

SECTION 41 22 14
BRIDGE CRANE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Design, Furnish, Install, and Test 30 Ton Bridge Crane:
 - 1. Payment: Lump-sum price offered in the Price Schedule.
 - a. Includes cost of crane motors.
- B. Conduct Rail Survey of 30 Ton Bridge Crane Runway Rails:
 - 1. Payment: Lump-sum price offered in Price Schedule.
- C. Furnish and Install Access Ladder Fall Arrest System:
 - 1. Payment: Lump-sum price offered in Price Schedule.
- D. Adjust and Repair 30 Ton Bridge Crane Runway Rails:
 - 1. Payment: Lump-sum price offered in Optional Price Schedule 1.
- E. Furnish and Install 30 Ton Bridge Crane Runway Rails:
 - 1. Payment: Lump-sum price offered in Optional Price Schedule 2.

1.02 REFERENCE STANDARDS

- A. American Gear Manufacturers Association (AGMA)
 - 1. *AGMA 2001 - D04-04(R2010)* *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth*
 - 2. *AGMA 6013 - B16-17(R2021)* *Industrial Enclosed Gear Drives*
- B. American Institute of Steel Construction (AISC)
 - 1. AISC 360 - 2022 Specification for Structural Steel Buildings
- C. American Society of Mechanical Engineers (ASME)
 - 1. ASME B30.2 - 2022 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
- D. *American Society for Nondestructive Testing (ASNT)*

	1. ASNT CP-189-2020	<i>Qualification and Certification of Nondestructive Testing Personnel</i>
E.	ASTM International (ASTM)	
	1. <i>Deleted.</i>	
	2. ASTM A29/A29M – 23	General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
	3. <i>ASTM A148/A148M-24</i>	<i>Steel Castings, High Strength, for Structural Purposes</i>
	4. <i>ASTM A290/A290M-16(2021)</i>	<i>Carbon and Alloy Steel Forgings for Rings for Reduction Gears</i>
	5. <i>ASTM A291/A291M-19(2025)</i>	<i>Steel Forgings, Carbon and Alloy, for Pinions, Gears and Shafts for Reduction Gears</i>
	6. <i>ASTM A513/A513M - 25</i>	<i>Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing</i>
	7. <i>ASTM A519/A519M - 24</i>	<i>Seamless Carbon and Alloy Steel Mechanical Tubing</i>
	8. <i>ASTM A563/A563M - 24</i>	<i>Carbon and Alloy Steel Nuts</i>
	9. <i>ASTM A572/A572M - 25</i>	<i>High-Strength Low-Alloy Columbium- Vanadium Structural Steel</i>
	10. <i>ASTM A759 - 21</i>	<i>Carbon Steel Crane Rails</i>
	11. ASTM A992/A992M - 22	Structural Steel Shapes
	12. <i>ASTM A1011/A1011M - 25</i>	<i>Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength</i>
	13. ASTM A1023/A1023M - 21	Carbon Steel Wire Ropes for General Purposes
	14. ASTM D229-19e01	Rigid Sheet and Plate materials Used for Electrical Insulation
	15. <i>ASTM E543-21</i>	<i>Agencies Performing Nondestructive Testing</i>
	16. <i>ASTM F436/F436M - 24</i>	<i>Hardened Steel Washers</i>
	17. <i>ASTM F3125/F3125M - 25</i>	<i>High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength</i>

- F. American Welding Society (AWS)
1. AWS D1.1/D1.1M - 2020 Structural Welding Code - Steel
 2. AWS D14.1/D14.1M - 2005 Welding of Industrial and Mill Cranes and Other Material Handling Equipment
- G. Code of Federal Regulations (CFR)
1. 29 CFR Part 1910 Occupational Safety and Health Standards
 2. 29 CFR Part 1910.179 Overhead and Gantry Cranes
 3. **29 CFR Part 1910.28** ***Duty To Have Fall Protection and Falling Object Protection***
 4. **29 CFR Part 1910.29** ***Fall Protection Systems and Falling Object Protection – Criteria and Practices***
- H. ***Deleted.***
- I. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 841 – 2021 Standard for Petroleum and Chemical Industry – Premium Efficiency, Severe Duty, Totally Enclosed Squirrel Cage Induction Motors from 0.75 kW to 370 kW
 2. IEEE C37.2-2022 Electrical Power System Device Function Numbers, Acronyms, and Contact Designation
 3. IEEE C37.13-2015 Low-Voltage AC Power Circuit Breakers Used In Enclosures
 4. IEEE C37.21-2017 Control Switchboards
- J. ***Material Handling Industry (MHI) Crane Manufacturers Association of America, Inc. (CMAA)***
1. ***MHI CMAA 70 - 2020*** ***Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes***
- K. National Electrical Manufacturers Association (NEMA)
1. NEMA 250 - 2020 Enclosures for Electrical Equipment (1000
 2. ***NEMA IA 10030-24*** ***Industrial Control and Systems: Enclosures***
 3. NEMA MG 1 - 2021 Motors and Generators

- 4. NEMA ATS-2021 Standard for Acceptance Testing
Specifications for Electric Power Equipment
and Systems
- L. National Fire Protection Association (NFPA)
 - 1. NFPA 70 – 2023 National Electrical Code

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittals and
Section 01 33 26 – Electrical Drawings and Data.
- B. RSN 41 22 14-1, Qualifications:
 - 1. Qualifications of designer/engineer, inspector, technician, electrician, and crane
operator.
- C. RSN 41 22 14-2, Runway Rail Survey and Report
 - 1. Pictures and diagrams of existing rails.
 - 2. Recommendations for either adjusting or removing and replacing existing rails.
 - 3. Include commercial product data if replacement is recommended.
- D. RSN 41 22 14-3, Approval Drawings and Data:
 - 1. ***Sufficiently detailed to show technical and functional requirements met,
compliance with performance criteria, or justification for noncompliance.***
 - 2. Drawings:
 - a. General arrangement. Show layout and dimensions of equipment; hook
limits, approaches and clearances; parts ***identification and bill of***
materials; assembly and details of crane components, including
nameplates, controls, and control cabinets.
 - 3. Design and sizing calculations:
 - a. Verify and demonstrate choice of components for crane, including, but not
limited to the following:
 - 1) Hoist, end trucks and wheels, structural beams, drive systems,
brakes, motors, controls, and overcurrent protection of motors,
controls, and branch circuits.
 - b. Provide weights of components, maximum wheel loads, and rated speeds
of bridge, trolley and hoist when loaded to full capacity.
 - 4. Commercial product data. Provide dimensional and rating data. Mark data sheets
to indicate specific make, model number and features of equipment provided.
Identify which assembly (e.g.: main hoist, aux hoist, trolley, bridge, etc.)
equipment used. Include data for:

- a. For all electrical equipment, submit the following rating information in addition to manufacturer product data:
 - 1) Voltage.
 - 2) Ampacity.
 - 3) Horsepower (if applicable).
 - 4) Short Circuit.
 - 5) NEMA Sizes.
 - b. Electric motors:
 - 1) Submit one IEEE 841 Annex A datasheet per motor in addition to manufacturer product data.
 - 2) Motor characteristics and tabulated data (tested or calculated):
 - a) Motor ratings and settings.
 - b) Speed-torque curves.
 - c) Time-current characteristic curves.
 - c. **Encoders.**
 - d. Load cell.
 - e. Gear reducers.
 - f. Hook and blocks.
 - g. Hoist assembly.
 - h. Bridge, trolley, and end truck assembly.
 - i. Bumpers.
 - j. End stops.
 - k. Brakes.
 - l. Bearings.
 - m. Overload devices.
 - n. Limit switches.
 - o. Service disconnect switch.
 - p. Recommended spare parts list.
 - 5. Certified by a Professional Engineer.
- E. RSN 41 22 14-4, PLC Code:
- 1. Copy of the PLC code to implement for crane.
 - 2. Using ladder logic format

3. With comments for each block or blocks describing its functional intent.
 4. Include a copy of the development software, and license if applicable, for viewing.
- F. RSN 41 22 14-5, Installation Plan and Procedures:
1. Provide a narrative including details for installation plan and procedures for crane components:
 - a. Scope of installation.
 - b. Preparation for installation.
 2. Format narrative in step-by-step fashion with diagrams and figures where necessary to explain exact means and methods, as well as procedure for installation of crane equipment.
 3. Include storage and handling plans, construction loads, test weight plan.
- G. RSN 41 22 14-6, Crane Operational and Load Test Plan:
1. Includes check list for all crane operation for commissioning, alarms, simultaneous travel operations, speed modification zones and criteria.
 2. Engineered Lift Plan per ASME B30.2 for load test, including:
 - a. Floor loading calculations.
 - b. Stacking diagrams.
 - c. Rigging details.
 - d. Crane operator certifications or training.
 - e. Equipment required.
- H. RSN 41 22 14-7, Shop Weld Report:**
1. ***Qualifications of independent weld inspector:***
 - a. ***Company qualifications.***
 - b. ***Inspector qualifications including for intended method.***
 2. ***Welded joint preparation and fit-up reports.***
 3. ***25 percent weld quality reports.***
 4. ***100 percent weld quality reports.***
 5. ***Subsequent weld quality reports for weld inspections until inspection where no issues are reported.***
- I. RSN 41 22 14-8, Field Weld Report:**
1. ***Qualifications of independent weld inspector:***

- Bridge Crane
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- 1) Contractor field quality testing.
- 2) Record test data on report form including crane operational and load test.
- 3) ***Deleted.***

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment on site in shipping containers with labeling in place.
- B. Protect equipment from damage, moisture, and dust, ***free from contact with soil and weather.***

1.05 QUALIFICATIONS

- A. Qualified Professional Engineers: Demonstrated experience on cranes of similar size and capacity as the Warehouse crane on at least three separate crane contracts.
 1. Registered in the state of California.
- B. Qualified Crane Inspectors: Demonstrated experience on cranes of similar size and capacity as the those described on at least three separate crane contracts and employed as crane inspectors for at least the two (2) previous years by firm specializing in crane inspection work.
- C. ***Independent Weld Inspector:***
 1. ***Third party not an employee of fabricator or Contractor. Independent Weld Inspector's employing company shall not be a subsidiary, parent, or sister company of the fabricator or installer.***
 2. ***Company Qualifications:***
 - a. ***Minimum of 5 years' experience in non-destructive testing, including weld inspecting and reporting and meets the requirements of ASTM E543.***
 - b. ***Company meets the requirements of the definition of Independent Weld Inspector company in these specifications.***
 3. ***AWS Certified Weld Inspector:***
 - a. ***Inspector Certification: Certify that the Weld Inspector is an AWS Certified Weld Inspector and an employee of an independent established company; and submit certifications. ASNT CP-189 NDT level II or level III for the testing methods performed.***
- D. Qualified Crane Electricians: Minimum of one (1) licensed electrician during field wiring and critical aspects of the crane field work.
- E. Qualified Crane Operators: Meeting requirements of OSHA 1910.179 and ASME B30.2.

1.06 FIELD MEASUREMENTS

- A. Verify field measurements, building and site dimensions prior to fabrication. Coordinate and relate work to building structure and work done by various trades.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel:

1. *Plates and bars: ASTM A572, Grade 50.*
2. *Rolled W-shapes: ASTM A992, Grade 50.*
3. *Sheet and strip: ASTM A1011.*
4. *Mechanical tubing: ASTM A513 or A519.*

B. Cast Steel: ASTM A148, Grade 80-40, annealed.

C. Forged Steel: ASTM A290 or A291, as applicable.

D. Bolts, Nuts, and Washers:

1. *Mounting bolts: ASTM F3125, Grade A325, Type 1, galvanized.*
2. *Mounting nuts: ASTM A563, Grade DH, heavy-hex style, galvanized.*
3. *Mounting washers: ASTM F436, Type 1, galvanized.*
4. *Nuts and washers suitable for high-strength bolts: In accordance with the requirements of AISC 360.*

2.02 DESIGN REQUIREMENTS

- A. Design, furnish and install one overhead, top-running, traveling bridge crane in the Warehouse at Folsom Dam, CA.
- B. New crane shall have equal or greater hook boundary limits as existing crane.
- C. See Sections 41 22 15 – Bridge Crane Electrical Components for items not included in this Section.**
- D. Design Features:**
1. Comply with applicable sections of:
 - a. **MHI** CMAA 70, Class C, indoor service.
 - b. ASME B30.2.
 - c. Electrical: NFPA 70.

- d. Safety: 29 CFR Parts 1910 and 1910.179.
- 2. ***Components suitable for indoor operation in ambient operating temperature range from 20 to 120 degrees F at approximate elevation 500 feet above sea level.***
- 3. Retention of historical character defining features:
 - a. Design crane components to have similar size, shape, and scale of existing crane, ***except where required otherwise in the specifications***, to preserve and maintain their historical character. Including but not limited to:
 - 1) Trolley.
 - 2) Crane structure.
 - 3) Bridge platform/walkway.
 - 4) Access ladders (where OSHA does not require change).
 - b. Coatings: Match existing crane color and gloss of finish coats using manufacturer's standard finishes, unless otherwise indicated, in accordance with Section 09 96 20 – Coatings.
- 4. Type: Overhead, top running, single trolley, single hoist, bridge crane.
- 5. Capacity: 30-tons.
- 6. Operation: Electrically-operated.
- 7. Control: Pendant. See Section 41 22 15 – Bridge Crane Electrical Components and Section 25 00 01 – Automation Control System.
- 8. Span: 40-feet.
 - a. New crane is to be installed on the existing rails if possible.
- 9. Runway length: Equal to that of existing crane, approximately 150-feet.
- 10. Single swivel hook, spring loaded gate with locking pin.
 - a. Match dimensions of existing hook.
- 11. Hook travel: Approximately 22-feet.
- 12. ***Crane Operating Speeds:***
 - a. ***Match the operating speed of the existing crane.***
 - b. ***Provide each operation with micro-speed set to 10 percent of rated speed.***
- 13. Power supply: 480 Volts, 3-phase, 60 Hz. ***All power required for the operation of the hoists, trolley, travel, and end trucks shall be developed from this source.***
 - a. ***Control Voltage: 120 volts AC.***
- 14. Ladders, walkways, safety railing, steps, ramps, grating, screens, covers, etc., as required to provide full, safe access to components for maintenance and inspection.

- a. See Section 51 00 10 – Photographs.
- 15. ***Deleted.***
- 16. End stop zones:
 - a. Bridge travel speed limited to 10% of normal operating speed within 3 feet of all end stops.
 - b. Trolley travel speed limited to 10% of normal operating speed within 3 feet of all end stops.
 - c. Hoist travel speed limited to 10% of normal operating speed within 3 feet of upper limits.

2.03 MECHANICAL EQUIPMENT

A. Motors:

- 1. ***AC Inverter Duty Squirrel-cage induction motors, in accordance with NEMA MG 1, including characteristics, tests, and ratings unless otherwise specified.***
- 2. ***480 volt, 3-phase, 60 hertz.***
- 3. ***Speed: 1,800 rpm.***
- 4. ***NEMA Design B.***
- 5. ***Insulation Class: F or H.***
- 6. ***Duty: continuous.***
- 7. ***Winding protection: Integral armature winding thermostats.***
- 8. ***Enclosure: Totally enclosed, fan cooled (TEFC).***
- 9. ***Combination drain/breather for removal of moisture from motor enclosure.***
- 10. ***Quick reversing, suitable for crane duty.***
- 11. ***Bearings:***
 - a. ***Grease lubricated, antifriction type.***
 - b. ***Sealed against loss of the lubricant or entrance of dirt.***

B. Motor Brakes:

- 1. ***Self-adjusting, spring-set/electrical-release, intermittent-duty, disk-type brake suitable for energization from motor service conductors.***
- 2. ***Voltage: 480 volts, 60 Hz.***
- 3. ***Torque Capacity:***
 - a. ***Bridge travel: capable of stopping the motion of the bridge within a distance in feet equal to 10 percent of rated load speed in feet, when traveling at rated speed with rated load.***

- b. Trolley travel: capable of stopping the motion of the trolley within a distance in feet equal to 10 percent of rated load speed in feet, when traveling at rated speed with rated load, including the additional lateral forces due to the hoist load on the deflector sheaves.*
- 4. Hand Release: Holds in release position, then resets automatically when the motor is energized.*

C. Hoists:

- 1. Electric motor-driven.
- 2. Hoist ropes:
 - a. In accordance with ASTM A1023.
 - b. Construction: 6 by 37 *or 6 by 19*, improved (IPS) or extra-improved (EIP) plow steel (minimum), bright finish, preformed, regular lay, independent wire rope core (IWRC).
 - c. Maximum fleet angles: 4 degrees (drums), 4.75 degrees (sheaves).
 - d. End connections (other than drum connections): Termination fittings in accordance with manufacturer's recommendations, providing 100 percent termination efficiency.
 - e. Safety factor: 5:1 minimum, based on breaking strength of ropes.
 - f. Length: To provide minimum two dead wraps on rope drums when hooks reach low hook elevation.
- 3. Sheaves:
 - a. Material: steel per *MHI* CMAA 70.
 - b. D/d Ratio: 20:1 minimum ratio of pitch diameter to rope diameter.
 - c. Provide with sealed roller -bearings.
- 4. Drum:
 - a. Material: steel per *MHI* CMAA 70.
 - b. D/d Ratio: 20:1 minimum ratio of pitch diameter to rope diameter.
 - c. Helical grooves:
 - 1) Designed with capacity for minimum of two dead wraps at anchored ends when hooks reach low hook elevation.
 - 2) Machined on drum surfaces to receive hoisting ropes to ensure that they spool and unspool in an orderly and controlled manner.
 - 3) Maximum surface texture: 125 micro-inches.
 - 4) Minimum depth: Not less than 37.5 percent of rope diameter.

- 5) Minimum groove pitch: Nominal rope diameter multiplied by a factor of 1.14 or rope diameter plus 1/8", whichever is smaller.
 - d. All brakes shall have a separate brake drum and couplings shall not be used as brake drums.
 - 5. ***Holding Brake:***
 - a. ***Electro-mechanical continuous-duty, spring-set, energized-release, rated to 125 percent of the rated load hoisting torque.***
 - b. ***Brakes shall set after the motors have slowed to a controlled stop.***
 - 6. Overload limit devices.
 - 7. Secondary upper limit switch.
 - 8. Machinery enclosures: Steel.
- D. Gearing:
- 1. Steel, sizing in accordance with requirements of AGMA 2001 and 6013.
 - 2. Rated for reversing loads where applicable and with service factor appropriate for application, in accordance with manufacturer's recommendations.
 - 3. Fully enclosed in reducer housings, except for final reduction, which may be open gears. Open gears required to be provided with safety guards or covers, with access for inspection and lubrication.
 - 4. Reducer housings:
 - a. Oil-tight, split-case, steel. Provide jack bolts to aid removal of upper portion of housing and lifting eyes/connections.
 - b. Inspection ports: Oil-tight, removable cover, located to accommodate inspection of gearing.
 - c. Provide packing glands or seals at gear shaft openings.
 - d. Oil-tight, with filler cap, breathers, oil level dipstick or sight glass, lifting lugs.
 - e. Lubricant drainage:
 - 1) Accessible, piped to convenient locations where necessary.
 - 2) Shut-off ball-type drain valves and drain plugs.
- E. Bearings:
- 1. Sealed roller- or ball-type, unless otherwise indicated.
 - 2. Replaceable.
 - 3. Fit and load rating: Per manufacturer's recommendations for application, with appropriate rating factors.

- F. Shafts: Structural design in accordance with **MHI** CMAA 70.
1. Provide guards for all rotating shafts.
- G. Flexible couplings:
1. Metallic (except for grease seals), gear-type, dustproof, and fully enclosed.
 2. Gear teeth: Crowned at base, tip, and face.
 3. Bored and fit to the actual diameter of the shaft, within tolerance of manufacturer's recommendations.
 4. Capacity: Torque rating, with appropriate service factor, suitable for loads transmitted.
 5. Enclosed, sealed oil-tight, retaining lubricant, even in the case of misalignment.
 6. Keys, setscrews, bolts, nuts, and revolving surfaces made flush or guarded by a metal cover, so the coupling will present no hazard to personnel.
 7. Grease fittings.
 8. Single-engagement couplings: Accommodating angular misalignment of 0.75 degrees. Provide paired single-engagement couplings on floating shafts as required.
 9. Double-engagement couplings: Accommodating angular misalignment of 0.75 degrees per half coupling and offset misalignment of 1.5 percent of maximum bore.
- H. Service platforms, ladders, and stairways:
1. Designed per CFR 1910.29.
 2. Permanent service platforms, ladders, and stairways required for accessing equipment in accordance with ASME B30.2. Attach securely to steel framework.
 - a. Match platform layout of existing crane. See Section 51 00 10 – Photos.
 3. Fabricate from welded structural steel shapes and plates, with slip-resistant checkered steel flooring plate, designed for live load of 50 pounds per square foot.
 4. Platforms and stairways: 42-inch high guard rails, intermediate guard rails, and toe plates.
 - a. Where possible, employ passive fall protection through the use of guard rails, rather than active fall protection means.
 5. Minimum clearance in front of control equipment in accordance with NFPA 70, sufficient to open hinged doors 90 degrees.
 6. Minimum 15-inch clearance from machinery.
 7. Provide self-closing, spring-loaded safety gates at all ladder access locations.

I. Deleted.

J. Bridge:

1. ***Design per MHI CMAA 70.***
2. ***Unless otherwise stated in this Section, the structure is to match the appearance of the existing crane.***
3. Electric motor-driven. Provide ***MHI CMAA 70*** type A-4 drive arrangement.
4. Steel Frame: Structural steel construction, in accordance with ASTM A992, braced and welded to maintain squareness with trucks.
5. End Trucks:
 - a. Frame: Steel, welded from structural shapes, designed to prevent distortion and mismatch of gears under maximum rated load.
 - b. Provide with restraining lugs to prevent truck drop of greater than 1-inch in the event of an axle or wheel failure.
 - c. Provide jacking pads for removal or repair of wheel assemblies.
 - d. Wheelbase: In accordance with ***MHI CMAA 70***.
 - 1) 4-wheel.
 - 2) ***Wheel spacing shall match existing crane.***
 - e. Wheels: Steel, sized in accordance with ***MHI CMAA 70***.
 - f. Designed to run on upper surface of crane runway rail.
6. ***Provide with bumpers in accordance with MHI CMAA 70.***
7. Provide a fire extinguisher mounted to bridge walkway handrail.
 - a. ***10-pound capacity, dry chemical, ABC rating.***

K. Trolley:

1. Electric motor-driven.
 - a. End drive system coupled directly to both drive wheels with a fixed wheel axle.
2. Wheeled, suitable for mounting on bridge rails.
3. Wheels: Steel, sized in accordance with ***MHI CMAA 70***.
4. Frame: Structural steel truck and load girts, welded into one-piece unit. Provide jacking pads for removal or repair of wheel assemblies.
5. Bearings: Sealed, roller- or ball-type, permanently lubricated.
6. ***Parking*** brake: Electro-mechanical continuous-duty, spring-set, energized-release, disk-type, rated for minimum ***50*** percent full load traveling torque.
7. ***Provide with bumpers in accordance with MHI CMAA 70.***
8. ***Trolley Rail:***

- a. Material: Steel in accordance with ASTM A759.*
- b. Sized in accordance with trolley wheel size and MHI CMAA 70.*
- c. Length: divided into approximately equal sections adding up to a total travel length.*
- d. Punch rail section ends at splice locations.*
- e. Splice bars, bolts, and accessories:*
 - 1) Commercial quality free from scale and rust which can be removed by firm rubbing with burlap or equivalent treatment.*
- f. Threaded Weld Studs:*
 - 1) ASTM A29*
 - 2) Fully threaded.*
- g. Rail clips:*
 - 1) Permit mounting of crane rail with resilient pad.*
 - 2) Attached to structural steel with welded studs.*
 - 3) Capacity: capable of withstanding the maximum vertical, lateral and axial forces of the crane.*
 - 4) Dimensions compatible with rail size.*
 - 5) Constrain rail in vertical and lateral planes while allowing controlled movement in axial direction.*

2.04 ELECTRICAL EQUIPMENT

A. Electrical Enclosures:

- 1. In accordance with requirements of NEMA IA 10030 and NFPA 70.*
 - 2. Enclosure design shall allow free and easy access to internal components. Provide adequate room for opening of enclosure doors.*
 - 3. Enclosures located indoors: NEMA 250 Type 12.*
 - 4. Doors: Hinged, latching, lockable.*
 - 5. Provide cooling fans and heaters to keep the control equipment within the acceptable temperature range required by the manufacturer.*
 - 6. Nameplates shall be provided for each enclosure and for equipment mounted to the enclosure.*
- Deleted.*

B. Controls:

- 1. Pendant controls of hoists, trolley, and bridge.*

- a. See Section 41 22 15 – Bridge Crane Electrical Components.
2. Variable frequency drive (VFD) controls for bridge, trolley, and hoist:
 - a. See Section 41 22 15 – Bridge Crane Electrical Components.
- C. Load cells:
 1. Sheave block pin strain gauge type, with range suitable for associated hoist.
 2. Alarm and disconnect circuitry for adjustable overload limit.
 3. Continuous readout.
 4. Capacity to “zero” or calibrate readout.
 5. Display: 4-Digit, with readout to 1/100 Ton (e.g XX.XX Ton).
 6. Accuracy: Indication within 2 percent of the actual load, at the rated hoist capacity.
- D. Electrification:
 1. In accordance with requirements of **MHI** CMAA 70 Class C service.
 2. Runway conductor rails:
 - a. ***See Section 41 22 15 – Bridge Crane Electrical Components.***
- E. ***Warning devices:***
 1. ***Warning horn, operable from operator station.***
 - a. ***Maximum noise level: 70 dB***
 2. ***Travel warning bell, automatically operated during bridge and trolley motion.***
 - a. ***Maximum noise level: 70 dB***
 3. ***Warning strobe or rotating beacon, illuminated during movement of hoist, bridge or trolley.***
 - a. ***Provide one Amber beacon illuminated during movement of hoist, trolley, or bridge.***
 - b. ***Provide one Red beacon illuminated upon a major fault.***
 - c. ***Mounted to the crane structure in a location easily visible from the floor below.***
- F. ***Convenience power receptacles:***
 1. ***Extra-heavy duty type, industrial grade.***
 2. ***GFCI type, duplex 125-Volt, 20 Ampere, 2-pole, 3-wire, polarized.***
 3. ***Two (2) located bridge walkway.***
 4. ***One (1) located on trolley platform.***

2.05 MISCELLANEOUS

A. Stops:

1. Provide stops at each end of runways, located to permit maximum possible travel.

B. Labeling:

1. Mark rated crane load capacity, in tons, on each side of crane bridge so that it is legible from the operating floor.
2. Mark on the crane structure, in a location visible from the operating floor, with direction arrows coinciding with those indicated on control station.
3. Identification plates:
 - a. Provide permanently attached, non-corrosive metal plates for crane components identifying manufacturer, model number, size, serial number, capacity, and other essential information.
 - b. Provide in accordance with drawing No. 40-D-6234.
4. Mount a crane hand signal chart on existing column at a location determined by COR.

Deleted.

C. Bridge Runway Rails (*Optional Price Schedule 2*):

1. Material: ***Steel in accordance with ASTM A759.***
2. Size for wheel loads per ***MHI CMAA 70 and ASME B30.2.***
3. Length: divided into approximately equal sections adding up to a total travel length of 150-feet.
4. Punch rail section ends at splice locations.

Deleted.

5. Splice bars, bolts, and accessories:
 - a. Commercial quality free from scale and rust which can be removed by firm rubbing with burlap or equivalent treatment.
6. Threaded Weld Studs (if applicable):
 - a. ASTM A29.
 - b. Fully threaded.
7. ***Continuous Rail Pad: RailLok Series Model MK9.1 manufactured by Gantrex, <https://www.gantrex.com>; or equal, having the following essential characteristics:***
 - a. ***Synthetic rubber pad reinforced with a high-strength steel strip.***
 - b. ***Shore A hardness: 75 plus or minus 5.***

- c. Tensile strength, after aging, minimum: 1,500 pounds per square inch.*
- d. Elongation, after aging, minimum: 200 percent.*
 - 1) Permanent set, maximum: 20 percent.*

D. Crane rail clips:

- 1. Permit mounting of crane rail with resilient pad.
- 2. Attached to structural steel with welded studs.
- 3. *Capacity: capable of withstanding the maximum vertical, lateral and axial forces of the crane.*
- 4. Dimensions compatible with rail size.
- 5. Constrain rail in vertical and lateral planes while allowing controlled movement in axial direction.

E. Lubrication:

- 1. Suitable for ambient air temperatures ranging from 50 to 120 degrees F.
- 2. Grade and type meeting manufacturer's recommendations.
- 3. Grease fittings: Industrial button-type fittings and grease vent fittings of uniform size and design, located for ease of accessibility.

F. Spare parts:

- 1. Greases and lubricants for minimum 2 years of service.
- 2. Manufacturer recommended spare parts.

2.06 ACCESS LADDER

- A. Modify existing access ladder, mounted on the South wall of the Warehouse, to meet CFR 1910.28 for new fixed ladders.
 - 1. Remove the existing ladder cage.
 - 2. Install a ladder safety device to be used in conjunction with a fall arrest harness.
 - 3. Ladder height: 25 feet.

2.07 FABRICATION

- A. Structural Steel: In accordance with these specifications and AISC 360.*
- B. Assemble using corrosion resistant hardware.*
- C. Attach neoprene gaskets with oil-resistant adhesive.*
- D. Perform fabrication and welding of welded joints in accordance with AWS D1.1.*

E. *Welding performed in the shop shall be inspected prior to shipping to the site.*

F. *Weld Inspection:*

- 1. *The quality of welded joints shall be inspected, tested, and reported by the Independent Weld Inspector:***
 - a. *Welded joint inspections, testing, and acceptance in accordance with AWS D1.1.***
 - b. *Visually inspect 100 percent of the welds performed in the shop and in the field, including joint preparation and fit-up, for defects.***
 - c. *Inspect 100 percent of fillet welds and partial joint penetration (PJP) groove welds performed in the shop and in the field with dye penetrant testing or magnetic particle.***
 - d. *Inspect 100 percent of butt joints and complete joint penetration (CJP) welds performed in the shop, and in the field by ultrasonic testing. Defective welds shall be repaired in accordance with AWS D1.1 at Contractor's expense.***

G. *Weld Report:*

- 1. *Submit one report after the inspection of the welds performed in the shop and one report after the inspection of the welds performed in the field.***
- 2. *Each report shall be prepared by the Independent Weld Inspector meeting the qualifications specified herein. Ongoing welded joint inspections are required and reported at the following stages of fabrication:***
 - a. *Approximately 25 percent of welding is complete.***
 - b. *100 percent of welding is complete.***
 - c. *Re-inspection to verify corrections to deficiencies noted in the 100 percent report and after. The Independent Weld Inspector shall continue to conduct inspections until no errors are noted and a final report stating no errors is submitted.***
 - d. *Previously approved welds are not required to be re-inspected.***
- 3. *Each report shall include notes on the following results and findings of inspected work and records in accordance with AWS D1.1:***
 - a. *Weld quality.***
 - b. *Joint preparation and fit-up of components.***
 - c. *Other deficiencies required to be corrected.***
- 4. *Do not ship materials until weld report has been submitted and approved.***

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prior to submitting approval drawings and data, survey and measure existing crane runway rails. Submit survey report detailing recommendations for either reuse and adjustment or replacement of the rails.
1. For reuse and adjustment:
 - a. Adjust existing crane rails to be straight, parallel, level, at same elevation, and aligned in accordance with **MHI** CMAA 70 tolerances.
 - 1) Replace rail hardware as necessary where broken or missing items are discovered.
 - 2) Fully torque all clamping nuts, bolts, and anchors.
 - 3) Prepare report that confirms rail alignment.
 2. For replacement:
 - a. Install rails on existing structure in same location as existing rails.
 - b. Reuse existing mounting bolts where possible. Install new mounting bolts where missing or damaged.
 - c. Align rails to within acceptable tolerances set forward by **MHI** CMAA 70.
- B. Work to replace crane shall not proceed until entirety of replacement crane equipment has been delivered on-site.
- C. As required, install shear blocks at corners of gear reducer bases with welds adequately sized to resist shearing forces.
- D. Perform electrical installation and grounding procedures in accordance with NFPA 70 and other applicable Sections.
- E. Perform work in accordance with manufacturer(s) installation instructions. Ensure all components are fully lubricated and ready for operation upon installation.
- F. Install crane on crane rails, adjust and calibrate equipment, and perform brake run-in operations as required.
- G. Conduct a full inspection of the installed crane with COR, prior to testing. Visually inspect all steel castings. Subject to non-destructive testing if deficiencies are observed. Verify crane is ready for testing.
- H. *Welding Operators: Capable of meeting qualification tests for operators as outlined in AWS D1.1. COR may require test specimens by welding operator in accordance with AWS D1.1 appendix.***

3.02 CONTRACTOR FIELD QUALITY TESTING

- A. Notify COR at least five days prior to testing.
- B. Perform operational and load tests designated for new crane in accordance with the requirements for an Initial Inspection as outlined in ASME B30.2. The tests are to include but are not limited to the following items:
 - 1. Conduct an operational test including the following items with no load:
 - a. ***Operation of all controls, switches, lights, warning devices, and other electrical equipment to determine full functionality of crane.***
 - b. ***Operation of all functions of the HMI are operational.***
 - c. Lifting and lowering of hoist.
 - d. Bridge travel the full length of the runway.
 - e. Trolley travel the full length of the bridge.
 - f. Operation of limit devices.
 - 2. Conduct a load test including the following items:
 - a. Use test weights to test the hoist at a load greater than 100% capacity but not greater than 110% capacity.
 - 1) Contractor shall supply all equipment for testing.
 - b. Complete and submit all requirements of an engineered lift prior to completing the load test.
 - c. Lift the load to above the floor level and hold for 10-minutes to ensure hoist brakes are holding the load.
 - d. Travel the bridge and trolley the full length of their respective runways.
 - 3. Verify that bridge, trolley, and hoist brakes automatically set upon loss of power.
 - 4. During and after operation and tests, inspect for:
 - a. Permanent deformation, cracking, bending, or damage to structural elements.
 - b. Slippage of wire ropes at their terminations.
 - c. Proper spooling of wire ropes on drums and sheaves.
 - d. Proper operation of electrical drives.
 - e. Overheating, abnormal noise or vibration.
 - f. Damage to or abnormal wear of gear teeth.
 - g. Proper lubrication of mechanical components.
- C. Record test data on report form and submit with operations and maintenance manuals:

1. Record operating and startup current (and corresponding loads) data for motors and verify that they meet manufacturer's recommended values.
 2. Record speeds of hoist, trolley and bridge during each test cycle. Verify that performance requirements have been met.
 3. Measure and verify shaft and gear alignment are within tolerances.
 4. Monitor system harmonics during operation of VFDs.
 5. Verify full functionality and correct deficiencies and improper adjustments encountered during testing. Perform any adjustments or repairs in accordance with standard practice or manufacturer's recommendations.
 6. If required, retest crane operation to satisfaction of COR.
 7. Reset overload limit devices for hoist for the rated capacity.
- D. Provide an approved marking to be installed in the operator cab indicating that the crane has been certified for operation and including the following information:
1. Name of crane.
 2. Certifying organization.
 3. Certification date.

E. *Deleted.*

3.03 COATING REPAIR AND REMEDIAL WORK

- A. Repair defective or damaged areas of coatings in accordance with coating manufacturer's recommendations.
1. Coating damaged by the Contractor during installation shall be repaired at the Contractor's expense.

3.04 FINAL AND AS-BUILTS DRAWINGS

- A. Final As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents and Section 01 33 26 – Electrical Drawings and Data.
1. Marked prints of specifications drawings indicating "Final As-Built" changes made to crane and crane components during construction.

3.05 TRAINING

- A. Refer to Section 01 79 20 – Training.

END OF SECTION

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