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

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

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the committee organized November 4, 1926, with 57 members representing 29 national organizations. Commencing June 1, 1927, and using the eight-page code published by ASME in 1916 as a basis, the Sectional Committee developed the Safety Code for Cranes, Derricks, and Hoists. The early drafts of this safety code included requirements for jacks, but, due to inputs and comments on those drafts, the Sectional Committee decided in 1938 to make the requirements for jacks a separate code. In January 1943, ASA B30.2-1943 was published addressing a multitude of equipment types, and in August 1943, ASA B30.1-1943 was published just addressing jacks. Both documents were reaffirmed in 1952 and widely accepted as safety standards.

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Bureau of Yards and Docks (now the Naval Facilities Engineering Command), was reorganized on January 31, 1962, with 39 members representing 27 national organizations. The new committee changed the format of ASA B30.2-1943 so that the multitude of equipment types it addressed could be published in separate volumes that could completely cover the construction, installation, inspection, testing, maintenance, and operation of each type of equipment that was included in the scope of ASA B30.2. This format change resulted in B30.3, B30.5, B30.6, B30.11, and B30.16 being initially published 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 contains revisions to all chapters. The most notable changes include installation requirements, clarification of testing, lift director responsibilities, and setup and operating practices. This 2021 edition contains revisions to qualifications and responsibilities, operating practices, maintenance, construction among other changes.

This Volume, which was approved by the B30 Committee and by ASME, was approved by ANSI and designated as an American National Standard on TBD.
ARTICULATING BOOM CRANES

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

SECTION 22-0.2: DEFINITIONS

22-0.2.2 General Definitions

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

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

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

*axle:* the shaft or spindle with which or about which a wheel rotates. On wheel-mounted cranes, it refers to a type of axle assembly, including housings, gearing, differential, bearings, and mounting appurtenances.

*axle (tandem axle assembly):* two or more axles mounted in tandem in a frame so as to divide the load between the axles and permit vertical oscillation of the wheels.

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

*cab:* a housing that covers machine operator’s or driver’s station.

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

*cab, station, or top seat:* a control station directly attached to the crane where the operator sits or stands on the crane.

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

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

*crane rating:* the crane shall be rated in ft-lb (N·m). This rating shall be established by multiplying the manufacturer’s rated load by the minimum boom radius with the boom in its horizontal retracted position (all extension booms retracted), outer and jib boom fully extended and hook pin height equal to the inner boom pin height.

*crossover points:* in multiple layer spooling of rope on drum, those points of rope contact where the rope crosses preceding rope layer.

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

*dynamic loads:* loads introduced into the machine or its components due to accelerating or decelerating forces.

*electrically insulated:* a material property that is related to the material’s ability to resist conduction of electricity.

*flange point:* a point of contact between rope and drum where the rope changes layers.
ground or floor controls: a control station directly attached to the crane, but where the operator stands on the ground — not the crane.

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

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

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

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

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

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

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

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

remote controls: a fixed or moveable control station not directly attached 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. Refers to wire rope unless otherwise specified.

rotation resistant rope: a wire consisting of an inner layer of strands laid in one direction covered by a layer of strands laid in the opposite direction; this has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.

running rope: a rope that travels around sheaves or drums.

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

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

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

swivel: a load-carrying member with thrust bearings to permit rotation under load in a plane perpendicular to the direction of the load.
telescoping boom: consists of a boom from in which one or more boom sections are telescoped for additional length.
tipping: see stability.

transit: the moving or transporting of crane equipment from one job site to another.
travel: the function of the machine equipment moving under its own power from one location to another on a jobsite.
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.

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

Weight of crane: weight of manufacturer’s standard articulating boom crane. List separately weights of optional items such as hydraulic pump, hydraulic oil, counterweight, ballast, accessories, and equipment added by installer.

SECTION 22-0.6: TRANSLATIONS OF SAFETY-RELATED INFORMATION AND CONTROL DESIGNATIONS

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

Section 22-0.6.2: Translation of Technical and Safety-Related Information and Manual(s).
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 Section 22-0.6.1 (c) and (d).

(a) Translation of Non-English Documentation into English
(1) The wording of written non-English safety information and manuals regarding use, inspection, and maintenance shall be translated into English using professional translation industry standards, which include, but are not limited to, the following:
(a) translation of the complete paragraph message, instead of word by word
(b) grammatical accuracy
(c) respectfulness of the source document content without omitting or expanding the text
(d) accurate translation of the terminology
(e) reflection of the level of sophistication of the original document
The finished translation shall be verified for compliance with (a)(1)(a) through (a)(1)(e) above by a qualified person having an understanding of the technical content of the subject matter.

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

Any non-English documentation provided in addition to English shall be translated and reviewed in accordance with the requirements listed above.

SECTION 22-0.7: REFERENCES

ASME B30.5-2011, Mobile and Locomotive Cranes
ASME B30.10-2014, Hooks
ASME B30.23-2014, Personnel Lifting Systems
ASME B30.25-2013, Scrap and Material Handlers
ASME B30.26-2010, Rigging Hardware
ASME B30.30-2019, Ropes

Rationale for Chapter 22-0 changes:
Updated global language for translations and updated references. Removed definitions that were no longer needed with the inclusion of B30.30 and updated others to align with the B30 Lexicon 2017.

Rationale for Recirculation Changes:
All recirculation changes are as approved on comments to first consideration ballot and as approved by the main committee during the September 2019 main committee meeting.
Chapter 22-1 Construction and Characteristics

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

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.
   (2)(3) Winch drums shall be in accordance with ASME B30.30.
   (a) The minimum number of wraps that remain on the drum when the hook is in the extreme low position and the booms are at maximum elevation and extension, shall be as specified in B30.30. Not less than two full wraps of rope shall remain on the drum 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 two the minimum number of wraps of rope remain.
   (b) The drum end of the rope shall be anchored to the drum by an arrangement specified by the crane or winch manufacturer.
   (c) The drum flange shall extend a minimum 1\(\frac{2}{3}\) in. (13 mm) over the top layer of rope at all times.
   (2)(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.

NOTE: The winch drum diameters, minimum wraps, and flange height extension specified above are applicable to winch drums for wire rope. If synthetic rope is utilized, the minimum drum diameter, minimum wraps, and minimum flange height extension of the winch drum shall be as specified by the synthetic rope manufacturer or a qualified person.

(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 22-1.5: ROPES, ROPE-LIFTING COMPONENTS, AND REEVING ACCESSORIES

Hoist ropes and rope-lifting components reeving accessories shall be in accordance with ASME B30.30.

22-1.5.1 Rope Design Factors

(a) For supporting rated loads and for supporting the boom and working attachments at recommended travel or transit positions and boom lengths, the design factor for live or running ropes that wind on drums or travel over sheaves shall not be less than 3.5.

(b) For supporting the boom under recommended boom erection conditions, the design factor for live or running ropes shall not be less than 3.0.

(c) The design factors for rotation resistant ropes and synthetic ropes shall not be less than 5.0.

(d) The design factors specified in paras. 22-1.5.1(a) through 22-1.5.1(c) shall be the total minimum breaking force of all ropes in the system divided by the load imposed on the rope system when supporting the static weights of structure and crane rated load.

NOTE: Minimum breaking force was formerly referred to as nominal breaking strength.

22-1.5.2 Ropes

(a) All ropes shall be of a specification recommended by the rope manufacturer, crane manufacturer, or a qualified person for the intended use.

(b) Socketing shall be done as recommended by the manufacturer of the assembly or a qualified person.

(c) If a load is supported by more than one part of rope, the tension in the parts shall be equalized.

(d) Wherever exposed to ambient temperatures at the rope in excess of 180°F (82°C), rope having an independent wire rope core, wire strand core, or other temperature-damage resistant core shall be used.

(e) Rotation-resistant ropes and fiber core ropes shall not be used for boom extension systems.

22-1.5.3 Reeving Accessories

(a) Eye splices shall be made in a manner recommended by the rope or crane manufacturer, and rope thimbles should be used in the eye.

(b) Wire rope clips shall be drop forged steel of the single saddle (U-bolt) or double saddle type clip. Malleable cast iron clips shall not be used. Wire rope clips shall be installed and assembled in accordance with ASME B30.26.

(c) Poured sockets, swaged, compressed, or wedge socket fittings shall be applied as recommended by the rope, crane, or fitting manufacturer.

Wire rope clips used in conjunction with wedge sockets shall be attached in accordance with ASME B30.26. This does not preclude the use of devices specially designed for dead ending rope in a wedge socket.

22-1.5.4 Sheaves

Sheaves shall be in accordance with ASME B30.30

(a) Sheave grooves shall be free from surface conditions which would cause rope damage. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size rope used, and the sides of the groove should be tapered outwardly to facilitate entrance of the rope into the groove. Flange corners should be rounded and the rims should run true about the axis of rotation.

(b) Sheaves carrying ropes that can be momentarily unloaded shall be provided with close-fitting guards or other devices to guide the rope back into the groove when the load is reapplied.

The sheaves in the lower load block shall be equipped with close fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with ropes slack.

All sheave bearings, except permanently lubricated bearings, shall be provided with means for lubrication.

22-1.5.5 Sheave Sizes

(a) Load hoisting sheaves, including those used in conjunction with cylinders to provide a rope reeving system, shall have pitch diameters not less than 18 times the nominal diameter of the rope used.
(b) Lower load block sheaves shall have pitch diameters of not less than 16 times the nominal diameter of the rope used.

(c) Boom extension system sheaves shall have a pitch diameter of not less than 15 times the nominal diameter of the rope.

NOTE: The diameters specified above are applicable to sheaves for wire rope. If synthetic rope is utilized, the minimum pitch diameters of the sheaves shall be as specified by the synthetic rope manufacturer or a qualified person.

22-1.5.26 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 (refer to ASME B30.10).

SECTION 22-1.8: CONSTRUCTION

22-1.8.7 Miscellaneous Equipment

(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 22-3.4.2-1, 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.

Rationale for Chapter 22-1 changes:
Replaced rope criteria with reference to ASME B30.30 22-1.8.7(f) was moved from chapter 3.

Rationale for Recirculation Changes:
All recirculation changes are as approved on comments to first consideration ballot and as approved by the main committee during the September 2019 main committee meeting.
Chapter 22-2 Inspection, Testing, and Maintenance

SECTION 22.2.3: MAINTENANCE

SECTION 22.2.3.54: ROPE INSPECTION, REPLACEMENT, AND MAINTENANCE

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

22-2.4.1 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.

Due to crane design configuration to maintain mobility, sheave diameters, drum diameters, and rope design factors are limited. Because of these limited design parameters, inspection to detect deterioration in accordance with para. 22-2.4.2 and timely replacement in accordance with para. 22-2.4.3 are essential. If synthetic ropes are provided in lieu of wire ropes, the inspection, replacement, and maintenance criteria for the rope shall be provided by the synthetic rope manufacturer or a qualified person.

22-2.4.2 Inspection

(a) Frequent Inspection

(1) All running ropes in service should be visually inspected once each working day. A visual inspection shall consist of observation of all rope that can reasonably be expected to be in use during the day’s operations. These visual observations should be concerned with discovering gross damage that may be an immediate hazard, including the following:

(-a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. Loss of rope diameter in a short rope length or unevenness of outer strands should provide evidence that the rope or ropes must be replaced.

(-b) general corrosion.

(-c) broken or cut strands.

(-d) number, distribution, and type of visible broken wires [see paras. 22-2.4.3(b)(1), 22-2.4.3(b)(2), and 22-2.4.3(b)(7) for further guidance].

(-e) core failure in rotation resistant ropes (see Fig. 22-2.4.2-1). When such damage is discovered, the rope shall be either removed from service or given an inspection as detailed in para. 22-2.4.2(b).

(2) Care shall be taken when inspecting sections of rapid deterioration such as flange points, crossover points, and repetitive pickup points on drums.

(3) Care shall be taken when inspecting rotation resistant ropes, because of their higher susceptibility to damage and increased deterioration when working on equipment with limited design parameters. The internal deterioration of rotation resistant ropes may not be readily observable.

(b) Periodic Inspection

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

(2) This inspection shall cover the entire length of the rope. Only the surface wires of the rope need be inspected. No attempt should be made to open the rope. Any deterioration resulting in an appreciable loss of
original strength, such as the conditions described below, shall be noted and determination made as to whether further use of the rope would constitute a hazard.

- (a) points listed in para. 22-2.4.2(a)
- (b) reduction of rope diameter below nominal diameter due to loss of core support or internal or external corrosion
- (c) severely corroded or broken wires at end connections
- (d) severely corroded, cracked, bent, worn, or improperly applied end connections

(3) Care shall be taken when inspecting sections of rapid deterioration, such as the following:

- (a) sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited
- (b) sections of the rope at or near terminal ends where corroded or broken wires may protrude

### 22-2.4.3 Rope Replacement

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

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

1. broken wires

   - (1) in running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay
   - (2) in rotation-resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30-rope diameters

   - (2) one outer wire broken at the point of contact with the core of the rope that has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.

   - (1) independent wire rope core (IWRC) or strand core protrusion between the outer strands.

   - (1) kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.

   - (1) apparent damage from any heat source, including, but not limited to, welding, power line strikes, or lightning.

   - (1) reduction from nominal diameter of more than 5%.

   - (1) severe corrosion as evidenced by pitting.

   - (1) deviation shall be allowed from the removal criteria listed in paras. 22-2.4.3(b)(1) through 22-2.4.3(b)(7) only with written approval of the manufacturer of the specific wire rope.

   - (1) Broken wire removal criteria cited in this Volume applies to wire rope operating on multilayer drums regardless of sheave material.

   - (1) Replacement rope shall have the same or higher minimum breaking force as the original rope furnished or recommended by the crane manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the crane manufacturer, or a qualified person.

   - (1) Ropes not in regular use: All rope that has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given an inspection in accordance with para. 22-2.4.2(b) before it is placed in service. This inspection shall be for all types of deterioration and shall be performed by a designated person.
Inspection Records

(1) Frequent Inspection. No records required.

Periodic Inspection. To establish data as a basis for judging the proper time for replacement, a dated report of rope condition at each periodic inspection shall be kept on file. This report shall cover points of deterioration listed in para. 22-2.4.2(b)(2). If the rope is replaced, only the fact that the rope was replaced need be recorded.

(a) A long-range inspection program should be established and should include records on the examination of ropes removed from service so that a relationship can be established between visual observation and actual condition of the internal structure.

22-2.4.4 Rope Maintenance

(a) Rope should be stored to prevent damage or deterioration.

(b) Unreeiling or uncoiling of rope shall be done as recommended by the rope manufacturer and with care to avoid kinking or inducing a twist.

(c) Prior to cutting a wire rope, seizings shall be placed on each side of the point to be cut. The minimum length of each seizing shall be equal to or exceed the nominal diameter of the wire rope to which it is being applied. Seizing may consist of wire, strand, tape, or other material as long as the seizing holds the wires and strands firmly in place during the rope’s cutting and handling. The required number of seizings is as follows:

(1) on preformed wire rope, one seizing on each side of the point to be cut

(2) on nonpreformed wire rope, at least three seizings on each side of the wire rope to be cut

(d) During installation, care should be exercised to avoid dragging of the rope in dirt or around objects that will scrape, nick, crush, or induce sharp bends in it.

(e) Rope should be maintained in a well-lubricated condition. It is important that lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and to this end, the rope manufacturer should be consulted; lubricant applied shall be of the type that does not hinder visual inspection. Those sections of rope that are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.

(f) When an operating rope shows greater wear at well-defined localized areas than on the remainder of the rope, rope life can be extended (in cases where a reduced rope length is adequate) by cutting off a section at the worn end, and thus shifting the wear to different areas of the rope.

Rationale for Chapter 22-2 changes:

Replaced detailed rope inspection criteria with reference to ASME B30.30 Editorial changes.
Chapter 22-3 Operation

SECTION 22-3.1: QUALIFICATIONS AND RESPONSIBILITIES

22-3.1 Responsibilities

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. Signalperson may not be required for every lifting operation. (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.
- **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.

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

22-3.1.3.2 Responsibilities of the Lift Director.

The lift director’s responsibilities shall include the following:

(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 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.
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 person who is directing the lift or an appointed 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, 54 have been met.

(z) if power fails during operations
   (1) land any load under control, if practical
   (2) set all brakes and locking devices move all power controls to the “OFF” or neutral position.

22-3.1.3.3 Signalperson Responsibilities. A signalperson assigned to a load handling activity shall at a minimum be responsible for:

(a) Confirming with the operator the method of communication and the associated signals that are to be used during the load handling activity.

(b) Ensuring that standard, discernible hand or voice signals provided to the operator are in accordance with para. 22-3.3.
(c) Verifying that load handling activities are stopped if there is a need to give instructions to the operator, other than those provided by the established signal system.

(d) Ensuring that telephones, radios or other equipment intended for use as the primary signal system are tested prior to the load handling activity.

(e) Ensuring that a form of communication is maintained with the operator during all load handling activities.

(f) Avoiding giving signal commands that would result in loads being lifted over personnel whenever possible.

SECTION 22-3.2: OPERATING PRACTICES

22-3.2.3 Crane Setup

(a) The operator shall level the crane per the manufacturer’s requirements and, where necessary, properly block the vehicle.

(b) Tires and stabilizer pads should rest on firm level footing. Where such a footing is not otherwise supplied, it should be provided by timbers, cribbing, or other structural members to distribute the load so as not to exceed allowable bearing capacity of the underlying material.

(c) Blocking under stabilizers shall meet the requirements as follows:

(1) strong enough to prevent crushing

(2) of such thickness, width, and length as to completely support the stabilizer pad

(d) When stabilizers are used, they shall be extended or deployed per the crane manufacturer’s load rating chart specifications and set per manufacturer specifications. When partially extended stabilizers are used, the following requirements, when applicable, shall be met:

(1) Crane operation with partially extended stabilizers shall be undertaken only if approved by the crane manufacturer.

(2) Stabilizers shall be set at equal positions that correspond to the load rating charts supplied by the manufacturer for those positions. Only the load chart(s) corresponding to the stabilizer positions shall be used for operation.

(3) When situations arise where stabilizers must be set at unequal positions that correspond to the load rating charts supplied by the manufacturer, the load rating charts corresponding with the individual quadrants of operation shall be used. The manufacturer or qualified person shall be consulted to determine if any capacity reductions, special operating procedures, or limitations are required.

(4) When situations arise that will not permit stabilizers to be set at positions that correspond to the locations established by the manufacturer’s load rating chart(s), the crane manufacturer shall be consulted to determine if any capacity reductions, special operating procedures, or limitations are required. If required information is not available from the manufacturer, a qualified person shall be consulted.

SECTION 22-3.4 OPERATING NEAR Operation in the Vicinity of ELECTRIC POWER LINES

22-3.4.1 General

This Volume recognizes that operating articulating cranes where they can become electrified from electric power lines can be an extremely hazardous practice. It is advisable to perform the work so there is no possibility of the crane, load line, or load becoming a conductive path. [See Fig. 22-3.4.1-1, illustrations (a) and (b).] Cranes shall not be used to handle materials stored under electric power lines unless any combination of boom, load, load line, or machine component cannot enter the prohibited zone. However, when required to work in the vicinity of electric power lines, the requirements below shall be followed to address the hazard. However, working in the vicinity of electric power lines should be avoided whenever possible. See Figure 22-3.4.1-1 to determine the subsection to reference in a given situation. Operating articulating boom cranes where they can become electrified with electric power lines is not recommended, unless there is no less hazardous way to perform the job.
Figure 22-3.4.1-1 Flowchart to Assist in Determination of the Applicable Subsection for Operation in the Vicinity of Power Lines

- Identify crane placement at the worksite.
- Identify the crane to be used and its configuration.
- Identify the dimensions of the load(s), rigging, and rigging accessories.
- Define the area 360 degrees around the equipment up to the equipment’s maximum horizontal reach.

- Power lines in the vicinity?
  - NO: Not applicable
  - YES: Power lines de-energized?
    - NO: See 22-3.4.2 or 22-3.4.3
    - YES: See Table 22.3.4.1.1 to establish specified clearance

- Power line voltage known?
  - YES: Contact utility company-voltage provided?
    - YES: Use Table 22.3.4.1.1 to establish specified clearance
    - NO: Estimate voltage using Figure 22-3.4.1-2
  - NO: See 22-3.4.5(a)(2) to establish specified clearance

- Crane in transit or travel with no load and boom lowered?
  - YES: See 22-3.4.4
  - NO: Maximum horizontal reach, load, or rigging could encroach into specified clearance or below power line?
    - YES: Operating inside specified clearance?
      - NO: See 22-3.4.8
      - YES: See 22-3.4.7
    - NO: See 22-3.4.6
Figure 22-3.4.1-2 illustrates the specified clearance around an energized electric power line and how crane position and configuration can affect the ability to remain outside the specified clearance. Figure 22-3.4.1-3 illustrates the specified clearance around an energized electric power line that shall be maintained when the crane is in travel or transit.

(a) To prevent the crane, load line, rigging, or load from becoming a conductive path when operating in the vicinity of energized electric power lines, the specified clearance shall be maintained at all times. The following two ways can be used to determine the specified clearance:

(1) Preferred Method: have a qualified representative of the utility owner/operator of the electric power lines determine the voltage and elevation of the electric power lines. Use Table 22-3.4.1-1 to determine the specified clearance.

(2) Alternate Method: estimate the voltage of the electric power lines by comparing the electric power line support structures to those depicted in Figure 22-3.4.1-4. If multiple electric power line support structures are in the vicinity of the worksite, use the highest typical voltage shown in Figure 22-3.4.1-4. Maintain a specified clearance of 20 ft for electric power lines with typical voltages below or equal to 350 kV and a specified clearance of 50 ft for electric power lines with typical voltages above 350 kV.

(b) Operation of articulating cranes where they can become energized by electric power lines shall not be performed unless the requirements of this section are followed.

(c) Additional precautions and measures may need to be taken beyond those identified in this Volume for crane operation, transit, or travel in the vicinity of electric power lines when snow, ice, rain, fog, wind, darkness, or other conditions or environments affect visibility or induce unwanted movement or position of the crane, load, or electric power lines. These precautions or measures may include, but are not limited to, additional spotters, warning systems, increased distance from specified clearance, and procedures.

(d) Crane operators, signalpersons, riggers, and other involved personnel shall receive training on, as well as an evaluation of their understanding of, the electrical hazards associated with crane operation in the vicinity of electric power lines, the requirements of this section, and the procedures and emergency responses that are to be implemented should the equipment (crane, rigging, and lifting accessories), load line, or load become energized.

(e) Any overhead wire shall be considered to be an energized electric power line unless and until the utility owner/operator of the electric power lines indicates that it is deenergized, and for transmission and distribution lines, that the electric power lines are visibly grounded at the jobsite. Crane operators and other personnel directly involved with the lifting operations shall not rely on the coverings of wires for protection.

(f) Operation of boom and load over energized electric power lines is extremely dangerous, due to possible misperception of distance and multiple contact points as viewed from the position of the operator and/or position of the signalperson. The operator should avoid operating the crane, with or without a load, in this area.

(g) If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of this section, even if such devices are required by law or regulation. Electrical hazards are complex, invisible, and lethal. To lessen the potential of false security, instructions related to the devices and hazards shall be reviewed with the crane operator, crew, and load-handling personnel. Instructions shall include information about the electrical hazard(s) involved, operating conditions for the devices, limitations of such devices, and testing requirements prescribed by the device manufacturer. The specified clearances to electric power lines, established in Table 22-3.4.1-1, shall be maintained, regardless of any devices used on the crane.

(h) Before beginning operations, the site supervisor shall ensure that

(1) The area of crane placement at the worksite has been established.
(2) The crane to be used and its configuration have been identified.
(3) The area 360 deg around the crane has been defined up to the maximum horizontal reach.
(4) The dimensions of the load(s), rigging, and rigging accessories that will be used have been identified.
(5) A preliminary determination is made if any part of the equipment, load line, or load, if operated at the crane’s maximum horizontal reach, has the capability to get closer than the specified clearance.
(6) The applicable paragraph listed in para. (i) below and the requirements to be followed to address the given condition are identified.
(7) The lift director has the information contained in (1) through (6) above.
The lift director shall reevaluate the information contained in (h)(1) through (h)(6) above whenever changes that affect the crane position, crane configuration, or lift plan are required during operation.

The following paragraphs provide additional requirements:

22-3.4.2 Operation in the Vicinity of Deenergized and Grounded Electric Power Transmission and Distribution Lines
22-3.4.3 Operation in the Vicinity of Deenergized Electric Power Lines Other Than Transmission and Distribution Lines
22-3.4.4 Transit or Travel in the Vicinity of Energized Electric Power Lines With No Load and Boom Lowered
22-3.4.5 Operation in the Vicinity of Energized Electric Power Lines and the Crane Configuration May Not Be Capable of Reaching Within the Specified Clearance
22-3.4.6 Operation in the Vicinity of Energized Electric Power Lines and the Crane Configuration May Be Capable of Reaching Within the Specified Clearance
22-3.4.7 Operation Below Energized Electric Power Lines
22-3.4.8 Operation Within the Specified Clearance With the Electric Power Lines Energized

Any overhead line shall be considered to be an energized line, unless and until the person owning such line or the electrical utility authorities, indicate that it is not an energized line. Crane operators shall not rely on the coverings of lines for their protection. Four conditions to consider when operating an articulating boom crane near electric power lines are the following:

(a) power lines de-energized and grounded as in para. 22-3.4.2
(b) power lines energized, crane operating less than the erected/fully extended boom length away as in para. 22-3.4.3 [see Fig. 22-3.4.1-1, illustration (c)]
(c) power lines energized, crane within prohibited zone as in para. 22-3.4.4
   crane in transit, no load, and boom lowered as in para. 22-3.4.5

Fig. 22-3.4.1-2 Specified Clearance Around an Energized Power Line
Record#: 19-1858
Standard: B30.22 – Articulating Boom Cranes
Subject: Chapter 3 Added signalperson responsibilities as required by global revision. Reorganized electrical section to match what is approved in B30.5.
Date: July 2019

Fig. 22-3.4.1-1 Danger Zone for Cranes and Lifted Loads Operating Near Electrical Transmission Lines (Cont’d)

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Fig. 22-3.4.1-1 Danger Zone for Cranes and Lifted Loads Operating Near Electrical Transmission Lines (Cont’d)
Record#: 19-1858
Standard: B30.22 – Articulating Boom Cranes
Subject: Chapter 3 Added signalperson responsibilities as required by global revision.
Reorganized electrical section to match what is approved in B30.5.
Date: July 2019

**Fig. 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**

See 22-3.4.5
**Subject:** Chapter 3 Added signalperson responsibilities as required by global revision. Reorganized electrical section to match what is approved in B30.5.

**Record#: 19-1858**

**Standard:** B30.22 – Articulating Boom Cranes

**Date:** July 2019

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**Table 22-3.4.12-1 Required Specified Clearance for Normal Voltage in Operation Near High Voltage in the Vicinity of Energized Electric Power Lines and Operation in Transit With No Load and Boom or Mast Lowered**

<table>
<thead>
<tr>
<th>Normal Voltage, kV (Phase to Phase)</th>
<th>Minimum Required Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When during operating operation near high voltage power lines</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 50</td>
<td>10 (3.05)</td>
</tr>
<tr>
<td>Over 50 to 200</td>
<td>15 (4.6)</td>
</tr>
<tr>
<td>Over 200 to 350</td>
<td>20 (6.1)</td>
</tr>
<tr>
<td>Over 350 to 500</td>
<td>25 (7.62)</td>
</tr>
<tr>
<td>Over 500 to 750</td>
<td>35 (10.67)</td>
</tr>
<tr>
<td>Over 750 to 1,000</td>
<td>45 (13.72)</td>
</tr>
<tr>
<td><strong>During while in transit or travel</strong> with no load and boom or mast lowered</td>
<td></td>
</tr>
<tr>
<td>Up to 0.75</td>
<td>4 (1.22)</td>
</tr>
<tr>
<td>Over 0.75 to 50</td>
<td>6 (1.83)</td>
</tr>
<tr>
<td>Over 50 to 345</td>
<td>10 (3.05)</td>
</tr>
<tr>
<td>Over 345 to 750</td>
<td>16 (4.87)</td>
</tr>
<tr>
<td>Over 750 to 1,000</td>
<td>20 (6.1)</td>
</tr>
</tbody>
</table>

**NOTE:**
(1) Environmental conditions such as fog, smoke, or precipitation may require increased clearances.

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**Fig. 22-3.4.1-4 Electric Power Line Support Structures**
22-3.4.2 Operation in the Vicinity of Deenergized and Grounded Electric Power Transmission or Distribution Lines

This is the preferred condition under which the crane operation can be performed when the crane is required to work in the vicinity of power transmission and distribution lines since the hazard of injury or death due to electrocution has been removed.

The following steps shall be taken to ensure the de-energization of the power lines:

(a) The power utility owner/operator company or owner of the power lines shall de-energize the power lines.
(b) The power lines shall be visibly grounded to avoid electrical feedback and appropriately marked at job site location.
(c) The necessity for grounding of wiring that has a manufacturer’s applied coating of insulation and is a 600 V service or less shall be determined by electrical utilities or the owner of the power line.
(d) A qualified representative of the utility owner/operator of the power lines or a designated representative of the electrical utility shall come to the site to verify that the steps of paras. 22-3.4.2(a) and 22-3.4.2(b) have been completed and that the power lines are grounded and not deenergized.

(e) Durable signs shall be installed at the 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 22-3.4.2-1, are maintained between the crane or the load being handled and energized power lines.

If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of Section 22-3.1, even if such devices are required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved and to lessen the potential of false security, instructions on the electrical hazard involved, operating conditions for the devices, limitations of such devices, and testing requirements prescribed by the device manufacturer, if used, shall be understood by the crane operator, crew, and load-handling personnel. The required clearances to electrical lines, established in Table 22-3.4.2-1, shall be maintained, regardless of any devices used on the crane.
22-3.4.3 **Operation in the Vicinity of Deenergized Electric Power Lines Other Than Transmission and Distribution Lines**

Crane Operation: Within the Erected/Fully Extended Boom Length of the Prohibited Zone, With the Electric Power Lines Energized

This is the preferred condition for crane operation when the crane is required to work in the vicinity of electric power lines that are not in transmission or distribution service and that are insulated for the voltage at which they operate since the hazard of injury or death due to electrocution has been removed.

The following steps shall be taken to ensure deenergization of power lines:

(a) The utility owner/operator of the power lines shall deenergize the power lines.
(b) The necessity for grounding the power lines shall be determined by the utility owner/operator of the electric power lines.
(c) A qualified representative of the utility owner/operator of the power lines shall come to the site to verify that the steps of paras. 22-3.4.3(a) and 22-3.4.3(b) have been completed and that the power lines are grounded and deenergized.

The following steps shall be taken to minimize the hazard of electrocution or serious injury as a result of contact between the energized power lines and the crane, load line, or load (see Fig. 22-3.4.1-1, illustration (c)).

(a) An on-site meeting between project management and a qualified representative of the owner of the lines or a designated representative of the electrical utility shall take place to establish the procedures to safely complete the operations.
(b) The specified clearance between the power lines and the crane, load line, and load shall be maintained at all times (see Table 22-3.4.2-1).
(c) Load control, when required, shall use tag lines of a nonconductive type.
(d) A qualified signalperson(s) whose sole responsibility is to verify that the required clearance is maintained shall be in constant contact with the crane operator.
(e) No one shall be permitted to touch the crane or the load, unless the signalperson indicates it is safe to do so.
(f) Operation of boom and load over electric power lines is extremely dangerous, due to perception of distance and multiple contact points as viewed from the position of the operator and/or position of the signalperson. The operator should avoid operating the crane, with or without a load in this area.
(g) The horizontal and vertical distance of movement of long span lines due to the wind shall be added to the minimum clearance distance as specified in Table 22-3.4.2-1. A qualified representative of the owner of the lines or a designated representative of the electrical utility shall be consulted for specific distances.
(h) Devices such as ribbons or balls should be attached by a qualified person to the power lines to improve visibility, or equivalent means employed to aid in location of the prohibited zone.
(i) Durable signs shall be installed at the 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 22-3.4.2-1, are maintained between the crane or the load being handled and energized power lines.
(j) If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of Section 22-3.4, even if such devices are required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved and to lessen the potential of false security, instructions on the electrical hazard involved, operating conditions for the devices, limitations of such devices, and testing requirements prescribed by the device manufacturer, if used, shall be understood by the crane operator, crew, and load-handling personnel. The required clearances to electrical lines, established in Table 22-3.4.2-1, shall be maintained, regardless of any devices used on the crane.

22-3.4.4 **Transit or Travel in the Vicinity of Energized Electric Power Lines With No Load and Boom Lowered**

Crane Operation Within the Prohibited Zone With the Electric Power Lines Energized

(a) While the crane is in transit or traveling with no load and the boom and boom support system are sufficiently lowered, the specified clearance in Table 22-3.4.2-1 shall be maintained. When planning transit or travel of the crane, the effect of speed and terrain on boom and crane movement shall be considered.
(b) While traveling, a dedicated spotter shall be used if any part of the equipment will be within 20 ft (6.1 m) of an electric power line at any time.
22-3.4.5 Operation in the Vicinity of Energized Electric Power Lines and the Crane Configuration May Not Be Capable of Reaching Within the Specified Clearance.

No part of the equipment, load line, or load shall be allowed in the vicinity of a power line unless the power lines are deenergized in accordance with para. 22-3.4.2 or para. 22-3.4.3 or where the power lines remain energized during crane operations in the vicinity of power lines, the following is required:

(a) The horizontal and vertical distance of movement of power lines due to the wind, sag, or other conditions shall be added to the initial specified clearance.

(b) Evaluate if the equipment, load line, or load is capable of reaching within the resultant specified clearance.
   (1) If the equipment, load line, or load is capable of entering within the resultant specified clearance and the crane is not operating below energized power lines, the requirements applicable under either para. 22-3.4.6 or para. 22-3.4.8 shall be followed.
   (2) If the equipment, load line, or load is not capable of reaching within the resultant specified clearance and the crane is not operating below energized power lines, the lift director shall conduct an on-site planning meeting with the operator and the other workers who will be in the area of the equipment or load to review the location of the power line(s).

Steps shall be taken to minimize the hazard of electrocution or serious injury as a result of contact between the energized power lines and the crane, load line, or load.

(a) Before such operations take place, a qualified person together with a qualified representative of the utility or an engineer qualified in power-line transmission shall, after visiting the site, determine if this is the most feasible way to complete the operation and set minimum required clearances and procedures for such operations. These operations shall be under their supervision. The following may be required:
   (1) Crane/load grounded to line neutral by the utility
   (2) Electrical system protective devices that automatically re-energize the circuit after a power line contact occurrence should be blocked or disengaged to inhibit this function
   (3) Insulated barriers that are not a part of nor an attachment to the crane and will not allow contact between the energized electric power lines and the crane, load lines, or load
   (4) Nonconductive barricades to restrict access to the crane work area
   (b) Load control, when required, shall use tag lines of a nonconductive type.
   (c) Crane shall not be operated from control station where operator is in contact with both the controls/crane and the ground. Only elevated control stations or wireless remotes shall be used.
   (d) A qualified signalperson(s), whose sole responsibility is to verify that the clearances established in para. 22-3.4.4(a) are maintained, shall be in constant contact with the crane operator.
   (e) The person(s) responsible for the operation shall alert and warn the crane operator and all persons working around or near the crane about the hazard of electrocution or serious injury and instruct them on how to avoid the hazard.
   (f) All nonessential personnel shall be removed from the crane work area.
   (g) No one shall be permitted to touch the crane or the load, unless the signalperson indicates it is safe to do so.

If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of Section 22-3.4, even if such devices are required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved and to lessen the potential of false security, instructions on the electrical hazard involved, operating conditions for the devices, limitations of such devices, and testing requirements prescribed by the device manufacturer, if used, shall be understood by the crane operator, crew, and load-handling personnel. The required clearances to electrical lines, established in Table 22-3.4.2-1, shall be maintained, regardless of any devices used on the crane.

22-3.4.65 Operation in the Vicinity of Energized Electric Power Lines and the Crane Configuration May Be Capable of Reaching Within the Specified Clearance. Operations in Transit With No Load and Boom Lowered.

No part of the equipment, load line, or load shall be allowed in the vicinity of a power line unless the lines are deenergized in accordance with para. 22-3.4.2 or para. 22-3.4.3, or where the power lines remain energized during crane operations in the vicinity of power lines, the following is required:
(a) The horizontal and vertical distance of movement of power lines due to the wind, sag, or other conditions shall be added to the initial specified clearance.

(b) Evaluate if the equipment, load line, or load is capable of reaching within the resultant specified clearance.

   (1) If the equipment, load line, or load is not capable of reaching within the resultant specified clearance and the crane is not operating below energized power lines, the requirements applicable under para. 22-3.4.5 shall be followed.

   (2) If the equipment, load line, or load is capable of reaching within the resultant specified clearance but the work is planned so that the equipment, load line, or load shall not enter into the specified clearance and the crane is not operating below energized power lines, the following steps shall be taken to minimize the hazard of electrocution or serious injury as a result of contact between the energized power lines and the equipment, load line, or load:

      (-a) The equipment, load line, or load shall not enter into the resultant specified clearance.

      (-b) The lift director shall conduct an on-site planning meeting with the operator and the other workers who will be in the area of the equipment or load to review the location of the power line(s) and the steps that shall be implemented to prevent encroachment / electrification.

      (-c) Tag lines, when required, shall be of a nonconductive type. Nonconductive material can become conductive when exposed to moisture or contamination.

      (-d) Erect and maintain an elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings to mark the working radius at or farther than the specified clearance distance from the power lines.

      (-e) Implement at least one of the following measures. If at any time the operator is unable to see the elevated warning line, barricade, or line of signs, a dedicated spotter shall be used in addition to complying with (-2) or (-3) below.

         (-1) A dedicated spotter shall

            (+a) be equipped with a visual aid to assist in identifying the specified clearance distance.

            (+b) be positioned to accurately gauge the clearance distance.

            (+c) when necessary, use equipment that enables direct communication with the operator.

            (+d) give timely information to the operator so that the specified clearance can be maintained.

         (-2) A device that automatically warns the operator when to stop movement shall be set to give the operator sufficient warning to prevent encroachment.

         (-3) A device that automatically limits the range of movement shall be set to prevent encroachment.

(a) While in transit with no load and boom and boom support system lowered, the clearance shall be as specified in Table 22-3.4.2-1 [also see Fig. 22-3.4.1-1, illustration (b)].

(b) When planning transit of the crane, the effect of speed and terrain on boom and crane movement shall be considered.

22-3.4.7 Operation Below Energized Electric Power Lines.

No part of the crane, load line, or load (including rigging and lifting accessories) shall be allowed directly below a power line unless the power lines are deenergized in accordance with para. 22-3.4.2 or para. 22-3.4.3 or where the power lines remain energized during crane operations below power lines, the following is required:

(a) The horizontal and vertical distance of movement of power lines due to the wind, sag, or other conditions shall be added to the initial specified clearance as established in para. 22-3.4.1. A qualified representative of the utility owner/operator of the power lines shall be consulted for specific movement distances.

(b) Identify if the crane is capable of reaching within the resultant specified clearance.

   (1) If the load or uppermost part of the crane is capable of entering within the resultant specified clearance and the crane is operating below energized power lines, the requirements of para. 22-3.4.8 shall be followed even if the work is not within the specified clearance.
If the load or uppermost part of the crane is not capable of reaching within the resultant specified clearance, the lift director shall conduct an on-site planning meeting with the operator and the other workers who will be in the area of the equipment or load to review the location of the power lines.

**22-3.4.8 Operation Within the Specified Clearance With the Electric Power Lines Energized.**
The following steps shall be taken to minimize the hazard of electrocution or serious injury as a result of contact between the energized power lines and the equipment, load line, or load. Before such operations take place, the lift director, together with a qualified representative of the utility owner/operator of the power lines or an engineer qualified in electrical power transmission, shall, after visiting the site, determine if this is the most feasible way to complete the operation and set minimum approach distances and procedures for such operations. The procedures developed to comply with this section shall be documented and readily available on site. These operations shall be under their supervision. The following shall be required:

(a) The lift director shall conduct an on-site planning meeting with the operator and the other workers who will be in the area of the equipment or load to review the location of the power line(s) and the steps that shall be implemented to prevent encroachment/electrification.

**Section 22-3.5 MISCELLANEOUS**

**22-3.5.1 Cabs**

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

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