The American Society of Mechanical Engineers

PERFORMANCE STANDARD FOR MANUALLY LEVER OPERATED CHAIN HOISTS

AN AMERICAN NATIONAL STANDARD

REAFFIRMED 2004

FOR CURRENT COMMITTEE PERSONNEL
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ASME HST-3-1999
[Revision of ASME HST-3M-1991 (R1996)]

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FOREWORD

This Standard is one in a series that provide performance requirements for hoists and was originally issued in 1985. It was developed by the ASME Standards Committee HST, Hoists — Overhead. It is intended to serve as a guide to manufacturers of the equipment, and to the purchasers and users of the equipment.

Standards in this series are:

HST-1 Electric Chain Hoists
HST-2 Hand Chain Manually Operated Chain Hoists
HST-3 Manually Lever Operated Chain Hoists
HST-4 Electric Wire Rope Hoists
HST-5 Air Chain Hoists
HST-6 Air Wire Rope Hoists

This revision adds a new appendix that, in conjunction with ASME HST-3-1999, is intended to replace MIL-H-904.

Suggestions for improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers; Attn: Secretary, HST Committee, Three Park Avenue, New York, NY 10016-5990.

This Standard was approved as an American National Standard on July 12, 1999.

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Hoists — Overhead

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PERFORMANCE STANDARD FOR MANUALLY LEVER OPERATED CHAIN HOISTS

1 GENERAL

1.1 Scope

(a) This Standard establishes performance requirements for manually lever operated chain hoists used for lifting, pulling, and tensioning-type applications.

(b) The specifications and information contained in this Standard apply to manually lever operated chain hoists of the following types:

(1) ratchet and pawl operation with:

(a) roller-type load chain;

(b) welded link-type load chain.

(2) friction brake operation with:

(a) roller-type load chain;

(b) welded link-type load chain.

(c) Manually lever operated hoists using wire rope as the lifting medium and specially insulated lever hoists designed for handling high voltage lines are not covered by this Standard.

(d) This Standard is applicable to hoists manufactured after the date on which this Standard is issued. This Standard is not applicable to:

(1) damaged or malfunctioning hoists;

(2) hoists that have been misused or abused;

(3) hoists that have been altered without authorization of the manufacturer or a qualified person;

(4) hoists used for lifting or supporting people;

(5) hoists used for marine and other applications as required by the Department of Defense (DOD).

1.2 The Appendix

Nonmandatory Appendix A, Performance Requirements for Manually Lever Operated Chain Hoists Used in Marine and Other Applications as Required by the U.S. Department of Defense (DOD), applies to the performance requirements for hoists used in marine and other applications. The requirements stated in Appendix A are in addition to the requirements of ASME HST-3-1999 and shall be specifically invoked.

1.3 Reference Standards

The following documents form a part of this Standard to the extent specified herein. The latest issue shall apply.

ANSI Z535.4, Product Safety Signs and Labels

Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Rosslyn, VA 22209

ANSI/NFPA 70, National Electrical Code

Publisher: National Fire protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101

ASME B30.9, Slings
ASME B30.10, Hooks
ASME B30.11, Monorails and Underhung Cranes
ASME B30.16, Overhead Hoists (Underhung)

Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016; ASME Order Deptartment: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

1.4 Definitions

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to or for the operation of a hoist, such as excessively high or low ambient temperature, exposure to weather, corrosive fumes, dust laden or moisture laden atmospheres, and hazardous locations.

ambient temperature: the temperature of the atmosphere surrounding the hoist.

brake: a device for retarding and stopping motion of the load (see load controlling mechanism).

hazardous (classified) locations: locations where fire or explosion hazards may exist. Locations are classified according to the properties of the flammable vapors, liquids, or gases, or combustible dust or fibers that may be present, and the likelihood that a flammable or combustible concentration or quantity is present. Refer to ANSI/NFPA 70, latest issue.

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headroom (closed height): the distance between the saddle of the suspension hook and the saddle of the load hook when the load hook is in its fully retracted position (upper limit of travel) (see Fig. 1).

hook latch: a mechanical device to bridge the throat opening of a hook.

idler sprocket: a device free to rotate that changes the direction of the load chain. This device is sometimes called idler wheel, idler sheave, pocket wheel, or chain wheel.

lever pull: the average force measured in lbf (kN) exerted by the operator at the end of the operating lever (handle) to lift or pull rated load.

lever-type hoist: a lever operated manual device used to lift, lower, or pull a load and to apply or release tension.

lift: the maximum distance through which the load hook can travel (see Fig. 1).

lifting devices: devices that are not normally reeved onto the hoist chain(s), such as supplemental devices used for handling or attaching to the load. The weight of these devices is to be considered part of the load to be lifted.

load: the total imposed weight on the load block or load hook and includes weight of lifting devices.

load block: the assembly of hook or shackle, swivel, bearing, pins, sprocket, and frame suspended by the load chain. This term shall be understood to include all appurtenances reeved into the load chain.

load chain: a specially constructed hoist chain that passes through the hoist to support the load.

roller link: a series of alternately assembled roller links and pin links in which pins articulate inside the bushings and rollers are free to turn on the bushings. Pins and bushings are pressfit in their respective link plates. Rollerless chain may be provided on some manufacturer's equipment.

welded link: a chain consisting of interwoven links formed and welded.

NOTE: Load chain properties do not conform to those shown in ASME B30.9.

load controlling mechanism: a mechanism that functions automatically to hold and control the load. In each of the following general types, a reciprocating force must be applied to the hoist lever to lower the load.

(a) friction brake type: an automatic type of brake used for holding and controlling loads. This unidirectional device requires a force applied to the operating lever to lower the load, but does not impose additional lever pull when lifting the load.

(b) ratchet and pawl type: a load controlling mechanism consisting of interlocking pawl(s) and ratchet that act to hold the load by mechanical engagement.

load hook: the hook used to connect the load to the hoist.

load sprocket: a hoist component that transmits motion to the load chain. This component is sometimes called a load wheel, load sheave, pocket wheel, chain wheel, or lift wheel.

load suspension parts: the suspension hook, the chain, the sprocket(s), the structure or housing which supports the sprocket(s), and the load block.

normal operating conditions: conditions during which a hoist is performing functions within the scope of the original design.

operating lever: the lever or handle provided to operate the hoist.

overload: any load greater than the rated load.

parts (lines): number of lines of chain supporting the load block or hook.

pawl: a device for holding the machinery against undesired rotation by engaging a ratchet.

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

ratchet: a toothed member that engages with a pawl.

rated load: the maximum load for which a hoist is designated by the manufacturer.

reach (extended height): the distance from the saddle of the load hook at its fully extended position (lower limit of travel) to the saddle of the suspension hook. Reach is equal to lift plus headroom (see Fig. 1).

reeving: the reeving of the hoist is the path of the load chain between the hoist and load block (see Fig. 1).

shall: the word *shall* indicates that adherence to the particular requirement is necessary to conform to this Standard.

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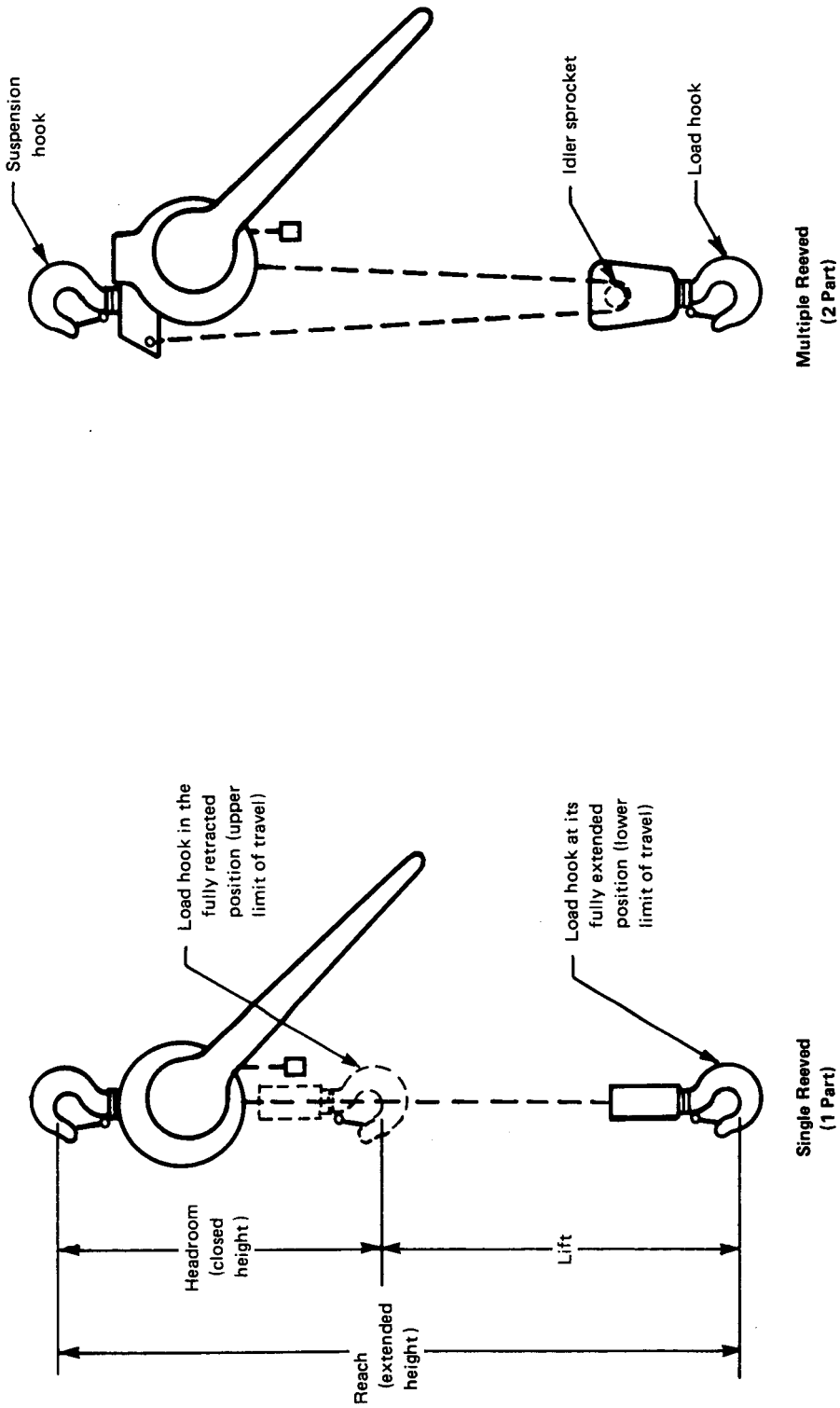

FIG. 1 MANUALLY LEVER OPERATED CHAIN HOIST

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should: the word *should* indicates a recommendation, the use of which depends upon the facts in each situation.

side pull: any force or operating condition that restricts the load block, chain, and hoist body from forming a straight line with the direction of loading.

suspension hook: the hook attached to the body of the hoist.

2 PERFORMANCE

2.1 General

All equipment selected in accordance with this Standard is designed to perform satisfactorily when used in accordance with para. 4.4 and used within the rated load. The user should consult with the manufacturer for lever operated hoists to be used in hazardous (classified) locations or under abnormal operating conditions.

All equipment shall provide operating lever pull, lift, and headroom in accordance with the manufacturer's specifications or the specifications agreed upon by the manufacturer and user.

2.2 Application

Lever operated hoists shall be suitable for lifting or lowering, pulling, or tensioning loads within their rated load. They shall be capable of being used in pulling or tensioning applications at any angle, provided the load block, chain, and hoist body are not restricted from forming a straight line with the direction of loading.

The hoists covered by this Standard are intended for industrial use in ambient temperatures from 0°F (−18°C) to 130°F (54°C) and should perform satisfactorily when applied and operated in the manner described in the pertinent sections of this Standard.

Because of varying environmental conditions, loading, and usage, the hoist service life is interrelated to the type and frequency of maintenance performed on the unit. Equipment covered by this Standard should be inspected and maintained according to para. 4.5.

2.3 Operating Characteristics

Lever operated hoists shall be constructed to provide the following operating characteristics:

(a) the hoist shall lift, lower, or pull a load and apply or release tension in controlled increments when a manual force is applied to the operating lever (handle);

(b) the hoist shall lift or pull the rated load when a typical lever pull is exerted by one operator (see Tables 1 and 2);

(c) the hoist shall be equipped with a mechanism (friction brake or ratchet and pawl) that shall hold and control loads within rated load when the hoist is being operated in either direction;

(d) the hoist shall be equipped with accessible operating controls;

(e) the hoist should have a free-chaining (free-wheeling) capability which will allow the operator to adjust the load hook position when the unit is not under load.

2.4 Performance Characteristics

See Tables 1 and 2 for generally available lever hoist capacities and typical performance characteristics.

3 MECHANICAL

3.1 Design Stresses

(a) The hoist shall be designed to withstand all stresses imposed under normal operating conditions while handling loads within the rated load.

(b) Load suspension parts shall be designed so that the static stress calculated for the rated load shall not exceed 25% of the average ultimate material strength. Elements specifically intended to give visible warning of severe overload by permanent deformation shall be designed to show obvious deformation before failure of other load suspension parts.

(c) Modifications to upgrade or rerate hoist equipment shall be as authorized only by the original equipment manufacturer. If it is impossible or impractical to contact the manufacturer, the work shall be authorized by a qualified person [see para. 4.1(b)].

3.2 Load Sprockets

(a) Load sprockets shall have pockets or teeth formed to allow proper engagement of the load chain.

(b) Load sprockets shall be guarded to minimize entrance of foreign objects.

(c) Provision shall be made to guard against jamming of the load chain within the hoist mechanism under normal operating conditions.

3.3 Load Chain

(a) Load chain may be either roller link or welded link type and shall be suitable for hand operated hoist

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TABLE 1 TYPICAL CHARACTERISTICS OF MANUALLY LEVER OPERATED CHAIN HOISTS — RATCHET AND PAWL TYPE, WELDED LINK AND ROLLER CHAIN [NOTE (1)]

Rated Load			Headroom		Lever Pull to Lift Rated Load		Weight [Note (3)]		Lever Length	
tons [Note (2)]	kg	No. of Chains	in.	mm	lbf	kN	lb	kg	in.	mm
1/2	454	1	9–11	230–280	98–105	0.44–0.47	5–9	2–4	12–15	305–380
3/4	680	1	11–13	280–330	56–98	0.25–0.44	8–14	3–7	15–22	380–560
1	908	1	11–15	280–380	80–90	0.36–0.40	13–15	6–7	20–24	510–610
1 1/2	1,361	1	11–17	280–430	60–116	0.27–0.52	13–27	6–12	17–28	430–710
1 1/2	1,361	2	15–18	380–460	60–98	0.27–0.44	17–21	8–10	18–21	460–535
2	1,815	2	15–18	380–460	85–90	0.38–0.40	20–22	9–10	20–24	510–610
2 1/2	2,268	1	15–18	380–460	70–76	0.31–0.34	21–36	10–16	14–33	355–840
3	2,722	2	16–20	405–510	62–120	0.28–0.53	22–35	10–16	17–28	430–710
4 1/2	4,082	3	19–27	480–690	72–124	0.32–0.55	36–53	16–24	17–34	430–865
5	4,536	2	22–27	560–690	74–125	0.33–0.56	55–65	25–30	33–36	840–915
5	4,536	4	18–25	460–640	76–82	0.34–0.36	42–60	19–27	14–18	355–460
6	5,443	4	22–27	560–690	75–124	0.33–0.55	46–65	21–30	17–34	430–865
9	8,164	5	30–36	760–915	124–140	0.55–0.62	120–145	54–66	34–37	865–940
11	9,979	6	30–36	760–915	124–145	0.55–0.64	130–155	59–70	34–37	865–940
13	11,793	7	30–36	760–915	124–150	0.55–0.67	140–165	64–75	34–37	865–940
15	13,607	8	30–36	760–915	124–155	0.55–0.69	150–175	68–80	34–37	865–940

GENERAL NOTE: This table indicates the range of capacities and characteristics generally available. Those values including a dash (e.g., 98–105) denote typical ranges. Consult individual manufacturer's catalog for specific values.

NOTES:
(1) Standard lifts (not shown in Table) range from 48–60 in. (1,220–1,525 mm). Longer lifts are available on application.
(2) Indicates ton of 2,000 lb.
(3) Weight ranges shown are based on standard lift range [see Note (1)].

service. Chain shall be accurately pitched and sized to pass over sprockets without binding.

(b) Load chains shall be proof tested by the chain manufacturer or hoist manufacturer with a load at least equivalent to 1 1/2 times the hoist rated load divided by the number of chain parts (lines) supporting the load.

(c) If a load is supported by more than one part (line) of load chain, the tension on the parts (lines) shall be equalized.

3.4 Hooks

(a) If the hooks are of the swiveling type, they should be free to rotate. Load block hooks should be capable of rotating through 360 deg when supporting the rated load.

(b) Hooks shall be equipped with latches unless the application makes the use of a latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.

3.5 Load Blocks

Load blocks shall be guarded against load chain jamming during normal operating conditions.

3.6 Load Controlling Mechanism

(a) The hoist shall be equipped with a load controlling mechanism of a ratchet and pawl type, a friction brake type, or a combination of the two, which shall perform the following functions under normal operating conditions with rated load and under test conditions with test loads up to 125% of rated load:

(1) stop and hold the load when the lever force is removed;

(2) provide for incremental movement of the load when lifting or lowering.

(b) The friction brake mechanism shall have provision for adjustment where necessary to compensate for wear.

(c) The load controlling mechanism shall have heat

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TABLE 2 TYPICAL CHARACTERISTICS OF MANUALLY LEVER OPERATED CHAIN HOISTS — FRICTION BRAKE TYPE, WELDED LINK AND ROLLER CHAIN [NOTE (1)]

Rated Load			Headroom		Lever Pull to Lift Rated Load		Weight [Note (3)]		Lever Length	
tons [Note (2)]	kg	No. of Chains	in.	mm	lbf	kN	lb	kg	in.	mm
¼	226	1	9–14	230–355	28–40	0.12–0.18	6–16	3–8	12–15	305–380
½	454	1	9–14	230–355	40–60	0.18–0.27	9–16	4–8	14–16	355–405
¾	680	1	10–14	255–355	32–70	0.14–0.31	12–16	6–8	10–22	255–560
1	908	1	12–15	305–380	40–75	0.18–0.33	16–20	8–9	12–22	305–560
1½	1,361	1	13–17	330–430	40–87	0.18–0.39	16–32	8–15	16–22	405–560
1½	1,361	2	15–17	380–430	34–87	0.15–0.39	20–36	9–16	12–21	305–535
2	1,815	2	15–18	380–460	42–90	0.19–0.40	23–38	10–17	12–21	305–535
3	2,722	1	17–19	430–485	65–90	0.29–0.40	41–45	19–21	16–21	405–535
3	2,722	2	17–21	430–535	49–95	0.22–0.42	34–50	16–23	18–22	460–560
4½	4,082	3	20–24	510–610	54–96	0.24–0.43	48–90	22–41	18–21	460–535
6	5,443	2	21–24	535–610	51–71	0.23–0.32	61–70	28–32	16–21	405–535
6	5,443	4	21–25	535–635	58–108	0.26–0.48	61–110	28–50	18–24	460–610
15	13,607	8	31–36	785–915	86–120	0.38–0.53	243–260	110–118	18–24	460–610

GENERAL NOTE: This table indicates the range of capacities and characteristics generally available. Those values including a dash (e.g., 98–105) denote typical ranges. Consult individual manufacturer's catalog for specific values.

NOTES:
(1) Standard lifts (not shown in Table) range from 48–60 in. (1,220–1,525 mm). Longer lifts are available on application.
(2) Indicates ton of 2,000 lb.
(3) Weight ranges shown are based on standard lift range [see Note (1)].

dissipating capability for the specified frequency of operation.

3.7 Overtravel Restraint

Before the load chain can be completely run out of the hoist, it shall be restrained in its fully extended position. The restraint shall be such that the unloaded hoist can withstand a lowering operating lever force of twice the force required to lift the rated load, or such that the hoist with rated load can withstand a lowering operating lever force equivalent to the force required to lift the rated load.

3.8 Convertible Capacity

On hoists with a convertible capacity feature, the rated load is converted by changing the number of parts (lines) of load chain supporting the load. This conversion shall be accomplished without the use of additional parts or special tools.

3.9 Overload Limiting Device

An overload limiting device, when furnished, shall be designed to permit operation of the hoist within its rated load and to limit the amount of overload that can be lifted or pulled by a properly maintained hoist under normal operating conditions.

The overload limiting device may allow the lifting or pulling of an overload, but shall be designed to prevent the lifting or pulling of an overload that could cause damage to the hoist. This does not imply that any overload is to be intentionally applied to the hoist.

The overload limiting device is an emergency device and shall not be used to measure the maximum load to be lifted or pulled and shall not be used to sense the overload imposed by a constrained load.

3.10 Overload Warning Device

An overload warning device, when furnished, shall consist of an element or elements designed to warn the operator of an overload condition that could damage a properly maintained hoist.

The presence of an overload warning device does not imply that any overload is to be intentionally applied to the hoist.

The overload warning device is an emergency device and shall not be used to measure the maximum load to be lifted or pulled and shall not be used to sense the overload imposed by a constrained load.

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4 LOAD TESTING, MARKING, MANUALS, OPERATING, INSPECTION, AND MAINTENANCE PROCEDURES

4.1 Load Testing

(a) Load Testing of New Hoists. All complete new hoists shall be tested by the manufacturer with a test load of at least 125% of rated load, except hoists incorporating overload devices, in which case the hoist shall be tested with at least rated load. In addition, all operating functions shall be checked to ensure proper operation.

(b) Load Testing of Altered Hoists. All hoists in which load sustaining parts have been altered, replaced, or repaired shall be tested statically or dynamically by or under the direction of an appointed person, and a record of the test should be made. The applied test load shall be at least equal to the rated load or greater as approved by the manufacturer. The replacement of load chain is specifically excluded from this hoist load test; however, a functional test of the hoist should be made prior to putting the hoist back in service.

4.2 Marking (by Manufacturer)

4.2.1 Rated Load. The rated load shall be marked on the hoist or load block.

4.2.2 Controls. All control functions shall be identified.

4.2.3 Identification. The hoist shall be marked with the following information:

(a) name of the manufacturer;

(b) manufacturer's model or serial number.

4.2.4 Warnings. All hoists shall have affixed to the hoist or load block in a readable position information concerning operating procedures. The label or labels shall be in compliance with ANSI Z535.4, and shall include cautionary language against:

(a) lifting more than the rated load

(b) operating a hoist with a twisted, kinked, or damaged chain;

(c) operating a damaged or malfunctioning hoist;

(d) lifting people or loads over people;

(e) operating a hoist with other than manual power; and

(f) removing or obscuring a warning label.

4.3 Manual

The manufacturer shall furnish with each hoist one copy of an instruction manual. The manual shall include information on the following:

(a) operation;

(b) inspection and testing;

(c) lubrication, maintenance, and repair.

4.4 Operation

4.4.1 Procedures. Operating procedures recommended in the manufacturer's instruction manual should be followed. In addition to these recommendations, operating practices (para. 4.4.2) and load handling procedures (para. 4.4.3) should be followed.

4.4.2 Operating Practices. It is recommended that the following practices be adhered to when using a lever operated hoist.

(a) The supporting structure or anchoring means shall have a load rating at least equal to that of the hoist.

(b) The operator shall familiarize himself with the operation of the equipment and its proper care. If adjustments are necessary or any damage is known or suspected, the hoist shall be removed from service and not used until corrections are made.

(c) Hoists shall be used only in locations that will allow the operator to be free of the load.

(d) The operator shall ensure that he has firm footing and is otherwise secured before operating the hoist.

(e) The operator shall have access to the operating lever.

(f) Before using the hoist, the operator shall be certain that all people in the area are clear of the load.

(g) The operator shall not engage in any activity that will divert his attention while operating the hoist.

(h) The operator shall not attempt to use the free-chaining feature with any load on hoist. Load shall not be applied with the hoist control in the free-chaining mode.

(i) Hoists shall not be operated by means other than hand power nor operated with an extension on the lever.

4.4.3 Handling the Load

(a) The rated load shall not be exceeded.

(b) The hoist chain shall not be wrapped around the load.

(c) The load shall be attached to the hook or attached by means of slings or other approved devices.

(d) The load slings or other approved devices shall be seated properly in the saddle of the hook, and the

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hook latch (if used) shall be closed before operating the hoist. Hooks shall not be tip loaded.

(e) Before lifting or pulling a load, the operator shall be certain that:

(1) chain is not kinked, twisted, or fouled, and is properly seated in the sprocket(s);

(2) load is not caught on any obstructions;

(3) multiple chain parts are not twisted and are free to take up load with the load equilized on each supporting strand;

(4) clearance is available to avoid personal injury or property damage.

(f) Hoists shall not be operated until the load block, chain, and hoist body are directly in line with the direction of loading to avoid side pull.

(g) When starting to lift or pull, the load should be moved a few inches, at which time the hoist should be checked for proper load holding action. The operation shall be continued only after the operator is assured that the hoist is operating properly.

(h) Do not release the hoist lever while it is under load. Keep control of the lever until the ratchet pawl is engaged and the lever is at rest.

(i) A hoist shall not be used to lift, support, or otherwise transport people.

(j) The operator shall not use the hoist to carry loads over people.

(k) The operator should not leave a loaded hoist unattended at the end of a work shift or for extended periods during the work shift. Where operations are such that this condition cannot be avoided, the operator must be assured that the condition does not create a hazard to people or property.

4.5 Inspection and Maintenance Procedures

Although lever operated hoists are specifically excluded from the requirements of ASME B30.16, the lever hoist user should be familiar with this safety standard. The inspection and maintenance procedures as covered in the manufacturer's manual should be followed.

Consideration should also be given to pertinent federal, state, and local regulations in the use of this equipment.

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PERFORMANCE REQUIREMENTS FOR MANUALLY LEVER OPERATED CHAIN HOISTS USED IN MARINE AND OTHER APPLICATIONS AS REQUIRED BY THE U.S. DEPARTMENT OF DEFENSE (DOD)

A1 GENERAL

A1.1 Scope

This Appendix provides performance requirements beyond those cited in ASME HST-3-1999 for manually lever operated chain hoists for use in marine and other applications as required by the Department of Defense (DOD).

This Appendix, in conjunction with ASME HST-3-1999, is replacing the requirements of MIL-H-904 for manually lever operated chain hoists.

A1.2 Classification

Manually lever operated chain hoists shall be of the following classes and types [see para. A5.1(b)]:

A1.2.1 Classes

Class 1 Conventional weight, for general material handling.

Class 2 Light weight for general material handling.

Class 3 Free of cast iron load bearing parts, used for special purpose service (such as reactor component handling).

A1.2.2 Types

Type A Manually Lever Operated Hoist, Link or Roller Chain Hoist, Hook Suspension Fixed Capacity.

Type B Manually Lever Operated, Link or Roller Chain Hoist, Hook Suspension Convertable Capacity.

A1.3 Definitions

brittle material: material showing less than 10% elongation in gage length for the tensile test specimen.

operating cycle: the lifting and lowering of the hoist rated load through a minimum distance of 4 ft, with a 6 sec maximum pause between lift and lowering.

recovered materials: materials that have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials.

A1.4 References to Other Codes and Standards

Refer to the following publications, copies of which may be obtained from the publisher as indicated. The edition bearing the latest date of issue shall be used.

ASTM A 48, Standard Specification for Gray Iron Castings (DOD adopted)

ASTM A 143, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement (DOD adopted)

ASTM A 304, Standard Specification for Alloy Steel Bars Subject to End-Quench Hardenability Requirements (DOD adopted)

ASTM A 322, Stadard Specification for Hot-Rolled Alloy Steel Bars (DOD adopted)

ASTM B 26, Standard Specification for Aluminum-Alloy Sand Castings (DOD adopted)

ASTM B 108, Standard Specification for Aluminum-Alloy Permanent Mold Castings (DOD adopted)

ASTM B 633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DOD adopted)

Publisher: American Society for Testing and Materials (ASTM), 100 Barr Harbor, West Conshohocken, PA 19428

MIL-E-917, Electric Power Equipment, Basic Requirements

MIL-S-901, Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for

Publisher: Department of Defense, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

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A2 PERFORMANCE REQUIREMENTS

A2.1 General

Performance requirements shall be in accordance with ASME HST-3-1999, and as specified in this Appendix.

A2.2 Application

Metals susceptible to corrosion attack in a sea water environment shall be treated, plated, or painted to provide corrosion resistance. In order to minimize electrolytic corrosion between dissimilar metals in contact with each other, metal-to-metal contacts shall be limited to those metals, which when coupled, are in accordance with sea water corrosion of galvanic couples requirements of MIL-E-917. If a metal is coated or plated, the coating or plating metal rather than the base metal shall be considered in metal-to-metal contact between parts that depend upon coating or plating for corrosion resistance.

When specified [see para. A5.1(c)], hooks shall be zinc plated. Zinc Plating shall be in accordance with ASTM B 633, Type II, Class Fe/Zn 12. The hook throat safety device shall be constructed of noncorrosive material or treated for corrosion resistance.

When specified [see para. A5.1(d)], the link load chain shall be protected by zinc coating in accordance with ASTM B 633, Type II, Class Fe/Zn 12. The roller chain shall have a blue oxide finish supplemented by a coating of combination lubricant and rust preventative.

The safeguarding against and procedure for detecting embrittlement of zinc coating shall be in accordance with ASTM A 143.

A2.3 Characteristics

A2.3.1 Type A and B, Manually Lever Operated Link or Roller Chain Hoist, Hook Suspension, Fixed (A) and Convertable (B) Capacity. Types A and B shall be hook suspended, lever operated, and shall contain a mechanism for hoisting and lowering, which is either a pawl, ratchet and lever, or a spur geared (friction brake) arrangement constructed for safe operation of the hoist. There shall be no limitation on position of the hoist when in use. Hoists shall be in accordance with Tables 1 and 2 of ASME HST-3-1999 and as specified herein.

A2.4 Lubrication

Lubricants used shall be readily available and be free of ozone depleting chemicals (ODC).

A2.5 Painting

Paints and coatings shall be lead and chromate free.

A2.6 Workmanship

The hoist shall withstand any operation specified herein without malfunction or component failure caused by faulty workmanship. Edges and surfaces exposed to operating and maintenance personnel shall be smooth and rounded so that a hazardous surface does not exist.

A2.7 Interchangeability

In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength. Component parts for the same type of hoists from the same manufacturer shall be interchangeable to the greatest extent possible.

A3 MECHANICAL REQUIREMENTS

A3.1 Design Stress

The maximum combined stress in component parts shall not exceed 35% of the tensile yield strength of the material for hoist operation at rated load. The maximum combined stress in component parts shall not exceed 70% of the tensile yield strength of the material. For all classes of hoists at rated load, the safety factor for load bearing parts shall be not less than three, based on the yield strength of the materials used; or a minimum safety factor of five, based on the ultimate strength, whichever provides the lowest design stress. For hoists requiring repair parts, all wear parts shall be readily accessible for replacement. Equivalent spares for the same class and type hoists shall be interchangeable.

When specified [see para. A5.1(e)], the hoist shall withstand the grade A high-impact shock. Unloaded hoists, when stowed on a pad, shall withstand high-impact shock in accordance with grade A of MIL-S-901, without permanent deformation or degradation of any operating functions.

A3.2 Load Chain

As specified [see para. A5.1(f)], load chain shall be link or roller type. The load chain shall have a safety factor of five for the rated load of the hoist, based on the ultimate strength of the material. The load chain shall be selected from any of the AISI grade designations

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TABLE A1 HOOK THROAT OPENINGS

Hoist Rated Load, lb	Hook Throat Opening, Min., in.
1,000	0.75
2,000	0.906
3,000	1.0
4,000	1.125
5,000	1.125
6,000	1.5
7,500	1.375
10,000	1.625
11,000	2.0
13,000	2.063
15,000	2.063
17,000	2.063
20,000	2.25
25,000	2.25
30,000	2.75
40,000	3.0

of ASTM A 304 or A 322. The load chain shall be easily replaceable.

A3.2.1 Load Chain Container. When specified [see para. A5.1(g)], hoists shall be equipped with a load chain container of durable construction to store the slack load chain. The load chain container shall have sufficient volume to contain the slack load chain and shall be located to prevent interference with the hoist operation.

A3.2.2 Load Chain Sprocket and Shaft. The load chain sprocket may be integral with or rigidly connected to the load chain shaft. Welding of the load chain sprocket to the shaft is not permitted.

A3.3 Chain Stop

Type B convertable capacity hoist may have a chain stop attached to the load chain end in lieu of securing the chain to the hoist. The chain stop shall prevent unreeving of the hoist and shall be removable.

A3.4 Lever

The operating lever length for Types A and B shall be a maximum of 34 in. measured from the center of the yoke pin to the extreme end. The hoist shall engage to lift or lower with a lever stroke of 36 deg or less. The hoist shall permit a lever power stroke through a minimum arc of 60 deg.

A3.5 Load Hooks

Hook throat openings shall be in accordance with the dimensions shown in Table A1. The hook shall be clearly marked with manufacturer identification and allowable hook load or allowable hook load designator. Positive means shall be provided to prevent the load hook from loosening due to rotation of the load.

A3.6 Construction

Rotating shafts shall be supported in anti-friction, lubricated, or self-lubricated bearings or bushings. Shaft bushings or bearings shall be enclosed against entry of foreign matter. Rotating and sliding surfaces shall be lubricated. Chain replacement shall be accomplished by use of simple hand tools. Gears shall be enclosed against foreign matter (such as dirt, dust, and water spray) in a casing that will permit ready access for inspection and cleaning. Positive means of securing loose parts shall be provided to prevent any component from working loose.

A3.6.1 Hoist Brake. Hoist construction shall provide for automatic brake operation to secure a suspended load if the hand lever is released or operating mechanism fails. Lowering shall be possible only by manual operation of the hoist hand lever. The brake device shall be self-adjusting for the service life of the brake lining. The brake shall support the required hoist loads with no evidence of permanent deformation or excessive wear. The brake device and brake surfaces shall be protected against the retention of dirt, dust, and water.

A3.7 Chain Guides

Enclosed chain guides shall be provided to ensure that the hoist load chain enters the sprocket in the proper position to prevent misalignment or jamming of the hoist load chain and sprocket. These guides, if bolted on, shall have means to prevent loosening under vibration.

A3.8 Overload Protection

Overload limiting devices shall not be used in Naval applications.

A3.9 Materials

Materials used shall be of sufficient hardness and strength to withstand intended use and applicable tests.

A3.9.1 Recycled, Recovered, or Environmentally Preferable Materials. Recycled, recovered (see para. A1.3), or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the

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operational and maintenance requirements, and promotes economically advantageous life cycle costs.

A3.9.2 Prohibited Materials. Cadmium, asbestos, beryllium, brittle materials, and magnesium or magnesium based alloys (except steel or aluminum alloys that contain less than 0.5% magnesium) shall not be used unless otherwise specified.

A3.9.3 Material for Class 3 Hoists. Metal castings, weldments, and steel forging used for load bearing parts on Class 3 hoists shall be inspected as specified. Cast iron shall not be used for load bearing parts. Cast iron for non-load bearing parts shall be in accordance with ASTM A 48, Class 35 or better. Aluminum castings for load bearing or non-load bearing parts shall be in accordance with ASTM B 26 or ASTM B 108, Type UNS A03560, temper T6.

A4 TESTING, MARKING, AND DATA

A4.1 Testing

A4.1.1 High-Impact Shock. When specified [see para. A5.1(f)] shall undergo the high-impact shock test in accordance with MIL-S-901. Resilient mountings shall not be used. Hoists shall be tested in stowed position (horizontal attitude), constrained (not fastened) to prevent lateral movement, and clamped or strapped to resist vertical movement. Hoists shall have the load hook or load block retracted for the test. The test fixture for mounting the hoist shall conform, as applicable, to the deck-platform or bulkhead mounting figures shown in MIL-S-901. Following successful completion of high-impact shock test, the hoist shall be subjected to the following tests:

A4.1.2 Static Load. The hoist shall support a static load of twice the maximum rated load for 10 min. The load shall be suspended with the hoist load chain extended to the limit of the hoist rated lift height. This extension may be changed to not less than 1 ft, provided the contractor demonstrates that the entire length of chain will support 200% of rated load. The suspended test load shall be held by the hoist brake for 10 min.

A4.1.2.1 Dynamic Load. The hoist, fixed capacity and convertible capacity (convertible hoists shall be reeved for their fixed load rating), shall be loaded to 150% of rated load and operated by hoisting and lowering the test load through the required lift height. With the test load clear of the ground, a minimal length of 1 ft of load chain shall be overhauled in each direction. This test shall be performed at a minimum speed of 10 ft/min. Hoist shall operate satisfactorily and the brake shall exhibit no sign of slippage.

A4.1.3 Efficiency. The hoists shall be loaded to rated capacity and operated to raise the load through any conveniently measured distance. A spring balance shall be connected not more than 2 in. from the end of the opening lever of the hoist. The mean force required to operate the lever through one operating stroke shall be determined by measuring the force at five equidistant positions over the operating stroke. Measurement shall be made with the spring balance always at a right angle to the lever and for at least six successive operating strokes. The total distance through which the operating force acts and the distance through which the load is lifted shall be noted. The mechanical efficiency of the hoist shall be determined from the following formula:

$$E = \frac{C \times L \times 100}{P \times T}$$

where:

E = mechanical efficiency in percent of 100
C = rated capacity of hoists in lb
L = distance lifted (ft)
P = mean operating force in lbf
T = total distance through which P acts

A4.1.4 Endurance. Types A and B hoists shall be tested to 2,000 continuous operating cycles when single reeved. The operating cycles for testing multiple reeved hoists shall be determined by dividing 2,000 by the number of hoist load lines. Convertible hoists shall be reeved for their fixed rated load. An operating cycle for these hoists shall consist of lifting and lowering the hoist rated load through a distance of 6 in. Lever operated hoists shall be operated at a minimum speed of 15 ft/min and a maximum of 70 ft/min. Hoists shall be clean and free of foreign material and excess lubricant. During operation of these hoists, no wear particles greater than 0.031 in. in any direction shall be generated.

A4.2 Marking

A4.2.1 Identification. In addition to the requirements of para. 4.2.3 of ASME HST-3-1999, the hoist shall be identified with the following:

(a) hoist weight and shock (grade), as applicable;
(b) Class and Type, as applicable;
(c) rated load;
(d) Appendix A, ASME HST-3-1999;

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(e) national stock number (NSN) (if established);

(f) manufacturer's model number, part number, or serial number;

(g) contract or order number;

(h) manufacturer's name or trademark; and

(i) date of manufacture.

A4.2.2 Class 3 Marking. For Class 3 hoists, space shall be provided, either on the identification plate or in another prominent location, for a 21-word inscription (135 spaces) of 0.125 in. (min.) size lettering.

Metal castings for load bearing parts of Class 3 hoists shall be identified with the foundry heat number cast or stamped on a raised pad 0.125 in. above the casting surface using 0.250 in. letters. When a raised pad is not practical due to space or function, the heat number shall be applied in a legible, permanent manner. Marking stamps shall be of the low stress type.

A4.3 Data

A4.3.1 Technical Manuals. When specified [see para. A5.1(h)] in the contract or order, the manufacturer shall prepare technical manuals in accordance with the data ordering documents and include the following:

(a) complete list of material;

(b) identification of each component for replacement; and

(c) final drawings.

A5 TYPICAL HOIST INQUIRY DATA

A5.1 Acquisition

In addition to the typical hoist inquiry data of ASME HST-3-1999, acquisition documents must specify the following:

(a) Appendix A, ASME HST-3-1999;

(b) Class, Type, and rated load of hoist required (see para. A1.2). When Class 3 is specified, special service should be defined.

(c) if zinc coating of hooks is required (see para. A2.2);

(d) if zinc plating is required for load chain (see para. A2.2);

(e) hoist shock resistance grade A or B (see paras. A3.1 and A4.1.1);

(f) Type of load chain, link or roller (see para. A3.2);

(g) if chain container is required (see para. A3.2.1); and

(i) if technical manual is required (see para. A4.3.1).

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AMERICAN NATIONAL STANDARDS FOR HOISTS, PALLETS, AND TRANSMISSION CHAINS

Performance Standard for Electric Chain Hoists HST-1-1999
Performance Standard for Hand Chain Manually Operated Chain Hoists HST-2-1999
Performance Standard for Manually Lever Operated Chain Hoists HST-3-1999
Performance Standard for Overhead Electirc Wire Rope Hoists HST-4-1999
Performance Standard for Air Chain Hoists..... HST-5-1999
Performance Standard for Air Wire Rope Hoists..... HST-6-1999

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