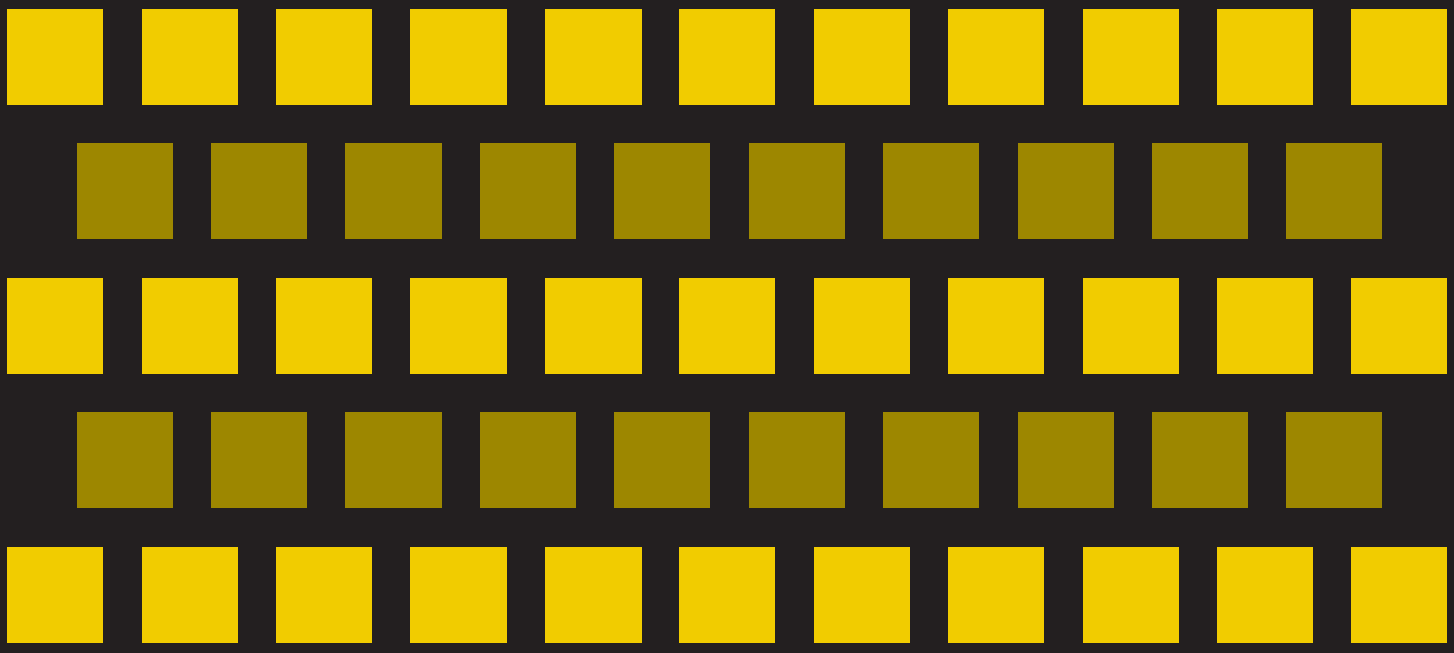
STP-SA-055

GUIDE TO MOBILE CRANE STANDARDS



ASME STANDARDS TECHNOLOGY, LLC

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GUIDE TO MOBILE CRANE STANDARDS

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FOREWORD

Numerous standards applicable to the design and manufacturing of mobile cranes exist in the United States. Heretofore there have been no published guidance criteria to assist the prospective manufacturer, owner or user of mobile cranes in determining which standards should be invoked for a particular application or facility. ASME Standards Technology, LLC (ASME ST-LLC) produced this guide to mobile crane standards to provide some guidance.

"Guide to Mobile Crane Standards" considers the equipment covered by the following ASME B30 Volumes: B30.5 Mobile and Locomotive Cranes, B30.8 Floating Cranes and Floating Derricks), B30.14 Side Boom Tractors, B30.22 Articulating Boom Cranes, B30.25 Scrap and Material Handlers, B30.29 Self-Erect Tower Cranes, and related equipment. This guide will provide a starting point for the listing of the relevant standards, codes, regulations and guidelines impacting the construction, characteristics, design, inspection, testing, maintenance, operation and safe use of mobile cranes. It will focus on North America but will be global in its scope including the listing of ISO and significant international standards addressing mobile cranes. The prospective owner and user of cranes must comply with all federal, state and local requirements including but not limited to the ones listed in this document.

Established in 1880, the American Society of Mechanical Engineers (ASME) is a professional not-for-profit organization with more than 127,000 members promoting the art, science and practice of mechanical and multidisciplinary engineering and allied sciences. ASME develops codes and standards that enhance public safety, and provides lifelong learning and technical exchange opportunities benefiting the engineering and technology community. ANSI does not itself write standards, but does certify Standards Developing Organizations that meet the due process requirements of the American National Standards Institute (ANSI). Standards that are developed under an accredited program may be designated as American National Standards. Visit www.asme.org for more information.

The ASME Standards Technology, LLC (ASME ST-LLC) is a not-for-profit Limited Liability Company, with ASME as the sole member, formed in 2004 to carry out work related to newly commercialized technology. The ASME ST-LLC mission includes meeting the needs of industry and government by providing new standards-related products and services, which advance the application of emerging and newly commercialized science and technology and providing the research and technology development needed to establish and maintain the technical relevance of codes and standards. Visit www.stllc.asme.org for more information.

ABSTRACT

The purpose of this publication is to provide guidance the users, manufacturers and specifiers of mobile cranes by identifying relevant documents/standards that may be applicable to mobile cranes. This publication identifies U.S. federal, state and local laws, national and industry consensus standards, international standards and other documents written specifically for mobile cranes, or having provisions specific to mobile cranes. Some of the national or industry consensus standards are applicable to nearly all mobile crane applications and are typically invoked by owner specifications. Others apply to unique crane applications and are not necessarily appropriate for commercial or standard industrial cranes.

1 INTRODUCTION

The purpose of this report is to provide guidance to the users, manufacturers and specifiers of mobile cranes by identifying relevant documents/standards that may be applicable to its use. This report identifies U.S. federal, state and local laws, national and industry consensus standards, international standards and other documents written specifically for mobile cranes, or having provisions specific to mobile cranes. Some of the national or industry consensus standards are applicable to nearly all mobile crane applications and are typically invoked by owner specifications. Others apply to unique crane applications and are not necessarily appropriate for commercial or standard industrial cranes.

It is common for one standard to list many others as references, and to invoke specific provisions of the referenced standards. This document does not attempt to cover every standard which may have some application to cranes, or which may become part of a "chain" of references. The intent is to cover the primary crane standards and selected additional standards in an attempt to be helpful to the user and provide a guide for thinking about what types of standards or laws may apply to the manufacture or use of a load handling equipment.

The guidance in this document includes summaries of the provisions of each standard, and when appropriate, recommendations as to when it should be invoked. Note, however, that the determination of standards, codes, regulations and laws applicable to a project and the load handling equipment used is the responsibility of the load handling equipment user.

2 U. S. FEDERAL GOVERNMENT DOCUMENTS

2.1 Occupational Safety and Health Act (OSHA)

Occupational Safety and Health Act of 1970, Public Law 91-596, 29 CFR, Labor, is the section of U.S. federal law commonly known as OSHA (Occupational Safety and Health Act). Mobile Crane Regulations and Standards adopted by OSHA include:

- Code of Federal Regulation, General Industry Standards, Title 29, Part 1910
- Code of Federal Regulations, Construction Standards, Title 29, Part 1926

There are 25 states, plus the territories of Puerto Rico and the U.S. Virgin Islands that operate their own safety and health programs for private or public sector workers and most of them have adopted Federal OSHA's standards. Some have developed their own regulations concerning specific hazards in certain industries.

Additionally, the General Duty Clause of the United States Occupational Safety and Health Act states:

> 29 U.S.C. 654, 5(a)1: each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees. Each employee shall comply with occupational safety and health standards and all rules, regulations and orders issued pursuant to this Act, which are applicable to his own actions and conduct.

2.1.1 OSHA 29 CFR Part 1910.180 Crawler and Locomotive Truck Cranes in General Industry [1]

29 CFR, Part 1910.180 is the section of the regulation dealing with crawler, locomotive, wheel mounted cranes of both self-propelled and truck wheel type, and any other variations that retain the same fundamental characteristics. Its main intent is to ensure the safety of persons operating or maintaining the equipment or having reason to be on or near it.

2.1.2 OSHA 29 CFR Part 1926.1400 Subpart CC – Cranes and Derricks in Construction [2]

29 CFR, Part 1926.1400 Subpart CC is the section of the regulation that applies to power-operated equipment, when used in construction that can hoist, lower and horizontally move a suspended load. It applies to: articulating cranes (knuckle-boom cranes); crawler cranes; floating cranes; cranes on barges; locomotive cranes; mobile cranes (e.g., wheel-mounted, all-terrain, rough terrain, commercial truck-mounted, and boom truck cranes); multi-purpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load; industrial cranes (e.g. carry-deck cranes); dedicated pile drivers; service/mechanic trucks with a hoisting device; a crane on a monorail; tower cranes (such as a fixed jib, i.e., "hammerhead boom"), luffing boom and self-erecting; pedestal cranes; portal cranes; overhead and gantry cranes; straddle cranes; sideboom cranes; derricks; and variations of such equipment.

2.1.3 OSHA 29 CFR Part 1915 – Shipyard Employment - Subpart G - Gear and Equipment for Rigging and Materials Handling [3]

29 CFR, Part 1915 is the section of the regulation that, except where otherwise provided, applies to all ship repairing, shipbuilding and shipbreaking employments and related employments.

2.1.4 OSHA 29 CFR Part 1915 – Shipyard Employment – Part 1915.136 – Internal combustion engines, other than ship's equipment [4]

29 CFR, Part 1915 is the section of the regulation that, except where otherwise provided, applies to all ship repairing, shipbuilding and shipbreaking employments and related employments. Part 1915.136 is the section of the regulation that applies to the internal combustion engines other than the ship's equipment such as forklifts and mobile cranes.

2.1.5 OSHA 29 CFR Part 1917 - Maritime Terminals – Subpart C – Cargo Handling Gear and Equipment [5]

The regulations of this part apply to employment within a marine terminal as defined in 1917.2, including the loading, unloading, movement or other handling of cargo, ship's stores or gear within the terminal or into or out of any land carrier, holding or consolidation area, any other activity within and associated with the overall operation and functions of the terminal. All cargo transfer accomplished with the use of shore based material handling devices shall be regulated by this part.

2.1.6 OSHA 29 CFR Part 1918 – Safety and Health Regulations for Longshoring - Subpart G – Cargo Handling Gear and Equipment Other Than Ship's Gear [6]

The regulations of part 1918 apply to longshoring operations and related employments aboard vessels. All cargo transfer accomplished with the use of shore-based material handling devices is covered by part 1917 of this chapter.

2.2 Safety and Health Requirements Manual, EM 385-1-1, U.S. Army Corps of Engineers, (USACOE) Department of the Army [7]

The purpose of this manual is to prescribe the safety and health requirements for all Corps of Engineers activities and operations and is applicable to Headquarters, USACOE elements, major subordinate commands, districts, centers, laboratories, and field operating activities, as well as USACOE and Naval Facilities (NAVFAC) Engineering Command contracts. Applicability also extends to occupational exposure for missions under the command of the Chief of Engineers, whether accomplished by military, civilian, or contractor personnel.

2.3 Management of Weight Handling Equipment, NAVFAC P-307 [8]

This publication provides requirements for the maintenance, inspection, test, certification, repair, alteration, operation, and/or use of weight handling equipment (WHE) owned by the Navy and/or under the technical cognizance of the NAVFAC Engineering Command. Activities covered include Navy shore activities, the Naval Construction Force (NCF), Naval Special Operating Units (SOU), and the Naval Construction Training Center (NCTC). Also included are Navy fleet activities and detachments that operate shore based WHE. These minimum requirements meet or exceed all applicable OSHA requirements for maintenance, inspection, testing, certification, repair, alteration, and the operation of equipment.

2.4 Department of Energy (DOE) Hoisting and Rigging Standard, DOE-STD-1090-2011, Section 8, Mobile Cranes [9]

This chapter specifies operation, inspection, maintenance, and testing requirements for the use of mobile cranes and implements the requirements of ASME B30.5. The DOE Hoisting and Rigging Standard is intended to be used by supervisors, line managers, safety personnel, equipment operators, riggers and other personnel responsible for the safety of hoisting and rigging operations at DOE sites. It may be used as either contract document or as a best practice at the discretion of the site or program office.

3 STATE AND LOCAL LAW

3.1 State Laws

Twenty-two states or territories currently operate their own OSHA-approved state plans (covering private and public sector employees), and four additional states and one territory (Connecticut, Illinois, New Jersey, New York and the Virgin Islands) operate plans that cover public sector employees only. The OSHA-approved state-run safety and health plans must be "at least as effective as" the Federal OSHA program. Most state plans adopt standards identical to federal standards. However, state plans have the option of promulgating more stringent standards or standards covering hazards not addressed by Federal OSHA standards.

The following lists the 27 states or territories have approved state plans as noted above:

Alaska	Iowa	New Mexico	Vermont
Arizona	Kentucky	New York	Virginia
California	Maryland	North Carolina	Washington
Connecticut	Michigan	Oregon	Wyoming
Hawaii	Minnesota	South Carolina	Puerto Rico
Illinois	Nevada	Tennessee	Virgin Islands
Indiana	New Jersey	Utah	

More information can be found on the federal OSHA website: http://www.osha.gov/cranes-derricks/index.html.

The following list represents a sample set of state-level codes/authorities, for which requirements are applied *in addition* to the federal OSHA requirements:

- California: California OSHA Crane Unit
- Connecticut: Examining Board for Crane Operators
- Hawaii: Hoisting Machine Operators Advisory Board
- Maryland: Maryland's Crane Safety Regulations
- Massachusetts: Hoisting Operator Licensing Department of Public Safety
- Montana: Montana Crane & Hoist Operator Program Department of Public Safety
- Nevada: Nevada Administrative Code
- New Jersey: Crane Operators License Advisory Board
- New Mexico: Regulation and Licensing Department Hoisting Program
- New York: Department of Labor License & Certification Unit
- Pennsylvania: State Board of Crane
- Rhode Island: Department of Labor and Training
- Utah: Division of Occupational and Professional Licensing
- Washington State: Washington State Department of Labor and Industry
- West Virginia: West Virginia Division of Labor

3.2 Local Laws

There may additional local, state and city laws that apply the operation and safe use of mobile cranes. The following are examples of cities that have additional requirements, which are to be applied *in addition* to Federal OSHA regulations:

- Chicago (Bureau of Licensing & Registration Crane Operator Licensing Exam)
- Los Angeles
- New Orleans
- Omaha
- Philadelphia
- Washington DC (Board of Examiners of Steam and Other Operating Engineers)
- New York City (NYC Building Department Codes)

  There are local laws such as New York City Local Law 73 and the amendment to the New York City Building Code Reference Standard RS 19-2 relating to power operated cranes and derricks. Additionally, there are four sections of New York City regulations that apply to mobile cranes:

  - 28-405, Hoisting Machine Operator License
  - Rule 104-09, Hoisting Machine Operator Licensing and Registration Requirements
  - Section 3319, Cranes and Derricks
  - Reference Standard (RS) 19-2

4 INDUSTRY AND NATIONAL CONSENSUS STANDARDS

4.1 American National Standards

The American National Standards Institute (ANSI) provides all interested U.S. parties with a neutral venue to come together and work towards common agreements. ANSI does not itself write standards, but does certify Standards Developing Organizations that meet the due process requirements of the ANSI. Standards that are developed under an accredited program may be designated as an American National Standard.

4.1.1 A1264.1-2007 Safety Requirements for Workplace Walking/Working Surfaces and Their Access: Workplace, Floor, Wall, Roof Openings; Stairs and Guardrail Systems [10]

This standard sets forth safety requirements in industrial and workplace situations for protecting persons in areas/places where danger exists of persons or object falling through floor, roof or wall openings, or from platforms, runways, ramps, and fixed stairs, or roof edges in normal, temporary, and emergency conditions. It does not apply to construction work covered by American National Standard Safety Requirements for Construction, A10 Series, or to private residences.

4.1.2 ANSI A14.3 Safety Requirements for Fixed Ladder [11]

This standard prescribes minimum requirements for the design, construction, and use of fixed ladders, and sets forth requirements for cages, wells, and ladder safety systems used with fixed ladders, in order to minimize personal injuries.

4.1.3 ANSI B15.1 Safety Standard for Mechanical Power Transmission Apparatus [12]

The requirements of this standard apply to any source of hazard to people from the operation of mechanical power transmission apparatus on machines, equipment, or systems that are stationary in their use, other than the point of operation. This standard applies to the sources of mechanical power, and also to pulleys, gears, and other mechanical components used to transmit power to the point of operation.

4.1.4 ANSI C2 National Electrical Safety Code [13]

The purpose of the National Electrical Safety Code (NESC) is the safeguarding of persons during the installation, maintenance, or operation of electrical supply and communication power lines, equipment and associated work practices employed by a public or private electric supply, communications, railway or similar utility in the exercise of its function as a utility. The NESC includes installation requirements to protect the public from contact with hazardous voltage and rules to protect utility workers in the construction, operation, and maintenance of electric supply and communication lines and equipment.

4.2 American Society of Mechanical Engineers (ASME)

The charter of the ASME B30 Standard Committee, on Safety Standards for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings is to develop, maintain, and interpret safety codes and standards covering the construction, installation, operation, inspection, testing, and maintenance of cranes and related lifting equipment.

The following Volumes of the ASME B30 standard are accredited by ANSI as American National Standards:

4.2.1 ASME B30.5: Mobile and Locomotive Cranes [14]

ASME 30.5 is a widely used standard that addresses crawler cranes, locomotive cranes, wheel-mounted cranes, and any variations thereof that retain the same fundamental characteristics and are powered by internal combustion engines or electric motors. The scope of this Safety Standard includes only cranes of the above types that are powered by internal combustion engines or electric motors. Side boom tractors and cranes designed for railway and automobile wreck clearance, digger derricks, cranes manufactured specifically for, or when used for, energized electrical line service, knuckle boom, trolley boom cranes, and cranes having a maximum rated capacity of one ton or less are excluded.

4.2.2 ASME B30.8: Floating Cranes and Floating Derricks [15]

This standard applies to cranes and derricks mounted on barges or pontoons. Floating cranes are convertible for excavation service and other uses that are categorically not considered to be lifting service. The requirements for this volume are applicable only to floating cranes and floating derricks used for vertical lifting and lowering of freely suspended unguided loads.

4.2.3 ASME B30.9: Slings [16]

This standard includes provisions that apply to slings used for lifting purposes, used in conjunction with equipment described in other volumes of the B30 Standard, except as restricted in B30.12 and B30.23. Slings fabricated from alloy steel chain, wire rope, metal mesh, synthetic fiber rope, synthetic webbing, and synthetic fiber yarns in a protective cover(s) are addressed. Slings fabricated from other materials or constructions other than those detailed in this volume shall be used only in accordance with the recommendations of the sling manufacturer or a qualified person.

4.2.4 ASME B30.10: Hooks [17]

This volume contains provisions that apply to hooks used for lifting and load handling purposes, in conjunction with equipment described in other volumes of the B30 Standard. Hooks supporting a load in the base (bowl/saddle or pin hole) of the hook are covered in Chapter 10-1. Hooks that may be loaded in other than the base (bowl/saddle or pin hole) are covered in Chapter 10-2. This safety standard offers comprehensive solutions applying to the fabrication, attachment, use, inspection, and maintenance of this equipment.

4.2.5 ASME B30.14: Side Boom Tractors [18]

This volume includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of side boom tractors powered by an internal combustion engine used for pipe laying operations, utilizing a lifting boom, drum, wire rope, and/or hydraulic cylinders.

4.2.6 ASME B30.15: Mobile Hydraulic Cranes [19]

B30.15-1973 had been withdrawn circa 1982 and provisions are now incorporated into B30.5.

4.2.7 ASME B30.20: Below-the-Hook Lifting Devices [20]

This volume addresses Structural and Mechanical Lifting Devices, Vacuum Lifting Devices, Operated Close Proximity Lifting Magnets, Remotely Operated Lifting Magnets, Remotely Operated Lifting Magnets, and Scrap and Material Handling Grapples. It offers comprehensive solutions

applying to the marking, construction, installation, inspection, testing, maintenance, and operation of equipment used for attaching loads to a hoist.

4.2.8 ASME B30.22: Articulating Boom Cranes [21]

This volume applies to the construction, installation, operation, inspection, and maintenance of cranes with knuckle booms articulated by hydraulic cylinders, which are powered by internal combustion engines or electric motors and are mounted on a mobile chassis or stationary installation. Articulating cranes with load hoist mechanisms are also covered by this volume.

4.2.9 ASME B30.23: Personnel Lifting Systems [22]

This volume applies to hoisting equipment and accessory equipment covered within certain volumes of the ASME B30 Standard that is used to lift, lower, or transport personnel in a platform, by wire rope or chain, from hoist equipment, or by a platform that is mounted on a boom of the hoist equipment. The lifting of personnel is not allowed using some ASME B30 standard equipment.

4.2.10 ASME B30.25: Scrap and Material Handlers [23]

This volume applies to the construction, installation, operation, inspection, and maintenance of scrap and material handlers consisting of a base, a revolving upper structure with operator's station(s), and a front for lifting scrap or materials using attachments such as magnets and grapples, and any variations thereof in which the equipment retains the same fundamental characteristics. The provisions included in this volume apply to scrap and material handlers that are crawler mounted, rail mounted, wheel mounted, or on pedestal bases. The scope also includes hydraulically operated scrap and material handlers powered by internal combustion engines or electric motors to lift, lower, and swing scrap and material at various radii. Exclusions include: hydraulic excavators designed for digging and trenching, forestry machines, machines designed for demolition, lattice and telescopic boom cranes, rail mounted cranes for railway and automobile wreck clearance, and equipment covered by other B30 volumes.

4.2.11 ASME B30.26: Rigging Hardware [24]

This volume applies to the construction, installation, operation, inspection, and maintenance of detachable rigging hardware used for load handling activities in conjunction with equipment described in other volumes of the B30 Standard. This hardware includes shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, rigging blocks and load indication devices.

4.2.12 ANSI B30.29: Self-Erect Tower Cranes [25]

Volume B30.29 applies to the construction, operation, inspection, testing and maintenance of powered, self-erect tower cranes, which adjust operating radius by means of a trolley traversing a jib. These may be horizontal, elevated, articulating, or telescoping, used for vertical lifting and lowering of freely suspended, unguided loads which consist of equipment and materials. Self-erect tower cranes have vertical or nearly vertical masts that are bottom slewing and mounted on fixed, traveling, or mobile bases. The cranes are capable of moving or being moved from jobsite to jobsite fully assembled or nearly fully assembled.

4.3 American Society of Safety Engineers

4.3.1 ANSI A10.28: Work Platforms Suspended from Cranes or Derricks [26]

This standard applies to platforms suspended from the load lines of cranes or derricks in order to (1) perform work at elevations that cannot normally be reached by other types of scaffolds or aerial work platforms; or (2) transport personnel to elevations where other means of access are unsafe or impractical because of design or worksite conditions.

4.3.2 ANSI A10.18: Floor and Wall Openings, Railings and Toeboards [27]

This standard prescribes rules and establishes minimum safety requirements for the protection of employees and the public from hazards rising out of or associated with temporary roof and floor holes, wall openings, stairways and other unprotected sides and edges, roofs, during construction and demolition activities.

4.4 ANSI/AWS American Welding Society

4.4.1 D14.1: Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment [28]

Requirements are presented for the design and fabrication of constructional steel weldments that are used in industrial and mill cranes, lifting devices and other material handling equipment. Requirements are also included for modification, weld repair, and post-weld treatments of new and existing weldments. The standard is produced by the American Welding Society (AWS).

D14.1 is comprehensive, covering among other subjects such as welding symbols, testing, filler metals, base metals, allowable stresses, weld joint design, qualification of welders and welding procedures, weld quality and inspection, weld repair and correction of defects.

4.4.2 ANSI/AWS D1.1: Structural Welding Code-Steel [29]

AWS D1.1 is broader in scope than D14.1, and covers the requirements for fabricating and erecting welded steel structures. This standard is intended for commonly used carbon and low-alloy construction steels, excluding those with yield strengths greater than 100 ksi (690 MPa), base metals thinner than 118in. (3 mm), pressure vessels or piping and also excluding base metals other than carbon and low alloy steel.

4.5 Society of Automotive Engineers (SAE), Technical Standards [30]

Relevant SAE standards are listed below.

- SAE J115: Safety Signs
- SAE J159: Crane Load Moment System
- SAE J220: Crane Boomstop
- SAE J375: Radius-of-Load and Boom Angle Measuring System
- SAE J376: Load Indicating Devices in Lifting Crane Service
- SAE J765: Crane Load Stability Test Code
- SAE J820: Crane Hoist Line Speed and Power Test Code
- SAE J881: Lifting Crane Sheave and Drum Sizes
- SAE J874: Method for Locating the Center of Gravity (Technically Equivalent to ISO 5005:1993)
- SAE J958: Nomenclature and Dimensions for Crane Shovels (Stabilized Feb 2012)
- SAE J983: Crane and Cable Excavator Basic Operating Control Arrangements
- SAE J987: Crane Structures - Lattice Boom Cranes - Method of Test

- SAE J999: Crane Boom Hoist Disengaging Device
- SAE J1028: Mobile Crane Working Area Definitions
- SAE J1063: Cantilevered Boom Crane Structures - Method of Test
- SAE J1078: A Recommended Method of Analytically Determining the Competence of Hydraulic Telescopic Cantilevered Crane Booms
- SAE J1093: Latticed Crane Boom Systems ~ Analytical Procedure
- SAE J1180: Telescoping Boom Length Indicating System
- SAE J1238: Rating Lift Cranes on Fixed Platforms Operating in the Ocean Environment
- SAE J1257: Rating Chart for Cantilevered Boom Cranes
- SAE J1289: Mobile Crane Stability Ratings
- SAE J1305: Two-Block Warning and Limit Systems in Lifting Crane Service
- SAE J1332: Rope Drum Rotation Indicating Device
- SAE J1362: Graphical Symbols for Operator Controls and Displays on Off-Road Self-Propelled Work Machines
- SAE J1366: Rating Lift Cranes Operating on Platforms in the Ocean Environment
- SAE J1393: Heavy Duty Vehicle Cooling Test Code R
- SAE J1977: Braking Performance ~ Rubber-Tired, Self-Propelled Cranes
- SAE J2688: Parking Brake Control Identification ~ Vehicles with Hydraulic Brake Systems and Automatic Transmissions
- SAE J2703: Cranes Access and Egress

4.6 National Electrical Code (NFPA 70) [31]

The National Electrical Code (NEC) is prepared by the National Electrical Code Committee and published by the National Fire Protection Association, Inc. (NFPA). Chapter 6 Article 610, Cranes and Hoists, is applicable to the installation of electrical equipment and wiring used in connection with cranes and hoists. It includes provisions for: hazardous locations, wiring methods, types of conductors and their rating, fittings, disconnecting means, protective features, controllers and grounding, etc.

5 INTERNATIONAL STANDARDS

5.1 Canadian Standards Association

The Canadian Standards Association (CSA) is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. Provincial Health and Safety Regulations may override the CSA regulations.

5.1.1 CSA Z150 - Safety Code on Mobile Cranes [32]

This is a Canadian safety standard used to help prevent mobile crane failures and help to protect workers and the general public. The third edition of Z150 applies to hoisting and lifting activities and describes the design, construction, load rating, installation, erection, inspection, maintenance, repair, modification, test and operation of lattice and telescopic boom mobile cranes.

5.1.2 CSA Z150.3 - Safety Code on Articulating Boom Cranes [33]

This Canadian standard is designed to:

a) provide requirements to guard against and minimize injury to workers, and otherwise provide for the protection of life, limb, health, and property, by specifying minimum safety requirements for articulating boom cranes;
b) provide direction and guidance to manufacturers and buyers of articulating boom cranes regarding the minimum standards expected of such machines in Canada;
c) provide direction and guidance to owners, employers, supervisors, workers, users, and others concerned with, responsible for, or involved in the application and use of articulating boom cranes;
d) guide Canadian federal, provincial/territorial, and other regulatory bodies in the development and promulgation of appropriate health and safety legislation and directives concerning articulating boom cranes.

5.2 European Standards - European Committee for Standardization (CEN)

5.2.1 EN12999: Cranes - Loader Cranes [34]

This European standard is meant for loader cranes to conform to the essential health and safety requirements of the Machinery Directive 2006/42/EC. It specifies minimum requirements for design, calculation, examinations and test of hydraulic powered loader cranes and their mountings on vehicles or static foundations. This standard does not apply to loader cranes used on board ships or floating structures or to articulated boom systems cranes, which are designed as total integral parts of special equipment such as forwarders.

5.2.2 EN13000: Cranes - Mobile Cranes [35]

This European standard is a method to comply with the machinery directive. It is applicable to the design, construction, installation of safety devices, and provides information for the use, maintenance and testing of mobile cranes as defined in ISO 4306-2 with the exception of loader cranes (see 3.1.1 of EN 12999:2002). Examples of mobile crane types and of their major parts are given in its Annexes A and B. This standard does not cover hazards related to the lifting of persons. It should be noted that the use of mobile cranes for the lifting of persons is subject to specific national regulations. Mobile cranes covered by this standard are designed for a limited number of stress cycles and particular properties of motions, e.g. smooth application of the driving forces and loading conditions according

to ISO 4301-2:1985, group A1. For a duty cycle such as grab, magnet or similar work, additional provisions are required which are outside the scope of this European standard. The hazards covered by this standard are identified in its Annex C. This document is not applicable to mobile cranes that are manufactured before the date of publication of this document by CEN.

- CEN/TC 147: Cranes - Safety
- EN 13001-1: Cranes – General design – Part 1: General Principles and Requirements
- EN 13001-2: Crane Safety – General Design – Part 2: Load actions
- EN13001-3-1: Cranes – General Design – Part 3-1: Limit states and proof competence of steel structure
- CEN/TS 13001-3-2: Cranes – General design – Part 3-2: Limit states and proof of competence of wire ropes in reeving systems
- CEN/TS 13001-3-5: Cranes – General design – Part 3-5: Limit states and proof of competence of forged hooks

5.3 Additional International Standards

Many countries have standards for mobile cranes including but not limited to Great Britain (BSI), Germany (DIN and StVZO), Switzerland (SNV), Russia (GOST), Australia (SA), France (AFNOR), Spain (AENOR), and Japan (JSA and JIS). The following discusses a few of those standards.

5.3.1 British Standards Institution (BSI) [36]

BSI standards and publications specify requirements for health and safety in the building industry. These include codes of practice for operating and supervising personnel, requirements for the design of cranes, and guidelines for inspection, testing and examination. BSI standards and publications will help meet essential health and safety requirements of regulations such as the Machinery Directive.

- BS EN 13001-1:2004+A1:2009 - Cranes. General design & principles and requirements
- BS EN 13001-2:2011 – Crane Safety. General design. Load actions.
- BSEN 1993-6:2007 – Eurocode 3. Design of steel structures. Crane supporting structures
- BS 8888:2008 – Technical product specifications (TPS). CD-ROM
- BS7262:1990 – Specification for Automatic Safe Load Indicators
- BS ISO 10571:2011 – Tires for mobile cranes and similar specialized machines
- BS EN 12999:2011 – Cranes. Loader cranes
- BS ISO 15513:2000 – Cranes. Competency requirements for crane drivers (operators), slingers, signalers and assessors

5.3.2 German Institute for Standardization (Deutsches Institut fur Normung) [37]

Deutsches Institut fur Normung (DIN), the German Institute for Standardization, offers stakeholders a platform for the development of standards as a service to industry, the state and society as a whole. DIN's primary task is to work closely with its stakeholders to develop consensus-based standards that meet market requirements. By agreement with the German Federal Government, DIN is the acknowledged national standards body that represents German interests in European and international standards organizations.

DIN EN 13000 Berichtigung 1: 2011 Cranes - Mobile cranes; German version EN 13000:2010, Corrigendum to DIN EN 13000:2010-05; German version EN 13000:2010/AC: 2010.

This standard is applicable to the calculation/design, construction, safety devices installation, information for use, maintenance and testing of mobile cranes as defined in ISO 4306-2 with the

exception of loader cranes and lifting of persons. It covers cranes employed with a limited number of stress cycles and with particular properties of motions, e. g. smooth application of the driving forces and loading conditions according to ISO 4301-2. For duty cycle like grab, magnet or similar work, additional provisions are required

5.3.3 Australian Standards (AS) [38]

These standards are voluntary consensus documents that are developed by Standards Australia. Standards Australia is an independent, not-for-profit organization, recognized by the Australian Government as the primary non-government standards body in Australia. Application of their standards is voluntary, unless specifically mandated by government or cited in a contract. Australian Standards are not legal documents but many, because of their rigor, are invoked by legislation.

- AS 1418.1-2002 – Cranes, hoists and winches – General requirements
- AS 1418.5-2002 – Cranes, hoists and winches – Mobile cranes
- AS 2550.1-2011 – Cranes, hoists and winches – Safe Use – General requirements
- AS 2550.5-2002 – Cranes, hoists and winches – Safe Use – Self-erecting tower cranes
- AS 3775-2004 – Chain slings – Grade T (Sling ratings cannot exceed 2 arm slings)

5.4 International Organization for Standardization (ISO) [39]

ISO is the world's largest developer of voluntary International Standards. These International provide specifications for products, services and good practice, with the objective of making industry more efficient and effective. Developed through global consensus, they help to break down barriers to international trade.

- TC 96/SC 6 – Mobile Cranes
- ISO 4301-2:2009 – Cranes – Classification Part 2: Mobile Cranes
- ISO 4302:1981 – Cranes – Wind load assessment
- ISO 4305:1991 – Mobile Cranes – Determination of Stability
- ISO 4306-2:2012 – Cranes Vocabulary – Part 2: Mobile Cranes
- ISO 4308-2:1988 – Cranes and lifting appliances – Selection of wire ropes – Part 2: Mobile cranes – Coefficient of utilization
- ISO 4309: 2010– Cranes – Wire ropes –Care and maintenance, inspection and discard
- ISO 4310:2009 – Cranes – Test code and procedures
- ISO 7296-1:1991—Cranes – Graphical symbols Part 1: General/Amd 1:1996
- ISO 7296-2:1996 – Cranes – Graphical symbols Part 2: Mobile cranes
- ISO 7752-2:2011 – Cranes – Control layout and characteristics – Part 2: basic arrangement and requirements for mobile cranes; Addendum 1
- ISO 8087:1985 – Mobile cranes – Drum and sheave sizes
- ISO 8566-2:1995 – Cranes – Cabins – Part 2: Mobile cranes
- ISO 8686-2:2004 – Cranes – Design principles for loads and load combinations – Part 2: Mobile Cranes
- ISO 9926-1: 1990 – Cranes – Training of drivers – Part 1: General
- ISO 9927-1: 2009 – Cranes – Inspections: Part 1: General
- ISO 9928-2:2007 – Cranes – Crane driving manual – Part 2: Mobile crane operators
- ISO 9942-1:1994 – Cranes – Information labels – Part 1: General
- ISO 10245-2:1994 – Cranes – Limiting and indicating devices – Part 2: Mobile cranes
- ISO 10972-2:2009 – Cranes – Requirements for mechanisms – Part 2: Mobile cranes
- ISO 11660-2:1994 – Cranes – Access, guards and restraints – Part 2: Mobile cranes
- ISO 11661:1998 – Mobile Cranes – Presentation of rated capacity charts

- ISO 11662-1:1995 – Mobile Cranes – Experimental determination of crane performance – Part1: Tipping loads and radii
- ISO 12480-1: 1997 – Cranes – Safe Use – Part 1: General
- ISO 12482-1: 1995 – Cranes – Condition monitoring – Part 1: General
- ISO 13200:1995 – Cranes – Safety signs and hazard pictorials – General principles
- ISO 15442:2012 – Cranes – Safety requirements for loader cranes
- ISO/TR 19961:2010 – Cranes – Safety code on mobile cranes

6 INDUSTRY GUIDELINES AND ADDITIONAL CORPORATE REQUIREMENTS

6.1 American Society of Civil Engineers Manuals and Reports [40]

The American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 93 is entitled Crane Safety on Construction Sites. This special publication is written as an aide to the construction industry in the management of crane operations.

6.2 Power Crane and Shovel Association (PCSA) [41]

PCSA Standard No. 4, Mobile Power Crane and Excavator and Hydraulic Crane Standards, was established to provide uniform methods and procedures for the guidance of manufacturers, distributors and users in specifying mobile cranes and in presenting data concerning them. Topics also cover safety considerations, machine types, certification, and uniform specification data. This standard was developed by Association of Equipment Manufacturers' (AEM) Power Crane and Shovel Association.

6.3 AEM Crane Safety Manual [42]

The Crane Safety Manual provides extensive information regarding safe crane operation and maintenance. It is heavily illustrated with an entire section devoted to hand signals.

6.4 Additional Requirements

Many corporations, organizations and other individual entities have their own standards and/or rules and regulations affecting the operation and safe use of mobile cranes.

Additionally there are trade associations and other organizations that give guidance on mobile cranes such as Specialized Carriers and Rigging Associations (SC&RA) and European Federation of Materials Handling or Fédération Européenne De La Manutention, (FEM).

7 CERTIFICATIONS

7.1 OSHA Crane Operator Certification [43]

29 CFR 1926.1427 requires that employers must ensure that, prior to operating any equipment covered under Subpart CC, the person is qualified or certified to operate the equipment in accordance with one of the four options by 2014:

1. Certification by an accredited crane operator testing organization
2. Qualification by an audited employer program
3. Qualification by the U.S. military
4. Licensing by a government entity

7.2 Crane Operator Licensing and Certification Requirements

As of December 2012, there were 16 states and 7 cities within the U.S. that have licensing requirements for crane operators. Administrative procedures change periodically and appropriate authorities should be contacted prior to operation.

STATES	
California	New Jersey
Connecticut	New Mexico
Hawaii	New York
Maryland	Pennsylvania
Massachusetts	Rhode Island
Minnesota	Utah
Montana	Washington
Nevada	West Virginia

CITIES
Chicago
Los Angeles
New Orleans
New York City
Omaha
Philadelphia
Washington D.C.

REFERENCES

[1] 29 CFR 1910.180, Crawler and Locomotive Truck Cranes [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[2] 29 CFR 1926.1400 Subpart CC, Cranes and Derricks in Construction [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[3] 29 CFR 1915 – Shipyard Employment – Subpart G – Gear and Equipment for Rigging and Materials Handling [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[4] 29 CFR 1915 – Shipyard Employment – Part 1915.136 – Internal Combustion Engines, Other Than Ship's Equipment [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[5] 29 CFR 1917 – Maritime Terminals – Subpart C – Cargo Handling Gear and Equipment [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[6] 29 CFR 1918 – Safety and Health Regulations for Longshoring – Subpart G – Cargo Handling Gear and Equipment Other Than Ship's Gear [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

[7] EM 385-1-1, Safety and Health Requirements Manual, U.S. Army Corps of Engineers (USACOE), Washington D.C., November 15, 2008

[8] NAVFAC P-307, Management of Weight Handling Equipment, Naval Facilities Engineering Command (NAVFAC), Washington D.C, December 2009

[9] DOE-STD-1090-2011, Hoisting and Rigging, U.S. Department of Energy (DOE), Washington D.C., September 2011

[10] A1264.1-2007 Safety Requirements for Workplace Walking/Working Surfaces and Their Access: Workplace, Floor, Wall, Roof Openings; Stairs and Guardrail Systems, American Society of Safety Engineers (ASSE), Des Plaines, IL

[11] A14.3, Safety Requirements for Fixed Ladder, The American National Standards Institute (ANSI), New York, NY

[12] B15.1, Safety Standard for Mechanical Power Transmission Apparatus, The American National Standards Institute (ANSI), New York, NY

[13] C2, National Electrical Safety Code, The American National Standards Institute (ANSI), New York, NY

[14] B30.5, Mobile and Locomotive Cranes, The American Society of Mechanical Engineers (ASME), New York, NY

[15] B30.8, Floating Cranes and Floating Derricks, The American Society of Mechanical Engineers (ASME), New York, NY

[16] B30.9, Slings, The American Society of Mechanical Engineers (ASME), New York, NY

[17] B30.10, Hooks, The American Society of Mechanical Engineers (ASME), New York, NY

[18] B30.14, Side Boom Tractors, The American Society of Mechanical Engineers (ASME), New York, NY

[19] B30.15, Mobile Hydraulic Cranes, The American Society of Mechanical Engineers (ASME), New York, NY

[20] B30.20, Below-the-Hook Lifting Devices, The American Society of Mechanical Engineers (ASME), New York, NY

[21] B30.22, Articulating Boom Cranes, The American Society of Mechanical Engineers (ASME), New York, NY

[22] B30.23, Personnel Lifting Systems, The American Society of Mechanical Engineers (ASME), New York, NY

[23] B30.25, Scrap and Material Handlers, The American Society of Mechanical Engineers (ASME), New York, NY

[24] B30.26, Rigging Hardware, The American Society of Mechanical Engineers (ASME), New York, NY

[25] B30.29, Self-Erect Tower Cranes, The American Society of Mechanical Engineers (ASME), New York, NY

[26] A10.28, Safety Requirements for Work Platforms Suspended from Cranes or Derricks, American Society of Safety Engineers (ASSE), Des Plaines, IL

[27] A10.18, Floor and Wall Openings, Railings and Toeboards, American Society of Safety Engineers (ASSE), Des Plaines, IL

[28] AWS D14.1, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment, American Welding Society (AWS), Miami, FL

[29] AWS D1.1, Structural Welding Code – Steel, American Welding Society (AWS), Miami, FL

[30] Society of Automotive Engineers (SAE), Technical Standards, Washington D.C.

[31] NFPA 70, National Electrical Code, (NEC) Article 610, National Fire Protection Association, Quincy, MA

[32] CSA Z150-11, Safety Code on Mobile Cranes, Canadian Standards Association (CSA), Toronto, ON

[33] CSA Z150.3-11, Safety Code on Articulating Boom Cranes, Canadian Standards Association (CSA), Toronto, ON

[34] BS EN 12999, Cranes – Loader Cranes, British Standards Institution (BSI), London, UK

[35] BS EN 13000, Cranes – Mobile Cranes, British Standards Institution (BSI), London, UK

[36] BSI, British Standards Institution (BSI), London, UK

[37] DIN, German Institute for Standardization, Deutsches Institut fur Normung (DIN), Berlin, DE

[38] Standards Australia (SA), Sydney, AU

[39] TC 96/SC 6, Mobile Cranes, International Organization for Standardization (ISO), Geneva, CH

[40] Manual of Practice No. 93, Crane Safety on Construction Sites, American Society of Civil Engineers (ASCE), Reston, VA

[41] PCSA Standard No. 4, Mobile Power Crane and Excavator Standards and Hydraulic Crane Standards, Power Crane and Shovel Association (PCSA), Milwaukee, WI

[42] Crane Safety Manual, Association of Equipment Manufacturers (AEM), Milwaukee, WI

[43] 29 CFR 1926.1427 Subpart CC – Cranes & Derricks in Construction – Operator Qualification and Certification, [Occupational Safety and Health Act (OSHA)], Code of Federal Regulations

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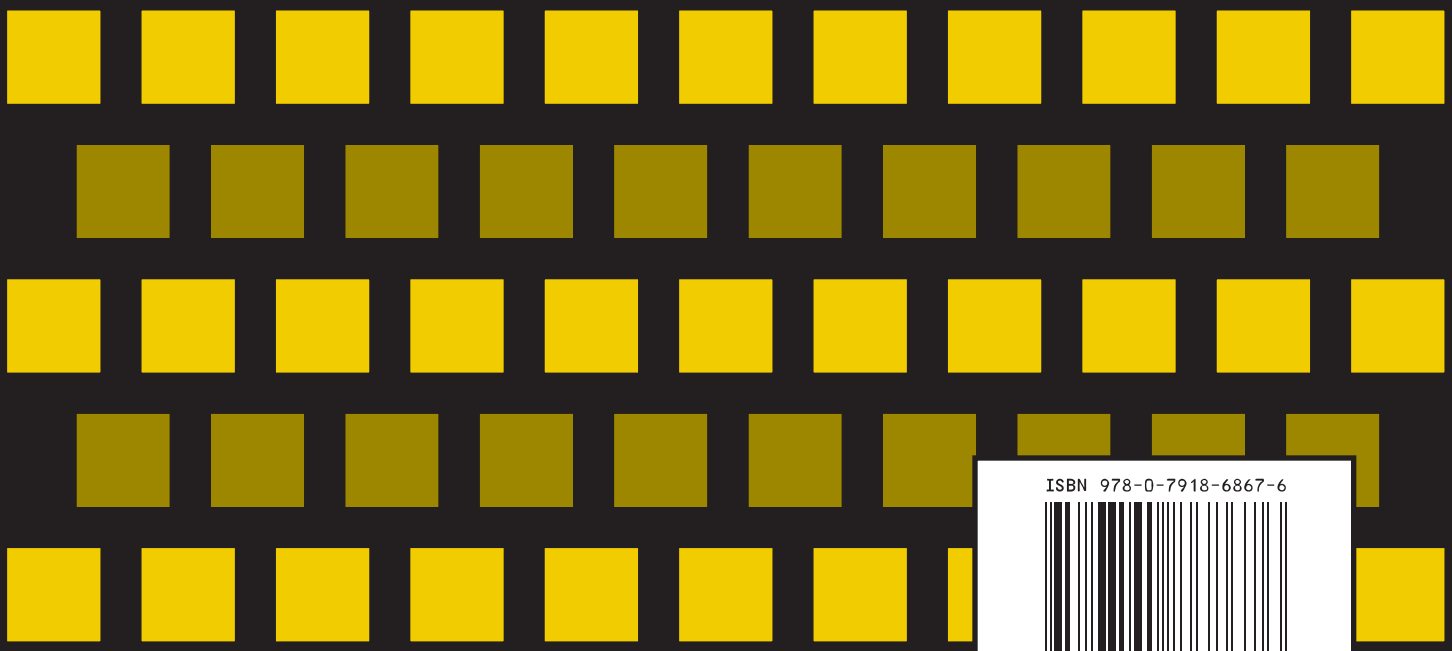

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