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USACE / NAVFAC / AFCEA / NASA UFGS-21 22 03.16 20 (April 2006)  
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Preparing Activity: NAVFAC Replacing without change  
UFGS-14535N (September 1999)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

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### SECTION 21 22 03.16 20

#### MONORAILS WITH AIR MOTOR POWERED HOIST 04/06

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NOTE: This guide specification covers the requirements for monorails with air motor powered hoists.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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NOTE: This guide specification is not to be used for monorail systems that operate in hazardous areas as defined in the National Electrical Code or for nonstandard monorail systems or for the monorail systems that handle hot metals or fissionable materials. All procurement of such monorail systems shall be forwarded to the Northern Division, Naval Facilities Engineering Command, Attn: 09A4, Crane Center, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090.

Monorail Systems procurement that does not fall within the options of this specification should be forwarded to the Northern Division, Naval Facilities Engineering Command, Attn: 09A4, Crane Center, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090. (See NAVFAC Instruction 4330.17C.)

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## PART 1 GENERAL

### 1.1 REFERENCES

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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 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.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### ASME INTERNATIONAL (ASME)

ASME HST-5 (1999; R 2004) Air Chain Hoists

ASME HST-6 (1999) Air Wire Rope Hoists

#### ASTM INTERNATIONAL (ASTM)

ASTM A 275/A 275M (2003) Magnetic Particle Examination of Steel Forgings

#### MONORAIL MANUFACTURERS ASSOCIATION (MMA)

MMA MH27.1 (2003) Underhung Cranes and Monorail Systems

### 1.2 VERIFICATION OF DIMENSIONS

The Contractor shall be responsible for the coordination of his work with the work of all trades involved and as it relates to the building structure. The Contractor shall verify all building dimensions that relate to fabrication of the monorail system, and shall notify the Contracting Officer of any discrepancy before order to the monorail manufacturer is finalized.

### 1.3 SUBMITTALS

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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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.

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

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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.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[[\_\_\_\_\_] will review and] [\_\_\_\_\_] Division, Naval Facilities Engineering Command will approve submittals requiring special review in this section.

#### SD-02 Shop Drawings

Monorail; G

#### SD-05 Design Data

Design calculations; G

#### SD-06 Test Reports

Hooks and hook nuts magnetic-particle tests; G

Load tests; G

#### SD-07 Certificates

Wire rope

## Load chain

### SD-10 Operation and Maintenance Data

#### Monorail system, Data Package 3; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Drawings: Monorail

Submit drawings showing the general arrangement of the track beam system, including curves and switches, clearances, principal dimensions, details of structural connections, air system details, and all component details. Manufacturer's catalog data will suffice for items of standard manufacturer.

##### 1.4.2 Certificates: Load Chain

Submit certification of minimum wire rope breaking strength for each hoist. Where applicable, submit factory certification of the load chain rated capacity.

##### 1.4.3 Design Data: Design Calculations

Submit design calculations verifying the size of structural members, structural supports (fittings, rods, brackets, and components), and lifting beams for the track beam system. The calculations shall include stress and loading diagrams. Submit calculations with monorail drawings.

#### 1.5 MAINTENANCE

##### 1.5.1 Monorail System

Submit data package for the entire monorail system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

### PART 2 PRODUCTS

#### [2.1 FABRICATION AND CONSTRUCTION

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NOTE: Select the applicable paragraph(s) from the following:  
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The hoist and trolley shall conform to ASME HST-5 or ASME HST-6, [2] [3] [5] metric ton ton, for [general service] [protected indoor] [all weather outdoor (-18 to 38 degrees C 0 degrees to 100 degrees F)] working conditions. 2 metric ton ton design criteria shall apply to hoists of 2 metric ton ton, or less, rated lifting capacity. Hoists of 2, 3, or 5 metric ton ton rated capacity, shall be equipped with an automatic mechanical load lowering brake.

##### 2.1.1 Capacity

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NOTE: When there is one hoist on one monorail

system, the monorail system capacity and the hoist capacity will be comparable. When there is more than one hoist on the monorail system, the capacity of the monorail system should be comparable to the total sum of the system hoists individual rated capacity with the following exception:

1. There are positive monorail track beam stops to restrict the approach of the hoists.
2. Calculations indicate that at the point of closest approach of the hoists, with rated capacity load on the hoists, the monorail track beam and monorail support points (and appurtenances) are not loaded in excess of the load condition imposed by any one hoist with rated load in any location.

Should conditions 1 and 2 exist, than the capacity of the monorail system may be comparable to the capacity of the highest rated individual hoist in the monorail track system. Do not specify a monorail system of greater capacity than required as this will increase the system cost.

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The hoist shall have a minimum rated capacity of [\_\_\_\_\_] metric ton tons.  
The monorail system shall have a minimum rated capacity of [\_\_\_\_\_] metric tons tons.

#### 2.1.2 Hook [Lift and] Speed

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NOTE: Unless otherwise specified, the nominal rated maximum speed of the hoists will be the manufacturer's standard within the limits of Table 1, for 2, 3, and 5 metric ton ton capacity hoists.

Table 1. Standardized Hoists Lift Ranges and Rated Lifting Speed Ranges For 2, 3, and 5 metric ton Capacity

Rated Load Capacity (metric tons)	Hoist Lift Range (m)	Hoist Lifting Speed range (mm/s)	
		Low	High
2	3 to 10	30	to 160
3	3 to 10	30	to 85
5	3 to 10	30	to 60

Table 1. Standardized Hoists Lift Ranges and Rated Lifting Speed Ranges For 2, 3, and 5 ton Capacity

Rated Load Capacity (tons)	Hoist Lift Range (ft. )	Hoist Lifting Speed range (ft./min)	
		Low	High
2	10 to 30	6	to 32
3	10 to 30	6	to 17

**Table 1. Standardized Hoists Lift Ranges and Rated  
Lifting Speed Ranges For 2, 3, and 5 ton Capacity**

Rated Load Capacity (tons)	Hoist Lift Range (ft. )	Hoist Lifting Speed range (ft./min)	
		Low	High
5	10 to 30	6	12

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 NOTE: Do not specify a longer lift range than  
 required as this will increase the building height  
 and hoist cost.  
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Shall be the manufacturer's standard within the limits specified in  
 ASME HST-5 or ASME HST-6. [The hook lift shall be at its highest point a  
 minimum of [\_\_\_\_\_] m feet above the finished floor and at its lowest point  
 a minimum of [\_\_\_\_\_] m feet below the finished floor.]

[FABRICATION AND CONSTRUCTION

The [1/4] [1/2] [1] metric ton ton hoist and trolley shall meet the design  
 requirements specified in ASME HST-5 or ASME HST-6 for the 2 metric ton ton  
 hoist trolley.

Capacity:

The hoist shall have a minimum rated capacity of [\_\_\_\_\_] metric tons tons.  
 The monorail system shall have a minimum rated capacity of [\_\_\_\_\_] metric  
 tons tons.

Hook [Lift and] Speed:

[For [1/4] [1/2] [and] [1] metric ton ton hoist(s), the hook lift shall be  
 at its highest point a minimum of [\_\_\_\_\_] m feet above the finished floor  
 and at its lowest point a [maximum] [minimum] of [\_\_\_\_\_] m feet [above]  
 [below] the finished floor.] The hook [lift and] speed limits for 1/4,  
 1/2, and one metric ton ton rated capacity hoists shall be within the  
 limits shown in the following table.

Standardized hoist lift ranges and rated lifting speed  
 ranges for 1/4, 1/2, and 1 metric ton rated capacity

Rated load capacity (metric tons)	Hoist lift range (meter)	Hoist lifting speed range (mm/s)		
		Low		High
1/4	3 to 15	120	to	350
1/2	3 to 12	80	to	250
1	3 to 10	40	to	225

Standardized hoist lift ranges and rated lifting speed  
ranges for 1/4-, 1/2-, and 1-ton rated capacity

Rated load capacity (tons)	Hoist lift range (feet)	Hoist lifting speed range (feet per minute)		
		Low		High
1/4	10 to 50	24	to	70
1/2	10 to 40	16	to	50
1	10 to 30	8	to	45

]2.1.3     **Hooks**

Shall be of the safety type with hook nuts keyed to hook shanks by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or by any other similar easily removable securing device. All hook components shall be magnetic-particle inspected over the entire area in accordance with **ASTM A 275/A 275M**. The acceptance standard shall be one of no defects. A defect is defined as a linear indication revealed by magnetic-particle inspection that is greater than **3 mm 1/8 inch** long whose length is equal to or is greater than three times its width.

2.1.4     **Hoist Wire Rope**

Rope lengths shall be sufficient to maintain a minimum of two full wraps of rope at the dead end(s) of the drum, with the block in its lowest indicated position.

2.1.5     **Hoist Chain**

Chain hoists of **3 m 10 foot** lift or more shall be equipped with a load chain bucket.

2.1.6     **Hoist Limit Switch**

Hoists shall be equipped with upper and lower hoist limit switches/devices.

2.1.7     **Control Pendant**

Shall extend [\_\_\_\_\_] below the underside of the track beam.

2.1.8     **Trolley**

Shall have a [manual] [geared manual] [air motor powered] drive and shall be designed to operate from [[\_\_\_\_\_] track beam section] [the track beam section furnished under this contract]. Where two or more hoists are located on the same monorail beam, the trolleys shall be equipped with rubber bumper devices designed to prevent contact of any part or parts of the hoists.

]2.2     **MONORAIL TRACK BEAM SYSTEM**

Shall conform to **MMA MH27.1**, for powered hoists. The maximum allowable deflection shall not exceed 1/600 of the unsupported span, with the hoist(s) at rated load(s) and at any location(s). The track beam system



shall have trolley stops at all open end locations. The stops shall be designed to retain the hoist on the track. Wheel stops shall interface with the trolley wheel treads on both sides of the track web simultaneously and shall not interface with the trolley wheel flanges. The air supply valve specified shall be of the quick shutoff type, readily accessible from the floor, and located within proximity to the monorail system.

#### 2.2.1 Color of Finished Equipment

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**NOTE: For corrosive atmospheres, specify appropriate protective requirements.**  
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Shall be the manufacturer's standard brilliant yellow.

#### 2.2.2 Identification Plates

The manufacturer shall furnish and install identification plates of noncorrosive metal. Information and data on the plates shall include, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating, and other essential information. In addition, the monorail track beam system shall be furnished with identification plates showing the capacity of the system, which shall be legible from the floor and from either side of the monorail track beam.

### PART 3 EXECUTION

#### 3.1 ERECTION AND INSTALLATION

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**NOTE: Supervisory erection services should be required only on projects with extensive monorail systems; when not applicable this requirement should be deleted.**  
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The Contractor shall erect and install the hoist and monorail system in accordance with of **MMA MH27.1**. [The monorail supplier shall provide supervisory erection services.]

#### 3.2 FIELD INSPECTION AND TESTS

##### 3.2.1 Pre-Erection Inspection

Before erection, the Contractor [and the manufacturer's representative] shall [jointly] inspect the monorail and hoist systems and components at the job site to determine compliance with specifications and manufacturer's data and detail drawings as approved. The Contractor shall notify the Contracting Officer [\_\_\_\_\_] days before the inspection.

##### 3.2.2 Load Tests

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**NOTE: For LANTDIVENGCOM, add the bracketed sentences.**  
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Upon completion, and before final acceptance, the hoist, trolley, and

monorail shall be tested in operation as specified, carrying 125 percent of the rated capacity, and with the units spaced to obtain maximum possible loads in the monorail track beam systems. The air equipment will not necessarily operate at rated speed with a 125 percent overload. For hoists that incorporate mechanical load brakes, the mechanical load brake shall hold a static, as well as control a dynamic, 125 percent rated load. The systems shall be thoroughly tested 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. [The Contractor shall furnish test loads, operating personnel, instruments, and other apparatus as necessary to conduct field tests on hoist and monorail. The test and final adjustments of the equipment shall be under the supervision of the Contracting Officer.] The Contractor shall rectify any deficiencies found and completely retest work affected by such deficiencies.

-- End of Section --