

**SECTION 105626 (10672) HIGH-DENSITY MOBILE STORAGE UNITS  
(LOW PROFILE ELECTRICALLY ASSISTED MOVEMENT)**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawing and general provisions of the contract, including general and supplementary conditions and related specification sections, apply to this section.

**1.2 SUMMARY**

- A. This section includes the following:

Solid state electronic controlled motor driven carriages and related equipment containing new or existing storage housings elsewhere specified

**1.3 RELATED WORK FURNISHED BY OTHERS**

- A. Base floor capable of withstanding line load weight distribution created by load transfers from weight of system, storage housings, media, and occupants.
- B. Finished floor material and installation within system footprint.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI) Standards
- B. American Society for Testing and Materials (ASTM) Standards
- C. Underwriters Laboratories, Inc. (UL)

**1.5 DESCRIPTION**

- A. General: High-density mobile storage system consisting of storage housings mounted on wheeled carriage assemblies riding on multiple steel rails. Purpose is to allow multiple ranges of storage housings to be accessed by means of one moving aisle, thus greatly reducing floor space requirements from that of conventional rows of storage housings. For clarification, the term storage housing shall refer to the shelving, rack, or cabinets which are a component of the high-density mobile system herein specified.
- B. Carriage: The carriage shall be formed of a welded structural steel frame with machined steel wheels mating and/or aligning to corresponding steel rails. All bearings shall be permanently lubricated and shielded.
- C. Drive Controls: Each movable carriage shall have an aisle control directly adjacent to the corresponding aisle to facilitate carriage movement and create the aisle selection. Each controller shall have an "Open" and "Stop" button. Control shall be positioned 44 inches (1118 mm) up on the right side of the face panel. All aisle controls shall be within ADA reach guidelines.
  - 1. Each carriage shall be powered by a 1/8 HP 24 VDC motor. Carriages with motors requiring greater voltage shall be unacceptable.

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2. Carriage drive mechanism shall be a direct drive, line shaft drive, or a synchro drive per manufacturer recommendations to best provide a smooth, non-binding, and non-slipping movement. Drive system shall be designed to provide a movement speed of 3 inches (76 mm) per second.
3. All bearings in drive system shall be permanently lubricated and shielded.

### D. Safety Items:

1. An infrared photoelectric safety sweep shall be provided at a minimum of one per aisle.
  - a. (optional) An infrared photoelectric safety sweep shall be provided on both sides of all movable carriages.
  - b. (optional) An infrared photoelectric safety sweep shall be provided at waist level one per aisle or on both sides of all movable carriages.
2. (optional) An infrared photoelectric aisle entry sensor shall be provided at the entrance to each aisle.

### E. Finishes:

1. Metal Components and Assemblies:
  - a. All components shall be finished with an electrostatically applied Gloss-Tek™ powder coat. Finish shall consist of a non-glare raised surface that provides scuff and scratch resistance. Finish shall be a non-VOC emitting hybrid powder coat which meets or exceeds ASTM test criteria for adhesion, flexibility, hardness, and humidity resistance. A minimum of 29 standard manufacturer's colors shall be offered at no additional charge and a minimum of 3 standard metallic colors shall be provided at an upcharge not to exceed 15%. Any special color match shall be made available per the standard manufacturer's published policy.
  - b. (optional) An antimicrobial powder coat finish which shall hinder the growth of gram positive and gram negative bacteria. This shall also include molds and yeasts. The antimicrobial properties shall be present and fully active for the life of the finish. All other Gloss-Tek™ powder coat characteristics shall apply.
  - c. (optional) An ESD powder coat finish which shall dissipate an electrostatic charge. The electrostatic dissipation properties shall be present and fully active for the life of the finish. Availability shall be limited to black or granite colors. All other Gloss-Tek™ powder coat characteristics shall apply.
2. Laminate Panels:
  - a. High Pressure Laminate Finish: To be selected from manufacturer's standard high pressure WilsonArt™ available colors and patterns.
  - b. (optional) High Pressure Laminate Finish: Provide another laminate manufacturer's color and pattern selection as selected by owner or architect.
  - c. Low Pressure Laminate Finish: To be selected from manufacturer's standard Thermal Fused low pressure laminate finishes.

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F. Sizes: Per manufacturer's standard offering.

### 1.6 PERFORMANCE REQUIREMENTS

A. Design Requirements:

1. Consult drawing for plan view and elevation details.
2. For ceiling height or sprinkler code requirements, rail with required grout for leveling, carriage structure, and storage housing heights must be considered for an overall system height.
3. Carriages shall be designed to accommodate existing or new storage housings as specified in accompanying documentation.

B. Seismic Performance: Provide high-density mobile (compact) storage units capable of withstanding the effects of earthquake motion as required by applicable building codes. Site specific third party evaluation shall be provided by licensed local structural engineer.

### 1.7 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions.

B. Drawings: Provide dimensional layout of complete system including elevations, adjacent room details including pertinent notations and descriptions. Provide dimensional drawings including elevations of all storage housings locating on or adjacent to the system specified.

C. Initial Selection Samples: For initial selection of colors and textures, submit manufacturer's color chart(s) showing full range of colors and textures available.

D. Samples: (optional) Provide minimum 3 inch (76 mm) square sample of each color and texture selected.

E. Warranty: Submit a copy of manufacturer's warranty.

F. Maintenance Data: Provide manufacturer's operation manual, maintenance and care instructions, and instructions for care and cleaning of the finish.

G. Reference List: Provide list of recently installed similar type high-density mobile installations.

H. A list shall be submitted of all specification deviations with a complete description and validation.

### 1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage an experienced manufacturer who has been continuously manufacturing this type of product without interruption for a minimum of 20 years and can supply a list of references upon request.

B. Manufacturing Qualifications: Engage an experienced manufacturer whose internal processes meet or exceed ISO 9001 requirements.

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- C. **Installer Qualifications:** Engage an experienced installer who is authorized by the manufacturer to install a high-density mobile system of this magnitude and has a minimum of 1 year experience doing so.

### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

### 1.10 PROJECT CONDITIONS

- A. **Field Measurements:** Verify all dimensions of perimeter area and proposed system prior to manufacture. Any variations shall be addressed by the general contractor or designated project representative prior to manufacture. Coordinate fabrication and delivery to ensure there is no delay in progress of the work.
- B. **Established Dimensions:** Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating high-density mobile storage units. At this point it is the sole responsibility of the general contractor or designated project representative to coordinate verified field dimensions with the manufacturer in a timely fashion.

### 1.11 SEQUENCING AND SCHEDULING

- A. Sequence high-density mobile storage system with adjoining work to minimize possibility of damage and soiling during entire construction period.
- B. Schedule installation of specified high-density mobile system after finishing operations; including painting have been completed.
- C. **Delivery, Storage, and Handling:** Comply with all instructions and recommendations made by manufacturer or manufacturer's representative for delivery, storage, and handling requirements.
- D. **Pre-installation Conference:** Schedule and conduct conference on project site to review methods, procedures, and logistic details for coordination of installation of high-density mobile system.
  - 1. Recommend attendees:
    - a. Owner's representative
    - b. Prime contractor or representative
    - c. Architect, engineer, or person responsible for the layout design
    - d. Manufacturer's representative
    - e. Subcontractors or installers whose work may affect, or be affected by the installation of this system

### 1.12 WARRANTY

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- A. Provide a written warranty, executed by contractor, installer, and manufacturer, agreeing to repair or replace equipment which fails in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the owner may have under general conditions provisions of the contract documents.
- B. In addition, shall warrant the high-density mobile storage system against defects in material and workmanship for a minimum of 10 years from date of final acceptance by owner.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS

- A. General: Specifications stated herein are based upon high-density compact mobile storage products supplied by Material Handling USA, 222 S Main St, 5th Floor, Salt Lake City, UT 84101. 800-326-4403

#### 2.2 BASIC MATERIALS

- A. General: Provide materials and quality of workmanship, which meet or exceed established industry standards for products specified. Material selection and composition shall be manufacturer's option unless indicated otherwise. Fabricate units from ASTM Class 1, cold-rolled commercial grade sheet or coil steel with all bends and radiuses consistent and true.
- B. Laminate Panels:
  - 1. High Pressure Plastic Laminate: Shall conform to NEMA LD-3 .040 inch (1 mm) vertical grade.
  - 2. Low Pressure Laminate: Shall be constructed from 3/4 inch (19 mm) 45 lb./cu. ft. (720 kg/m<sup>3</sup>) particleboard core panel with integral thermal fused laminated surface on face and back.
- C. Grout: Shall be ready-mixed high strength; controlled expansive grout with superior dynamic load stability, which when mixed with water shall harden rapidly to produce a permanent foundation for the mobile storage system. Grout shall be non-corrosive, non-metallic and non-shrink. The grout after curing shall have a minimum strength of 8000 pounds (3629 kg) per square inch.

#### 2.3 MANUFACTURED COMPONENTS

- A. Rail:
  - 1. Rail shall be ASTM/AISI Type 1045 steel of manufacturer's selection designed and manufactured to carry a load of 1000 pounds per lineal foot (1488 kg/m) of carriage length.
  - 2. Rail surface shall be parkerized with a zinc phosphate solution to prevent rust and minimize wear. Rail surfaces which make contact with wheels that are simply painted or powder coated are unacceptable.

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3. Rail shall be designed to be anchored to a structurally sound base floor capable of supporting fully loaded system and exhibiting a maximum deflection not to exceed  $L/480$ .
  4. Rail shall be positioned, leveled and grouted in accordance with the manufacturer's instructions, providing a minimum of  $7/16$  inch (11 mm) of grout under the rail from the high spot on the floor. Void under leveled rail shall be completely filled with a non-shrink grout.
  5. Shimming of rail is not acceptable either as a means of support or for leveling. Rail shall be drilled and tapped to accommodate leveling screws adjacent to all anchor holes. Each rail shall have a minimum width of  $2-3/8$  inch (60 mm) and all rails must extend completely under all stationary ranges.
  6. Rail shall be level not to exceed  $1/16$  inch (1.6 mm) maximum variation from true level within module and  $1/16$  inch (1.6 mm) maximum variation between adjacent rails perpendicular to rail direction. Each section of rail shall be a minimum of 12 inches (305 mm) and a maximum of 120 inches (3048 kg) with shorter length used only to terminate each individual rail assembly.
  7. Each end of the rail shall be connected by means of twin stainless steel dowels pinned between the rail splice. The splice shall be designed for the most severe operating conditions. Connection joints shall demonstrate vertical and horizontal continuity and provide a transfer of load to and from the adjoining rail sections. Butt splice joints and tongue and groove rail splice joints which only prevent movement in one direction are unacceptable.
- B. Floor and Ramp:
1. Floor shall be constructed of a minimum of  $3/4$  inch (19 mm) underlayment grade exterior glue 5-ply plywood. There shall be no open gaps between the floor and the rail. Fire retardant rated plywood shall be available as an option where required by code.
  2. Ramp shall be constructed of stainless steel or galvanized steel.
  3. Ramp shall not extend beyond the end of the carriage if at all avoidable. It shall be understood that with certain ramp and carriage size combinations this may be unavoidable. The vertical transition from the ramp edge to the floor shall be a maximum of  $1/8$  inch (3 mm) with ramp having a maximum slope of nine degrees.
  4. Ramp shall extend under all mobile and stationary carriages.
- C. Carriages:
1. Carriages are to be welded steel construction. Riveted or bolted carriages shall be unacceptable. Galvanized components are unacceptable. Components of unlike finish or material are unacceptable.
  2. Overall height shall be no greater than  $4-1/2$  inches (114 mm) from top surface of rail to base for storage housing on top of carriage.
  3. Carriage shall be designed for a capacity of 750 pounds per linear foot (1116 kg/m).

4. Carriage construction shall provide for shelving to be securely anchored with vibration-proof fasteners.
5. Carriages designed to recess the shelving or storage housing, thus causing the carriage to protrude beyond the plane of the face of the shelving or storage housing shall be unacceptable.
6. Carriages shall be powder coat finished inside and out. Galvanized components are unacceptable.
7. Fixed carriages shall be of the same construction and height as the mobile carriages and securely anchored to the continuous rail located beneath the fixed carriages.
8. Splices shall be designed to maintain proper unit alignment with no visible fasteners on the outside of the carriage. Fasteners connecting any carriage splice joint shall be vibration-proof in design.
9. Carriages shall be straight and square. There shall be no movement in any splice or welded joint when loaded to recommendation and normal operation is applied.

**D. Wheels:**

1. All wheels whether load or driven shall be a minimum of 3-5/8 inches (92 mm) in diameter, constructed of cast ductile iron, and precision machined for smooth operation and to ensure compatibility to the corresponding rail.
2. Bearings shall be permanently lubricated and shielded.
3. Dynamic load rating on wheel bearings shall be a minimum of 5775 pounds (2620 kg) per wheel.

**E. Guidance:**

1. Guide Design:
  - a. A minimum of 2 guide rails shall be required to ensure precise carriage tracking alignment.
  - b. All guide rails shall have a convex top surface to provide friction-free self-centering alignment with the carriage guide wheels.
  - c. All carriage guide wheels shall have a concave load surface which aligns with the guide rail to provide precise carriage tracking.
  - d. Roller guide and dual flange wheel methods of guidance which have play between the guide points and the rail sides shall be unacceptable.
2. Drive Design:
  - a. Carriage drive shall consist of a continuous thru-wheel shaft assembly driving all rails.
  - b. Drive shaft shall be a minimum of 3/4 inch (19 mm) diameter solid steel and a non-load bearing member of the drive mechanism for ease of movement.

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- c. Couplers shall be securely keyed into place to prevent looseness in the drive mechanisms.
- d. Systems that do not drive all rails shall be unacceptable.

F. Operation:

1. Carriage control shall start carriage motors sequentially to minimize power demands and to decrease point load concentration at the floor.
2. Power Requirements: 120 VAC 15 amp 60 Hertz single phase.
3. All control functions shall be intuitive and user friendly whether for public or private usage. Controls shall incorporate touchpad interface for reliability. Physical pushbuttons are unacceptable.
  - a. Carriage control shall contain indicator LEDs to provide a visual safety status.
  - b. Carriage control shall flash a green arrow indicating a new aisle selection.
  - c. Carriage control shall display solid red when a safety is activated adjacent to the open aisle.
  - d. Carriage control shall display solid amber when the Passive Aisle Block has been activated.
4. Entire system shall incorporate "plug and play" microprocessor technology for reliability and ease of service.
5. Entire system shall be UL and C-UL System Listed. Those which are component only listed shall be unacceptable.
6. (optional) Dual control – Carriage controls shall be available at each end of each possible aisle.
7. All movable carriages shall have a "LOCK" capability, which electronically converts a moveable carriage into a stationary parked carriage. The "LOCK" capability can also be used to lock out aisle access.
8. All moveable carriages shall have a "DISTANCE CALIBRATION" capability which electronically adjusts stopping distances.
9. All moveable carriages shall have a "MANUAL DRIVE" capability which electronically temporarily over-rides all settings.
10. All moveable carriages shall have a "PASSIVE AISLE BLOCK" capability which can be electronically enabled or disabled.
11. Each movable carriage shall have a manual override capability to provide carriage movement in the unlikely event of motor failure.
12. Operator controls and aisle access both into and around the system shall conform to all applicable codes including but not limited to the Americans with Disabilities Act.

G. End/Face Panels:

1. End panels or chain box covers shall be provided to cover the drive chain mechanism and enhance the aesthetics of the system.



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2. End panels must extend the full width of the carriage and extend from the bottom edge of the carriage to the top of the storage housing on the carriage.
  3. End panel selection shall be from the following options:
    - a. Steel: Panels less than 48 inches (1219 mm) in width shall be fabricated from 16 gauge powder coated steel. Panels 48 inches (1219 mm) wide and greater may be fabricated from a lesser gauge sheet steel if additional reinforcing hat channel are provided. Finish and color shall be selected from manufacturer's full offering.
    - b. High Pressure: Shall consist of plastic laminate clad particle board with matching self-edged laminate clad side returns.
    - c. High Pressure: Shall consist of plastic laminate clad particle board with black plastic integral side edge covers and spacer tubes.
    - d. Thermal Fused Low Pressure: Shall consist of plastic laminate clad particle board with black plastic integral side edge covers and spacer tubes.
    - e. Solid Wood: Shall be design, wood species and finish as determined by architect. Finished product shall meet applicable AWI standards for appearance and craftsmanship. Benchmark shall be products provided by Wood-Tek™.
- H. Accessories: (optional)
1. Provide manufacturer's standard. Location and quantity as indicated on the drawings.
    - a. Touch Screen Programmable Control
    - b. Programmability for 99 PINs for security and/or lockout purposes
    - c. Fire Park
    - d. Night Park
    - e. Manual Aisle Reset
    - f. Uninterrupted Power Supply (UPS) Battery Backup
    - g. Aisle Lighting
  - I. Environmental Requirements: All carriages, steel shelving, and steel end panels shall contain a minimum of 40% recycled steel content, comprised of a mixture of post and pre-consumer and industrial. Finishes on carriages, steel shelving, and steel end panels shall be a Gloss-Tek™ powder coat finish with low VOC (volatile organic compounds) and application must incorporate a powder recycle process.

### 2.4 FABRICATION

- A. General: Coordinate all parties to ensure timely execution of this project and to related work. Ensure that all necessary information relating to this portion of the project has been transmitted to the parties involved.

## PART 3 – EXECUTION

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### 3.1 EXAMINATION

- A. Verify that building floor structure is adequate to support high-density mobile system within limits of established deflection criteria based on mobile system type and manufacturer's published criteria.
- B. With installer present, examine floor area within area of mobile system to verify that it is in condition per manufacturer's requirements for rail installation.
- C. With installer present, examine mobile carriages for proper sizing, proper placements of support members for the shelving, and to ensure that mounting surface is square and level
- D. For all installations it shall be the installer's responsibility to know and to execute all phases of the installation in compliance with local building codes.

### 3.2 INSTALLATION

- A. General: Follow all manufacturer's documented instructions and procedures for installation of rail, floor and ramp if applicable, fixed and movable carriages, shelving, panels and related accessories.

### 3.3 FIELD QUALITY CONTROL

- A. Verify all fixed and movable carriages are installed and operating square and level. Correct if necessary.
- B. Verify all end or face panels, shelving components and accessories are aligned properly. Correct if necessary.
- C. Replace components that are scratched, dented, or damaged in any manner with new items from the manufacturer. Surface scratches may be touched up but repair must be complete and undistinguishable.

### 3.4 ADJUSTING

- A. Adjust all components and accessories to provide smooth operation and proper tracking alignment. Perform final visual check that all panels align when aisles are closed, and all gaps are consistent.

### 3.5 CLEANING

- A. Upon completion of installation, clean all components and surfaces. Cover to protect from dust and environmental fallout as a result of other work continuing in the surrounding area. Remove all packaging material and debris that accumulated as a result of the installation immediately upon completion. Leave area of installation neat, in broom clean condition, and ready to present to appropriate persons.

### 3.6 DEMONSTRATION AND TRAINING

- A. Schedule and conduct demonstration of the high-density mobile system. Review all safety features and proper carriage operation with owner's personnel. Review any additional features or points of interest as appropriate.

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- B. Schedule and conduct maintenance training with owner's maintenance personnel. Training session should include a full operation demonstration and all preventative maintenance and minor repair procedures for the high-density mobile system that they would normally be expected to perform.

3.7 PROTECTION

- A. Protect system against dirt and damage during remainder of construction period. Recommend to owner of any additional precautions needed to ensure that system will remain unharmed during balance of construction in surrounding area.

END OF SECTION