UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 41 22 13.16

GANTRY CRANES

04/08, CHG 1: 02/20

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USACE / NAVFAC / AFCEC / NASA	**UFGS-41 22 13.16 (April 2008)** **Change 1 - 02/20**
Preparing Activity: NAVFAC	**Superseding** **UFGS-41 22 15.00 10 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION 41 22 13.16

GANTRY CRANES

04/08, CHG 1: 02/20

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NOTE: This guide specification covers the requirements for overhead electric traveling (OET) gantry cranes with capacities in excess of 9 tons 10 tons 9072 kg 20,000 pounds capacity but less than 27 metric tons 30 tons 27,000 kg 60,000 pounds, suitable for [indoor][or outdoor] use in [hazardous][or non-hazardous] environments.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

Forward all procurement of crane systems at Naval Shore based activities with rated capacities of 9072 kg 20,000 pounds or greater, or for use in specialized applications to: Naval Facilities Engineering Command, Navy Crane Center, Building 491, Norfolk Naval Shipyard, Portsmouth, Va., 23709-5000. (See NAVFAC Instruction 11450.1a of 22 January, 1997)

****

PART 1 GENERAL

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Use SECTION 41 22 13.14 BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING for top running cranes with

top running bridges and trolleys with capacities less than 27 metric ton 30 ton 27,000 kg 60,000 pounds, CMAA 70 Class A, B, C, D, E, or F, suitable for indoor or outdoor use in general purpose service, ordnance handling service, or hazardous area environments.

Use SECTION 41 22 13.15 BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER RUNNING for top running and under running single girder cranes with under running trolleys and hoists, with capacities less than 27 metric ton 30 ton 27,000 kg 60,000 pounds, CMAA 74 Class A, B, C, or D, suitable for indoor or outdoor use in general purpose service, ordnance handling service, or hazardous area environments.

Use SECTION 41 22 23.19 MONORAIL HOISTS (manual, electric, or air-powered).

Types of crane covered, (more than 9.07 tons 10 tons 9072 kg 20000 pounds, but less than 27 tons 30 tons 27215 kg 60000 pounds, including:

Top-running gantry and trolley, single or multiple-girder, with CMAA 70 or CMAA 74 service class of A through E. Control types and systems may be specified as follows:

1. Remote, Cab, or Pendant Crane Controls or a combination of the three can be provided.

2. Alternating current or direct current control systems can be specified.

Crane Terminology: - refer to DEFINITIONS in this specification.

a. Tracks for gantry crane travel may be at the same (gantry) or different (semi-gantry) levels, depending on the leg design and intended purpose. Trolley travel and leg position defines the type of gantry.

b. Top-running Trolley is a trolley which travels on the top surfaces of rails of the gantry girder(s).

c. Types of Gantry Cranes may include; Deck-Leg Gantry, Through-Leg Gantry, Semi-Gantry Deck-Leg, Semi-Gantry Through Leg, Outdoor Storage or Hauling Gantry, and Polar Gantry.

Show the following information, as a minimum, on the project drawings:

1. Complete details of plan, elevations, and sections of Gantry Crane system including data.

2. Maximum span of runway girder.

3. Gantry Runway rail size.

[4. Runway girder size (for semi-gantry applications).]

5. Channel cap size.

6. Size and location of gantry crane stops.

7. Electrical junction box location (including mounting height).

****

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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 GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 2011	(2014B) Cylindrical Wormgearing Tolerance and Inspection Methods
AGMA ISO 10064-6	(2010A) Code of Inspection Practice - Part 6: Bevel Gear Measurement Methods
AGMA ISO 17485	(2008A; Supplement 2008) Bevel Gears - ISO System of Accuracy (Including Supplement - Tolerance Tables 2008)
ANSI/AGMA 2001	(2004D; R 2010) Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
ANSI/AGMA 2015-1	(2001A; R 2014) Accuracy Classification System - Tangential Measurements for Cylindrical Gears

ANSI/AGMA 6013	(2006A; R 2016) Standard for Industrial Enclosed Gear Drives
ANSI/AGMA 6113	(2016B) Standard for Industrial Enclosed Gear Drives (Metric Edition)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325	(2017) Steel Construction Manual

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.2	(2017) Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
ASME B30.10	(2019) Hooks
ASME B30.11	(2010) Monorails and Underhung Cranes - Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
ASME B30.16	(2017) Overhead Underhung and Stationary Hoists
ASME B30.17	(2015) Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoists)
ASME HST-1	(2012) Performance Standard for Electric Chain Hoists
ASME HST-4	(2016) Performance Standard for Overhead Electric Wire Rope Hoists
ASME NOG-1	(2015) Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)
ASME NUM-1	(2016) Rules for Construction of Cranes, Monorails, and Hoists with Bridge or Trolley or Hoist of the Underhung Type.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel
AWS D14.1/D14.1M	(2019) Specification for Welding of Industrial and Mill Cranes and Other

ASTM INTERNATIONAL (ASTM)

ASTM A159	(1983; R 2020) Standard Specification for Automotive Gray Iron Castings
ASTM A275/A275M	(2018) Standard Practice for Magnetic Particle Examination of Steel Forgings
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A490M	(2014a) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A668/A668M	(2020a) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A931	(2008; R 2013) Standard Test Method for Tension Testing of Wire Ropes and Strand
ASTM A1023/A1023M	(2019) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
ASTM B438	(2017) Standard Specification for Bronze-Base Powder Metallurgy (PM) Bearings (Oil Impregnated)
ASTM B439	(2018) Standard Specification for Iron-Base Powder Metallurgy (PM) Bearings (Oil-Impregnated)
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ASTM E125	(1963; R 2013) Photographs for Magnetic Particle Indications on Ferrous Castings
ASTM E543	(2015) Standard Practice for Agencies Performing Non-Destructive Testing
ASTM F436	(2011) Hardened Steel Washers
ASTM F436M	(2011) Hardened Steel Washers (Metric)
ASTM F959/F959M	(2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 70	(2015) Specification for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes
CMAA 74	(2015) Specifications for Single Girder Cranes

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 3	(2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC
NEMA ICS 5	(2017) Industrial Control and Systems: Control Circuit and Pilot Devices
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA ICS 8	(2011) Crane and Hoist Controllers
NEMA MG 1	(2018) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.179	Overhead and Gantry Cranes
29 CFR 1910.306	Specific Purpose Equipment and Installations

UNDERWRITERS LABORATORIES (UL)

UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1004-1	(2012; Reprint Nov 2020) UL Standard for Safety Rotating Electrical Machines - General Requirements
UL 1449	(2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices

1.2 DEFINITIONS

a. Crane Bridge: That part of an overhead crane system consisting of girder(s), end trucks, end ties, walkway, and drive mechanism which carries the trolley(s) and travels along the runway rails perpendicular to the gantry runway.

b. Crane Runway: The track system along which the crane operates horizontally, including track, track hangar rods, track connection devices, and runway structural supports.

c. Dead Loads: The loads on a structure which remain in a fixed position relative to the structure.

d. Girder: The principal horizontal beam of the crane gantry. It is supported by the crane end legs. Normally the crane trolley is mounted on top of the girder, and the hoist is suspended from the trolley to below the crane girder; however,the trolley and cab may also be suspended from the girder.

e. Live Load: A load which moves relative to the structure under consideration.

f. Pendant: A control for a hoist and/or a crane. The pendant hangs from the hoist or the crane by a cord at a height that is easy for the operator to reach.

g. Rated Load: For the purpose of this specification the rated load is defined as the maximum working load suspended under the load hook.

h. Standard Commercial Cataloged Product: A product which is currently being sold, or previously has been sold, in substantial quantities to the general public, industry or Government in the course of normal business operations. Models, samples, prototypes or experimental units do not meet this definition. The term "cataloged" as specified in this section is defined as "appearing on the manufacturer's published product data sheets. These data sheets must have been published or copyrighted prior to the issue date of this solicitation and have a document identification number or bulletin number.

i. Top Running Crane: An electric overhead traveling (OET) crane that runs on rails on top of support beams (bridge girders); or OET with equal or unequal legs supporting a girder, trolley, hoist (and cab)which travels horizontally on legs. The load is supported by the entire cross-section of the beam in bridge cranes. The load is carried by the cross-section of the beam supported by movable legs for a gantry crane, distributing the load to the legs, wheels, and gantry track.

j. Trolley Mounted Hoist: A combined unit consisting of a wheeled trolley that provides horizontal motion along the gantry girder, and a hoist suspended from the trolley, that provides lifting and lowering of a freely suspended load.

k. Under running (Underhung) Crane: An electric overhead traveling crane that is supported by crane end trucks suspended below the crane runway. The load is supported by hanging from the lower flange of a beam.

1.3 SYSTEM DESCRIPTION

The requirements for the crane runway and rail supporting structures are specified in Section 05 12 00 STRUCTURAL STEEL.

[1.3.1 Load and Sizing Calculations

****

NOTE: Design data for Load and Sizing Calculations, and welding procedures, may not be available for commercially procured hoists and trolleys.

****

Submit complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Submit calculations verifying the sizing of the gantry girder, end trucks and travel drives.[Include seismic analysis of gantry girder and end trucks.]

]1.3.2 OET Design Criteria

****

NOTE: Clearly show the area of hook coverage, runway dimensions, rail size, hook vertical travel, clear hook height and lifting capacity on drawings.

****

Cranes will operate in the given spaces and match the runway dimensions and rails indicated. Hook coverage, hook vertical travel, clear hook height, lifting capacity, and load test weight shall not be less than that indicated.

1.3.2.1 General

****

NOTE: Add number of cranes, building name, crane span and rated load capacity expressed in tons pounds. The last sentence may be deleted if only one hoist system is in project.

****

Include the following: Number of cranes [_____], located in building identified as [_____], the required span, and the rated capacity expressed in [_____] metric tons tons kilograms pounds, for each OET. Also clearly locate and identify each multiple girder hoist and system components.

1.3.2.2 Classification

****

NOTE: CMAA 70 covers top running bridge and gantry electric overhead traveling cranes with a duty rating of A, B, C, D, E and F. CMAA 74 covers top running and under running single girder electric traveling cranes utilizing an under running trolley with a duty rating of A ,B, C and D. Make a selection from the following CMAA 70 and CMAA 74 service classifications.

Class A (Standby or Infrequent Service): This service covers cranes which may be used in installations such as powerhouses, public utilities, turbine rooms, motor rooms and transformer stations where precise handling of equipment at slow speeds with long, idle periods between lifts are required. Capacity loads may be handled for initial installation of equipment and for infrequent maintenance.

Class B (Light Service): This service covers cranes which may be used in repair shops, light assembly operations, service buildings, light warehousing, etc., where service requirements are light and the speed is slow. Loads may vary from no load to occasional full rated loads with 2 to 5 lifts per hour, averaging 3 m 10 feet per lift.

Class C (Moderate Service): This service covers cranes which may be used in machine shops of paper mill machine rooms, etc., where service requirements are moderate. In this type of service the crane will handle loads which average 50 percent of the rated capacity with 5 to 10 lifts per hour, averaging 4.5 m 15 feet, not over 50 percent of the lift at rated capacity.

Class D (Heavy-Duty): This service covers cranes

which may be used in heavy machine shop, foundries, fabricating plants, steel warehouses, container yards, lumber mills, etc., and standard duty bucket and magnet operations where heavy-duty production is required. In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour averaging 4.5 m 15 feet, not over 65 percent of the lifts at rated capacity.

Class E (Severe Service): This type of service requires a crane capable of handling loads approaching rated capacity throughout its life. Applications may include magnet, bucket, magnet/bucket combination cranes for scrap yards, cement mills, lumber mills, fertilizer plants, container handling, etc., with 20 or more lifts per hour at or near the rated capacity.

Class F (Continuous Severe Service): This type of service requires a crane capable of handling loads approaching rated capacity continuously under severe service conditions throughout its life. Applications may include custom designed specialty cranes essential to performing the critical work tasks affecting the total production facility. These cranes must provide the highest reliability with special attention to ease of maintenance features.

****

Provide crane designed and constructed to[CMAA 70 Class [_____], [_____] service][CMAA 74 [Duty Class A][Duty Class B] [Duty Class C] service] requirements for operation in[indoor][outdoor][hazardous][non-hazardous] environment with[multiple girder hoist system][electric chain hoist conforming to ASME HST-1][electric wire rope hoist conforming to ASME HST-4].

1.3.2.3 Rated Capacity and Speeds

NOTE: Auxiliary [monorail hoist][multiple girder hoist] may be specified. VFAC drive should be specified if precise handling and position are required. VFAC drives are normally capable of driving the crane at 5 mm/s 1 fpm or less. Delete reference to VFAC-drive and auxiliary hoist if not applicable.

Delete micro-drive and columns from the table if not applicable.

****

Provide crane conforming to[CMAA 70][CMAA 74] with rated capacity of [_____] metric tons tons kg pounds.[Provide auxiliary hoist with [_____] metric tons tons kg pounds capacity.] Lower load block or assembly of hook, swivel bearing sheaves, pins and frame suspended by the hoisting ropes are not considered part of the rated capacity. Rated speeds (in meters/second fpm) for the hoist,[hoist micro-drive, gantry micro-drive,

trolley micro-drive,] gantry and trolley at the rated load are as follows:

Rated Speeds [meters per second] [feet per minute]			
Description	Minimum	Maximum	[Micro-drive]
Main Hoist	[_____]	[_____]	[[_____].]
[Auxiliary Hoist]	[_____]	[_____]	[[_____].]
Trolley	[_____]	[_____]	[[_____].]
Gantry	[_____]	[_____]	[[_____].]

1.4 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that

will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Overhead Electric Traveling (OET) Crane(s); G[, [_____]]

Crane Runway System; G[, [_____]]

Complete Schematic Wiring Diagram; G[, [_____]]

Description of operation.

SD-03 Product Data

OET Design Criteria; G[, [_____]]

Overhead Electric Traveling (OET) Crane(s); G[, [_____]]

Load and Sizing Calculations; G[, [_____]]

Festoon System; G[, [_____]]

Runway Electrification System; G[, [_____]]

Variable Frequency Drives; G[, [_____]]

Bumpers; G[, [_____]]

End Stops; G[, [_____]]

[Spare Parts; G[, [_____]]

] Framed Instructions; G[, [_____]]

SD-06 Test Reports

Acceptance Testing; G[, [_____]]

SD-07 Certificates

Overload Test Certificate

No Hazardous Material; G[, [_____]]

Loss of Power Test; G[, [_____]]

Crane Runway System; G[, [_____]]

Certificate of Compliance; G[, [_____]]

Including listed Standards.

Wire Ropes; G[, [_____]]

Including Manufacturer's Certificate of Breaking Strength.

Hook NDT Reports; G[, [_____]]

NDT Vendor Certification; G[, [_____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]]

1.5 QUALITY ASSURANCE

1.5.1 Manufacturer Qualification

Overhead Electric Traveling (OET) Crane(s) shall be designed and manufactured by a company with a minimum of 10 years of specialized experience in designing and manufacturing the type of overhead crane required to meet requirements of the Contract Documents.

1.5.2 Pre-Delivery Inspections

Contractor is responsible for performance of quality control inspections, testing and documentation of steel castings, hook assembly and nuclear safety as follows. Submit all crane test data recorded on appropriate test record forms suitable for retention for the life of the crane. Visually inspect and test load-carrying steel castings ASTM A668/A668M using the magnetic-particle inspection method per ASTM A275/A275M. Reference allowable degree of discontinuities to ASTM E125, and relationship to service loads and stresses, critical configuration, location and type. Methods of repairing the discontinuities is subject to review by the Contracting Officer.

1.5.3 Certificates

Submit an Overload Test Certificate stating that the crane can be periodically load tested to 125 percent (plus 5 to minus 0) 131.25 percent of rated load. Also submit the following certificates:

a. stating that No Hazardous Material, including, but not limited to asbestos, cadmium, chromium, lead, elemental mercury, or PCB'c, is contained within system or components.

b. stating that the system is safe to perform a Loss of Power Test

c. stating that the Crane Runway System conforms to the requirements as specified herein and as specified in Section 05 12 00 STRUCTURAL STEEL.

d. Certificate of Compliance with Listed Standards

e. Provide manufacturer's Wire Ropes Breaking Strength certification that each rope meets the published breaking strength, or actual breaking strengths, of samples taken from reels and tested. Certifications shall be traceable to the crane and to the hoist to which the wire rope is installed. Wire rope must conform to ASTM A1023/A1023M. and ASTM A931.

f. Hook NDT Reports

1.5.4 NDT Vendor Certification

Provide certification that the NDT vendor meets the requirements of ASTM E543. Provide the NDT report to the Government which is traceable to the unique ID number on the hook and nut.

a. Submit for review the NDT vendor's procedures, including technique sheets specific to the types, shapes, and sizes of the parts being examined (e.g., shank hook, eye hook, duplex hook, eye bar, nut).

b. For the magnetic particle method, adequately describe the procedures for the orientation of the hooks, nuts, or pins with the magnetizing equipment. Procedures shall bear the approval of an independent Level III examiner.

c. Prior to performing any operational testing of the cranes, inspect the hook and hook nut by the magnetic particle method (MT) over their entire surface area[in accordance with NAVSEA Technical Publication T9074-AS-GIB-010/271]. ASTM A275/A275M may be used with the following restrictions:

1. Do not use DC yokes (including switchable AC/DC yokes used in the DC mode) and permanent magnet yokes;

2. Do not use automatic powder blowers or any other form of forced air other than from a hand-held bulb for the application or removal of dry magnetic particles;

3. Remove all arc strikes;

4. Equipment ammeters shall have an accuracy of plus/minus 5 percent of full scale (equipment ammeter accuracy other than that stated is acceptable provided the MT procedure states that a magnetic field indicator is used to establish and verify adequate field strength for all aspects of the inspection).

5. If NDT cannot be performed on surfaces inside holes, visually inspect those surfaces to the maximum extent practical. Acceptance criterion is "no linear indications greater than 1/16 inch".

1.5.5 Overhead Electric Traveling (OET) Crane(s)

a. Submit shop drawings detailing all OET Design Criteria, showing the general arrangement of all components in plan, elevation, and end views; hook approaches on all four sides, clearances and principal dimensions, assemblies of hoist, trolley and gantry drives, and complete schematic wiring diagram with description of operation, and Runway Electrification System. Include weights of components and maximum gantry wheel loads and spacing.

b. Provide shop drawings whose quality is equivalent to the contract drawings accompanying this solicitation.

c. Provide integral schedule of crane components on each drawing. Provide maximum wheel loads (without impact) and spacing imparted to the crane runway system track beams. Indicate the crane speeds along the runway, the trolley speeds along the gantry girder, and the hoist lifting speeds; all speeds indicated are speeds with hoist loaded with rated crane capacity load.

[1.5.6 Welding Qualifications and Procedures

Perform welding in accordance with qualified procedures using

AWS D14.1/D14.1M as modified. Written welding procedures shall specify the Contractor's standard dimensional tolerances for deviation from camber and sweep not exceeding those specified in AWS D14.1/D14.1M. Welders and welding operators shall be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1/D14.1M. Allowable stress values shall comply with CMAA 70.

]1.5.7 Safety Requirements

****

NOTE: Certification is required for cranes handling nuclear materials. Results from the Safety Analysis will be utilized by the Using Agency as a basis for gantry crane certification. Delete this paragraph if the crane is not required to handle nuclear materials.

****

Comply with the mandatory and advisory safety requirements of ASME B30.10, ASME B30.11,ASME B30.16, ASME B30.17, ASME B30.2, ASME HST-1, ASME HST-4, NFPA 70, 29 CFR 1910, 29 CFR 1910.179, and 29 CFR 1910.306. Nuclear certification, testing, and rules of construction shall be in accordance with 29 CFR 1910.147, and [ASME NOG-1 top running type cranes][ASME NUM-1 for underhung type cranes]. Submit analysis and test reports to Contracting Officer for approval.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect all delivered and stored equipment from the weather, humidity, temperature variations, dirt and dust, and other contaminants.

[1.7 EXTRA MATERIALS

****

NOTE: The extent to which spare parts are stocked is an economic judgment determined by the user. The impact of downtime expense must be weighed versus the prompt availability and amount of cost allocated to spare parts. Power plant cranes, and similar use cranes receive severe service during the plant construction period, and normal wearing parts should be maintained at the project site.

****

Submit spare parts data for each different item of material and equipment specified and/or as recommended by the manufacturer, after approval of the detail drawings and not later than [_____] months prior to the date of beneficial occupancy. Include in data a complete list of parts and supplies, with current unit prices and source of supply. Furnish and deliver one set of manufacturer's recommended spare parts to the site. Suitably package the spare parts for long-term protection and storage. Legibly label the packaging to identify the spare parts. Also include a list of the furnished spare parts in the Maintenance manual.

]PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General

Provide materials and equipment which are standard products of manufacturers regularly engaged in the fabrication of complete and totally functional cranes including necessary ancillary equipment.

2.1.2 Nameplates

Secure nameplates to each major component of equipment with the manufacturer's name, address, type or style, model or catalog number, and serial number. Provide two gantry identification plates , one for each side of gantry. Provide noncorrosive metal identification plates with letters which are easily read from the floor, showing a separate number such as BC-1, BC-2, for each gantry crane.

2.1.3 Prohibited Use of Asbestos Products

Materials and products required for designing and manufacturing cranes shall not contain asbestos.

2.1.4 Capacity Plates

Two capacity plates indicating the crane capacity in metric tons and tons tons kilograms pounds are required, one secured to each side of gantry. Fabricate each capacity plate with a steel backing plate and exterior quality/fade-resistant stick-on labels with letters large enough to be easily read from the floor. Place capacity plates in a location visible to pendant operator's position after the crane has been installed.

2.1.5 Safety Warnings

Affix labels in a readable position to each lift block or control pendant in accordance with ASME B30.16, ASME B30.2 and ASME B30.17. Submit safety warnings, diagrams and other framed instructions suitably framed and protected for display as indicated by the Contracting Officer as follows:

a. Design and locate the word "WARNING" or other legend to bring the label to the attention of the operator. Provide durable type warning labels and display the following information concerning safe-operating procedures:

   Cautionary language against lifting more than the rated load; operating the hoist when the hook is not centered under the hoist; operating hoist with twisted, kinked or damaged rope; operating damaged or malfunctioning hoist; operating a rope hoist with a rope that is not properly seated in its hoist drum groove; lifting people; lifting loads over people; and removing or obscuring the warning label.

b. To avoid operation of the crane in the wrong direction, affix the appropriate directions, with arrows, NORTH, SOUTH, EAST and WEST on the bottom of the girder where they can be easily seen by the operator. Labels on the controls shall have corresponding direction (NORTH, SOUTH, etc.). Markings shall agree with the markings on control pendant. Do not indicate directional arrows on control pendant.

2.2 STRUCTURAL MATERIALS

2.2.1 Bolts, Nuts and Washers

Utilize corresponding lockwashers with high-strength bolted connections ASTM F436M ASTM F436, nuts ASTM A563M ASTM A563, etc., conforming to requirements of AISC 325. Bolts, nuts and washers ASTM F959/F959M shall conform to ASTM A325M ASTM A325 bolts or ASTM A307. Galvanized bolts are not acceptable. Do not use ASTM A490M ASTM A490 bolts.

2.2.2 Gantry Girder or Girders

****

NOTE: Specify welded structural steel box sections for multiple girder cranes Class C, D, or E with a capacity greater than 18 metric tons 20 tons 16330 kg 36,000 pounds or a span greater than 12 m (40 feet).

****

Provide[welded structural steel box section][wide flange beam, standard I-Beam, reinforced beam or section fabricated from rolled plates and shapes] gantry girders.

2.2.3 Gantry Rails or Bars

****

NOTE: Remove this paragraph for underhung cranes and cranes having a capacity less than 18 metric tons 20 tons 16330 kg 36,000 pounds (many crane manufacturers do not need or want rails or bars).

****

Trolley runway rails, crane girders and other sections shall be straight and true. When loaded with motor driven cranes the deflection of rails shall not exceed 1/888 of the span. Calculate the deflection with the worst case of two loaded gantry cranes located adjacent each other. Make all rail joints flush and true without misalignment of running tread and design to minimize vibration. The gap between adjacent rail ends and the vertical misalignment of running treads shall not exceed 1.588 mm 0.0625 inch. Level the gantry rail to a plus-or-minus 3 mm 1/8 inch at all rail support joints.[Fasten upper gantry rail to[top cover plate][wide flange] or centered on flange or offset near web plate for welded box sections, complete with welded clips.] Bolt gantry rail joints using standard joint bars. Stagger rail joints. Provide a positive stop at gantry rail ends to prevent creep.

2.2.4 End Ties and Gantry Girder End Connections

****

NOTE: Specify end ties for cranes with more than four wheels. Specify welded structural steel box sections for multiple-girder cranes Class C, D, or E with a capacity greater than 18 metric tons 20 tons 16330 kg 36,000 pounds or a span greater than 12 m 40 feet.

****

Use welded steel box sections for end ties. Provide full depth diaphragms

at girder connections and jacking points. Provide horizontal gusset plates at the elevation of top and bottom end tie flanges for connection to girder ends. Make end connections with high-strength bolts per AISC 325. Use body-bound bolts fitted in drilled and reamed holes to maintain the crane square.

2.2.5 Gantry End Trucks

Provide[rotating][fixed axle] type end trucks fabricated of structural tubes or from structural steel to provide a rigid box section structure. Provide jacking pads for removal of wheel assemblies.

[2.2.6 Trolley Frame

****
NOTE: Trolley frame is applicable only to multiple girder cranes.
****

Provide trolley frame consisting of two structural steel side frames or trucks welded together with one or more structural steel load girts to form a one-piece unit. Provide pads for the use of jacks or wedges when changing truck wheels.

]2.2.7 End Stops and Bumpers

****
NOTE: Rubber bumpers dry out with time. Hydraulic type bumpers are more expensive. Using the words shock-absorbing allows the manufacturer to choose. Rubber like materials are not acceptable as an option.
****

Fit crane runways and gantry girders with structural steel end stops. Fit gantry end trucks and trolley frames with shock-absorbing, [spring][or][hydraulic] type bumpers capable of decelerating and stopping the gantry and/or trolley within the limits stated by OSHA and MHI CMAA. Provide trolley end stops of sufficient strength to withstand the impact of a fully loaded trolley moving at 50 percent of maximum rated travel speed. When two gantry cranes are on the same runway, fit one crane with shock-absorbing bumpers on each face of each end-truck, and the other crane shall have shock-absorbing bumpers as per above on one face only of each end-truck which is the opposite face of the adjacent crane. Fit the other face of the end-truck with a structural steel stop to engage the bumpers of the adjacent crane. Provide gantry bumper stops as specified in Section 05 12 00 STRUCTURAL STEEL. Locate stops to permit maximum gantry and trolley travel.

[2.2.8 Footwalks

****
NOTE: Delete the following paragraph if footwalks are not required. Provide footwalk fall protection with guard rails or static line with safety belts.
****

The location and construction of footwalks shall conform to ASME B30.2. A full-length structural platform is required on the driver's side of the

gantry. Provide[checkered steel][non-slip] flooring for platform, double member handrail and a suitable toe-guard, with 760 mm 30 inch clearance in front of control equipment. Minimum 380 mm 15 inch clearance is required in front of gantry machinery.[To give access to the opposite side of the trolley, gantry conductors, or other equipment, mount a footwalk a minimum of twice the length of the trolley on the opposite side of the crane. Provide a cross-over footwalk over an end tie between the two girder footwalks.] Mate the drive side footwalk with the crane access platform. Make the length of the drive side footwalk[adequate to provide access to the trolley and provide sufficient room for mounting control cabinets][along the entire length of the gantry]. Provide safety handrails for footwalks.

]2.2.9 Runway Rails

Provide runway rail size as specified in Section 05 12 00 STRUCTURAL STEEL.

[2.2.10 Operator's Cab

****
NOTE: Applicable if a cab is specified, otherwise delete paragraph. Specify enclosed cab for outdoor use. Open cab may be used indoors. Enclosed cabs can be provided with a heating and/or air conditioning unit according to environmental conditions. Specify the location of cab and the direction the operator should face.
****

[2.2.10.1 Design

Design and construct operator's cab in accordance with[CMAA 70][CMAA 74] [and ASME B30.2]. Locate cab access to facilitate entry and exit by crane operator. Provide space near cab entrance for storage of a carbon-dioxide, dry chemical, or equivalent hand fire extinguisher.

][2.2.10.2 Cab Construction

Provide a[standing][seated] type[fixed cab mounted on gantry][trolley mounted cab] of the[enclosed][open] type for[outdoor][indoor] use, and designed to provide a clear view of the operating floor and hook for operator.[Provide cab with a suitable[heating][heating and air conditioning] unit]. Locate cab on the [_____] of the[gantry][trolley] with the operator facing [_____].

]][2.2.11 Additional Provisions for Outside Service

****
NOTE: This paragraph is applicable for outdoor cranes only.
****

Seal weld structural members on outdoor cranes. Provide crane gantries with parking brakes which will sufficiently hold the crane against a wind pressure of 244 Pa 5 psf for in-service conditions. Provide crane gantries with manually-operated pin locks at each rail, designed to securely anchor the crane against a wind pressure of 1.5 kPa 30 psf for out-of-service conditions.

]2.3 MECHANICAL EQUIPMENT

2.3.1 Variable Frequency Drives

2.3.1.1 Gantry Drives

****
NOTE: If the span is less than 12 m 40 feet and the application is CMAA Class "A" or "B", then A-1 drive may be included as an option. A-1 and A-4 drives are only referenced in CMAA 70, and if selected, delete the reference to CMAA 74.
****

Provide Variable Frequency AC (VFAC) [either the A-1 or][A-4] gantry drive arrangement as specified in[CMAA 70][CMAA 74], consisting of a single electric motor mechanically connected through gear reduction and drive shafts to the drive wheels or separate drive motors at each end of gantry. Perform acceleration and deceleration meeting the requirements specified in this section. Gears shall conform to applicable AGMA standards. Provide gear reducers that are oil tight and fully enclosed with pressure or splash type lubrication. Gantry-travel limit-switches are optional.

2.3.1.2 Trolley Drives

Provide complete trolley drive arrangement with a minimum of two wheels driven by an integral electric motor. Drive mechanism shall run in totally enclosed oil bath. Limit switches are optional for drive mechanism. Provide acceleration and deceleration controls meeting the requirements specified in this section.

[2.3.1.3 Micro-Drives

****
NOTE: Current industry standards use Variable Frequency Alternating Current Drives (VFAC) in lieu of micro-drive motors. The following paragraph is included in this section for instances where the micro-drive motors will not be replaced with newer VFAC drives. If micro-drives are not to be used, delete this paragraph.

Include those motions where a micro-drive is required. If micro-drive is not specified, delete these paragraphs. Micro-drives are generally required when slow speeds are required for an extended amount of time. If precision movement is required for limited time for final positioning of loads, use adjustable frequency or dc variable voltage crane controls instead of micro-drives.
****

Provide the following crane motions with a separate micro-drive: [main hoist,] [auxiliary hoist,] [trolley drive][and][gantry drive]. The micro-drives are used to precisely position loads. Provide each micro-drive with an electric motor, gear reducer, magnetic coupling clutch and necessary controls. Connect the output shaft of the reducer to an extension of the primary drive high-speed shafting with a magnetic

coupling clutch. Coupling shall normally be disengaged and become engaged only if the micro-drive is required. Provide electrical clutch components, required for proper operation, conforming to the requirements specified in paragraph ELECTRICAL COMPONENTS. Provide magnetic coupling type clutches which engage and disengage the micro-drives from the high speed shafts of the main drive arrangement. The clutch shall be engaged by electromagnet and released by springs. Provide clutch ratings not less than 150 percent of the micro-motor rated torque as amplified by the intervening gearing. Provide clutch enclosures to facilitate easy access for wear inspection of the friction elements and visual examination of the clutch assemblies.

]2.3.2 Gearing

Provide enclosed gear reducers type gearing. Gears and pinions shall be spur, helical, or herringbone type only, and be forged, cast or rolled steel. Open-type gearing is not acceptable, except for final drives. Provide gears and pinions with adequate strength and durability for the crane service class and manufactured to ANSI/AGMA 2001 Quality Class 6 or better precision per [AGMA ISO 10064-6] [AGMA ISO 17485] [AGMA 2011] [ANSI/AGMA 2015-1].

2.3.2.1 Gear Reducers

Provide gear reducers which are [standard items of manufacturers regularly engaged in the design and manufacture of gear reducers for Class D and E cranes][or][integral components of standard hoists or hoist/trolley units of manufacturers regularly engaged in the design and manufacture of hoists or hoist/trolley units for Class A, B or C cranes]. Provide gear reducers designed, manufactured and rated in accordance with ANSI/AGMA 6113 ANSI/AGMA 6013 (for trolley drives only), as applicable. Except for final reduction, provide the gear reduction units with fully enclosed in oil-tight housing. Design gearing to AGMA standards and to operate in an oil bath. Operation shall be smooth and quiet.

2.3.2.2 Open Gearing

Provide gears and pinions possessing adequate strength and durability for the crane service class and manufactured to ANSI/AGMA 2001 quality class 6 or better precision per [AGMA ISO 10064-6] [AGMA ISO 17485] [AGMA 2011] [ANSI/AGMA 2015-1]. Enclose open gears with safety guard removable covers over openings for inspection and access for grease lubrication.

2.3.3 Hoist Brakes

a. General: In addition to the requirements of CMAA 70, provide shoe, disc, or conical type brakes with thermal capacity suitable for class and service specified in this section. Shoe, disc, and conical brakes shall be spring-set and electrically-released by a continuously rated direct acting magnet. Provide brakes which are self-aligning and easily adjusted for torque setting and lining wear. Use brake lining material which is asbestos free. Provide cast iron brake wheels conforming to ASTM A159 or the manufacturer's standard high-strength ductile cast-iron brake wheels, provided that the material exhibits wear characteristics in the form of powdered wear particles and is resistant to heat-checking. Provide disc brakes totally enclosed and having multiple discs with stationary releasing magnets. Brake torque shall be easily adjustable over a 2:1 torque range.

b. Gantry Brakes:[Provide gantry braking system with a spring-applied and electrically-released single shoe, disc, or conical brake for each gantry drive motor.] Braking system which automatically sets when controls are released or power is interrupted. Make provisions to facilitate easy brake adjustment. Provide brakes with a torque rating of at least 50 percent of gantry drive motor rated torque.

2.3.4 Wheels

****
NOTE: Include the second sentence for CMAA 70 class D and E, cranes; otherwise delete. Include the requirement for trolley wheels only for multiple girder cranes.
****

Furnish wheels manufactured of rolled or forged steel.[Wheel treads and flanges shall be rim toughened to between 320 and 370 Brinell hardness number.] Provide double-flanged [gantry][gantry and trolley]wheels. Trolley and gantry wheels shall have straight treads. Equip wheels with self-aligning double-row spherical roller-bearings of capacity as recommended by bearing manufacturer for design load of trolley or gantry.

2.3.5 Bearings

****
NOTE: Equalizer sheaves compensate for unequal length, stretch of the hoisting, and swinging of the load block.
****

All bearings, except those subject to a small rocker motion, shall be anti-friction type. Provide a means for lubrication for bearings not considered lifetime lubricated by the manufacturer. Equip equalizer sheaves with sintered oil-impregnated type bushings in accordance with ASTM B438 or ASTM B439.

[2.3.6 Anti-Drip Provisions

Design cranes to preclude leakage of lubricants onto the lifted loads, floor, or external grounds. Fit all equipment and components which cannot be made leak-proof with suitable drip pans. Provide drip pans manufactured of steel and designed to permit removal of collected lubricant.

]2.4 ELECTRICAL COMPONENTS

[2.4.1 Explosion Proof Requirements

****
NOTE: Delete this paragraph if explosion proofing is not part of design criteria. Define hazardous classification and evaluate Contractor's proposal for electrical equipment. Show location of the hazardous areas.
****

Provide equipment and wiring in locations indicated conforming to NFPA 70 for Class [I] [II] [III], Division [1] [2] hazardous locations. Provide

equipment suitable for[Group [_____]][operating temperature of [_____] degrees C degrees F]. Provide wiring and equipment in locations indicated of the classes, groups, divisions, and suitable for the operating temperature as specified.

]2.4.2 Control Systems

Provide a separate controller for each motor; however, use a duplex controller two motor gantry drives. Provide overload protection in conformance with the requirements of NEMA ICS 2 and mechanically and electrically interlock contactors that are used for starting, stopping, and reversing.

2.4.2.1 Travel Motion Control System

Provide AC inverter duty, totally enclosed non-ventilated (TENV), squirrel cage induction type bridge and trolley drive motors.

2.4.2.2 Drive Control System

Provide static reversing, adjustable frequency controllers conforming to[NEMA ICS 3][,][NEMA ICS 8] for the [hoist][trolley][and bridge]infinitely variable electric drives. Provide dynamic braking. Provide two step infinitely variable speed control for the bridge and trolley functions, controlled via pendant pushbuttons. The trolley, and bridge brakes shall set after associated controller decelerates motor to a controlled stop. Size the bridge and trolley controllers to provide sufficient starting torque to initiate motion of that crane drive mechanism from standstill with 0 to 131.25 percent of rated load on the hook and not produce any hook rollback. Drive motors shall run smoothly, without torque pulsations at the lowest speed, and be energized at a frequency not exceeding 60 HZ.

2.4.3 Power Sources

2.4.3.1 System Supply Voltage

Design cranes to be operated from a [_____] volt,[three-phase, 60 Hz, alternating current][direct current] system power source. Design energy isolating devices for such machine or equipment to accept a lockout device in accordance with NFPA 70.

2.4.3.2 Transformers

****
NOTE: This paragraph is applicable to ac power supplies only.
****

Provide dry type transformers and carry full load continuously at rated voltage and frequency without exceeding an average temperature rise of 115 degrees C above an ambient temperature of 40 degrees C. Provide transformer with totally enclosed case finished with manufacturer's standard coating system. Fully encapsulate transformers, except for those specifically designed for use as an isolation transformer for static power conversion units.

2.4.4 Motors

****

NOTE: Motor heaters are desirable for outdoor cranes, unheated warehouse service cranes, or any other condensing high-humidity application, but specify heaters only if an integral component of the hoist and motor manufacturer. Select a motor from the following types and coordinate with the desired control type.

Select industrial motors for CMAA 70, Class A, B, C and D cranes, as follows:

a. For critical load handling, self-excited alternator with electrical load brakes or emergency dynamic braking is preferred.

b. Select crane type motors for ac motors.

c. Select 800 Series dc mill type motors or dc industrial motors for dc motors.

d. If crane and/or industrial type motors are specified, select NEMA MG 1.

Select mill motors for CMAA 70, Class E cranes, as follows:

a. If 800 Series dc mill type motors are specified, select AISLE Std No. 1.

b. Select dc motor type (squirrel cage, wound rotor) for the appropriate control system.

c. Select dc series wound motors for dc constant potential control.

d. Select dc shunt wound for dc variable voltage control.

e. Select ac motor (squirrel cage, wound rotor) for the appropriate control system.

****

2.4.4.1 General Requirements for Motors

a. Provide motors designed specifically for crane and hoist duty. Provide drain holes at low points near each end; inspection and service covers with gaskets; and hardware which is corrosion-resistant. Provide motors conforming to the requirements of NFPA 70[,] [NEMA MG 1]and UL 1004-1.

[b. Motor heaters shall energize when mainline contactor is de-energized, and water heaters de-energize when mainline contactor is de-energized. Provide motors 15 kW 20 HP and larger with a suitable heater to prevent condensation during long periods of inactivity. Provide motor heater which is an integral component of the hoist and motor manufacturer.

] c. Provide one embedded thermal sensitive device in hoist motor windings. Device and associated circuitry shall serve as an alarm activating an amber signal or pilot light visible to control stations when motor temperatures become excessive. Establish set point below the Class B insulation temperature limit. Thermal-sensitive device and associated circuits shall be self-restoring (automatic reset). Two-speed, two-winding motors with a solid-state control are not allowed for creep-speed use.

2.4.4.2 Gantry and Trolley Drive Motors

Provide [ac crane type] [dc industrial type] [800 Series dc mill type] [[single-speed; single-winding] [two-speed; two-winding]] [NEMA design B squirrel cage ac type rated] [wound rotor ac induction type] [ac type designed for ac adjustable frequency operation] [dc series wound type] [dc shunt-wound type] gantry and trolley drive motors.

2.4.4.3 Motor Enclosures

****

NOTE: Applicable to 1 or 2 speed ac magnetic control of ac squirrel cage motor. If it is not desirable to have the motor immediately reverse direction, include sentence on plugging to allow the motor to stop prior to reversing direction. If excessive load swing cannot be tolerated during the start of the gantry or trolley, include sentence on reduced voltage starting.

a. Select drip-proof enclosure for indoor usage, except in a hazardous atmosphere.

b. Select totally enclosed nonventilated enclosure for outdoor use and indoor use in a hazardous atmosphere.

c. Select totally enclosed fan cooled enclosure for motors operating at rated speed for long periods.

d. Select forced ventilated enclosure for Class E service.

****

Provide motor enclosures which are [totally enclosed, non-ventilated (TENV)] [totally enclosed, fan cooled (TECH)] [totally enclosed, air-over frame (TAO)] [drip-proof] [drip-proof forced ventilation] conforming to NEMA 250.

2.4.4.4 Motor Insulation and Time Rating

****

NOTE: For gantry and trolley motors, select Class F or H insulation based on rated temperature rise of 105 (Class F)/125 (Class H) degrees C by resistance above a 40 degree C ambient for CMAA Class A, B, C cranes and CMAA 74 cranes with ac or dc magnetic control and electrical control braking.

For gantry and trolley motors, select Class F insulation for Duty Class H1, H2, and H3 hoists and CMAA 70 Class A, B, C cranes and CMAA 74 cranes with ac or dc magnetic control.

For all motors, select Class F or H insulation with a rated temperature rise of 105 (Class F)/125 (Class H) degrees C by resistance above a 40 degree C ambient for CMAA 70 Class A, B, C and CMAA 74 cranes with ac or dc static controls.

For all motors, select Class F or H insulation based on a rated temperature rise of 105 (Class F)/125 (Class H) degrees C by resistance above a 40 degree C ambient for CMAA 70 Class D and E cranes.

Delete frame size selection if not needed for the project.

****

Provide motors with [Class F] [Class H] rated insulation based on an [105] [125] degree C motor temperature rise above 40 degrees C ambient, with frame size selection based on continuous ratings.

[2.4.4.5 Micro-Motors

Micro-motors for gantry [and trolley] drives shall be [direct current industrial type, shunt wound motors] [industrial type, single-speed; single-winding; ac squirrel cage motor] and conform to the requirements of NEMA MG 1. Provide totally enclosed micro-motor , fan cooled (TEFC), with Class F or H insulation. Motor voltage rating shall comply with system supply voltage rating specified.

]2.4.5 Electric Hydraulic Brakes

[2.4.5.1 Travel Brakes

****

NOTE: Delete this paragraph if hydraulic braking system is not required.

If electric brakes are used, provide a drift point so the brakes will release after the motor is de-energized, thereby allowing the motion to coast and reduce swing of the load. A drift point can also allow the trolley to center itself over the load before actually starting to lift.

For pendant control cranes and cab controlled cranes where hydraulic braking is not desired, select spring-applied electrically-released brakes.

For cab operated cranes, specify electric-hydraulic brakes for gantry or trolley brakes except in the case of constant speed/speed regulated (at a particular controller setting) type controls.

Limit electric-hydraulic brakes to ac magnetic or secondary saturable reactor and dc magnetic controls

for ac wound rotor motors and dc series/compound wound motors respectively. Limit electric-hydraulic brakes to gantry brakes on gantry mounted cabs and trolley brakes for trolley mounted cabs.

Do not specify electric-hydraulic brakes for the following:

a. Single and multi-speed magnetic control of squirrel cage motors.

b. Alternating current adjustable frequency control of squirrel cage motors.

c. Direct current variable voltage control of shunt wound ac motors.

****

Provide electric-hydraulic [gantry][trolley] brakes which are dc shunt magnet type equipped with hydraulic actuators manually-operated with a foot-operated master control unit in the operator's cab, and electrically released with the operation of the mainline contactor POWER-OFF pushbutton or power failure. Provide remote control bleeders operable by pushbutton and foot pedal except for power-assisted brake systems. Remote control bleeders shall be complete with pushbutton clearly labeled and located in operator's cab where the operator can easily depress the pushbutton and pump the brake simultaneously. In lieu of the combination electric-hydraulic brakes, separate hydraulic and electric brakes may be provided. Design hydraulic brake system to ensure equal pressure at each brake cylinder.

][2.4.5.2 Hoist Brake Time Delay

****

NOTE: Delete this paragraph if one brake is specified.

****

Provide one of the hoist holding brakes with a time-delay setting (from 1 to 3 seconds). Initiate the time-delay upon releasing the control pushbutton or returning the master switch to OFF. Operation of mainline POWER-OFF pushbutton or power failure shall result in each hoist brake's setting without any time-delay.

]2.4.5.3 Automatic Stop System

Provide fail-safe spring set electrically-controlled brakes when power is interrupted. Release brakes with a mainline contactor POWER-OFF pushbutton or a master switch for the associated drive. Brakes shall automatically stop when there is a power failure. Design electric system to be mechanically released. Provide enclosures for electrical-controlled brake components conforming to NEMA ICS 6 Type [_____]. Provide direct current shunt magnetic shoe brakes with an electrical forcing circuit for rapid release of brake. Circuit each shunt coil brake for both conductors to open simultaneously when the brake is de-energized.

2.4.6 Controls

2.4.6.1 Control Panels

****

NOTE: Control panel heaters are desirable for outdoor cranes, unheated warehouse service cranes or any other condensing high-humidity application.

Alternating current or dc static crane control for outdoor cranes need thermostatically-controlled panel heaters for outdoor panels or any other application which is colder than 0 degrees C. Alternating current or dc static crane control may need both thermostatic control and mainline contactor control.

****

Fabricate control panels of solid sheet steel designed and constructed to conform to requirements of NEMA ICS 6 Type [_____]. [Provide thermostatically-controlled heaters to keep control enclosure temperatures at or above 0 degrees C in each static crane control panel.][Control panel heaters shall be energized when mainline contactor is de-energized, and be de-energized when mainline contactor is energized to prevent anti-condensation.]Hinge and equip control panel doors with gaskets and fitted with key-lock handle design, complete with a single key to open all locks. Provide a non-resettable hour meter, connected across the main line contactor, readable from the exterior of the main control panel, to indicate the elapsed number of hours the crane is energized.

2.4.6.2 Drift Point

****

NOTE: Provide gantry and trolley directions normally oriented to main compass headings.

Select method of festoon suspension. For multiple girder cranes select underneath footwalk and for single girder cranes select auxiliary girder. If a hoist thermal sensor is specified, include requirement for yellow pilot light. If a micro-drive is specified, include the sentence, "A 2-position [_____]."

Pendant handles are required only if pendant is in an explosion area. Monorail cranes do not require an independent track for pendants.

****

Provide trolley and gantry main control systems with a drift point between OFF and first speed control point in each direction or have a separate pushbutton.

[2.4.6.3 Micro-Drive Motor and Clutch Control

Design micro-drive system such that when micro-drive is selected at control station, all main motors are disconnected, and all micro-drive clutches energized. Operation of micro-drive motors shall be from crane control station. Provide micro-motor control systems with single-speed in

each direction by means of an electrically-operated, full-magnetic, [reduced][full] voltage type starter. Do not apply power to any micro-motor unless all clutches are fully engaged. If a clutch disengages during operation of micro-motors, the mainline contactors shall open and all brakes shall set. Prevent application of power to any main motor with any clutch engaged. Provide a transfer switch at crane control station to allow transfer from either mode of operation to the other only when all brakes have been set for not less than 5 seconds. Provide a single CLUTCH-ENGAGED green pilot light [at the pendant station][in the cab] when all clutches are energized; also provide individual CLUTCH ENGAGED pilot lights on drive control panels.

][2.4.7 Cab Control Station

****
NOTE: Delete this and the following four paragraphs if a cab is not required.
****

2.4.7.1 General

****
NOTE: Provide gantry and trolley directions normally oriented to main compass headings. If stepped speeds and/or drift point are specified, include the applicable requirements in this paragraph. Delete auxiliary hoist switch if not necessary for the project.
****

Accomplish crane control by a [gantry-mounted][trolley-mounted] cab control. Provide spring-return to "OFF" for master switch operating handles, with [distinct drift point detents,][distinct speed-point intents,] and OFF position latching. Provide NEMA Type 1 master switch enclosures. Provide POWER-OFF pushbutton with a red mushroom head and a green or black POWER-ON pushbutton. Provide the following cab master switches:

a. Main Hoist - up/down.

[b. Aux Hoist - up/down.

] c. Gantry - [_____] [_____].

d. Trolley - [_____] [_____].

e. POWER-OFF.

f. POWER-ON.

2.4.7.2 Cab Indications

****
NOTE: If hoist thermal sensor is specified, include requirement for red light. Voltmeter applicable to dc control systems only. If rail clamps are specified, include sentence regarding rail clamp operation and indication. If flood lighting is specified, include requirement for toggle switch.

****

Provide red pilot lights to indicate excessive hoist motor temperature. Provide a white pilot light to indicate that power is available on load side of crane disconnect switch. Provide a blue pilot light to indicate that the main contactor is energized.[Supply a minus 300 to plus 300 Dc voltmeter to monitor the main rectifier output voltage, and provide a selector switch to select the voltage to be monitored.][Provide a red pilot light to indicate the rail clamps are set.][Provide a single-toggle switch to operate crane floodlights.][Provide a single green pilot to indicate all micro-drive clutches are engaged.]

[2.4.7.3 Cab Controls

****

NOTE: Delete this paragraph if combination controls (cab and pendant or cab and radio control) are not used. If it is desirable to raise the pendant out of the way, include the last sentence. Otherwise, delete.

****

Provide cab with a 2-position key-operated switch to allow transfer of control from cab to [pendant][radio control] station and a red pilot light mounted in cab to indicate that the control has been transferred to other station. Selection of one operating station shall lock out the controls of other stations.[Also provide a 2-position switch to raise and lower the pendant station.]

][2.4.7.4 Cab Heating & Ventilating [& Air-Conditioning]

****

NOTE: If heating or air conditioning of the cab is required, edit this paragraph to specify design requirements; otherwise delete this paragraph. Refer to UFC 3-400-02, "Design: Engineering Weather Data" ambient temperatures for cab heating and air conditioning.

****

Provide thermally-insulated cab with [air-conditioner][and electric heater]. Provide a filter unit to pressurize the cab with filtered outside air. Provide air filter which is a standard commercial type capable of removing airborne dust and located where it can be readily cleaned or changed. Provide adjustable thermostat to control [air conditioner][with][heater]. The unit shall meet the Energy Efficient requirements of ASHRAE 90.1 - SI ASHRAE 90.1 - IP. Keep the cab interior at 18 degrees C 65 degrees F in winter with [_____] degrees C F ambient temperature and [_____] degrees C F in summer with [_____] degrees C F dry bulb and [_____] degrees C F wet-bulb ambient temperatures. Provide corrosion-resistant material or protection against corrosion for all other hardware and components. Mount motor compressor assembly on vibration isolators.

]][2.4.8 Pendant Control Station

****

NOTE: Delete the following paragraphs if pendant control is not specified. If the crane is higher

than 18 m 60 feet above the operating floor and the span is greater than 15 m 50 feet, consider including a pendant drive for ease of movement of the pendant if it is not towed by the trolley; otherwise delete this paragraph. Pendant drive speed should be the same as the trolley.
****

[2.4.8.1 General

Provide NEMA Type [1] [3R] [7] [9] [12] pendant control station. Hold physical size of pendant to a minimum. Provide a separate cable of corrosion-resistant chain consisting of minimum 6.4 mm 1/8 inch wire. Attach pendant station to [underside of crane gantry footwalk][an auxiliary girder] and hang vertically with bottom of pendant at 1 m 40 inches above floor. Do not support weight of pendant by control cable.

]2.4.8.2 Operating Pushbuttons

****
NOTE: Provide gantry and trolley directions normally oriented to main compass headings. Select method of festoon suspension: For multiple girder cranes select underneath footwalk and for single-girder cranes select auxiliary girder. If a hoist thermal sensor is specified, include requirement for yellow pilot light.
****

Provide heavy-duty, dust-and-oil-tight type operating pushbuttons with distinctly-felt operating positions which meet requirements of NEMA ICS 2. Pendant control buttons shall be momentary pushbuttons. Provide recessed type pushbuttons (except the POWER-OFF button) to avoid accidental operation. Make diameter of buttons a size which will make operation possible with a thumb while holding the pendant with same hand. Provide nameplates adjacent to each pushbutton. Provide barriers on pendant between various pushbutton functions, except on elements mounted in junction box. In a multi-speed application, provide dual-position pushbuttons that have a definite click-detent position for each speed. Design and manufacture pushbuttons not to hang up in control case. Include with the pendant a separate set of pushbuttons for each motion and for POWER-ON POWER-OFF. Provide the following pushbuttons:

POWER-OFF.

POWER-ON.

Hoist-up.

Hoist-down.

[Gantry]-[_____].

[Gantry]-[_____].

Trolley-[_____].

Trolley-[_____].

2.4.8.3 Light Indicators

****
NOTE: Coordinate requirement for pilot lights and selector switches. Delete micro-drive if not applicable.
****

Provide pilot lights meeting heavy-duty requirements of NEMA ICS 5. Provide one red pilot light to indicate excessive hoist motor temperature on pendant station. Provide a blue pilot light to indicate that the main contactor is energized, and a white pilot light to indicate that power is available on the load side of crane disconnect switch. Provide a bright red mushroom head for the POWER-OFF pushbutton. Provide a 2-position selector switch to select between normal and micro-drive.[Provide a single green pilot light to indicate all [micro-drive]clutches are engaged.]

[2.4.8.4 Pendant Drive Control

****
NOTE: If the crane is higher than 18 meters 60 feet above the operating floor and the span is greater than 15 meters 50 feet, consider including a pendant drive for ease of movement of the pendant if it is not towed by the trolley; otherwise delete this paragraph. Pendant drive speed should be the same as the trolley.
****

Provide a 3-position momentary contact spring-return to OFF toggle switch to control the motorized trolley for pendant.

][2.4.8.5 Transfer of Control Stations

Provide pendant with a green pilot light to indicate that control has been transferred to pendant station from cab with key lock-out.

]][2.4.9 Radio Remote Control, Infrared Remote Control

****
NOTE: Include this and the following paragraph if radio remote control or infrared remote control is desired; otherwise delete.
****

2.4.9.1 General

Equip crane with a complete digital radio remote-control system to permit full control of crane from a portable wireless transmitter. Provide a system which is the use-proven product of a manufacturer regularly engaged in design and manufacture of crane radio remote-control systems. Provide a "fail-safe" designed system so that the failure of any component or loss of signal will cause all crane motors to stop. The system shall permit complete, independent and simultaneous operation of all crane functions.[Set system frequency in the 72MHz-76MHz band.][Frequencies shall conform to FCC Part 15.] Include transfer relays in receiver if crane is also cab or pendant controlled.

2.4.9.2 Transmitter

****
NOTE: Provide gantry and trolley directions normally oriented to main compass headings.
****

Provide portable transmitter complete with an adjustable belt or harness. Crane motion switches shall spring-return to OFF. Provide transmitter with two spare batteries and battery charger to permit continuous operation. Provide a key-lock with the key removable in the OFF position only to control transmitter operation. Provide a blue signal light mounted on crane visible from floor to indicate the main contactor is energized. Make POWER-OFF toggle-switch bright red. Provide the transmitter with the following controls:

Hoist-up/down.

Gantry-[_____].

Trolley-[_____].

POWER-ON.

POWER-OFF.

]2.4.10 Protection

2.4.10.1 Main Line Disconnect

Provide a main line disconnect consisting of a combination circuit breaker (50,000 AIC) and non-reversing starter, starter without overloads (mainline contactor) in NEMA Type [_____] enclosure. Control circuit of mainline disconnect shall cause all crane motions to stop upon mainline undervoltage, overload, control circuit fuse failure, or operation of POWER OFF pushbutton. Equip mainline disconnect with energy isolating devices designed to accept lockout devices.

2.4.10.2 Isolation Transformer

****
NOTE: Specify an isolation transformer and surge protection to protect electronics from external faults. Recommended for dc static control systems. Applicable to ac power supplied systems only.
****

Provide an SCR drive type isolation transformer specifically designed for cranes, with a continuous rating which will exceed that required of the sum of rated full-load full-speed KVA of hoist plus 50 percent of rated full-load full-speed KVA of trolley and gantry motors plus the rated KVA of controls. Multiply the total KVA by 1.05 (efficiency factor). Connect the isolation transformer to the load side of mainline disconnect of the transformer. Supply crane dc static control electric power distributed on the crane through this isolation transformer.

2.4.10.3 Surge Protection

Provide surge suppressors meeting the requirements of UL 1449. Provide

three metal oxide varistors on the line side of each SCR drive isolation transformer to provide transient over-voltage protection.

2.4.10.4 Circuit Breakers

Provide circuit breakers meeting the requirements of UL 489.

2.4.10.5 Overloads

****
NOTE: Select applicable overload protection based on control circuit type.
****

[Provide alternating current circuit overload relays of the ambient compensated, automatic reset, inverse time type located in all phases individual motor circuits. Arrange overload relays to de-energize the associated motor on an overload condition.] [Provide an automatically reset inverse time-trip running overload relay for each dc motor circuit. Provide an automatically reset instantaneous trip overload relay in each dc motor circuit or for a pair of series-connected motors. Arrange overload relays to de-energize the associated motor on an overload condition.] [Alternating current adjustable frequency-control motor overload-protection shall be electronic and protected by inverse time and current versus output frequency which will allow less current for a given amount of running time when frequency (speed) is lower than rated.] [Provide electronic direct current variable voltage control motor overload-protection.]

2.4.11 Limit-Switches

****
NOTE: Delete reference to micro-drive control system if not applicable.
****

Provide heavy-duty quick-break double-pole double-throw type gear limit switches conforming to NEMA ICS 2. The geared limit-switch interruption of a motion in one direction shall not prevent the opposite motion. Geared limit-switches shall reset automatically. Provide NEMA Type [1] [4] limit switch housings. Provide limit-switches to interrupt power to the primary [and micro-drive]control systems. Provide a geared limit switch to limit upward travel at an upper limit and a geared limit switch to limit downward travel at a lower limit. Provide also a block activated mechanical limit switch that removes power from the brake, motor and control drive simultaneously.

2.4.11.1 Gantry and Trolley Travel Limit-Switches

Provide runway (track-type) limit-switches for crane gantry and trolley motions to stop the gantry and trolley motions, respectively. Install limit-switch actuators on building and trolley frame to actuate the limit-switches and stop the crane gantry or trolley prior to contacting the trolley frame bumpers. Locate trip mechanism for trolley motion on crane runway to trip the switch before the bumper contacts the stop. Locate trip mechanism for gantry motion on crane runway to trip switch before bumper contacts the stop. When the switch is tripped, permit the switch opposite travel in the direction of stop and to automatically reset.

[2.4.11.2 Rail Clamp Limit-Switches

****
NOTE: Include paragraph for outdoor cranes; otherwise delete. Delete reference to micro-drive when not applicable.
****

When rail clamps are set, furnish each rail clamp with a limit-switch designed to interrupt the primary [and micro-drive]control circuits to gantry drive. Provide a red pilot light at control station to indicate the rail clamps are set.

]2.4.12 Wiring

Perform wiring complying with Article 610 of NFPA 70. Number or tag wires at connection points. Make all splices in boxes or panels on terminals boards or standoff insulators. Base motor loop, branch circuit and brake conductor selection on NFPA 70 for 90 degrees C 194 degrees F conductor rating on indoor cranes, and for 75 degrees C 164 degrees F conductor rating on outdoor cranes. Provide Type SRML conductors in the vicinity of resistors and conductors connected to resistors.

2.4.13 Electrification

2.4.13.1 Main Power Electrification

Main power electrification system shall provide power to crane starter/disconnect circuit breaker.

2.4.13.2 Crane Runway Conductors

****
NOTE: Select covered conductor bar system for:

a. Indoor non-hazardous service
b. Outdoor non-corrosive environment

Select festoon system for:

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

[Provide covered conductor bar type crane runway conductor system designed and manufactured to meet UL requirements. Provide rigid or flexible self-closing type protective cover designed to cover all live conductors and shaped to prevent accidental contact with conductors. Provide heavy-duty sliding shoe type collectors compatible with the electrification system. Provide two tandem designed collector heads for each conductor rail to provide redundancy.] [Provide festooned type crane runway conductor system consisting of a support rail, cables, junction boxes, cable cars and accessories. Hardware shall be corrosion-resistant or protected against corrosion. Festoon storage area shall not restrict the crane travel at the ends of runway.]

2.4.13.3 Gantry Span Conductors

Provide[festooned type consisting of a support rail, electrical cables,

junction boxes, cable cars and accessories][rigid conductor/collector type located within enclosure] gantry span conductor system. Do not allow cable loops to drop below the hook high position. Furnish corrosion resistant, outdoor crane gantry festoon, system hardware.

[2.4.13.4 Pendant Festoon System

****
NOTE: The pendant festoon system is an option to the Designer.
****

Provide pendant festoon system consisting of a support rail, cables, junction boxes, cable cars and accessories. Do not allow cable loops to drop below the hook high position. Provide pendant control car with NEMA Type [1] [3R] [12] junction box. Pendant festoon shall be[towed by trolley][independent of trolley motion]. Furnish corrosion resistant, outdoor crane, pendant festoon system hardware.

][2.4.13.5 Pendant Drive System

Provide pendant festoon system with a motor-drive system capable of driving the pendant control car at [_____] m/s fpm. Control of pendant motor drive shall be from the pendant.

][2.4.13.6 Pendant Retraction System

****
NOTE: Select method of pendant retraction if specified; otherwise delete paragraph.
****

[Provide pendant control car with an electric-powered cable reel so that the pendant station will retract fully.][Provide a wire-rope hoist to hoist the pendant station. Pendant and pendant drop-cable shall be retractable to approximately 1/3 of drop cable length.]Control retraction system from cab.

]2.4.14 Special Requirements

2.4.14.1 Warning Horn

****
NOTE: Delete last sentence if not applicable to project.
****

Provide a solid-state electronic warning horn on the crane. Accompany any gantry or trolley motion by a continuous series of alternating tones.[The warning horn shall not sound when the crane is in the micro-drive mode.]

2.4.14.2 Accessory Power

****
NOTE: If lighting, motor or control cabinet heaters or receptacles are specified, include the following paragraph if 460 volt ac is the power source. Select the components requiring power.

****

Use three-phase 208Y/120 volt ac power supplied via a circuit breaker and isolation transformer from the line side of the main line disconnect for [lighting,] [heaters,] [and accessory circuits] on the crane. Provide the circuit breaker with a NEMA Type [1] [3R] [12] enclosure. The enclosure shall have provisions to lock the breaker in the OFF position. Provide each circuit breaker pole with individual thermal and magnetic trip elements and the enclosure cover with a button for mechanically tripping the circuit breaker. Supply three-phase 480 volt delta primary and 208Y/120 volt wye secondary general lighting transformer from the accessory circuit breaker and feed a 208Y/120 volt UL listed circuit breaker panelboard and a heater circuit breaker/combination starter. Provide a panelboard to supply branch circuits for utilization of various accessories such as [receptacles,] [lighting,] [panel internal lighting,] [motor heaters and control enclosure which meets NEMA requirements]. Transformer and panelboard shall have the same NEMA classification as the circuit breaker.

2.4.14.3 Receptacles

****

NOTE: Specify receptacles for multiple girder cranes. Specify ground fault protection for outside cranes. Delete requirement for receptacle in cab when not applicable.

****

Provide single-phase, 120-volt 15-amp, grounded, duplex type receptacles complete with metal weather-proof enclosure with self-closing weatherproof receptacle cover. Provide a receptacle on the trolley at each end of the front gantry walkway in the vicinity of gantry travel drive motors and in the cab. Provide several receptacles in the vicinity of the control equipment equally spaced every 3 m 10 feet. Breakers used to protect circuits supplying the receptacles for outside cranes shall incorporate ground fault current interruption feature and meet the requirements of UL 943.

2.4.14.4 Lighting

****

NOTE: Specify lighting for outdoor cranes or in dimly lighted areas.

****

Provide control panels with a 120-volt lamp fixture with an unbreakable lens and switch. Provide floodlights to illuminate the work area under the crane and drum area on crane, controlled from crane control station. Provide metal halide industrial floodlight luminaries. Totally enclose each floodlight, vapor-tight design, gasketed and provided with a heat-resistant and impact-resistant glass lens. Space and attach floodlights to underside of crane to provide uniform lighting.

[2.4.14.5 Anti-Condensation Heaters

****

NOTE: Motor heaters recommended for outdoor cranes, unheated warehouse service cranes or any other condensing high-humidity application; if not desired

delete this paragraph. Thermostatically-controlled heaters is a designer option.
****

Equip motor and control panels with anti-condensation heaters. Provide thermostatically-controlled heaters in each static-control panel to keep control enclosure temperatures at or above 0 degrees C. Provide NEMA Type [1] [3R] [12] enclosure for circuit breaker combination magnetic starter. Equip magnetic starter with manually-reset overload relays and interlock with the mainline disconnect so that anti-condensation heaters are de-energized when the mainline contactor is energized and the magnetic starter is energized when the mainline contactor is de-energized.

][2.4.14.6 Wind Indication and Alarm

****
NOTE: Specify location of wind alarm station for outdoor cranes, normally mounted near center of the gantry. Provide location of cutout. Delete paragraph if not applicable.
****

Provide a wind-indicating device with an adjustable alarm trip point. Provide alarm trip with time-delay for wind gusts. Adjustable trip shall actuate an oscillating blue light and bell mounted near [_____]. Provide ability to cut off bell alarm from the[pendant station][cab].

][2.4.14.7 Electrically-Driven Oil Pump Alarm

****
NOTE: Delete this paragraph for equipment which does not contain an oil pump.
****

Provide electrically -driven lubricating pump complete with an audible alarm and red light for indication of pump malfunction. Make location of alarm the factory standard location.

]2.4.15 Load-Limit System

****
NOTE: Specify load sensing if loads approaching the capacity of the crane are to be lifted routinely.
****

Provide a load-limit visual/audible system for the main hoist to inform the operator that the preset load has been exceeded. Provide a load-limit system consisting of a load-cell, load-sensing electronics, overload indicator lights, overload alarm bell and alarm cut-out switch. Mount load cell to receive the load from equalizing sheave pin or upper block sheave pin. The alarm setpoint shall be adjustable.

2.4.15.1 Load-Sensing Electronics

Provide NEMA Type [1] [3R] [12] enclosures for load sensing electronics. Alarm setpoint shall be adjustable.

2.4.15.2 Alarm and Indicator Light

Provide an overload alarm light to indicate a load greater than the preset maximum. Indicate overload alarm with a red light and clearly labeled "OVERLOAD". Also provide a bell to indicate when an overload condition exists. Make provisions to turn off the bell from[pendant station][cab] [_____].

2.4.16 Fungus Resistance

****
NOTE: Specify fungus resistance for cranes in marine or humid environments.
****

Coat electrical connections such as terminal connections, circuit connections, components and circuit elements with fungus-resistant varnish. Do not treat components and elements which are inherently inert to fungi or hermetically sealed. Do not treat elements whose operation will be adversely affected with the application of varnish.

2.5 ELECTROMAGNETIC INTERFERENCE SUPPRESSION

****
NOTE: Specify EMI suppression if electro-magnetic interference from the crane may be a problem to sensitive electronics in the work area.
****

2.5.1 Shielded Cable

Provide shielded type pendant and festooned cables of braided tinned-copper. Ground each cable shielding with a single connection to equipment grounding conductor.

2.5.2 EMI/RFI Shielded Boxes

2.5.2.1 General

Boxes designed to house electronic and electrical control equipment, instruments, metering equipment, etc., in installations where electromagnetic compatibility and/or system security is required shall protect interior components from stray radio frequency (RF) fields and contain RF signals produced by interior components.

2.5.2.2 Construction

Design Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) shielded boxes to meet UL 50 Type 12 and Type 13. Construct the shielded boxes of [1.519] [1.897] mm [16] [14] gauge steel with seams continuously welded and ground smooth, without holes and knockouts. Cover gasket shall be a combination of woven plated steel mesh and oil-resistant gasket which will provide an EMI/RFI seal as well as an oil-tight, dust-tight and water-tight seal between cover and body. Attach gasket to cover with oil-resistant adhesive. Provide stainless steel cover clamps and screws which are quick and easy to operate on three sides of hinged cover for positive clamping.

2.5.2.3 Attenuation

Design EMI/RFI shielded boxes to provide maximum shielding of electric and magnetic components of radiated RF energy. Provide RF filters to suppress conducted radio frequency in cables and conductors. Provide shielded boxes with attenuation greater than 60 db at 14.5 KHz to greater than 100 db at 1 MHz for magnetic fields and greater than 100 db from 14.5 KHz to 430 MHz for electric fields.

2.5.2.4 Finish

Provide zinc-plated EMI/RFI shielded boxes in accordance with ASTM B633 SC3/Type II to provide corrosion-resistant conductive surfaces for gasket contact area and conduit entries. Match the finish coat with the crane finish.

[2.5.3 Hoist Drum Grounding

****
NOTE: A grounding drum is required for non-sparking environment only (general nuclear or explosive).
****

Provide a copper ring/collector assembly to ground each drum. Provide electrically-bonded ring to drum. Collector shall be stationary and connected to equipment grounding conductor system with a No. 8 AWG copper wire.

]PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, and before performing any work, verify all dimensions in the field and submit a letter describing the results of this verification including discrepancies to the Contracting Officer and crane manufacturer. The Contractor is responsible for the coordination and proper relation of the contracted work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

3.2 ERECTION

Perform the entire crane erection in accordance with manufacturer's instructions under the full-time supervision of the manufacturer's representative. Provide a written certificate from crane manufacturer indicating the crane is erected in accordance with manufacturer's recommendations before testing the completed installation.

3.2.1 Shop Assembly

Shop assemble major crane components as completely as possible. Match mark disassembled parts and tag electrical connections after complete no-load shop testing. Protect all parts and equipment at site from weather, damage, abuse and loss of identification. Erection procedures shall ensure that the crane is erected without initial stresses, forced or improvised fits, misalignments, nicks of high-strength structural steel components, stress-raising welds and rough burrs. Clean and repaint

damaged surfaces after crane is erected. Provide all necessary grease and oil of approved quality and grade for the initial servicing and field test.

3.2.2 Mechanical Alignment

Align motors, couplings, brakes, gear boxes and drive components when reinstalled in accordance with manufacturer's instructions.

3.2.3 Electrical Alignment

Align control system in accordance with manufacturer's instructions. Store a copy of the final alignment data in control panel door, including but not limited to, timer settings, resistor tap settings, potentiometer settings, test-point voltages, supply voltages, motor voltages, motor currents and test conditions such as ambient temperature, motor load, date performed and person performing the alignment.

3.2.4 Welding

Qualify or pre-qualify welders, welding operations and welding procedures in accordance with AWS D14.1/D14.1M. Perform welding indoors. Surface of parts to be welded shall be free from rust, scale, paint, grease or other foreign matter. Minimum preheat and interpass temperatures shall conform to the requirements of AWS D14.1/D14.1M. Perform welding in accordance with written procedures which specify the Contractor's standard dimensional tolerances for deviation from camber and sweep. Such tolerances shall not exceed those specified in accordance with AWS D14.1/D14.1M. Allowable stress ranges shall be in accordance with CMAA 70. Perform welding of girders and beams conforming to AWS D14.1/D14.1M.

3.2.5 Field Painting

****

NOTE: The last sentence will only be required if the gantry crane is in an explosion proof area.

****

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the facility, shall conform to SSPC SP 6/NACE No.3 and as specified in Section 09 90 00 PAINTS AND COATINGS. Paint gantry crane including gantry, trolley, hoist and all attached items in accordance with the manufacturer's standard practice. Paint the complete crane of one color. Paint gantry rail, supports and bracing in accordance with Section 09 90 00 PAINTS AND COATINGS. **Do not paint** items such as surfaces in contact with the rail wheels, wheel tread, hooks, wire rope, surfaces on the electrical collector bars in contact with the collector shoes and nameplates.[Coordinate the requirements of explosion proof cables with cable manufacturer.]

3.3 ACCEPTANCE TESTING

3.3.1 General

****

NOTE: This paragraph applies to new construction only. Specify the test weights required. The weights normally required are the rated load, 125 percent of the rated load and 10 percent of the

rated load (for the grounding and the acceleration/deceleration test).
****

Provide all personnel necessary to conduct the required testing, including but not limited to, crane operators, riggers, rigging gear and test weights. Perform testing in the presence of Contracting Officer or his designated representative. Notify the Contracting Officer [_____] days prior to testing operations. Operate all equipment and make all necessary corrections and adjustments prior to the testing operations witnessed by Contracting Officer. A representative of the Contractor responsible for procuring and installing hoist equipment shall be present to direct the field testing. Use compact test loads and permit a minimum of 50 percent of vertical lift. Test loads shall be minus 0 percent to plus 5 percent of the required weight, and be verified prior to testing. Test weights required are [_____], [_____] and [_____] kg [_____], [_____] and [_____] pounds. Do not perform operational testing until after building interior has been painted. Furnish [three] [_____] copies of all test reports to Contracting Officer.

3.3.1.1 Test Sequence

Test crane in accordance with applicable paragraphs of this procedure in the sequence provided. Verify clearance envelope is clear to ensure there are no interferences.

3.3.1.2 Test Data

Record operating and startup current measurements for coils, hoist, trolley, and gantry motors using the appropriate instrumentation. Record speed measurements as required by facility evaluation tests (normally at 100 percent load). Compare recorded values with design specifications or manufacturer's recommended values. Abnormal differences shall be justified in the remarks and appropriate adjustments performed. Note any high temperatures or abnormal operation of any equipment or machinery, investigate and correct. Record hoist, trolley and gantry speeds during each test cycle.

3.3.1.3 Equipment Monitoring

Monitor improper operation or poor condition of safety devices, electrical components, mechanical equipment and structural assemblies during the load test. Report defects observed to be critical during the testing period immediately to the Contracting Officer and suspend the testing operations until the defects are corrected. During each load test and immediately following each load test, make the following inspections:

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. Test all safety devices including emergency stop switches and POWER-OFF pushbuttons and inspect separately to verify proper operation of the brakes. When provided, inspect all safety accessories including warning horn, lighting, gauges, warning lights and accuracy of wind indicating device and alarm.

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

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

f. Check electrical drive components for proper operation, freedom from chatter, noise, overheating, and lockout/tag-out devices for energy isolation.

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

h. Verify that locations of crane capacity plates are visible from pendant operator's position.

[3.3.2 Trolley Travel

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NOTE: Delete references to micro-drive when not applicable.
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Operate trolley the full distance of gantry rails exercising all primary drive [and micro-drive]speed controls in each direction. Verify brake operation in each direction. In slow speed [or micro-drive,]trolley bumpers shall contact trolley stops located on the gantry girders. In slow speed, test the proper operation (interrupt power, automatic reset) of the trolley limit-switches at both limits of trolley motion.

]3.3.3 Gantry Travel

****
NOTE: Delete references to micro-drive when not applicable.
****

Operate gantry in each direction the full distance of runway exercising all primary drive [and micro-drive]speed controls. Verify brake operation in each direction.[In slow speed the proper operation (interrupt power, automatic reset) of the gantry, test limit-switches at both limits of gantry motion.] In slow speed [or micro-drive]the crane gantry bumpers shall contact the runway rail stops.

3.3.4 Gantry Crane Tests

3.3.4.1 Dynamic Load Tests

a. Trolley Dynamic Load Test: While operating the trolley the full distance of gantry rails in each direction with test load on the hook (one cycle), test proper functioning of all primary drive and micro-drive speed control points and proper brake action.

b. Gantry Dynamic Load Test: With test load on hook, operate gantry for the full length of runway in both directions with trolley at each extreme end of gantry. Verify proper functioning of all primary drive and micro-drive speed control points and brake action. Binding of the gantry end trucks indicates a malfunction requiring adjustment.

3.3.4.2 Trolley and Gantry Loss of Power Test

A test load of 100 to 105 percent of rated load shall be raised clear of any obstructions on operating floor. Starting at a safe distance from walls or other obstructions, select a slow speed using the trolley and gantry primary drive. While maintaining a safe distance to obstructions, disconnect the main power source and verify brakes have set and that the equipment stops within the distance recommended by manufacturer.

3.3.5 Overload Tests

After the operational tests, test gantry crane system and all functions of gantry crane at 125 percent of rated load. With the trolley in the center of the bridge span, raise the test load approximately 1 foot and hold the load for 10 minutes. Verify the load does not move. Verify the girder deflection is within specifications.

3.3.6 Acceleration and Deceleration Tests

Test the acceleration and deceleration of gantry and trolley with approximately 10 percent of rated load at lowest possible location of hook. Operate gantry and trolley to run up to high speed and then stop without jarring or swinging the load.

3.3.7 Grounding Test

Test hoist to determine that the hoist, including hook and pendant, are grounded to building during all phases of hoist operation. Test the grounding of gantry and trolley with approximately 10 percent of rated load on hook. Test grounding between hoist hook and the structure's grounding system.

3.3.8 Adjustments and Repairs

Perform adjustments and repairs under the direction of the Contracting Officer at no additional cost to the Government, until satisfactory conditions are maintained, and contract compliance is affected. After adjustments are made to assure correct functioning of the components, repeat pertinent testing.

3.4 SCHEMATIC DIAGRAMS

Store schematic diagrams for equipment where indicated on drawings.

3.5 MANUFACTURER'S FIELD SERVICE REPRESENTATIVE

Furnish a qualified experienced manufacturer's field service representative to supervise the crane installation, assist in the performance of the on site testing, and instruct personnel in the operational and maintenance features of the equipment.

3.6 OPERATION AND MAINTENANCE MANUALS

Provide [six] [_____] copies of operation and [six] [_____] copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Detail in the operation manuals the step-by-step procedures required for system startup, operation and shutdown. Include the manufacturer's name, model number, parts list, and brief description of all equipment and basic operating

features. List in the maintenance manuals routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Also include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Secure approval of operation and maintenance manuals prior to the field training course.

3.7 FIELD TRAINING

Conduct a training course for the operating staff. Provide a training period consisting of a total of [_____] hours of normal working time and starting after the system is functionally completed but prior to final acceptance. Cover all pertinent points involved in operating, starting, stopping, and servicing the equipment, including all major elements of the Operation and Maintenance Manuals. Demonstrate in course instructions all routine maintenance operations such as lubrication, general inspection, and [_____]. Give Contracting Officer at least 2 weeks advance notice of field training.

3.8 FINAL ACCEPTANCE

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NOTE: Use this paragraph as written for projects where the crane is the principal construction element, or represents a very significant portion of the Contract cost. However, if the crane is part of a new facility or renovation, delete the acceptance paragraph from this section. Warranty period and operating and maintenance processes must coincide with the actual beneficial occupancy of the entire facility.

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Final acceptance of crane system will not be given until Contractor has successfully completed all testing operations, corrected all material and equipment defects, made all proper operation adjustments, and removed paint or overspray on wire rope, hook and electrical collector bars.

-- End of Section --