

CHAPTER 8

HOISTS

This chapter provides safety standards for inspecting, testing, and operating hoists not permanently mounted on overhead cranes and implements the requirements of ASME B30.11 (“Monorail Systems and Underhung Cranes”), B30.16[“Overhead Hoists (Underhung)”], and B30.21 (“Manually Lever Operated Hoists”) (for latest ASME standards, see <http://catalog.asme.org/home.cfm?Category=CS>).

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8.1 GENERAL

- a. Hoists described in this chapter include hand-powered, air-powered, and electric-powered hoists that are not permanently mounted on overhead cranes.
- b. This chapter applies to the following types of equipment (see Figures 8-1 through 8-6):
 1. Overhead hoists (underhung).
 2. Jib cranes/hoists (floor and wall mounted).
 3. Monorail systems.
 4. Manual-lever-operated hoists (wire rope, chain, and web-strap types).
- c. Wire-rope ratchet and pawl lever-operated hoists should not be used for lifting service (see Figure 8-8).
- d. Systems used for transporting personnel and specially insulated hoists used for handling electrically energized power lines require special considerations and are not included in this chapter.



Figure 8-1. Hand-chain-operated hoists.

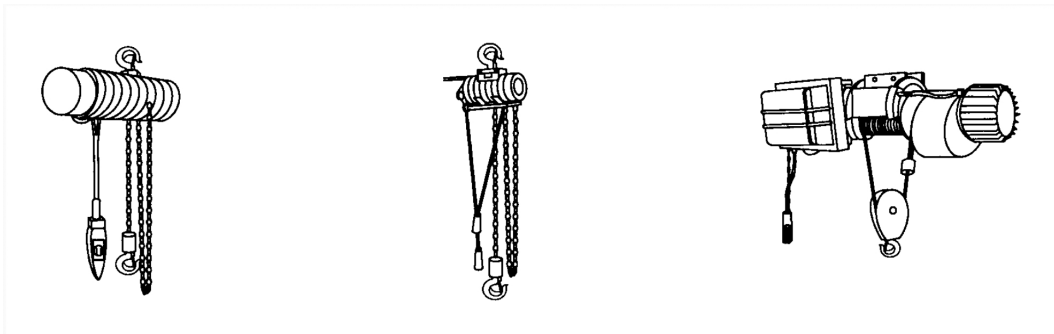


Figure 8-2. Electric/air-powered chain and wire-rope hoists.

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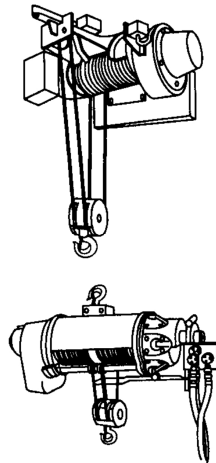


Figure 8-3. Electric/air-powered wire-rope hoists.

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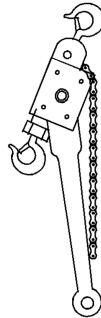


Figure 8-4. Manual-lever-operated hoist – chain type.



Figure 8-5. Manual-lever-operated hoist – wire-rope type.

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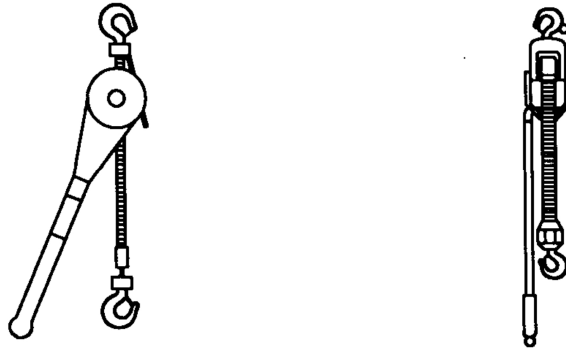


Figure 8-6. Manual-lever-operated hoist – web-strap type.

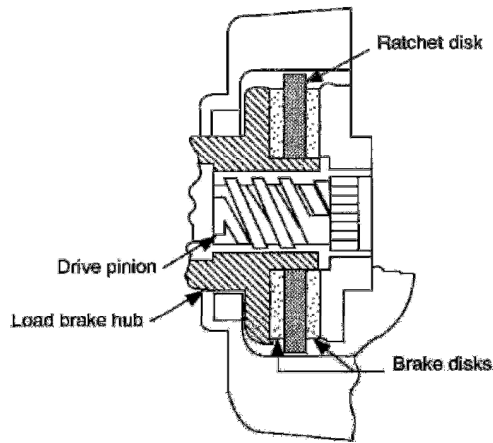


Figure 8-7. Recommended – hoists with friction brake type load-controlling mechanisms.

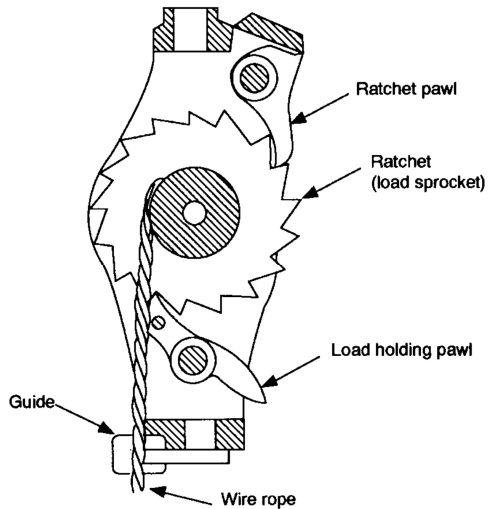


Figure 8-8. Not recommended – hoists with ratchet and pawl load-controlling mechanisms.

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8.1.1 OPERATOR TRAINING/QUALIFICATION

Hoist operators shall be trained and qualified according to requirements found in Chapter 6, "Personnel Qualification and Training."

8.1.2 MARKING

- a. The rated capacity shall be permanently marked on the hoist or load block.
- b. Electric-powered hoists shall be marked with:
 1. Name of manufacturer.
 2. Manufacturer's model or serial number.
 3. Voltage of AC or DC power supply and phase/frequency of AC power supply.
 4. Circuit ampacity.
- c. Air-powered hoists shall be marked with:
 1. Name of manufacturer.
 2. Manufacturer's model or serial number.
 3. Rated air pressure.
- d. Hand-chain-operated hoists shall be marked with:
 1. Name of manufacturer.
 2. Manufacturer's model or serial number.
- e. Manual-lever-operated hoists shall be marked with:
 1. Name of manufacturer.
 2. Manufacturer's model or serial number.

8.1.3 WARNING LABELS

Documented evidence of equivalent training of the user of the hoist demonstrating that the information on the warning labels has been conveyed and understood by the user will waive the requirement to maintain warning labels.

8.1.3.1 Electric- or Air-Powered Hoists

- a. Labels shall be affixed to the hoist, load block, or controls that display the word WARNING or other legend designed to bring the label to the attention of an operator.
- b. The label shall contain cautionary language against any of the following:
 1. Lifting more than the rated load.
 2. Operating a hoist when the load is not centered under the hoist.
 3. Operating a hoist with twisted, kinked, or damaged chain or wire rope.
 4. Operating a damaged or malfunctioning hoist.
 5. Lifting personnel or lifting loads above personnel.
 6. Operating a wire-rope hoist with a wire rope that is not properly seated in its grooves.
 7. Removing or obscuring warning labels.
- c. A label shall be affixed on all electrical control enclosures. The label shall be in compliance with ASNI Z535.4, and shall include, but not be limited to, information such as:
 1. "Disconnect power and lockout/tagout disconnecting means before removing cover or servicing this equipment."
 2. "Do not operate without cover in place."

8.1.3.2 Hand-Chain-Operated or Manual Lever-Operated Hoists

- a. Labels shall be affixed to the hoist or load block and shall display the word WARNING or other legend designed to bring the label to the attention of an operator.
- b. The label shall contain cautionary language against any of the following:

1. Lifting more than the rated load.
2. Operating a hoist when it is restricted from forming a straight line with the direction of loading.
3. Operating the hoist with twisted, kinked, or damaged wire rope, chain, or webbing strap.
4. Operating damaged or malfunctioning hoists.
5. Lifting personnel or lifting loads above personnel.
6. Operating a hoist with lever extensions (for lever-operated hoists).
7. Operating hoists with other than manual power (for hand-chain-operated hoists).
8. Removing or obscuring warning labels.

8.1.4 DESIGN STANDARDS

- a. At a minimum, safety features and operation shall meet the provisions of ASME B30.16 and B30.21.
- b. Mechanical, electrical, and structural components of hoist design shall meet accepted hoist design standards contained in ASME HST-1M, -2M, -3M, -4M, -5M, and -6M (“Performance Standard for Electric Chain Hoists”; “Performance Standard for Hand Chain Manually Operated Chain Hoists”; “Performance Standard for Manually Lever Operated Chain Hoists”; “Performance Standard for Electric Wire Rope Hoists”; “Performance Standard for Air Chain Hoists”; and “Performance Standard for Air Wire Rope Hoists,” respectively).

8.1.5 DESIGN FACTORS

- a. For electric- or air-powered hoists, load-suspending parts of powered hoists shall be designed so that the static stress calculated for the rated load will not exceed 20 percent of the average ultimate material strength. This requirement is commonly reflected by quoting a minimum design factor of 5:1.

- b. For hand-chain-operated and manual-lever-operated hoists, load-suspending parts shall be designed so that the static stress calculated for the rated load will not exceed 25 percent of the average ultimate strength. This requirement is commonly reflected by quoting a minimum design factor of 4:1.

8.1.6 LOAD-BRAKING/LOAD-CONTROLLING MECHANISMS

8.1.6.1 Electric-Powered Hoists

- a. Under normal operating conditions with rated load and under test conditions with test loads up to 125 percent of rated load, the braking system shall perform the following functions:
 1. Stop and hold the load hook when controls are released.
 2. Limit the speed of the load during lowering, with or without power, to a maximum of 120 percent of the rated lowering speed for the load being handled.
 3. Stop and hold the load hook in the event of a complete power failure.
- b. The braking system shall have thermal capacity for the frequency of operation required by the service.
- c. The braking system shall have provision for adjustments, where necessary, to compensate for wear.

8.1.6.2 Air-Powered Hoists

- a. Under normal operating conditions with rated load and under test conditions with test loads up to 125 percent of rated load, the braking system shall perform the following functions:
 1. Stop and hold the load hook when controls are released.
 2. Prevent an uncontrolled lowering of the load in the event of a loss of air pressure.

- b. The braking system shall have thermal capacity for the frequency of operation required by the service.
- c. The braking system shall have provision for adjustments, where necessary, to compensate for wear.

8.1.6.3 Hand-Chain-Operated Hoists

The Hoist shall be designed so that when the actuating force is removed, it will automatically stop and hold any test load up to 125 percent of the rated load.

8.1.6.4 Manual-Lever-Operated Hoists

- a. The hoist shall be equipped with a load-controlling mechanism.
- b. The load-controlling mechanism shall perform the following functions under normal operating conditions with test loads up to 125 percent of rated capacity:
 - 1. Stop and hold the load when the lever force is removed and the lever stroke is completed.
 - 2. Provide for incremental movement of the load when lifting or lowering.
- c. The friction brake mechanism shall have provision for adjustment where necessary to compensate for wear.

8.1.7 WIRE ROPE

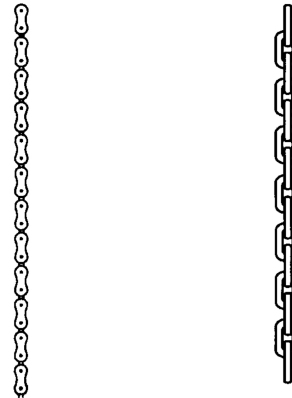
- a. Wire rope shall be of a construction specified by the hoist manufacturer or by a qualified person.
- b. If a load is supported by more than one part of wire rope, the tension on the parts shall be equalized.
- c. Socketing shall be done in the manner specified by the manufacturer of the assembly or the rope.
- d. Eye splices shall be made in a manner recommended by a qualified person. Rope thimbles should be used in the eye.

- e. Swaged or compressed fittings shall be applied as recommended by the rope, hoist, or fitting manufacturer or a qualified person.
- f. Use rope having an independent wire-rope, wire-strand core, or other temperature-damage-resistant core if the rope will be exposed to ambient temperatures greater than 180 degrees F (82 degrees C).
- g. The rope ends should be attached to the hoist in a manner to prevent disengagement throughout rated hook travel. No less than two wraps of rope shall remain on the anchorage of the hoist load sprocket (drum) when the hook is in its fully extended position, unless a lower-limit device is provided, in which case one wrap shall remain on each anchorage of the drum hoist.

8.1.8 LOAD CHAIN

8.1.8.1 Electric-Powered, Air-Powered, and Manual-Lever-Operated Hoists

- a. Load chain may be either roller or welded link type (see Figure 8-9). Chain shall be pitched (calibrated) so as to pass over all load sprockets without binding.



Roller Type

Welded-Link Type

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Figure 8-9. Load Chain

- b. The load chain shall be proof-tested by the chain or hoist manufacturer with a load at least equivalent to 1.5 times the hoist's rated

load divided by the number of chain parts supporting the load.

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

8.1.8.2 Hand-Chain-Operated Hoists

- a. The hand chain shall be of a shape and pitch to fit the hand-chain wheel without binding or jamming under normal operating conditions.
- b. The hand chain shall be guarded to prevent disengagement from the hand-chain wheel.
- c. The hand chain shall withstand, without permanent distortion, a force of three times the pull required to lift the rated load.

8.1.9 WEB STRAP

The following applies for manual-lever-operated hoists:

- a. Web strap should be nylon, polyester, or similar synthetic material.
- b. If a load is supported by more than one part of web strap, the tension on the parts shall be equalized.
- c. End terminations shall be done in the manner specified by the manufacturer of the assembly or the web strap.
- d. Eyes shall be made in a manner recommended by the hoist manufacturer or a qualified person.
- e. Nylon and polyester web straps shall not be exposed to an ambient temperature greater than 200 degrees F (93 degrees C).
- f. The web strap shall be attached to the hoist in a manner to prevent disengagement throughout rated hook travel; no less than two wraps of web strap shall remain on the hoist load sprocket (drum) when the hook is extended to its full rated lift.

8.1.10 OVERTRAVEL PROTECTION

8.1.10.1 Upper-Limit Switches/Devices

For electric- or air-powered hoists, the hoist shall be designed and constructed so that the load hook, either loaded or empty, shall not exceed the upper limit of travel. In lieu of a limit switch, a mechanism such as a slip clutch may be used.

8.1.10.2 Lower-Limit Switches/Devices

- a. For electric-or air-powered hoists, the hoist shall not be installed where, during normal operating conditions, the hook can be lowered beyond rated hook travel unless the hoist is equipped with a lower-limit device. Lower-limit devices should be provided for hoists where the load block enters pits or hatchways in the floor.
- b. For hand-chain-operated and manual-lever-operated hoists, 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 hand chain or operating lever force equivalent to twice the pull required to lift the rated load, or with the rated load on the hoist, a hand chain or operating lever force equivalent to the pull required to lift the rated load.

8.1.11 SUPPORT

Support structures, including trolleys and monorails, shall have a rated capacity at least equal to that of the hoist.

8.1.12 LOCATION

The hoist shall be installed only in locations that will permit the operator to remain clear of the load at all times.

8.1.13 LOAD RATING

The rated capacity shall not be exceeded except for properly authorized tests.

8.2 INSPECTIONS

8.2.1 HOIST SERVICE

Hoist service is defined as follows:

- a. Normal service – operation with randomly distributed loads within the rated load limit, or uniform loads less than 65 percent of rated load for not more than 15 percent of the time for manual-lever-operated hoists or for not more than 25 percent of the time for electric- or air-powered hoists.
 - b. Heavy service – operation within the rated capacity that exceeds normal service.
 - c. Severe service – operating at normal or heavy service under abnormal operating conditions, (i.e., extreme temperatures, corrosive atmospheres).
5. Hoist rope for kinking, crushing, birdcaging, and corrosion.
 6. Hoist chain for nicks, gouges, distortion, wear, cracks, and corrosion.
 7. Synthetic web strap for abrasive wear, knots, cuts, or tears, broken stitching, acid or caustic burns, melting or charring, or weld splatter.
 8. Hook latch, if used, for proper operation.
- b. Operators or other designated personnel shall examine deficiencies and determine whether they constitute a safety hazard.

8.2.2 INITIAL INSPECTION

Prior to their initial use, all new, repaired, or modified hoists shall be inspected by a qualified inspector to ensure compliance with the applicable provisions of ASME B30.11, B30.16, and B30.21. Dated and signed inspection records shall be kept on file and shall be readily available.

8.2.3 DAILY INSPECTION

- a. Operators or other designated personnel shall visually inspect items such as the following at the beginning of each shift or prior to first use if the hoist has not been in regular service (records are not required):
 1. Controls and operating mechanisms for proper operation.
 2. Hoist upper-limit switch, as applicable, for proper operation.
 3. Lines, valves, and other parts of air systems for leakage.
 4. Hooks for cracks, deformation, and damage from chemicals (see Chapter 13, "Load Hooks," for additional hook requirements).
1. Normal service – monthly.
 2. Heavy service – weekly to monthly.
 3. Severe service – daily to weekly.
- b. In addition to the requirements listed above in Daily Inspection, these inspections shall include the following:
 1. Hoist braking system for proper operation.
 2. Hoist rope or chain reeving for compliance with hoist manufacturer's recommendations.
 3. Lever for bends, cracks, and the like.
 4. Observations during operation.
 - c. Examine deficiencies and determine whether a more detailed inspection is required.

8.2.4 FREQUENT INSPECTION

- a. Operators or other designated personnel shall visually inspect the hoist at the following intervals (records are not required):
 1. Normal service – monthly.
 2. Heavy service – weekly to monthly.
 3. Severe service – daily to weekly.
- b. In addition to the requirements listed above in Daily Inspection, these inspections shall include the following:
 1. Hoist braking system for proper operation.
 2. Hoist rope or chain reeving for compliance with hoist manufacturer's recommendations.
 3. Lever for bends, cracks, and the like.
 4. Observations during operation.
- c. Examine deficiencies and determine whether a more detailed inspection is required.

8.2.5 PERIODIC INSPECTION

- a. A qualified inspector shall perform a complete inspection at the following intervals:
 - 1. Normal service – yearly.
 - 2. Heavy service – semiannually.
 - 3. Severe service - quarterly
- b. The qualified inspector shall examine deficiencies and determine whether they constitute a safety hazard and whether disassembly is required.
- c. Dated and signed inspection records shall be kept on file and shall be readily available.
- d. A sample load test and inspection form is included as Exhibit I, which appears at the end of this chapter. This form is intended to be a sample only, and is not intended to be mandatory.

8.2.5.1 Hoists

- a. In addition to the requirements listed in Section 8.2.4, “Frequent Inspection,” periodic inspections of hoists shall include the following:
 - 1. Bolts, rivets, nuts, and pins for being loose or absent.
 - 2. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1).
 - 3. Cracked or worn drums or sheaves.
 - 4. Worn, corroded, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers locking, and clamping devices.
 - 5. Excessive wear on motor or load brakes.
 - 6. Excessive wear of chains, ropes, synthetic web strap, load sprockets, drums, sheaves, and chain stretch.

- 7. Deterioration or damage of end connections and terminations of wire rope, load chains, and synthetic web.
- 8. Hooks damaged from chemicals, cracks, any visibly apparent bend or twist from the plane of the unbent hook, or any distortion causing an increase in throat opening of 5% not to exceed 1/4 inch unless otherwise recommended by the manufacturer. See Chapter 13 for additional hook requirements.
- 9. Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining members.
- 10. Suitable crack-detecting inspections for hooks, such as dye-penetrant or magnetic-particle inspections (performed when required by the inspector).
- 11. Electrical apparatus for signs of pitting or any deterioration of controller contactors, limit switches, and push-button switches.
- 12. Supporting structures and trolleys, if used, for continued ability to support the imposed loads.
- 13. Warning labels for illegibility or absence.

8.2.5.2 Wire Rope

- a. A qualified inspector shall inspect running rope at least annually. This inspection shall include examination of the entire length of rope, without detaching it from the hoist drum. More frequent intervals shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. The qualified inspector shall carefully note any deterioration, such as described below, resulting in appreciable loss of original strength and determine whether further use of the rope constitutes an acceptable risk.

1. Reduction of rope size below nominal diameter, whether due to loss of core support, internal or external corrosion, or wear of outside wires. (see Table 8-1).
2. A number of broken outside wires and the distribution or concentration of such broken wires.
3. Worn outside wires.
4. Sections of rope that are normally hidden during inspection or maintenance procedures, such as parts passing over sheaves (these are points most subject to deterioration).
5. Corroded or broken wires at end connections.
6. Corroded, cracked, bent, worn, or improperly applied end connections.
7. Kinking, crushing, cutting, or unstranding.

rope because many factors are involved. Safety depends largely on the use of good judgment by an appointed person in evaluating remaining strength in a used rope, after allowance for deterioration disclosed by inspection. Safety of rope operation depends on this remaining strength.

- c. Conditions such as the following shall be reason for questioning rope safety and considering replacement:
 1. In hoist ropes, 12 randomly distributed broken wires in one rope lay, or 4 broken wires in one strand in one rope lay.
 2. Wear of one-third of the original diameter of outside individual wires.
 3. Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
 4. Evidence of heat damage from any cause.
 5. Reductions from nominal diameter greater than those shown in Table 8-1.
- d. The qualified inspector shall give special attention to end fastenings and shall examine ropes frequently at socketed fittings; on the development of two broken wires adjacent to this point, resocket or replace the rope. Resocketing shall not be attempted if the resulting rope length will be insufficient for proper operation. Those portions of the rope subjected to reverse bends and operation over small-diameter drums or sheaves shall be closely examined.
- e. Replacement rope and connections shall have a strength rating at least as great as the original rope and connections furnished by the hoist manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the hoist manufacturer, or a qualified person.
- f. Never use discarded rope for slings.

Table 8-1. Maximum allowable rope reductions.

Rope diameter	Maximum allowable reduction from Nominal diameter
Up to 5/16 in. (8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in. to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over 3/4 in. to 1 1/8 in. (29 mm)	1/16 in. (1.6 mm)
	3/32 in. (2.4 mm)
Over 1 1/8 in. to 1 1/2 in. (38 mm)	

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- b. No precise rules can be given for determining the exact time to replace wire

8.2.5.3 Welded-Link Chain

- a. A qualified inspector shall do the following during periodic inspections:
 1. Operate the hoist under load in raising and lowering directions, and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.
 2. Make sure that, if the chain binds, jumps, or is noisy, first clean and properly lubricate it. If the trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.
 3. The chain should be cleaned before inspection. Examine visually for cracks, gouges, nicks, weld spatter, corrosion, and distorted links. Slacken the chain and move adjacent links to one side to inspect for wear at the contact points. If you observe wear or suspect stretching, measure the chain according to the hoist manufacturer's instructions. If instructions are not available, proceed as follows:
 - i. Select an unworn, unstretched length of the chain (e.g., at the slack end).
 - ii. Suspend the chain vertically under tension and, using a caliper-type gauge, measure the outside length of any convenient number of links approximately 12 in. (305 mm) to 14 in. (356 mm) overall.
 - iii. Measure the same number of links in the used sections and calculate the percentage of increase in length.
 - iv. If the used chain exceeds a hoist manufacturer's recommended length, or in the absence of such a recommendation, if the used chain is 1.5 percent longer than the unused chain for powered hoists or is 2.5 percent longer than the unused chain for hand-operated hoists, replace the chain.
 - v. Examine the chain for gouges, nicks, corrosion, weld spatter, or distorted links. Any of these conditions shall be sufficient reason for questioning safety and considering replacement. Safety in this respect depends largely on the use of good judgment by an appointed person in evaluating the degree of damage.
 4. No one except the chain manufacturer shall repair the load chain by welding or any other means.
 5. Ensure that replacement chain is the same size, grade, and construction as the original chain furnished by the hoist manufacturer, unless otherwise recommended by the hoist manufacturer due to working conditions.
 6. Load-chain links that pass over the hoist-load sprocket on edge (alternate to those that lie flat in the pockets) should be installed with the welds away from the center of the sprocket. This precaution is not required on idler sprockets, which change the direction but not the tension in the chain.
 7. Ensure that replacement chain is installed without any twist between the hoist and an anchored end on either the loaded side or the slack side.
 8. When a chain is replaced, disassemble and inspect the mating parts (sprockets, guides, stripper) for wear, and replace if necessary.
 9. Never use discarded load chain for slings.

8.2.5.4 Roller Chain

- a. A qualified inspector shall do the following during periodic inspections:
 1. Test the hoist under load in raising and lowering directions, observing the operation of the chain and sprockets. If the chain binds, jumps or is noisy, clean and properly lubricate it. If the trouble persists, inspect the chain and mating parts for wear, distortion, or damage.

2. If you observe wear or suspect stretching, measure the chain according to the hoist manufacturer's instructions. If instructions are not available, proceed as follows:
 - i. Suspend the hoist in normal position and apply a light load of approximately 100 lb (46 kg).
 - ii. Select a 12-in. (305 mm) section of chain that normally travels over the load sprocket.
 - iii. Determine elongation by measuring with a caliper from the edge of one chain pin to the corresponding edge of another pin. If elongation exceeds $\frac{1}{4}$ in. (6.3 mm) in 12 in. (305 mm) compared to new or unstretched chain values, replace the chain.
 - iv. Inspect for twists. Replace if the twist in any 5-ft (1.52 m) section exceeds 15 degrees.
 - v. Check for straightness in a plane perpendicular to the plane of the rollers. Replace if the chain has a bow exceeding $\frac{1}{4}$ in. (6.3 mm) in any 5-ft (1.52 m) section.
3. Make additional inspections by removing the chain from the hoist and cleaning it thoroughly. Carefully examine deficiencies such as those listed below and determine whether they constitute a safety hazard. Any deficiencies are reason for questioning chain safety and considering its replacement.
 - i. Pins turned from original position.
 - ii. Rollers that do not run freely with light finger pressure.
 - iii. Joints that cannot be flexed by easy hand pressure.
 - iv. Side plates that are spread open.
 - v. Corrosion, pitting, or discoloration.
 - vi. Gouges, nicks, or weld spatter.
4. Do not attempt to repair roller chain by welding or heating.
5. Ensure that replacement chain is the same size, grade, and construction as the original chain furnished by the hoist manufacturer unless otherwise recommended by the hoist manufacturer due to working conditions.
6. Never use discarded or new roller chain for slings.

8.2.5.5 Synthetic-Web Strap

- a. No precise rules can be given for determining the exact time to replace web strap. Safety depends largely on the use of good judgment by an appointed person in evaluating remaining strength in a used web, after allowance for deterioration disclosed by inspection.
- b. Conditions such as the following shall be reason for questioning continued use of the web strap or increasing the frequency of inspection:
 1. Severely worn end connections.
 2. Distortion of the web-strap structure.
 3. Evidence of any heat damage.
- c. The web strap shall be removed from service when damage such as the following is discovered:
 1. Melting or charring.
 2. Acid or caustic burns.
 3. Weld spatter.
 4. Broken stitching.
 5. Cuts or tears.
 6. Damaged eyes or fittings.
 7. Abrasive wear.
 8. Knots

8.2.6 HOISTS NOT IN REGULAR SERVICE

- a. A hoist that is not in regular service (idle for a period of 1 month or more, but less than 1 year) shall be inspected before being placed in service according to the requirements listed above in Section 8.2.4, "Frequent Inspection."
- b. A hoist that is not in regular service (idle for a period of 1 year or more) shall be

inspected before being placed in service according to the requirements listed above in Section 8.2.5, "Periodic Inspection."

- c. The determination supporting these alternate inspection frequencies and procedures shall be made by a qualified person for each affected hoist. Documentation supporting this determination shall be kept readily available.

8.3 TESTING

8.3.1 OPERATIONAL TESTS

All new hoists shall be tested by the hoist manufacturer. All modified or repaired hoists or hoists that have not been used within the preceding 12 months shall be tested before being placed in service. All tests shall be done by a qualified inspector or under the direction of that inspector as detailed in the following paragraphs.

8.3.1.1 Electric- or Air-Powered Hoists

- a. Check lifting and lowering (testing through complete rated lift length is not required).
- b. Check operation of brakes.
- c. Determine the trip-setting of limit devices by tests under no-load conditions. Conduct tests first by hand, if practical, and then under slowest speed obtainable. Test with increasing speeds up to maximum speed.

8.3.1.2 Hand-Chain-Operated Hoists

- a. Check all functions of the hoist, including lifting and lowering, with the hoist suspended in an unloaded state.
- b. After testing unloaded, apply a load of at least 50 lb (23 kg) multiplied by the number of load-supporting parts of chain to the hoist to check proper load control.

8.3.1.3 Manual-Lever-Operated Hoists

- a. Check all functions of the hoist with the hoist suspended in an unloaded state.
- b. After testing unloaded, apply a load of at least 100 lb (46kg) multiplied by the number of load-supporting parts of load line to the hoist to check proper load control.

8.3.2 RATED LOAD TEST

Test anchorages or suspensions shall be approved by a qualified person.

8.3.2.1 Electric- or Air-Powered Hoists

- a. The manufacturer shall dynamically test new hoists as specified in Section 8.3.1.1,

(“Electric- or Air-Powered Hoists”), steps a. and b., with a test load of at least 125 percent of the rated load. If the manufacturer cannot test the hoist, the user shall be notified and the test shall be accomplished at another location or job site by a qualified inspector or under the direction of that inspector.

- b. A qualified inspector shall test hoists in which load suspension parts have been modified, replaced, or repaired as specified in Section 8.3.1.1, steps a. and b., by or under the direction of a qualified inspector, and a record of the test should be made. A designated or authorized person shall determine if repairs made to a hoist are extensive, and require a rated load test, or routine maintenance and require only an operational test. The applied test load shall not be less than 100 percent of the rated capacity of the hoist, or more than 125 percent of the rated capacity of the hoist unless otherwise recommended by the manufacturer or a qualified person. The replacement of load chain and rope is specifically excluded from this hoist test; however, a functional test of the hoist under a normal operating load should be made in accordance with 8.3.1., “Operational Tests,” prior to putting the hoist back in service.

8.3.2.2 Hand-Chain-Operated or Manual-Lever-Operated Hoists

- a. The manufacturer shall dynamically test new hoists with a test load of at least 125 percent of the rated capacity. If the manufacturer cannot test the hoist, the user shall be notified and the test shall be accomplished at another location or job site by a qualified inspector or under the direction of that inspector.
- b. Hoists in which load suspension parts have been modified, replaced, or repaired shall be tested statically or dynamically by or under the direction of a qualified inspector, and a record of the test should be kept. A designated or authorized person shall determine if repairs made to a hoist are extensive and require a rated load test or are routine maintenance and require only an

operational test. The applied test load shall not be less than 100 percent of the rated capacity of the hoist or more than 125 percent of the rated capacity of the hoist, unless otherwise recommended by the manufacturer or a qualified person. The replacement of load chain is specifically

excluded from this hoist load test; however, a functional test of the hoist should be made in accordance with Section 8.3.1.2, or 8.3.1.3, “Hand-Chain-Operated Hoists,” and “Manually Lever-Operated Hoists,” respectively, prior to putting the hoist back in service.

8.4 MAINTENANCE

- a. A preventive maintenance program shall be established and be based on the hoist manufacturer's recommendations. If equipment maintenance procedures deviate from published manufacturer's recommendations, the alternate procedures shall be approved in advance by the manufacturer or another qualified person and be kept readily available. Dated maintenance records should be kept where readily available to appointed personnel.
- b. Replacement parts shall be at least equal to the original manufacturer's specifications.

8.5 OPERATION

- a. The following shall apply to all personnel involved in hoist operations.
- b. At the initial stage of the planning process, an appointed person shall classify each lift into one of the DOE-specified categories (ordinary, critical, or preengineered production).

8.5.1 CONDUCT OF OPERATOR

- a. Do not engage in any practice that will divert your attention while engaged in operating the hoist.
- b. Do not operate equipment if you are physically or mentally unfit.
- c. Familiarize yourself with the equipment and its proper care. If adjustments or repairs are necessary, or any damage is known or suspected, report it promptly to the appointed person. Notify the next operator of the problem upon changing shifts. Correct deficiencies before resuming normal operation.
- d. Test all controls before beginning a shift. If any controls do not operate properly, adjust or repair them before beginning operations.
- e. Operators are responsible for those operations under their direct control. Whenever there is doubt as to safety, consult with responsible management before handling the load.
- f. Do not operate a hoist that bears an out-of-order sign or is otherwise tagged out-of-service.
- g. If there is a tag, sign, or lock on electric- or air-powered equipment, do not energize the equipment until the tag, sign, or lock is removed by the person who placed it there or by an authorized person.
- h. Do not close the main line disconnect device on powered equipment until you are certain that no one is on or adjacent to the hoist or carrier.

8.5.2 SIZE OF LOAD

Know the weight of the load and do not load the hoist beyond the rated capacity, except as provided for in Section 8.3, "Testing."

8.5.3 ATTACHING THE LOAD

- a. The supporting structure or anchoring means shall have a load rating at least equal to that of the hoist.
- b. Use hoists only in areas that will allow you to be clear of the load.
- c. Do not wrap the hoist rope or chain around the load.
- d. Attach the load to the hook using slings or other approved devices.
- e. Do not use chain or wire rope as a ground for welding.
- f. Do not touch a welding electrode to the chain, wire rope, or any other part of the hoist or monorail system.
- g. Operate hand-chain-operated hoists with hand power only and with no more than one operator per hand chain.
- h. Do not use a lever extension ("cheater") on manual-lever-operated hoists.
- i. Properly seat the slings or other approved devices in the saddle of the hook before carrying out hoisting operations.

8.5.4 MOVING THE LOAD

- a. Take care in hoisting to be certain that:
 1. Hoist ropes or chains are not kinked or twisted.
 2. The load does not contact any obstructions.
 3. Multiple-part ropes or chains are not twisted around each other.

- b. Before starting to hoist, ensure that the rope or chain is properly seated on the drum, sheaves, or sprockets.
 - c. Before starting the hoist, be certain that all personnel are clear of the equipment.
 - d. Do not operate hoists until the hook is positioned above the center of gravity of the load, except when specifically authorized by an appointed person who has determined that the components of the hoist and its mounting will not be overstressed.
 - e. Do not move or lift a load more than a few inches until it is well balanced in a sling or lifting device.
 - f. Do not lift, lower, or travel the hoist while anyone is on the load or hook.
 - g. Avoid carrying loads above personnel.
 - h. Test the brakes each time a load approaching the rated capacity is handled by raising the load just enough to clear the floor or supports and checking for brake action. Continue the lift only after you are sure that the braking system is operating properly.
 - i. Do not lower a loaded wire-rope hoist drum beyond the point where less than two full wraps of wire rope remain on the drum.
 - j. Inch the hoist into engagement with a load, and avoid unnecessary stops and starts.
 - k. Do not perform side pulls with hoists except as specifically authorized by a qualified person.
 - l. If power goes off during operation of cab-operated equipment, immediately place all controllers in the OFF position. Before reuse, check operating motions for proper direction.
 - m. Do not leave a suspended load unattended unless specific precautions have been instituted and are in place.
 - n. Tag lines should be used as required to guide, snub, or otherwise control the load.
 - o. Take signals from only one person using the standard hand signals shown in Chapter 7,
- “Overhead and Gantry Cranes.” Obey a STOP signal regardless of who gives it.
- p. Lift the hoist load block above head level for storage when the equipment is not in use.

8.5.5 HOIST-LIMIT SWITCH

- a. At the beginning of a shift, test the upper-limit switch of each hoist under no load conditions. If the hoist has a lower-limit switch, test it with no load before lowering any load that could bring the lower-limit switch into operation. Exercise extreme care; inch the block into the limit switch or run in at slow speed. If the limit switch does not operate properly, notify the designated person immediately.
- b. If a lift is in progress during a shift change, this testing requirement is considered to have been satisfied for the completion of that lift. However, test the limit switch again before the next lift.
- c. Never use the hoist-limit switch that controls the upper limit of travel of the load block as an operating control.

8.5.6 ORDINARY LIFTS

- a. Hoisting and rigging operations for ordinary lifts require a designated leader. The designated leader shall be present at the lift site during the entire lifting operation. If the lift is being made by only one person, that person assumes all responsibilities of the designated leader.
- b. Leadership designation may be by written instructions, specific verbal instructions for the particular job, or clearly defined responsibilities within the crew's organizational structure.
- c. The designated leader's responsibility shall include the following:
 1. Ensure that personnel involved understand how the lift is to be made.
 2. Ensure that the weight of the load is determined, that proper equipment and accessories are selected, and that rated capacity is not exceeded.

3. Survey the lift site for hazardous/unsafe conditions.
 4. Ensure that equipment is properly set up and positioned.
 5. Ensure that a signaler is assigned, if required, and is identified to the operator.
 6. Direct the lifting operation to ensure that the job is done safely and efficiently.
 7. Stop the job when any potentially unsafe condition is recognized.
 8. Direct operations if an accident or injury occurs.
- d. The operator or other designated person shall visually examine the hoist in accordance with the requirements for a daily inspection described in Section 8.2, "Inspections."
 - e. A qualified person shall examine any deficiencies and determine whether they constitute a hazard. Correct these deficiencies before operating the hoist.
 - f. Load lines shall be checked after strain is put on them, before the load is lifted clear of the ground. If not plumb, the slings or equipment shall be repositioned so the lines are plum before continuing.

continuous 12 month period, except as provided in para. 8.5.7.d. If greater lift frequency is desired, consideration shall be given to rerating or replacing the hoist.

- d. The hoist manufacturer shall be consulted if the planned engineered lift exceeds 125% of rated load or if the frequency of planned engineered lifts exceeds two during a continuous 12-month period.
- e. Each planned engineered lift shall comply with the following requirements:
 1. A written review of the hoist service history shall be prepared, including reference to previous planned engineered lifts, structural repairs, and modifications of original design
 2. The design of the structural, mechanical, electrical, pneumatic, and hydraulic components of the hoist shall be reviewed, by means of applicable calculations for the load to be lifted, and approved by the hoist manufacturer or a qualified person, in accordance with accepted hoist design standards if the load to be lifted exceeds 125% of rated load, or if the frequency of planned engineered lifts exceeds two during a continuous 12-month period
 3. The design of the hoist-supporting structure shall be reviewed and approved by a qualified person for conformance to applicable design criteria. The hoist support shall be inspected and any deterioration or damage shall be taken into consideration in design calculations for the load to be lifted.
 4. The hoist shall be inspected in accordance with para. Section 8.2.5 just prior to making the lift.
 5. The lift shall be made under controlled conditions under the direction of a designated person in accordance with a previously prepared lift plan. All persons in the area of the hoist shall be alerted that the lift is being made.
 6. The operator shall test the hoist at the planned engineered load by lifting the load a short distance and setting the brakes. The lift shall only be continued if the brakes stop and hold the load. Any

8.5.7 PLANNED ENGINEERED LIFTS

Lifts in excess of the rated load may be required from time to time on a limited basis for specific purposes such as new construction or major repairs. Every planned engineered lift exceeding the rated load shall be treated as a special and separate event. Limitations and planned requirements shall be applicable, as follows:

- a. Planned engineered lifts shall be limited to powered hoists having a load rating of 5 tons and above.
- b. When planned engineered lifts are made, the load shall not exceed 125% of the hoist load rating, except as provided in para. 8.5.7.d.
- c. Planned engineered lifts shall be limited to two occurrences on any hoist within any

- failure to hold the load shall be corrected before proceeding with the lift.
7. The hoist shall be inspected in accordance with Section 8.2.5 after the lift is completed and prior to being used for the lifting of any other load.
 8. A record of the planned engineered lift, including calculations, inspections, and all distances moved, shall be placed on file for availability to appointed personnel.

- f. The rated load test specified in Section 8.3.2 is not applicable to planned engineered lift provisions.

8.5.8 CRITICAL LIFTS

See Chapter 2, “Critical Lifts,” for critical-lift requirements.

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Exhibit I is intended to be a sample form only.
The equipment manufacturer's inspection/testing
criteria supercede any other criteria.
In cases where the equipment manufacturer does not include
inspection/testing criteria, other forms developed to facilitate
required inspection/testing are acceptable.

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**EXHIBIT I
(SAMPLE FORM)**

HOIST LOAD TEST

INSPECTED BY _____

HOIST ID# _____ LOCATION _____ DATE _____

- Notes: 1. Load test prior to initial use, at 125% of rated capacity, all new hoists or hoists in which load-sustaining parts have been modified, repaired, or replaced. Test weights shall be accurate to within -5%, +0% of stipulated values. Load test at 100% of rated capacity hoists with overload devices. Test the function of the overload device.
2. Qualified inspector shall verify all steps as listed below.
3. Craftsmen will initial all tests, work, and inspections completed below.

-
- _____ 1. Perform the annual periodic inspection. Check unit for proper operation.
- _____ 2. HAND-CHAIN-OPERATED HOISTS ONLY. Check brake mechanism for work glazed, or contaminated disks, worn pawls, cams, or ratchets. Check for broken, corroded, or stretched pawl springs. Repair as needed.
- _____ 3. ELECTRIC- AND AIR-POWERED HOISTS. Check:
- a. All functional operating mechanisms for maladjustment interfering with proper operation
 - b. Limit switches or devices for proper operation
 - c. External evidence of damage or excessive wear of load sprockets, idler sprockets, and drums or sheaves
 - d. External evidence of wear on motor or load brake
 - e. Electrical apparatus for signs of pitting or any deterioration of visible controller contacts
 - f. All anchorage or hoist suspensions.
- _____ 4. Set hoist up for load test and inspection. Where applicable, ensure that the load chart is legible.
- _____ 5. Perform load test using the required test weights (See Note 1) and appropriate slings. Measure a length of the load chain under tension; measure a length of 15 links. If wire rope is used, measure the diameter.

IF HOIST IS EQUIPPED WITH A TROLLEY:

- _____ 1. Mount hoist on a monorail.
- _____ 2. Rig test weight to load hook (see step 4 above).
- _____ 3. Perform load test moving weight along monorail. Observe hoist and trolley. Observe performance of all load-bearing components.
- _____ 4. Lower test weight to floor. Note performance of hoist during lowering operation. Remove rigging.

EXHIBIT I (continued)

HOIST LOAD TEST

At the completion of the load test, inspect the following items.

1. Visually inspect and remeasure the load chain and/or hoist rope after the load test. Check for deformed or broken links, stretch, etc.
2. Inspect load hook and suspension hook for bending or twisting.

<u>LOAD HOOK:</u>	<u>PREVIOUS</u>	<u>PRESENT</u>
Qualified Inspector Verify _____	Throat Opening _____	_____
Qualified Inspector Verify _____	Hook Twist _____	_____
<u>SUSPENSION HOOK:</u>		
Qualified Inspector Verify _____	Throat Opening _____	_____
Qualified Inspector Verify _____	Hook Twist _____	_____

Qualified inspector shall perform nondestructive tests on hook by visual examination, liquid penetrant examination, or magnetic particle examination.

Acceptance: No cracks, linear indications, laps, or seams.

Hooks with more than 5% normal (new hook) throat opening not to exceed 1/4 in. (or as recommended by the manufacturer) shall be replaced. Hooks with any visibly apparent bend or twist from the plane of the unbent hook (new hook) shall be replaced. Hooks having more than 10% wear in the bowl section or 5% elongation of the shank shall be replaced. Lubricate hook bearing and latch pin as applicable.

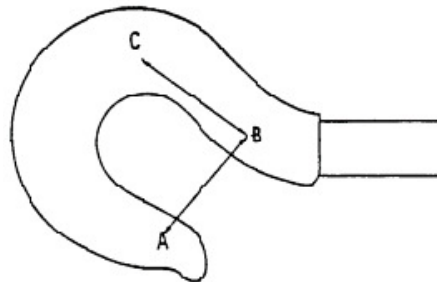
Establish three marks, A, B, and C, with a center punch. For ease in measuring, set distances on an even number of inches.

BEFORE LOAD TEST

Length AB _____ in
 Length BC _____ in

AFTER LOAD TEST

Length AB _____ in
 Length BC _____ in



Check for:

1. Wear and deformation
2. Cracks
3. Signs of opening between Point A and Point B.

Equipment Operator _____

Actual Load Test _____ lb Qualified Inspector Verify Load Test _____ Date _____

**EXHIBIT II
(SAMPLE FORM)**

UNDERHUNG HOIST PERIODIC INSPECTION REPORT

HOIST # : _____	MODEL: _____	LOCATION: _____
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STATUS CODE: [- O.K., A – Adjusted, R – Repaired, NR – Needs Repair, N/A – Not Applicable

	CODE	COMMENT		CODE	COMMENT
Housing			Cable		
- Distortion			-Broken Wires		
- Cracks			- End Connections		
- Loose Hardware			- Excess Wear		
- Warning Label			- Kinked or Distorted		
			- Corrosion		
Support Structure			- Heat Damage		
- Worn or distorted Trolley					
- Load Beam Condition			Chains		
- End Stops			- Binding		
			- Cracked		
Internal Inspection			- Twisted		
- Brake Pad Condition			- Distorted		
- Lubrication			- Corroded		
- Excess Oil			- Excess Wear		
- Sheaves			- Worn Chain Guide		

**EXHIBIT II (continued)
(SAMPLE FORM)**

UNDERHUNG HOIST PERIODIC INSPECTION REPORT

STATUS CODE: [- O.K., A – Adjusted, R – Repaired, NR – Needs Repair, N/A – Not Applicable

	CODE	COMMENT		CODE	COMMENT
Hook			Sheaves		
- Loose Retaining Hardware			-Excess Wear		
- Cracks			- Cracked or Scored		
- Excess Wear			- Bearing Noise		
- Bent					
- Spreading			Final Operations		
- Rotating Freely			- Free and Easy		
- Latch			- Inspection Tag Update		

Comments: Note any potential hazards or malfunctions:

CIRCLE ONE: PASS FAIL

INSPECTOR (Print): _____ SIGNATURE: _____ Date: _____