ADVISORY STANDARDS
FOR
HOISTING MACHINES USED FOR SUSPENDED SCAFFOLDS

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NEW YORK STATE
DEPARTMENT OF LABOR

Telephone (518) 457-1536 nysdol@labor.state.ny.us Fax (518) 457- 1301

ADVISORY STANDARDS FOR CONSTRUCTION, OPERATION, AND MAINTENANCE OF

HOISTING MACHINES

USED FOR SUSPENDED SCAFFOLDS

AS-111-1 PREFACE

1) **INTRODUCTION**

a) These advisory standards may be used in all matters in the consideration of applications for approval of hoisting machines used for suspended scaffolds which are required to be approved by the provisions of Industrial Code Part (Rule No.) 23, (12 NYCRR 23), relating to "Protection in Construction, Demolition and Excavation Work", Subpart 23-5.8, Subdivision (d), Paragraph (1), herein quoted: **"**(1) Any manual or power-operated hoisting machine used for suspended scaffolds shall be approved.

b) These advisory standards are minimum standards and the Department in its discretion may at any time amend them or take other appropriate action in regard thereto to assure safety.

c) In regard to any deviation from these advisory standards, the applicant should submit such a proposal to the Engineering Services Unit (ESU) along with an application for approval before proceeding with the design of any such deviation.

2) **APPLICATION FOR APPROVAL**

a) **Procedure and data required.** The following data should be submitted in duplicate with any application for approval of a hoisting machine to be used for a suspended scaffold.

i) **Application form.** An applicant should file a General Approval Application (SH-753) with the New York State Department of Labor. These forms may be obtained from the New York State Department of Labor offices or obtained on the Department's website http://www.labor.state.ny.us .

ii) **Hoisting machine drawings.** An applicant should file a complete set of engineering drawings for the hoisting machine. Such drawings should contain dimensions as well as complete delineation and material specifications. Engineered drawings must contain the sign and seal of a licensed New York State Professional Engineer.

iii) **Design calculations.** An applicant should file a complete stress analysis for the hoisting machine to substantiate the ability of the hoist to raise and hold its maximum design load with stresses that will not exceed those established by recognized national standards when considering impact loading. Maximum loading should be determined by doubling the sum of the live load plus the dead load imposed on the hoist's suspension rope.

iv) **Test reports.** An applicant may file with the ESU a report of tests made by an independent laboratory acceptable to the ESU or certified by a professional engineer licensed to practice in the State of New York as an alternative to providing the design calculations required by Paragraph (iii) above. Such tests should be made on prototype models only to determine the safety of the hoisting machine and to insure that such machine meets all the requirements of these advisory standards.

v) **Description.** An applicant should file with the ESU a word description of the construction, use, operation and safety features of the hoisting machine.

b) For a list of recognized national standards acceptable to the ESU see Subpart 111-4 of these advisory standards.

c) **Modification of approved hoisting machines.** Prior approval by the ESU is required before any modification or alteration of a previously approved hoisting machine is made. When any modification or alteration is anticipated, the applicant should submit a proposal to the ESU for its consideration. Such a proposal should include substantiating data.

AS-111-2.1 GENERAL STANDARDS

1) **DEFINITION OF TERMS.** Whenever used in these advisory standards, the following terms mean:

a) *Approved.* In respect to a device or a material: in compliance with a subsisting resolution of approval adopted by the Commissioner. In respect to action by the Commissioner: made the subject of a resolution of approval.

b) *Hoisting machine*. A device intended to be used to raise or lower a suspended scaffold. The term includes the following:

i) All parts, materials, components, assemblies and devices of the hoisting machine.

ii) The method of attachment of the hoisting machine to the suspended scaffold.

iii) The means of suspension of the hoisting machine.

c) *Prime mover*. The source of power for the hoisting machine.

d) *Speed reducer*. A gearing device used to reduce the output speed of the prime mover to the desired speed of the hoist.

e) *Primary brake*. A brake used to stop the hoisting machine and its load under normal operating conditions.

f) *Secondary brake*. A brake that is intended to stop the hoist and its load under emergency conditions only.

g) *Traction sheave*. A type of pulley that due to its shape “grabs” the wire rope through the creation of friction. Pressure rollers are required to keep the wire rope in the groove of the sheave. This hoist does not accumulate wire rope.

h) *Traction drum*. A type of drum that does not accumulate the suspension rope but is designed to climb the rope by the application of a friction force between the rope and the drum.

i) *Winding drum*. A drum that accumulates the suspension rope.

j) *Single wrap drum*. A winding drum that accumulates the suspension rope in a single layer in spiral groves on the surface of the drum.

k) *Multiple wrap drum*. A winding drum that accumulates the suspension rope in more than one layer on the surface of the drum.

AS-111-3 DETAILED STANDARDS

1) **HOISTING MACHINE MINIMUM STANDARDS.** A hoisting machine shall be provided for all installations where a suspended or supported portion of the equipment is required to be raised and lowered. Each hoisting machine shall require the application of a motivating force to raise and lower its suspended or supported load and shall be designed and constructed to arrest any overspeed descent of the load. The following are the minimum standards for a hoisting machine to be considered for approval:

   a) **Prime mover Each** hoisting machine shall be provided with a source of power sufficient to raise and lower 125% of the hoist's rated load. No hoisting machine shall be capable of exerting power sufficient to exceed three quarters of the system moment resisting overturning or one-third of the catalog strength of the support ropes.

      i) **Electric motors.** Each electric motor of any hoist should be provided with a thermal overload device and a circuit protected by a current limiting device and should be of a weather-proof type construction. Each such motor should bear the manufacturer's name plate which lists the rating and other characteristics of the motor.

      ii) **Gasoline motors.** Gasoline motors will not be considered for approval.

      iii) **Liquid propane gas motors.** Liquid propane gas motors will not be considered for approval.

      iv) **Air motors.** Air motors may be considered for approval provided such motors are in compliance with all the provisions of these advisory standards.

   b) **Speed reducers.** A hoisting machine should have a speed reducer or an equivalent device to obtain a mechanical advantage. Such speed reducer or other device should contain positive type gearing such as a worm and gear, spur gears or bevel gears.

      i) Friction type speed reducers shall not be used with any hoist.

      ii) Speed reducers shall be directly connected to the drum or elevating mechanism of the hoisting machine. They shall not be connected by means of chains, belts, clutches, shear pins, or friction-type devices.

      iii) All gearing should conform to the standards as established by the American Gear Manufacturers' Association in effect on the date that the application for approval is filed with the ESU. Each shall have a service factor of not less than 1.2.

   c) **Brakes.** All hoisting machines shall be provided with at least two independent brakes, which shall comply with the following:

      i) **Primary brake.**

         (1) Every manually-powered hoisting machine should be provided with a primary brake that automatically engages upon the release of effort by the operator on the crank or other operating device.

         (2) Every power-operated hoisting machine should be provided with a primary brake that automatically engages whenever power to the prime mover is interrupted.

(3) Any primary brake should be rated to stop and hold 125 per cent of the rated load of the hoisting machine, but in no case less than the maximum lifting capacity of the hoist.

(4) Any primary brake should be capable of preventing downward drift of the hoisting machine and its rated load.

(5) Any primary brake should be directly connected to the drive train of the hoisting machine and should not be connected through belts, roller chains, clutches or any friction device.

ii) **Secondary brakes.**

(1) Every hoisting machine should be provided with an automatic emergency-type secondary brake that will stop and hold at least 125 per cent of the rated load of the hoist under an accelerating or overspeed condition. If such a secondary brake is of the instantaneous stopping type it should stop and hold the hoist and its rated load before the hoist travels a vertical distance of 18 inches. If such a secondary brake is of the decelerating type it should stop and hold the hoist and its rated load before the hoist travels a vertical distance of 24 inches.

(2) The secondary brake should act directly on the wire suspension rope on a traction type hoist or winding drum type hoist and may act directly on the drum or drum extension on a winding drum type hoist. Secondary brakes should be independent of the drive trains on all hoists. The actuating mechanism of a secondary brake may be separate from the brake.

(3) Every secondary brake should be so designed, installed and maintained to stop and hold 125 per cent of the rated load of the hoist when any of the following emergency conditions occur:

(a) An instantaneous change in momentum (free fall).

(b) An accelerating overspeed.

(4) The secondary brake should not be used to stop and hold the hoist except under overspeed or abnormal conditions. It shall not be bypassed or prevented from operating by any other device (during overspeed conditions). Such a brake should not engage before the hoist is stopped by the primary brake in normal operation.

(5) The design of every secondary brake should include a provision for periodic testing under simulated overspeed conditions.

(6) The design, installation and maintenance of every secondary brake should be such that the brake is prevented from being made defective or inoperative by outside contamination.

iii) ***Overload Protection****,* Overload protection shall be provided in the hoisting or suspension system to protect against the equipment operating in the up direction with a load in excess of the capacity of the hoist braking systems.

iv) ***Braking Loads****.* Dynamic loads induced by activation of primary or secondary braking systems shall be accounted for in the design and installation of the equipment.

v) ***Braking Actuation Results***. Actuation of the secondary brake shall not:

(1) Damage the suspension wire rope.

(2) Impose an overturning moment in excess of 75% of the system's stability.

(3) Impose stresses in structural members in excess of 75% of their yield strength.

vi) ***Secondary Brake Test***. Prior to use on an installation, a secondary brake shall be dynamically tested. (The test on a prototype unit will be deemed as compliance with this requirement.)

d) **Hoisting machine lubrication.** Each separate compartment of every hoisting machine should be provided with a separate means of lubrication to assure that all moving parts of the hoist are adequately lubricated at all times.

i) Self-sealed, self-lubricating, or dry bearings of a suitable design may be used.

ii) All oil-lubricated gear boxes shall be provided with means for determining that the proper quantity of lubricant is contained in the gearbox.

e) **Gearing.** The rating, strength, and surface durability characteristics of gearing shall be in conformance with good engineering practice and shall comply with applicable standards of the American Gear Manufacturers Association.

f) **Guards.** All moving parts shall be so enclosed or guarded as to adequately reduce the likelihood of injury to persons who may accidentally contact the parts.

g) **Shafts, Fillets, Keys, and Splines.** Fillets shall be provided as points of change in the diameter of hoisting machinery shafts and sheave shafts to prevent excessive stress concentration in the shafts. Fitted keys, splines, bolts, or machine screws shall be used in all connections subject to torque. All threaded fasteners shall have an antiloosening device. Threaded areas of bolts and screws shall not be subjected to shear loads. Set screws shall not be used to transmit torque.

h) **Hoisting drums**.

i) The drums of all hoisting machines used for suspended scaffolds should be designed for use with a suspension wire rope of not less than five-sixteenths inch diameter.

ii) Each winding drum should be provided with a positive means of attachment of the suspension rope. The drum portion of the attachment shall be capable of developing at least 4 times the rated capacity of the hoist. The wire rope portion of the attachment shall develop at least 80% of the wire rope catalog strength.

(1) Each drum shall be provided with a means to level wind the suspension wire rope.

(2) Each drum shall have a minimum of four complete turns of rope on the drum at all times when in use.

(3) On drums where the suspension wire rope is not maintained under tension at all times, a means shall be provided to prevent the rope from moving off the drum ends or causing a loose wrap on the drum. A loose wrap detector shall be provided which, if actuated, will shut off power to the hoist and actuate the hoist's

primary brake. All hoists shall be provided with a means to maintain tension in the wire rope during rerigging.

(4) Hoist drums shall have a pitch diameter at least 10 times the diameter of the suspension wire rope.

(5) The minimum diameter of every single-wrap winding drum should not be less than 25 times the diameter of the suspension rope used.

iii) *Traction Hoists.* Each traction drum or sheave hoist shall be constructed to depend on a continuous force from the suspension wire rope to ensure reliable friction contact between the rope and the drum or sheave under all conditions. Tail line counterweights are not acceptable as a means of obtaining traction. Further, each traction hoist shall be designed and constructed so that the suspension wire rope cannot be unintentionally disengaged from the hoist.

iv) *Traction Drum Hoists*

(1) Each traction drum shall be provided with grooves, or equivalent means, to ensure that a wearing surface on the drum will not have a detrimental effect on the suspension wire rope.

(2) Each drum shall have a pitch diameter not less than 18 times the diameter of the wire rope used.

(3) Transfer drums, used to transfer the wire rope from one drum groove to an adjacent drum groove, shall have a pitch diameter not less than 10 times the diameter of the suspension wire rope used.

v) *Traction Sheave Hoists.* Each traction sheave (single groove) shall have a pitch diameter not less than *22* times the diameter of the wire rope used.

vi) *Sheaves.* Sheaves that change the direction of the suspension rope shall have a pitch diameter not less than 10 times the diameter of the rope. Sheaves used with combination cables shall have a pitch diameter at least 22 times the rope diameter.

vii) *Fairlead Rollers.* Fairlead rollers that change the direction of the wire rope less than 10 degrees shall be at least 3 times the nominal rope diameter.

i) **Electrical wiring and equipment.**

i) The electrical wiring and equipment contained on a hoisting machine should comply with the standards established by the National Fire Protection Association in the National Electrical Code and which are in effect on the date the application for approval is filed with the ESU.

ii) All electrically-powered hoisting machines used should be powered by motors rated at no more than 220 volts. Voltage up to 480v 3-phase may be acceptable for roof powered systems.

iii) The power supply cable to any hoisting machine should contain a separate conductor which will serve as a ground connection for the hoist.

iv) Strain relief devices should be provided for cables supplying power to hoisting machines. Such devices should be located at the receptacles where the cables are plugged in as well as at the cable connections on the hoists.

j) **Hoisting machine controls.** Controls for all hoisting machines should be of the momentary contact type (dead man controls) which requires the maintenance of constant pressure in order for the hoisting machines to operate.

k) **Welding.**

i) All welds used in the manufacture of any hoisting machine, its associated parts or components should be made only by welders certified to American Welding Society standards and all welds should be made in compliance with such standards.

ii) All welds that provide structural support for a hoisting machine or the scaffolds to be suspended should be subjected to non-destructive tests in accordance with the manufacturer's recommendations and the reports of such tests should be submitted to the ESU.

AS-111-4 RECOGNIZED DESIGN STANDARDS ACCEPTABLE TO THE ESU

1) The following list of recognized design standards are acceptable to the ESU in all matters relating to the applications for approval of hoisting machines used for suspended scaffolds.

a)AISC American Institute of Steel Construction.

b)ASCE American Society of Civil Engineers.

c)ASME American Society of Mechanical Engineers.

d)ASTM American Society for Testing Machines.

e)AGMA American Gear Manufacturers' Association.

f) AWS American Welding Society.

g)Structural Aluminum Design Reynolds Aluminum Company.

h)ALCOA Structural Handbook Aluminum Company of America.

2) When submitting design data from such recognized standards in an application for approval of a hoisting machine used for a suspended scaffold, the applicant should refer to the standard and section used in obtaining such data.