**********
**USACE / NAVFAC / AFCEC / NASA** | **UFGS-41 22 13.15 (April 2008)**

**Preparing Activity: NAVFAC** | **Superseding**
**UFGS-41 22 13.14 20 (April 2006)**
**UFGS 41 22 15.00 10 (April 2006)**

**UNIFIED FACILITIES GUIDE SPECIFICATIONS**

**References are in agreement with UMRL dated January 2018**
**********

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DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

SECTION 41 22 13.15

BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER RUNNING

**04/08**

-- End of Section Table of Contents --

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|---|---|
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**References are in agreement with UMRL dated January 2018**

**********

SECTION 41 22 13.15

BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER RUNNING
**04/08**

**********

**NOTE: This guide specification covers requirements for top running and under running single girder electric traveling (OET) cranes with under running trolleys and hoists, Crane Manufacturers Association of America (CMAA) 74 Class A, B and C and with capacities less than 9 metric ton 10 ton 9072 kg 20,000 pounds.**

**Single girder underrunning crane configuration is not recommended for spans greater than 40 feet or capacities greater than 20,000 lbs. See Section 41 22 13.14 BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING for double girder configurations more appropriate at longer spans and higher capacities.**

**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)**.**

**********

**********

**Use this guide specification to specify general purpose cranes that are procured as part of a building construction contract for such applications as machine shops, warehouses, and other areas that do not require specialized weight handling equipment.**

**The crane specified herein will handle loads which average 50 percent of rated capacity with 5 to 10 lifts per hour averaging 5 m 15 feet with not over 50 percent of the lifts at rated capacity. This criteria places the specified crane, per the Crane Manufacturers Association of America (CMAA) as Duty Class A - Standby or Infrequent Service; B - Light Service; or Class C - Moderate Service. Minimum requirement for Navy Crane Center is Class C.**

**NOTE: Do not use this guide specification to procure overhead electric traveling (OET) cranes of 9 metric ton 10 ton 9072 kg 20,000 pounds capacity or greater; cranes that operate in "hazardous locations" as defined in the National Electrical Code; nonstandard cranes; or cranes that handle hot (molten) metals, ordnance, or fissionable materials.**

**Forward all procurement of crane systems at Naval Shore based activities with rated capacities of 9072 kg 20,000 pounds, 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).**

**NOTE: TO DOWNLOAD UFGS GRAPHICS**

**Go to** http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf

**********

**********

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

**1. Complete details of plan, elevations, and sections of crane.**

**2. Runway track system, including span and size of girder, runway rail size, channel cap size, size and location of crane stops, and building clearances.**

**3. Electrical junction box location (including mounting height).**

**********

PART 1 GENERAL

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 in 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 2011) 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 |
| AISC 360 | (2016) Specification for Structural Steel Buildings |

AMERICAN WELDING SOCIETY (AWS)

| | |
|---|---|
| AWS D1.1/D1.1M | (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel |
| AWS D14.1/D14.1M | (2005; Amd 1 2017) Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment |

ASME INTERNATIONAL (ASME)

| | |
|---|---|
| ASME B1.1 | (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form) |
| ASME B18.2.2 | (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
| ASME B30.10 | (2014) 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-4 | (2016) Performance Standard for Overhead Electric Wire Rope Hoists |
| ASME NUM-1 | (2016) Rules for Construction of Cranes, Monorails, and Hoists with Bridge or Trolley or Hoist of the Underhung Type. |

ASTM INTERNATIONAL (ASTM)

| | |
|---|---|
| ASTM A1023/A1023M | (2015) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes |
| ASTM A194/A194M | (2017a) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both |
| ASTM A275/A275M | (2015) Standard Test Method 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 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 | (2017) 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 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 | (2017) 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 74 | (2015) Specifications for Single Girder Cranes |

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

| | |
|---|---|
| MHI MH27.1 | (2009) Specifications for Underhung Cranes and Monorail Systems |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|---|---|
| NEMA 250 | (2014) Enclosures for Electrical Equipment (1000 Volts Maximum) |
| NEMA ICS 3 | (2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC |
| NEMA ICS 6 | (1993; R 2016) Industrial Control and Systems: Enclosures |
| NEMA ICS 8 | (2011) Crane and Hoist Controllers |
| NEMA MG 1 | (2016; SUPP 2016) Motors and Generators |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---|---|
| NFPA 70 | (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code |

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 1004-1 | (2012; Reprint Aug 2017) UL Standard for Safety Rotating Electrical Machines - General Requirements |

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 parallel to the runway.

b. Crane Runway: The track system along which the crane operates horizontally, including 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 bridge. It is supported by the crane end trucks. Normally the crane trolley mounted hoist is suspended from the girder below the crane.

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

f. Patented Track: A generic term referring to track built in accordance with MHI MH27.1 utilizing a composite track section incorporating a proprietary bottom flange shape. For this crane system, it is provided for the crane bridge girder and also the crane runway track.

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. Trolley Mounted Hoist: A combined unit consisting of a wheeled trolley that provides horizontal motion along the bridge girder, and a hoist

suspended from the trolley, that provides lifting and lowering of a freely suspended load.

j. Underrunning (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.

k. Top Running Crane: An overhead electric traveling crane that is supported by end trucks which run on top of supporting rails.

1.3 REQUIREMENTS

The requirements for the crane runway and rail supporting structures are specified in Section 05 12 00, STRUCTURAL STEEL, and must conform to AISC 325.

1.4 VERIFICATION OF DIMENSIONS

The Contractor is responsible for the coordination and proper relation of his 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.

1.5 SUBMITTALS

**********

**NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.**

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

**Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability eNotebook to fulfill federally**

**mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.**

**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" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Under Running Overhead Electric Crane system; G[, [_____]]

SD-03 Product Data

Under Running Overhead Electric Crane system; G[, [_____]]

Submit data for all system components, including the following:

bridge end trucks; G[, [_____]]

hoist trolley; G[, [_____]]

crane controllers; G[, [_____]]

couplings; G[, [_____]]

[ pendant push-button station; G[, [_____]]
]
[ Radio Controls; G[, [_____]]
]
[ Inverter Duty Motors; G[, [_____]]
]
[ Crane Control Parameter Settings; G[, [_____]]
]

crane electrification; G[, [_____]]

motors; G[, [_____]]

brakes; G[, [_____]]

Crane runway track system; G[, [_____]]

Overload Protection; G[, [_____]]

Hoist Limit Switches; G[, [_____]]

SD-05 Design Data

Load and sizing calculations; G[, [_____]]

Crane bridge girder; G[, [_____]]

Crane runway track system; G[, [_____]]

Custom runway track suspension devices; G[, [_____]]

SD-06 Test Reports

Hook and hook nut magnetic particle tests; G[, [_____]]

Hook Proof Test; G[, [_____]]

Hoisting rope breaking strength; G[, [_____]]

Load Test; G[, [_____]]

No-load Test; G[, [_____]]

Post-erection inspection report; G[, [_____]]

Operational test report; G[, [_____]]

SD-07 Certificates

Brake Setting Record; G[, [_____]]

Overload Test Certificate; G[, [_____]]

Loss of Power (Panic Test) Certificate; G[, [_____]]

No Hazardous Material Certificate; G[, [_____]]

Certificate of Compliance with Listed Standards; G[, [_____]]

SD-10 Operation and Maintenance Data

Under Running Overhead Electric Crane system,including runway system,[ Data Package 4]; G[, [_____]]

Submit data package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA including weekly, monthly, semi-annual, and annual required maintenance items.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Manufacturer Qualification

Under Running Overhead Electric Crane system, including sub-system components manufactured by vendors, must 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 and conforming to [ASME B30.16] [ASME B30.17].

### 1.6.2 Pre-Delivery Inspections

Contractor is responsible for performance of quality control inspections, testing and documentation of steel castings, hook assembly and trolley as follows.

1.6.2.1 Inspection of Steel Castings

**********

**NOTE: Navy Crane Center does not require magnetic-particle testing of steel castings. For NASA projects, select both magnetic particle testing and ultrasonic testing. Magnetic testing for USACE projects should be co-coordinated with the Contracting Officer.**

**********

Visually inspect [and test ]load-carrying steel castings[ using the magnetic-particle inspection method][ using ultrasonic testing].[ Reference allowable degree of discontinuities to ASTM E125, and relationship to service loads and stresses, critical configuration, location and type.] All load bearing components, couplings, shafts, and gears, in the hoist drive train must be rolled or forged steel, except brake drums which may be ductile iron. Methods of repairing the discontinuities is subject to review by the Contracting Officer.

1.6.2.2 Inspection of Hook Assembly

Inspect hook and nut [by a magnetic-particle type inspection][ and X-rayed][and tested ultrasonically] prior to delivery. Furnish documentation of hook inspection (Hook Proof Test) to Contracting Officer prior to field operational testing. As part of the acceptance standard, linear indications[ greater than 1/16 inch] are not allowed. Welding repairs of hook are not permitted. A hook showing linear indications, damage or deformation is not acceptable and must be replaced immediately.

1.6.3 Certificates

Submit a statement that the crane can be periodically load tested to 125 percent (plus 5 minus 0) of rated load.

Also provide the following certificates:

Overload Test Certificate
Loss of Power (Panic Test) Certificate
Certificate of Compliance with Listed Standards
No Hazardous Material Certificate, stating no asbestos, lead, cadmium, chromium, PCB's, elemental mercury, or any other hazardous materials.

Submit a loss of power (panic test) certificate stating that a test may be performed in which power is removed from the crane while the hoist, bridge and trolley are in operation to simulate a loss of power.

1.6.4 Drawings: Under Running Overhead Electric Crane System

Submit shop drawings 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 bridge drives, motor nameplate data, overcurrent protective device ratings, and electrical schematic drawings. Include weights of components and maximum bridge wheel loads and spacing.

Shop drawing quality must be equivalent to the contract drawings accompanying this solicitation. Drawings must be reviewed, signed and sealed by a licensed professional engineer.

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

1.6.5 Design Data: Load and Sizing Calculations

Submit calculations verifying the sizing of the bridge girder, end trucks and travel drives. [Include seismic analysis of bridge girder and end trucks.] Calculations must be must be reviewed, signed and sealed by a licensed professional engineer.

1.6.6 Welding Qualifications and Procedure

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

1.7 CRANE SAFETY

Comply with the mandatory and advisory safety requirements of ASME B30.11, ASME B30.16, ASME HST-4, NFPA 70, 29 CFR 1910, 29 CFR 1910.147, 29 CFR 1910.179, and 29 CFR 1910.306.

[1.7.1 Nuclear Safety Analysis

**********
**NOTE: Do not use this paragraph for NAVFAC projects.**
**********

**********
**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 bridge crane certification. Delete this paragraph if the crane is not required to handle nuclear materials.**
**********

Nuclear certification, testing, and rules of construction must be in accordance with ASME NUM-1. Submit analysis and test reports to Contracting Officer for approval.

]PART 2 PRODUCTS

2.1 UNDER RUNNING CRANE SYSTEM

**********
**NOTE: Specify Class A Crane where precise handling of equipment at slow speeds with long idle periods between lifts are required. Full capacity loads may be handled for initial installation of machinery and for infrequent maintenance.**

**Specify Class B Crane where service requirements are light and speeds are slow. Loads may vary from no load to full capacity, averaging 50 percent of full capacity, with two to five lifts per hour averaging ten feet per lift. Not over 50 percent of the lifts will be at full capacity.**

**Specify Class C Crane where service requirements are moderate. Loads may vary from no load to full capacity, averaging 50 percent to full capacity, with 5 to 10 lifts per hour averaging 15 feet. Not over 50 percent of the loads will be at full capacity.**

**********

**********

**NOTE: A footwalk is recommended unless: the crane can be safely serviced by another means; or where lack of clearance would prohibit one.**

**********

Provide [top running] [under running] bridge overhead electric crane, with under running trolley mounted hoist , conforming to CMAA 74, [Class A (Standby or Infrequent Service)][Class B (Light Service)][Class C (Moderate Service)] for [indoor] [outdoor] service. Crane must be controlled by [ radio controls][a pendant push button station mounted on the hoist][a pendant on a separate festooned cable system].

All components of the crane system must comply with MHI MH27.1, Class C (Moderate Service),and CMAA 74, Class C, except as modified and supplemented in this specification section. The crane span must be [_____] feet.

Reference in publications to the "authority having jurisdiction" means the "Contracting Officer."

The crane must operate in an [indoor][ and ][outdoor] environment having an ambient temperature [range] of [_____] [to [_____]] degrees C F.

Maximum crane wheel loads (without impact) due to dead and live loads, with the trolley in any position, causing a more severe loading condition in the runway support structure than that produced by the design wheel loads and spacing indicated on the design drawings is not permitted.

2.1.1 Power Characteristics

**********

**NOTE: Coordinate thoroughly with the electrical designer to ensure that the crane power characteristics specified below agree with the crane power characteristics indicated on the drawings.**

**********

Provide crane operating from a [_____] volt AC, 60 Hz three phase power source.

2.1.2 Capacity

**********
**NOTE: Indicate on the drawings the required capacity. Coordinate with the designer to ensure that the crane capacity specified below agrees with the crane capacity indicated on the drawings.**
**********

Provide a crane with a minimum rated capacity of [_____] metric ton ton kg pounds. Mark the rated capacity in both [ metric ton][ ton] and[ kilogram][ pound] units printed in different colors on each side of the crane bridge girders. Capacity marks must be clearly legible to the operator at ground level. Individual hoist units must have their rated capacity clearly marked on their bottom block, and additionally labeled on the hoist body. Rated capacity must include all accessories below the hook, such as load bars, magnets, grabs, etc. as part of the load to be handled.

2.1.3 Speeds & Crane Control Parameter Settings

**********
**NOTE: For NAVFAC projects add the last bracketed sentence.**
**********

**********
**NOTE A: Slow full-load operating speeds invariably provide improved load control and increased productivity. The full-load speeds enclosed in brackets are recommended for most applications. However, if other speeds are required, the following guidelines are provided:**

**1. Hoist: Select hoist speed which conforms to the recommendations of CMAA 74 or ASME tables.**

**2. Trolley: Trolley travel speed must conform to the recommendations of CMAA 74.**

**3. Bridge: Bridge travel speed must not exceed the maximum speed that the floor walking, crane pendent control operator can comfortably negotiate in a work area, approximately 750 mm/s 150 ft/min, and as recommended in CMAA 74.**
**********

Provide the crane with the following rated load speeds[ plus or minus 15 percent]:

a. Hoist - rated speed of[ 6.1 meters per minute 20 feet per minute ][ [_____]meters per minute [_____] feet per minute]

b. Trolley - rated speed of[ 36.6 meters per minute 120 feet per minute][ [_____]meters per minute [_____] feet per minute]

c. Bridge - rated speed of[ 45.7 meters per minute 150 feet per minute][ [_____]meters per minute [_____] feet per minute]

**********
**NOTE: Use the following applicable sections for infinitely variable drive control.**
**********

d. Hoist - minimum speed of[ [_____]meters per minute [_____] feet per minute]

e. Trolley - minimum speed of [ [_____]meters per minute [_____] feet per minute]

f. Bridge - minimum speed of [ [_____]meters per minute [_____] feet per minute]

2.1.4 Crane Bridge

2.1.4.1 Crane Bridge Girder

Provide a patented track, in accordance with MHI MH27.1 for the crane bridge girder. The summation of all normal stresses on a girder section under analysis can not exceed the allowable stress for tension or compression as stated in CMAA 74.

2.1.4.2 Bridge End Trucks

**********
**NOTE: Use first bracketed paragraph for under running bridge. Use the second bracketed paragraph for top running bridge.**
**********

[Provide swiveling type wheel assemblies for the crane end trucks so that connections between the end truck and the wheel assemblies have rotational movement in two axes. Further, these connections must ensure contact of all end truck wheels with the runway operating (lower) flange at all times. Provide end truck wheels hardened to a minimum hardness of 375 BHN, with flat treads and side guide rollers. No hollow stamped steel wheels are permitted.]

[Provide end trucks conforming to CMAA 74.]

Configure bridge trucks with a feature that limits load movement to one inch in the event of wheel or shaft failure.

2.1.4.3 Bridge Brake

**********
**NOTE: Select "100 percent" for an outdoor crane, "50 percent" for an indoor crane.**
**********

Provide bridge drive with an electro-mechanical brake conforming to the requirements of CMAA 74, capable of stopping the motion of the bridge within a distance in feet equal to 10 percent of the full load speed in feet per minute when traveling at full speed with a full load. Provide brake with a minimum torque rating of [100][50] percent of the drive motor rated torque.

Provide brakes with an externally accessible means to manually defeat the

brake.[ Select disc brake (if applicable) having housing which permits easy access for wear and setting inspection of the friction discs.]

2.1.4.4 Bumpers

Provide trolley and bridge bumpers conforming to CMAA 74 guidelines.

2.1.5 Hoist Trolley

Configure trolley such that the trolley frame contacts the trolley stops and prevents the trolley from dropping more than one inch in the event of an axle or wheel failure. Trolley must be mounted on straight and flat bridge beam. No hollow stamped steel wheels are permitted.

2.1.5.1 Trolley Drive

Provide motor-driven trolley.

2.1.5.2 Trolley Brake

Provide trolley brake or non-coasting worm drive capable of stopping the trolley within a distance in meters feet equal to 10 percent of the rated speed in meters feet per minute when traveling at rated speed with rated load. Provide brakes with an externally accessible means to manually defeat the brake.

2.1.6 Hoist

ASME HST-4, Class H3, double reeved, except as modified and supplemented in this section. Equip hoist with a spring set, electro-mechanically released brake plus a mechanical load brake.

2.1.6.1 Load Block

**********
**NOTE: Include sentences for custom design load block with trunnion if requested by using activity.**
**********

Construct the load block entirely of steel. The design must preclude the wire rope from being cut, pinched, crushed, or chafed in case of two-blocking.

[Provide load block with a trunnion separate from the sheave pin. Bore the trunnion for swivel mounting of the hook and securely retain in the block side plates. The trunnion must rotate about its horizontal axis in holes bored in the side plates.]

Construct the load block so that the hook and hook nut may be removed from the load block without disassembly of the block. Provide hook and hook nut forged from steel conforming to ASTM A668/A668M. Provide the hook with a safety latch per OSHA requirements. Provide the equalizer bar or sheave perpendicular to the running sheaves. Mark hoist capacity in pounds on both sides of the load blocks.

2.1.6.2 Hook and Hook Nut

Provide hook conforming to ASME B30.10, except as modified and supplemented in this specification section. Do not coat, galvanize, or paint hook nut.

Provide hook and hook nut capable of complete disassembly that enables access to all surfaces of hook, including shank and hook nut for inspection purposes. Make provision for the hook nut, or other hook-to-block fastener, to be keyed to hook shank by means of a set screw or similar, easily removable, securing device. Provide bearing or bushing as necessary to ensure the hook rotates easily within the hook block when loaded at 131.25 percent of the rated hoist capacity. Do not coat, galvanize, or paint hook.

Inspect each hook, including shank and hook nut, over the entire surface areas by magnetic particle inspection. If hook nut is not used, inspect any device that functions the same as the hook nut by magnetic particle inspection.

a. Procedure: Conduct magnetic particle inspection in accordance with ASTM A275/A275M with the following restrictions:

    1. DC yokes (including switchable AC/DC yokes used in the DC mode) and permanent magnet yokes must not be used.

    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 must have an accuracy of plus or 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.)

       Conduct this inspection at the factory of the hook manufacturer or hoist manufacturer. Alternately, a recognized independent testing lab may conduct the inspections if equipped and competent to perform such a service, and if approved by the Contracting Officer. The performing organization must provide a written statement of certification to ASTM E543, have the procedures used for testing of the hook and hook nut reviewed and approved by an independent Level III examiner, and submit the approved procedures and certification to the Contracting Officer with the test report.

b. Acceptance Criteria: Defects found on the hook or hook nut will result in rejection of defective items for use on furnished hoist. For this inspection, a defect is defined as a linear or non-linear indication for which the largest dimension is greater than 1.5 mm 1/16 inch.

c. Test Report: Provide a test report of the magnetic particle inspection of each hook and hook nut and submit to and secure approval from the Contracting Officer prior to final acceptance of hoist installation. Test reports must be certified by the testing organization.

d. Weld Repair: Weld repairs for defects on hooks or hook nuts are not acceptable.

2.1.6.3 Hoisting Rope

Provide wire rope conforming to ASTM A1023/A1023M, improved or extra

improved plow steel as a minimum, regular lay, uncoated, 6 by 37 class construction, with an independent wire rope core. Provide double reeved reeving arrangement. Connect hoisting rope dead end to equalizer bars (if used) by means of zinc-speltered sockets or swaged fittings installed in a manner which develops the full breaking strength of the hoisting rope.

Anchor hoisting rope ends on the drum by means of swaged fittings or by clamping. Neatly and securely seize hoisting rope ends with corrosion resistant wire, except where terminated in zinc-speltered sockets or swaged fittings.

Provide wire rope minimum safety factor of 5 to 1 based on the ratio of actual minimum wire rope breaking load to the calculated load on rope when hoist is assumed loaded to rated capacity. Certification from rope manufacturer verifying provided wire rope breaking strength, conforming to ASTM A931 must be approved by the Contracting Officer. No paint or coatings are allowed on the wire rope. Minimum length of the wire rope must enable the load hook to operate through its full hook lift range and still have a minimum of two full wraps of wire rope around the rope drum.

2.1.6.4 Sheaves

**********
**NOTE: Select "24" if custom design load block with trunnion has been specified; otherwise, select "16".**
**********

Provide steel sheaves. Machine or grind the grooves to contour and rim toughen, flame, or induction harden to not less than 320 BHN. Provide minimum pitch diameters of running sheaves of not less than [24][16] times the rope diameter. Provide sheave groove depth of not less than 1.15 times the hoisting rope diameter. Do not paint wire rope contact surfaces of sheaves.

2.1.6.5 Drum

Provide drum with turned helical grooves cut right and left hand to receive, in a single layer, the full winding length of the rope plus not less than two dead wraps on each end.

Provide drum of steel construction. Design drum so that not less than two dead wraps of hoisting rope remains on each anchorage when the hook is in its extreme low position. Provide right and left hand drum grooving beginning at the ends of the drum and grooving towards the center of the drum. Minimum drum groove depth, must be 0.375 times the rope diameter.

Provide minimum drum groove pitch either 1.14 times the rope diameter, or the rope diameter plus 3 mm 1/8 inch, whichever is smaller. Minimum drum pitch diameter must be [16] [18] times the rope diameter. Do not paint, coat or galvanize the surface of the drum which comes in contact with wire rope.

2.1.6.6 Hoist Brake

Provide both a mechanical load brake and an electro-mechanical brake (shoe or disc). The mechanical load brake and the electro-mechanical brake must each, independently, stop and hold 131.25 percent of rated capacity. The electro-mechanical brake must be adjustable to 50 percent of its rated capacity, and must have an externally accessible means of manual release.

## 2.2 STRUCTURAL

### 2.2.1 Welding

Use AWS D14.1/D14.1M for welding design and procedures, including pre-weld and postweld heat treatments. However, the minimum classification of electrodes must be the E70 series.

### 2.2.2 Structural Bolted Connections

Structural bolted connections must be in accordance with CMAA 74, Section 3.8.[ Structural direct tension indicators must conform to ASTM F959/F959M ].

## 2.3 MECHANICAL

### 2.3.1 Threaded Fasteners

Fasten base-mounted and flange-mounted components and all mechanical connections subjected to calculable loads with ASTM A325M ASTM A325 plain uncoated bolts (ASTM A307) with appropriate ASTM A194/A194M or ASTM A563M ASTM A563plain nuts; and ASTM F436M ASTM F436 plain, through hardened, flat, circular washers. Match bolt and nut threads. Oversize tapping is not permitted. Bolt and nut threads must conform to ASME B18.2.2 and ASME B1.1. Bolts and screws may be installed into tapped holes only in heat treated steel with a minimum hardness of 195 BHN.

### 2.3.2 Antifriction Bearings

Provide antifriction type bearings, except where bushings are specifically permitted or required. Provide grease lubricated bearings with means for relubrication through easily accessible lubrication fittings or provide permanently lubricated and sealed bearings.

### 2.3.3 Bushings

Provide manufacturer's standard bronze alloy bushings and thrust washers. Provide means for relubrication of grease lubricated bushings through easily accessible lubrication fittings or provide oil impregnated type bushings.

### 2.3.4 Gears

Gears must conform to the applicable requirements of ANSI/AGMA 2015-1, ANSI/AGMA 2001, AGMA ISO 10064-6, AGMA ISO 17485, AGMA 2011, and ANSI/AGMA 6113 ANSI/AGMA 6013.

## 2.4 ELECTRICAL

The design, selection, rating, and installation of the electrical portions of the crane and its accessories must conform to the requirements of NEMA ICS 3,NEMA ICS 8, ASME HST-4, and NFPA 70, and other requirements specified herein.

The crane manufacturer must furnish and install all electrical equipment on the crane conforming to NEMA ICS 6, including motors, conforming to NEMA MG 1, electrically released brakes, switches, crane controllers, panels, operating station, wiring system, cables, and bridge-to-trolley

crane electrification[, and the runway electrification].

2.4.1 Motors

**********
**NOTE: Inverter duty motors are required for Variable Frequency Drives (VFD). Select two speed motors for bridge and trolley drives if magnetic controls are specified in paragraph titled "Controls". Select single speed motors if electronic controls are specified in paragraph titled "Controls".**
**********

Motors must meet all applicable requirements of NEMA MG 1 and UL 1004-1.

[Provide insulated inverter duty motors for Variable Frequency Drives (VFD). Motor insulation must be Class H, but with a Class B temperature rise.]

[Provide [two] [single] speed AC squirrel cage induction type motors for the bridge and trolley drives with class F motor insulation.]

[Provide two speed, AC squirrel cage induction type motor for the hoist with class F motor insulation].

Provide motor overload protection utilizing a thermal sensitive device embedded in its windings.

[2.4.2 Pendant Pushbutton Station

Suspend the pendant push-button station from an independent festooned messenger track system, operating the length of the bridge. Locate the pendant pushbutton station [1200 mm] [4 feet] [_____] above the finished floor. Clearly mark all controls for identification of functions. Provide directional contactors with both mechanical and electrical interlocks.

Arrange pushbuttons in accordance with ASME B30.11 recommendations, except as supplemented or modified herein. On the pushbutton station, provide a pilot light to indicate that the pendant is energized . Provide a pilot light on the crane mounted electrical panel to indicate that power is available to the crane . Provide pendant station with an on and off button that removes power from the motors, brakes and control circuit. Provide directional contactors with both mechanical and electrical interlocks.

]2.4.3 AC Controls

**********
**NOTE: Use the first paragraph to select electronic controls for the hoist, bridge or trolley. Use the second paragraph to select one or two speed control for the hoist, bridge, or trolley. Selections can be made using a combination of electronic controls and one or two speed motor control**
**********

[Provide static reversing, adjustable frequency controllers for the [hoist], [bridge] [and] [trolley] electric drives. Provide dynamic braking for all electric drives. Speed control must be of the [three step infinitely variable type for the hoist function] [and] [two step infinitely

variable type for the bridge and trolley functions]. The [hoist], [trolley] [and] [bridge] brakes must set only after the associated controller decelerates the motor to a controlled stop.

All motors must run smoothly, without torque pulsations at the lowest speed and be energized at a frequency not exceeding 60 HZ at the highest speed.[ The hoist controller must enable the drive motor to develop full torque continuously at zero speed.]]

[Provide [one][two]-speed magnetic controls for the [bridge drive], [trolley drive], [and] [hoist] drive. Ensure that an energized drive motor initially rotates only in the direction selected by the operator by activating the corresponding direction; i.e., is not overhauled. Provide the motor control systems with resistive or reactive reduced voltage starting, acceleration, and deceleration utilizing, for each, separate banks of voltage reducing resistors or reactors and timing relays. On deceleration, resistors or reactors must be inserted into the motor's high speed leads prior to de energization of the high speed contactor. Acceleration and deceleration must be smooth.[ Provide the bridge and trolley motor control systems with a drift point between OFF and the first speed control point in each direction.] Provide plugging protection for the [hoist] [bridge] [and] [trolley] drives. Provide time delay relays, which will prevent the plugging of bridge and trolley drive motors, in the control circuit. Arrange the controls to set the associated drive's brake if attempts are made to plug.]

The use of definite purpose contactors is prohibited. All contactors must be NEMA rated. Feed control circuits from a single phase, air cooled, double wound transformer with a grounded metal screen between the primary and secondary windings of the transformer.

[2.4.4 Radio Controls

The remote radio control system must be designed to meet the requirements of NEMA ICS 8, Part 9. Provide radio control system conforming to FCC Part 15 (unlicensed frequencies)

]2.4.5 Protection

Protection must not be less than that required by NEMA ICS 3, and NFPA 70. Provide enclosed type circuit breaker for crane disconnect. Provide an On/Off button that removes power from the motors, brakes and control circuit on the operator's control pendant station or radio controller. The control circuit must not operate unless the "On" button is depressed. Provide for lockout/tagout of all hazardous energy sources

2.4.6 Resistors

**********
**NOTE: Include "125 percent of" only if electronic controls have been selected previously.**
**********

Provide resistors rated for continuous duty operation based upon [125 percent of] the motor nameplate amperes and fabricated of corrosion resistant metal; the use of "wire wound" type resistors is prohibited for segments of 8 ohms or less. Mount resistors in substantial, ventilated enclosures constructed entirely of non-combustible materials. Provide resistors with terminals fitted in the coolest position in the enclosure.

2.4.7 Limit Switches

Provide primary upper and lower geared limit switches. Geared limits must allow reversing direction to back out of the limit without resetting. Provide a backup mechanical hook block activated upper limit switch wired independent of the directional controllers and the primary upper limit switch that removes power from the hoist motor, hoist brake and hoist controls. The backup limit must require hoist resetting prior to operation of the hoist in any direction. Provide a three position keyed switch on the pendant control with positions for bypass of the primary upper limit (to allow testing of the backup upper limit) and bypass of the backup upper limit in the lower direction only.

[Do not furnish clutch-to-stop devices with the hoist.]

[2.4.8 Overload Protection

Provide overload protection for bridge, runway, and hoist systems. Hoist overload protection must be adjustable between 80 and 150 percent of hoist capacity

][2.4.9 Reactors

Provide line reactors rated for continuous duty operation based upon the motor nameplate amperes. Select reactors for 60 Hz operation and having taps for field adjustment of inductance so as to permit achievement of the optimum acceleration characteristics for the drive. For a drive motor branch circuit that exceeds 100 feet in length, a reactor must also be connected in series with the controller load (output) terminals to provide standing wave protection

][2.4.10 Warning Devices

**********
**NOTE: A warning horn or light is required for all radio controlled cranes and recommended for all others.**
**********

Provide a warning horn that is operable from a push button at the [pendant pushbutton] [radio control] station. Provide a warning [strobe][rotating beacon] that is illuminated at all times during movement of the hoist, trolley, or bridge function.

][2.4.11 Indicator Lights

Place indicator lights in an enclosure mounted on the bottom of the bridge with lights sized and positioned to be visible from the ground. The lights must be the dual-lamp type. Provide a white light to indicate that power is available on the load side of the crane disconnect and a blue light to indicate that the main contactor is energized. Voltage of the lights must be 115 VAC.

Provide nameplates that are legible from ground level. The nameplates must read, in their respective order. "POWER AVAILABLE" and "CRANE ENERGIZED". Energization of the "POWER AVAILABLE" light must be supplied by a separate, fused transformer.

]2.4.12 Enclosures

Provide enclosures for control panels, controls, and brakes in accordance with NEMA 250 and NEMA ICS 6, Classification Type [1 indoor, general purpose] [2 indoor, drip-proof] [3 outdoor, dust-tight, rain-tight, sleet-resistant] [_____].

2.4.13 Electrification

**********
**NOTE: Select runway electrification installation to suit other contract requirements. Select Type 1 enclosures for an indoor crane; select Type 3 enclosures for an outdoor crane.**
**********

Runway electrification includes providing conductors between the electrification system and the junction box indicated on the drawings. Provide NEMA Type [1][3], as defined by NEMA 250, enclosures for control panels, for pendent pushbutton station, and for auxiliary devices and mount along the bridge. For runway electrification provide copper conductors enclosed in a solid plastic cover. Provide two sets of current collectors for each conductor.

**********
**NOTE: Festooned type electrification is preferred along runway for short bridge crane runway lengths or along the crane bridge when there are hoist trolley runs along a short crane bridge. Enclosed safety bar electrification are recommended where crane runway lengths are longer or hoist trolley runs along a long crane bridge.**

**If festooned electrification is used on crane runways, allow space for a parking area of the festoon trolley.**
**********

Provide runway electrification of the [flat festooned type] [enclosed safety bar type with four [continuous] copper conductors]. Provide electrical work for the crane system in accordance with NFPA 70.

2.5 CRANE PAINTING

**********
**NOTE: For corrosive atmospheres, specify appropriate protective requirements.**
**********

Paint exposed portions of the crane and girders in accordance with CMAA 74. Desired color is brilliant yellow.

Coat faying surfaces of bolted connections per AISC 325, but do not apply finish paint.

Paint the load block brilliant yellow with black diagonal striping, 25 mm one inch wide diagonal black stripes located on 50 mm 2 inch centers.

Factory paint electrical and mechanical equipment in accordance with the

manufacturer's best standard practice (for the specified environment), except that electrical equipment doors, which expose current-carrying electrical conductors when opened, must be orange.

## 2.6 IDENTIFICATION PLATES

Furnish and install identification plates. Provide non-corrosive metal identification plates with clearly legible permanent lettering giving the manufacturer's name, model number, serial number, capacity in both kilogram and pound units printed in different colors, and other essential information or identification.

### 2.6.1 Markings on Crane, Trolley, and Hook

**********
**NOTE: NAVFAC requires markings to be indicated in pounds.**
**********

Markings include: bridge motion direction arrows on both sides of the bridge; and trolley motion direction arrows on both sides of trolley. Markings must be visible from push button station and from the loading point, corresponding to the push button labeling on the pendant pushbutton station. Mark the hook rated capacity on both sides of the hoist and hoist load block[ in tons][ and][ in pounds].

## 2.7 PATENTED TRACK

Provide specially designed beam, i.e., patented track beam, constructed from welded steel components. Provide patented track fabricated by a manufacturer regularly engaged in the production of this type of beam. Provide the lower flange (T-rail) of the beam section with a flat wheel tread surface. Minimum lower flange width must be 81 mm 3.25 inches and have a chemical composition of 0.45 to 0.60 percent carbon content, 0.60 to 1.1 percent manganese content. The lower flange wheel tread surface must be tempered to a minimum hardness of 195 BHN.

Provide a structural steel upper flange and web beam section as one monolithic piece rolled to shape or fabricated from two pieces with the flange and web continuously fillet welded on both sides. The joint between the web and the T-rail must be continuously welded from both sides. The structural joint must conform to AISC 360. Size beam, as a minimum, to withstand all expected forces and the load combinations specified herein.

## 2.8 CRANE RUNWAY TRACK SYSTEM

**********
**NOTE: Select only Class C for NAVFAC projects.**
**********

Provide patented track runway track beams designed and constructed in compliance with MHI MH27.1 and [CMAA 74], [Class A (Standby or Infrequent Service)][Class B (Light Service)][Class C (Moderate Service)], except as modified and supplemented in the section.

Submit manufacturer's standard published tables that verify the crane bridge girder and crane runway track are sized in compliance with all specification requirements. When standard published tables are not available, provide calculations for the strength design and deflection

of the bridge beams.

If any runway track suspension device is not the track manufacturer's standard commercial cataloged product, submit complete design data for each instance to substantiate that the device complies with the requirements of MHI MH27.1 and [CMAA 74],[Class A (Standby or Infrequent Service)][Class B (Light Service)][Class C (Moderate Service)].

It is the Contractor's responsibility to provide the complete runway track suspension system that is required to hang the crane runway track at its indicated location from the structural supports indicated on the drawings. For the track suspension system, provide all the standard commercial cataloged products possible. Custom runway track suspension devices that are not standard commercial cataloged products, designed and constructed for this particular application, are acceptable if their design documentation is approved by the Contracting Officer.

Provide flexible suspension type runway system including runway track beams, hanger rods, suspension fittings, lateral and longitudinal sway bracing, and necessary hardware.

Select runway suspension hanger rods fabricated from alloy steel with rolled threads. Provide threads of sufficient length to permit at least 1.0 inch of vertical adjustment (up or down) after runway installation. Provide rods with self-aligning gimbals or ball-and-socket joints at each end which allow at least 5.0 degrees of deflection from the vertical. Provide not more than two rods per suspension point and in such cases consider the unequal loads induced in the rods. Fluid-filled load equalizing cells are not acceptable.

## PART 3 EXECUTION

### 3.1 POST-ERECTION INSPECTION

After erection, the Contractor, the activity crane certifying official, and the Contracting Officer must jointly inspect the crane bridge and hoist systems and components to verify compliance with specifications and approved shop drawings and manufacturer's data. Notify the Contracting Officer [_____] days before the inspection.

Document the results of this inspection and submit the post-erection inspection report to the Contracting Officer for approval.

### 3.2 OPERATIONAL TEST

After erection and inspection, test the hoist, bridge, and trolley as specified herein. All tests must be witnessed by a technical representative of the Contracting Officer and the activity crane certifying official.

Perform the 125 percent rated load test with the bridge and trolley located to obtain maximum loads on the runway and bridge girders. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship.

Rectify all deficiencies disclosed by testing and retest the system or component to prove the crane meets the specified requirements.

Provide all personnel and equipment required to meet the specified test requirements. This includes test loads, and rigging gear, crane operating personnel, instruments, and all other necessary apparatus.

3.2.1 Operational Test Report

Record crane test data on appropriate test record forms suitable for retention for the life of the crane. Include in the test records:

a. Test date

b. Crane identification number

c. Weather conditions (temperature, humidity, barometric pressure, dew point, [prevailing wind direction and velocity,] and crane orientation)

d. Identification of each test performed

e. Results of each test performed

f. Data collected during testing

g. Remarks

Record operating and startup current and motor terminal voltage measurements for electrical equipment (motors) using appropriate instrumentation (e.g., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) must be justified or appropriate adjustments performed. In addition, note, investigate, and correct any high temperatures or abnormal operation of any equipment or machinery. Record hoist, trolley, and bridge speeds during each test cycle. Ensure that any energized drive motor initially rotates only in the direction selected by the operator by depressing the corresponding pushbutton; i.e., is not overhauled.

3.2.2 Hook

Measure hook for hook throat spread before and after load test. Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 0.4 mm 1/64 inch). Record this base dimension. Measure the distance between tram points before and after load test. Any increase in throat opening from the base measurement is cause for rejection.

3.2.3 No-Load Test

Check entire clearance envelope to ensure there are no obstructions. Raise and lower the hook through the full range of normal travel at rated speed for three complete cycles. Then raise and lower the hook through the full range of normal travel in slow speed. Verify proper operation of hoist limit switches. Operate the bridge and trolley in each direction the full distance between end stops; bring bumpers into contact with bumper stops at each end of travel. Perform one complete cycle to check each speed point and verify proper brake operation.

3.2.4 Hoist Load Test

Perform the following tests, as specified, with test loads of 100 percent

(plus 0 minus 10 percent) and 125 percent (plus 5 minus 0) of rated load.

a. Static Load Test (125 percent only): Check entire structure, holding brake and hoisting components as follows:With the trolley in the center of the bridge span, raise the test load approximately one foot. Hold the load for 10 minutes. Rotate load and hook a full 360 degrees to check bearing operation. Ensure there is no vertical movement of the load. Verify beam and girder deflections do not exceed CMAA 74 and MHI MH27.1 design limits.

b. Dynamic Load Test (100 percent only):
Raise and lower the test load through the full lift height to test limit switches. Check speed points during raising and lowering. Lower the load to the floor, operate continuously for 5 minutes, then raise and lower the load through two more cycles, in order to demonstrate proper operation and repeatability of all functions without component overheating or malfunction. Completely stop the machinery at least once in each direction during each cycle to ensure proper brake operation.

c. Hoist Load Brake (125 percent only): Raise test load approximately 1500 mm 5 feet. With neither pushbutton depressed, release (by hand) the holding brake. The load brake must hold the test load. Again with the holding brake in the released position, start the test load down (first point) and then release the pushbutton as the test load lowers. The load brake must prevent the test load from accelerating. Submit [_____] copies of the brake setting record.

d. Hoist Loss of Power (Panic Test) Certificate (125 percent only): Raise the test load to approximately 2400 mm 8 feet. While slowly lowering the test load, disconnect the crane's power source. Verify that the test load does not lower and that the brake is set.

3.2.5 Trolley/Hoist Load Test

Operate the trolley/hoist the full distance of the bridge rails in each direction with a test load of 125 percent of rated load on the hook (one cycle). Check proper functioning of all drive speed control points. Verify proper brake action.

3.2.6 Bridge Load Test

With a test load of 125 percent of rated load on the hook, operate the bridge for the full length of the runway in one direction with the trolley/hoist at the extreme end of the bridge, and in the opposite direction with the trolley at the opposite extreme end of the bridge (one cycle). Check proper functioning of all drive speed control points. Check for any binding of the bridge end trucks and verify proper brake action. Record deficiencies. Secure from testing if deficiencies are found.

3.2.7 Rated Travel Test

Repeat travel tests for trolley/hoist and bridge with a test load of 100 percent of rated load. Repeat the test for 2 cycles to demonstrate proper

operation and repeatability of all functions without the overheating or malfunction of any components. Check speed points during each cycle. Completely stop the machinery at least once in each direction during each cycle to ensure proper brake action.

-- End of Section --