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USACE / NAVFAC / AFCESA **UFGS-14602A (November 2002)**

Preparing Activity: USACE (CW) **Superseding UFGS-14602A (August 1995)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

Latest change indicated by CHG tags
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11/02

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SECTION 14602A

CRANES, SINGLE-GIRDER BRIDGE, MONORAIL AND JIB
11/02

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NOTE: This guide specification covers the requirements for top running or underhung single-girder bridge electric overhead traveling cranes utilizing underrunning trolley hoists, monorail hoists, and jib cranes, suitable for indoor or outdoor use in hazardous or nonhazardous environments in civil works projects.

Drawings must indicate where the hoist, rail, or jib is to be supported, location, capacity, power source (air or electric), headroom and lift requirements, size of trolley rail or beam, switches, and special conditions of mounting, size and type of jib (freestanding, mast type, or wall-mounted).

Drawings must schedule each hoist separately and completely when multiple hoists of different types, capacity, power source, and operating characteristics are required.

Various hoist manufacturer's data and specifications must be reviewed to aid in developing specific job requirements and to avoid the possibility of specifying improper combinations.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by

the designer.

****

PART 1 GENERAL

****

NOTE: Hoist types covered include (1) electric chain hoist, (2) electric wire-rope hoist, (3) air-chain hoist, and (4) air wire-rope hoist. Monorail types covered include (1) standard I beam, (2) wide flange or H-beam, and (3) patented beam. Jib crane framework types include (1) freestanding type, (2) mast type, and (3) wall-mounted type. Manual hoists are not recommended as electric and air hoists are much more convenient to use.

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1.1 REFERENCES

****

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 9005	(2002; Rev E) Industrial Gear Lubrication

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 348	(2000) Structural Joints Using ASTM A325 or A490 Bolts

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.1	(1994) Rigid Steel Conduit - Zinc Coated
ANSI MH27.1	(1996) Patented Track Underhung Cranes and Monorail Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2002) Structural Welding Code - Steel

AWS D14.1	(1997) Welding Industrial and Mill Cranes and Other Material Handling Equipment

ASME INTERNATIONAL (ASME)

ASME B30.16	(2003) Overhead Hoists (Underhung)
ASME HST-1	(1999) Electric Chain Hoists
ASME HST-2	(1999) Hand Chain Manually Operated Chain Hoists
ASME HST-4	(1999) Overhead Electric Wire Rope Hoists
ASME HST-5	(1999) Air Chain Hoists
ASME HST-6	(1999) Air Wire Rope Hoists

ASTM INTERNATIONAL (ASTM)

ASTM A 325	(2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(2003) Structural Bolts, Steel, Heat Treated, 830 Mpa Minimum Tensile Strength (Metric)
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 490	(2002) Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A 490M	(2003) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM E 10	(2001) Brinell Hardness of Metallic Materials

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 74	(2000) Top Running and Under Running Single Girder Electric Overhead Cranes Utilizing Under Running Trolley Hoist, No. 74

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures
NEMA KS 1	(2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA WC 3	(1992; Rev 1 1994) Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J534	(1998) Lubrication Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-C-271	(Rev D; Am 1) Chains and Attachments, Welded and Weldless
FS RR-W-410	(Rev E) Wire Rope and Strand

UNDERWRITERS LABORATORIES (UL)

UL 355	(1996; Rev thru Sep 2001) Cord Reels
UL 50	(1995; Rev thru Sep 2003) Enclosures for Electrical Equipment
UL 674	(2003) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations

1.2 DEFINITIONS

1.2.1 Capacity

Capacity shall mean the rated load in pounds, or tons of 2,000 pounds each, specified by the manufacturer for the hoist and marked plainly on the hoist and loadblock so as to be clearly legible. In determining the applied load, the weight of the handling devices shall be included.

1.2.2 Hoisting Speed

Hoisting speed shall mean the velocity in mm/s feet per minute at which the hoist will lift the rated load. Actual lifting speed shall be within plus or minus 10 percent of the manufacturer's rating.

1.2.3 [Bridge Crane Travel Speed

Bridge crane travel speed shall mean the velocity in mm/s feet per minute at which the bridge crane will travel carrying with the rated load. Actual travel speed shall be within plus or minus 10 percent of the manufacturer's

rating.]

1.2.4 Rated Lift

Rated lift shall mean the distance between the upper and lower elevations of travel of the load block.

1.2.5 Headroom

Headroom shall be measured with the load hook in the highest position with full load which is the distance between the saddle of the load hook and the following points:

a. The bottom of the beam when S-shape runways are used.

b. The top of the bottom flange for all flat, wheel-bearing flange surfaces.

1.2.3.6 [Minimum Radius

Minimum radius shall mean the smallest radius to the centerline of the beam or track on which the trolley will operate properly.]

1.2.7 Trolley Speed

Trolley speed shall mean the velocity in mm/s feet per minute at which a motor-driven trolley with hoist will travel carrying the rated load on level track; actual speed shall be within plus or minus 10 percent of the manufacturer's rating.

1.3 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy

projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detailed Drawings

Detailed drawings as specified.

SD-03 Product Data

Hoist Hook Assembly
Heat Treatment

Record of hook material and any heat treatment performed shall be submitted and shall be stamped on the hook shank or documented in certification papers furnished with the hooks.

[Materials and Equipment

A complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions shall be submitted.] [Diagrams, instructions, and other sheets proposed for posting shall be submitted.]

Hoist

Manufacturer's catalog data shall be submitted showing the equipment and accessories to be provided. Diagrams, instructions, and other sheets proposed for posting shall be submitted.

Spare Parts

Spare parts data shall be submitted and shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-06 Test Reports

Electrification System Tests[; G][; G, [_____]]

Results of electrification system tests shall be submitted.

Acceptance Testing

Test reports in booklet form shall be submitted showing all

field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The report shall include the information as required by paragraph ACCEPTANCE TESTING.

SD-07 Certificates

[Hoist
Track Design
Jib Framework

[Certification shall be submitted attesting that each hoist, hoist trolley and track, jib framework, and hoist control has been factory tested for rated load capacity and operation, and that each hoist complies with the requirements specified.]

[Certification shall be submitted attesting that a sample hoist of each type specified has been factory tested for the tests specified.]

[Motor Controller

Certified results of thermal monitoring of motor components during tests shall be submitted.]

[Electric Hoists
Trolleys
Wiring
Contact Conductors
Hoist Controls
Overcurrent Protection
Grounding]

Certification shall be submitted attesting that electric hoists, trolleys, wiring, contact conductors, controls, overcurrent protection, and grounding conform to NFPA 70 and to UL standards. The label or listing with reexamination by the UL will be accepted as evidence that the materials conform to this requirement and to NFPA 70. Certification shall be submitted attesting that each hoist, hoist trolley and track, jib framework, and hoist control has been factory tested for rated load capacity and operation, and that each hoist complies with the requirements specified.]

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions[; G][; G, [_____]]

[Six][_____] copies of operation manuals shall be furnished for the equipment furnished. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their operating features. [Operation manuals shall include a copy of the acceptance test report for information and future reference.][Operation manuals shall include an overall description of the system describing any unique features that may need special attention.] [Six][_____] copies of maintenance manuals shall be furnished for the equipment furnished.

Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping, layout diagrams, equipment layout diagrams, and wiring and control diagrams of the system as installed. Maintenance manuals shall include a spare parts list of manufacturers recommended spare parts that should be maintained onsite and any long lead time items should be clearly identified. Maintenance manuals shall contain replacement part numbers for the entire assembly.

1.4 DELIVERY AND STORAGE

Equipment delivered shall be placed in indoor storage, protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 SYSTEM DESCRIPTION

1.5.1 General Requirements

1.5.1.1 Materials and Equipment

Materials and equipment shall be standard products of manufacturers regularly engaged in the fabrication of cranes and hoists and shall essentially duplicate items which have been in satisfactory use for at least 2 years prior to bid opening. Any company licensed by a crane and hoist manufacturer to manufacture cranes and hoists bearing their name shall have the design and components approved by the licensor prior to submission to the Government for approval.

1.5.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or catalog number, and serial number on a metal plate secured to the equipment.

1.5.1.3 Verification of Dimensions

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.5.1.4 Welding

****

NOTE: Select appropriate alternative paragraphs. The first paragraph should only be used with bridge cranes; whereas, the second paragraph should only be used with hoists, monorail hoists, and jib cranes.

****

[Welding shall be in accordance with qualified procedures using AWS D14.1 as modified herein. Written welding procedures shall specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and such tolerances shall not exceed those specified in AWS D14.1. All welding shall be performed indoors. Welders and welding operators shall be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1. Allowable stress values shall be in accordance with CMAA 74.] [Welding shall be in accordance with AWS D1.1/D1.1M.]

1.5.1.5 Detailed Drawings

The Contractor shall submit detailed drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.5.1.6 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified. Coordinate this paragraph with the requirements specified in the Submittals paragraph.

1.5.2 Design Criteria

****
NOTE: Select crane or hoist and delete other type. If bridge cranes are not specified, delete bracketed words regarding runway dimensions and rails/beams.
****

The [crane(s)][hoist(s)] shall be designed to operate in the spaces[and match the runway dimensions and [rails][beams]] indicated. The hook coverage and hook vertical travel shall not be less than that indicated.

1.5.2.1 Classification

****
NOTE: The following references provide and explain the different service classifications that need to be selected for the crane, monorail and hoist: CMAA 74 provides service classifications for cranes. ANSI MH27.1 provides monorail service classifications. ASME HST-1, ASME HST-4, ASME HST-5, and ASME HST-6 provide service classifications for hoists.
****

a. [The crane shall be designed and constructed to CMAA 74 Class [_____], [_____] service requirements for operation in [indoor][outdoor] [hazardous][nonhazardous] environment.]

b. [The monorail system shall be designed and constructed to ANSI MH27.1 Class [_____] service requirements.]

c. The hoist shall be designed and constructed to [ASME HST-1][ASME HST-4][ASME HST-5][ASME HST-6], Class [_____], service requirements for operation in [hazardous][nonhazardous] environment.

1.5.2.2 Hoist Characteristics

****
NOTES: Drawings must indicate special lifting requirements, for example, loads lowered from one elevation into pits or through floor openings to an intermediate or lower level.

Subparagraph "e" must be included.
****

[Hoist shall be an electric-chain hoist of type, class, control, suspension, lift, and operating characteristics specified.][Hoist shall be an electric-wire-rope hoist of type, class, control, suspension, lift, and operating characteristics specified.][Hoist shall be an air-chain hoist of class, suspension, lift, and operating characteristics specified.][Hoist shall be a air-wire-rope hoist of suspension, lift, and operating characteristics specified.] Each hoist shall have the capacity, lift-height, suspension, power source, and operating characteristics indicated and as follows:

a. [Hoist capacity shall be [_____] metric tons tons.][Each hoist shall have the capacity indicated.]

b. [Hoist shall be a standard lift with a minimum lift of [_____] m feet.][Each hoist shall have the minimum height of lift indicated.]

c. [The hoist shall be the hook-suspension type.][The hoist shall be the lug-suspension type, mounted on a plain, hand-propelled trolley.][The hoist shall be the lug-suspension type mounted on an electric-motor-driven trolley.][The hoist shall be the lug-suspension type mounted on an air-motor-driven trolley.][The hoist shall be tractor mounted with a motor-driven tractor-trolley unit.]

d. [The hoist and suspension shall be the standard headroom type.][The hoist and suspension shall be the minimum headroom type.][Each hoist shall be standard headroom or minimum headroom type as indicated.]

e. Components of the hoist shall be designed and constructed for safety of operation and durability of components. Replacement parts shall be interchangeable and readily accessible.

1.5.2.3 [Bridge Crane Characteristics

****
NOTE: Delete this paragraph if bridge cranes are not required.
****

The bridge crane shall be [top running][underrunning] single-girder overhead traveling crane utilizing an underrunning trolley hoist. [Bridge crane travel speed shall be [_____] mm/s feet per minute.][Each bridge crane shall have the travel speed indicated.]]

1.5.2.4 [Monorail Characteristics

****
NOTE: Delete this paragraph if monorails are not required.
****

The monorail shall be of the [standard I beam][wide flange or H beam][patented beam] style.]

1.5.2.5 [Jib Framework Characteristics

****
NOTE: Delete this paragraph if jib framework is not required.
****

[The jib framework shall be of the [freestanding][mast-type][wall-mounted] style.] The jib framework shall [be manually rotated][have [electrically][air] motorized rotation].]

1.5.2.6 Capacity Plates

Two capacity plates shall be provided, one for each side of the bridge. Each plate shall be lettered to indicate the total rated hoisting capacity of the crane. All lettering shall be of sufficient size to be easily read from the floor. Each lower load block shall be marked with the hoist rated capacity.[Rated load of the hoist on the monorail shall be marked in accordance with ASME B30.16.]

PART 2 PRODUCTS

2.1 [ELECTRIC HOIST]

2.1.1 [General

Electric hoist shall be of capacity, lift, type, suspension, headroom, and materials specified. Each unit shall be factory wired and ready for operation. Load-carrying parts of the hoist shall be designed so that the calculated static stress of the material, based on the rated capacity, will not exceed 20 percent of the average theoretical strength of the material. Each hoist shall be factory lubricated and shall be complete and ready for operation with the specified hoist controls and accessories.]

2.1.2 [Types of Electric Hoists]

2.1.2.1 [Electric Chain Hoist

Electric chain hoist shall be equipped with a [noncorroding, nonsparking chain and hook assembly][standard chain and hook assembly as specified, with no-corrosion or spark-resistant requirements][standard chain and hook assembly or with a noncorroding, nonsparking chain and hook assembly as indicated on the drawings].]

2.1.2.2 [Electric Wire-Rope Hoists

Electric wire-rope hoists shall be equipped with [a noncorroding, nonsparking wire-rope and hook assembly][the specified standard wire-rope and hook assembly with no corroding or sparking requirements][standard wire-rope and hook assembly or with a noncorroding, nonsparking wire-rope and hook assembly as indicated on the drawings].]

2.1.3 [Hoist Speed

****
NOTE: Consult manufacturer's data to correlate speed with type of hoist and required motor size.
****

Each electric [chain][wire-rope] hoist speed shall be [approximately [_____] fpm][two-speed, as indicated and scheduled. Slow speed of two-speed hoist shall be one-third full speed].]

2.1.4 [Load and Motor Brakes

Load brake shall be a totally enclosed, automatic, mechanical-type brake with a hardened-steel, Weston-type ratchet and pawl mechanism that will hold the capacity load of the hoist at any point when the motor is stopped. Motor brakes are specified in paragraph MOTOR BRAKE.]

2.2 [AIR HOISTS]

****

NOTES: Air hoists must be considered for applications where flammable fluids and gases are present, where high heat conditions are prevalent, and where air supply is readily available.

Air hoists are generally more expensive than electric hoists except when the application requires a nonsparking type. Air hoists are seldom used with bridge cranes.

****

2.2.1 [General

Hoist shall be designed for operation with air pressure supplies of 550 to 620 kPa 80 to 90 pounds per square inch.]

2.2.2 [Types of Air Hoists]

2.2.2.1 [Air-Operated Chain Hoists

Air-operated chain hoists shall be [equipped with a noncorroding, nonsparking chain and hook assembly][standard chain and hook assembly as specified]. Load chain shall be [roller][link] chain of materials as specified.]

2.2.2.2 [Air-Operated Wire-Rope Hoists

Hoist shall be [equipped with a noncorroding, nonsparking wire-rope and hook assembly][standard wire-rope and hook assembly].]

2.2.3 [Lift Speed

Hoists shall be designed for low-hoisting and lowering-speed application at the specified lift and for accurate load positioning. Hoist speeds shall not exceed the following:

CAPACITY IN TONS	HOIST TYPE	MAX. LIFT SPEED, FPM
[_____]	[Chain]	[_____]
[_____]	[Wire]	[_____]

A tolerance of ±25 mm/s5 feet per minute is acceptable.]

2.2.4 [Air Motors

****
NOTES: Piston-type air motors must be used where slow-speed, high-torque, heavy-duty, accurate load positioning and control is required and where minimum servicing is desired.

Vane-type air motors must be considered for high-speed applications at moderate torque. Vane-type motors are less expensive than piston type and normally require more maintenance.
****

[Air motors shall be totally enclosed, nonventilated, axial or radial, piston, and geared. Unit shall be high-torque, reversible motor design with renewable and interchangeable cylinders, renewable crank-pin bushings, and counterbalanced crankshaft.]

[Air motor shall be totally enclosed, nonventilated gear-reduction, rotary-vane type. Unit shall be reversible motor design with removable, renewable vanes and antifriction bearings on rotating or oscillating parts. The motor shall include an adjustable rate-of-descent device.]]

2.2.5 [Controls

****
NOTES: Pull-chain control is least expensive and will provide precise control.

Pendant control must be considered for combined air hoist and air-trolley drive control, control is precise.
****

Hoist motor shall be controlled by a [pull-chain throttle arranged for single-hand control][lever-operated, pendant throttle].[Pendant throttle shall include a strain reliever chain or cable permanently attached to the hoist frame and the pendant throttle.]]

2.2.6 [Limit Stop Valves

Adjustable, automatic, upper- and lower-limit stop valves shall be provided to prevent overtravel of the hook in either direction. Limit stop valves shall act to return the control to neutral and to cut off air supply.]

2.2.7 [Fittings and Accessories

Each air hoist shall include a swivel-type air inlet, a muffler, an air line filter and oiler, speed couplers and connectors, and the required air hose and fittings between hoist, motor, and air supply source and between hoist, motor, and controller.]

2.2.7.1 [Swivel-Type Air Inlets

Swivel-type air inlets shall be capable of not less than 180-degree rotation.]

2.2.7.2 [Muffler

Muffler shall be a heavy-duty, removable, pressed-steel device, chain attached to the hoist or motor.]

2.2.7.3 [Air Filter and Oiler

Air filter and oiler shall be a cast-bronze, combination assembly with removable glass bowls and adjustable oil feed. Unit shall have a 64-micron bronze screen air filter. Unit shall deliver not more than a 5-psi pressure drop when supplying maximum required air.]

2.2.7.4 [Quick Connect Couplers

Quick connect couplers shall be stainless steel fittings not less than 10 mm 3/8 inch national pipe thread size.]

2.2.7.5 [Air Hose and Fittings

Air hose shall be braided rubber hose sized to deliver, at the air motor, required volume of air at not less than 550 kPa 80 pounds per square inch to operate the air hoist and trolley at the specified maximum lift speed and travel speed, with rated capacity load. Hose shall be not less than a 19 mm 3/4 inch inside diameter. Air hose shall be fitted with couplers and connectors and be the length required for equipment indicated.]

2.2.8 [Brake

The air-powered hoist braking system shall meet the requirements of ASME B30.16.]

2.3 HOIST MECHANICAL EQUIPMENT

2.3.1 [Chain Hoist]

****

NOTE: Delete this paragraph in its entirety if chain hoist are not required.

****

2.3.1.1 [Hoist Load Chain

****

NOTE: Select appropriate alternate paragraph. The last sentence in this paragraph must be added to the selected paragraph.

****

[Load chain shall be steel roller chain conforming to FS RR-C-271, Type III. Pins, bushings, rollers, and side bars shall be carbon or alloy steel suitable for hoist use and of sufficient hardness, and strength to withstand the tests specified in ASME HST-2.]

[Chain shall be a zinc electro-plated, resistance-welded, heat-treated alloy steel link chain conforming to FS RR-C-271, Type I, Grade C, Class 1 or 2. Chain shall be designed for hoist service and shall be of sufficient section, hardness, and strength to meet specification requirements and to withstand the tests specified in ASME HST-2.]

[Noncorroding, nonsparking roller load chain or link load chain shall be AISC Series 300 chrome-nickel alloy corrosion-resistant steel chain designed for hoist service and of sufficient section, hardness, and strength to meet specification requirements and to withstand the tests specified in ASME HST-2.]

Load chain shall have a safety factor of not less than 5, based on the minimum ultimate strength of the material.]

2.3.1.2 [Hoist Load-Chain Wheels

Load-chain wheels and roller-chain sprockets and shafts shall be manufactured from steel or heat-treated nodular cast iron. Wheels shall be pocket or sprocket type, shaped to fit the links of the load chain or to accommodate roller chain. Chain shall operate freely and smoothly over load wheels without binding or jamming. The load-chain shaft may be integral with or rigidly connected to the load-chain wheel. Welding of the wheel to the shaft will not be permitted. Load chain shall be provided with surface-hardened, heat-treated steel guides that surround the load wheel and which will prevent wedging or jamming regardless of angle of pull.]

2.3.1.3 [Hoist Chain Container

****

NOTES: These containers receive the idle load chain and prevent the chain from interfering with the load and marking finished surfaces.

Delete this paragraph if chain containers are not required.

****

A chain container shall be provided for each chain hoist. Design of chain container shall maintain the headroom and clearance requirements of the hoist and shall not interfere with the operation of the load chain or load chain wheel.]

2.3.2 [Wire-Rope Hoist]

****

NOTE: Delete this paragraph in its entirety if wire-rope hoist are not required.

****

2.3.2.1 [Hoist Wire Rope

****

NOTE: Select appropriate alternate paragraph. The last paragraph must be added to the selected paragraph.

****

[Wire rope for standard applications shall be extra flexible, preformed, extra improved or improved plow steel, 6 by 37 fiber core sealed construction wire conforming to FS RR-W-410, Type I, Class 3.]

[Wire rope for single-line application shall be preformed, extra improved or improved plow steel 18 by 7, fiber core, nonrotating wire conforming to

FS RR-W-410, Type IV, Class 2.]

[Wire rope for noncorroding, nonsparking hoist application shall be preformed AISC Type 304, 18-8 corrosion-resistant steel, 6 by 19, bright finish, conforming to FS RR-W-410, Type I, Class 2.]

Wire rope shall be anchored to drum or dead end. Anchoring shall be of captive type, easily detached for changing and repair. Wire rope shall have a factor of safety of not less than 5, based on the minimum ultimate tensile strength of the material.]

2.3.2.2 [Hoist-Rope Drum

****
NOTE: The last two sentences must be retained if the hoist has a lift of 10 m (30 feet) or more or if the load must be exactly centered to pass through pit openings or through limited dimension openings.
****

Wire-rope drum shall be hardened steel or special grade alloy ductile iron. Minimum diameter of the drum shall be 20 times the diameter of the hoisting rope for hoists with a capacity of 900 kg 2,000 pounds or less and 24 times the diameter of the hoisting rope for hoists over 2,000-pound capacity. Drum shall have accurate, machine-cut grooves, cut to full depth of wire-rope diameter, with rounded corners of dimension as required for the specified lift. In addition, the drum shall have not less than two complete turns of rope around it when the hook is in its lowest position. Groove diameter and pitch centers shall be 0.78 mm 1/32 inch greater than diameter of rope. Drum shall be flanged at each end and shall have enclosed tops and sides to preclude cable binding and jamming. Cable reeving shall be arranged for double reeving. Hook shall remain centered under the drum at all times.]

2.3.2.3 [Hoist Load Block and Sheaves

The cable load block shall be an enclosed, safety type that will shroud the sheave and protect the operator. The sheave assembly shall be mounted on a steel axle and carried on sealed, prelubricated antifriction bearings. Wire-rope sheaves shall be machine-grooved, hardened steel, or cast iron with chilled groove surfaces. The pitch diameter for running sheaves shall be not less than 18 times the diameter of the wire rope, and the diameter of the idler and equalizer sheaves shall be not less than 16 times the diameter of the rope used.]

2.3.3 Hoist Hook Assembly

****
NOTE: Select appropriate alternate paragraph by selecting hook material for standard application or for nonsparking, noncorrosive uses. The last unbracketed paragraph must be added to the selected paragraph.
****

a. [Hooks and hook swivels shall be heat-treated alloy steel forgings. Yokes, crossheads, and bars shall be of suitable strength steel or cast iron. The Contractor shall submit data on heat treatment as specified in the Submittals paragraph.]

b. [Load blocks and hook assembly shall be the nonsparking, noncorroding type, fabricated of AISC Type 304, 18-8 chrome-nickel corrosion-resistant steel; or they shall be a bronze alloy of suitable strength and section for the rated capacity load.]

c. Hook assembly for electric- or air-operated hoists shall be carried on antifriction bearings to permit free swivel under rated capacity load without twisting load chain or wire. Each hook shall have a spring-loaded safety latch. Each hook assembly shall include a machined and threaded shaft and swivel locknut with an effective locking device to prevent nut from backing off.

2.3.4 Hoist Gear Assembly

2.3.4.1 Gears

Gears shall be spur, helical, spiral, or bevel-type, accurately machined, and conforming to AGMA standards for this type of service.

2.3.4.2 Gear Shafts

Gear shafts shall be manufactured from high-carbon steel or alloy steel, machined and ground for accurate fit, and splined for fitting to the mating gear.

2.3.4.3 Gear Train Assembly

Gear train assembly shall be totally enclosed in the hoist frame casting and shall operate in a sealed oil bath. Frame casting shall be provided with lubrication fittings and inspection ports.

2.3.5 Hoist Bearings

2.3.5.1 Antifriction Bearings

Bearings in the hoist mechanism of electric- or air-powered hoists shall be antifriction bearings.

2.3.5.2 Factory Sealed Bearings

Sprocket bearings, motor bearings, and load-block bearings shall be prelubricated factory sealed bearings.

2.3.6 Hoist Lubrication

Adequate lubrication shall be provided for moving parts of the hoist and trolley and for filling, draining, and checking the level of the lubricant. Lubricant shall be designed for use in an ambient temperature of [12 to 43][[_____] to [_____]] degrees C [54 to 109][[_____] to [_____]] degrees F. Hoist reduction gearing, load brake, and trolley wheel gears with electric motor drive shall operate in an oil bath. Lubrication and mechanism housing shall prevent leaking and shall prevent lubricant from coming into contact with [electric][air] motors and equipment. Lubricant shall conform to AGMA 9005.

2.3.7 Hoist Frame and Housing

Operating parts of the hoist shall be mounted and enclosed in a sealed,

factory-painted metal frame of malleable iron, cast steel, welded steel, or aluminum. Welded or bolted frames shall carry loads on the fabricated pieces. Welds or bolts shall be used only to hold the fabricated parts in position.

2.3.8 Hoist Paint Finish

Each hoist and accessory shall receive a factory-applied paint finish. Hooks shall not be painted.

2.4 TROLLEYS

****
NOTE: Delete this paragraph in its entirety if trolley suspension is not required. Drawings must indicate location, size, and details of track and must indicate lift heights and trolley types where more than one hoist is required.
****

2.4.1 Paint

Each trolley assembly shall be factory-painted, designed specifically for use with the specified hoist, and shall be furnished by the hoist manufacturer. Paint finish shall be the same type and quality specified for the hoist.

2.4.2 Wheels

2.4.2.1 Load Distribution

Each trolley assembly shall have not less than four wheels. Sufficient wheels shall be provided to properly distribute the load. The load on a wheel shall not exceed 1,200 DW pounds where D equals the diameter of the wheel in inches and W equals the width of the rail head or the nominal length of bearing on the tread.

2.4.2.2 Design and Type

Wheels shall be single-flange type manufactured from forged alloy steel with machined, hardened treads and flanges, or high-strength cast or nodular iron with machined flanges and treads, chill-hardened not less than 1.5 mm1/16 inch deep. Flanged wheels for motor-driven trolleys shall have treads and flanges hardened to not less than No. 320 Brinell hardness. Manually driven, trolley-wheel treads shall be hardened to not less than Brinell hardness No. 245 as defined in ASTM E 10. Wheels shall be designed to operate on sloped or flat flange I-beams.

2.4.2.3 Bearings

Trolley wheels shall be carried on sealed, permanently lubricated, antifriction bearings designed for axial and thrust loading. Bearings shall conform to the applicable requirements of ABMA 9 and ABMA 11. Bearings shall have an L-10 life of 3,000 hours or more, as defined by ABMA 9 or ABMA 11 as applicable.

2.4.3 Side Plates, Pins, and Axles

2.4.3.1 Side Plates

Side plates shall be fabricated from structural-quality rolled-steel plate milled to the required profile with integral bosses where necessary to support equalizing pins; side plates shall be fitted with steel end bumpers.

2.4.3.2 Pins and Axles

Equalizing pins and axles shall be heat-treated alloy steel, machined and finish ground to the required size.

2.4.4 Gearing

2.4.4.1 Gears

Gears shall be cut from heat-treated alloy steel accurately machined into spur, helical, and pinion gears, conforming to AGMA requirements.

2.4.4.2 Drive Pinions

Drive pinions shall be carburized alloy steel, malleable iron, or bronze, with cut or cast teeth, conforming to AGMA requirements.

2.4.4.3 Clamps

Plain trolleys and geared, manual-drive trolleys shall have suitable, quick-acting, steel track clamps. Clamps shall be adjustable for wear and shall not injure track flanges. They shall function satisfactorily on curved and straight track and shall be capable of withstanding a pull equivalent to one-third the rated capacity of the hoist when executed parallel to the track.

2.4.5 Safety Hangers or Lugs

****
NOTE: This paragraph must be included.
****

Safety hangers or lugs shall be steel and shall be integral with, or fastened to, each hoist frame or to trolley frame. They shall ride free above the bottom flange of the beam. Hanger shall be of sufficient capacity to hold the hoist, fully loaded, in the I-beam in case of wheel or axle failure. Safety factor of each part of trolley assembly shall be not less than 5, based on the ultimate strength of the material used.

2.5 TROLLEY TYPE

2.5.1 [Plain Trolley

****
NOTE: Delete this paragraph if not required.
****

Plain trolley assembly shall comply with ASME HST-2 and the requirements specified.]

2.5.2 [Geared, Manual-Drive Trolley

****
NOTE: Delete this paragraph if not required.
****

Geared, manual-drive trolley shall conform to ASME HST-2 and the requirements specified.]

2.5.2.1 [Gears

Trolleys shall have gears provided on not less than two wheels to permit propelling the hoist along the rail by a gear mechanism operated by a hand chain and wheel.]

2.5.2.2 [Hand-Chain Wheel

Hand-chain wheel shall be manufactured from steel, malleable iron, high-strength cast iron, or aluminum alloy, with shaped pockets to receive hand chain and with guides that will permit operation of the hand chain from an angle of 10 degrees from either side of the chain wheel without slipping or jumping the wheel rim.]

2.5.2.3 [Hand Chain

[Hand chain shall be endless-coil, welded-link, zinc electro-plated, proof-coil steel chain conforming to FS RR-C-271, Type 1, Grade C, Class 4.][Noncorroding, nonsparking hand chain shall be endless-coil, link-type, fabricated from AISC Type 304 corrosion-resistant steel or suitable bronze or aluminum alloy.][Hand-chain reach distance shall be standard length for specified lift height of hoist and shall reach approximately 30 inches above the operating floor.]]

2.5.3 [Electric-Motor-Driven Trolleys

****
NOTES: Select appropriate alternative paragraph.

The geared-trolley type must be considered for standard applications and for any capacity loading.

Tractor-drive types are individual power units and are desirable for motorizing hoists with plain trolley suspension and for negotiating smaller radius turns and switches than generally possible with geared types. The tractive force developed is independent of the load and can be increased or decreased by adjusting the spring tension of the drive wheel.

In the last sentence select trolley speed in mm per second (feet per minute). In general, standard hoists with a capacity of [_____] kg (6,000 pounds) or less have a trolley speed range of [_____ to _____] mm per second (65 to 150 feet per minute). Hoists with a capacity of [_____] kg (10,000 pounds) have a speed range of [_____ to _____] mm per second (50 to 150 feet per minute).
****

[Trolley shall be an electric-motor-driven geared type conforming to NFPA 70, the specified general trolley requirements, and the requirements specified.]

[Trolley drive shall be an electric-motor-driven, tractor type conforming to the specified general trolley requirements. Motor shall drive through a totally enclosed gear train to an adjustable-tension, spring-loaded, rubber-tired, drive wheel. Trolley wheels shall be the flangeless type, carried on the specified type of antifriction bearings. Tractor frame shall include two guide rollers on each side of the frame, carried on sealed, permanently lubricated antifriction bearings.]

Trolley speed shall be not more than [250][375][500][750] mm/s [50][75][100][150] feet per minute.]

2.5.4 [Air-Motor-Driven Trolleys

****

NOTE: Select maximum trolley speed in m (feet) per minute.

****

Trolley travel speed shall be not less than [300][400][500] mm/s [60][80][100] feet per minute at 550 kPa 80 psi.]

2.5.4.1 [Trolley Drive

****

NOTES: Select appropriate alternative paragraph.

Geared type must be considered for standard applications where side room requirements are not critical and when radius curves are not minimum. This type is available in special low headroom types.

Tractor-drive types are individual power units and are desirable for motorizing hoists with plain trolley suspension and for negotiating smaller radius turns than generally possible with geared types. The tractive force developed is independent of the load and can be increased or decreased by adjusting the spring tension of the drive wheel.

****

[Trolley shall be an air-motor-drive geared type conforming to the specified general trolley characteristics and the requirements as specified.]

[Trolley drive shall be an air-motor-driven tractor type conforming to the specified general trolley characteristics and the requirements as specified. Motor shall transmit drive through a totally enclosed gear train to an adjustable-tension, spring-loaded, rubber-tired drive wheel. Trolley wheels shall be flangeless type carried on the specified type of antifriction bearings.]

[Tractor frame shall include two guide rollers on each side of the frame, carried on sealed, permanently lubricated, antifriction bearings.]]

2.5.4.2 [Trolley Motor

****
NOTE: This paragraph must be included.
****

Trolley motor shall be a totally enclosed, nonventilated, radial, piston type or rotary-vane type, reversible air motor of sufficient horsepower to propel the trolley and rated capacity load at the specified speed.]

2.5.4.3 [Trolley Control

[Trolley motor shall be controlled by a pull-chain throttle arranged for single-hand control.][Trolley motor shall be controlled by a lever-operated, pendant throttle. Throttle shall include a strain-reliever chain or cable permanently attached to the trolley frame and to the pendant throttle. The strain-reliever chain or cable shall not be used as a grounding circuit.][Trolley motor controller shall be integrated with the air-hoist lever operating pendant control throttles to form a two-motor pendant throttle.]]

2.5.4.4 [Brake

****
NOTE: Delete this paragraph if brake is not required.
****

Mechanically operated or pneumatically operated torsion brake, friction disc or shoe type, designed for air-motor trolley application shall be provided. Brake shall be interlocked with controller and shall apply and release gradually and smoothly during starts and stops to minimize pendulum action of the load. Braking torque shall be not more than 50 percent of motor torque and shall match motor torque characteristics.]

2.5.5 [Air-Motor-Driven Trolley Accessories]

****
NOTE: Delete this paragraph in its entirety if air-motor-driven trolleys are not required.
****

2.5.5.1 [Fittings and Accessories

Each air-motor-driven trolley shall include a swivel-type air inlet, a muffler, an air line filter and oiler, quick connect couplers, and the required air hose, hose trolleys, and fittings between the trolley motor and air-supply source and between trolley motor and controller.

a. Swivel-type air inlet shall be capable of not less than 180-degree rotation with no leaks at joints.

b. Muffler shall be a heavy-duty, removable, formed steel or iron casting, chain-attached to the motor.

c. Air filter and oiler shall be a cast-bronze, combination assembly with removable glass bowls and adjustable oil feed. Unit shall have a removable 64-micron bronze filter. Assembly shall deliver air at not less than 4 000 000 mm^3/s 85 cubic feet per minute to the motor.

d. Quick connect couplers shall be stainless-steel fittings not less than 10 mm 3/8 inch national pipe thread size.

e. Air hose shall be braided rubber air hose, sized as required for equipment, and fitted with couplers and connectors in [one length, [8][15] m[25][50] feet of air hose][one length, 30 m 100 feet of air hose and hose trolley][length of hose as required by equipment indicated].]

2.5.5.2 [Hose Trolley

****
NOTES: Delete this paragraph if hose trolleys are not required.

Drawings must indicate length of hose run.
****

A sufficient number of hose trolleys shall be provided to allow a spacing of not more than 2.5 m 8 feet on center when fully extended at the maximum trolley run.

a. Hose trolleys shall be two-wheel carrier type.

b. Wheels shall be single-flanged type conforming to specified general trolley characteristics and carried on sealed, permanently lubricated, antifriction bearings.

c. Trolley frame shall be adjustable for flange width and height of I-beam track.

d. Hose clip shall be adjustable spring steel designed to carry not less than two air hoses.]

2.6 [BRIDGE STRUCTURAL ITEMS]

****
NOTE: Delete this paragraph in its entirety if bridge cranes are not required.
****

2.6.1 [Bolts, Nuts, and Washers

Bolts, nuts, and washers shall conform to ASTM A 325M ASTM A 325 bolts. High-strength bolted connections shall conform to the requirements of AISC 348, except that ASTM A 490M ASTM A 490 bolts shall not be used. No galvanized bolts shall be used.]

2.6.2 [Bridge Girders

Bridge girders shall be welded structural steel box sections, wide-flange beams, standard I-Beams, reinforced beams or sections fabricated from rolled plates and shapes.]

2.6.3 [End Ties and Bridge Girder End Connections

****
NOTE: Jacking pads are normally provided for a top

running bridge.
****

Horizontal gusset plates shall be provided at the elevation of the top and bottom end tie flanges for connection to girder ends. End connections shall be made using high-strength bolts. Body-bound bolts fitted in drilled and reamed holes shall be used to maintain the crane square.]

2.6.4 [Bridge End Trucks

End trucks shall be fabricated from structural steel providing a rigid structure and shall be of the rotating or fixed-axle type.[Jacking pads shall be provided for removal of wheel assemblies.] A means shall be provided to prevent the crane from dropping more than 25 mm one inch in case of axle failure.]

2.6.5 [Runway [Rails][Beams]

****
NOTE: Use the first alternate paragraph if the runway [rails][beams] are furnished and installed by the Government. Indicate what [rail][beam] is used for runway [rails][beams]. Use the second alternate sentence if the runway [rails][beams] are to be furnished and installed by the Contractor.
****

[The runway [rails][beams] for the bridge travel are existing and are [_____].][The runway [rails][beams] for the bridge travel shall be of the size recommended by the crane manufacturer and shall be in accordance with CMAA 74.]]

2.6.6 [Additional Provisions for Outside Service

****
NOTE: Applicable for outdoor cranes only, otherwise delete paragraph.
****

Welded structural members on outdoor cranes shall be seal welded. Cranes shall be provided with parking brakes sufficient to hold the crane against a wind pressure of 5 psf. Cranes shall be provided with manually operated rail clamps at each rail, designed to securely anchor the crane against a wind pressure of 30 pounds per square foot.]

2.7 [BRIDGE MECHANICAL EQUIPMENT]

****
NOTE: Delete this paragraph if bridge cranes are not required.
****

2.7.1 [Bridge Drives

Bridge drives shall consist of motor or motors driving through a suitable reduction unit or units to the wheels located at each end of the bridge.]

2.7.2 [Bridge Crane Gear Assembly]

2.7.2.1 [Gears

Gears shall be spur, helical, spiral, or bevel type, accurately machined, and conforming to AGMA standards for this type of service.]

2.7.2.2 [Gear Shafts

Gear shafts shall be manufactured from high-carbon steel or alloy steel, machined and ground for accurate fit, and splined for fitting to the mating gear.]

2.7.2.3 [Gear Train Assembly

Gear train assembly shall be totally enclosed in the drive housing and shall operate in a sealed oil bath. The drive housing shall be provided with lubrication fittings and inspection ports.]

2.7.3 [Bridge Brakes

Bridge brakes are specified in paragraph BRAKES.]

2.7.4 [Bridge Wheels]

2.7.4.1 [Wheels

****

NOTES: For top running bridge cranes, use the first alternate paragraph. Include the bracketed sentence on Brinell hardness for CMAA 74 class D cranes; otherwise delete.

For underrunning bridge cranes, use the second alternate paragraph. Include the bracketed sentence on Brinell hardness for CMAA 74 class D cranes; otherwise delete.

****

[The wheels shall be made of rolled or forged steel.[The wheel treads and flanges shall be rim toughened to between 320 and 370 Brinell hardness number.] Bridge wheels shall be double-flanged. Bridge wheels shall have [tapered][straight] treads.]

[The bridge assembly shall have not less than four wheels. Sufficient wheels shall be provided to properly distribute the load. The load on a wheel shall not exceed 13 600 DW kg 1,200 DW pounds where D equals the diameter of the wheel in mm inches and W equals the width of the rail head or the nominal length of bearing on the tread. Wheels shall be single-flange type manufactured from forged alloy steel with machined, hardened treads and flanges, or high-strength cast or nodular iron with machined flanges and treads, chill-hardened not less than 1.5 mm 1/16 inch deep.[Flanged wheels shall have treads and flanges hardened to not less than No. 320 Brinell hardness.] Wheels shall be designed to operate on sloped or flat flange I-beams.]]

2.7.4.2 [Bearings

Wheels shall be carried on sealed, permanently lubricated, antifriction bearings designed for axial and thrust loading. Bearings shall conform to

the applicable requirements of the ABMA 9 or ABMA 11. Bearings shall have an L-10 life of 3,000 hours or more, as defined by ABMA 9or ABMA 11 as applicable.]

2.8 [MONORAIL TRACK

****

NOTES: Delete this paragraph in its entirety if monorail tracks are not required.

Drawings must indicate location and size of beam, radius of turns, suspension method, and fittings.

****

Monorail track, splice plates, and hangers shall be painted, hot-rolled AISC structural steel "S" shapes or "W" shapes and plates conforming to ASTM A 36/A 36M, of size and weight as required for the specified hoist. The upper surface of the lower flange shall be free from bumps, depressions, and irregularities.]

2.8.1 [Track Design

The track shall be designed with a minimum safety factor of 5. Deflection of track shall not exceed 1/450 of the span, as determined by total load of trolley, track, hoist, and full-capacity load. Track curve radii shall permit smooth trolley operation without binding.]

2.8.2 [Flanges

Flanges shall be smoothly curved and without deformation.]

2.8.3 [Miscellaneous Track Items

Necessary clamps, hanger rods, hangers, track splice plates, safety end stops, fasteners, and fittings shall be provided as required for a complete system.]

2.8.3.1 [Splice Plates and Fasteners

Web-type splice plates or other suitable couplings shall be installed at track joints to provide flush and level connections, with maximum gap between adjacent ends at load-carrying ends not exceeding 1.6 mm 1/16 inch; 4.7 mm 3/16 inch at switches. Splice fasteners shall be regular hexagon or special, flat-head fasteners.]

2.8.3.2 [Safety End Stops

Safety stops capable of withstanding the impact of a fully loaded hoist and trolley shall be provided.]

2.8.3.3 [Fittings

Fittings with means for not less than 25 mm 1 inch vertical adjustment of the track for level erection shall be provided, with provision for additional adjustment after the system has been in operation.]

2.8.4 [Finishing

The finished monorail shall be inspected after erection, and fasteners,

welds, abrasions, and handling marks shall be painted in the finish color. Brackets and hangers of the monorail electrification system shall be painted in the finish color of the monorail track.]

2.9 [JIB FRAMEWORK]

****

NOTE: Delete this paragraph if jib framework is not required.

Jib cranes consist of a jib framework and a hoist. Hoists for jib cranes are similar to those used for monorails.

Drawings must indicate location and size of jib framework, radius of rotation, type of rotation (motorized or manual), suspension method, and fittings.

****

2.9.1 [General

The jib framework shall conform to accepted engineering and manufacturing practices relative to design, capacity, and quality of materials. The rated lifting capacity shall be based on full-rated live load at the hoist hook. Full allowance shall be made for the dead weight of the hoist and trolley and an impact load of 1/2 percent of rated load per foot per minute of hoisting speed but not less than 15 percent. The maximum allowable stress on mast, boom, tie rod assembly, and mounting brackets shall not exceed one-half the yield stress of the material. Hardware necessary for field erection of sections disassembled for shipment and parts required for installation of a trolley and hoist shall be provided.]

2.9.2 [Floor Mounted Jib Framework

****

NOTE: Delete this paragraph if floor mounted jib framework is not required.

****

Floor mounted jib cranes shall be designed for anchorage to a concrete floor or foundation. The height of the underside of the boom above the floor shall be as specified.]

2.9.2.1 [Head Assembly

The head assembly shall support the boom beam atop the mast tube on a self-aligning spherical roller bearing assembly which allows a full 360-degree rotation. A self-aligning guide roller assembly shall support the radial load between the mast tube and lower portion of the head. A self-aligning guide roller assembly shall support the radial load between the mast tube and upper portion of the head. Guide rollers shall be ball or roller bearing mounted and shall make full contact with the mast tube or roller race. An adjustment means shall be provided for leveling of the boom.]

2.9.2.2 [Mast Assembly

The mast assembly shall consist of a structural steel pipe, seamless steel

tube, or a rolled section. The mast shall be heavily gusseted to a steel flange plate base and fitted at the top with a center-mounted bearing support. The mast shall be designed to support the boom in level position when the rated load is suspended at the end of the span.]

2.9.3 [Wall Bracket Jib Framework

****
NOTE: Delete this paragraph if wall bracket jib framework is not required.
****

Wall bracket jib framework shall be designed for mounting to existing building columns, walls, or supports.]

2.9.3.1 [Hinge Assembly

The hinge assembly shall consist of steel hinge brackets, fittings, and pins for mounting of the tie rod assembly and boom. The hinge brackets shall be designed for welded or bolted attachment to the supporting structure. The boom web fitting and the upper pivot fitting shall turn on roller bearings and shall be provided with pressure lubrication fittings. Hinges shall be equipped with thrust washers of hardened alloy steel. The hinge assembly shall enable rotation of the boom through at least 180 degrees.]

2.9.3.2 [Tie Rod Assembly

The tie rod assembly shall consist of two diagonal tie rods, a top flange fitting, and required clevises for connection of the upper hinge to the boom at a point which minimizes the largest deflection imparted to the beam when traversing the rated load the length of the beam. The tie rods shall be furnished with threaded adjustments which permit leveling of the boom.]

2.9.4 [Boom Section

The boom section dimensions and properties shall correspond to AISC structural steel "S" shapes or "W" shapes. The upper surface of the lower flange shall be free from bumps, depressions, and irregularities. Trolley stops shall be provided to stop the trolley at both ends of the boom. The stops shall be mounted on both sides of the web of the boom and shall be in alignment. The span, from the mast centerline or lower hinge pin to the free end of the boom, shall be as specified. The maximum vertical deflection of the boom produced by the dead load, the weight of hoist, trolley, and the rated load shall not exceed 1/600 of the span. Impact will not be considered when determining deflection.]

2.9.5 [Bearings

All antifriction bearings shall be of the commercially standard type as specified herein and shall have not less than a 5,000-hour fatigue life rating at 90-percent reliability. Ball and roller bearing ratings shall be in agreement with ABMA 9 or ABMA 11, as applicable, and shall be determined for maximum thrust and radial loads developed at the rated capacity. Bushings, where permitted, shall be grooved to distribute the lubricant.]

2.9.6 [Lubrication

Means for lubrication shall be in accordance with the manufacturer's

standard practice. The lubricating points shall be easily visible and accessible. Hydraulic lubrication fittings shall be in accordance with SAE J534. Where use of high-pressure lubricating equipment, 1,000 psi or higher, will damage grease seals or other parts, a suitable warning shall be affixed to the equipment in a conspicuous location.]

2.10 [ELECTRICAL

****
NOTE: Delete this paragraph if electrical equipment is not required.
****

Materials and installation, including electrical wiring, contact conductors, controls, overcurrent protection, and grounding shall meet the requirements of NFPA 70 and applicable UL and NEMA standards and specified requirements.]

2.10.1 [Power Supply

Electrical power for operation of the [crane] [hoist] will be supplied from the nominal [_____] volt, [3] phase, 60-Hz alternating-current (a-c) power distribution system.]

2.10.1.1 [Bridge Incoming Power Supply

****
NOTE: Delete this paragraph if bridge crane is not supplied.

Select enclosed safety rail system, festoon, or cable reel for:

a. Indoor nonhazardous service
b. Outdoor noncorrosive environment

Select festoon or cable reel system for:

a. Indoor-hazardous service
b. Outdoor-corrosive (marine) environment

ALTERNATE 1 - Use the first set of alternate subparagraphs "a" and "b" below for installations using cable and reel for the supply.

ALTERNATE 2 - Use the second set of alternate subparagraphs "a", "b", and "c" below for installations using main contact conductor system (Enclosed Safety Rail).

ALTERNATE 3 - Use the third alternate subparagraph "a" for festoon system.
****

[a. Incoming power shall be brought into the crane by means of a Type G, three-conductor, 600-volt rubber or rubber-like insulated and extra-heavy-duty neoprene-jacketed portable power cable. The cable shall have a usable length of not less than [_____] m feet and shall be wound upon the cable reel to be furnished and mounted

on the crane. The power plug shall be installed on the free end of the cable, and an anchorage shall be provided to relieve the power plug and receptacle from the strain of reeling and unreeling the cable. The grounding conductors shall make electrical connection to the crane structure through the fourth collector ring and brush of the cable reel and shall be connected to the ground terminal of the power plug.

b. The cable reel shall be rated for continuous duty, 600-volt alternating current (AC), shall be provided with collector rings and brushes, shall be of weather-proof construction, shall maintain approximately uniform tension in the cable, and shall automatically "payout" and "takeup" the cable as required by the crane travel. The cable reel shall be provided with a positive driven or actuated limit switch that will prevent excess "takeup." The reel shall be mounted on the crane in a location, as approved by the Contracting Officer, that will allow ready maintenance and inspection as well as satisfactory operation.]

[a. The contact conductor system shall be furnished complete with collector and all necessary accessories for mounting the contact assembly.

b. The contact conductor system shall be of the enclosed type and shall be rated for 600 volts AC with a continuous current carrying capacity as required by the connected load of the crane. Voltage drop shall be limited to not more than 1 percent from the power input connection at the main contact conductors to the input terminals of the crane main circuit breaker when the crane is operating with the greatest load condition and is at the maximum distance from the point of connection of the power feeder. Mounting supports shall provide means to accommodate contraction and expansion due to temperature changes and to permit installation with proper alignment. The mounting supports shall be spaced at intervals that will limit the maximum deflection of the contact conductors to not more than 3 m 10 feet. All mounting bolts and screws shall be of a suitable corrosion-resisting material. Standard products of the manufacturer furnishing the conductors shall be provided to connect the power supply to the conductors. Contraction and expansion sections shall be provided at each monolith joint. Except as otherwise specified, the contact conductor system shall conform to the following:

(1) Conductor insulation shall be of the nonburning type, suitable for outdoor service at an ambient temperature of 100 degrees F. It shall be designed and installed so as to accommodate independent and/or unequal movements of the conductors and enclosures.

(2) Stainless-steel hanger clamps with insulators shall be used to support the insulated conductor.

(3) If outdoors, an ice shield shall be provided and arranged to prevent icing of the conductors or collectors. The shield, shield straps, and strap nuts shall be made of aluminum conforming to ASTM B 209M ASTM B 209, Alloy 3003, Temper H14. The shields shall not be less than 1.3 mm 0.050 inch in thickness, and the shield strap nuts shall be not less than 3.2 mm 0.125 inch in thickness. Bolts and screws shall be made of stainless steel. The ice shield

shall be provided with expansion and contracting joints.

c. Collector shall have two individually spring-loaded conductor contact shoes for each phase or shall have no exposed current carrying surfaces for each main conductor and shall be articulated, if necessary, to maintain full contact against the contact conductor. Contact shoes shall be of graphite bronze or other suitable material as approved by the Contracting Officer, and shall be suitable for use with contact conductors furnished. The collector mounting shall provide means for adjustment as required to make proper contact and to travel properly on the contact conductors. Supporting wheels, if required, shall be provided with self-lubricating bearings.]

[a. Festoon Conductors - Power shall be brought to the crane by means of a "Festoon" system consisting of flexible power cable supported by cable trolleys running on a steel messenger cable, an I-beam rail, or a channel. The power cable shall be Type G, 75 degree C 167 degree F, 600-volt insulation and heavy-duty neoprene or chlorosulfonated polyethylene jacket. The cable shall be sized as required by NFPA 70. The cable shall conform to the applicable requirements of NEMA WC 3, Part 7, and shall have class H or class K stranding. Cable conductors shall be terminated at both ends with terminal lugs on terminal blocks in terminal boxes. Cable ends shall have strain relief devices to protect the cable terminations.]]

2.10.1.2 [Trolley Power Supply

****
NOTE: Delete this paragraph if trolley is not supplied.
****

Power may be brought to the trolley by a cable reel or a festoon system.

a. Cable reel shall be an automatic rewind assembly with four-conductor type G cables sized for the current-carrying capacity of the hoist[and trolley]. Reel shall have a replaceable spring or electric motor with adjustable tension and sufficient takeup for the entire cable length. Main shaft shall be carried on permanently lubricated antifriction bearings. Unit shall include a bronze brush and collector ring assembly, wired into a safety terminal block. Unit shall be listed in the UL 355. Each reel shall include a guide roller cable outlet and cable length as required. Cable reel assembly shall include a swivel-mount base that will permit the indicated turn in either direction.

b. Festoon system shall consist of flexible power cable supported by cable trolleys running on a steel messenger cable, an I-beam rail, or a channel. The power cable shall be type G, 75-degree C, 600-volt insulation and heavy-duty neoprene or chlorosulfonated polyethylene jacket. The cable shall be sized as required by NFPA 70. The cable shall conform to the applicable requirements of NEMA WC 3, Part 7, and shall have class H or class K stranding. Cable conductors shall be terminated at both ends with terminal lugs on terminal blocks in terminal boxes. Cable ends shall have strain relief devices to protect the cable terminations.]

2.10.2 [Motor Controller

Motor controller shall be a reversing-type magnetic starter with thermal-overload protection, molded case circuit breaker, and control transformer operated by a pushbutton control station. Controller and control station shall be mechanically or electrically interlocked to preclude possibility of operating opposing control circuits simultaneously.]

2.10.2.1 [Contactor Fingers

Contactor fingers shall be adjustable and shall have renewable tips.]

2.10.2.2 [Transformer

Transformer shall reduce the control-circuit voltage to 120 volts AC, to 48 volts AC, or to 24 volts AC.]

2.10.2.3 [Enclosure for Mounting

****
NOTE: Drawings must list class and group for NEMA Type 7 enclosures. Refer to NFPA 70, Article 500.
****

Motor controller shall be mounted in either a gasketed cast metal or sheet metal enclosure, as required or noted, with hinged door conforming to the requirements of UL 50. Motor controller enclosures, complying with NEMA ICS 6, shall be NEMA, Type [1][4][7][12].]

2.10.3 [Pendant Control Station

Each hoist shall have a pendant-mounted conductor cable and pushbutton station with a strain-reliever chain or cable permanently attached to the hoist frame and integral with the pendant conductor cable. The control station shall be a full-guarded, momentary-contact, pushbutton type with each button clearly marked to indicate its function. A separate button or a single button providing steps for each speed of multispeed hoists or [trolleys][bridge][jib] shall be provided. The pushbuttons shall return to the off (normally open contacts) position when pressure is released by operator. The pushbutton station shall be grounded to the hoist. The strain reliever chain or cable shall not be used as a grounding circuit.]

2.10.4 [Mainline Disconnect Switch

****
NOTE: Drawings must indicate class and group for NEMA 7 enclosures. Refer to NFPA 70, Article 500.
****

A mainline disconnect switch shall be provided and shall be a surface-mounted, heavy-duty, single-throw, air-break, enclosed type conforming to NEMA KS 1 as indicated. Disconnect switch shall be [fused][nonfused]. Enclosure shall be NEMA [Type 1][Type 3][Type 7][Type 12].]

2.10.5 [Hoist Limit Switches

****
NOTE: Delete bracketed sentence if lower-limit

switch is not required.

****

Adjustable upper-limit switch shall be provided to prevent overtravel of the hook or load block in the hoisting direction. Limit switch shall be arranged to stop the hoist motor and apply the motor brake before reaching the uppermost safe limit of travel. In case of hook overtravel, the motor shall automatically and momentarily be reversed.[Adjustable lower-limit switch shall be provided to stop the hoist motor and apply the motor brake when the load hook reaches a predetermined lower limit.]]

2.10.6 [[Bridge][Jib] and Trolley Travel Limit Switches

****

NOTE: Specify bridge, jib, and trolley limit switches if critical loads are handled or for other special requirements.

****

Limit switches shall be mounted to the [bridge][jib] and trolley, respectively, to interrupt current to the [bridge][jib] and trolley controls. Adjustable limit switch actuators shall be installed on both ends to actuate the limit switches and stop the crane [bridge][jib] or trolley prior to contacting the bumpers.]

2.10.7 [Hoist Motors

****

NOTE: Verify explosion-proof class and group with the current edition of UL 674.

****

Hoist motor shall be a high-starting torque, high-slip, 30-minute time rated, reversible electric motor specifically designed for hoist duty and capable of operating at the specified duty class, capacity, and speed. The motor shall be [_____]-volts, [_____]-phase, [_____]-hertz and horsepower as recommended by manufacturer for capacity and lift speed of hoist. The hoist motors shall be provided with Class B[, F or H] insulation, and motor enclosures shall be totally enclosed, nonventilated (TENV). Enclosure shall be fitted with a UL-approved drain and breather and shall be certified and labeled in accordance with UL 674, Class 1, Groups C and D.]

2.10.8 [[Bridge][Jib][and][Trolley] Motors

[Bridge][Jib][and][Trolley] motors shall be [single-speed, single-winding][two-speed, two-winding] conforming to the requirements for hoist motors except they may be NEMA design B (high torque and slip not required).]

2.10.9 [Motor Brake

****

NOTE: Delete the bracketed paragraph below if brake is not required.

****

Motor brake shall be an externally adjustable, electrically operated single- or multiple-friction disk brake that shall apply automatically when the power is off. The brake shall be capable of holding 125 percent of the

rated load from any operating speed. The brake shall hold a static load equal to 150 percent of the rated capacity of the hoist.

[[Bridge][Jib][Trolley] unit shall have an automatic, adjustable, solenoid-operated, electric brake designed for trolley application. Brake shall apply and release smoothly during starts and stops to minimize pendulum action of the load. Braking torque shall be not less than 100 percent of motor torque and shall match motor torque characteristics.]]

2.10.10 [Conduit and Wire]

2.10.10.1 [Conduit

Conduit between feeder enclosure and disconnect switches and fixed control stations shall be zinc-coated rigid-steel conduit, couplings, elbows, bends, and nipples conforming to ANSI C80.1. Zinc coating shall be an electrodeposited coating conforming to ASTM B 633.]

2.10.10.2 [Wire

Building wire for use in conduits, raceways, and wireways in wet or dry locations shall be single-conductor, 600-volt, heat- and moisture-resistant Type RHW or THW with a maximum temperature rating of 75 degrees C, or cross-linked thermosetting, polyethylene insulation with a temperature rating of 90 degrees C.]

PART 3 EXECUTION

3.1 ERECTION

Erection shall be in accordance with the manufacturer's instructions.

3.2 [INSTALLATION OF MONORAIL TRACK

****
NOTE: Delete this paragraph if monorail tracks are not required.
****

Monorail tracks shall be installed in accordance with the applicable requirements of ANSI MH27.1. Tracks shall be accurately assembled to the lines and elevations indicated. Fastening of splices shall be performed after the abutting surfaces have been brought completely in contact. Connections shall be bolted or welded connections. Splices will be permitted only when indicated. Erection bolts used in welded construction may be tightened securely and left in place when they form no interference to trolley operation. If erection bolts are removed, the holes shall be plug welded and ground smooth. Monorail track shall be installed plumb and level to a tolerance of not more than 25 mm in 30 m 1 inch in 100 feet from the indicated elevation. The track shall be free of burrs, kinks, and deformation. Curves shall be smooth and even with no kinks or sharp bends. Track flanges shall be smooth and level. Welded joints and connections shall be ground smooth and offer no obstruction to trolley-wheel movement.]

3.3 [ONSITE ELECTRIFICATION SYSTEM TESTS

****
NOTE: Delete this paragraph if electrification system is not required.

****

Electrification system shall be given continuity and insulation testsafter the installation has been completed but before equipment is energized. Contractor shall provide necessary test equipment, labor, and personnel to perform the tests as specified. Electrification system equipment shall be completely isolated from all extraneous electrical connections. Substation and switchboard feeder breakers, circuit breakers in panelboards, and other disconnecting devices shall be used to isolate the equipment under test. Insulation tests on equipment and wiring shall be conducted using a 1,000-volt, insulation-testing instrument. Readings shall be recorded every minute and until three equal and consecutive readings are obtained. The resistance between phase conductors and between phase conductors and ground shall be not less than 1 megohm. Test data shall be recorded and shall include megohm readings versus time. Final acceptance shall depend upon satisfactory performance under test. Electrification system shall not be energized until recorded test data of the electrification system tests are approved.]

3.4 ACCEPTANCE TESTING

Acceptance testing shall comply with the following paragraphs.

3.4.1 Acceptance Test

The Contractor shall provide all personnel necessary to conduct the tests including but not limited to operators, riggers, rigging gear, and test weights. Testing shall be performed in the presence of Contracting Officer. The Contractor shall notify the Contracting Officer [_____] days prior to testing operations.

3.4.1.1 Test Sequence

The equipment shall be tested according to the applicable paragraphs of this procedure in the sequence provided.

3.4.1.2 Test Data

Operating and startup current measurements shall be recorded for electrical equipment (motors and coils) using appropriate instrumentation. Speed measurements shall be recorded as required by the facility evaluation tests (normally at 100-percent load). Recorded values shall be compared with design specifications or manufacturer's recommended values; abnormal differences shall be explained in the remarks and submitted for approval or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Hoist and trolley speeds should be recorded during each test cycle.

3.4.1.3 Equipment Monitoring

****
NOTE: Delete paragraph "b" below if a chain hoist is specified. Delete paragraph "g" below if external gears are not used.
****

During the load test, improper operation or poor condition of safety devices, electrical components, mechanical equipment, and structural

assemblies shall be monitored. Observed defects critical to continued testing shall be reported immediately to the Contracting Officer and testing shall be suspended until the deficiency is corrected. During and immediately following each load test, the following inspections shall be made:

a. Inspect for evidence of bending, warping, permanent deformation, cracking, or malfunction of structural components.

[b. Inspect for evidence of slippage in wire-rope sockets and fittings.]

c. Check for overheating in brake operation; check for proper stopping. All safety devices, including emergency stop switches and POWER OFF pushbuttons, shall be tested and inspected separately to verify proper operation of the brakes.

d. Check for abnormal noise or vibration and overheating in machinery drive components.

e. Check [wire rope sheaves and drum spooling][chain sprockets] for proper operation, freedom of movement, abnormal noise, or vibration.

f. Check electrical drive components for proper operation, freedom from chatter, noise, or overheating.

[g. Inspect external gears for abnormal wear patterns, damage, or inadequate lubrication.]

3.4.1.4 Hooks

Hooks shall be measured for hook-throat spread before and after load test. A throat dimension base measurement shall be established by installing two tram points and measuring the distance between these tram points (to within 0.4 mm 1/64 inch). This base dimension shall be recorded. The distance between tram points shall be measured before and after load test. An increase in the throat opening by more than 1 percent from the base measurement shall be cause for rejection.

3.4.2 No-Load Testing

3.4.2.1 Hoist Operating and Limit Switch Test

The load hook shall be raised and lowered through the full range of normal travel at rated speed and other speeds of the crane. The load hook shall be stopped below the geared limit switch upper setting. In slow speed only, proper operation of upper and lower limit switches shall be verified. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Brake action shall be tested in each direction.

3.4.2.2 Trolley Travel

****
NOTE: Select applicable test to be performed.
****

[The plain trolley shall travel the full distance of the [monorail][jib crane] rails.]

[The trolley shall be operated the full distance of the [monorail][jib crane] rails using geared manual drive.]

[The trolley shall be operated the full distance of the [monorail][jib crane] rails exercising all drive speed controls in each direction. Brake operation shall be verified in each direction. In slow speed, the trolley bumpers shall contact the trolley stops located on the rails.]

3.4.2.3 Hoist Loss of Power No-Load Test

The hooks shall be raised to a height of approximately 2 m 6 feet or less. While slowly lowering the hook, the main power source shall be disconnected verifying that the hook will not lower and that the brake will set.

3.4.2.4 [Travel Loss of Power No-Load Test

****

NOTE: Delete this paragraph if plain trolleys or geared manual drive trolleys are used.

****

With the hook raised to clear obstructions and the trolley traveling in slow speed, the main power source shall be disconnected, verifying that the trolley will stop and that the brake will set.]

3.4.3 Load Test

3.4.3.1 Hoist

****

NOTE: Delete subparagraph "c" below if plain trolleys or geared manual drive trolleys are used.

****

Unless otherwise indicated, the following tests shall be performed using a test load of 125 percent of rated load.

a. Dynamic Load Test: The test load shall be raised and lowered through the full-range while operating in each speed. The machinery shall be completely stopped at least once in each direction to ensure proper brake operation.

b. Hoist Loss of Power Test: After raising the test load to approximately 2 m 6 feet above ground level and while slowly lowering the test load, the main power source and the control pushbutton shall be released verifying that the brake will set and that the test load will stop lowering.

[c. Trolley Dynamic Load Test: While operating the trolley the full distance of the [monorail][jib crane] rails in each direction with test load on the hook (one cycle), the proper functioning of drive speed control points and proper brake action shall be tested.]

3.4.4 Jib Hoist Framework

****

NOTE: Delete this paragraph if jib hoist framework is not required.

****

The boom shall have no tendency to drift, without assistance, toward any point of the circumference of rotation under loaded or unloaded conditions. When rotated manually, the boom shall start moving easily and shall move steadily without evidence of bearing binding. The suspended load shall not rise or fall unduly at any point of rotation. Trolleys shall move smoothly along the boom and shall have no tendency to drift when stopped. The jib crane shall perform properly over the full area the crane is designed to service and shall do so when supporting any load within the rated capacity. An overload of 125 percent of the rated load shall cause no bearing damage as a result of the various motions.

3.5 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, erection, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.6 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of [_____] hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions. The Contracting Officer shall be given at least 2 weeks advance notice of such training.

-- End of Section --