Handling Loads Suspended from Rotorcraft
FOREWORD

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

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

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the committee organized November 4, 1926, with 57 members representing 29 national organizations. The Safety Code for Cranes, Derricks, and Hoists, ASA B30.2-1943, was created from the eight-page document referred to in the first paragraph. This document was reaffirmed in 1952 and widely accepted as a safety standard.

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Naval Facilities Engineering Command, U.S. Department of the Navy, was reorganized as an American National Standards Committee on January 31, 1962, with 39 members representing 27 national organizations.

The format of the previous code was changed so that separate volumes (each complete as to construction and installation; inspection, testing, and maintenance; and operation) would cover the different types of equipment included in the scope of B30.

In 1982, the Committee was reorganized as an Accredited Organization Committee, operating under procedures developed by 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 B30 Standard 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.

This Volume of the Standard contains many revisions that were approved by the B30 Committee and ASME. This Volume of the Standard was approved by ANSI and designated as an American National Standard on TBD.
Handling Loads Suspended from Rotorcraft

Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
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Chapter 12-0 Scope, Definitions, and References

SECTION 12-0.1: SCOPE OF B30.12

Within the general scope as defined in Section I of the Introduction, B30.12 applies to the load handling activity (LHA), of loads suspended from rotorcraft using a cargo sling or powered hoist, or other attaching means to lift, carry, pull, or tow a jettisonable load outside of the rotorcraft airframe. This volume does not establish any design specifications for the rotorcraft or the non-human external cargo (NHEC) components specified by the rotorcraft manufacturer and this volume is not applicable to unmanned aerial vehicles (UAV). See ASME B30.32 for UAVs.

Section 12-0.1.1 Purpose of B30.12

The purpose of this Volume is to protect flight crews, ground personnel, and property on the surface while working directly with or in the vicinity of rotorcraft conducting non-human external-load operations.

SECTION 12-0.2: DEFINITIONS

12-0.2.1 Rotorcraft External Load Classifications

Class A rotorcraft external load: a load combination in which the external load cannot move freely, cannot be jettisoned, and does not extend below the landing gear. This category usually features multiple attachments to the airframe. A typical example is a hard-mounted cargo basket attached to the rotorcraft airframe that is used to carry cargo from points A to B (included for reference only).

Class B rotorcraft external load: a load combination in which the external load is jettisonable and lifted free of land or water during the rotorcraft LHA. The load is typically suspended from a hook or similar device. The hook may be attached to the rotorcraft structure or to a movable hoist cable and the hoist itself rigidly attached to the rotorcraft. Typical use is to lift a cargo load until it is completely airborne and fly it from points A to B.

Class C rotorcraft external load: a load combination in which the external load is jettisonable and remains in contact with land or water during rotorcraft operation. The load is typically partially suspended by a net, slings, or ropes from a cargo hook or similar device. The cargo hook may be attached to the rotorcraft structure, or to a movable hoist cable and the hoist itself rigidly attached to the rotorcraft. It is typically used for stringing wire or laying cable, rope, strand, etc. where the load is partially suspended from the ground or attached to a structure elevated from the ground.

Class D rotorcraft external load: a load combination in which the external load is other than a Class A, B, or C, and has been specifically approved by the administrator for that operation. This load combination includes human cargo. For human cargo operations, the load that typically consists of personnel and their containment device is suspended from a hook or similar device during all or part of the flight. The hook may be attached to a movable hoist cable and the hoist itself rigidly attached to the rotorcraft. Typical use is for transfer of personnel to/from a ship. Carrying devices may transport one or more persons. Typical carrying devices are vest and straps, baskets, life preservers with straps and attachment devices, cages, harnesses, or a suspended container (included for reference only).

12-0.2.2 General Definitions

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to the operation of the equipment, such as excessively high or low ambient temperatures, exposure to weather, corrosive fumes, dust-laden or moisture-laden atmospheres, and hazardous locations.
administrative or regulatory authority: governmental agency or the employer, in the absence of governmental jurisdiction.

administrator: The Federal Aviation Administrator or any person to whom he has delegated his authority in the matter concerned.

aircraft: a device that is used or intended to be used for flight in the air.

airframe: the fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces (including rotors but excluding propellers and rotating airfoils of engines), and landing gear of an aircraft, and their accessories and controls.

approach/departure path: Means a prescribed area extending outward and upward at a prescribed ratio from a landing or takeoff area.

attitude: the position of the rotorcraft or suspended load with reference to a horizontal position, such as nose up or down.

backup quick-release subsystem (BQRS): the secondary or second-choice subsystem used to perform a normal or emergency jettison of external cargo.

bank angle: The angle between the lateral axis of flight and the horizon.

below-the-hook lifting device: a device used for attaching a load to a hoist, hook or load attachment point. The device may contain components such as slings, hooks, and rigging hardware addressed by other ASME B30 volumes.

birdcaging: a rope condition that results in deformation with the outer strands being displaced away from the rope axis. It is usually the result of shock loading or localized twisting in a rope.

cargo: the part of the rotorcraft load combination (RLC) that is removable, changeable, and attached to the rotorcraft by an approved means.

cargo net: A type of net made of synthetic rope, or wire rope that is typically square or rectangle with cinch ropes extending from the corners.

chocking: blocking to prevent rolling or other inadvertent movement of the wheels of an aircraft when on the ground or other supported areas with a block of wood, metal, or other substance.

choker hitch: a method of rigging a sling in which the sling is passed around the load, then through one loop eye, end fitting, or another device with the loop eye or end fitting attached to the lifting device. This hitch can be made with a sliding choker hook or similar device.

closed-throat load beam: that weight-bearing part of a primary cargo hook that must be manually relatched or closed. See Fig. 12-0.2.1-1).

commercial operator: the company, firm, individual, or other business enterprise that, for compensation or hire, engages in the carriage by aircraft in air commerce of persons or property.

container, load: A conveyance used to transport material with attachments points used to secure itself and cargo to the rigging.
contractor: the company, firm, individual, other business enterprise, or entity that contracts with a commercial operator to perform work.

copilot: a pilot who is designated to be second in command of an aircraft during flight time.

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

design factor: ratio between nominal or minimum breaking force and rated load of the component.

designed breaking load: the minimum load at which a newly fabricated and unused sling is expected to break when loaded to destruction in direct tension.

suspended load drag angle: is the angle formed between a vertical line passing through the suspension point of the load and trailing line suspending the load.

dynamic rollout: aka Ring Rollout, is a situation that can occur when loads are hooked up to certain hoist or long line hooks not currently under a load.

external lift or load operation: any operation involving a rotorcraft carrying an external load.

external load: a load that is carried or extends outside of the aircraft fuselage.

external load attaching means: the structural components used to attach an external load to an aircraft, including external load containers, the backup structure at the attachment points, and any quick-release device used to jettison the external load. This includes any structure, mounts, hooks, hoists, and lines used to connect the external load

FAA: Federal Aviation Administration.

FAR: Federal Aviation Regulations.

Flexible Intermediate Bulk Container, FIBC (Super Sack): A fluid (solid in the granulated/suspension form) handling container whose contents conform to its shape, and whose contents exert a pressure on the supporting surfaces of the container.

flight crew member: a person assigned to perform duty in an aircraft during flight time.

flight visibility: the average forward, horizontal distance from the cockpit of an aircraft in flight at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

ground crew(s): those designated persons specifically required to be on or near the job site in support of the load handling activity.

helicopter: a rotorcraft that derives its horizontal and vertical flight ability primarily from its engine-driven rotors. In this Volume, it will be the basic vehicle for lifting, hoisting, pulling, towing, and moving cargo.

hoist (noun): a powered, airframe-mounted device for raising or lowering a rotorcraft external load.

hoist (verb): to raise or lower a load with a rotorcraft-mounted hoist.
hook, cargo, primary: a device attached to or suspended from an aircraft that is used to connect an external load to the aircraft through direct coupling or by lead lines; this unit features both a primary (electrical) quick-release device and a backup (nonelectric) quick-release device.

hook cage enclosure: A Guard placed around the remote cargo hook to prevent accidental contact with adjacent objects or structures.

human external cargo (HEC): a person(s) that at some point in the operation is carried external to the rotorcraft.

jettison, emergency (complete load release): the intentional, instantaneous release of nonhuman external cargo (NHEC) or HEC in a preset sequence by the quick-release system (QRS) that is normally performed to achieve safer operation of the rotorcraft in an emergency.

jettison, normal (selective load release): the intentional release, normally at optimum jettison conditions, of NHEC.

jettisonable load: a Class B, C, or D rotorcraft external load that can be intentionally released by the PIC or designated flight crew member in flight, using either a primary quick-release system (PQRS) or BQRS.

keeper: a device, usually spring loaded, that prevents the apex fitting of a sling from slipping off the load beam of the cargo hook (see Fig. 12-0.2.1-2).

kV: kilovolts; equal to 1,000 V of electricity.

large aircraft: an aircraft of more than 12,500 lb, maximum certificated takeoff weight.

leadline: an external load attachment sling system in which any combination of load and line causes the external load to extend 50 ft or less beneath the aircraft fuselage when suspended from the aircraft’s primary cargo hook, or hoist.

lift: to raise the load by flight of the rotorcraft.

lift director: lift director (load handling director): the person designated to direct the load handling activity.

lifting attachment: a load-supporting device that is bolted or permanently attached to the lifted load, such as lifting lugs, padeyes, trunnions, and similar appurtenances

limit loads: the maximum load(s) to be expected in service.

limit switch: a device that, by predetermined adjustment, limits the rotational or linear movement of a mechanism.

load: the static weight of the object being lifted or lowered, including the sling and any other ancillary attachments, not included as part of the rotorcraft or rotorcraft hoist system.

load factors: bank load factor; drag load factor; combined load factor;

  drag load factor, DLF: is static equilibrium derived from the angle of loading between the rigging equipment eg. longline and a vertical rigging attachment point to the rotorcraft.

  bank load factor, BLF: is static equilibrium derived from the angle of loading between the rigging equipment eg. longline and a horizontal plane through rigging the attachment point to the rotorcraft.
combined Load Factor, CLF: is the product of the DLF x BLF x Gs where “Gs” is a multiple to the acceleration due to gravity.

load ratings: the maximum load that a rotorcraft or other item of lifting equipment is authorized to lift, as specified by the manufacturer, the FAA, or the applicable regulatory authority.

longline: an external load attachment sling system in which any combination of load and line causes the external load to extend greater than 50 ft beneath the aircraft fuselage when suspended from the aircraft’s primary cargo hook, or hoist.

main rotor(s): the rotor that supplies the principal lift to a rotorcraft.

manual-release device: a cargo hook-mounted, mechanical release mechanism typically used by ground crews to open the cargo hook independent from the rotorcraft’s PQRS or BQRS (see Fig. 12-0.2.1-2).

maximum gross weight: the maximum approved gross weight of the rotorcraft and its load in any configuration.

nonhuman external cargo (NHEC): any external cargo operation that does not, at any time, involve a person(s) carried external to the rotorcraft.

open-throat load beam: that load-bearing member of a cargo hook designed so that in its normal operating position, it is possible to slide the apex fitting of a sling directly onto the load beam without opening the hook (see Fig. 12-0.2.1-2).

operation: the use of a rotorcraft lifting loads outside its fuselage to accomplish various lifting and placing tasks. The task may consist of just one lift or may be of long or indefinite duration. (See also external lift or load operation.)

operator (rotorcraft): the company, firm, individual, or other business enterprise owning or leasing the rotorcraft that is responsible for its operation and airworthiness.

pilot-in-command (PIC): the person who has the final authority and responsibility for the operation and safety of the flight, has been designated as pilot-in-command before or during the flight, and holds the appropriate category, class, and type rating, if appropriate, for the conduct of the flight.

primary quick-release subsystem (PQRS): the primary or first-choice subsystem used to perform a normal or emergency jettison of external cargo.

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

quick-release system (QRS): the entire release system for jettisonable external cargo (i.e., the sum total of both the PQRS and BQRS). The QRS consists of all components, including the controls, the release devices, and any other associated components.

rated load: the maximum allowable working load established by the lifting component manufacturer.

rated load (rotorcraft): the maximum allowable gross weight of the rotorcraft and any external load combination established by the rotorcraft manufacturer, and regulated by the FAA or authority having jurisdiction.
rating: a statement that, as a part of a certificate, sets forth special conditions, privileges, or limitations.

rescue hook: a hook that can be rated for both HEC and NHEC. It is typically used in conjunction with a winch/hoist or equivalent system.

rope: refers to wire rope unless otherwise specified.

rotorcraft: a heavier-than-air aircraft that depends principally for its support in flight on the lift generated by one or more rotors.

rotorcraft flight manual: the FAA- or other regulatory authority-approved flight manual issued by the rotorcraft manufacturer that defines the operating limitations for each aircraft.

rotorcraft ground crew: those personnel employed and/or designated by a rotorcraft operator or the PIC to support and assist the PIC in the conduct of an external load operation.

rotorcraft load combination (RLC): the combination of a rotorcraft and an external load, including the external load-attaching means. RLCs are designated as Classes A, B, C, and D.

rotorcraft load combination operation and flight manual: the FAA- or other regulatory authority-approved manual prepared and used by the aircraft operator, designating each rotorcraft model’s limitations, performance, and procedures for which the airworthiness of the rotorcraft has been demonstrated.

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

rotorcraft user: The rotorcraft user has physical control of a rotorcraft by virtue of lease or rental.

second-in-command (SIC): a pilot who is designated to be second in command of an aircraft during flight time. (See also copilot.)

shall: indicates that the rule is mandatory and must be followed.

should: indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

signalperson: a designated individual who, through radio, intercom, or standardized hand signals, can direct the PIC when a load is being lifted or set into place.

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

small aircraft: an aircraft of 12,500 lb or less, maximum certificated takeoff weight.

tagline: a line attached to a load used as a guide or restraint by the ground or erecting crew.

tail rotor: a small, horizontally positioned auxiliary rotor system located at the rear (tail) of the helicopter that provides anti-torque thrust in the appropriate direction to neutralize the main rotor torque effect inherent in single-rotor helicopters.

vertical reference: the PIC technique of controlling the aircraft while looking down vertically at the load attached to the cargo hook.
**vertical acceleration**: is the change in velocity vertically during the ascent or descent of a body and is expressed as a factor of the gravitational acceleration, \( g \).
SECTION 12-0.3: REFERENCES
The following is a list of publications referenced in this Volume:

ASME B30.3-2019, Tower Cranes

ASME B30.9-2018, Slings

ASME B30.10-2019, Hooks


ASME B30.16-2022 Overhead, Underhung, and Stationary Hoists

ASME B30.20-2018, Below-the-Hook Lifting Devices

ASME B30.26 2015, Rigging Hardware

ASME BTH-1-2017, Design of Below-the-Hook Lifting Devices

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM A391-2007, Specifications for Alloy Steel Chain

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, (www.astm.org)

Federal Aviation Regulations (FAR), Parts 1, 21, 27, 29, 43, 61, 63, 65, 67, 91, and 133


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

ISO 21898 – 2004-07-01 Packaging — Flexible intermediate bulk containers (FIBCs) for non-dangerous goods;

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Further operational recommendations and best practices for power line work can be found in the Helicopter Association International; Utilities, Patrol and Construction Committee document; UPAC Safety Guide for Helicopter Operators

Revised June, 2019.
CHAPTER 12-1 External Load Ratings and Characteristics

SECTION 12-1.1: LOAD RATINGS

12-1.1.1 Rotorcraft
The Rotorcraft Load Combination, RLC, may only be operated within the limitation parameters as established by the rotorcraft manufacturer.

12-1.1.2 External Load Attaching Means
The rotorcraft shall be certified by the FAA or authority having jurisdiction for specific External Load classifications for non-human external cargo (NHEC). The Users and Owners shall provide/use rotorcraft and components for NHEC operations that are compliant with the requirements of the Federal Aviation Administration (FAA) or other authority having jurisdiction.

12-1.1.3 Primary Hook(s)
The primary hook(s) rated capacity on the rotorcraft for NHEC shall be as specified by the manufacturer. Load handling activities shall not exceed the hook manufacturer's rating or the certification of the FAA or other authority having jurisdiction.

12-1.1.4 Hoist
The hoist rated capacity on the rotorcraft for NHEC shall be as specified by the manufacturer. Load handling activities shall not exceed the hoist manufacturer's rating or the certification of the FAA or other authority having jurisdiction.

SECTION 12-1.2: LOAD CHARACTERISTICS and CONTROL
During NHEC operations, abnormal operating conditions as well as the load’s size, composition and weight shall, in the judgment of the PIC, not adversely affect the air worthiness and safety of the rotorcraft. The PIC shall refuse to undertake any load handling activity that in his judgement will adversely affect the air worthiness and safety of the rotorcraft.

Recommendations of the PIC, for the use of additional load handling control means such as drogue chutes, to assist in the air worthiness of the rotorcraft shall be implemented prior to commencing NHEC operations.
Chapter 12-2 Lifting – Rigging Components

Section 12-2.1 Hook with Open-Throat Load Beam

12-2.1.1 General Requirements

12-2.1.1.1 Rotorcraft External-load attaching means shall be specified by the rotorcraft manufacturer and approved by the FAA or authority having jurisdiction.

12-2.1.1.2 Remote Cargo Hook Arrangements (non-External-load attaching means)
Only Cargo hooks of the self-locking type, having a QRS operable by the flight crew during flight, shall be used. Note: The remote cargo hook is typically attached to the rotorcraft main structure or other features designed into the rotorcraft that meet FAA regulations or authority having jurisdiction.

SECTION 12-2.2 Impact of Rotorcraft Maneuvering on Resultant Forces on Rigging Components

12-2.2.1 Combined Maneuvering Forces/Tension/Load on Rigging Components.

12-2.2.1.1 Combined Maneuvering Forces on Rigging Components.
(a) The effects of bank angle, see Figure 12-2.2.1-1, drag angle, see Figure 12-2.2.2-1, and acceleration shall be considered and applied by the PIC or a qualified person when sizing the rigging components for load handling activities. The calculated combined forces of maneuvering (bank, drag, acceleration, environment) on rigging components shall be evaluated and approved by the PIC.

(b) The rigging components rated capacities shall be sufficient for the load combination creating the highest rigging component tension during load handling activity, and shall have addressed at least:

i. Load weight and bank angle load factor (BLF)
ii. Load weight and drag angle load factor (DLF)
iii. Load weight and vertical acceleration (Gs)
iv. Sling angle to the line of action of the longline or leadline in use.
v. Any other factors that impose additional forces on the rigging components including environmental conditions
12-2.2.2 Rotorcraft Bank Angle Impact on Rigging Components Strength

The tension in the load’s rigging components will increase due to forces imposed by a rotorcraft’s bank angle while in flight. The PIC shall evaluate the rated load of the rigging components to assure they are of sufficient capacity to meet both the effects of the load’s weight and any anticipated bank angle. BLFs can be found in nonmandatory Appendix A along with a calculation method.

12-2.2.3 Rotorcraft Drag Angle Impact on Rigging Components Strength

The tension in the load’s rigging components will increase due to forces imposed by the load’s drag angle while in flight. The PIC shall evaluate the rated load of the rigging components used to assure they are of sufficient capacity to meet both the effects of the load’s weight and any anticipated drag angle. Drag forces may be reduced by increasing the length of longline or leadline in use. DLFs can be found in nonmandatory Appendix A along with a calculation method.
12-2.2.4 Changes in Acceleration
The tension in the load’s rigging components will increase due to forces imposed by changes in vertical acceleration of a rotorcraft while in flight. The PIC shall evaluate the rated load of the rigging components used to assure they are of sufficient capacity to accept both the effects of the load’s weight and any expected vertical acceleration. Vertical acceleration factors used shall be those provided in the rotorcraft manufacturer’s operation documentation or by communication with the rotorcraft manufacturer, or as specified by the PIC.

SECTION 12-2.3 Longlines and Leadlines

12-2.3.1 Longline

Figure 12-2.3.1-1 shows a longline arrangement consisting of two lines hooked together end to end through end connections.

Figure 12-2.3.1-1 represents an in-field assembly of a longline consisting of compatible structural assemblies. Electrical components used in any longline assembly shall be compatible with the rotorcraft and the assembled longline shall be operationally tested prior to use.

12-2.3.1.1 Synthetic Rope Longline
Longlines shall be constructed utilizing high performance synthetic ropes in accordance with ASME B30.30 Chapter 2.
(a) Longlines shall have a minimum length of 50 feet including end fittings.
(b) Synthetic longlines shall be sized not less than ½ inch diameter.
(c) Synthetic longlines, including rope terminations, shall have a minimum design factor of 5 based on section 12-2.2.4 Combined Maneuvering Effects on Rigging Components.
(d) Longlines designed, constructed, and selected based on (c) above shall be proof tested to 2X its rated load by the longline manufacturer. The proof tested Longline shall be inspected in accordance with manufacturer’s inspection criteria for removal from service.
(e) Synthetic Longline Certification and Identification Markings shall comply with ASME B30.30, 30-2.5.5 Synthetic Rope Certificate.
(f) Longlines should be weighted to reduce the hazards from excess line movement caused by rotor wash and turbulence.

12-2.3.1.3 Wire Rope Longline
External loads should be lifted with longlines manufactured using rotation-resistant wire rope. Alternative wire rope selection for longline fabrication and use shall be evaluated by a qualified person for hazards related to the types of load handling activity planned. These hazards may include unlaying of the wire rope strands caused by rotation.

Wire rope longline shall:
(a) have a minimum design factor of 5 including rope terminations based on section 12-2.2.4 Combined Maneuvering Effects on Rigging Components,

12-2.3.2 Synthetic and Wire Rope Leadlines
Leadlines shall be approved by the PIC for use in load handling activity. Figure 12-2.3.1.2-1 below shows an example of a standard leadline.

Leadline particulars shall include the following:
(a) have a minimum length of 12 feet
(b) maximum length shall not exceed 50 feet including end fittings;
(c) Leadlines shall be sized not less than ½ inch diameter.

![Figure 12-2.3.1.2-1 shows the standard leadline length from bearing edge to bearing edge](image_url)

12-2.3.2.1 Synthetic Rope Leadline
Leadlines shall be constructed utilizing high performance synthetic ropes in accordance with ASME B30.30 Chapter 2.

(a) Synthetic leadlines, including rope terminations, shall have a minimum design factor of 5 based on section 12-2.2.4 Combined Maneuvering Effects on Rigging Components.
(b) Leadlines shall be weighted to eliminate the hazard of entanglement with rotorcraft rotors, and any other rotorcraft structure.
(c) Leadlines designed, constructed, and selected based on (a) above shall be proof tested to 2X its rated load. The proof tested leadlines shall be inspected in accordance with manufacturer’s inspection criteria for removal from service, and the end fitting manufacturer criteria for removal from service.

(d) Synthetic Leadline Certification and Identification Markings shall comply with ASME B30.30, 30-2.5.5 Synthetic Rope Certificate

12-2.3.2.2 Wire Rope Leadline
External loads should be lifted with leadlines manufactured using rotation-resistant wire rope. Alternative wire rope selection for leadline fabrication and use shall be evaluated by a qualified person for hazards related to the types of load handling activity planned. These hazards may include unlaying of the wire rope strands caused by rotation.

Wire rope leadline shall;
(a) Have a minimum design factor of 5 including rope terminations based on section 12-2.2.4 Combined Load Factor, CLF, from rotorcraft maneuvering effects on Rigging Components,
(b) Comply with ASME B30.9, Chapter 2.

Section 12-2.4 Rigging Components
The minimum rated load for rigging components attached to the load for rotorcraft load handling activity shall be determined using the following requirements:

12-2.4.1 Rigging Component Minimum Rated Load
(a) rotorcraft Combined Load Factor, CLF of 2.5
(b) the total static weight of the load applied.
(c) configuration applied includes.
   i. Hitch
   ii. Angle of loading
   iii. D/d Ratios
   iv. Center of Gravity
(d) component material strength
(e) design factor

SECTION 12-2.5 SLINGS
12-2.5.1 Slings Minimum Rated Load
The minimum rated load on slings shall be in accordance with Section 12-2.4.1

12-2.5.2 Sling Selection, Use, and Maintenance
Sling selection, use, and maintenance shall be in accordance with ASME B30.9

SECTION 12-2.6 RIGGING HARDWARE
12-2.6.1 Rigging hardware Minimum Rated Load
The minimum rated load on rigging hardware shall be in accordance with Section 12-2.4.1

12-2.6.2 Rigging hardware Selection, Use, and Maintenance
Rigging hardware selection, use, and maintenance shall be in accordance with ASME B30.26
Section 12-2.7 Hooks

12-2.7.1 Hooks Minimum Rated Load
The minimum rated load on hooks shall be in accordance with Section 12-2.4.1

12-2.7.2 Hooks; Selection, Use, and Maintenance
Hooks selection, use, and maintenance shall be in accordance with ASME B30.10

Section 12-2.8 Below-The-Hook (BTH) Devices

12-2.8.1 BTH Minimum Rated Load
The minimum rated load on BTH devices shall be in accordance with Section 12-2.4.1

12-2.8.2 BTH; Selection, Use, and Maintenance
BTH selection, use, and maintenance shall be in accordance with ASME B30.20

SECTION 12-2.9 Cargo Nets

12-2.9.1 Cargo Nets Minimum Rated Load
The minimum rated load for cargo nets shall be in accordance with Section 12-2.4.1

12-2.9.2 Cargo Nets; Selection, Use, and Maintenance
Cargo net selection, use, and maintenance shall be in accordance with the cargo net manufacturer’s instructions.

12-2.9.3 Cargo Net Material
Cargo net construction materials include polyester, polypropylene, nylon, Kevlar, and wire rope (IWRC).

SECTION 12-2.10 Flexible Intermediate Bulk Containers, FIBC

12-2.10.1 FIBC Minimum Rated Load
The minimum rated load for FIBC shall be in accordance with Section 12-2.4.1

12-2.10.2 FIBC; Selection, Use, and Maintenance
FIBC selection, use, and maintenance shall be in accordance with the FIBC manufacturer’s instructions, and ISO 21898.

12-2.10.3 FIBC Material
Flexible Intermediate Bulk Containers, FIBC, material, construction, and design shall comply with Section 4, ISO 21898 or a comparable standard for handling non-dangerous solid materials in powder, granular or paste form.

SECTION 12-2.11 LOAD ATTACHMENTS POINTS (NON-AIRFRAME)

12-2.11.1 LOAD ATTACHMENTS POINTS Minimum Rated Load
The minimum rated load for load attachments points shall be in accordance with Section 12-2.4.1

12-2.11.2 LOAD ATTACHMENTS POINTS; Selection, Use, and Maintenance
Load Attachment Points selection, use, and maintenance shall be in accordance with the manufacturer’s instructions, or qualified person performing the design, review of construction, fabrication, and testing of the load attachment points at final assembly.
12-2.11.3 LOAD ATTACHMENTS POINTS DESIGNED FOR LIFTING;
The Lift Planner shall ensure the calculated load on the load attachment points does not exceed the attachment rated load, as established by the attachment manufacturer.

12-2.11.4 LOAD ATTACHMENTS POINTS Material
Load Attachment Points, material, construction, and design shall meet the requirements of the load, stresses, configuration, and factor of safety imposed.
Chapter 12-3 Inspection

Section 12-3.1 Open Throat Load Beam Inspection

12-3.1.1 Primary Hook Inspection
The primary hook shall be inspected in accordance with the manufacturer’s recommendations, FAA Regulations, and/or the Authority having jurisdiction.

12-3.1.2 Remote Cargo Hook Inspection
The remote operated cargo hook visual inspection shall be performed prior to the beginning of load handling operations and prior to each lift.

The visual and operational inspections shall be in accordance with the manufacturer’s recommendations:

Section 12-3.2 Synthetic Slings and Synthetic Longline Inspection
Synthetic slings, and synthetic long lines shall comply with the following sections of ASME B30.9.

(a) Synthetic Rope Slings:
   a. SECTION 9-4.9: INSPECTION, REMOVAL, AND REPAIR
(b) Synthetic Webbing Slings:
   a. SECTION 9-5.9: INSPECTION, REMOVAL, AND REPAIR
(c) Polyester Roundslings:
   a. SECTION 9-6.9: INSPECTION, REMOVAL, AND REPAIR
(d) High Performance Roundslings:
   a. SECTION 9-7.9: INSPECTION, REMOVAL, AND REPAIR

Section 12-3.3 Wire Rope Slings and Wire Rope Longlines

12-3.3.1 Sling Inspection
Wire rope sling shall comply with ASME B30.9, Section 9-2.9 for inspection of wire rope slings.

12-3.3.2 Longline Inspection, Removal, And Repair
Wire rope longline inspections shall comply with requirements specified below. All inspections shall be performed by a designated person. Any deficiency identified shall be examined and a determination made by a qualified person as to whether it constitutes a hazard, and if so, what additional steps need to be taken to address the hazard.

12-3.3.2.1 Initial Inspection
Prior to use, all new, altered, modified, or repaired longlines shall be inspected to verify compliance with the applicable provisions. Written records are not required for initial inspections.

12-3.3.2.2 Frequent Inspection
a) Each shift: a visual inspection for damage shall be performed before the longline is used. Longlines used in severe or special service should be inspected before each use.
   (b) Longlines found with conditions such as those listed in para. 12-3.3.2.4 shall be removed from service. Longlines shall not be returned to service until approved by a qualified person.
12-3.3.2.3 Periodic Inspection

(a) A complete inspection of the longline shall be performed. Inspection shall be conducted on the entire length, including splices and fittings. Longlines found with conditions such as those listed in para. 12-3.3.2.4 shall be removed from service. Longlines shall not be returned to service until approved by a qualified person.

(b) Periodic Inspection Frequency. Periodic inspection intervals shall not exceed 1 yr [see (d)]. The frequency of periodic inspections shall be determined by the qualified person and should be based on:
   (1) frequency of longline use
   (2) severity of service conditions
   (3) nature of load-handling activities
   (4) experience gained on the service life of longlines used in similar circumstances

(c) Guidelines for the time intervals are
   (1) normal service — yearly
   (2) severe service — monthly to quarterly
   (3) special service — as recommended by a qualified person

(d) Periodic inspection is not required while the longline is in storage or idle. However, if more than 1 yr has passed since the last periodic inspection, the longline shall be subjected to applicable inspection.

12-3.3.2.4 Removal Criteria

A longline shall be removed from service if any of the following conditions are present:

(a) missing or illegible longline identification

(b) broken wires
   (1) 2 randomly broken wires in 6 rope diameters, or 4 broken wires in 30 rope diameters (pending research by the sub-committee, Al to review)

(c) severe localized abrasion or scraping resulting in a reduction from nominal diameter of more than 5%

(d) kinking, crushing, bird caging, or any other damage resulting in damage to the rope structure

(e) evidence of heat damage

(f) fittings that are cracked, deformed, or worn to the extent that the strength of the longline is substantially affected

(g) severe corrosion of the rope or fittings

(h) for hooks, removal criteria as stated in ASME B30.10

(i) for rigging hardware, removal criteria as stated in ASME B30.26

(j) other conditions, including visible damage, that cause doubt as to the continued use of the longline

(k) Loss of diameter in rotation-resistant rope could indicate core failure, and a qualified person shall immediately inspect the affected section(s) to determine if the rope needs to be removed from service. This condition will likely be characterized by lengthening of lay and diameter reduction in localized areas.

12-3.3.2.5 Repair

(a) Longlines shall be repaired only by the longline manufacturer, or a qualified person.
(b) A repaired longline shall be marked to identify the repairing entity.
(c) Components used for longline repair shall comply with the longline manufacturer’s recommendations, or the directions of a qualified person.
(d) Repair of hooks shall be as specified in ASME B30.10. Repair of below-the-hook lifting devices shall be as specified in ASME B30.20. Repair of all other components shall be as specified by the longline manufacturer, component manufacturer, or a qualified person.
(e) The wire rope used in the longline shall not be repaired.
(f) Modifications or alterations to a longline shall conform to all repair provisions of the longline manufacturer, or a qualified person.
(g) All repairs shall comply with the proof test requirements of longline manufacturer, or a qualified person.

Section 12-3.4 Cargo Nets Inspection

12-3.4.1 Cargo Net Inspection Criteria
Initial, frequent, and periodic inspections shall be performed by a qualified person in accordance with the cargo net manufacturer’s instructions.

Cargo nets shall be removed from service in accordance with the manufacturer’s removal criteria.

Section 12-3.5 Structural load attachments points

12-3.5.1 Inspection Deficiencies
Prior to the start of rotorcraft operations all structural load attachments points shall be inspected by a designated person. The inspection shall include the following:
(a) Deformation of the structural load attachment points
(b) Broken, cracked or missing welds
(c) Missing bolts, and fasteners
(d) Loose or improper fit between the structural load attachment and the load to be lifted
(e) Damaged or corroded components
(f) Excessive wear of components
(g) Missing instructions, configuration, and rated load information.

12-3.5.2 Deficiency Determination
(a) Deficiencies identified from inspections shall be cause for cancellation of the lift. A manufacturer or qualified person may examine these deficiencies to determine if they constitute a load handling hazard.
(b) The manufacturer or qualified person shall document the deficiencies and return the load handling activity to service once a determination is made that the deficiencies do not constitute a load handling hazard. A dated record of deficiencies found and disposition of the deficiencies shall be maintained on file by the net owner.

Section 12-3.6 Below-The-Hook Devices

12-3.6.1 Inspection and Testing
The inspection and testing of structural and mechanical lifting devices shall comply with ASME B30.20, SECTION 20-1.3
Section 12-3.7 Rigging Hardware and Hooks

12-3.7.1 Rigging hardware
Rigging hardware used in rotorcraft NHEC operations shall be inspected in accordance with the applicable ASME B30.26 as listed below:
(a) Shackles Section 26-1.8
(b) Adjustable hardware Section 26-2.8
(c) Compression Hardware Section 26-3.8
(d) Wire rope clips shall not be used in rotorcraft NHEC operations.
(e) Links, Master Link Subassemblies, Rings, and Swivels Section 26-4.8

12-3.7.2 Hooks
Hooks used in rotorcraft operations NHEC operations shall be inspected in accordance with the applicable ASME B30.10 as listed below:
(a) Section 10-1.10

Section 12-3.8 Selection, Inspection and Use of FIBCs

12-3.8.1
The FIBC (Flexible Intermediate Bulk Containers) should follow the inspection and use requirement such as provided in ISO 21898, Annex D.
Chapter 12-4 Operations

Section 12-4.1 Pre-Job Coordination: Rotorcraft Operator and Contractor
Where applicable, the rotorcraft operator’s representative and responsible contractor’s representative shall have a pre-job conference or communication for coordination.

This conference or communication shall cover, as a minimum, the following:

(a) precautions to be in effect at the rotorcraft landing area, pickup area, route to be flown, and delivery (setting) area, and arrangements for compliance with any other mutual requirements, including preparation, submission, and FAA or other regulatory approval of any required lift plan

(b) design, strength, and quantity of rigging, and how it will attach to the load, Chapter 12-4.

(c) accuracy of weights; structural strength of the load including lift points, size, and number of loads; and number of ground crews and personnel required for the operation

(d) assignment of responsibility for clearing and securing pickup and setting sites (see para. 12-4.4.17)

(e) maximum time that the rotorcraft can hover while ground crews are working beneath it

(f) type and quantity of personal protective gear provided for the ground crews

(g) type of scaffolding, if necessary, to be erected for ground crews to provide stable footing when attaching and unhooking the loads at elevated sites

(h) working conditions that could be hazardous to ground crews, such as rotor wash, rain, dust, static electricity discharge, and gusty winds

(i) if applicable, operations of the rotorcraft in proximity to electrical power lines (see para. 12-4.4.12)

(j) clearance of nonessential personnel from pickup site, setting site, and along the route of flight

(k) procedures for wetting down dusty and sandy areas

(l) provisions for a point of reference when the rotorcraft is hovering

(m) provisions for determining wind direction

(n) Regular signalpersons who are part of the rotorcraft operators crew should be used for difficult or otherwise precision-setting airlifts to make certain that the load is properly rigged, attached, and set before lifting or releasing.

(o) Suspending Operations

The PIC can suspend external load operations at any time, when, in the PIC opinion, unsafe or unfavorable conditions exist.
Section 12-4.2 Pre-Job Coordination: Instructions to ground crews directly participating in the operation shall be provided by the rotorcraft crew and include at least the following:

(a) Maintain in view the load and rotorcraft at all times

(b) Avoid working directly under any suspended load, except, when necessary, to the operation.

(c) To avoid injury, avoid being caught between the load and rotorcraft. Keep hands clear and in view when steadying the load, and grasp rigging from the sides or top, not underneath or between, the rigging and load.

(d) Verify installation and operation of keepers on all rigging hooks.

(e) Verify proper application of all hooks used for rigging.

(f) Wear all required personal protective equipment. Ensure personal protective gear fits properly.

(g) When using taglines, avoid entanglement. Do not wrap around any limbs or portions of the body.

(h) Use railings, lifelines, or fall-protection devices to prevent falling. Be aware of obstacles on the ground or deck that may be a trip or fall hazard. Take special care on slippery and wet surfaces.

(i) Pull cinch lines on cargo nets and rigging tight to prevent any objects from falling when the load is airborne. Avoid sharp objects protruding from cargo nets.

(j) Be alert for loads with damaged lifting provisions or rigging. Notify the rotorcraft crew immediately of suspected damage to rigging or lifting components.

(k) Position hooks so that when the strain is taken, the slings or cables will not damage or otherwise break keepers and slip out.

(l) Verify that all sling legs are free of detrimental twists or knots.

(m) Hold hook up during load attachment, and, when possible, load detachment so it can be seen by the signalperson(s) and will not snag objects on the ground when the rotorcraft is moving.

(n) Always watch the rotorcraft and be ready to move quickly out of the way in the event of an emergency. Know the emergency signals and procedures to be used and the need for rapid response.

(o) Report any mishaps or near mishaps to the rotorcraft crew immediately.

(p) To prevent being pinned and injured, do not stand or work between the load and other objects.

(q) Stay clear of swinging cargo hooks, rigging, and cargo suspended from rotorcraft.

(r) Do not grasp the load or tagline if it is rotating or swinging too fast.

(s) loads connected to the rotorcraft shall be discharged electrostatically before and during contact by ground personnel.
Section 12-4.3 Pre-Lift Meeting
(a) At a minimum, the following elements should be reviewed with all load handling activity personnel:

(1) Overview of the load handling activity

(2) LHE, rigging, and other equipment involved in the load handling activity

(3) the sequence of events and step-by-step procedures for the entire load handling activity

(4) safety measures, as required (e.g., Job Safety Analysis action items)

(5) load handling activity personnel assignments, addressing

   (a) individual responsibilities (e.g., location, time, task)

   (b) work location hazards

   (c) communication methods

      • Primary and back-up communications methods.

   (d) personal protective equipment requirements

   (e) qualification(s) of assigned personnel

(6) contingency measures as required for the load handling activity

(7) emergency action plan as required for the load handling activity

(b) Concerns raised during this meeting shall be addressed prior to proceeding with the load handling activity.

(c) At the completion of the pre-lift meeting, the lift director should confirm that the attendees understand the plan and their roles and responsibilities during the load handling activity.

Section 12-4.4 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. (A single individual may perform one or more of these roles).

a) Rotorcraft Owner. The rotorcraft owner has custodial control of a rotorcraft by lease or ownership, see 12-4.4.1.1
b) Rotorcraft User. The rotorcraft user arranges the rotorcraft’s presence on a worksite and determines it’s use there, see 12-4.4.1.2
c) Site Supervisor. The site supervisor exercises supervisory control over the work site on which the rotorcraft is being used and over the work that is being performed on that site, see 12-4.4.2.1.1.
d) Lift Director. The lift director directly oversees the work being performed by the rotorcraft and the associated rigging crew, see 12-4.4.2.1.2
e) Pilot in Command (PIC). The pilot in charge directly controls the rotorcraft functions and air crew, see 12-4.4.4.3
f) Rigger, see 12-4.4.5
g) Signal person see, 12-4.4.6
h) Static electricity discharge person, see 12-4.4.7
i) Ground Crew. In addition to lift director and site supervisor, the ground crew consist of the following personnel: rigger(s), signal person(s), and static electricity discharge person(s).

12-4.4.1 Responsibilities of the Rotorcraft Owner/Operator and Rotorcraft User.
In some situations, the owner and the user may be the same entity and is therefore accountable for all of the following responsibilities. In other cases, the user may lease or rent a rotorcraft from the owner without supervisory, operational, maintenance, support personnel, or services from the owner. In these situations, paras. 12-4.4.1.1 and 12-4.4.1.2 shall apply.

12-4.4.1.1 Rotorcraft Owner Operator. The rotorcraft owner’s responsibilities shall include the following:

a) Providing a rotorcraft that meets the requirements of all FAA guidelines and regulations or authority having jurisdiction, as well as specific job requirements defined by the user.
b) Providing a rotorcraft and all necessary components, specified by the manufacturer, that meets the user’s requested configuration and capacity.
c) Providing additional technical information pertaining to the rotorcraft, necessary for rotorcraft operation, when requested by the rotorcraft user.
d) Conducting site visits and risk assessment in advance of the operation.
e) Selecting/approving staging area, flight plan, refueling area, and emergency landing location.
f) Identifying load and lift information required.
g) Specifying ground crew identification needed from contractor such as colored hard hats, vests, or coveralls.
h) Providing ground crew operation-lift briefing.
i) Supporting actions and judgments of air crew.
j) Explaining flight limitations.

12-4.4.1.2 Rotorcraft User. The rotorcraft user’s responsibilities shall include the following:

a) Complying with the requirements of this Volume, manufacturer’s requirements, and regulations applicable at the worksite.
b) Clearly identifying and defining needs, tasks, and schedule.
c) Working with lifting subcontractor to locate and size an appropriate staging area, developing lift and flight plans, and making lift and laydown arrangements.
d) Complying with other requirements such as security along flight path and limiting access of non-essential personnel.
e) Using supervisors for rotorcraft activities that meet the requirements for a qualified person.
f) Verifying that the rotorcraft has the necessary lifting capacity to perform the proposed lifting operations in the planned configuration.
g) Ensuring that all personnel involved with the lifting operation are aware of their responsibilities, assigned duties, and associated hazards.
SECTION 12-4.4.2 Ground Crew Responsibilities

12-4.4.2.1 Responsibilities of the Site Supervisor and Lift Director. In some situations, the site supervisor and the lift director may be the same person and is therefore accountable for all of the following responsibilities.

12-4.4.2.1.1 Site Supervisor.
The site supervisor’s responsibilities shall include the following:

a) Ensuring that the rotorcraft meets the requirements prior to initial site staging.
b) Working with the lifting subcontractor and owner to plan and schedule moves.
c) Ensuring that rigging equipment is selected and approved, and plans are prepared and approved
d) Ensuring that a qualified person is designated as the lift director.
e) Ensuring that rotorcraft operations are coordinated with other jobsite activities that will be affected by or will affect lift operations.
f) Ensuring that the area for the rotorcraft is adequately prepared.
g) Restricting unauthorized access to the rotorcraft working area.
h) Coordinating risk assessment activities, including site visits at staging area, along flight path, and at laydown area.
i) Ensuring that necessary local, state, and federal permits are obtained, authorities notified and lift(s) are coordinated.
j) Ensuring that ground crew is trained and receives pre-job briefing.
k) Ensuring proper safety equipment is available for the ground crew

12-4.4.2.1.2 Lift Director. The lift director’s responsibilities shall include the following:

a) Being present at the jobsite during lifting operations.
b) Stopping rotorcraft operations if alerted to an unsafe condition affecting those operations.
c) Ensuring that the preparation of the area needed for rotorcraft operations has been completed prior to operations.
d) Ensuring that necessary ground-based traffic control is in place to restrict unauthorized access to the rotorcraft’s work area.
e) Ensuring that personnel involved with rotorcraft operations understand their responsibilities, assigned duties, and the associated hazards.
f) Identifying the signalperson(s) and conveying that information to the rotorcraft operator.
g) Ensuring that signalperson(s) appointed meet the requirements of Section 12-4.4.7.
h) Allowing rotorcraft operation near electric power lines only when the requirements of 12-4.5 and any additional requirements determined by the site supervisor have been met.
i) Informing the rotorcraft operator of the weight of loads to be lifted, as well as the lifting, moving and placing locations for these loads.
j) Shall verify that the stated weight does not exceed the rotorcraft rated capacity.
k) Ensuring that a rotorcraft’s load rigging is performed by personnel that meet the competence requirements in Section 12-4.4.6.
l) Ensuring that the load is properly rigged and balanced before it is lifted more than a few inches.

12-4.4.4.3 Pilot in Command. The PIC’s responsibilities shall include the following:

a) Confirming any changes in load specifications.
b) Conducting and review risk assessment.
c) Ensuring all parties are briefed.
d) Being well-rested before the load handling activity.
e) Not putting the aircraft or others at unnecessary risk.
f) Inspecting all equipment before job- hooks, electrical and manual releases.
g) Confirming communication methods, signals, and equipment.
h) Confirming load sequence and orientation markings.
i) Preparing and communicate emergency plans.

12-4.4.4 Ground Crew.
The ground crew responsibilities shall include:

a) Knowing and checking out communication equipment and signaling methods.
b) Knowing the procedures for emergency preparedness.
c) Knowing the load weights and all lift requirements.
d) Ensuring there is a briefing on load rigging, load sequence, and flight plan (direction of approach).
e) Knowing and following load-handling procedures.
f) Knowing the load orientation requirements and markings.
g) Wearing appropriate protective clothing and safety equipment.

12-4.4.5 Rigger Responsibilities and Qualifications.

12-4.4.5.1 Riggers Responsibilities
Riggers assigned to a rotorcraft load handling activity shall at a minimum be responsible for:

a) Ensuring the weight of the load and its approximate center of gravity have been obtained, provided or calculated.
b) Selecting the proper rigging equipment, inspecting it, and complying with the applicable operating practices according to the criteria of the applicable ASME volume (i.e., B30.9, B30.10, B30.20, B30.26).
c) Ensuring the rated load of the rigging equipment as selected and configured is sufficient for the load to be handled, based on the number of legs, hitch configuration, effects of angles, and effects of rotorcraft maneuvering load factors and vertical acceleration.
d) Ensuring the rigging equipment is properly attached to the hook, shackle, or other load handling device.
e) Ensuring that rigging equipment is adequately protected from abrasion, cutting or other damage, during load handling activities.
f) Ensuring the load is rigged in a manner to ensure stability during the load handling activity.
g) Knowing and understanding the applicable signals for the equipment in use.
h) Ensuring a tag line(s) is installed and used when additional load control is required.
i) Ensuring drogue chutes or equivalent devices are safely installed, when necessary, for load control during flight conditions with consultation with the PIC.

12-4.4.5.2 Riggers Qualifications
Prior to rotorcraft activities, rigger(s) shall be tested by a designated person and demonstrate their qualifications through written and practical examination in the following areas:

a) The requirements for slings, rigging hardware, and below-the-hook lifting devices, including their limitations, rigging practices, associated hazards, inspection requirements, and effects of rotorcraft maneuvering load factors and vertical acceleration on selection of rigging components attached to the load;
b) The application of the type of hitches used;
c) Load weight estimation, center of gravity, and effect of angle on rigging components.
d) The applicable operating practices according to the criteria of the applicable ASME volume (i.e. B30.9, B30.10, B30.20, B30.26).
e) Personnel performing rigging tasks who do not meet qualifications (a) thru (d) above (i.e. rigger trainees) shall be directly supervised by a qualified rigger while performing rigging activities.
f) Rigging personnel shall be competent in the use, application, configuration, and inspection of
equipment, included in the following ASME B30 Volumes listed in the Table 12-4.4.5.2-1 below.
Table 12-4.4.5.2-1 of Applicable ASME B30 Volumes

<table>
<thead>
<tr>
<th>Applicable ASME B30 Volumes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B30.9</td>
<td>Slings</td>
</tr>
<tr>
<td>B30.10</td>
<td>Hooks</td>
</tr>
<tr>
<td>B30.20</td>
<td>Below-The-Hook Lifting Devices</td>
</tr>
<tr>
<td>B30.26</td>
<td>Rigging Hardware</td>
</tr>
</tbody>
</table>

12-4.4.6 Signal Person Responsibilities and Qualifications

A signalperson assigned to a load handling activity shall at a minimum be responsible for:

a) Identifying themselves as the signalperson(s) to the PIC before commencing a load handling activity.
b) Confirming with the PIC the method of primary and back-up communications and the associated signals that are to be used during the load handling activity.
c) Ensuring that standard, discernible hand or voice signals provided to the PIC are in accordance with para. 12-4.4.6.1, 12-4.4.6.1.1, 12-4.4.6.1.2 and 12-4.4.6.1.3
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 PIC during all load handling activities.
f) Ensuring that all directions given to the PIC shall be given from the PIC’s perspective
g) Ensuring that each series of voice signals contains three elements stated in the following order:
   1) function and direction
   2) distance and/or speed
   3) function stop
h) Ensuring that special signals (when needed) that are not covered by para. 12-4.4.6.1.1 do not conflict with standard signals.
i) Avoiding giving signal commands that would result in loads being lifted over personnel whenever possible.
12.4.6.1 Standard Signals

12.4.6.1.1 Hand Signals

**HANDLING LOADS SUSPENDED FROM ROTORCRAFT**

- **LAND**
  - Arms crossed in front of body and pointing down.

- **TAKEOFF**
  - Right hand behind back, left hand pointing up.

- **MOVE REARWARD**
  - Hands above arm, palms out using a noticeable shoving motion.

- **MOVE FORWARD**
  - Combination of arm and hand movement in acollicating motion pulling toward body.

- **MOVE LEFT**
  - Right arm extended horizontally; left arm sweeps upward to position overhead.

- **MOVE RIGHT**
  - Left arm extended horizontally; right arm sweeps upward to position overhead.

- **MOVE UPWARD**
  - Arms extended, palms up, arms sweeping up.

- **MOVE DOWNWARD**
  - Arms extended, palms down; arms sweeping down.

- **HOLD – HOVER**
  - The signal “hold” is executed by placing arms over head with clenched fists.

- **RELEASE SLING LOAD**
  - Left arm held down away from body. Right arm cuts across left arm in a slashing movement from above.

Fig. 12.4.6.1-1 Rotorcraft Hand
12-4.4.6.1.2 Voice Signals
Prior to beginning lifting operations using radio communications, the communication terminology shall be discussed and agreed upon by the person directing lifting operations, the PIC, and the qualified signalperson. A dedicated channel shall be used for radio communications.

a) For lifting operations using voice signals, the lift director shall consider the complexity of the lift, the capabilities of the particular rotorcraft, the experience and skill of the PIC and signalperson, and the ability to communicate the necessary signals before permitting multiple simultaneous rotorcraft function signals.

b) Radios, or equivalent, if used, shall be tested before lifting operations begin. If the system is battery powered, extra batteries should be available at the jobsite.

c) Prior to commencing a lift, the PIC and signalperson shall contact and identify each other.

d) All directions given to the PIC by the signalperson shall be given from the PIC’s perspective (e.g., move left).

e) Each series of voice signals shall contain three elements stated in the following order:

(1) function and direction

(2) distance and/or speed

(3) function hold

NOTE: These are some examples of voice signals.

(a) move right 50 ft, 25 ft, 15 ft, 10 ft, 5 ft, 2 ft, hold

(b) move down 100 ft, 50 ft, 40 ft, 30 ft, …, 2 ft, hold

(c) move up slow, slow, slow, hold

12-4.4.6.1.3 Emergency Signals
a) Emergency signals shall be agreed upon prior to conducting lifting operations.

12-4.4.7 Static Probe (Wand) Person Responsibilities and Training
a) The person with the static probe shall be responsible for discharging the rotorcraft static electricity, and maintain the rotorcraft free of harmful static electricity during hookup of load

b) The static probe person will place the static probe into the cargo hook of the rotorcraft discharging rotorcraft static electricity.

c) The static probe person will maintain constant contact with the cargo hook during hook-up.

d) The static probe person will assist the hookup person as necessary.

e) The hookup person and the static probe person will conduct an inspection of the load from their positions. If everything looks proper and the load appears safe to fly, they will give the "thumbs up" signal to the signalperson.

12-4.4.7.1 Static Probe Person Qualifications
a) The static probe person shall be instructed by the rotorcraft operator in the proper method of wearing personal protective equipment and in the proper use of static probe.

Section 12-4.5 Rotorcraft Operation in the Vicinity of Electric Power Lines
12-4.5.1 General.
This volume recognizes that operating rotorcraft and performing rotorcraft external load operations near electric power lines is an extremely hazardous practice and should be avoided if possible. If external load operations are necessary near power lines, precautions shall be taken to prevent the possibility of the Rotorcraft Load combination from becoming electrified by or entangled in the electric power lines.

Electrical hazards are complex, invisible, and lethal. Rotorcraft operators and other personnel directly involved with the external load operations shall not rely solely on protective devices such as wires coverings, insulating links, non-conducting longlines or proximity warning devices even when such devices are required by law or regulation. Instructions related to the safety devices and hazards of external load operations near powerlines shall be understood by the rotorcraft operator, PIC, crew, and load handling personnel. Instructions shall include information about the electrical and physical hazards involved, operating conditions for safety devices, limitations of such devices, and testing requirements prescribed by the device manufacturers. Regardless of any protective devices used during the external load operations, the required clearances to power lines shall be maintained.

12-4.5.2 Rotorcraft External Load Operations Unrelated to Power Line Work
Prior to any planned external load operations near powerlines, the owner of the lines or their authorized representative shall be notified of the external load operation. If possible, the lines shall be de-energized and grounded, by the owner/utility authorities. However, any powerline shall be considered an energized line unless and until the owner of such line or the electrical utility authorities confirm that it has been de-energized.

The rotorcraft should be operated above any power line or supporting structure at least one rotor disc diameter laterally and/or vertically. There shall be a minimum clearance of at least 15 ft (4.6 m) between any energized power line rated 50 kV or below and any part of the RLC. This minimum clearance requirement shall increase proportionally to the increase in voltage of the line at the rate of 0.5 in. (12.7 mm) for each increase of 1 kV.

No part of the RLC shall be located directly under the electric power lines. The external load shall be moved away from the electric power lines to meet at least the minimum clearance requirement for the RLC prior to any rotorcraft lift operation. Long line length and rigging size should be minimized to help maintain powerline approach distance requirements.

12-4.5.2.1 Rotorcraft Operation in the Vicinity (within two rotor disks diameter) of De-Energized Power Transmission and Distribution Lines.
This is the preferred condition for rotorcraft external load operations near power transmission and distribution lines since the electrical hazard has been removed. The following steps shall be taken to ensure de-energization of the power lines:

(a) The power company or owner of the power transmission and distribution lines shall de-energize the lines.

(b) A qualified representative of the owner of the lines or a designated representative of the electrical utility shall be on the site to verify that the step (a) above have been completed.

Once the lines have been de-energized, the external load operations may commence provided all other applicable safety requirements of this volume have been completed, and governmental regulations and utility industry safety standards are adhered to.
12-4.5.2.2 Rotorcraft External Load Operation in the Vicinity (within two rotor disks diameter) of Energized Power Lines.

The following steps shall be taken to minimize the hazard of electrocution or serious injury due to contact between the energized power lines and the RLC

(a) An on-site meeting between project manager 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 RLC shall be maintained at all times during the external load operation.

(c) External 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 PIC.

(e) No one shall be permitted to touch the load unless the signalperson indicates it is safe to do so.

(f) Operation of rotorcraft 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 PIC and/or position of the signalperson. The PIC should avoid operating the rotorcraft, 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.

(h) Environmental conditions such as fog, smoke, or precipitation may require increased clearances.

12-4.5.3 External Load Operations for Power Line Construction, Maintenance, and Inspection

External load operations for inspection, maintenance, and construction of powerlines shall be performed in accordance with government safety regulations, aviation authority regulations and utility industry regulations.

Further operational recommendations and best practices for powerline work can be found in the Helicopter Association International; Utilities, Patrol and Construction Committee document; UPAC Safety Guide for Helicopter Operations.

12-4.6 Transportation of Ground Crew

If ground crews are transported by rotorcraft, the PIC shall ensure that all persons are briefed before takeoff on the following minimum procedures to be followed:

(a) the use of seat belts and shoulder harnesses, if installed

(b) location of exits and means of opening doors
(c) location and use of fire extinguishers and emergency gear as applicable to the type of operation being performed, i.e., for overwater flights, ditching procedures, and the location and use of flotation equipment (d) in-flight operating procedures, including normal, abnormal, and emergency procedures

(e) applicable smoking restrictions in the aircraft and while on the ground

(f) ingress and egress procedures appropriate to the terrain, i.e., to depart downhill if the landing site is on a hill and always walk around to the front of the rotorcraft, never to the rear (see Figs. 12-4.6-1 and 12-4.6-2)

(g) approaching the rotorcraft from the side or the front, never out of the PIC’s line of sight

(h) avoiding contact with the rotors by tools or other handheld equipment by carrying horizontally (see Fig. 12-4.6-3)

(i) holding firmly to hats and loose articles

12-4.7 Precautions to Prevent Hazards to Rotorcraft and Ground Personnel
Precautions shall be taken to provide for the protection of the rotorcraft from objects being blown or otherwise drawn into the rotor systems or aircraft engine(s) intakes. All items capable of creating such hazards shall be secured or removed at the operating sites. In general, material of low density or objects of relatively high
surface area are easily moved or blown by the rotor downwash. Typical of these are plywood, tarps or plastic sheeting, flashing, cartons, paper and plastic bags, rope, rags, sheet metal panels, roofing material, and flimsy temporary structures.

12-4.8 Personal Protective Equipment

Personal protective equipment for persons connecting, disconnecting, or guiding a load into place shall consist of eye protection and hard hats securable by chin straps. The static electricity charge that may build up on a suspended load should be dissipated with a grounding device before being touched by ground crews, or alternatively, rubber gloves should be worn by all ground crews touching the suspended load. Figure 12-4.8-1 list personnel protective equipment typically used in rotorcraft load handling operations.

Figure 12-4.8-1 Personnel protective gear for use during rotorcraft load handling operations

(a) **Head and Neck Protection.** A helmet or cranial protector is required to protect ground crew personnel from such hazards of flying debris and other objects including rotorcraft cargo hook. The helmet shall be securely fastened to ensure that it cannot be blown off or lifted up into the rotorcraft blades.

(b) **Eye and Ear Protection.** A protective mask or eye goggles are required to protect ground crewmen’s eyes and to allow them to see well enough to operate effectively. Hearing protection, such as ear plugs, must be used to protect ears from noise and the entry of sand or dust.

(c) **Hand Protection.** Personnel operating the static wand hookup shall wear electrical workers gloves for protection against static discharge burn hazard. To ensure adequate protection from static electric shock, electrical workers gloves must be inspected before and after each operation for the following deficiencies;

(i) excessive wear
(ii) fraying, holes
(iii) tears.
(iv) Holes and punctures
(d) **Clothing.** Personnel clothing shall be secured from flapping or snagging on cargo, the ground crew will roll their sleeves down and button their shirts and jackets. Personnel should remove watches, rings, and jewelry to prevent them from being caught in the sling set or load.

(e) **Other Equipment.** The static discharge wand is used to protect the hookup person from static electric shock. Figure 12-4.8-1 shows a typical list equipment that is normally needed.

**12-4.8.1 Rigging and Emergency Procedures**

Personnel trained or used as signalpersons should have a working knowledge of both rigging and emergency procedures applicable to safety and operations as established by the PIC.

**12-4.9: Below-The-Hook, OPERATIONS**

Inspections shall be accomplished prior to every lift in accordance with ASME B30.20-2018 Section 20-1.3.2, as follows:

12-4.9.1 Operators
See ASME B30.20, Section 20-1.4.1 Operators

12-4.9.1.1 Qualifications
See ASME B30.20, Section 20-1.4.2 Qualifications

12-4.9.1.2 Responsibilities
See ASME B30.20, Section 20-1.4.3 Responsibilities

12-4.9.1.3 Responsibilities of the Lifting Device Owner.
See ASME B30.20, 20-1.4.3.1 Responsibilities of the Lifting Device Owner.

12-4.9.1.4 Responsibilities of Operators
See ASME B30.20, 20-1.4.3.2 Responsibilities of Operators

12-4.9.1.5 Lifting Device Operating Practices
See ASME B30.20, 20-1.4.4 Lifting Device Operating Practices

12-4.9.1.6 Miscellaneous Operating Practices
See ASME B30.20, 20-1.4.5 Miscellaneous Operating Practices

12-4.9.1.7 INSTRUCTION MANUALS
See ASME B30.20, SECTION 20-1.5: INSTRUCTION MANUALS
SECTION 12-5.1: HOOKING AND UNHOOKING LOADS

(a) All loads shall be inspected and lifting points identified before rigging.

(b) The ground crew has the responsibility of ensuring that the cargo/load to be transported has been correctly prepared and rigged for external transport.

(c) When ground crews are required to work under hovering rotorcraft, means of access and egress shall be provided. Consult the rotorcraft manufacturer’s instructions for the hazardous areas associated with this work. Below in Figure 12-5.1.2 are examples of rotorcraft configurations with potentially varying hazardous areas.
(d) The ground crew shall be equipped with and use personal protective equipment, e.g., hard hat with chin strap, goggles, and gloves.

(e) Ground crews shall not perform work under a hovering rotorcraft except to attach, detach, or guide loads into place.

(f) Signalpersons shall make certain that the load being lifted is free and positioned correctly and that the rigging has not become entangled.

(g) The number of persons working below the rotorcraft shall be kept to a minimum to perform defined tasks by the Lift Director.

(h) Equipment used to rig the load shall be inspected prior attachment to the rotorcraft

(i) Nets used for load handling shall be inspected prior to attachment. Inspection shall include:

- All attachments engaged in the rotorcraft lifting attachment device
- All contents are enclosed within the net, and positioned within the net per manufacturer’s instruction or qualified person instructions

SECTION 12-5.2: TAGLINES

(a) Taglines, if used, shall be of such length that contact with the rotors is precluded.

(b) Taglines shall be free of knots and loops that might cause them to catch or snag persons or objects.

SECTION 12-5.3: ATTACHMENT METHODS

Rotorcraft cargo hooks or other rotorcraft suspension systems should be attached to the suspended load by, but not limited to, one of the following:

(a) slings attached to lifting points provided by the manufacturer of the load

(b) slings attached to convenient structural points on the load

(c) shackles, rings, and other rigging hardware that attach directly between the load and cargo hook

(d) cargo nets

(e) attachment methods need to be protected from damage due to contact with the load edges, and/or from being pinched
SECTION 12-6.1: SIGNAL SYSTEMS

12-6.1.1 General
There shall be constant reliable communications between the PIC and a designated member of the ground crew at each end of an external load operation while lifting operations are underway. Signal systems shall be agreed to, understood, and verified prior to each new operation or change of designated ground crew personnel or PIC.

12-6.1.2 Hand Signal Communication
Hand signals shall be as shown in Fig. 12-4.3.4-1. The speed with which the hand signals are given shall determine the rate of compliance requested of the PIC or, in the case of helicopter winch/hoist operations, requested of the winch/hoist operator.

12-6.1.3 Signalperson Identification
The signalpersons shall readily distinguish themselves from a distance to the PIC, as the signalpersons.

12-6.1.4 Radio Communication
The use of two-way radio communication between the ground crew and rotorcraft flight crew may be used in lieu of hand signals.

12-6.1.5 Secondary Communication
Operations shall be conducted in such a way that in the event of radio communications failure, an effective backup system of communications shall be immediately available.

12-6.1.6 Regulatory Requirements
Radio communications procedures shall comply with the requirements of the Federal Communications Commission (FCC) or other regulatory authority, and the rotorcraft operator’s written procedures.

SECTION 12-6.2: PERSONNEL
(a) Signalpersons shall be instructed by the rotorcraft operator in the proper use of hand signals.
(b) Signalpersons shall be instructed by the rotorcraft operator in the proper use of radio communications equipment and procedures if intended to be used.
(c) Signalpersons should be familiar with means and methods of determining wind direction at the landing area.
NONMANDATORY APPENDIX A
MANEUVERING FORCES ON RIGGING GEAR

SECTION A: Impact of Rotorcraft Maneuvering on Resultant Forces on Rigging Components

A-1 Combined Maneuvering Forces on Rigging Component; Minimum Rated Load Example.
The following is an example for sizing rigging components in support of load handling activity:

(a) Example of heaviest weight of load to be handled by rotorcraft **1000 pounds**.
(b) The expected bank angle of the rotorcraft during load handling activity is **11 to 25** degrees.
(c) The expected drag angle of the rotorcraft during load handling activity is **26 to 35** degrees.
(d) The expected maximum vertical acceleration of the rotorcraft to achieve flight altitude, **1.5Gs**
   (where G is the acceleration due to gravity).

<table>
<thead>
<tr>
<th>Minimum Rated Load for Longline or Leadline lifting 1000 Pounds†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static weight of heaviest load to be lifted, pounds</td>
</tr>
<tr>
<td>Bank Angle Load Factor Table A-3-1, <strong>11 to 25</strong> degrees, BLF</td>
</tr>
<tr>
<td>Drag Angle Load Factor Table A-4-1, <strong>26 to 35</strong> degrees, DLF</td>
</tr>
<tr>
<td>Vertical Acceleration, Gs (Manufacturer or PIC provided)</td>
</tr>
<tr>
<td><strong>Combined Load Factor, CLF = BLF x DLF x Gs</strong></td>
</tr>
<tr>
<td>Longline or Leadline Minimum Rated Load, pounds, equals W x 2.0</td>
</tr>
<tr>
<td><strong>Design Factor of Safety</strong></td>
</tr>
<tr>
<td>Longline or Leadline Minimum Breaking Force, pounds</td>
</tr>
</tbody>
</table>

Table A-1-1 shows an example calculation of the **effective change in force being lifted**, and imposed load on longlines or leadlines used in load handling activities subject to rotorcraft maneuvers. The longline or leadline tension is twice the total static load carried by the longline or leadline.

† Note: The analysis above does not include several unquantifiable variables which can include lack of smoothness of operation, vibration of the rigging during flight, shock load due variation in air density that negatively affect rated load estimates etc.
A-2 Maximum Allowable Combined Load Factor, CLF

The maximum permissible Combined Load Factor (CLF) should not exceed 2.5 as defined by the product of the three factors shown in Table 1 below.

<table>
<thead>
<tr>
<th>Bank Load Factor</th>
<th>Drag Load Factor</th>
<th>Vertical Acceleration</th>
<th>Combine Load Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLF</td>
<td>1.00</td>
<td>#Gs</td>
<td>2.5</td>
</tr>
<tr>
<td>1.00</td>
<td>DLF</td>
<td>#Gs</td>
<td>2.5</td>
</tr>
<tr>
<td>BLF</td>
<td>DLF</td>
<td>#Gs</td>
<td>2.5</td>
</tr>
</tbody>
</table>

These non-typical operating conditions (Bank angle, drag angle, and vertical acceleration) illustrate the impact of maneuvering on the effective force of load. The intent is to adjust the forces on the load and the selection of rigging to match the increased forces.

(a) Drag angle shall not exceed 60 degrees during transit of load to destination

(b) Bank angle shall not exceed 30 degrees

(c) Table 1 above does not include the effects of rotorcraft downwash.

(d) The qualified person preparing the lift plan shall verify rotorcraft performance with the PIC to determine variation or expected changes in maneuvering load factors.

(e) Loads applied to field assembled longlines shall not exceed the rated load of any rigging component in the longline assembly.

(f) Rated loads on load attachment points installed on the rotorcraft shall not be exceeded during load handling operations

(g) The PIC shall approve the maneuvering limitations of bank angle, drag angle, and vertical acceleration combination for the load handling activity. Changes to the maneuvering limitations shall be documented and approved by the PIC.

(h) The calculated load on rigging components is the total weight of the load times a combined load factor of 2.5.
A-3 Rotorcraft Bank Angle Impact on Rigging Components Strength

The tension in the load’s rigging components will increase due to forces imposed by a rotorcraft’s bank angle while in flight. The PIC shall evaluate the rated load of the rigging components to assure they are of sufficient capacity to meet both the effects of the load’s weight and any anticipated bank angle.

The PIC’s evaluation of the bank angle shall use BLF at least equal to those presented on Table A-3-1

**Bank Angle Load Factor, BLF, Per Chart**

<table>
<thead>
<tr>
<th>Angle to Horizontal, Degrees</th>
<th>Bank Angle Load Factors = BLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 10</td>
<td>1.00</td>
</tr>
<tr>
<td>11 to 25</td>
<td>1.10</td>
</tr>
<tr>
<td>26 to 35</td>
<td>1.22</td>
</tr>
<tr>
<td>36 to 45</td>
<td>1.41</td>
</tr>
<tr>
<td>46 to 60</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*Table A-3-1 shows the effects rotorcraft bank angle on attached rigging components*
A-4 Rotorcraft Drag Angle Impact on Rigging Components Strength

The tension in the load’s rigging components will increase due to forces imposed by the load’s drag angle while in flight. The PIC shall evaluate the rated load of the rigging components used to assure they are of sufficient capacity to meet both the effects of the load’s weight and any anticipated drag angle. Drag forces may be reduced by increasing the length of longline or leadline in use.

The PIC’s evaluation shall use DLF factors at least equal to those presented on table 12-2.2.1-2.

### Drag Angle Load Factor, DLF Per Chart

<table>
<thead>
<tr>
<th>Angle to Vertical, Degrees</th>
<th>Drag Angle Load Factor = DLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 10</td>
<td>1.00</td>
</tr>
<tr>
<td>11 to 25</td>
<td>1.10</td>
</tr>
<tr>
<td>26 to 35</td>
<td>1.22</td>
</tr>
<tr>
<td>36 to 45</td>
<td>1.41</td>
</tr>
<tr>
<td>46 to 60</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*Table A-4-1 shows the effects rotorcraft travel speed drag on attached rigging components*

**A-5 Changes in Acceleration**

The tension in the load’s rigging components will increase due to forces imposed by changes in vertical acceleration of a rotorcraft while in flight. The PIC shall evaluate the rated load of the rigging components used to assure they are of sufficient capacity to accept both the effects of the load’s weight and any anticipated vertical acceleration. Vertical acceleration factors used shall be those provided in
the rotorcraft manufacturer’s operation documentation or by communication with the rotorcraft manufacturer, or as specified by the PIC.