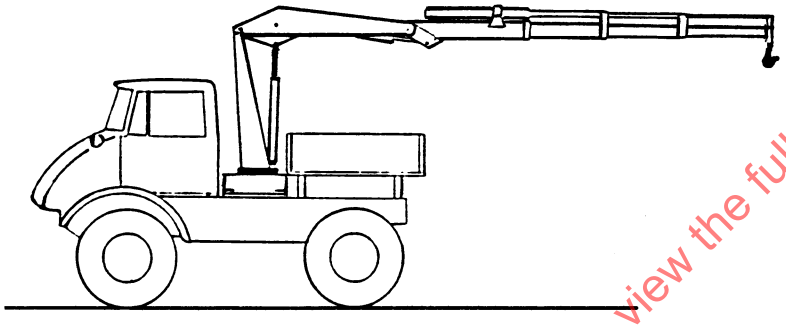


Figure 22-0.2.1-9
Off-Road Vehicle



alteration (modification): any change in the original equipment manufacturer's design configuration of the crane that pertains to load-supporting components, load-positioning components, and other components that affect the safe load-carrying capability of the crane (e.g., counterweights, holding valves) including operational aids, limit devices, and load charts.

anti-two-block device: a device that, when activated, disengages all equipment functions whose movement can cause two-blocking.

axle: the shaft or spindle with which or about which a wheel rotates. It refers to a type of axle assembly, including housings, gearing, differential, bearings, and mounting appurtenances.

ballast (counterweight): weight used to supplement the weight of the machine in providing stability for lifting working loads.

boom extension cylinder: the hydraulic cylinder(s) that extends the boom's extensions.

boom extensions, manual or hydraulic: structural members, which extend and are usually located in or on the outer boom or on the jib boom.

brake: a device used for retarding or stopping motion.

cab: a housing that covers an equipment control station.

cab, station, or top seat control: a control station directly attached to the equipment where the operator sits or stands above the ground.

commercial truck vehicle: a commercial motor vehicle designed primarily for the transportation of property in connection with business and industry.

controls: a means for controlling the movement functions of the crane.

crane: articulating boom crane.

drum: a cylindrical member around which the rope is wound for lifting and lowering the load.

ground or floor control: a control station directly attached to the crane, but where the operator stands on the ground, not the crane.

inner boom: the structural member, attached to the mast, which supports the outer boom(s).

inner boom lift cylinder: the hydraulic cylinder that lifts the inner boom.

inner boom pivot: the horizontal pin about which the inner boom is raised or lowered relative to the mast.

jib (fly jib): an articulating or fixed boom assembly with or without extendable boom sections that attaches to the outer boom.

load, working: the external load in pounds (kilograms) applied to the crane, including the weight of load-attaching equipment such as slings, pallet forks, and grapples.

load hoist: a hoist drum or rope reeving system used for lifting and lowering loads.

load hook: a structural component that pins to the outer boom, jib boom, extensions, or the load line and is used for attaching loads to the crane.

load indicator: a device that measures the weight of the load.

load ratings: ratings in pounds (kilograms) established by the manufacturer.

lower load block: the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting rope.

mainframe (base): the stationary base of the crane that supports the mast or turntable.

mast: a frame for use in connection with supporting a boom from mainframe or base.

minimum breaking force: the minimum load at which a new and unused wire rope will break when loaded to destruction in direct tension.

mounting or suspension beam: a structural member used in three-point mounting concept, which allows the chassis frame to twist and transfers the crane's loading into chassis rails.

mounting structure: the structure on which the crane is mounted.

nonlifting attachment: devices attached to the crane that perform functions other than lifting a load, such as augers, tampers, and hydraulic hammers.

operational aid: an accessory that provides information to facilitate operation of the equipment or that takes control of particular functions without action of the operator when a limiting condition is sensed. Examples of such devices include, but are not limited to, the following:

(a) two-block damage-prevention system
(b) rated capacity indicator
(c) rated capacity (load) limiter
(d) crane level indicator
(e) load indicator
(f) minimum wrap limiter

original language(s): language(s) used by the manufacturer to develop product instructions and manual(s).

outer boom: the structural member, attached to the inner boom, which supports the jib boom.

outer boom cylinder: a hydraulic cylinder that lifts and lowers the outer boom in relation to the inner boom.

outer boom pivot: a horizontal pin about which the outer boom is raised and lowered relative to the inner boom.

overload protection system: a system that automatically monitors the crane's lifting condition and prevents movement of the crane that results in an overload condition.

payload: the load or loads being transported by the commercial truck chassis from place to place.

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

radius (load): the horizontal distance from the centerline of rotation to the centerline of the hook pin at any boom position.

rated capacity indicator: a device that automatically monitors radius, load weight, and load rating and warns the crane operator of an overload condition.

rated capacity (load) limiter: a device that automatically monitors radius, load weight, and load rating and prevents movements of the crane, which would result in an overload condition.

reeving: a rope system in which the rope travels around drums and sheaves.

remote control: a fixed or moveable control station not mounted to the crane. This could be electrical (wired or wireless) or hydraulic controls.

rope: refers to rope covered by ASME B30.30 unless otherwise specified.

shall: a word indicating a requirement.

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

should: a word indicating a recommendation.

side loading: a load applied at an angle to the vertical plane of the boom.

stability: a condition in which the sum of the moments tending to overturn the unit is less than the sum of the moments resisting overturning.

stabilizer: an extendable or fixed member(s) attached to the mounting base to increase the stability of the equipment, but which may not have the capability of relieving all of the weight from wheels or tracks.

stabilizer cylinder, horizontal: a hydraulic cylinder that extends the stabilizer.

stabilizer cylinder, vertical: a hydraulic cylinder that lowers the stabilizer pad to ground surface.

stabilizer pad: the structural member that distributes unit load over ground surface.

standard crane: as defined by the manufacturer.

structural competence: the ability of the equipment and its components to withstand the stresses imposed by applied and dynamic loads.

swing (slewing): rotation of the mast and boom for movement of loads in a horizontal direction about the axis of rotation.

swing (slewing) cylinders: two opposed single-acting cylinders that act on a rack gear which engages the mast pinion.

swing (slewing) drive gearbox: a mechanism that drives the mast or turntable.

swing (slewing) mechanism: the machinery involved in providing rotation of the mast and boom.

swivel: a load-carrying member with thrust bearings to permit rotation under load in a plane perpendicular to the direction of the load.

swiveling: the rotation of the load attachment portion (hook or shackle) of a lower load block or hook assembly about its axis of suspension in relation to the load line(s).

telescoping boom: a boom in which one or more boom sections are telescoped for additional length.

tipping: see *stability*.

transit: the moving or transporting of equipment from one job site to another.

travel: the function of the equipment moving under its own power from one location to another on a job site.

two-block damage-prevention system: a system that will stall when two-blocking occurs without causing damage to the hoist rope or crane machinery components.

two-blocking: the condition when the lower load block or hook assembly comes in contact with the upper load block or boom point sheave assembly.

upper load block: the assembly of shackle, swivel, sheaves, pins, and frame suspended from the boom point.

vehicle: a mobile chassis on which an articulating crane is mounted. May include, but is not limited to, a commercial truck, a crawler chassis, an off-road chassis, a railcar, or a trailer.

wheelbase: the distance between centers of front and rear axles. For a multiple axle assembly, the axle center for wheelbase measurement is taken at the midpoint of the assembly.

winch (hoist): a power driven drum(s) capable of lifting and lowering loads.

SECTION 22-0.3: LEGEND FOR FIGURES 22-0.3-1 THROUGH 22-0.3-4

A *articulating angle* — the angle through which the outer boom moves from full retraction to full extension of the outer boom lift cylinder (see Figure 22-0.3-2)

CA *cab-to-axle dimension* — the distance from the back of the chassis cab to the centerline of the rear axle, or tandem axle assembly [see Figure 22-0.3-1, illustration (a)]

CG *center of gravity of crane* [see Figure 22-0.3-1, illustration (a)]

CGH *crane center of gravity, horizontal* — the horizontal distance from the centerline of rotation to the center of weight of the stowed crane in the travel position [see Figure 22-0.3-1, illustration (a)]

CGL *crane center of gravity, longitudinal* — longitudinal center of gravity as measured from the centerline of rotation to the center of weight of the stowed crane in the travel position [see Figure 22-0.3-1, illustration (a)]

CGV *crane center of gravity, vertical* — the vertical center of gravity as measured from the mounting surface of the mainframe or base to the center of weight of the stowed crane in the travel position [see Figure 22-0.3-1, illustration (a)]

CH *crane height* — the overall height measurement from the mounting surface of the crane to the highest point on the crane when stowed for travel [see Figure 22-0.3-1, illustration (a)]

CLL *centerline of rotation location, longitudinal* — the horizontal distance parallel to the longitudinal centerline of the chassis from the rear axle of the chassis to the centerline of rotation of the mast [see Figure 22-0.3-1, illustration (a)]

CLR *centerline of rotation* — the vertical axis about which the mast rotates [see Figure 22-0.3-1, illustration (a)]

D *depth of crane* — mounting space for crane less clearances [see Figure 22-0.3-1, illustration (c)]

E1 *elevation below horizontal* — the travel of the hook to maximum depression below horizontal (see Figure 22-0.3-3)

E2 *elevation above horizontal* — the travel of the hook to maximum elevation above horizontal (see Figure 22-0.3-4)

F *chassis height* — the height of the top of the chassis frame rail above ground level [see Figure 22-0.3-1, illustration (a)]

FO *front overhang* — the distance from the most forward part of the vehicle or crane ahead of the front axle to the centerline of the front axle [see Figure 22-0.3-1, illustration (a)]

GC *ground clearance* — the distance from the lowest part of the crane to the ground [see Figure 22-0.3-1, illustration (a)]

GL *ground level* — the surface (assumed to be flat and level) on which the vehicle is supported [see Figure 22-0.3-1, illustration (a)]

HA *hook approach, horizontal (HA_H) and vertical (HA_v)* — the horizontal distance from the centerline of rotation to the centerline of the hook pin and the vertical distance from the crane mounting surface to the centerline of the hook pin when inner boom is at maximum elevation, outer boom is fully retracted, and all extension booms are fully retracted (see Figure 22-0.3-2)

HR *hook height, maximum retracted* — the height above the mounting surface of the base of the unit of the centerline of the boom tip hook pin with all booms at maximum elevation and all extensions fully retracted [see Figure 22-0.3-1, illustration (b)]

H1 *hook height, maximum 1st extension* — the height above the mounting surface of the base of the unit of the centerline of the boom tip hook pin with all booms at maximum elevation and the 1st extension stage boom fully retracted [see Figure 22-0.3-1, illustration (b)]

H2 *hook height, maximum 2nd extension* — the height above the mounting surface of the base of the unit of the centerline of the boom tip hook pin with all booms at maximum elevation and the 1st and 2nd extension boom fully retracted [see Figure 22-0.3-1, illustration (b)]

H3 *hook height, maximum 3rd extension* [see Figure 22-0.3-1, illustration (b)]

H4 *hook height, maximum 4th extension* [see Figure 22-0.3-1, illustration (b)]

MO *mast offset* — the amount of offset from the centerline of the longitudinal axis of the vehicle to the centerline of rotation of the mast of the crane [see Figure 22-0.3-1, illustration (c)]

P *stabilizer vertical travel* — the distance measured below mounting surface of crane to which the stabilizers could reach when fully extended [see Figure 22-0.3-1, illustration (b)]

R *load radius* — the horizontal distance from the centerline of rotation to the centerline of the hook pin at any boom position [see Figure 22-0.3-1, illustration (b)]

RO *rear overhang* — the distance from the most rearward part of the vehicle or crane behind the rear axle to the centerline of the rear axle in the traveling position [see Figure 22-0.3-1, illustration (a)]

RR *horizontal reach, retracted* — the distance from the centerline of rotation to the centerline of the boom tip hook pin with all booms horizontal and all extensions fully retracted [see Figure 22-0.3-1, illustration (b)]

R1 *horizontal reach, 1st extension* — the distance from the centerline of rotation to the centerline of the boom tip hook pin with all booms horizontal and 1st extension stage fully extended [see Figure 22-0.3-1, illustration (b)]

R2 *horizontal reach, 2nd extension* [see Figure 22-0.3-1, illustration (b)]

R3 *horizontal reach, 3rd extension* [see Figure 22-0.3-1, illustration (b)]

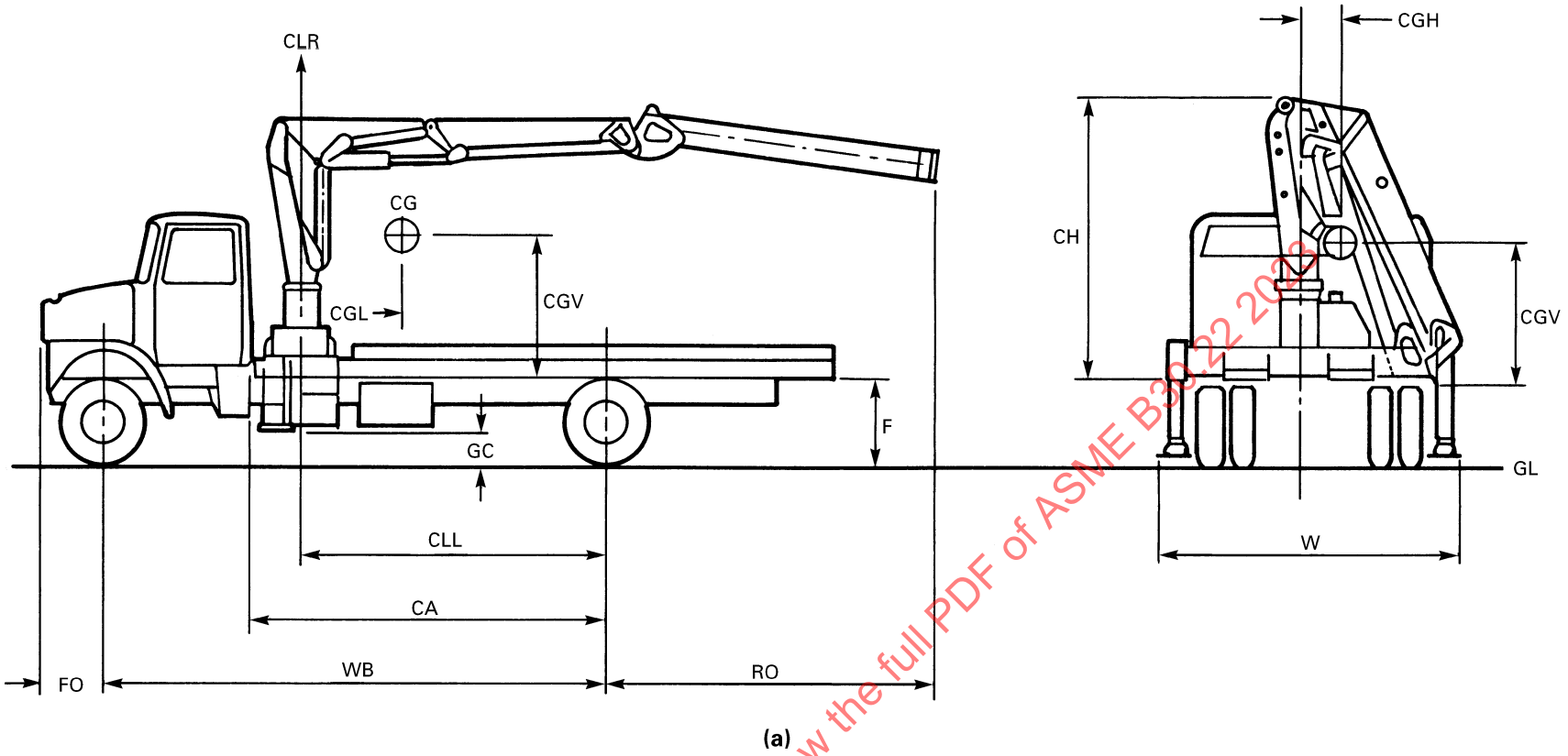
R4 *horizontal reach, 4th extension* [see Figure 22-0.3-1, illustration (b)]

S *stabilizer spread* — the distance measured between the centerlines of pivotal points of stabilizer pads at ground level at maximum spread [see Figure 22-0.3-1, illustration (b)]

W *width of unit in stowed position* [see Figure 22-0.3-1, illustration (a)]

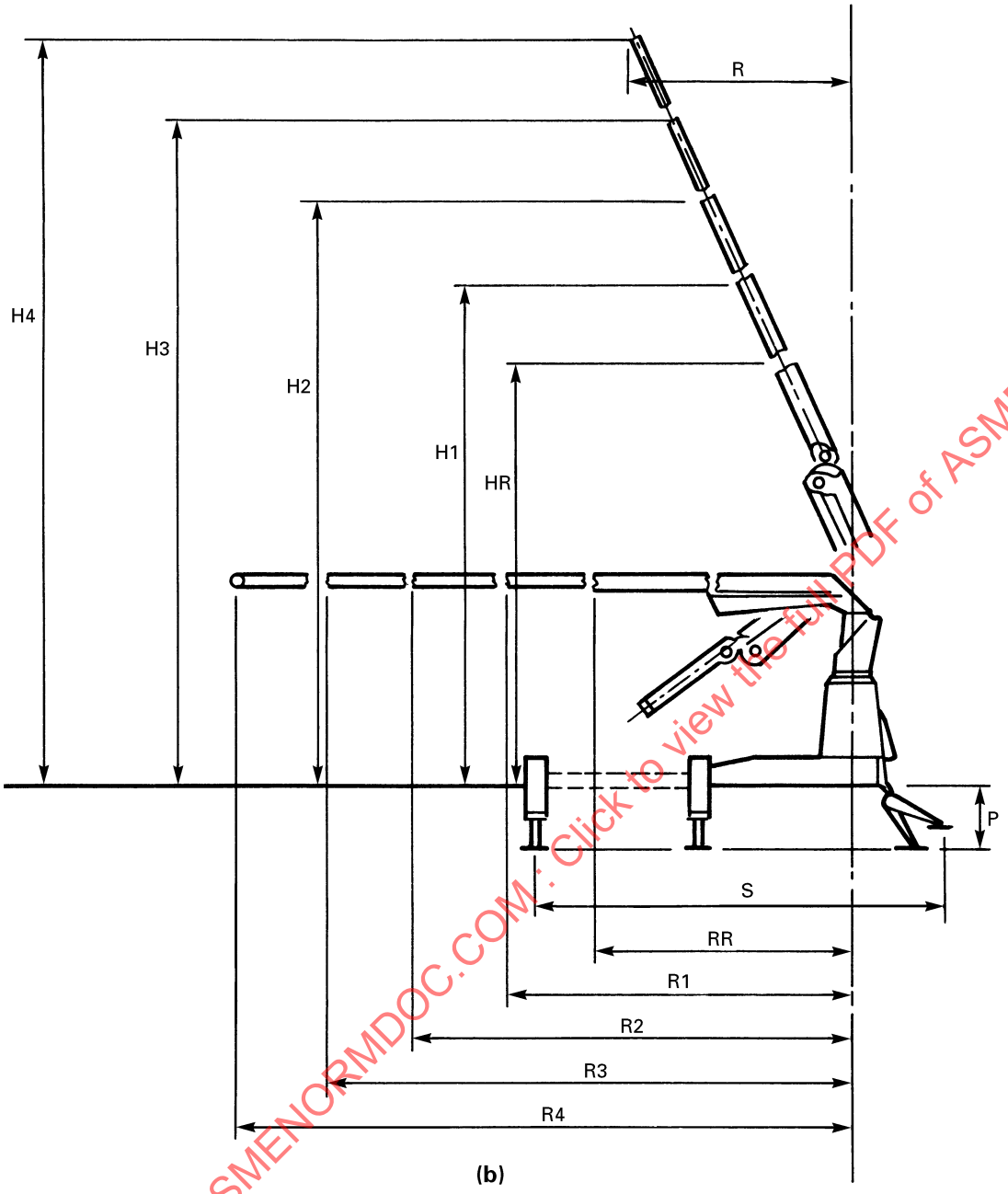
WB *wheelbase* [see Figure 22-0.3-1, illustration (a)]

Figure 22-0.3-1
Definitions of Specifications for Articulating Cranes



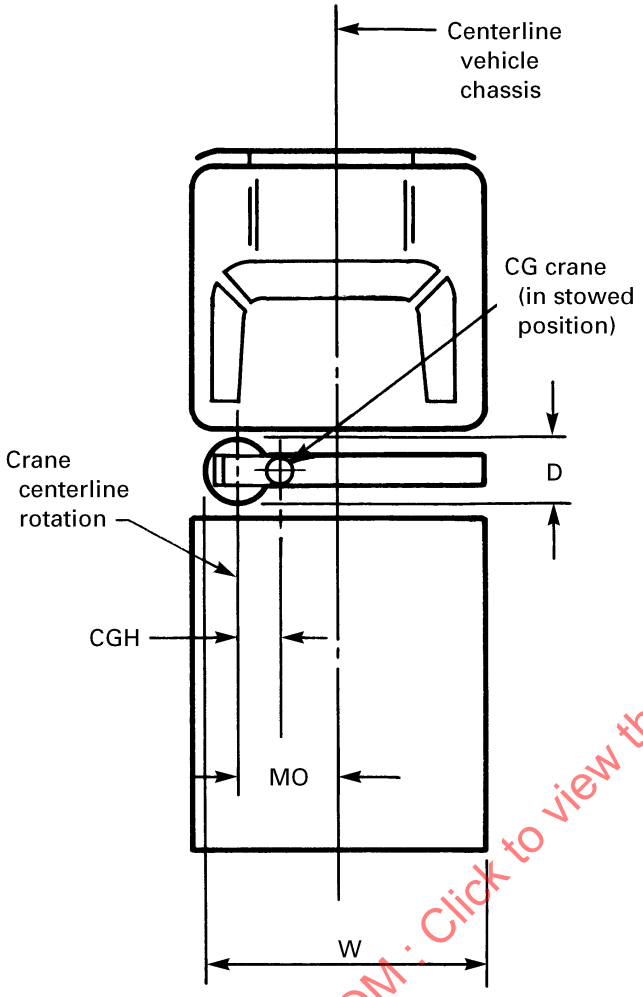
(a)

Figure 22-0.3.1
Definitions of Specifications for Articulating Cranes (Cont'd)



(b)

Figure 22-0.3.1
Definitions of Specifications for Articulating Cranes (Cont'd)



(c)

Figure 22-0.3-2
Hook Approach

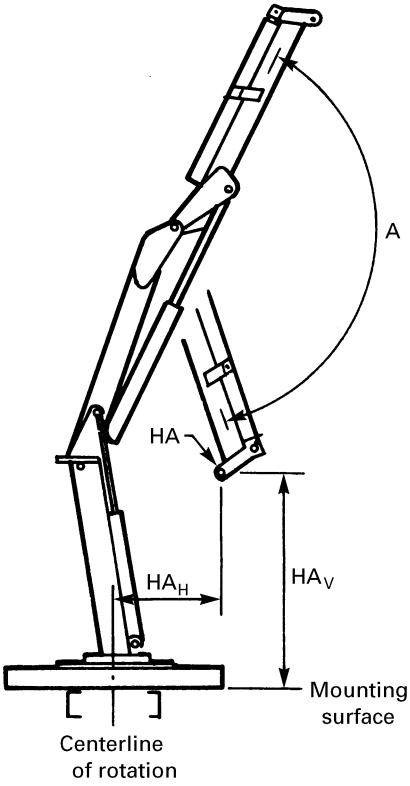
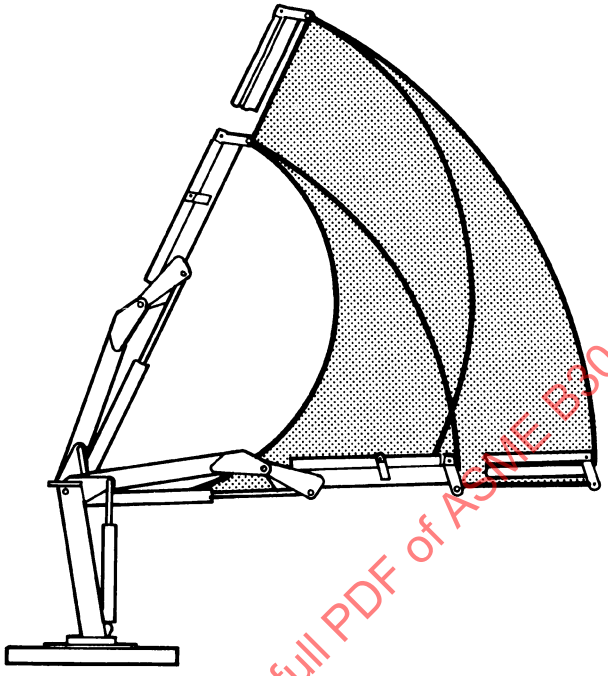
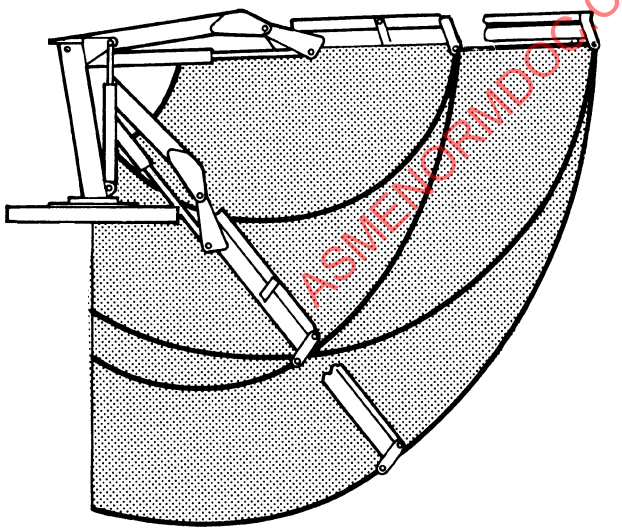


Figure 22-0.3-4
Elevation Above Horizontal



E2 — elevation above horizontal

Figure 22-0.3-3
Elevation Below Horizontal



E1 — elevation below horizontal

SECTION 22-0.4: NOMENCLATURE FOR ARTICULATING CRANES

Figure 22-0.4-1 provides nomenclature for articulating cranes.

SECTION 22-0.5: PERSONNEL COMPETENCE

Persons performing the functions identified in this Volume shall meet the applicable qualifying criteria stated in this Volume and 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.

(23) SECTION 22-0.6: TRANSLATIONS

22-0.6.1 Technical and Safety-Related Instructions and Manuals

The manufacturer shall provide instructions and manual(s) for the operation, inspection, testing, maintenance, assembly, and disassembly of the equipment.

(a) The instructions and manuals shall be provided in a language specified by the purchaser at the time of the initial sale by the manufacturer.

(b) Pictograms used to identify controls shall be described in the instructions. The pictograms should comply with ISO 7000, ISO 7296, or another recognized source, if previously defined.

(c) Translations of the original language instructions (if the manufacturer no longer exists, translation of the instructions with the machine is acceptable) shall meet professional translation industry standards, which include, but are not limited to, the following:

(1) translating the complete paragraph message, instead of word by word

(2) ensuring grammatical accuracy

(3) preserving the source document content without omitting or expanding the text

(4) translating the terminology accurately

(5) reflecting the level of sophistication of the original document

(d) The finished translation shall be verified for compliance with (c)(1) through (c)(5) by a qualified person having an understanding of the technical content of the subject matter.

22-0.6.2 Translation of Technical and Safety-Related Information and Manuals

The entities responsible for the operation, inspection, testing, maintenance, assembly, and disassembly of the covered equipment shall have the technical and safety-related information available in a language that their employees can read and understand. If the information is not available in a language understood by their employees, the entities shall obtain a translation of the original manufacturer's technical and safety-related information from the manufacturer or from a translation service provider. The translation(s) shall meet the requirements of paras. 22-0.6.1(c) and 22-0.6.1(d).

SECTION 22-0.7: REFERENCES (23)

Within the text, references are made to the following publications, copies of which may be obtained from the publishers as indicated.

ANSI/AWS D14.3. Welding Specifications for Earthmoving, Construction, and Agricultural Equipment. American Welding Society.

ASME B30.5-2018. Mobile and Locomotive Cranes. The American Society of Mechanical Engineers.

ASME B30.10-2014. Hooks. The American Society of Mechanical Engineers.

ASME B30.23-2016. Personnel Lifting Systems. The American Society of Mechanical Engineers.

ASME B30.25-2013. Scrap and Material Handlers. The American Society of Mechanical Engineers.

ASME B30.26-2015. Rigging Hardware. The American Society of Mechanical Engineers.

ASME B30.30-2019. Ropes. The American Society of Mechanical Engineers.

ASME P30.1-2014. Planning for Load Handling Activities. The American Society of Mechanical Engineers.

ISO 7000:2014. Graphical symbols for use on equipment.[1] International Organization for Standardization.

ISO 7296:2012. Cranes — Graphic symbols.[1] International Organization for Standardization.

SAE J765-Oct90. Crane Load Stability Test Code. SAE International.

SAE J1063-Nov93. Cantilevered Boom Crane Structures — Method of Test. SAE International.

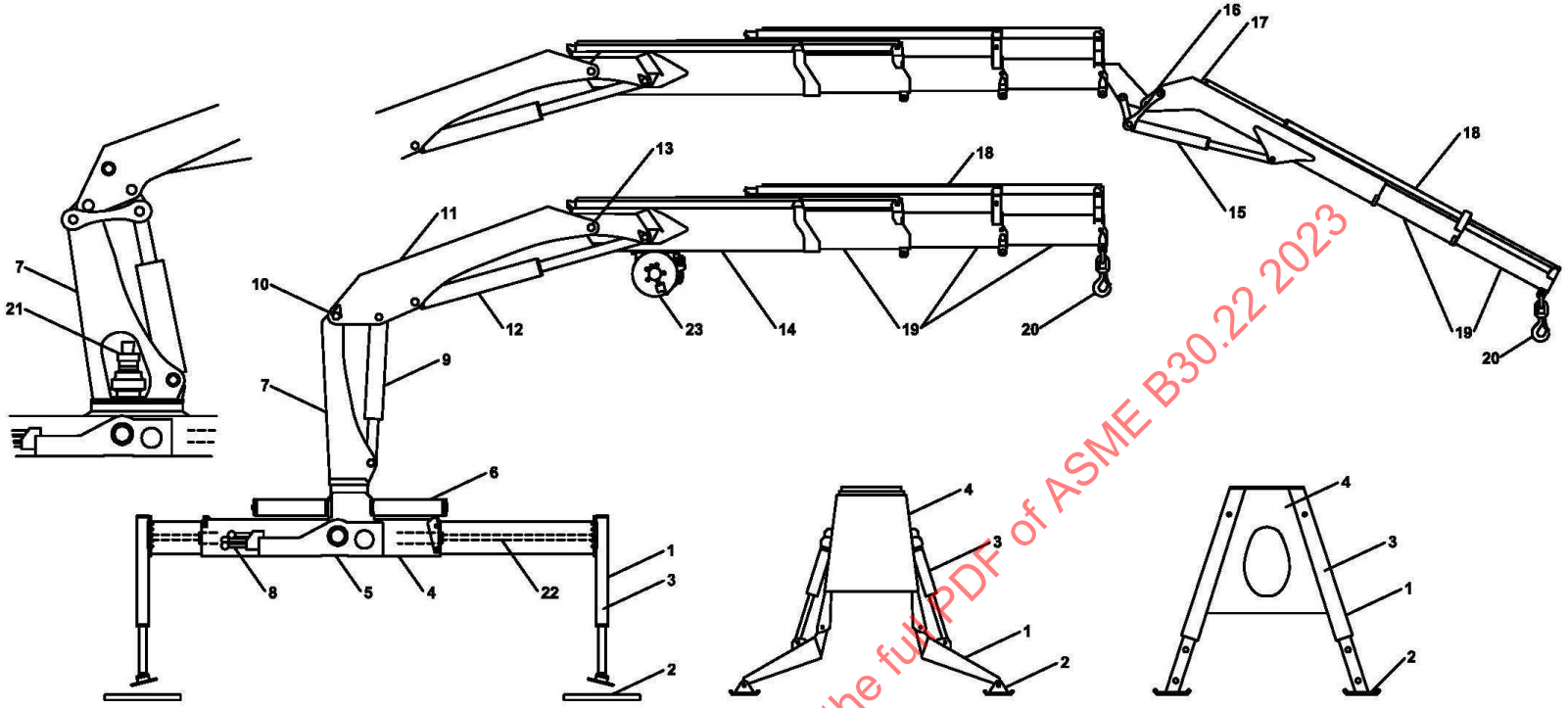
SAE J2703-Oct08. Cranes — Access and Egress. SAE International.

SAE Z26.1-1996. Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways — Safety Standard. SAE International.

U.S. Department of Transportation Standards. U.S. Government Publishing Office.

[1] May also be obtained from the American National Standards Institute (ANSI).

Figure 22-0.4-1
Nomenclature for Articulating Cranes



Legend:

1.	Stabilizer	7.	Mast or turntable	13.	Outer boom pivot	19.	Boom extensions (one or more)
2.	Stabilizer pad	8.	Controls	14.	Outer boom	20.	Load hook
3.	Stabilizer cylinder, vertical	9.	Inner boom lift cylinder	15.	Jib (fly jib) boom cylinder	21.	Rotation (slewing) drive, gearbox type
4.	Mainframe or base	10.	Inner boom pivot	16.	Jib (fly jib) boom pivot	22.	Stabilizer cylinder, horizontal
5.	Mounting or suspension beam	11.	Inner boom	17.	Jib (fly jib) boom	23.	Winch
6.	Rotation (slewing) cylinder type	12.	Outer boom cylinder	18.	Boom extension cylinder(s)		

Chapter 22-1
Construction and Characteristics

SECTION 22-1.1: LOAD RATINGS

22-1.1.1 Load Ratings Where Stability Governs Lifting Performance

(a) The margin of stability for determination of load ratings, with booms of stipulated lengths at stipulated working radii for the various types of crane mountings, is established by taking a percentage of the loads that will produce a condition of tipping or balance with the boom in the least stable direction, relative to the mounting. The load ratings shall not exceed the following percentages for cranes, when tested in accordance with SAE J765 for indicated types of mounting.

Type of Crane Mounting	Maximum Load Ratings, %
Wheel-mounted (including commercial truck, trailer, and off-road) crane with stabilizers extended and set	85
Wheel-mounted (including commercial truck, trailer, and off-road), using stabilizers partially extended and set	[Notes (1), (2)]
Wheel-mounted (including commercial truck, trailer, and off-road), without stabilizer support	75
Railcar, without stabilizer support [Note (3)]	85
Crawler, without stabilizer support	75
Crawler, using stabilizers fully extended and set	85

NOTES:

(1) The following equation shall be used for less than full extension of all stabilizer beams to find the rated capacity:

$$P \leq (T - 0.1F)/1.25$$

where

F = load applied at boom tip that gives the same moment effect as boom mass
P = rated capacity in the lifting direction specified
T = tipping load

(2) If crane operation with stabilizers in positions other than fully extended is permitted by the crane manufacturer, specified procedures, ratings, and limitations for any configurations that are permitted shall be provided.

(3) As a precaution while testing without stabilizer support, stabilizers should be loosely applied; rail clamps should not be used.

(b) The effectiveness of these preceding stability factors will be influenced by such additional factors as freely suspended loads; rail, wind, or ground conditions; condition and inflation to tire manufacturer's highway-rated pressure of rubber tires; boom lengths; proper operating speeds for existing conditions; and, in general, careful and competent operation.

22-1.1.2 Load Ratings Where Factors Other Than Stability Govern Lifting Performance

(a) Load ratings at some radii may be based on structural, mechanical, hydraulic, or pneumatic limitations rather than stability.

(b) A nonsymmetrical mounting requires a higher loading to produce a condition of tipping in a direction other than that of least stability on which the load ratings are established. Therefore, if the crane specification includes additional ratings for directions other than the least stable, such ratings also may be governed by structural competence rather than stability. For such specified additional ratings, the work area shall be indicated, and for those ratings which might be governed by tipping loads, the applicable percentage factors in para. 22-1.1.1(a) shall not be exceeded.

(c) For all operational applications, the crane load ratings established by the manufacturer shall not be exceeded.

22-1.1.3 Load Rating Charts

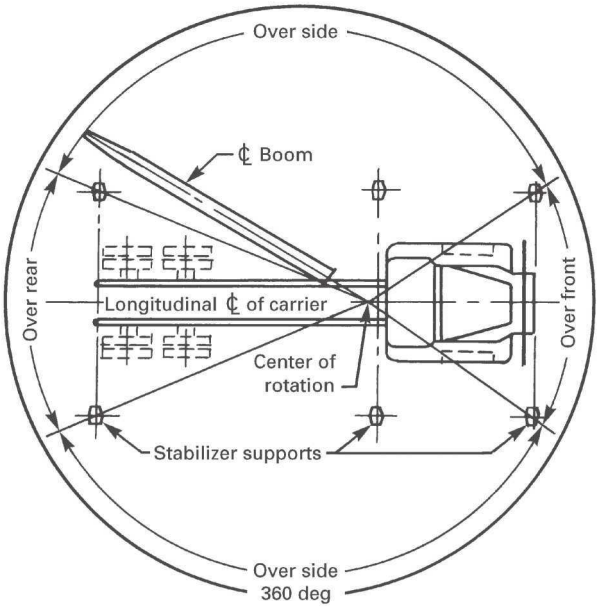
(a) Durable rating charts with legible letters and figures shall be provided with each crane, one attached to the crane at each fixed operator station. On wired and wireless remote operated cranes, a chart shall be on the crane at ground level. One rating chart shall be in the operator's manual. The data and information to be provided on these charts shall include but not be limited to the following:

(1) a range of manufacturer's crane load ratings at stated operating radii, work areas, boom lengths, configurations, and jib lengths

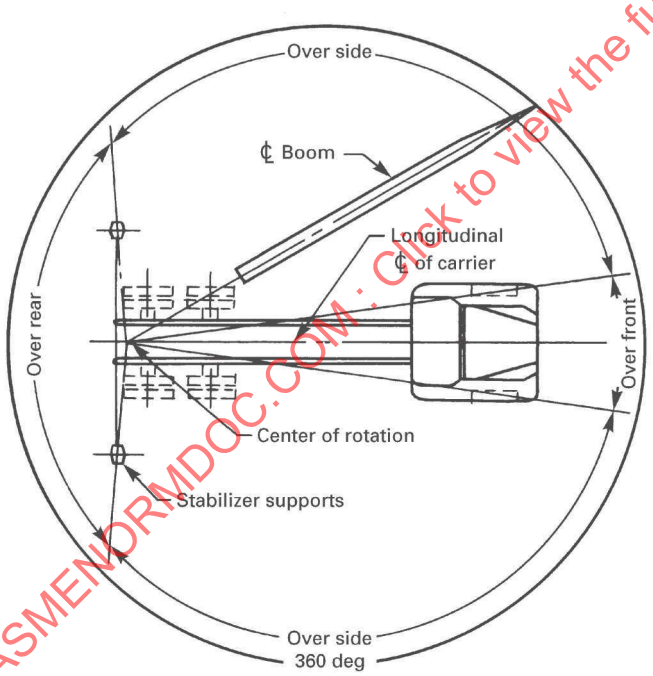
(2) in areas where no load or reduced load is to be handled, a work area figure or load rating chart shall so state (see Figure 22-1.1.3-1 for examples)

(3) levelness of the crane for rated loads

Figure 22-1.1.3-1
Work Areas

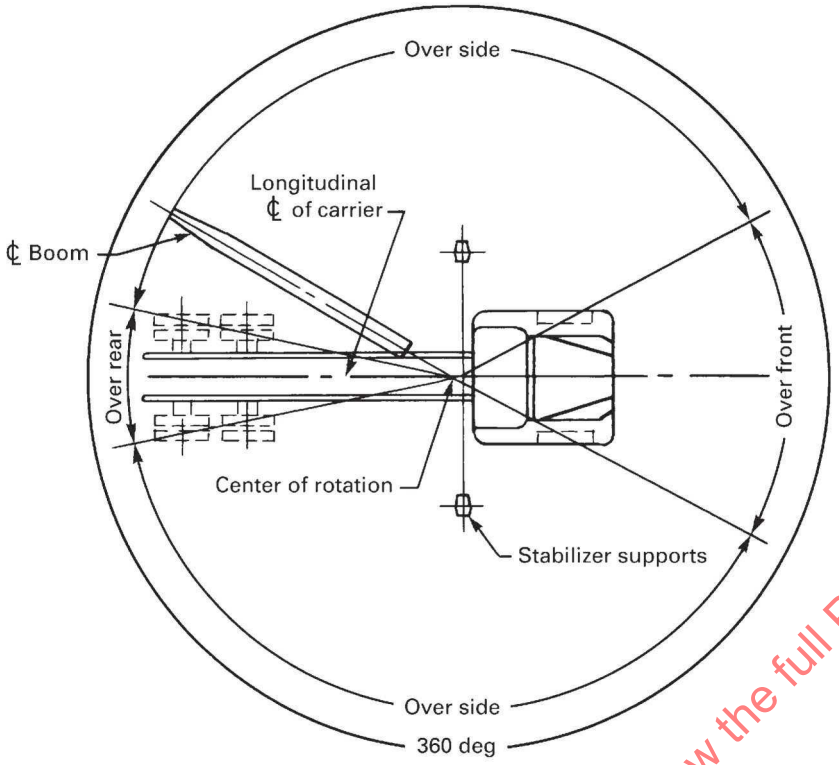


(a)



(b)

Figure 22-1.1.3-1
Work Areas (Cont'd)



(c)

GENERAL NOTES:
(a) These lines determine the limiting position of any load for operation within the working areas indicated.
(b) Configurations that deviate significantly from the work areas shown in Figure 22-1.1.3-1 shall have their working areas defined by appropriate sets of diagrams supplied by the manufacturer.

(4) if the crane is equipped with a winch, the line pull rating for all reeving (parts of line) configurations.

(b) In addition to the data required on the load rating chart, the following information shall be shown either on the load rating chart or in the operating manual:

(1) recommended tire pressure chart, where applicable.

(2) cautionary or warning notes relative to limitations on equipment and operating procedures.

(3) the maximum telescopic travel length of each boom telescopic section.

(4) whether sections are telescoped with power or manually.

(5) sequence and procedure for extending and retracting telescopic boom section.

(6) maximum loads permitted during actual boom extending operation, and any limiting conditions, or cautions.

(7) hydraulic relief valve settings specified by the manufacture.

(8) if the crane is equipped with a load hoist mechanism, recommended parts of hoist reeving, size, length and type of rope for various crane loads, and recommended hoist reeving diagram. Sufficient information to permit the user to procure replacement wire rope shall be provided.

SECTION 22-1.2: BOOM LIFT, BOOM TELESCOPING, AND LOAD HOIST MECHANISMS

22-1.2.1 Inner, Outer, and Jib Boom Lift Mechanism

(a) The inner, outer, and jib boom cylinder(s) shall be capable of elevating, lowering, and controlling the booms with rated load and shall be capable of supporting the boom and rated load without action by the operator.

(b) An integrally mounted holding device (such as a load holding check valve) shall be provided on the cylinder(s) to prevent uncontrolled lowering of the boom(s) in the event of a hydraulic system failure (e.g., supply hose rupture).

22-1.2.2 Telescoping Boom(s)

(a) Extension and retraction of boom sections may be accomplished through hydraulic, mechanical, or manual means.

(b) The powered retract and extend functions shall be capable of controlling the rated load.

(c) An integrally mounted holding device (such as a load holding check valve) shall be provided on the cylinder(s) to prevent uncontrolled movement of the boom(s) in the event of a hydraulic system failure (e.g., supply hose rupture).

(23) ### 22-1.2.3 Load Hoist Mechanism (Load Hoist Equipped Machines Only)

(a) The hoist mechanism may consist of a winch or hydraulic cylinder(s) with necessary rope reeving.

(b) Winch Assembly. The winch drum assemblies shall have power and operational characteristics to perform all load lifting and lowering functions required in crane service when operated under recommended conditions.

(1) When brakes are used with winch drums, they shall be of the size and thermal capacity to control all rated crane loads with minimum recommended reeving. Brakes shall be provided with adjustments, when necessary, to compensate for lining wear and to maintain force in springs, where used.

(2) Winch drums shall have rope capacity with the recommended rope size and reeving to perform crane service within the range of boom lengths, operating radii, and vertical lifts specified by the manufacturer.

(3) Winch drums shall be in accordance with ASME B30.30.

(-a) The minimum number of wraps that remain on the drum shall be as specified in ASME B30.30, when the hook is in the extreme low position and the booms are at maximum elevation and extension. The drum shall be equipped with a minimum wrap limiter that prevents further lowering motion of the hoist when the minimum number of wraps remains.

(4) A means controllable from the operator's station shall be provided to hold the drum from rotating in the lowering direction and be capable of holding the rated load without further action by the operator.

(c) Two-Block Damage-Prevention System. On an articulating crane equipped with a winch, a two-block damage-prevention system or an anti-two-block device shall be provided. Stalling of the hydraulic system is acceptable.

(d) Cylinders With Rope Reeving

(1) Cranes using a load hoist mechanism with hydraulic cylinder(s) and rope reeving shall have power and operational characteristics to perform all load lifting and controlled lowering functions required in crane service when operated under recommended conditions.

(2) Cylinders utilized with a load hoist rope reeving system shall provide a working rope capacity (length) for that system with the recommended rope size and reeving to perform crane service with the range of boom lengths, operating radii, and vertical lifts specified by the manufacturer.

(3) Cylinders shall be equipped with a load-holding device to prevent uncontrolled lowering of the load in case of hydraulic line failure.

(4) The load hoist cylinder shall be capable of holding rated load without action of the operator.

SECTION 22-1.3: SWING MECHANISM

22-1.3.1 Swing Control

The swing mechanism shall start and stop with controlled acceleration and deceleration.

22-1.3.2 Swing Braking Means and Locking Devices

(a) A stopping means with holding power in both directions shall be provided to restrict movement of the rotating mast, when desired under normal operation. The braking means shall be capable of being set in the holding position and remaining so without further action by the operator.

(b) A positive locking device or boom support shall be provided to prevent the boom from rotating when in stowed position for transit.

SECTION 22-1.4: CRANE TRANSPORT

Commercial truck vehicle-mounted cranes shall meet applicable requirements of U.S. Department of Transportation Standards.

(23) ## SECTION 22-1.5: ROPES, ROPE-LIFTING COMPONENTS, AND REEVING ACCESSORIES

Ropes and rope-lifting components shall be in accordance with ASME B30.30.

22-1.5.1 Sheaves

Sheaves shall be in accordance with ASME B30.30. All sheave bearings, except permanently lubricated bearings, shall be provided with means for lubrication.

22-1.5.2 Load Hooks, Ball Assemblies, and Load Blocks

Load hooks, ball assemblies, and load blocks shall be of sufficient weight to overhaul the line from the highest hook position for boom or boom and jib lengths, and the number of parts of line in use. Ball assemblies and load blocks shall be labeled with their rated capacity and weight. Hooks attached to the boom shall be labeled with their rated capacity. Hooks shall be equipped with latches unless the application makes the use of a latch impractical. When provided, the latch shall bridge the throat opening of the hook for the purpose of retaining slings, or other lifting devices, under slack conditions (see ASME B30.10).

SECTION 22-1.6: CONTROLS

22-1.6.1 General

(a) Controls used during the crane operating cycle shall be located within reach of the operator while at the operator's station and labeled as to their designated function and direction of movement.

(b) Controls for "swing," "inner boom," "outer boom," "jib boom," "boom extensions," and "optional hydraulic equipment," shall be provided with means for holding in neutral position without the use of positive latches.

(c) Each control station, including remote control stations, shall be equipped with an "emergency stop" system, located at the operator's control station.

22-1.6.2 Control Forces and Movements

(a) Forces shall not be greater than 35 lb (156 N) on hand levers and not greater than 50 lb (222 N) on foot pedals.

(b) Travel distance on hand levers shall not be greater than 14 in. (356 mm) from neutral position on two-way levers, and not greater than 24 in. (610 mm) on one-way levers. Travel distance on foot pedals shall not be greater than 10 in. (254 mm).

22-1.6.3 Wireless (Radio) Remote Controls

(a) If interference or loss of the transmission of the wireless (radio) signal occurs, all movements shall stop and the remote control system shall be designed such that restarting is required before any movement resumes.

(b) When a wireless system is initially activated and a crane function control is selected, that function shall not activate.

(c) The crane's manual controls shall be inoperative when the remote controls are in use.

(d) The wireless remote shall be designed so that only one controller can operate the crane.

SECTION 22-1.7: INSTALLATION

The crane manufacturer shall provide installation instructions, including the following:

(a) minimum frame strength [resistance to bending moment (RBM)] requirements for commercial truck mounting, or dynamic gross reactions (vertical force, torque, and moment) acting through the crane base for other mountings

(b) information about subframe types and design for commercial truck mountings, where applicable

(c) mounting bolt pattern, fastener types, and tightening torque sequence and values for vehicle mounting, and where different, for stationary mounting

(d) detailed load test and stability test procedures

(e) instructions for creating or obtaining custom load rating charts reflecting stability test results

(f) a predelivery inspection checklist

Installers shall follow all manufacturer's installation instructions. Where applicable installation instructions are no longer available from the crane manufacturer, a qualified person may provide instructions for the installation.

22-1.7.1 Testing

The installer shall perform tests on each crane installed in accordance with Section 22-2.2.

22-1.7.2 Exhaust Gases

Engine exhaust gases shall be piped and discharged in a direction away from the operator. All exhaust pipes shall be guarded or insulated to prevent contact by personnel when performing normal duties.

SECTION 22-1.8: CONSTRUCTION

22-1.8.1 Welding

All welding and welding operator qualifications for load sustaining members shall be in accordance with ANSI/AWS D14.3. Where special steels or other materials are used, the manufacturer shall provide welding procedures.

22-1.8.2 Operational Aids

The crane and/or device manufacturer's instructions shall describe the purpose of the device. The crane and/ or device manufacturer shall provide recommendations for continued operation or shutdown of the crane if operational aids are inoperative or malfunctioning. Without such recommendations and any prohibitions from the manufacturer against further operation, the requirements of para. 22-3.2.2(b) shall apply.

22-1.8.2.1 Two-Block Damage Prevention System or Anti-Two-Block Device. See para. 22-1.2.3(c).

22-1.8.2.2 Overload Protection Systems and Rated Capacity Limiters. An overload protection system or rated capacity limiter shall be provided.

22-1.8.2.3 Crane Level Indicator. Means shall be provided for the operator to visually determine the levelness of the crane required by the manufacturer.

22-1.8.3 Hydraulic and Pneumatic Line Protection

(a) Exposed lines subject to damage shall be protected insofar as it is practical.

(b) Hoses that contain fluid over 725 psi (5 MPa) or 122°F (50°C) and are within 3 ft (1 m) of a fixed control station shall be guarded to protect the operator.

22-1.8.4 Lubricating Points

Lubricating points should be accessible without the necessity of removing guards or other parts.

22-1.8.5 Stabilizers

(a) Means shall be provided to hold all stabilizers in the retracted position while in transit, and in the extended position for crane operation.

(b) Each power operated stabilizer shall be visible from an actuating location, unless the operator is assisted by a signalperson.

(c) Cylinders for vertical stabilization of the machine shall be equipped with an integrally mounted holding device (such as a pilot-operated check valve) to prevent loss of support under load in the event of a hydraulic system failure (e.g., supply hose rupture).

(d) Partially extended stabilizers — beams (if permitted), stabilizer beam position.

(1) A device or system shall be provided that accurately locates the stabilizer beam to coincide with the partially extended stabilizer position(s) on the load rating chart.

(2) Visible indication of the manufacturer's specified stabilizer positions shall be provided by means such as stripes painted on the stabilizers, decals, or an electronic display.

22-1.8.6 Design Requirements

Prototype models of production articulating boom cranes shall meet applicable requirements of SAE J1063. On special design booms (not production models) or other special lift conditions, calculations to a standard, by a qualified person, or by the crane manufacturer, are acceptable.

22-1.8.7 Miscellaneous Equipment (23)

(a) Means shall be provided for checking the manufacturer's specified pressure settings in each hydraulic circuit.

(b) Means shall be provided to hold the vehicle stationary while operating the crane.

(c) Handholds and steps shall be provided to an elevated operator station or cab, if equipped, and to elevated crane maintenance panels/doors and service points, in accordance with SAE J2703. Principal walking surfaces to elevated operator's stations, cabs, or maintenance and service points shall be of a skid-resistant type.

(d) If daily service or maintenance work must be performed from an elevated position, a platform or work positioning anchorages shall be provided.

(e) Platforms, if furnished, should comply with SAE J2703.

(f) Durable signs shall be installed at the fixed operator's station and on the outside of the crane, warning that electrocution or serious bodily injury may occur unless minimum clearances, as specified in Table 22-3.4.1-1, are maintained between the crane or the load being handled and energized power lines. On wired and wireless remote operated cranes, the warning sign shall be on the crane at ground level.

22-1.8.7.1 Cabs

(a) Cabs, if furnished, shall be constructed to protect the operator's station from the weather.

(b) All cab glazing shall be safety glazing material as defined in SAE Z26.1. Windows shall be provided in the front and on both sides of the cab with visibility forward and to either side. Visibility shall include a vertical range adequate to cover the boom point at all times. The front window may have a section that can be readily removed or held open, if desired. If the section is of the type held in the open position, it shall be secured to prevent inadvertent closure. A windshield wiper should be provided on the front window.

(c) All cab doors, whether of the sliding or swinging type, shall be restrained from inadvertent opening or closing while traveling or operating the machine. The door adjacent to the operator, if of the swinging type, should open outward and, if of the sliding type, should slide rearward to open.

(d) A clear passageway shall be provided from the operator's station to an exit door on the operator's side.

(e) A seat belt shall be provided in all single-control station, wheel-mounted cranes for use during transit and travel.

22-1.8.8 Replacement Parts

Replacement parts shall be manufactured by using at least the same design factors of the parts they are intended to replace.

SECTION 22-1.9: OPERATING MANUAL

The manufacturer shall furnish a crane operating and maintenance manual(s) with the crane. The manual(s) shall include operational safety guidance for the unit, crane operation instructions, crane specifications, and recommended service/maintenance information for the assembled unit.

Chapter 22-2
Inspection, Testing, and Maintenance

(23)

SECTION 22-2.1: INSPECTION

22-2.1.1 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.

22-2.1.2 Inspection Classification

(a) Initial Inspection. Prior to initial use, all new and altered cranes shall be inspected to verify compliance with the provisions of this Volume.

(b) Regular Inspection. Inspection procedure for cranes in regular service is divided into two general classifications based on the intervals at which inspection should be performed. The intervals depend on the nature of the critical components of the crane 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.

(1) Frequent Inspection. Daily to monthly intervals.

(2) Periodic Inspection. One- to 12-month intervals, or as specifically recommended by the manufacturer or a qualified person.

22-2.1.3 Frequent Inspection

Items such as the following shall be inspected for defects at intervals as defined in para. 22-2.1.2(b)(1) or as specifically indicated by the manufacturer, including observation during operation for any deficiencies that might appear between regular inspections:

(a) all control mechanisms for maladjustment interfering with proper operation; daily, when used

(b) all control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter

(c) operational aids for malfunction

(d) all hydraulic hoses, particularly those that flex in normal operation of crane functions, should be visually inspected once every working day, when used

(e) hooks and latches for deformation, chemical damage, cracks, and wear (see ASME B30.10)

(f) rope reeving for compliance with crane manufacturer's specifications

(g) electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation

(h) hydraulic system for proper oil level and leaks; daily, when used

(i) tires for cuts and recommended inflation pressure

(j) wheels for loose nuts

(k) connecting pins and locking devices for wear and damage

(l) structural members for damage or deformation

22-2.1.4 Periodic Inspection

Complete inspections of the crane shall be performed at intervals as generally defined in para. 22-2.1.2(b)(2), depending on the crane's activity, severity of service, and environment, or as specifically indicated below. Dated records for periodic inspections shall be maintained.

These inspections shall include the requirements of para. 22-2.1.3 and items such as the following:

(a) deformed, cracked, or corroded members in the crane structure and entire boom.

(b) loose bolts or rivets.

(c) cracked or worn sheaves and drums.

(d) worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, and locking devices.

(e) excessive wear on brake and clutch system parts, linings, pawls, and ratchets.

(f) any significant inaccuracies of operational aids (see para. 22-2.1.5).

(g) lack of performance and compliance with safety requirements of gasoline, diesel electric, or other power plants.

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

(i) cracked crane hooks.

(j) malfunctioning travel steering, braking, and locking devices.

(k) excessively worn or damaged tires.

(l) hydraulic and pneumatic hose, fittings, and tubing

(1) evidence of leakage at the surface of the flexible hose or its junction with the metal end couplings.

(2) blistering or abnormal deformation of the outer covering of the hydraulic or pneumatic hose.

(3) leakage at threaded or clamped joints that cannot be eliminated by normal tightening or recommended procedures.

(4) evidence of excessive abrasion or scrubbing on the outer surface of a hose, rigid tube, or fitting. Means shall be taken to eliminate the interference of elements in contact or otherwise protect the components.

(m) hydraulic and pneumatic pumps and motors
- (1) loose bolts or fasteners
- (2) leaks at joints between sections
- (3) shaft seal leaks
- (4) unusual noises or vibration
- (5) loss of operating speed
- (6) excessive heating of the fluid
- (7) loss of pressure

(n) hydraulic and pneumatic valves
- (1) cracks in valve housing
- (2) improper return of spool to neutral position
- (3) leaks at spools or joints
- (4) sticking spools
- (5) failure of relief valves to attain correct pressure setting
- (6) relief valve pressures as specified by the manufacturer

(o) hydraulic and pneumatic cylinders
- (1) drifting caused by fluid leaking across the piston
- (2) rod seals leakage
- (3) leaks at welded joints
- (4) scored, nicked, or dented cylinder rods
- (5) dented case (barrel)
- (6) loose or deformed rod eyes or connecting joints

(p) hydraulic filters, evidence of rubber particles on the filter element, which may indicate hose, "O" ring, or other rubber component deterioration. Metal chips or pieces on the filter may denote failure in pumps, motors, or cylinders. Further checking will be necessary to determine the origin of the problem before corrective action can be taken.

(q) labels are in place and legible.

22-2.1.5 Operational Aids

(a) Prior to daily operation, operational aids shall be inspected in accordance with the device/crane manufacturer's recommended procedures to determine if they are functioning properly.

(b) Operational aids shall be inspected and tested in accordance with the device/crane manufacturer's recommended procedures as part of the periodic inspection of para. 22-2.1.4.

(c) When operational aids are inoperative or malfunctioning, the crane and/or device, manufacturer's recommendations for continued operation or shutdown of the crane shall be followed until the problems are corrected [refer to para. 22-3.2.2(b)]. Without such recommendations and any prohibitions from the manufacturer against further operation, the requirements of para. 22-3.2.2(b) shall apply.

22-2.1.6 Cranes Not in Regular Use

(a) A crane that has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with the requirements of paras. 22-2.1.3 and 22-2.4.2(a) before being placed in service.

(b) A crane that has been idle for a period of over 6 months shall be given a complete inspection conforming with the requirements of paras. 22-2.1.3, 22-2.1.4, and 22-2.4.2 before being placed in service.

SECTION 22-2.2: TESTING

The following required tests should be conducted in the prescribed order as listed below: operational, load, and stability.

22-2.2.1 Operational Tests

(a) Prior to initial use, all new and reinstalled cranes shall be tested by a designated person to verify compliance with the operational requirements of this section, including functions such as the following:
- (1) load lifting and lowering mechanisms
- (2) boom lifting and lowering mechanisms
- (3) boom extension and retraction mechanism
- (4) swinging mechanism
- (5) travel mechanism
- (6) operational aids

(b) When the complete crane is not supplied by one manufacturer, such tests shall be conducted at final assembly.

(c) Operational test results shall be made available.

22-2.2.2 Load Test

(a) Prior to initial use, all new and reinstalled cranes shall be inspected and load tested by or under the direction of a qualified person. A written test report shall be prepared and placed on file. Test loads shall be as recommended by the crane manufacturer and shall not be less than 100% or more than 110% of rated load at a horizontal reach that is recommended by the manufacturer or a qualified person and produce the maximum bending moment through the crane base. Tests shall be conducted to the extent necessary to ensure compliance with the crane's maximum load ratings, including systems such as the following:
- (1) boom(s) — elevating and lowering
- (2) boom(s) — extending
- (3) swing (slewing)
- (4) operational aids
- (5) optional attachments

(b) The load tests shall consist of the following operations as a minimum requirement:

(1) Lift the test load to ensure that the load is supported by the crane.

(2) Swing the crane the full range of its swing.

(3) Articulate/extend the crane within the allowable working radius for the test load.

(4) For cranes equipped with a winch, hoist and lower the maximum load for the winch and ensure the load is held with the brake.

(c) The need for load testing of repaired, altered, or modified cranes shall be determined by a qualified person. When a load test is required, testing shall be in accordance with (b)(1) through (b)(4), as necessary, depending on the extent of the repair or alteration.

22-2.2.3 Stability Test

(a) Prior to use, all new and reinstalled vehicle-mounted cranes shall be stability tested by or under the direction of a qualified person. The test shall be conducted with the completed, unloaded vehicle on a firm, level surface. Tests shall be conducted in accordance with SAE J765. A written test report shall be prepared and kept on file. Test loads shall correspond with the inverse of the maximum load ratings percentage listed in para. 22-1.1.1 at the maximum horizontal reach and in the least stable direction(s) relative to the mounting.

(b) Operational aids that function to restrict the capacity of the crane may be temporarily overridden during the performance of the stability test, if required to handle the test load.

(c) The need for stability testing of a repaired, altered, or modified vehicle-mounted crane shall be determined by a qualified person. When a stability test is required, testing shall be in accordance with (a) and (b), as necessary, depending on the extent of the repair or alteration.

SECTION 22-2.3: MAINTENANCE

22-2.3.1 Preventive Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the crane manufacturer's manual. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the crane application and operations. Dated records should be placed on file.

(b) It is recommended that replacement parts be obtained from the original equipment manufacturer or be of equal quality.

22-2.3.2 Maintenance Procedure

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

(1) Place crane where it will cause the least interference with other equipment or operations in the area.

(2) Set all controls in the "OFF" position and ensure all operating features are secured from inadvertent motion.

(3) Render starting means inoperative.

(4) Stop power plant or disconnect at power takeoff.

(5) Lower the boom to the ground, if possible, or otherwise secure against dropping.

(6) Lower the lower load block to the ground or otherwise secure against dropping.

(7) Relieve hydraulic oil pressure from all hydraulic circuits before loosening or removing hydraulic components.

(b) "Warning" or "Out of Order" signs shall be placed on the crane controls. Signs shall be removed only by authorized personnel.

(c) After adjustments and repairs have been made, the crane shall not be returned to service until all guards have been reinstalled, trapped air removed from the hydraulic system, and maintenance equipment removed.

22-2.3.3 Adjustments, Alterations, and Repairs

(a) Any hazardous conditions disclosed by the inspection requirements of Section 22-2.1 shall be corrected before operation of the crane is resumed. Adjustments, alterations, and repairs shall be done only by designated personnel.

(b) Adjustments shall be made within the manufacturer's specified tolerances to maintain correct functioning of components. The following are examples of components that may need adjustment:

(1) functional operating mechanisms

(2) operational aids

(3) pneumatic, electronic, hydraulic, and mechanical control systems

(4) power plants

(5) braking systems

(c) Repairs or replacements shall be provided as needed for operation. The following are examples:

(1) critical parts of functional operating mechanisms that are cracked, broken, corroded, bent, or excessively worn.

(2) critical parts of the crane structure that are cracked, bent, broken, or excessively corroded.

(3) damaged or worn hooks as described under "Maintenance" in ASME B30.10. Repairs by welding or reshaping are not recommended.

(d) Repairs shall be made according to the manufacturer's instructions if instructions are available. Absent instructions from the manufacturer, repairs shall be made according to the directions of a qualified person.

(e) Repairs shall return the crane to a condition of structural, mechanical, and functional integrity to permit operation of the crane in accordance with the manufacturer's published performance specifications.

(f) Alterations shall only be performed according to instructions from the manufacturer. Absent instructions from the manufacturer, a qualified person may provide instructions for the alteration.

(g) Instructions shall be provided by the manufacturer for the removal of air from hydraulic circuits.

22-2.3.4 Lubrication

(a) All moving parts of the crane for which lubrication is specified should be regularly lubricated. Lubricating systems should be checked for proper delivery of lubricant. Care should be taken to follow the manufacturer's recommendations as to the points and frequency of lubrication, maintenance of lubricant levels, and types of lubricant to be used.

(b) Machinery shall be stationary while lubricants are being applied and protection provided as called for in paras. 22-2.3.2(a)(2) through 22-2.3.2(a)(5), unless equipped for automatic or remote lubrication.

22-2.3.5 Ropes

Rope inspection, replacement, and maintenance shall be in accordance with ASME B30.30.

Chapter 22-3
Operation

SECTION 22-3.1: QUALIFICATIONS AND RESPONSIBILITIES

22-3.1.1 Operators

Cranes shall be operated only by the following personnel:

(a) those who have met the requirements of paras. 22-3.1.2(a) through 22-3.1.2(c) and 22-3.1.2(f).

(b) those who have met the requirements of para. 22-3.1.2(d) and who are training for the type of crane being operated. While operating the crane, the trainee must be under the supervision of a designated person. The number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person.

(c) maintenance personnel who have completed all operator trainee qualification requirements. Operation by these persons shall be limited to those crane functions necessary to perform maintenance on the crane or to verify the performance of the crane after maintenance has been performed.

(d) inspectors who have completed all operator trainee qualification requirements. Operation by these persons shall be limited to those crane functions necessary to accomplish the inspection.

22-3.1.2 Qualifications for Operators

(a) Operator and operator trainees shall meet the following physical qualifications unless it can be shown that failure to meet the qualifications will not affect the operation of the crane. In such cases, specialized clinical or medical judgments and tests may be required.

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

(2) ability to distinguish colors, regardless of position, if color differentiation is required.

(3) adequate hearing to meet operational demands, with or without hearing aid.

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

(5) normal depth perception, field of vision, reaction time, manual dexterity, coordination, and no tendencies to dizziness or similar undesirable characteristics.

(6) a negative result for a substance abuse test. The level of testing will be determined by the standard practice for the industry where the crane is employed and this test shall be confirmed by a recognized laboratory service.

(7) no evidence of having physical defects or emotional instability that could render a hazard to the operator or others, or that in the opinion of the examiner could interfere with the operator's performance. If evidence of this nature is found, it may be sufficient cause for disqualification.

(8) no evidence of being subject to seizures or loss of physical control; such evidence shall be sufficient reason for disqualification. Specialized medical tests may be required to determine these conditions.

(b) Operator requirements shall include, but not be limited to, the following:

(1) evidence of successfully passing a physical examination as defined in (a).

(2) satisfactory completion of a written examination covering operational characteristics, controls, and emergency control skills, such as response to fire, power line contact, loss of stability, or control malfunction, as well as characteristic and performance questions appropriate to the crane type for which qualification is being sought.

(3) demonstrated ability to read, write, comprehend, and use arithmetic and a load rating chart, in the language of the crane manufacturer's operation and maintenance instruction materials.

(4) satisfactory completion of a combination written and verbal test on load rating chart usage that covers a selection of the configurations (the crane may be equipped to handle) for the crane type for which qualification is being sought.

(5) satisfactory completion of an operation test demonstrating proficiency in performing lifting, lowering, booming, telescoping, and swinging functions at various radii as well as shutdown. Testing shall also include proficiency in prestart and poststart inspection, securing procedures, and traveling by appropriate written, oral, or practical methods.

(6) demonstrated understanding of the applicable sections of the B30 Standard and federal, state, and local requirements.

(c) Operators who have successfully qualified for a specific crane type shall be requalified, if supervision deems it necessary. Requalification shall include, but not be limited to, the following:

(1) evidence of successfully passing a current physical examination as defined in (a)

(2) satisfactory completion of a written examination covering operational characteristics, controls, and emergency control skills, such as response to fire, power line contact, loss of stability, or control malfunction, as well as characteristic and performance stability questions appropriate to the crane type for which requalification is being sought

(3) demonstrated ability to read, write, comprehend, and use arithmetic and a load rating chart, in the language of the crane manufacturer's operation and maintenance instruction materials

(4) satisfactory completion of a combination written and verbal test on load rating chart usage that covers a selection of the configurations (the crane may be equipped to handle) for the crane type for which requalification is being sought

(5) satisfactory completion of an operation test demonstrating proficiency in handling the specific crane type for which requalification is being sought, including both prestart and poststart inspections, maneuvering skills, shutdown, and securing procedures

(6) demonstrated understanding of the applicable sections of the B30 Standard and federal, state, and local safety requirements

(d) Trainee qualification requirements shall include, but not be limited to, the following:

(1) evidence of successfully passing a current physical examination as defined in (a)

(2) satisfactory completion of a written examination covering safety, operational characteristics and limitations, and controls of the crane type for which qualification is being sought

(3) demonstrated ability to read, write, comprehend, and use arithmetic and a load rating chart, in the language of the crane manufacturer's operations and maintenance instruction materials

(4) satisfactory completion of a combination written and verbal test on load rating chart usage covering various crane configurations

(e) Trainee qualification, operator qualification, and operator requalification shall be performed by a designated person who, by experience and training, fulfills the requirements of a qualified person.

(f) Operator physical examinations, as defined in (a), shall be required every 3 yr or more frequently, if supervision deems it necessary.

22-3.1.3 Responsibilities (23)

While the organizational structure of various projects 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.)

crane operator: directly controls the crane's functions.

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

crane user: arranges the crane's presence on a work site and controls its use there.

lift director: directly oversees the work being performed by a crane and the associated rigging crew.

rigger: attaches the load to be lifted to the crane hook using slings, shackles, spreader beams, safety hoist rings, etc., and other gear as appropriate.

signalperson: delivers hand, voice, or special signals (see para. 22-3.3.6) to direct movement of the crane and/or load [see para. 22-3.1.3.3.1(q)].

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

22-3.1.3.1 Responsibilities of the Crane Owner and Crane User. In some situations the owner and the user may be the same entity and is therefore accountable for all of the following responsibilities. In other cases, the user may lease or rent a crane from the owner without supervisory, operational, maintenance, support personnel, or services from the owner. In these situations, paras. 22-3.1.3.1.1 and 22-3.1.3.1.2 shall apply.

22-3.1.3.1.1 Responsibilities of the Crane Owner. The crane owner's responsibilities shall include the following:

(a) provide a crane that meets the requirements of Chapters 22-1 and 22-2 of the applicable volume as well as specific job requirements defined by the user

(b) provide a crane and all necessary components, specified by the manufacturer, that meets the user's requested configuration and capacity

(c) provide all applicable load rating chart(s) and diagrams

(d) provide additional technical information pertaining to the crane, necessary for crane operation, when requested by the crane user

(e) provide operating and maintenance manuals, maintenance information, and warning decals and placards installed as prescribed by the crane manufacturer

(f) establish an inspection, testing, and maintenance program in accordance with Chapter 22-2 and inform the crane user of the requirements of this program

(g) use designated or qualified personnel as defined in Chapter 22-2 for the inspection, maintenance, or repair requirements outlined in this Volume

22-3.1.3.1.2 Responsibilities of the Crane User. The crane user's responsibilities shall include the following:

(a) comply with the requirements of this Volume, manufacturer's requirements, and those regulations applicable at the work site.

(b) address safety concerns raised by the operator or other personnel and being responsible if he decides to overrule those concerns and directs crane operations to continue. In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be adhered to.

(c) determine if additional regulations are applicable to crane operations.

(d) use crane operators that meet the requirements of paras. 22-3.1.1 and 22-3.1.2 and are qualified to perform the tasks that will be required with the crane which they are assigned to operate.

(e) inform the crane operator of the weight of loads to be lifted, as well as the lifting, moving, and placing locations for these loads.

(f) ensure that a crane's load rigging is performed by a designated person.

(g) appoint the signalperson(s) and convey that information to the crane operator.

(h) ensure that signalperson(s) appointed understands crane operation, limitations, and standard hand signals (see Figure 22-3.3.4-1 for hand signals).

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

(j) ensure that the operator has been informed who the designated person is for the purposes of reporting the need for any adjustments or repairs.

(k) use personnel that meet the requirements for a qualified or designated person for inspections as required in Section 22-2.1.

(l) use personnel that meet the requirements for a designated person for the purposes of maintenance and/or repair.

(m) ensure that all personnel involved in maintenance, repair, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(n) ensure that the inspection, testing, and maintenance programs specified by the crane owner are followed.

(o) ensure that the applicable requirements of para. 22-3.2.7 are met when lifting personnel.

22-3.1.3.2 Responsibilities of the Site Supervisor and Lift Director. In some situations the site supervisor and lift director may be the same person and is therefore accountable for all of the responsibilities listed in paras. 22-3.1.3.2.1 and 22-3.1.3.2.2.

22-3.1.3.2.1 Responsibilities of the Site Supervisor. The site supervisor's responsibilities shall include the following:

(a) ensure that crane operations are coordinated with other job site activities that will be affected by or will affect lift operations.

(b) ensure that the area for the crane is adequately prepared. The preparation includes, but is not limited to, the following:

(1) access roads for the crane and associated equipment

(2) an operating area that is suitable for the crane with respect to levelness, surface conditions, support capability, proximity to power lines, excavations, slopes, underground utilities, subsurface construction, and obstructions to crane operation

(3) traffic control as necessary to restrict unauthorized access to the crane's working area

(c) ensure that conditions which may adversely affect crane operations are addressed. Such conditions include, but are not limited to, the following:

(1) poor soil conditions
(2) wind velocity or gusting winds
(3) heavy rain
(4) fog
(5) extreme cold
(6) artificial lighting

(d) allow crane operation near electric power lines only when the requirements of Section 22-3.4 have been met.

22-3.1.3.2.2 Responsibilities of the Lift Director. The lift director's responsibilities shall include the following: (23)

(a) be present at the job site during lifting operations.

(b) stop crane operations if alerted to an unsafe condition affecting those operations.

(c) ensure that the preparation of the area needed to support crane operations has been completed before crane operations commence.

(d) ensure necessary traffic controls are in place to restrict unauthorized access to the crane's work area.

(e) ensure that personnel involved in crane operations understand their responsibilities, assigned duties, and the associated hazards.

(f) address safety concerns raised by any personnel and being responsible if he decides to overrule those concerns and directs crane operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be adhered to.)

(g) appoint the signalperson(s) when required for load movement and convey that information to the crew.

(h) ensure that signalperson(s) appointed meet the requirements of para. 22-3.3.3.

(i) allow crane operation near electric power lines only when the requirements of Section 22-3.4 and any additional requirements determined by the site supervisor have been met.

(j) ensure that the requirements of para. 22-3.2.7 are met when lifting personnel.

(k) inform the crane operator of the weight of loads to be lifted, as well as the lifting, moving, and placing locations for these loads.

(l) obtain the crane operator's verification that this weight does not exceed the crane's rated capacity.

(m) ensure that a crane's load rigging is performed by designated personnel.

22-3.1.3.3 Responsibilities of Crane Operators and Riggers. In some cases, the crane operator and rigger may be the same person. The operator shall be responsible for the following listed items. The operator shall not be responsible for hazards or conditions that are not under his direct control and that adversely affect the lift operations. Whenever the operator has doubt as to the safety of crane operations, the operator shall stop the crane's functions in a controlled manner. Lift operations shall resume only after safety concerns have been addressed.

(23) **22-3.1.3.3.1 Responsibilities of the Crane Operator.** The crane operator's responsibilities shall include the following:

(a) not operate the crane when physically or mentally unfit.

(b) know what types of site conditions could adversely affect the operation of the crane and determine the possible presence of those conditions.

(c) know and follow the procedures specified by the manufacturer or approved by a qualified person for setting up and reeving the crane.

(d) understand and apply the information contained in the crane manufacturer's operating manual.

(e) ensure that all controls are in the "OFF" or neutral position and that all personnel are in the clear before energizing the crane or starting the engine.

(f) perform daily inspection as specified in paras. 22-2.1.2 and 22-2.4.2.

(g) promptly report the need for any adjustments or repairs to a designated person.

(h) follow applicable lock out/tag out procedures.

(i) observe each stabilizer during extension, setting, and retraction, or use a signalperson to observe each stabilizer during extension, setting, or retraction.

(j) understand and avoid all boom and load crush zones and pinch-points.

(k) understand the crane's functions and limitations as well as its particular operating characteristics.

(l) test the crane function controls that will be used to operate the crane and validate that those function controls respond properly.

(m) not engage in any practice that will divert their attention while actually operating the crane controls.

(n) use the crane's load rating chart(s) and diagrams and apply all notes and warnings related to the charts, to confirm the correct crane configuration to suit the load, site, and lift conditions.

(o) calculate or determine the net capacity for all configurations that will be used, and verify, using the load rating chart(s), that the crane has sufficient net capacity for the proposed lift.

(p) consider all factors known that might affect the crane capacity and inform the crane user of the need to make appropriate adjustments.

(q) know the standard hand signals as specified in para. 22-3.3.4 and respond to such signals from the signalperson. When a signalperson is not required as part of the lift operation, the operator is then responsible for the movement of the crane. However, the operator shall obey a stop signal at all times, no matter who gives it.

(r) understand basic load-rigging procedures.

(s) ensure that the load and rigging weight(s) have been provided.

(t) operate the crane's functions, under normal operating conditions, in a smooth and controlled manner.

(u) stop crane operations if alerted to any unsafe condition affecting crane operations.

(v) before leaving the controls unattended

(1) land the load under control, if practical

(2) put the controls in the "OFF" or neutral position

(w) before leaving the crane unattended

(1) land the load under control

(2) put the controls in the "OFF" or neutral position

(3) set the transport, swing brakes, and locking devices, if equipped

(4) stop the engine or disengage power to the crane

(x) operate the crane near electric power lines only when the requirements of Section 22-3.4 and any additional requirements determined by the site supervisor have been met.

(y) refuse to operate the crane when any portion of the load or crane would enter the "prohibited zone" of energized power lines unless the site supervisor has determined that the requirements of para. 22-3.4.4 have been met.

(z) if power fails during operations

(1) land any load under control, if practical

(2) set all brakes and locking devices

(3) move all power controls to the "OFF" or neutral position

22-3.1.3.3.2 Rigger's Responsibilities. Riggers assigned to a load-handling activity shall at a minimum be responsible for

(a) ensuring the weight of the load and its approximate center of gravity have been obtained, provided, or calculated