

EMH, Inc.

Specifications for

- **Top Running Cranes**
- **Under Running Cranes**
- **Wire Rope Hoists**

DISCLAIMER

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Specifications for

Top Running Electric Overhead Cranes

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1. APPLICABLE PUBLICATIONS AND SPECIFICATIONS

The following publications of the issues listed below form a part of this specification to the extent indicated by the references thereto:

- **Crane Manufacturers Association Of America**
CMAA Specification No. 70 For Electric Overhead Traveling Cranes
CMAA Specification No. 74 For Top Running and Under Running
Single Girder Electric Overhead Traveling Cranes
- **American National Standard**
ANSI B-20.2.0 Overhead Crane & Gantry Cranes
ANSI B-30.16 Overhead Hoists
ANSI B-30.17 Single Girder Top running Cranes
- **Occupational Safety And Health Administration (OSHA)**
Par. 1910.179 Overhead & Gantry Cranes
- **Hoist Manufacturers Institute**
HMI 100-74 Specifications for Electric Wire Rope Hoist
- **National Electric Code**
NEC (Article 610 Cranes and Hoists)

2. GENERAL

- 2.1** Manufacturer shall be in business for at least five years, having successfully designed and built several installations of similar scope.

Manufacturer shall be responsible for providing equipment of highest quality and workmanship, which will perform specified functions reliably and safely and shall permit required maintenance procedures with minimum interference of service or degradation of reliability.

2.2 SCOPE

The work required under this request for quotation shall include but not necessarily be limited to designing, manufacturing, shipping or installation of the equipment. It may also include testing of equipment after installation, if so required.

2.3 CRANE DESCRIPTION

The following specific data should be given:

- Quantity of Cranes
- Capacity of Crane
- Type of Crane (if building design is based on this design)
- Span of Crane
- Classification of crane following CMAA Spec. If this selection is not possible, give frequency of use for each size load within a certain time frame.
- Preferred speeds of hoist, trolley and crane (Single or multiple speed)
- Required hook approaches
- (Hook height and lift,
- Approach towards runways,
- Approach towards walls at end of runway)

2.4 RUNWAY ELECTRIFICATION

- 2.4.1** The runway conductor system shall be sized and installed in accordance with all applicable codes and specifications.

- 2.4.2** The runway conductor shall be supplied with cranes for each crane runway, consisting of a totally enclosed insulation, utilizing conductors for three phases with an extra conductor used for grounding the equipment. The conductors shall have sufficient ampacity to carry the required current to the crane (or cranes), when operated at rated load and speed.

- 2.4.3** The fused main line disconnect switch and electrical power feed shall be designed according to the Requirements of the National Electric Code and will be provided by an electrical contractor. Electrical power conduit shall be run to within 3 ft. distance from the designated crane runway.

2.5 RUNWAY RAIL

2.5.1 Unless specified otherwise, the runway rails will be supplied and installed by the crane manufacturer. For existing runways the crane purchaser should request the crane supplier to check for proper alignment of crane runway and crane rail. If tolerances are not within CMAA requirements, re-alignment should be accomplished before crane installation. (see also 5.2.)

3. SUBMITTALS

3.1 Manufacturers' drawings shall be submitted for approval in at least two copies. Drawings shall include the following information:

- a.** Outline and clearance dimensions
- b.** Crane data
- c.** Overall arrangement, maximum wheel load shipping weight
- d.** Layout and detail of runway conductor system

3.2 At time of crane shipment, 2 sets of operation instructions, maintenance manuals and spare parts information shall be furnished.

4 CRANE SPECIFICATION

4.1 Crane Bridge

4.1.1 Girder

Crane girders shall be structural shape weldments, made from structural shape box sections fabricated from steel plate. Box girders shall be diaphragmed box sections designed to resist all vertical, horizontal and torsional forces. Girders may be of symmetrical or asymmetrical design (different plate thickness for top and bottom plates and possibly for web plates. Trolley rail sections may be welded to top plate directly over inside web.) Maximum allowable vertical deflection due to live load shall be limited to 1/888 of span.

Girders shall be fabricated using high penetration continuous welding and shall be factory cambered. Trolley rails on double girder cranes may be ASCE rails or high strength steel bars designed to carry trolley wheel loads with a minimum of wear.

On single girder cranes, girders shall be fabricated of A36 steel plate. Maximum allowable vertical deflection due to live load shall be limited to 1/600 of span.

4.1.2 Endtrucks

Endtrucks shall be of box type construction having double-flanged wheels supported on rotating axles with spline output shaft. The wheel-to-drive connection is made by means of a tapered lock system without keyway. The design of the Endtruck should allow easy wheel removal and exchange. The dual anti-friction bearings supporting the axle shall have a minimum B-10 bearing life in accordance with the crane classification specified (see par 2.3). Wheels shall be rolled or forged steel, or cast nodular iron, carbon or alloy steel. Wheels shall be designed to carry the wheel loads without undue wear. Endtrucks shall be fitted with shock absorbing bumpers capable of deceleration and stopping the crane within the limits stated by OSHA and CMAA.

4.1.3 Girder Endtruck Connection

Endtrucks shall be bolted to girder ends to form a rigid connection. Bolts in shear or welded connections shall not be permitted.

4.1.4 Crane Drives

Horizontal bridge drives shall be one of the arrangements as detailed by CMAA (A-1 through A-6). Totally enclosed motor and fully enclosed gearing should be directly connected to the rotating axle. If hollow shaft, individual drives are employed, gearbox and axle should be mated by use of a fully splined shaft for uniform rotational force distribution. Wheel-to-axle connection is made by means of a tapered lock system without keyway. All gears shall be heat treated and shall run on anti-friction bearings with constant oil bath lubrication.

Acceleration and deceleration rate must be as constant as possible and shall not be measurably affected by variation of live load or by location of live load on bridge span.

Motors shall have Class "F" insulation and shall be thermally protected. Two speed drives should be at high to low speed ration of 4:1 with automatic acceleration control. Variable speed drives should be based on variable frequency control system using squirrel cage. Travel speeds higher than 200 FPM should be cab or radio controlled.

Crane drives shall have quick disconnects on junction boxed to reduce maintenance and down time.

4.2 HOIST

4.2.1 Hoist motor and braking system

Hoist motor shall develop sufficient power to lift the rated load at the specified speed. Motor windings shall have Class F insulation. Motor shall be rated for the number of starts per hour expected in the application and for duty cycle (on-time V = vs. off-time.). Ratings such as "30 minute" to "60 minute" shall not be accepted, as they do not represent testing criteria that simulate hoisting service.

Motor shall not be mounted inside the hoist drum except in HMI Class H1 applications due to insufficient heat dissipation and difficulty of maintenance.

If the application requires a slow spotting speed in addition to the normal lifting and lowering speed, a two winding, squirrel cage motor shall be used to achieve a 6:1 ratio. If higher speed ratio is required, a Variable Frequency Drive hoist control shall be used.

All motors shall be protected from overheating by thermal protectors. Motors less than 5 HP shall be of the totally enclosed, fan cooled or non-ventilated type. Motors of 5 HP or greater shall be of the totally enclosed, fan cooled type.

The hoist holding brake shall be an electrically opened, mechanically closed unit. It may be of the shoe brake, disc brake or conical brake type having a minimum torque rating of 250% of motor full load torque. Control braking means may be mechanical or electrical and shall be capable of maintaining controlled lowering speed within 120% of rated lifting speed. For lifts greater than 25 feet or for higher duty classifications than HMI H3, electrical lowering control is required. Brake material shall not contain asbestos.

4.2.2 Gearing

Gear lubricant shall be synthetic and shall not require replacement for the normal life of the hoist.

4.2.3 Rope Drum

Rope drum shall be of welded construction, machine grooved to a minimum depth of 0.375 times the rope diameter. Drum shall be supported at each end by sealed anti-friction bearings. Drum shall be driven by a central, splined shaft.

4.2.4 Rope & Drum Guide

The hoisting rope shall be of proper design and construction for hoist service. The rated capacity load divided by the number of parts of rope shall not exceed 20% of the braking strength of the rope.

Hoist reeving shall be single or double as appropriate to the application. Double reeving ("true vertical lift") shall not be required except in applications where lateral hook travel must be less than 0.1 inch per foot of vertical hook travel.

To assure positive winding of rope on the drum and to prevent rope overlapping and potentially dangerous groove peak contact, a hoisting rope guide shall be employed. Double wrapping of rope shall not be permitted.

4.2.5 Bottom Block

Bottom block shall have a totally enclosed housing fabricated of steel. The rope sheaves shall be supported on anti-friction bearings and the hook shall be forged to steel and supported on an anti-friction thrust bearing. Hook shall be equipped with heavy spring safety latch.

4.2.6 Limit Switch

Hoist shall be equipped with a two geared upper and one lower limit switch. These switches shall be adjustable to set the extreme upper and lower limits of hook travel.

4.3 TROLLEY

4.3.1 Single Girder Trolley

Trolley wheels shall be cast and machined from spheroidal graphite nodular material for best wear characteristics. They shall be single or double flanged and shaped to match the running surface.

4.3.2 Double Girder Trolley

Trolley frame shall be a weldment of structural steels, wheels shall resist wear and be mounted on anti-friction bearings having a minimum B-10 bearing life in accordance with the crane classification specified. Totally enclosed motor and fully enclosed gearing should be directly connected to the rotating axle. If hollow shaft, individual drives are employed, gear box and axle should be mated by use of a fully splined shaft for uniform rotational force distribution. Wheel-to-axle connection is made by means of a tapered lock system without keyway. Trolleys shall be powered by high slip squirrel cage motor with brake of sufficient torque capacity. Insulation of motor windings shall be Class "F", and shall be thermally protected. Trolley drives shall have quick disconnects.

4.4 ELECTRIFICATION AND CONTROLS

4.4.1 Electrification

Electrification across bridge for power to hoist trolley and control of all motions shall consist of highly flexible type neoprene covered flat-section cable suspended from smooth running enclosed track system.

4.4.2 Controls

Control of crane hoist and trolley motions shall be by means of magnetic contactors mounted in type 12 control enclosures.

Control voltage shall be isolated from the main power supply by a transformer and shall not exceed 120 volts. Controls shall have quick disconnects.

4.4.3 Push-button Station

Floor control of crane shall be by means of a high impact abrasion-resistant push-button station. The push-button station should be mounted from a smoothly operating track system running along the girder, and should be arranged in close accordance with the applicable paragraphs of CMAA Spec. 70. Push-button station shall have quick disconnects.

4.4.4 Cab Control

Cab controlled cranes shall have cab of the type appropriate for the operation to be performed open, closed or skeleton-type (dummy). Open and closed cabs shall be for full time operation with master switches conveniently arranged before operation. Multi-directional joy sticks are preferred to increase operator's efficiency. Crane operator shall be afforded best possible visibility of working standard pushbutton station, which can be reached from cab. Open or enclosed cab shall be rigidly affixed to crane structure. Location of cab, whether either end of girder or center of span, is to be specified.

If environment requires, cab may be equipped with heater, fan, air conditioner, or any other convenience necessary. Access to walkway shall be furnished.

4.5 PAINTING

All structural parts shall be cleaned of rust and millscale. The complete crane shall be given the appropriate number of coats of anti-corrosion primer and finish paint to protect surface from environmental damage.

Type of paint and color of final coat shall be according to manufacturer's standard.

4.6 LUBRICATION

All gear boxes, bearings, etc. shall be properly lubricated prior to shipment from factory. Lifetime lubricated bearings shall be used where possible and appropriate.

5. MISCELLANEOUS

5.1 Shipping

Cranes may be shipped disassembled in the following sub assemblies:

- Bridge girders (with or without walkway)
- Hoist-trolley, endtrucks with drives
- Tagline electrification
- Cab

Unloading and installation, unless otherwise specified, shall be by others.

5.2 Runways and Runway Stops

Runways and runway stops, unless otherwise specified in this bid request, shall be by crane manufacturers. The runway is not supplied in this bid request, crane supplier may assume runways to be level and within tolerances required by CMAA Spec. 70. More detailed runway tolerances shall be given with certified approval drawing upon request.

Specifications for
Under Running
Electric Overhead Cranes

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- 5. Miscellaneous**
- 6. Glossary**

1. APPLICABLE PUBLICATIONS AND SPECIFICATIONS

The following publications of the issues listed below form a part of this specification to the extent indicated by the references thereto:

- **Crane Manufacturers Association Of America**
CMAA Specification No. 74 For Top running and Under running Single Girder Electric Overhead Traveling Cranes
- **American National Standard**
ANSI B-30. 16 overhead Hoists
- **Occupational Safety And Health Administration (OSHA)**
Par. 1910.179 Overhead & Gantry Cranes
- **Hoist Manufacturers Institute**
HMI 100-74 Specifications for Electric Wire Rope Hoist
- **National Electric Code**
NEC (Latest Edition, Article 610 Cranes and Hoists)

2. GENERAL

- 2.1** Manufacturer shall be in business for at least five years, having successfully designed and built several installations of similar scope.

Manufacturer shall be responsible for providing equipment of highest quality and workmanship, which will perform specified functions reliably and safely and shall permit required maintenance procedures with minimum interference of service or degradation of reliability.

2.2 SCOPE

The work required under this request for quotation shall include but not necessarily be limited to designing, manufacturing, shipping or installation of the equipment.

It may also include testing of equipment after installation, if so required.

2.3 CRANE DESCRIPTION

The following specific data should be given:

- Quantity of Cranes
- Capacity of Crane
- Type of Crane (if building design is based on this design)
- Span of Crane
- Classification of crane following CMAA Spec. If this selection is not possible, give frequency of use for each size load within a certain time frame.
- Preferred speeds of hoist, trolley and crane (Single or multiple speed)
- Required hook approaches
(Hook height and lift,
approach towards runways,
approach towards walls at end of runway)

2.4 RUNWAY ELECTRIFICATION

- 2.4.1** The runway conductor system shall be sized and installed in accordance with all applicable codes and specifications.

- 2.4.2** The runway conductor shall be supplied with cranes for each crane runway, consisting of a totally enclosed insulation, utilizing conductors for three phases with an extra conductor used for grounding the equipment. The conductors shall have sufficient ampacity to carry the required current to the crane (or cranes), when operated at rated load and speed.

- 2.4.3** The fused main line disconnect switch and electrical power feed shall be according to Requirements of the National Electric Code and will be provided by an electrical contractor. Electrical power conduit shall be run to within 3 ft. distance of the designated crane runway.

2.5 RUNWAY

2.5.1 Unless specified otherwise, the runway and crane end stops will be supplied and installed by others. Crane purchaser should request crane supplier to check alignment of crane runway. If the tolerances are not within CMAA requirements, re-alignment should be accomplished before the crane installation. (see also 5.2.)

3. SUBMITTALS

3.1 Manufacturers' drawings shall be submitted for approval in at least two copies. Drawings shall include the following information:

- a. Outline and clearance dimensions
- b. Crane data
- c. Overall arrangement, maximum wheel load shipping weight
- d. Layout and detail of runway conductor system

3.2 At time of crane shipment, 2 sets of operation instructions, maintenance manuals and spare parts information shall be furnished.

4. CRANE SPECIFICATION

4.1 Crane Bridge

4.1.1 Girder

Girders shall be designed to resist all vertical, horizontal and torsional forces. Girders may be manufactured from structural shapes or weldments made from structural shapes of steel plates. All steel shall conform to ASTM A36 Specification or be of equivalent quality.

Due consideration shall be taken to include local bending stress caused by wheel loads on lower girder flange.

Maximum allowable vertical deflection produced by the weight of the hoist and rated load shall not exceed 1/600 of the crane span. Impact shall not be considered in determining deflection.

4.1.2 Endtrucks

Endtrucks shall be constructed of structural steel providing a rigid structure. Design should allow easy wheel removal and exchange. Wheels shall be supported by anti-friction bearings with a Minimum B-10 life as required by crane classification.

Endtrucks shall be fitted with shock absorbing bumpers, capable of accelerating and stopping the crane within the limits stated by OSHA and CMAA.

4.1.3 Wheels

Wheels shall be of rolled or forged steel, or cast of iron or steel, or of other suitable material as specified by manufacturer.

Wheels shall be flanged. Running tread shall match the running surface of the lower girder flange.

When flangeless wheels and side roller assemblies are provided, they shall be of a type and design recommended by the crane manufacturer.

4.1.4 Crane Drive

Horizontal bridge drives shall be of the arrangement using geared wheel and pinion. Totally enclosed motor and fully enclosed gearing shall be used. At least 2 wheels must be driven.

Acceleration and deceleration rate must be as constant as possible and shall not be measurably affected by variation of live load or by location of live load on bridge span. Motors shall have Class "F" insulation and shall be thermally protected. Motors shall have quick disconnects

4.2 HOIST

4.2.1 Hoist motor and braking system

Hoist motor shall develop sufficient power to lift the rated load at the specified speed. Motor windings shall have Class F insulation. Motor shall be rated for the number of starts per hour expected in the application and for duty cycle (on-time V=vs. off-time.). Ratings such as "30 minute" to "60 minute" shall not be accepted as they do not represent testing criteria which simulate hoisting service.

Motor shall not be mounted inside the hoist drum except in HMI Class H1 applications due to insufficient heat dissipation and difficulty of maintenance.

If the application requires a slow spotting speed in addition to the normal lifting and lowering speed, a two winding, squirrel cage motor shall be used to achieve a 6:1 ratio.

All motors shall be protected from overheating by thermal protectors. Motors less than 5 HP shall be of the totally enclosed, fan cooled or non-ventilated type. Motors of 5 HP or greater shall be of the totally enclosed, fan cooled type.

The hoist holding brake shall be an electrically opened, mechanically closed unit. It may be of the shoe brake, disc brake or conical brake type having a maximum torque rating of 250% of motor full load torque. Control braking means may be mechanical or electrical and shall be capable of maintaining controlled lowering speed within 120% of rated

lifting speed. For lifts greater than 25 feet or for higher duty classifications than HMI H3, electrical lowering control is required Brake material shall not contain asbestos.

4.2.2 Gearing

All gears shall be ground and hardened and shall operate in an oil bath. Gear lubricant shall be synthetic and shall not require replacement for the normal life of the hoist.

4.2.3 Rope Drum

Rope drum shall be of welded construction, machine grooved to a minimum depth of 0.375 times the rope diameter. Drum shall be supported at each end by sealed antifriction bearings. Drum shall be driven by a central, splined shaft.

4.2.4 Rope and Drum Guide

The hoisting rope shall be of proper design and construction for hoist service. The rated capacity load divided by the number of parts of rope shall not exceed 20% of the braking strength of the rope.

Hoist reeving shall be single or double as appropriate to the application. Double reeving ("true vertical lift") shall not be required except in applications where lateral hook travel must less than 0.1 inch per foot of vertical hook travel.

To assure positive winding of rope on the drum and to prevent rope overlapping and potentially dangerous groove peak contact, a hoisting rope guide shall be employed. Double wrapping of rope shall not be permitted.

4.2.5 Bottom Block

Bottom block shall have a totally enclosed housing fabricated of steel. The rope sheaves shall be supported on anti-friction bearings and the hook shall be forged to steel and supported on an anti-friction thrust bearing. Hook shall be equipped with heavy spring safety latch.

4.2.5 Limit Switch

Hoist shall be equipped with a geared two upper and one lower limit switch. This switch shall be adjustable to set the extreme upper and lower limits of hook travel.

4.3 TROLLEY

Trolleys shall have wheels according to par. 4.1.3 wherever applicable and shall be powered by a high slip squirrel cage motor and shall have a brake. Motor shall have Class "F" insulation and shall be protected by heat sensors embedded in windings.

4.4 ELECTRIFICATION AND CONTROLS

4.4.1 Electrification

Electrification across bridge for power to hoist trolley and control of all motions shall consist of highly flexible type neoprene covered flat-section cable suspended from smooth running enclosed track system.

4.4.2 Controls

Control of crane hoist and trolley motions shall be by means of magnetic contactors mounted in type 12 control enclosures.

Control voltage shall be isolated from the main power supply by a transformer and shall not exceed 120 volts.

Controls shall have quick disconnects.

4.4.3 Pushbutton Station

Floor control of crane shall be by means of a high impact abrasion-resistant pushbutton station. The pushbutton station should be mounted from a smoothly operating track system running along the girder, and should be arranged in close accordance with the applicable paragraphs of CMAA Spec. 70.

Push-button station shall have quick disconnects.

4.5 PAINTING

All structural parts shall be cleaned of rust and millscale. The complete crane shall be given the appropriate number of coats of anti-corrosion primer and finish paint to protect surface from environmental damage.

Type of paint and color of final coat shall be according to manufacturer's standard.

4.6 LUBRICATION

All gear boxes, bearings, etc. shall be properly lubricated prior to shipment from factory. Lifetime lubricated bearings shall be used where possible and appropriate.

5. MISCELLANEOUS

5.1 Shipping

Cranes may be shipped disassembled in the following sub assemblies:

- Bridge girders
- Hoist-trolley, endtrucks with drives
- Tagline electrification

Unloading and installation, unless otherwise specified, shall be by others.

5.2 Runways and Runway Stops

Runways and runway stops, unless otherwise specified in this bid request, shall be by crane manufacturers. The runway is not supplied in this bid request, crane supplier may assume runways to be level and within tolerances required by CMAA Spec. 70. More detailed runway tolerances shall be given with certified approval drawing upon request.

Specifications for Wire Rope Hoists

Index

1. Applicable Publications And Specifications

2. General

3. Scope

4. Submittal

5. Hoist Specifications

1. APPLICABLE PUBLICATIONS AND SPECIFICATIONS

The following publications of the issues listed below form a part of this specification to the extent indicated by the references thereto:

- **AMERICAN NATIONAL STANDARD**
ANSI B-30.16 Overhead Hoists
- **HOIST MANUFACTURERS INSTITUTE**
HMI 100-74 Specifications for Electric Wire Rope Hoist
- **NATIONAL ELECTRIC CODE**
NEC (Article 610 Cranes and Hoists)

2. GENERAL

- 2.1** Manufacturer shall have been in business for at least 10 years or be an active member of the Material Handling Industry of America (MHIA).
- 2.2** Manufacturer shall be responsible for providing equipment of highest quality and workmanship, which will perform the specified functions reliably and safely and shall permit required maintenance procedures with minimum interruption of service.

3. SCOPE

The work required under this specification shall include by not necessarily be limited to designing, manufacturing, shopping, or installation of the equipment. It may also include testing of equipment after installation, if so required.

4. SUBMITTALS

- 4.1** Manufacturer's drawings shall be submitted for approval in at least two copies. Drawings shall include the following information.
 - a. Outline and clearance dimensions
 - b. Hoist data
 - c. Unit weight and shipping weight
- 4.2** At time of shipment, 2 sets of operation instructions, maintenance manuals and spare parts information shall be furnished.

5. MOTOR

- 5.1** Hoist motor shall develop sufficient power to lift the rated load at the specified speed. Motor windings shall have Class "F" insulation. Motor shall be rated for the number of starts per hour expected in the application and for duty cycle (on-time vs. off-time). Ratings such as "30 minute" or "60 minute" shall not be accepted as they do not represent testing criteria which simulate hoisting service.
- 5.2** Motor shall not be mounted inside the hoist drum except in HMI Class H1 applications due to insufficient heat dissipation and difficulty of maintenance.
- 5.3** If the application requires a slow spotting speed in addition to the normal lifting and lowering speed, a two winding, squirrel cage motor shall be used to achieve a 6 = 1 ratio. In applications requiring a creep spotting speed slower than 16% of the high speed, a Variable Frequency Drive shall be used for more accurate load handling.
- 5.4** All motors shall be protected from overheating by thermal protectors. Motors less than 5 HP shall be of the totally enclosed, fan cooled or non-ventilated type. Motors of 5 HP or greater shall be of the totally enclosed, fan cooled type.

6. HOIST BRAKE

- 6.1** The hoist holding brake shall be an electrically opened, mechanically closed unit. It may be of the shoe brake, disc brake or conical brake type having a minimum torque rating of 250% of motor full load torque. Control braking means may be mechanical or electrical and shall be capable of maintaining controlled lowering speed within 120% of rated lifting speed. For lifts greater than 25 feet or for higher duty classifications than HMI H3, electrical lowering control is required. Brake material shall not contain asbestos.

7. GEARING

- 7.1** All gears shall be ground and hardened and shall operate in an oil bath. Gear lubricant shall be synthetic and shall not require replacement for the normal life of the hoist.

8. ROPE DRUM

- 8.1** Rope drum shall be of welded construction, machine grooved to a minimum depth of 0.375 times the rope diameter. Drum shall be supported at each end by sealed antifriction bearings. Drum shall be driven by a central, splined shaft.

9. REEVING

- 9.1** Hoist reeving shall be single or double as appropriate to the application. Double reeving (true vertical lift) shall not be required except in applications where lateral hook travel must be less than 0.1 inch per foot of vertical hook travel.

10. ROPE

- 10.1** The hoisting rope shall be of proper design and construction for hoist service. The rated capacity load divided by the number of parts of rope shall not exceed 20% of the breaking strength of the rope.

11. ROPE GUIDE

- 11.1** To assure positive winding of rope on the drum and to prevent rope overlapping and potentially dangerous groove peak contact, a hoisting rope guide shall be employed. Double wrapping of rope shall not be permitted.

12. BOTTOM BLOCK

- 12.1** Bottom block shall have a totally enclosed housing fabricated of steel. the rope sheaves shall be supported on anti-friction bearings and the hook shall be forged of steel and supported on an anti-friction bearings and the hook shall be forged of steel and supported on an anti-friction thrust bearing. Hook shall be equipped with heavy spring safety latch.

13. TROLLEY WHEELS

- 13.1** Trolley wheels shall be cast and machined from spheroidal graphite nodular material for best wear characteristics. They shall be single or double flanged and shaped to match the running surface.

14. TROLLEY DRIVES

- 14.1** Motorized trolleys shall be powered by a high slip, single or two speed, squirrel cage motor. Acceleration and deceleration shall be limited to a maximum of 1.0 foot/second/second by means of an inertia wheel to minimize load swing.
- 14.2** Trolley brakes shall be provided.
- 14.3** Motor shall have Class F winding insulation and be totally enclosed.
- 14.4** Motor shall be protected from overheating by thermal protectors imbedded in the windings. Totally enclosed motor and fully enclosed gearing should be directly connected to the rotating axle. If hollow shaft, individual drives are employed, gear box and axle should be mated by use of a fully splined shaft for uniform rotational force distribution. Wheel-to-axle connection is made by means of a tapered lock system without keyway.

Trolley drives shall have quick disconnects.

15. CONTROLS

- 15.1** Control of hoist and trolley motions shall be by means of magnetic contactors mounted in type 12 control enclosures. Enclosures shall be selected to meet the service requirements of the application. Minimum enclosure classification shall be water tight and dust resistant.
- 15.2** Control voltage shall be isolated from the main power supply by a transformer and shall not exceed 120 volts.
- Controls shall have quick disconnects.
- 15.3** When Variable Frequency Control is used, it shall be of the “closed loop” flux vector type.

16. PUSH-BUTTON STATION

- 16.1** Control of hoist shall be via a high impact, abrasion resistant pushbutton station. Pushbutton material shall be flame resistant and self-extinguishing.

Push-button Station shall have quick disconnects.

17. LIMIT SWITCH

- 17.1** Hoist shall be equipped with a geared two upper and one lower limit switch. This switch shall be adjustable to set the extreme upper and lower limits of hook travel.

18. PAINTING

- 18.1** The hoist and trolley shall be given the appropriate number of coats of anti-corrosive primer and finish paint to protect surface from environmental damage.
- 18.2** Type of paint and color of final coat shall be according to manufacture's standard.

19. TESTING

- 19.1** Prior to shipment, hoists shall be tested at the manufacturer with a load simulating 125% of rated capacity.