

SECTION 14050
CRANE, TROLLEY AND HOIST

PART 1 - GENERAL

1.01 Scope of Work:

Furnish and install monorails overhead traveling bridge crane in the location shown on the Drawings, complete and ready to operate.

1.02 Quality Assurance:

- A. The complete assembly shall be designed to conform to the requirements of the United States Occupational Safety and Health Act of 1970 and to meet or exceed design criteria as outlined by Crane Manufacturer's Association of America Specification No.70, Revised 1983, "Specification for Electric Overhead Traveling Cranes".
- B. The hoist and trolley shall be supplied by the crane manufacturer and shall comply with the Hoist Manufacturers Institute HMI-100, "Standard Specification for Electric Wire Rope Hoists" and with ANSI B30.16.0, "Safety Standard for Overhead Hoists". CMAA Specification No.70 does not apply to the hoist and/or trolley.
- C. The monorail shall comply with ANSI MH27.1-81, "Specifications for underhung cranes and monorail systems".

1.03 Submittals:

Submit for approval all drawings, operating and maintenance instructions and other information. All equipment and installation practices shall conform to the applicable requirements of OSHA regulations.

1.04 Materials:

- A. Provide all new materials, with workmanship and materials of the very best quality, entirely suitable for the services they are to perform.
- B. All parts of the mechanism furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation.
- C. Corresponding parts of the equipment shall be interchangeable and all parts subject to wear shall be of standard pattern easily replaceable without the necessity of special cutting and fitting.

PART 2 - PRODUCTS

2.01 Equipment:

A. Design Criteria:

- 1) Field cutting, welding or drilling will not be permitted during installation, and the design shall incorporate provisions for bolted connections where required.
- 2) Select materials for the stresses to which they will be subjected. Design load carrying parts, except structural members and gears, so that the calculated static stress, based on the rated load, does not exceed twenty percent (20%) of the published average ultimate strength of the material.

B. All structural steel shall conform to the requirements of ASTM A36, Specification for Structural Steel, latest edition.

C. All welding shall conform to the requirements of A.W.S D-14.1, Specification for Welding Industrial and Mill Cranes, current edition, with the exception of Section 705, which shall conform with the CMAA standard tolerances for deviation from specified camber and sweep, with all such measurements taken at the manufacturer's plant prior to shipment.

D. Double prime after all fabricating work is completed, including all cutting, welding and drilling, all components of the bridge crane system. This includes but is not limited to, the traveling bridge crane, truck frames and bridge bumpers, runway beams, and all similar ferrous metal items (except stainless steel, and lateral bracing which shall be hot-dip galvanized). Clean all items after fabrication using manufacturer approved cleaning solvents and techniques. Remove all welding flux residue and shop prime with two (2) coats of Kop-Coat Pug Primer as manufactured by Kop-Coat Company, Inc., or approved equal. Each coat shall have a minimum dry film thickness of 1.5 mils.

E. Crane Runway:

- 1) The crane runway rail shall be straight, parallel, level and at the same elevation. The distance center-to-center and the elevation as measured at running surface of rail or flange shall be within a tolerance of plus or minus 3/16-inch. Maximum variation from absolutely straight longitudinal alignment on the horizontal and vertical planes shall not exceed 3/8-inch. Rail separation at joint shall not exceed 1/32-inch. The runway rails shall be standard 40-lb per yard ASCE rail section.
- 2) Runway beams shall be standard wide flange or S beam section. Double prime as specified in Article 2.1 (D) above.
- 3) The lateral deflection of the crane runway shall not exceed 1/400th of the span based on 10 percent of maximum wheel load without impact. The vertical deflection shall not exceed 1/600th of the span based on maximum wheel load without impact.

F. Traveling Bridge Crane:

1) Girders:

- (a) The crane girders shall be of welded structural steel wide flange beams, Standard "I" beams, reinforced beams, or box sections fabricated from structural shapes.
- (b) Proportion girders to resist all vertical, lateral and torsional loads.
- (c) The maximum vertical deflection of the girders produced by the dead load, the weight of the hoist, trolley and the rated load shall not exceed 1/800th of the span.

2) Bridge and End Trucks:

- (a) Provide end trucks to carry bridge of ample size to support the rated load when that load is lifted at one end of the crane bridge.
- (b) End trucks may be of the rotating axle or fixed axle type as specified by the crane manufacturer.
- (c) The bridge and trucks shall be constructed from structural steel providing a rigid structure. Provision shall be made to prevent a drop of more than one inch in case of axle failure. Provide substantial guards in front of each outside wheel and project below the top of the runway rail.

3) Bridge Drive:

- (a) Provide motors near each end of the bridge without torque shafts. Connect the motors to self-contained gear reduction units. Connect the gear reduction units to the track wheels by means of suitable shafts and couplings.
- (b) Provide a bridge brake or non-coasting mechanical drive capable of stopping the motion of the of the bridge within a distance in feet equal to ten percent (10%) of full load speed in feet per minute when traveling at full speed with a full load. Provide holding brakes to crane motors which shall engage automatically when power is interrupted. The braking means shall have the thermal capacity for the frequency of operation.

4) Wheels:

- (a) Wheels shall be double flanged with treads accurately machined. They may have straight treads or tapered treads assembled with the large diameter towards the center of the span. Drive wheels shall be matched pairs within 0.0001 inches per inch of diameter or a total of 0.010 inch of the diameter, whichever is smaller.
- (b) Cast wheels from an acceptable alloy steel with flame hardened treads to a minimum Brinell hardness of 300-350. Wheels shall be designed to carry the maximum wheel load under normal conditions without undue wear.
- (c) Design wheels for the crane end trucks to run on 40-lb ASCE rail.
- (d) Provide rail sweeps in front of each wheel.

- 5) Bumpers and Stops:
 - (a) Provide bridge rubber bumpers rigidly mounted in such a manner that the attaching bolts are not in shear and, designed and installed to minimize parts falling from the crane in case of breakage.
 - (b) Provide runway end stops located at the limits of the bridge travel. Attach stops to resist the force applied when contacted and of the type that engages the tread of the wheel. Determine actual location of runway stops from the dimensions on the manufacturer's approved shopdrawings. The manufacturer shall set these dimensions so as to give the required travel and conform with the requirements of his products.
- 6) Manufacturer:
 - a) The crane shall be as manufactured by Material Handling Systems, Inc., 720 S.W. 4th Court, Dania, Florida; or approved equal.

G. Trolley for crane and monorail:

- 1) Provide trolley frame made from heavy structural steel shapes with ribs and reinforcing plates welded together into a rigid one piece unit. Provide additional rigidity, as required, with spacing plates at each end of the trolley truck. Hold wheel pins stationary in the trucks with keeper plates.
- 2) The trolley drive unit shall be a double reduction gear reducer and motor assembly with an adjustable torque magnetic disc brake. An oil tight gear case shall enclose two reductions of high carbon steel machine-cut helical gears in an oil bath. The magnetic disc brake shall operate on the high speed shaft. Transfer power from the drive assembly to the geared wheels through cold rolled close tolerance ground steel shafting rotating on ball bearing pillow blocks.
- 3) Each wheel gear reduction shall be comprised of an accurately cut steel pinion and wheel gear. Cast trolley wheels from an acceptable alloy steel with flame hardened treads to a minimum Brinnel hardness of 300-350. Wheels shall be designed to carry the maximum wheel load under normal conditions without undue wear. Tread to be machined to exact matching diameters. Wheels shall rotate on anti-friction ball bearings, with pressure type lubrication fittings.
- 4) Provide trolley brakes with adjustment to compensate for wear and of sufficient capacity to stop the trolley within a distance in feet equal to 10 percent (10%) of the rated speed in feet per minute when traveling at rated speed with rated load. Trolley brakes shall have ample thermal capacity for the frequency of operation required by the class of service. Provide an adjustable torque electric brake and a solid state adjustable torque ballast resistor.
- 5) Provide trolley stops at the limit of trolley travel. Design stops to engage rubber bumper mounted on the trolley frame rather than the wheel treads.

- 6) The trolley shall be integral with the hoist and shall be the product of the same hoist manufacturer.

2.02 HOIST FOR CRANES AND MONORAILS:

A. General:

- 1) The hoist and appurtenances shall be designed to withstand all stresses imposed under normal operating conditions while handling loads within the rated load.
- 2) Load bearing parts shall be designed so that the static stress, calculated for the rated load, shall not exceed twenty percent (20%) of the average ultimate strength.
- 3) The load block shall be of enclosed type and of manganese bronze or AISI Type 304 stainless steel construction and the sheaves shall be furnished with close fitting guards that will prevent chains from becoming fouled when the block is lying on the ground.
- 4) Provide load hook of manganese bronze or AISI Type 304 stainless steel construction with sufficient ductility to open noticeably before failure as result of abuse or overload. Load hook shall be free to rotate 360° when supporting the rated load. The hook shall be retained in the housing by positively secured lock nuts, collars or other suitable devices which will prevent hooks from working loose. The hook shall be provided with a spring type latch made of the same material as the hook.

B. Wire Rope Hoist:

- 1) The hoisting rope shall be of stranded cable made of Improved Plow Steel (IPS) with Inner Wire Rope Core (IWRC), according to Federal Specification RR-W-410C. The rated load divided by the number of parts of the rope shall not exceed 20 percent (20%) of the nominal breaking strength of the rope. The rope ends shall be attached to the hoist in a manner preventing disengagement throughout rated hook travel. Rope clips attached with "U" bolts shall have the "U" bolts on the dead end or short end of the rope. The hoist manufacturer shall provide certification of strength on the hoisting rope.
- 2) Sheave grooves shall be smooth and free from surface irregularities which could cause rope damage. The cross-sectional radius of the groove shall form a close fitting saddle for the size of the rope used and the sides of the grooves shall be tapered outwardly to assist entrance of the rope into the groove. Flanged corners shall be rounded and rims shall run true around the axis of rotation.

- 3) Sheaves shall be so mounted as to guard against rope jamming. All running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed or shielded bearings are acceptable.
- 4) The pitch diameter shall not be less than 16 times the rope diameter for running sheaves and not less than 12 times for non-running sheaves.
- 5) The rope drum and surrounding members shall be so constructed as to minimize abrading, crushing or jamming of the rope. The rope drum pitch diameter should not be less than 18 times the diameter of the rope used. No less than two complete wraps of the rope shall remain on the drum after lowering the load hook through its rated lift distance, unless a lower limit device is provided, in which case no less than one complete wrap shall remain. Drum shall be grooved right and left for true vertical lift.
- 6) An automatic Weston type multiple disc mechanical load brake shall be incorporated in the hoist gear train. The load brake shall control the speed of the hoist during lowering. The load brake shall be self adjusting. A magnetic disc type motor brake shall be flanged mounted on the hoist motor. The magnetic brake shall set automatically when current is cut off from the hoist motor. The motor brake shall have a rating of 150 percent full load motor torque minimum.
- 7) The hoist shall be equipped with reversing type, geared upper limit switches which break the control circuit when the hook block reaches its maximum safe operating height. Over-travel for any reason shall automatically reverse the hoist motor and lower the block to a safe level. The installation and wiring of the crane, hoist, and trolley assembly shall be in accordance with the requirements of the latest issue of the National Electrical Code, Article 610 "Cranes and Hoists".
- 8) The hoist shall be reeved two parts double for true vertical lift, shall be integral with the trolley and shall be Yale Model BEW5X19RT1554, or approved equal.

C. Chain Hoist:

- 1) The load chain shall be of a type recommended for hoisting service and shall be of the following types: link chain or roller chain and shall be made of heat treated precision pitch steel. Plastic heavy duty slack chain containers shall be provided for the load chain.
- 2) All load and idler wheels or sprockets shall be suitably formed to fit links of the type chain used. Provisions shall be made to guard against the chain jamming between the load wheel or sprocket and any portion of the hoist under normal usage. The load chain shall have adequate angle of wrap around the load sprocket to give continuous lifting action. There shall be provisions made to force the nonloading end of the chain from the load sheave as the sheave revolves in the hoisting direction.
- 3) All bearings supporting torque-transmitting load shafts shall be removable sleeve or anti-friction types.

- 4) All gears used in lifting the load shall be designed for proper strength and surface durability using service factors determined by the hoist manufacturer. All hoist gearing shall be enclosed and provided with means for ample lubrication.
- 5) Means shall be provided for adequate lubrication of all moving parts of the hoist. Where life-lubricated bearings are used, no means of external lubrication will be required. Lubrication arrangements shall be such as to require infrequent attention. All exposed bearings shall be suitable sealed or shielded.
- 6) The motor shall be enclosed, reversible, intermittent duty type with torque suitable for hoist service and capable of operation at loads and speeds specified. The motor shall have a rating of not less than 30 above an ambient temperature of 40 degrees centigrade when equipped with class a insulation.
- 7) The hoist shall be so designed and constructed that the load hook, either loaded or empty, shall not exceed the upper safe limit of travel.
- 8) The hoist shall be equipped with a hoist motor brake. The brake shall be of the shoe, disc, cone or band type, and interlocked with the motor control to quickly stop the motor when power is interrupted. The torque rating of the hoist brake shall be not less than the full load torque rating of the hoist motor.
- 9) The hoist shall be equipped with a load brake which will control the load during lowering so as to prevent undue acceleration. This load brake may be an automatic mechanical type, dynamic braking D.C. control or electrical braking A.C. control. The hoist shall be integral with the trolley. The monorail hoist shall be integral with the trolley.

2.03 MISCELLANEOUS COMPONENTS FOR CRANE AND MONORAILS:

A. Gearing:

- 1) All gears and pinions shall be constructed of steel and adequate strength to meet the requirements for the rated class of service.
- 2) The horsepower rating for all gearing shall conform to the American Gear Manufacturers Association (AGMA) standards.
- 3) Means shall be provided to insure adequate and proper lubrication for all gearing.
- 4) Gears not enclosed in gear boxes, which may constitute a hazard under normal operating conditions shall be guarded and shall have provisions for lubrication and inspection.

B. Bearings:

- 1) Provide only precision ball and roller bearings for all crane assembly components with minimum B-10 life of 5000 hours at full rated load.

- 2) Provide all bearings with proper lubrication and means of lubricating. Design bearing enclosure to exclude dirt and prevent leakage of oil or grease.

C. Shafts:

- 1) Provide shafts made from cold rolled steel of shafting quality.

D. Couplings:

- 1) Provide couplings at each end truck and each side of the motor gear reducer, except they may be omitted when shaft mounted reducers are provided. Install additional couplings as may be required by design.

E. Bolts and Nuts: High strength steel, hot-dip galvanized with internal threads tapped or retapped after galvanizing.

F. Rotating Parts: All rotating parts that may be considered a hazard to operating or maintenance personnel shall be provided with protective guards conforming to OSHA standards and securely fastened to the crane.

G. Coat all interior surfaces of control enclosures with a fungus inhibitive varnish. Motors shall be given an extra "dip and bake" treatment, also known as "Tropical Insulation".

2.04 ELECTRICAL:

A. General: Furnish and install all electrical equipment on the crane, hoist and trolleys, including two speed motors, control and conduit. Crane manufacturer shall furnish, cut to length, and install as far as practical for shipment all wire on the crane.

B. All electrical equipment shall conform to the applicable requirements of the National Electrical Code, ANSI-CI, latest edition. The installation and wiring shall be made in a workmanlike manner. Electrical materials and components for the crane shall be dust-tight and shall be with NEMA Type 12.

C. Controls:

- 1) Provide floor operated pendant push button station for operation of the crane and/or, hoist and trolley and lights suspended from a moveable separate trolley with aluminum or plastic wheels on a track running along one side of the bridge.
- 2) Locate pendant controls at a distance of maximum 3 feet above the operating floor and mechanically support to protect the electrical conductors against strain. All controls shall be NEMA Class 12.
- 3) Ground pendant control station to guard against possible ground fault. The maximum voltage in the pendant control station shall be 120V A.C.
- 4) Provide clearly marked actuators on the pendant control, from top to bottom as follows:

- (a) "START-STOP", with "STOP" pushbutton in red.
 - (b) Hoist "UP-DOWN". with two contact pushbutton switch for low and high speeds.
 - (c) Trolley "NORTH-SOUTH" or "EAST-WEST", with two contact pushbutton switch for low and high speeds.
 - (d) Bridge "NORTH-SOUTH" or "EAST-WEST", with two contact pushbutton switch for low and high speeds and separate adjustable travel inching button.
 - (e) Provide wall arrows for North-South and East-West directions.
- 5) Pushbuttons in pendant station shall return to the "OFF" position when pressure is released by the crane operator.

D. Controllers:

- 1) Provide festoon type flat cable system to transmit power to crane bridge and/or hoist and trolley units and control of crane from hoist push button station. Support neoprene type SO cable from four-wheel cable carrier with ball bearing aluminum or plastic wheels running along side one runway and across the bridge beam in an inverted track.
- 2) Do not hang festoon loops more than 5 feet, measured from the bottom of the hoist beam. Festoon system shall be Aero-Motive Series 5240, Duct-O-Wire Co., Howel Corporation or approved equal.
- 3) Controls shall be of the magnetic reversing type, mechanically or electrically interlocked with 115 volts control circuit. All wiring shall conform to applicable NEC and CSA requirements.
- 4) Time delay fuses for branch circuit overcurrent protection shall be provided. Enclosures shall be NEMA Class 12.

E. Motors:

- 1) Motors shall be TEFC, NEMA Type 12, rated 30 minutes at 55°C rise with Class F insulation and thermal detectors embedded in motor windings. The motor shall be sized as not to overload at load capacity specified.
- 2) Motors shall be reversible, intermittent duty, with torque characteristics suitable for crane, hoist and/or trolley service and capable of operating at specified loads and speeds.

F. Resistors:

- 1) Crane bridge and trolley motors shall be provided with A.C. primary ballast resistors or adjustable solid state acceleration controls for cushioning the bridge starting.

- 2) Resistors shall be designed with the proper first point stalled torque as required by the control system used, and shall be installed with adequate ventilation, and with proper supports to withstand vibrations.

G. Electrification:

- 1) A totally enclosed power rail conductor system shall be used to transmit power to the crane bridge and hoist and trolley unit. The system shall be four conductor, 160 amp-intermittent, 600-volt rated. The conductor system shall have rolled stainless steel clad copper conductor with copper connector pins. The conductor system shall be fastened to the support beam and connected to the power rail trolley towing arm. The power rail conductor system shall be SAF-T-BAR Series C as manufactured by Howell Corporation, equivalent model by Duct-O-Wire Company, or approved equal.
- 2) Crane shall operate from a 460-Volt, three phase, 60 Hertz power source.

H. Grounding:

- 1) Provide a separate ground wire for each motor or piece of equipment.

2.05 TOOLS:

- A. Furnish a complete set of all special tools needed for adjustment, operation, and maintenance of the equipment.

2.06 OPERATING INSTRUCTIONS:

- A. Furnish four (4) complete list of parts; four (4) complete clear and concise set of instructions for the adjustment, operation, lubrication, and maintenance of the equipment; and six sets of detailed shopdrawings of all parts with catalog cuts, data, literature, manufacturer's name to allow ready identification of all parts. As-built electrical diagrams shall be a part of this material.

PART 3 - EXECUTION

3.01 ERECTION AND INSTALLATION:

- A. Pre-assemble the crane for fit at the manufacturers plant and take apart only to the extent necessary for transportation, with all parts carefully match-marked. Protect all finished parts and electrical equipment.
- B. Field assemble by means of bolted connections. No field welding shall be permitted outside of the manufacturers shop.
- C. Install complete overhead traveling crane and carefully align it on the runway beams.

- D. Crane installer shall be a licensed Master Transporter Assembly Installer in Metropolitan Dade County.
- E. The Contractor shall stencil in an appropriate place, visible from the operating floor, on each side of the crane bridge, the word "NORTH" or "EAST" with the corresponding directional arrow on the north half of the bridge and in the same manner the word "SOUTH" or "WEST" and an arrow on the south half of the crane bridge.

3.02 TESTING:

- A. After the complete overhead bridge crane assembly has been installed and carefully aligned on the supporting rails and beams, and prior to initial use, it shall be tested to insure proper installation and performance, including the following functions:
 - 1. Hoisting and lowering.
 - 2. Trolley travel.
 - 3. Bridge Travel.
 - 4. Limit switches, locking and safety devices. The trip setting of hoist devices shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit device shall be located so that it will trip the device under all conditions, in sufficient time to prevent contact of the hook or load block with any part of the trolley or crane.
- B. Rated Load Test:
 - 1. Prior to initial use, crane installer shall test and inspect crane in the presence of the Engineer. Crane installer shall furnish a written report confirming the load rating of the crane. The load rating shall be no more than eighty percent (80%) of the maximum load sustained during the test. The test load shall 125% of the rated load.
 - 2. The minimum requirements for the rated load test are:
 - a. Hoist the test load a distance to assure that the load is supported by the crane, and held, by the hoist brake.
 - b. Transport the test load by means of the trolley for the full length of the bridge, but taking care of not getting any closer than 2.5 feet (measured from the hoist hook to the center line of the runway rail) to any of the bridge ends.
 - c. Transport the test load by means of the end trucks for the full length of the runway. Place the trolley with the test load as close to the extreme right hand end as possible and, in the other direction with the trolley and test load as close to the left hand end as practical.
 - d. Lower the test load and stop and hold the load with the brakes.
 - 3. Provide the test load and submit to Engineer a certified weight certificate.

4. Correct, to the satisfaction of the Engineer, any portion of the assembly not performing satisfactorily. Re-test as necessary to insure proper operation.

END OF SECTION