

**Bid  
Specifications**

**Monorail  
Systems**



# Foreword

## **Bid Specifications for Patented Track Monorail Systems**

You are invited to use this document as a template for developing a bid specification for a Patented Track Monorail System.

The complete format of this document may not be applicable for all installations because of the wide variety of industrial material handling variables. But it will be a useful tool for developing most monorail bid specifications.

Note: The patented track rail referenced in this text is TC/A Series 325 rail. For systems appropriate for TC/A 200 Series, 400 Series or 450 Series rail, make the appropriate dimension and specification changes. For these rail details, see the TC/American Crane Catalog, available at [tcamerican.com](http://tcamerican.com); click on the "Catalog/Brochures" button.

We recommend that you contact a TC/American dealer for consultation. Our nationwide network of dealers stands ready to assist you with the important task of specifying the appropriate equipment for your application.

In addition, the following patented track bid specifications are also available:

- Underhung Motor Driven Single Girder and Double Girder Cranes and Runways, TC/A-500-a
- Underhung Hand Propelled Single Girder Cranes and Runways, TC/A-501-a



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**A Member of the  
MMA Monorail Manufacturers' Association  
and  
CMAA - Crane Manufacturers' Association of America**

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# Terms of this Bid Specification

## 1.0 Work Included in this Specification

- 1.1 Furnish all labor, materials and services to design and fabricate the monorail system as specified herein and/or as indicated on the drawings and as manufactured by TC/American Crane Company, Elk River, Minnesota 55330. TC/American Crane products are referenced as the level of quality, design, and equipment configuration desired for the application under consideration.

## 2.0 Related Work Not Included in this Specification

- 2.1 The building structure complete, including the structural steel to which the suspended overhead track system and/or steel supports shall be attached.
- 2.2 Furnish, mount and wire an individual fusible electrical disconnect switch including wiring from disconnect to the conductor bars.
- 2.3 Installation, load testing and unloading of all materials.

## 3.0 General Design Criteria:

### 3.1 CODES AND DEFINITIONS

Definitions of terms used in this specification shall be as used in the Glossary of ANSI MH27.1 as prepared by the Monorail Manufacturers Association (MMA). The latest editions of the following specifications and codes shall be conformed to the extent applicable for the application under consideration:

- 3.1.1 For all equipment:  
NFPA-70 National Electric Code (N.E.C.)
- 3.1.2 For underhung bridge cranes and monorail systems:  
ANSI B30.11 Safety Standard for Monorails and Underhung Cranes  
ANSI MH27.1 Specifications for Underhung Cranes and Monorail Systems.
- 3.1.3 For Hoists:  
ANSI B30.16 Safety Standard for Overhead Hoists, HMI Standard  
(Underhung):  
ANSI/ASME HST-1M Performance Standards for Electric Chain Hoists  
ANSI/ASME HST-2M Performance Standards for Hand Chain Manually Operated Chain Hoists  
ANSI/ASME HST-4M Performance Standards for Overhead Electric Wire Rope Hoists.
- 3.1.4 Specifications for Design, Fabrication and Erection of Steel for Buildings of the American Institute of Steel Construction (AISC).
- 3.1.5 American Welding Society (AWS) D14.1 Specifications for Welding Industrial and Mill Cranes and D1.1 Code for Welding in Building Construction
- 3.1.6 Occupational Safety & Health Act (OSHA)

### 3.2 MATERIALS

All materials shall be new, and the completed overhead handling system shall be essentially the product of one crane manufacturer regularly engaged in the production of such equipment.

### 3.3 SERVICE CLASS

All equipment shall be designed for minimum "Class C" (Moderate Service) as specified in the ANSI MH27.1 Specifications, and operation in normal ambient temperatures (0° to 40° C) and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.

### 3.4 VERTICAL IMPACT

Where powered hoists are used, an impact allowance shall be included in design calculations for carriers (trolleys), cranes, and runway monorail tracks. The impact allowance shall be 1/2% of the rated load for each foot per minute (1.6% of the rated load for each meter per minute) of hoisting speed with a minimum allowance of 15% and maximum of 50%. For bucket and magnet applications, the impact allowance shall be a minimum of 50% of the rated load.

## 4.0 Specific Design Criteria

### 4.1 TRACK & FITTINGS

4.1.1 The track shall be a specially fabricated section with a special rolled bottom section having a raised flat tread with a minimum bottom flange width of 3¼". Bottom flange shall have a minimum ultimate tensile strength of 125,000 p.s.i with a minimum Brinell hardness of 225. Track shall be straight, with factory prepared ends. No rough-cut ends will be permitted. Holes shall be factory punched or drilled.

4.1.2 The track size shall be computed based on the load positioned on the track system to produce the most severe conditions of stress and deflection.

4.1.3 The total track deflection shall not exceed 1/450 of the span or 1¼", whichever is the least.

4.1.4 Track end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.

4.1.5 Standard structural shapes or modifications of structural shapes will not be accepted as meeting the requirements of Paragraph 4.1.1.

4.1.6 Track sections shall be installed with bolted type splice plates to provide flush and level connections at the operating tread of the track. No welding will be permitted. The maximum gap between the adjacent ends at load carrying flange shall not exceed 1/16".

### 4.2 TRACK SUSPENSIONS

4.2.1 All necessary clamps, hanger rods, bolts and other fittings from which the track system is suspended, shall be provided as part of the overhead track system. Track hanger supports shall be spaced as per the drawings attached or as specified.

4.2.2 Means shall be provided on flexible type rod suspensions to allow for minimum 1" vertical adjustment of the track both before and after the system has been put in operation so that the track can be erected and maintained level.

4.2.3 Where flexible type rod suspensions are used, the hanger rod shall be made from high strength alloy steel with rolled or cut threads and furnished with a spherical washer and locking nut at each end. Each nut shall be equipped with a set screw. In addition, a roll pin shall be provided at each end of the rod to prevent the nut from backing off the rod.

4.2.4 Where flexible type rod suspensions are used, the top and bottom hanger fittings shall be provided with a spherical seat to match the spherical washer on the hanger rod.

4.2.5 Where track system is suspended by rod suspensions, the system shall be braced laterally and longitudinally. All bracing is to be provided by the erector.

4.2.6 Rigid suspensions can be accomplished by flush clamping or bolting the runway track direct to the supporting steel.

4.2.7 All suspension fittings shall be furnished with S.A.E. Grade 5 or ASTM A-325 mounting bolts.

- 4.3 TRACK ELECTRIFICATION (If Applicable)
  - 4.3.1 Conductor bar shall be roll formed electro-galvanized steel sections, rated 100 amps continuous. Insulation cover shall be rigid bright red PVC, self-extinguishing, with an operating temperature of 150° F. System shall include a dedicated ground bar.
  - 4.3.2 Conductors are to be complete with mounting clips, end caps, splices with covers and power feeds.
  - 4.3.3 Current collectors shall be the sliding shoe type, spring loaded and so designed that sparking and loss of contact will be minimized.
  - 4.3.4 Separate conductors shall be provided for each phase. More than one conductor in a single enclosure will not be permitted.
  
- 4.4 TROLLEYS
  - 4.4.1 Trolley assemblies shall be articulating type, such that, the articulated connection shall permit rotational movement in all three axes. Load bars shall be attached to yokes in such a manner to assure that all wheels are in contact with the operating flange at all times.
  - 4.4.2 Yokes shall be ductile castings, forgings, or steel fabrications and shall be fixture machined.
  - 4.4.3 Design shall be such to facilitate easy installation or removal of wheels at any point along the track system without removing the carrier assembly from the track.
  - 4.4.4 Trolley wheels shall be made from high strength forged or machined steel. The wheel tread shall be accurately machined to assure concentricity of axle and tread, and hardened to 425 Brinell. Wheels are to be furnished with electro-plate finish, black oxide, or equal treatment, in lieu of paint.
  - 4.4.5 Wheel bearings shall be precision ball or taper roller bearings, lubricated and sealed at assembly, and fitted with external grease fittings. Bearings must have a minimum B-10 life of 5,000 hours.
  - 4.4.6 Flangeless wheels with side guide rollers shall be provided when load exceeds 5,000 lbs., track curves less than 6'-0" radius, or travel speed exceeds 100 f.p.m.
  - 4.4.7 The wheelbase of trolleys (carriers) that operate on monorail systems with curves shall be equal to or less than the radius of the smallest curve in the monorail system (not including curved track in switches).
  
- 4.5 TRACK CURVES
  - 4.5.1 Curves shall be of such radius as to permit operation of the carrier without binding.
  - 4.5.2 Intermediate support locations as required are to be determined by the total trolley load.
  - 4.5.3 When electrified, conductor bars may be web mounted or bottom entry type and in accordance with Paragraph 4.3.
  - 4.5.4 Curve track sections shall be formed for accuracy and match up with the adjoining track sections.
  
- 4.6 MANUAL TRACK SWITCHES
  - 4.6.1 Track switch design shall provide for a movable inner frame, operating freely from one throw position to another, which is locked into position by a positive locking pin into receiver blocks. Tongue type switches are not acceptable.
  - 4.6.2 Switches shall maintain alignment of the incoming tracks and switch tracks with a maximum gap of 3/16" between adjacent ends of the load-carrying flanges. Vertical misalignment shall not exceed 1/16".
  - 4.6.3 Stops shall be provided as an integral part of the switch to protect the end of an incoming track when the switch track is set against the incoming track. Stops shall resist the impact forces of a fully loaded carrier traveling at a normal walking speed or at 50% of the full load speed if the carrier is motor propelled.

- 4.6.4 Stops shall also function to prevent a carrier (or trolley) on the movable track from running off the movable track when it is not aligned with an incoming track.
- 4.6.5 Inner and outer switch frames shall be fixture assembled and made of structural weldments.
- 4.6.6 When electrified, conductor bars may be web mounted or bottom entry type and in accordance with Paragraph 4.3. Conductor bars are to be factory mounted with flared guides at entry points. Switch to be complete with wiring raceway and harness to provide electrical continuity.

#### 4.7 MOTOR DRIVEN TRACTOR DRIVES (If Applicable)

- 4.7.1 When a motor driven carrier is required, the monorail manufacturer's drive must be used on monorail systems with track curves and track switches.
- 4.7.2 Traction shall be provided by:
  - 1) Load bearing on one or more pair of steel geared drive wheels.
  - 2) Pressure of a spring loaded friction drive tire on the underside of the track.

When steel wheel drive assembly is employed, both drive wheels shall be driven simultaneously through a specially machined drive pinion. Carrier wheels shall have hardened treads and employ hardened side guide rollers. Drive train shall be heavy duty, double or triple reduction, specially designed for crane service.

#### 4.8 DRIVETRACTOR OR MOTORIZED TROLLEY CONTROLS (If Applicable)

- 4.8.1 All motor starters shall be adequately sized for crane and hoist duty consistent with horsepower requirements and shall be of the reversing type, fully magnetic, with mechanical and electrical interlocks.
- 4.8.2 Motors shall be provided with thermal overload protection.
- 4.8.3 Fusing shall be provided on the secondary side of the control circuit transformer.
- 4.8.4 The complete control panel is to be factory mounted and wired. All wires within the panel are to be terminated on coded terminal strips.

#### 4.9 HOISTS

Monorail supplier shall furnish as part of their contract a hoist of the type most suitable for the particular application under consideration. Such hoist shall comply with the appropriate standard listed in Paragraph 3.1.3. Hoist capacities, speeds and lift shall be as shown on the drawings or as listed in the "Specific Job Requirements."

- 4.9.1 Hoists and appurtenances shall be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity. Load bearing parts shall be designed such that the static stress, calculated for rated load, shall not exceed 20% of the ultimate strength of the material.
- 4.9.2 Electric hoists are to be furnished complete with a suitable pushbutton control station. Pushbutton arrangement is to be supplied with strain relief protection. Control actuators shall be dead-man type with speed adjustment of multi-speed control obtainable by progressive depression of the pushbutton elements to increase lift speed and spring return to off position.
- 4.9.3 The braking system shall be capable under normal operating conditions with rated load to stop and hold the load when controls are released. Controlled lowering shall be limited to 120% of rated lowering speed. In the event of complete power failure, the load shall be stopped and held.
- 4.9.4 All bearings shall be heavy duty, anti-friction type with a minimum B10 life of 5,000 hours. Where applicable, motor bearings shall be lifetime lubricated, sealed ball bearings.
- 4.9.5 All gearing shall be heat treated alloy steel machined for smooth quiet operation.

- 4.9.6 Bottom block shall be completely shrouded for safety and fabricated from steel. Sheaves must be forged or rolled steel, running on anti-friction bearings. Hooks are to be forged steel supported by anti-friction thrust bearings and permit 360° rotation. Hooks shall be equipped with latches unless the application makes the use of the latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.
- 4.9.7 Where applicable, motors shall be totally enclosed, specifically designed for hoist service capable of starting and operating under any condition within the designed capacity and provided with thermal overload protection.
- 4.9.8 Each hoist shall incorporate at least one sensor to limit motion at the top of travel.
- 4.9.9 Electric hoist controls shall comply with N.E.C. requirements for the application being considered and shall include control circuit fusing and contactors mechanically and electrically interlocked.

## **5.0 Assembly and Test**

- 5.1 Tractor equipment is to be factory assembled, and a no-load running test of controls and drive machinery to ensure proper operation shall be performed.
- 5.2 Track switches shall be factory assembled and tested.

## **6.0 System Marking:**

All major components of the system shall be marked at the factory so as to assure prompt and proper field identification.

## **7.0 Painting**

- 7.1 All material shall be cleaned of loose rust, mill scale and foreign matter.
- 7.2 Hoists, trolleys, track switches, track and suspension fittings shall be painted one shop coat of manufacturer's standard finish.
- 7.3 Equipment must be adequately protected against damage and rust in shipment.

## **8.0 Warranty**

Manufacturer shall provide a suitable equipment warranty.

## **9.0 Manufacturer's Drawings and Data:**

- 9.1 General Arrangement Drawings:  
Drawings showing plan, elevation and sectional views along with all other pertinent data shall be provided by the Monorail Supplier.
- 9.2 Panel Layout and Schematic Wiring Diagrams: (as applicable)  
Complete wiring diagrams shall be provided, showing all electrical devices, numbered terminal strips and wiring

## **10.0 Spare Parts & Maintenance Manuals:**

Monorail supplier shall furnish two (2) complete sets of replacement parts and maintenance manuals for the equipment after shipment. These manuals are to include key component breakaway pictures for ease of parts ordering, catalog cut pages, part numbers, sub-assembly details, and periodic inspection and maintenance requirements recommendations.

## Specific Job Requirements for a Monorail System

The foregoing specification is basic and will require additional data in order to develop a detailed specification. This data will ensure that bidders will quote to the specific job requirements.

As an aid to you, following is a list of items, which are to be completed by the specification writer and included with the general specifications.

System Capacity: \_\_\_\_\_ tons

Material to be handled: \_\_\_\_\_

**Type of Service**, Reference ANSI MH27.1 Specification, Section 2, Paragraph 2.2 (applies to motor driven only).

Specify: \_\_\_\_\_

### Monorail:

Overall length of monorail is:

\_\_\_\_\_ Ft. \_\_\_\_\_ In. (nominal)

Distance between monorail support is:

\_\_\_\_\_ Ft. \_\_\_\_\_ In.

Distance from floor to top of monorail is:

\_\_\_\_\_ Ft. \_\_\_\_\_ In.

### Monorail Track Suspensions:

- Flexible rod
- Flush clamp
- Bolt direct

**Note:** Many factors enter into the selection of the proper suspension system, i.e., maximum hanger reaction, building configuration, distance from top of runway to bottom of support structure, etc. Therefore, in some cases, assistance from a TC/American dealer may be beneficial.

### Building Drawings:

General arrangement and structural drawings should be furnished whenever possible.

### Hoist:

Required Lift:

\_\_\_\_\_ Ft. \_\_\_\_\_ In.



Type:

- Hand chain
- Electric chain
- Electric wire rope

Lifting Speed:

- Single speed @ \_\_\_\_\_ f.p.m.
- Two-speed @ \_\_\_\_\_ f.p.m.
- Other (specify) \_\_\_\_\_ f.p.m.

**Hoist Trolley:**

Type:

- Hand propelled
- Hand geared drivetractor or trolley
- Motorized drivetractor or trolley

Travel Speed (if motor propelled):

- Single speed @ \_\_\_\_\_ f.p.m.
- Two-speed @ \_\_\_\_\_ f.p.m.
- Other (specify) \_\_\_\_\_ f.p.m.

Speed Control (if motor propelled):

- Single speed with solid state reduced torque starting
  - Two-speed with solid state reduced torque starting
  - Other (specify)
- 

**Building Power Supply:**

\_\_\_\_\_ volts \_\_\_\_\_ ph \_\_\_\_\_ Hz

**Control Voltage:**

\_\_\_\_\_ volts \_\_\_\_\_ ph \_\_\_\_\_ Hz