



## **HMI – HOISTS- BASICS AND STANDARDS**

### **COMPENDIUM OF BASIC INFORMATION AND STANDARDS FOR HOISTS**

#### **PURPOSE**

This HMI web page has been developed by member companies of the Hoist Manufacturers Institute (“HMI”), a trade association of Hoist Manufacturers, to familiarize potential hoist purchasers and users with the many different types of material handling hoists, hoist terminology, and hoist standards, as applicable in the United States, and in various countries and regions of the world. Standards may be mandatory by way of national or regional regulation, or voluntary as recommended by an engineering or manufacturers organization.

HMI believes that this overview may be helpful given the ever shrinking world wherein hoist products increasingly pass across international borders with resulting questions by the hoist purchaser and installer as to a hoist’s governing design and safety specifications from various regions and countries of the world.

The HMI involves itself in activities according to its Vision and Mission statement.

#### **MISSION**

To deliver exceptional value to our members, channel partners, consumers, end-users, and industry associates. HMI achieves this through:

- Educational Materials
- Marketing Information
- Standards Development
- Member Professional Development

## **VISION**

HMI is recognized as the leading authority and the principal resource in the hoist industry.

HMI is recognized as the leading advocate for the safe application and operation of hoisting equipment and related products.

HMI conducts business professionally with a spirit of enthusiasm, cooperation, honesty and integrity.

HMI's members are recognized as:

- The leaders in the marketplace
- Delivering superior value in their products and services
- Providing products and services that are safe and productive
- Providing high value solutions through knowledgeable and expert channel partners
- Providing an environment in which our customers can confidently purchase and derive superior value from our products

## **DISCLAIMER**

This Standards Overview for Overhead Hoists (“Overview”) is advisory only and has been promulgated by the Hoist Manufacturers Institute (“HMI”) with the sole intent of offering information for interested parties. HMI makes no warranties whatsoever in connection with this Comparison. HMI specifically disclaims all implied warranties of merchantability or of fitness for a particular purpose. Further HMI, its officers, agents and employees shall not be liable in tort, contract or otherwise – whether based on warranty, negligence, strict liability or any other theory of liability for any action or failure to act in connection with this Overview and this information, it being the user's intent and understanding to absolve and protect HMI, its successors and assigns, officers, agents and employees, from any and all liability in tort, contract or other liability

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## **Hoist Basics**

Some basic information about hoists is presented here. More in-depth information is available in the various manuals published by HMI [<http://www.mhiastore.org/category.cfm?Category=40>]

**AN OVERHEAD HOIST IS A MACHINE USED FOR VERTICAL LIFTING OF MATERIAL (NOT PEOPLE) THAT IS FREELY SUSPENDED (UNGUIDED).**

**A MANUALLY LEVER OPERATED HOIST IS A DEVICE USED TO LIFT, LOWER, OR PULL A LOAD (NOT PEOPLE), AND TO APPLY OR RELEASE TENSION TO ITEMS.**

Hoists can provide lifting and lowering motions in an overhead material handling system. When a hoist is mounted to a trolley on a fixed monorail, two directions of load motion are available: forward or reverse, up or down. When the hoist is mounted on a crane, three directions of load motion are available: right or left, forward or reverse, up or down. These systems can achieve straight-line moves, reduce material damage, reduce noise, minimize energy cost, reduce floor-based traffic, improve worker ergonomics, and accomplish other operational objectives.

Usually, a hoist is not a piece of stationary hardware. It is generally available for use whenever required and rarely requires a full time operator. Hoists can be integrated into a variety of automated handling systems.

In an overhead material handling system, hoists provide vertical movement of below-the-hook load supporting and positioning devices.

In any material handling system, the hoist is used to accurately position a load.

The majority of hoists used in the United States are classified as Standard or “packaged hoists”, typically defined as largely self-contained units, prepared to be installed on existing structures. They are selected and installed into an application, often as part of a system. These systems vary greatly from simple, manually controlled systems to complex integrated and automated systems involving sophisticated components and controls. Hoists can be powered manually, with air, hydraulics, or electricity. Trolley selection is dictated by system requirements.

This publication does not specifically address “Built-up Hoists”, which may be covered by other standards, more crane related.

## **Types of Overhead Hoists**

These hoists are defined by:

- Mounting Type – There are eight suspension/mounting methods for overhead hoists: Hook Mounted, Clevis Mounted, Lug Mounted, Trolley Mounted, Deck Mounted, Base Mounted, Wall Mounted, and Ceiling Mounted.
- Lifting Medium – Four types of lifting medium for overhead hoists: Welded Link Chain, Roller Load Chain, and Wire Rope, synthetic web or rope material.
- Power Application – Three methods of applying power for overhead hoists: Manually by Hand Chain, Electric Power, and Air Power.

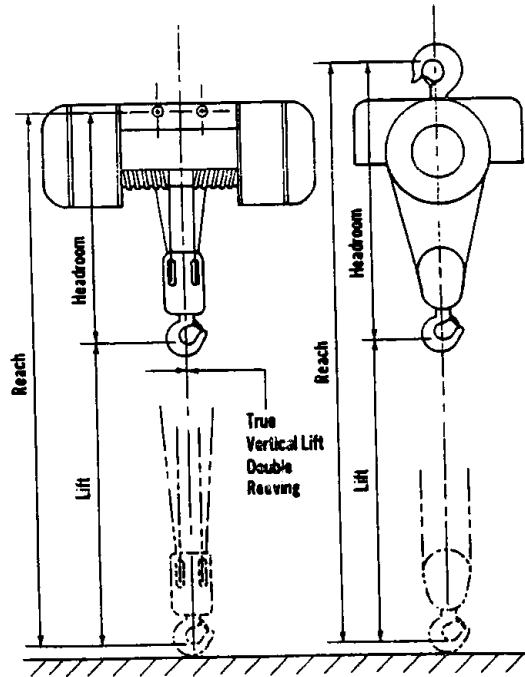
# Overhead Hoist Mounting Types

Hoist mounting selection depends upon the requirements of the application and must be considered in conjunction with other lifting considerations.

Hook  
Lug  
Clevis

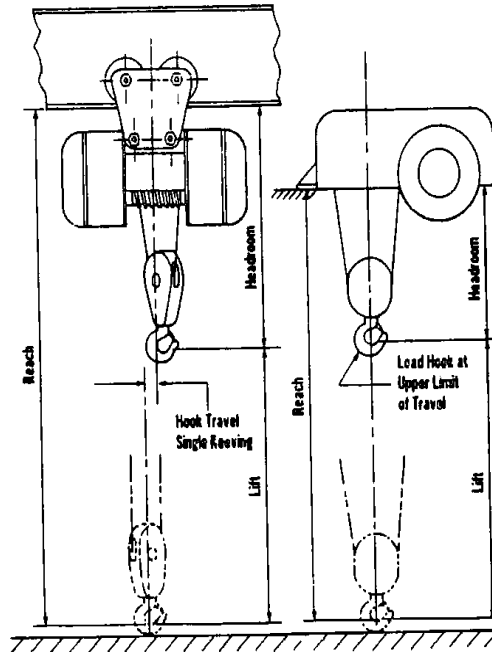
Trolley  
Deck  
Wall  
Base  
Ceiling

**Trolley Types:**  
Plain  
Hand Chain Geared  
Motor Driven



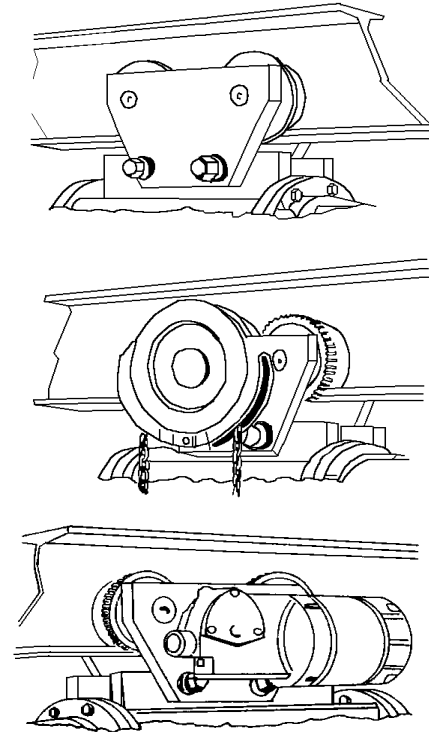
(a) Lug Suspended

(b) Hook Suspended



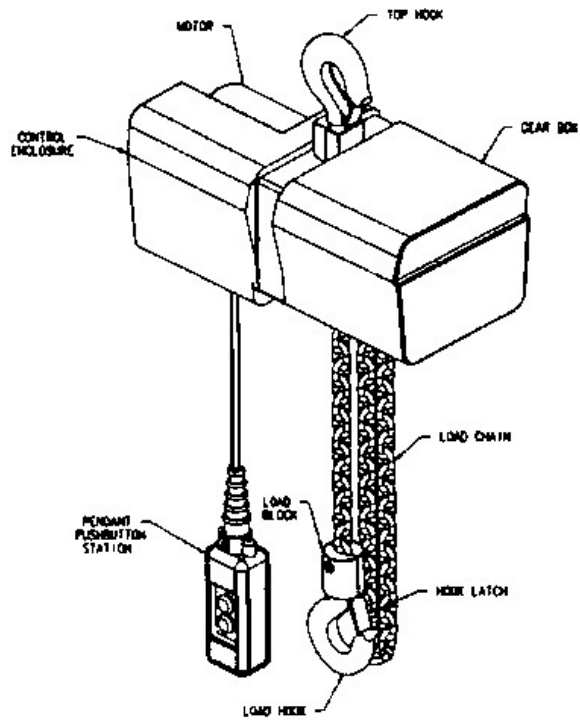
(c) Trolley Suspended

(d) Base or Deck Mount

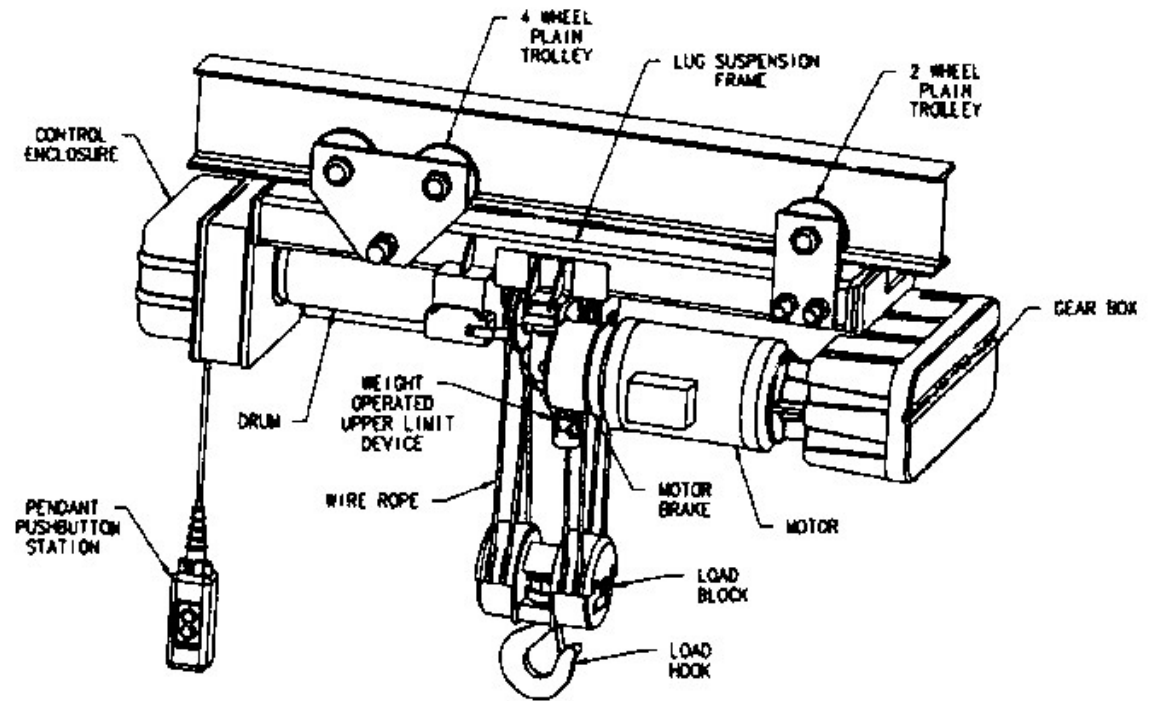


## Overhead Hoist Lifting Media

Welded Link Chain (Roller Load Chain not shown)

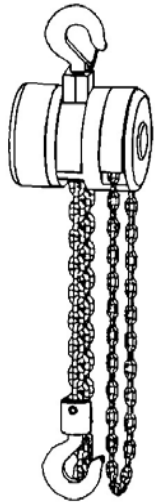


## Wire Rope



## Overhead Hoist Power Application

### Manual, by Hand Chain



### Electric

Electric is the most common power source

### Pneumatic

Pneumatic power is often required in applications of high speed, higher duty cycle involving rapid, repetitive tasks or hazardous areas where electric power is inadvisable.

### Supply Equipment Options

Power supply and control cords, cord reels, hoses, electrification systems, and flexible festooning systems provide means for supplying power to hoists. Such systems must be properly sized and meet all prevailing codes or regulations

### Control Options

A wide range of pendant and remote controls are available to provide suitable and convenient positioning for the operator.

## Operational Considerations

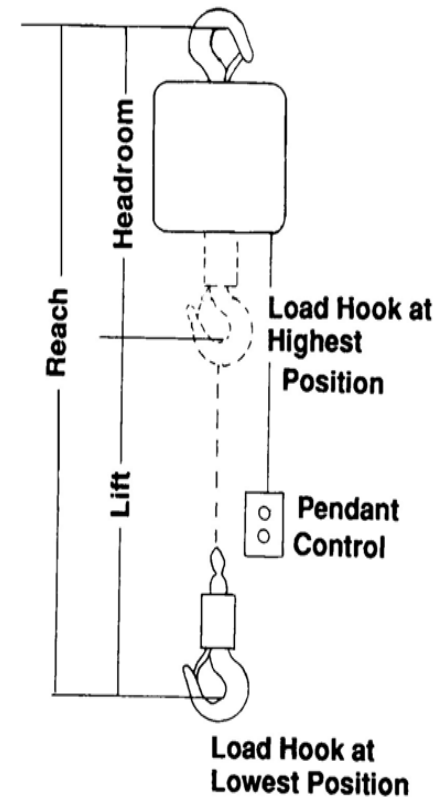
Hoist operators should be trained in the proper use of all hoisting equipment. Many accidents occur because operators simply do not know that they are doing something dangerous. Refer to the manufacturer's parts, maintenance and operating documents.

ASME B30.16 deals with equipment and the workplace safety issues, which apply to all overhead hoists that lift freely suspended unguided loads.

## Lifting Considerations

To select the proper hoist, consider:

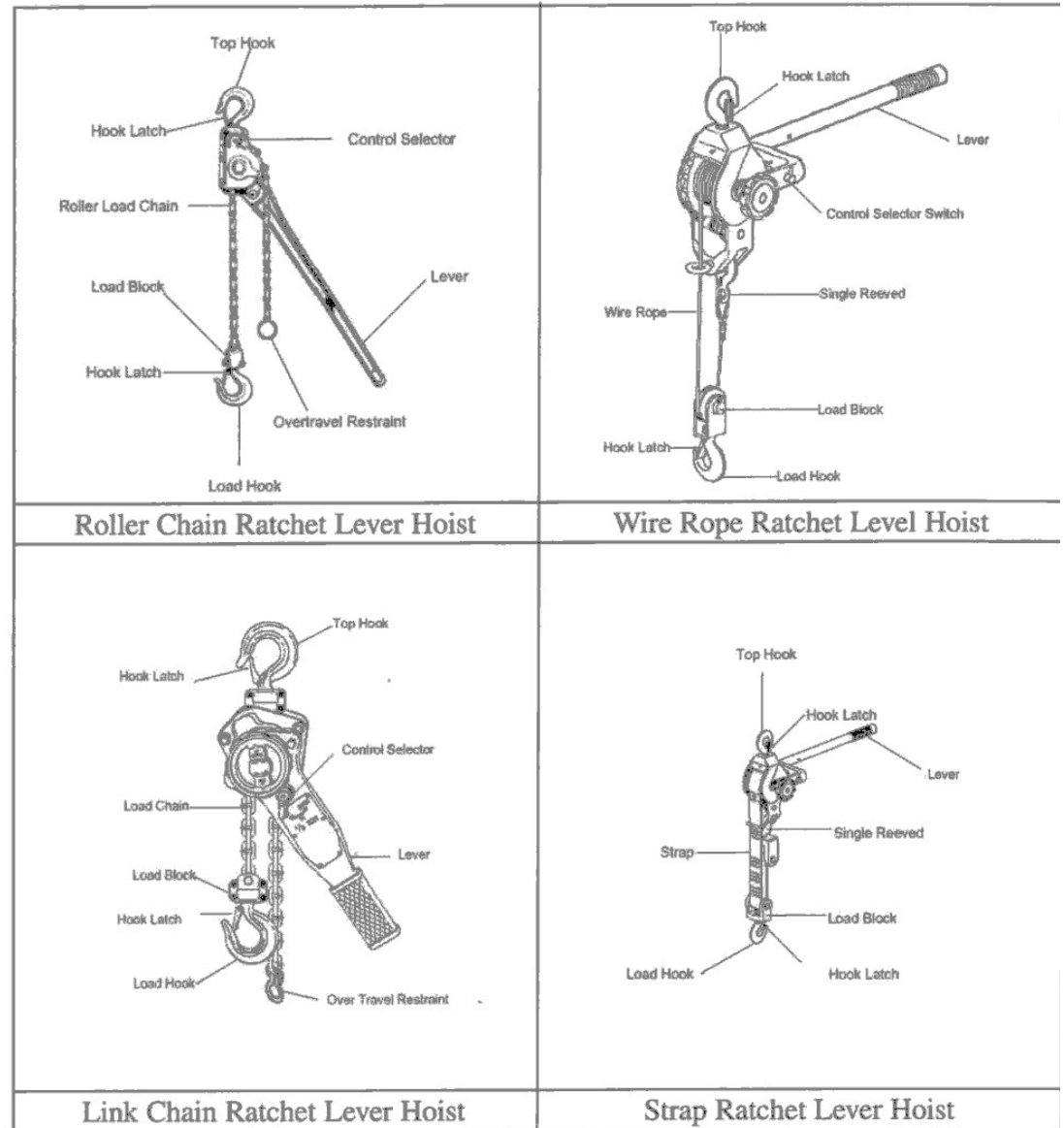
- A. The weight of the load to be lifted including below-the-hook lifting, load supporting, and positioning devices.
- B. Physical size of the load.
  1. Holding and orienting devices.
  2. Design for center of gravity (control & stability).
- C. Lift – the vertical distance the load can be moved.
- D. Clearance Considerations.
  1. Headroom
  2. Obstacles to be cleared during the load transfer.
  3. Design for vertical lift required including holding device height.
- E. Lifting Speed Considerations.
  1. Distance the load is to be raised and lowered
  2. Frequency of usage
  3. Required positioning accuracy
  4. Nature of the load being lifted
- F. Hoist duty Cycle Considerations based on:
  1. Number of lifts per hour
  2. Total number of lifts per shift
  3. Maximum number of starts and stops per hour
  4. Number of shifts per day
  5. Average distance load is raised and lowered
  6. Average weight to be lifted
  7. Maximum weight to be lifted
  8. Frequency of lifts with maximum weight.



## Types of Manually Lever Operated Hoists

These manually lever operated hoists are defined by four types of lifting media:

- Roller Load Chain
- Welded Link Chain
- Wire Rope
- Web Strap.



## Balancers

These overhead devices provide and perform functions different from overhead hoist in that they can lift, lower and float a load. The balancer configurations and suspensions are similar to a hoist.

The balancer functions differently from a hoist. The functional difference is indicated in the name: balancer. A balancer balances the load in a near weightless condition during the lifting operation. This feature allows the operator to maneuver the load easily.

Balancers are often used for awkward and / or rapid load movements. Balancers can also be used to suspend equipment, which is used in repetitive operation.

A variety of control options are available.

A very broad range of load handling devices (end effectors) can expand this product's versatility.

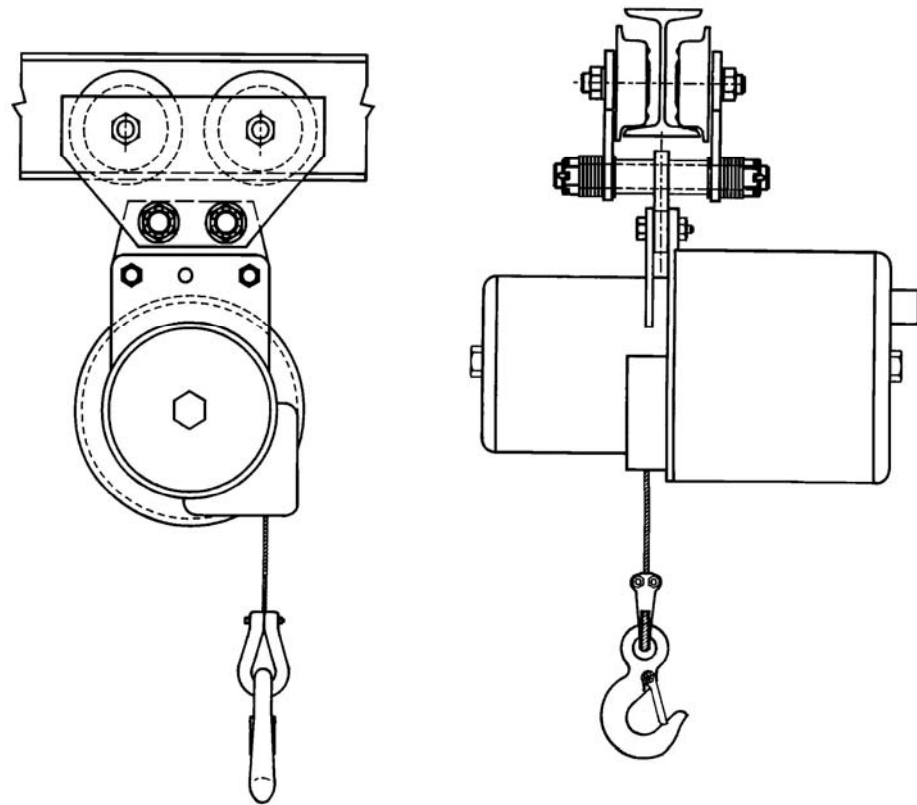
Balancers are typically supported on small jibs, light monorail systems, or enclosed track monorail systems.

### Equipment Characteristics

Vertical lift only

Max. Lifting Capacity: 500 pounds, approx.

Weight: 100 pounds, approx.



Balancers may or may not have been historically designed with hoist standards applied. Work is presently under way by the ASME B30 committee to prepare a safety standard for balancers. When available this standard will be released at B30.28

## **Hoist Standards**

There are many standards produced by many different standards-writing bodies. In an ever-shrinking world, hoist products increasingly pass across international borders. The list of standards referenced below is by no means complete, yet, in HMI's opinion, represents the standards that are applicable in different regions of the world. Since some of those standards may differ from the country to country, it is important for purchasers, installers, and users to know which ones apply for a particular situation.

### **USA**

In the USA, the American Society of Mechanical Engineers (ASME; website [www.asme.org](http://www.asme.org)) publishes standards for hoists. Three are safety standards and six are performance standards. All carry the American National Standards Institute (ANSI) designator for a consensus American National Standard (ANS):

|             |  |
|-------------|--|
| ASME-HST-1  | Performance Standard for Electric Chain Hoists                     |
| ASME-HST-2  | Performance Standard for Hand Chain Manually Operated Chain Hoists |
| ASME-HST-3  | Performance Standard for Manually Lever Operated Chain Hoists      |
| ASME-HST-4  | Performance Standard for Overhead Electric Wire Rope Hoists        |
| ASME-HST-5  | Performance Standard for Air Chain Hoists                          |
| ASME-HST-6  | Performance Standard for Air Wire Rope Hoists                      |
| ASME-B30.7  | Safety Standard for Base Mounted Drum Hoists                       |
| ASME-B30.16 | Safety Standard for Overhead Hoists (Underhung)                    |
| ASME-B30.21 | Safety Standard Manually Lever-Operated Hoists                     |

OSHA (Parts 1910 and 1926) adopts or invokes the American Society of Mechanical Engineers (ASME) HST Performance and B30 Safety Standards for hoists and related equipment.

Generally, for hoist installations in the US the standards published by the American Society of Mechanical Engineers apply.

## INTERNATIONAL NON-EUROPEAN

Outside North America, ISO (International Organization for Standardization) is sometimes referenced. For certain areas of the Asian markets the Japanese JIS standards may apply. Following is a selection of ISO and JIS standards applicable to hoists directly or through association with lifting machinery such as cranes:

### ISO STANDARDS

The International Organization for Standardization (ISO; website [www.iso.ch](http://www.iso.ch)) publishes many standards for numerous types of lifting machinery, many specifically for application, design, operation and maintenance of cranes. Below is a brief selection applicable to hoists and hoist components:

|          |   |
|----------|---|
| ISO 1837 | Lifting Hooks - Nomenclature  |
| ISO 2374 | Lifting Appliances - Range Of Maximum Capabilities for Basic Models |
| ISO 2408 | Steel Wire Rope for General Purposes                                |

### JIS STANDARDS

The Japanese Industrial Standards Committee (JIS; website [www.jisc.go.jp](http://www.jisc.go.jp)) publishes standards for hoists. Some of the primary ones are:

|            |                                      |
|------------|--------------------------------------|
| JIS B 8802 | Manually Operated Chain Hoists       |
| JIS B 8815 | Electric Chain Hoists                |
| JIS B 8819 | Manually Operated Chain Lever Hoists |
| JIS C 9620 | Electric Wire Rope Hoists            |

## EUROPEAN

Traditionally, European countries have maintained national standards in reference to a large number of industrial products, e.g. DIN (Germany), BSI (United Kingdom). In addition the FEM (Federation Europeenne de la Manutention) has published standards specifically for material handling and lifting equipment.

With the creation of the European Union, organizations for standardization were established at different levels of regulatory authority covering numerous product areas.

The highest regulatory level is a European Standards Commission. Its regulations are absolute and regulatory, focusing primarily on worker safety and protection from occupational hazards.

There are three main regulations:

- Machinery Regulation (including Lifting and Material Handling Equipment)
- Low Voltage Electricity Regulation
- EMV – Electro-magnetic Compatibility Regulation

At the next level are CEN (mechanical) and CENELEC (electrical) Standards. They are more detailed and product oriented than the regulations. Per definition, the publications of CEN and CENELEC are “Standards”, non-regulatory guidelines, reflecting state of the art design and construction practices. They are based on the highest level of probability that equipment, designed to these standards will be safe and functional. They do not preclude deviations or “product improvement based on technological progress”.

The goal of the CEN & CENELEC Committees is to harmonize the new, European norms with existing country-specific norms. The committees responsible for generating new standards include workgroups and sub-committees, which are comprised of representatives of related industries, academia and engineering research, as well as legal counsel. When a new CEN/CENELEC standard is introduced and “HARMONIZED” (language, legal, etc.) national norms (DIN (Germany), BS (England), AFNOR (France), AENOR (Spain), etc) lose validity.

CEN/CENELEC and ISO maintain communication between their committees working on related subjects.

FEM is an Industry Association of Material Handling Manufacturers, similar in nature and function to MHIA Product Councils (HMI, CMAA, MMA, etc.). FEM specifications are not regulatory, yet they are widely accepted in the international arena, and usually referred to in the absence of national standards.

Following is a listing of European standards and specifications for hoists and related equipment:

### **BSI STANDARDS**

Selection of primary standards published by British Standards (BSI website [www.bsi-global.com](http://www.bsi-global.com)) for hoists and related material handling equipment. (BS EN indicates harmonized standard):

|                |  |
|----------------|--|
| BS EN 292      | Safety of Machinery  |
| BS EN 14492-2  | Cranes – Power Driven Hoists   |
| BS EN 60034-1  | Rotating Electrical Machines: Rating and performance   |
| BS EN 60034-5  | Types of Enclosures for Rotating Electrical Machines   |
| BS EN 60204-32 | Safety of Machinery - Electrical Equipment of Machines - Part 32: Requirements for Hoisting Machines |

### **DIN STANDARDS**

Selection of primary standards published by the Deutsches Institut für Normung (DIN; website [www.din.de](http://www.din.de)) for application, design, maintenance and safety aspects of hoist and related equipment. (DIN EN indicates harmonized standard):

|                             |  |
|-----------------------------|--|
| DIN EN 14492-2              | Cranes – Power Driven Hoists   |
| DIN EN 60204-32             | Safety of Machinery; Electrical Equipment of Machines; Requirements for Hoisting Machines. |
| DIN 3051-Sections 1–4       | Lifting Ropes; Steel Wires   |
| DIN 15017                   | Cranes & Hoists; Principles of Motor and Gear Sizing                                       |
| DIN 15020- Sections 1–2     | Hoists; Principles of Rope Reeving   |
| DIN 15061- Sections 1–2     | Cranes & Hoists; Grooves for Rope Sheaves & Drums  |
| DIN 15100                   | Serial Lifting Equipment; Nomenclature   |
| DIN 15400 through DIN 15414 | Detailed Aspects of Load Hooks and Bottom Block Construction                               |

## FEM STANDARDS

The Federation Europeenne de la Manutention (FEM; website [www.fem-eur.com](http://www.fem-eur.com)) publishes many standards for hoists and related material handling equipment. Some of the primary ones are:

|           |  |
|-----------|--|
| FEM 1.002 | Illustrated Terminology of Heavy Lifting Equipment   |
| FEM 9.811 | Rope and Chain Hoists – General Specifications   |
| FEM 9.511 | Rules for the Design of Series Lifting Equipment - Classification of Mechanisms                          |
| FEM 9.661 | Rules for the design of Series Lifting Equipment - Dimensions and Design of Rope Reeving Components      |
| FEM 9.683 | Selection of Hoist and Travel Motors   |
| FEM 9.852 | Power Driven Series Hoist Mechanisms, Standardized Test Procedure for Verification of the Classification |
| FEM 9.755 | Measures for Achieving Safe Working Periods for Motorized Serial Hoist Units (S.W.P.)                    |
| FEM 9.751 | Power Driven Series Hoist Mechanisms, Safety   |
| FEM 9.901 | Rules for the Design of Series Lifting Equipment and Cranes Equipped with Series Lifting Equipment       |

## CEN STANDARDS

Selection of primary standards published by the European Committee for Standardization (CEN; website [www.cenorm.be](http://www.cenorm.be)) for hoists and related material handling equipment:

|             |  |
|-------------|--|
| EN 341      | Cranes – Bridge and Gantry Cranes  |
| EN 13135-1  | Cranes – Equipment – Part 1:Electrical Equipment   |
| EN 13135-2  | Cranes – Equipment – Part 2:Non-electrical Equipment                                       |
| EN 13157    | Cranes – Safety – Hand Powered Cranes  |
| EN 13155    | Cranes – Safety – Non-fixed Load Lifting Attachments                                       |
| EN 13557    | Cranes – Controls and Control Stations   |
| EN 14492-1  | Cranes – Power Driven Winches and Hoists – Part 1: Power Driven Winches                    |
| EN 14492-2  | Cranes – Power Driven Winches and Hoists – Part 2: Power Driven Hoists                     |
| EN 60204-32 | Safety of Machinery; Electrical Equipment of Machines; Requirements for Hoisting Machines. |