ASME B30.12-2011
(Revision of ASME B30.12-2006)

Handling Loads Suspended From Rotorcraft

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

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY • 10016 USA

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The next edition of this Standard is scheduled for publication in 2017. This Standard will become effective 1 year after the Date of Issuance.

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

The American Society of Mechanical Engineers
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FOREWORD

This American National Standard, Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, has been developed under the procedures accredited by the American National Standards Institute (ANSI, 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 minor 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 December 6, 2011.

ASME B30 COMMITTEE
Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

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

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

(11)

B30 STANDARD INTRODUCTION

SECTION I: SCOPE

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

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

B30.1 Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries
B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
B30.3 Tower Cranes
B30.4 Portal and Pedestal Cranes
B30.5 Mobile and Locomotive Cranes
B30.6 Derricks
B30.7 Winches
B30.8 Floating Cranes and Floating Derricks
B30.9 Slings
B30.10 Hooks
B30.11 Monorails and Underhung Cranes
B30.12 Handling Loads Suspended From Rotorcraft
B30.13 Storage/Retrieval (S/R) Machines and Associated Equipment
B30.14 Side Boom Tractors
B30.15 Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)
B30.16 Overhead Hoists (Underhung)
B30.17 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)
B30.18 Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist)
B30.19 Cableways
B30.20 Below-the-Hook Lifting Devices
B30.21 Manually Lever-Operated Hoists
B30.22 Articulating Boom Cranes
B30.23 Personnel Lifting Systems
B30.24 Container Cranes
B30.25 Scrap and Material Handlers
B30.26 Rigging Hardware
B30.27 Material Placement Systems
B30.28 Balance Lifting Units
B30.29 Self-Erect Tower Cranes[1]
B30.30 Ropes[1]

SECTION II: SCOPE EXCLUSIONS

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

SECTION III: PURPOSE

The B30 Standard is intended to

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

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

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

SECTION IV: USE BY REGULATORY AGENCIES

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

SECTION V: EFFECTIVE DATE

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

[1] These volumes are currently in the development process.

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

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

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

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

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

SECTION VII: USE OF MEASUREMENT UNITS

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

SECTION VIII: REQUESTS FOR REVISION

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

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

Requests should be in the following format:

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

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to the requester defining the actions undertaken by the B30 Standard Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

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

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

Requests should be in the following format:

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

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

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

SECTION X: ADDITIONAL GUIDANCE

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

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

(a) the condition of the equipment or material

(b) the loads

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

(d) the type of attachments

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

(f) environmental conditions causing corrosion or wear

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

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

ASME B30.12-2011
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.12-2011 was approved by the American National Standards Institute on December 6, 2011.

ASME B30.12-2011 includes the following changes identified by a margin note, **(11)**.

Page	*Location*	*Change*
viii	B30 Standard Introduction	Revised
1–4	12-0.2.2	(1) Definition of *hook, cargo, primary* revised (2) Definitions of *longline* and *vertical reference* added
	Section 12-0.3	Revised
5	12-1.1.2	Revised
7	Section 12-2.5	Added
10	12-3.2.2	Revised
	12-3.4.1	Revised
11	12-4.2.2	Revised
16	12-4.4.18	Added

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HANDLING LOADS SUSPENDED FROM ROTORCRAFT

Chapter 12-0
Scope, Definitions, and References

SECTION 12-0.1: SCOPE OF B30.12

This Volume applies to the protection of flight crews, ground personnel, and property on the surface while working directly with or in the vicinity of rotorcraft conducting external-load operations. Within the general scope as defined in Section I of the Introduction, B30.12 applies to the handling 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.

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 operation. 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 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 cables 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 attached to the rotorcraft. It is typically used for stringing wire or laying cable where the load is partially suspended 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, or a suspended container.

12-0.2.2 General Definitions (11)

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.

altitude, AGL: the height of a level, point, or object measured in feet above ground level (AGL).

altitude, MSL: the height of a level, point, or object measured in feet from mean sea level (MSL).

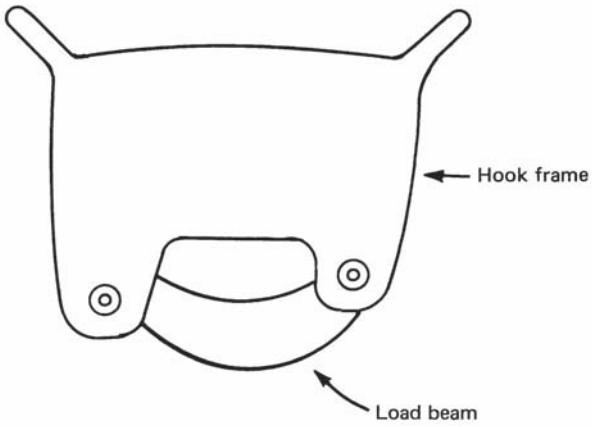
apex fitting: a ring or attaching device between the hook and sling and the supporting cables to the load.

appointed: assigned specific responsibilities by the employer or the employer's representative.

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

authorized: appointed by a duly constituted administrative or regulatory authority.

Fig. 12-0.2.2-1 Hook With Closed-Throat Load Beam



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

birdcaging: the deformation of a section of wire rope imparting to such section a birdcage-like appearance.

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

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 other 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 after an apex fitting has been placed on it (see Fig. 12-0.2.2-1).

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.

contractor: the company, firm, individual, or other business enterprise 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 strength and rated load of the component.

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.

FAA: Federal Aviation Administration.

FAR: Federal Aviation Regulations.

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 base facility: the site from which operations are conducted on a continuous basis or until a job is completed.

ground crew(s): those designated persons specifically required to be on or near the job site in connection with the actual conduct or performance of the external load operation.

ground visibility: prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

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 helicopter external load.

hoist (verb): to raise or lower a load with a rotorcraft-mounted hoist.

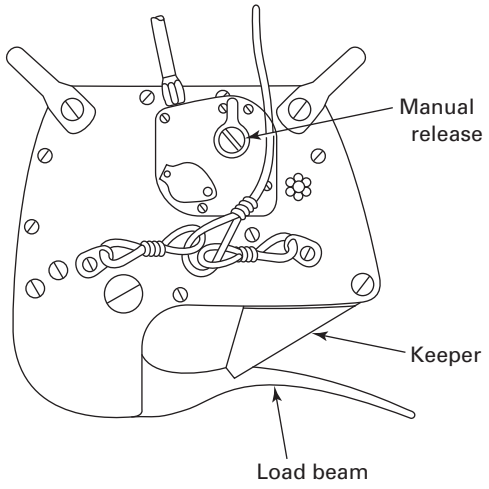
hook, cargo, primary: a device attached to or suspended from an aircraft that is used to connect an external load to the aircraft through direct coupling or by lead lines; this unit features both a primary (electrical) quick-release device and a backup (nonelectric) quick-release device.

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.

Fig. 12-0.2.2-2 Hook With Open-Throat Load Beam



jettisonable load: a Class B, C, or D rotorcraft external load that can be intentionally released by the pilot 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. 12-0.2.2-2).

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

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

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

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 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 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 cargo hook.

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. 12-0.2.2-2).

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. 12-0.2.2-2).

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

pendant: a synthetic or wire rope, chain, or webbing of specific length with fixed end connections.

personnel-carrying device system (PCDS): the entire attached or suspended system used to carry HEC. This is any HEC-carrying configuration, such as a suspended HEC system (e.g., winch/hoist, cable, harness) or an attached HEC system (e.g., a rigid basket or cage attached to the skids).

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 everything in between.

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

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.

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.

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.

ultimate loads: limit loads multiplied by prescribed factors of safety.

vertical reference: the pilot technique of controlling the aircraft while looking down vertically at the load attached to the cargo hook.

SECTION 12-0.3: REFERENCES (11)

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

ASME B30.9-2010, Slings
ASME B30.16-2007, Overhead Hoists (Underhung)

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
USAAMRDL Technical Report 72-36, Design Guide for Load Suspension Points, Slings, and Aircraft Hard Points

Publisher: Superintendent of Documents, U.S. Government Printing Office (GPO), 732 North Capitol Street, NW, Washington, DC 20401 (www.gpoaccess.gov/index.html)

NFPA 10, Standard for Portable Fire Extinguishers, 2010 Edition
NFPA 407, Standard for Aircraft Fuel Servicing, 2007 Edition

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

Chapter 12-1
External Load Ratings and Characteristics

SECTION 12-1.1: LOAD RATINGS

12-1.1.1 Rotorcraft

Rated loads for rotorcraft shall include the maximum gross weight of the rotorcraft and external load combination. In addition, the RLC may only be operated within the weight and center of gravity limitations as established by the manufacturer.

(11) **12-1.1.2 External Load Attaching Means**

(a) FAA airframe certification limit loads for rotorcraft load classifications Classes B, C, and D are 2.5 (minimum) at maximum gross weight and 3.5 for Class D (HEC only) at minimum gross weight.

(b) In addition to the calculated load(s) in (a) above, a 1.5 (minimum) safety factor is to be added to the weight of Classes B, C, and D loads being lifted for both NHEC and HEC.

12-1.1.3 Primary Hook(s)

Rated capacity load of the primary hook(s) for both HEC and NHEC shall be the maximum weight of the load to be lifted, carried, pulled, or towed. This maximum weight shall not exceed the weight approved by the FAA or other regulatory authority, and as specified in the manufacturer's rotorcraft flight manual or as listed within the operator's approved rotorcraft combination flight manual. A placard, marking, or instruction shall be displayed on or near the hook(s) stating the maximum external load.

12-1.1.4 Hoist

The maximum capacity of the hoist or winch system and its braking means shall not be exceeded as specified by the hoist manufacturer and approved by the FAA or other regulatory authority. A placard, marking, or instruction shall be displayed on or near the hoist/winch system stating the maximum external load.

12-1.1.5 Sling Materials

Rated loads for sling materials shall be based on the catalog strength. In addition to the rated load of sling material to be used to lift any load, consideration shall be given to its age, environmental conditions, and the rotorcraft load factor (see para. 12-2.4.3).

SECTION 12-1.2: LOAD CHARACTERISTICS

The size, type, and weight of a load shall not, in the judgment of the PIC, adversely affect the controllability of the rotorcraft.

Chapter 12-2
Lifting Components

SECTION 12-2.1: PRIMARY CARGO HOOK(S)

12-2.1.1 System Requirements

A primary cargo hook of the self-locking type, including a QRS to enable the flight crew to release the load quickly during flight, shall be provided. The primary cargo hook shall be located as close to the rotorcraft as possible to prevent inadvertent entanglement of the hook and its suspension system with the external fixed structures of the rotorcraft. The QRS must consist of a PQRS and BQRS that are isolated from one another. The primary cargo hook QRS and the means by which it is controlled shall conform to the following:

(a) A control for the PQRS shall be installed either on one of the pilot's primary controls or in an equivalently accessible location, and designed and located so that it may be operated either by the pilot or a crew member without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(b) A control for the BQRS shall be provided and readily accessible to either the pilot or another crew member.

(c) Both the PQRS and BQRS shall be reliable, durable, and function properly with all external loads for which the rotorcraft is certified.

(d) Both the PQRS and BQRS shall be protected against electromagnetic interference (EMI) from external and internal sources and lightning to prevent inadvertent load release.

(e) The minimum level of protection required for jettisonable RLCs used for NHEC is a radio frequency field strength of 20 V/m.

(f) The minimum level of protection required for jettisonable RLCs used for HEC is a radio frequency field strength of 200 V/m.

(g) Both the PQRS and BQRS shall be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(h) For RLCs to be used for human external load applications, the rotorcraft shall

(1) have a QRS that meets the requirements of paras. 12-2.1.1(a) and (b) for jettisonable external loads

(2) provide a dual actuation device for the PQRS

(3) provide a separate dual actuation device for the BQRS

(i) The load beam of the primary cargo hook shall be provided with a means to positively retain the apex fitting on the load beam.

(j) The primary cargo hook and its attachment means shall comply with the applicable strength requirements of the applicable regulatory authority, or FAR Part 21, 27, or 29, as applicable to the rotorcraft airworthiness category.

(k) A placard or marking shall be installed next to the external load attaching means clearly stating any operational limitations and the maximum authorized external load.

12-2.1.2 Multiple Primary Hooks

The intent of this section is not to limit the number of primary cargo hooks that may be used. However, if more than one primary cargo hook is used, all such hooks shall provide simultaneous release of all loads as defined in Section 12-2.1.

SECTION 12-2.2: HOIST/WINCH

A hoist or winch, when provided, shall be considered an integral component part of the rotorcraft and certified by the FAA or applicable regulatory authority.

12-2.2.1 Construction

The hoist or winch shall have a powered drum containing the primary lifting member and be equipped with an emergency load release mechanism or provisions for emergency load release.

12-2.2.2 Load Rating

The hoist or winch load rating shall be determined by the manufacturer and fully described and displayed in the operator's rotorcraft load combination operation and flight manual, maintenance manual, and associated placards.

12-2.2.3 Load Markings

Static load limits shall be displayed.

12-2.2.4 Limit Switches

The hoist or winch shall be equipped with upper and lower limit switches to control the length of the lifting member on the drum.

12-2.2.5 Breaking Strength

A combination of end attachments and wraps of rope on the drum shall be used to develop breaking strength.

12-2.2.6 Rope Marking

The length of hoist rope nearest the rope's attachment to the hoist/winch should be visually marked to indicate to the operator that the hoist rope is near full extension.

12-2.2.7 Rope Attachment

The hoist rope should be positively attached to the hoist/winch drum, and the attachment should meet the ultimate load capability, or equivalent means should be provided to minimize the possibility of inadvertent complete cable unspooling.

12-2.2.8 Storage

The hoist or winch should be disabled (or an overriding, fail-safe mechanical safety device, such as a flagged, removable shear pin or load-lowering brake, should be used) to prevent inadvertent load unspooling or release during any extended flight phase that involves HEC and in which hoist or winch operation is not intended.

SECTION 12-2.3: ROTORCRAFT

The rotorcraft shall be certified by the FAA or applicable regulatory authority, and carry proof of same by display of the registration certificate, airworthiness certificate, and rotorcraft load combination operation and flight manual.

SECTION 12-2.4: SLINGS

Sling strengths and configurations per ASME B30.9 do not apply because of the different dynamic load conditions present in flight operations versus ground-based lifting equipment. Sling strengths should be determined by the method given in para. 12-2.4.3. However, in no case shall a design factor of less than 2.5 limit load factor be used for NHEC applications, or a design factor of less than 3.0 be used on the yield strength of the weakest component in the QRS, PCDS, and attachments for HEC applications.

12-2.4.1 Types of Slings

The types of slings considered are as follows:

(a) vertical hitch (see Fig. 12-2.4.1-1)
(b) two leg (see Fig. 12-2.4.1-2)
(c) three leg (see Fig. 12-2.4.1-3)
(d) four leg (see Fig. 12-2.4.1-4)
(e) two-leg spreader (see Fig. 12-2.4.1-5)
(f) four-leg spreader (see Fig. 12-2.4.1-6)

12-2.4.2 Sling Materials

Slings should be constructed from synthetic ropes, webbing, wire rope, or chain. Wire rope slings should be IWRC (independent wire rope core, steel center). Natural fiber ropes shall not be used as sling materials since their strengths are not predictable.

12-2.4.3 Sling Strength

(a) Determining Sling Strength. Table 12-2.4.3-1 should be used to determine the breaking strength, *S*, of each leg of the sling.

(b) Two-Leg Spreader Sling. The sling portion of a two-leg spreader assembly shall have the same strength requirements as a two-leg sling. In addition, the bar itself must take compressive forces along its axis equal to those imposed by the breaking strength of the sling legs.

(c) Four-Leg Spreader Sling. The sling leg portion of a four-leg spreader assembly shall have the same strength requirements as a four-leg sling. In addition, the members of the spreader bar must resist the compressive forces imposed by the breaking strength of the sling legs. The spreader bar shall have a diagonal brace or other device to prevent distortion of its shape under these loads.

(d) Length of Sling Legs. The length of sling legs shall be such that no sling leg makes an angle from the vertical greater than 45 deg.

(e) Multiple-Leg Slings. The legs of a multiple-leg sling should be connected at the top by an apex fitting.

SECTION 12-2.5: LONGLINES (11)

12-2.5.1 Wire Rope Longline

Class B and Class D external loads should be conducted with rotation-resistant wire rope.

12-2.5.2 Synthetic Rope Longline

(a) The minimum rope diameter should be ½ in.

(b) Synthetic helicopter longlines should be constructed from the HMWPE or HMPE (high molecular weight polyethylene) family of rope fibers.

(c) Synthetic helicopter longlines, including rope terminations, shall have a minimum breaking strength of seven times the rated or working load.

Fig. 12-2.4.1-1 Vertical Hitch

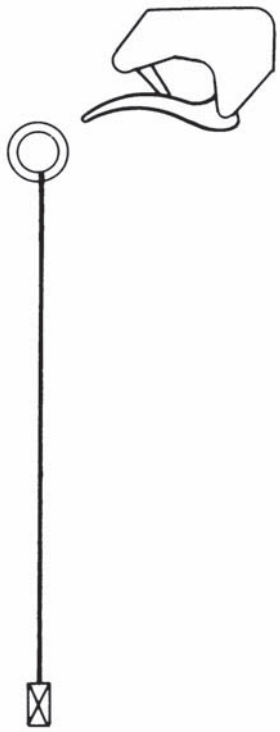


Fig. 12-2.4.1-2 Two-Leg Sling

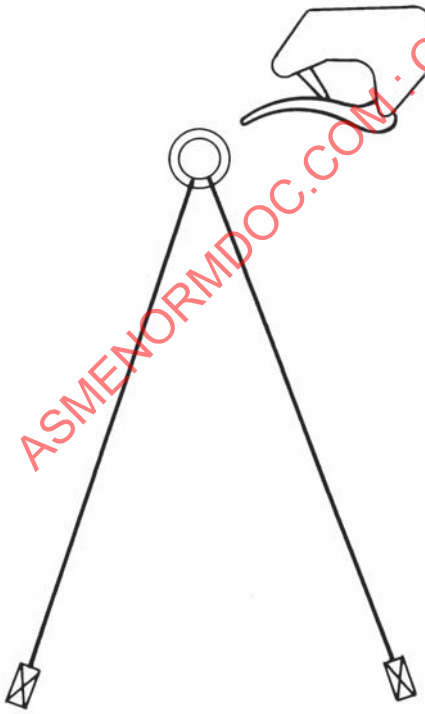


Fig. 12-2.4.1-3 Three-Leg Sling

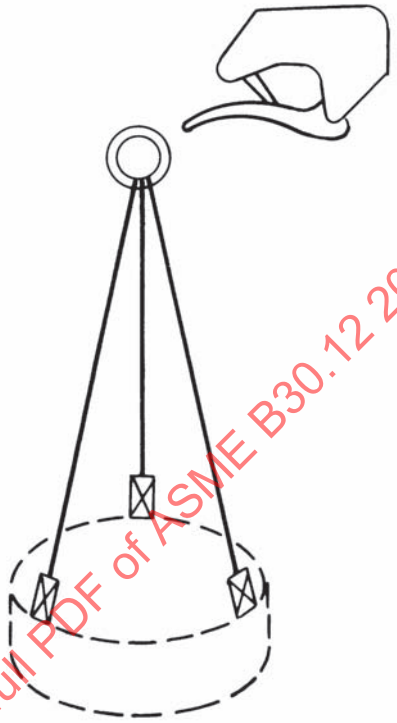


Fig. 12-2.4.1-4 Four-Leg Sling

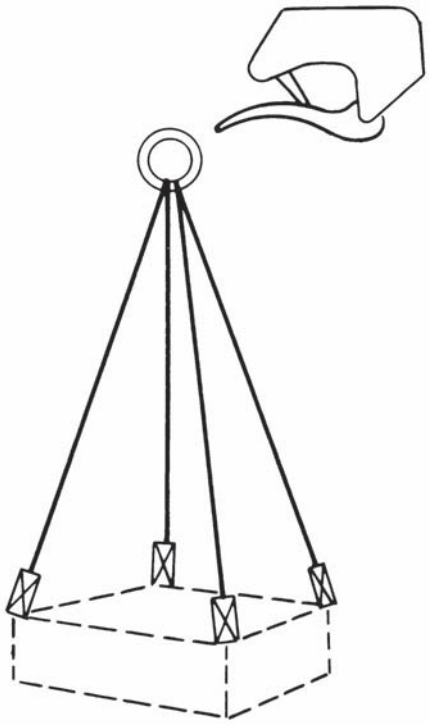


Fig. 12-2.4.1-5 Two-Leg Spreader Sling

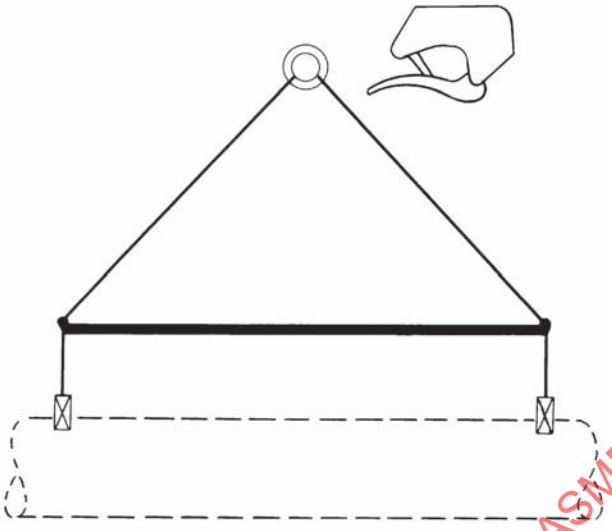


Fig. 12-2.4.1-6 Four-Leg Spreader Sling

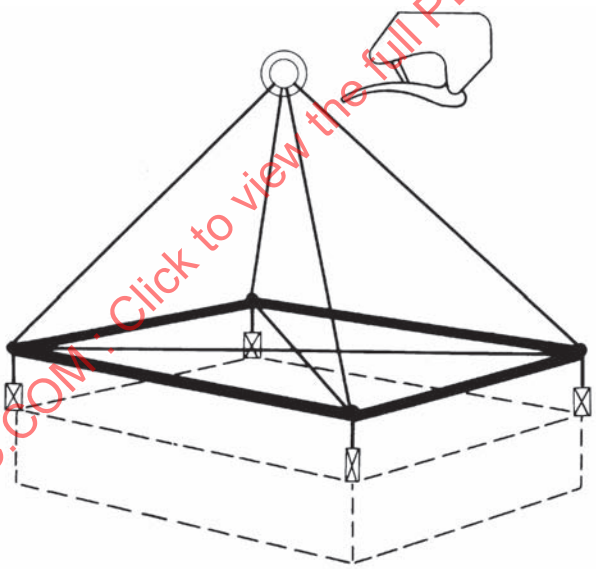


Table 12-2.4.3-1 Determining Sling Strength

Configuration	Single-Leg Breaking Strength, *S*	Design Factor — Sling Assembly With Legs Vertical
Single leg	5 *W*	5.0
Two leg	3.8 *W*	7.6
Three leg	2.6 *W*	7.8
Four leg	2 *W*	8.0

GENERAL NOTES:
(a) This table also applies to the primary lifting rope of a hoist.
(b) *S* = breaking strength of each leg
(c) *W* = rated capacity of the entire sling (i.e., the maximum load that can be safely lifted by the sling assembly)

Chapter 12-3
Inspection and Maintenance

SECTION 12-3.1: ROTORCRAFT INSPECTION AND MAINTENANCE

Rotorcraft shall be inspected, operated, and maintained in accordance with the rotorcraft manufacturer's maintenance and flight manuals, the operator's approved maintenance practices and procedures, and the requirements of the FAA or other applicable regulatory authority.

SECTION 12-3.2: PRIMARY HOOK(S) AND ATTACHING MEANS INSPECTION AND MAINTENANCE

12-3.2.1 Inspection

A prelift visual inspection shall be performed prior to conducting each operation and on at least a daily basis during the operation. Unless the primary hook(s) and attaching means being used pass the following minimum requirements, they shall not be used:

(a) Check hook attachments for correct connections.

(b) Verify operation and integrity of both hook(s) PQRS and BQRS.

(c) Check electrical connectors and wiring.

(d) Check the load beam for binding.

(e) Visually check the load beam and hook frame members for cracks, gouges, distortion, wear, and latch engagement.

(f) Test all other backup release equipment, as applicable.

(g) Check suspension members, if used, for proper alignment.

(h) Check the primary hook(s) suspension ropes for broken wires and overall condition.

(11) 12-3.2.2 Maintenance

The primary hook(s) and support system shall be maintained, serviced, and overhauled in accordance with the manufacturer's recommendations and maintenance manuals. If the manufacturer's operating and maintenance instructions are not available, the cargo hook and associated systems shall be completely disassembled, inspected, lubricated (if required), and subjected to an operations check in all operating modes every 24 mo by a qualified person.

SECTION 12-3.3: HOIST AND HOIST ROPE INSPECTION AND MAINTENANCE

Hoist and hoist rope inspection and maintenance shall be performed by a qualified person in accordance with current FAR, FAA, or other regulatory directives, and the manufacturer's recommendations as described in their operation and maintenance manuals, as well as the requirements of ASME B30.16.

SECTION 12-3.4: SLING INSPECTION, REPLACEMENT, AND MAINTENANCE

12-3.4.1 Sling Inspection (11)

All ropes (including synthetic) or chain used for slings (pendants) shall be visually inspected by a qualified person each working day they are used. Evidence of deterioration, such as described in the applicable sections of ASME B30.9, that could result in appreciable loss of original strength, shall be carefully noted and a determination made by a qualified person as to whether or not future use would constitute a hazard.

(a) Section 9-1.9 of ASME B30.9 shall be followed for the inspection of alloy chain slings.

(b) Section 9-2.9 of ASME B30.9 shall be followed for inspection of wire rope slings.

(c) Section 9-4.9 of ASME B30.9 shall be followed for inspection of synthetic fiber slings.

(d) Section 9-5.9 of ASME B30.9 shall be followed for inspection of synthetic webbing slings.

(e) Section 9-6.9 of ASME B30.9 shall be followed for the inspection of synthetic roundslings.

(f) Synthetic slings of any type shall be stored in such a manner as to prevent damage and deterioration.

12-3.4.2 Rope or Chain Maintenance

(a) Rope or chain should be stored in such a manner as to prevent damage or deterioration.

(b) Unreeling or uncoiling of rope should be accomplished as recommended by the rope manufacturers and with special care to avoid kinking or inducing a twist.

(c) Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands.

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

Chapter 12-4
Operations

SECTION 12-4.1: PILOTS AND CREW

12-4.1.1 Pilots

Rotorcraft used for commercial external load operations shall be operated by any one of the following personnel:

(a) PIC

(b) copilot

(c) rotorcraft pilot(s) who holds a current commercial or airline transport certificate or equivalent with a rating appropriate for the rotorcraft, or accompanied by a company-designated instructor or check pilot with the appropriate external load operation qualifications

12-4.1.2 Crew

No one other than the personnel designated in Section 12-4.1 shall be carried or otherwise enter the rotorcraft during rotorcraft external load operations unless that person fulfills one of the following requirements:

(a) is a flight crew member

(b) is a flight crew member trainee

(c) performs an essential function in connection with the external load operation

(d) is necessary to accomplish the work activity directly associated with that operation

The PIC shall ensure that all persons are briefed before takeoff on all pertinent procedures to be followed, including normal, abnormal, and emergency procedures, and on the equipment to be used during the external load operation.

SECTION 12-4.2: PILOT QUALIFICATIONS

12-4.2.1 General Qualification

Each pilot listed in Section 12-4.1 shall be qualified in accordance with all applicable Federal Aviation Regulations (or equivalent) and shall have on hand during the performance of any lift operation a commercial pilot or airline transport pilot license, letter of competency (or equivalent), and current Class I or II medical certificate issued by or pursuant to the FAA (or equivalent).

(11) ### 12-4.2.2 Load-Handling Qualifications

Pilots shall be qualified in both the class and type of rotorcraft used to perform the external load combination. This qualification shall be so recorded or otherwise documented as a letter of competency or an appropriate log book entry in the pilot's personal log book. Additionally, pilots engaging in external load operations using longlines shall have a vertical reference longline endorsement.

12-4.2.3 External Load Qualification

Instructor pilots, regardless of rating, shall have both demonstrated and documented appropriate external load operation experience.

SECTION 12-4.3: SIGNALPERSON QUALIFICATIONS AND RESPONSIBILITIES

12-4.3.1 Precision Lifts

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.

12-4.3.2 General Lifts

Except as provided for in para. 12-4.3.1, ground crews who have been thoroughly briefed and designated by the rotorcraft pilot or operator for airlifts not requiring precision lifting or setting may be used.

12-4.3.3 Radio Communication

If ground-to-air radios are used, the signalperson(s) shall be

(a) able to communicate without undue interference from the rotorcraft

(b) knowledgeable with applicable radio operation, phraseology, and Federal Communications Commission Regulations

12-4.3.4 Hand Signals

Signalpersons shall be knowledgeable in the use of hand signals depicted in Fig. 12-4.3.4-1.

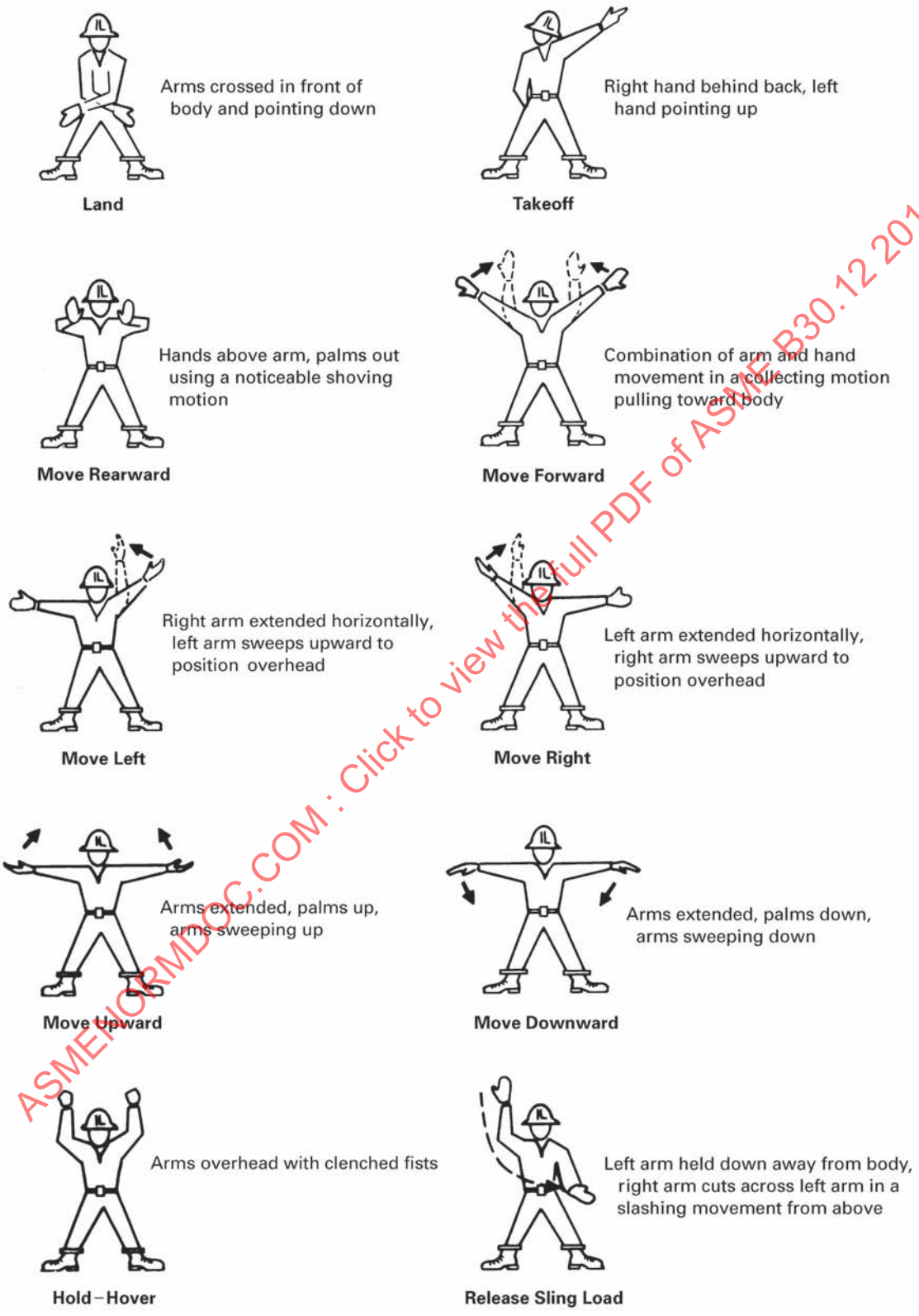
12-4.3.5 Rigging and Emergency Procedures

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

12-4.3.6 Responsibility

The signalperson(s) shall keep the PIC advised of any changed or otherwise unusual ground conditions, as

Fig. 12-4.3.4-1 Helicopter Hand Signals



well as ground-based and overhead obstacles, while directing the rotorcraft.

SECTION 12-4.4: OPERATING PRACTICES

12-4.4.1 Preflight Inspection

The PIC shall perform a preflight inspection of the rotorcraft prior to commencing any external load operation. The PIC shall be satisfied that the rotorcraft, rigging, and other lifting equipment are in safe condition before flight.

12-4.4.2 Logs

The PIC shall make certain that the rotorcraft airframe and engine(s) log books reflect the status of the rotorcraft and that the aircraft is designated as airworthy. This person shall make certain that all applicable certificates and placards are with the rotorcraft.

12-4.4.3 Operational Test

Prior to any external load operation with a load not previously accomplished by the operator, the following precautions shall be taken by the PIC:

(a) Determine that the weight of the RLC and location of its center of gravity are within approved limits.

(b) Determine that the external load is securely fastened and that the external load does not interfere with devices provided for its emergency release.

(c) Make an initial liftoff, and while hovering the rotorcraft, verify that directional control of the RLC is within acceptable limits.

(d) Accelerate the rotorcraft into forward flight to verify that no attitude (whether of the rotorcraft or the external load) is encountered in which the rotorcraft is uncontrollable or otherwise hazardous.

(e) In forward flight, check for hazardous oscillations of the external load, but if the external load is not visible to the pilot, other crew members or ground personnel may make this check and signal or otherwise notify the pilot.

(f) Increase the forward airspeed and determine an operational airspeed at which no hazardous oscillation or hazardous aerodynamic turbulence is encountered.

12-4.4.4 Plans

Where required by FAR or other regulatory authority, rotorcraft external load operations planned over congested areas may be conducted if those operations are conducted without hazard to persons or property on the surface and comply with the following:

(a) The operator must develop a plan for each complete operation, coordinate this plan with the FAA Flight Standards District Office or applicable authority having jurisdiction over the area in which the operation will be conducted, and obtain approval for the operation from that district office or authority.

(b) The plan must include an agreement with the appropriate political subdivision that local officials will exclude unauthorized persons from the area in which the operation will be conducted, coordination with air traffic control, if necessary, and a detailed chart depicting flight routes and altitudes.

(c) Each flight must be conducted at an altitude and on a route that will allow a jettisonable external load to be released and the rotorcraft landed in an emergency, without hazards to persons or property on the surface.

12-4.4.5 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.

12-4.4.6 Hazard Surveillance

The PIC shall survey the operation(s) area for landing, pickup, and delivery, and ascertain that no undue hazards, such as blowing debris, trees, power lines, sand, poles, or other obstacles, endanger the rotorcraft, persons, or property.

12-4.4.7 Rigging Authority

The PIC shall approve and be the final authority for all rigging procedures for the operation.

12-4.4.8 Work Area Clearance

The rotorcraft operator shall be responsible for making arrangements to restrain bystanders and other nonground crew personnel from the rotorcraft work area, including keeping them at least 50 ft (15.2 m) from the rotor blades.

12-4.4.9 Refueling

The rotorcraft operator shall be responsible for developing written refueling procedures for each type of rotorcraft operated. At a minimum, these practices shall be in accordance with the provisions set forth in Chapter 12-7. The rotorcraft crew shall be trained and responsible for conducting refueling practices in accordance with both the rotorcraft operator's written procedures as well as the provisions set forth in Chapter 12-7.

12-4.4.10 Suspending Operations

The PIC shall have the authority to suspend operations when, in the judgment of the pilot, any of the following conditions exist:

(a) flight or ground visibility prevents the pilot from seeing obstructions in the operating area

(b) the pilot becomes incapacitated due to illness, fatigue, or any other cause

(c) electrical storms are in the immediate area

(d) wind gusting or direction makes controllability of the rotorcraft or external load difficult

(e) any ground-based or airborne debris becomes hazardous and could cause damage to the rotorcraft or cause injury to persons or property on the ground

(f) any caution or warning light(s) or other device(s) or gage(s) within the rotorcraft indicate possible mechanical problems

(g) actions or inaction on behalf of rotorcraft ground crews or others involved in the operations endanger themselves or others

(h) atmospheric condition changes create an adverse effect on the performance of the rotorcraft

(i) damage is suspected or otherwise sustained by rigging used for airlifting that could affect its use

(j) crowd control becomes ineffective, and persons are subject to dangerous conditions

12-4.4.11 Evacuation

When rotorcraft operations include airlifting loads onto or into a building or building courtyard (congested area), all persons except those working with the rotorcraft shall be vacated along the flight path of the rotorcraft. Occupied structures along the path shall be evaluated by the rotorcraft operator as to whether or not the occupants within need to be vacated (see para. 12-4.4.4).

12-4.4.12 Operating Near Electrical Power Lines

If possible, the owner of the lines or their authorized representative shall be notified of the operation, and, if necessary, the lines shall be deenergized. 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.

EXCEPTION: These minimum clearances shall not apply to rotorcraft or NHEC or HEC loads specifically designed and intended for use in power line inspection, maintenance, and repair.

12-4.4.13 Pre-Job Coordination: PIC and Signalperson(s)

Before any external load operations are conducted, the rotorcraft PIC and signalperson(s) shall confer and agree upon the following:

(a) the position (or placement) the signalperson will assume so the signalperson can readily observe the hook-up/setting ground crew and load for pickup or delivery and still be seen or heard by the pilot.

(b) type of communications to be used for the specific operation, i.e., hand signals, ground-to-air radio, intercom or relay signals, or a combination of them.

(c) the use of hand signals shown in Fig. 12-4.3.4-1 and any additional agreed upon signals that would be used for the specific operation for safety or efficiency.

(d) alternative procedures to be followed if communications or sight become ineffective or are lost between the PIC and signalperson(s).

(e) distinguishing clothes, high-visibility safety vests, or gloves to be worn by the appointed signalperson(s). Only these designated individuals shall be authorized to give hand signals to the PIC.

(f) procedures to be used and followed if any unforeseen hazards develop.

(g) audible or other appropriate signals that should be used as a warning to ground crews working with the rotorcraft during external load operations.

12-4.4.14 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 (see Section 12-2.4)

(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 rotorwash, 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