

SECTION 10 56 26.23 - MOTORIZED MOBILE STORAGE SHELVING

* ALL FIELDS IN [] MUST BE EDITED.

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Related Specifications Sections, apply to this Section.

1.2. SUMMARY

- A. This section includes the following:
 - 1. Electric carriage mounted high-density mobile storage units, support rails, fabrication and installation including leveling of support rails.
 - 2. Cantilever shelving units, fabrication and installation on mobile carriages.

B. Related Work, Not Furnished:

- 1. Structural floor system capable of supporting live and dead loads required by prevailing building codes, including loads of storage units to be installed. Provide a maximum allowable sub floor deflection of [L/480] [L/360 with Automatic Brake] under specified mobile storage loads.
- 2. Finish floor covering and edging materials and installation on raised floors and ramps, or when on concrete with recessed rail installation.
- 3. Power wiring to units from adequate power supply. Final connections to units shall be provided by [installer] [electrician].
- 4. Fire suppression system is by others

C. Related Sections:

- 1. [Section 033000 – Concrete Work]
- 2. [Sections in Division 9 – Finishes, relating to finish floor and base materials.]
- 3. [Division 26 Specification Sections power wiring devices, conductors and circuit protection.]

D. Allowances:

E. Alternates

1.3. PERFORMANCE REQUIREMENTS

- A. Due to the user's preference and requirements for safety, performance, and flexibility, all following specification line items are mandatory.
- B. Seismic Performance: Provide mobile carriages and shelving capable of withstanding the effects of earthquake motions as determined according to IBC 2006 and local building codes.
- C. Design Requirements: All mobile carriage and shelving elevations as [per attached drawings] or [described in the specifications].

DIVISION 10 - SPECIALTIES

- D. Color Samples: Provide sample for each exposed product and for each color required.
- E. Selection Samples: For selection of colors and textures, submit manufacturer's color charts consisting of actual product samples, showing full range of colors and textures available. Vendors must provide a minimum of 12 color selections in powder coat paint finish.
- F. Installer Qualifications: Engage an experienced installer who is the manufacturer's authorized and certified representative.
 - 1. Minimum Qualifications: 1-year experience installing systems of similar size and complexity to specified project requirements
 - 2. Manufacturer Certification: Required by manufacturer on manufacturer's letterhead required at time of bid. Certifications by sales representatives, dealers, or distributors are unacceptable. Qualification must include resume of certified installation supervisor.
 - 3. Provide support within 24 hours for service call.

- G. Warranty: Submit a written warranty, executed by contractor, installer and manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to, not limitation of other rights the owner may have against the contractor under contract documents.

Lifetime Limited Warranty: For the lifetime of the shelving and mobile carriages ("structural frames"). For the purposes of this warranty, structural frames shall be deemed to exclude all moving parts, controls and guides that have immediate contact with any moving parts.

10-year Limited Warranty: For ten (10) years from the date written hereafter*, for all carriage drive motors. During the 10-year warranty period, all parts are included at no cost for 10 years. Labor installation is included at no cost during the first year of the 10-year warranty period.

5-year Limited Warranty: For five (5) years from the date written hereafter*, for all equipment, other than structural frames and motors. During the 5-year warranty period, all parts are included at no cost for 5 years. Labor installation is included at no cost during the first year of the 5-year warranty period.

*10-year limited warranty and 5-year limited warranty are applicable from the date of invoice. Warranty registration must be completed by the end-user at www.montel.com. As indicated on the registration form, registration constitutes the customer's written acceptance of installation.

- H. Reference List: Provide a list of three (3) minimum installed mobile storage installations to be contacted or visited by owner, architect and contractor. Installation must be of similar size, scope of specified system. Visit is intended to inspect operation, quality of installation and verify the suitability of manufacturer's products and comparison with materials and products specified. Manufacturer is required to address all issues raised by owner, architect and contractor. List must include contact names, phone numbers or e-mails, size and quantity of shelving units.
- I. LEED Data: Provide complete environmental data included recycled material content, VOC data, and other product related information. Describe all manufacturing processes or policies that contribute to environmental sustainability
- J. Project Schedule: Provide a project achievement plan detailing all critical elements necessary to plan, manufacture, ship, and install shelving product. Include critical project milestones and risk mitigation plan.
- K. Manufacturer Qualifications:
 - 1. ISO 9001:2008: Engage an experienced manufacturer who is ISO 9001:2008 certified for the design, production, installation and service of powered mobile systems. Submit manufacturer's ISO 9001:2008 quality system registration certificate.

DIVISION 10 - SPECIALTIES

2. ISO 14001:2004: Engage an experienced manufacturer who is ISO 14001:2004 certified. This international standard defines a process for monitoring and improving an organization's environmental performance. This process minimizes adverse impacts on the environment caused by the activities of the enterprise and helps to continually improve the environmental performance of the organization. Submit manufacturer's ISO 14001:2004 registration certificate, certifying the environmental performance of manufacturer.
3. Underwriters Laboratories Inc.: Entire powered mobile system shall be C-UL US listed certified. Manufacturer shall submit C-UL US certification with proposal.

1.4. SUBMITTALS

- A. Product Data: Submit manufacturer's product literature, schematics, testing data, and other items as described in this specification. Include data substantiating that products to be furnished comply completely with requirements of the contract documents and specifications. Include installed weight, load criteria, furnished specialties, and accessories.
- B. Shop Drawings: Prepared and detailing fabrication, assembly, and installation of mobile carriages and storage shelving, as well as procedures and diagrams. Include details of layout and installation, as well as clearances, spacing, relation to adjacent construction in plan, elevation, and section, components, assemblies, connections, attachments, reinforcements, and anchorage. Furnish floor layouts, technical, and installation manuals for every unit shipment.

1.5. QUALITY ASSURANCE (Submittals due from all bidding contractors at time of bid, failure to do so shall be cause for disqualification.)

- A. Manufacturer Certifications: Provide separate written certifications by manufacturer on manufacturer's letterhead at time of bid required stating compliance with all specifications of shelving systems. Shelving certifications must confirm compliance with all shelf sizes and gauges as noted in these specifications. If bidding different manufacturers for mobile and shelving, two (2) certifications are required. Preference shall be given to one-source supplier.

1.6. PROJECT CONDITIONS

- A. Field Measurements: Verify mobile carriages and shelving unit location by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating mobile carriage and shelving units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.
- B. Delivery, Storage, & Handling: Comply with instructions and recommendations of manufacturer for special delivery, storage and handling requirements.
- C. Sequence & Scheduling: Sequence mobile carriage and storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- D. Pre-Installation Conference: Conduct conference at project site. Review methods and procedures related to installation of mobile carriage and storage units including, but not limited to, the following:
 1. Inspect and discuss condition and levelness of flooring and other preparatory work performed under other contracts.
 2. In addition to the Contractor and the installer, arrange for the attendance of the following:
 - a. Other Installers affected by the work of this section.

DIVISION 10 - SPECIALTIES

- b. The Owner's Representative.
- c. The [Architect] [Architect/Engineer] [Engineer/Architect] [Engineer] [Designer].
- d. Manufacturer's representative.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

- A. General: Products are based on upon mobile shelving system products manufactured by Montel Inc. Contingent on meeting all specification requirements, other acceptable manufacturers may be included.

2.2. BASIC MATERIALS

A. Grout:

- 1. General: The compound shall be hydraulic type cement which, when mixed with water, will harden to produce a permanent bolt setting anchor. The compound shall conform to the following specifications, all of which are based on the performance of the test specimens at room temperature and in laboratory environment.
- 2. Linear Movement: It shall not shrink on setting, but shall exhibit a slight expansion of not more than .002 inch per linear inch.
- 3. Compression Strength: Two (2) inch cubes made in accordance with ASTM standards tested on a Balding-Southward machine of 60,000 pounds capacity shall have the following minimum average compression strengths:
Age:1 hour - 4,500 PSI
7 days - 8,000 PSI
- 4. All tracks shall be grouted the entire length of each run, including all track joints. As the grout slightly expands during the cure process, it shall be in permanent contact with the grouted structural members. This provides a continuous support to the system, and optimal weight distribution on the existing floor slab.

2.3. MANUFACTURED COMPONENTS – MOBILE

A. Tracks:

- 1. Rails shall be designed and manufactured to carry loads of 1,000 pounds per linear foot (1385kg/m) of carriage. Made of minimum cold rolled steel (CRS) rail assembly of ¾" (19mm) high x 1" (25mm) wide inserted in a corrosion resistant aluminum sub-rail treated against oxidation caused by concrete. Rail contact surface shall be minimum 1" (25mm) wide. The inserted steel rail shall be replaceable. One-piece rails with no sub-rails or corrosion barrier are not permitted.
- 2. Sub-rails shall be leveled with self-leveling screws above or below the walking surface. Shims shall not be accepted.
- 3. Sub-rails shall be designed to be anchored on top of structural concrete floor and to allow for adjustment so sub-rails can be leveled over an uneven floor.
- 4. In the sub-rail, the opening adjacent to rail which accommodate manufacturer's carriages guidance system and/or anti-tip system shall not exceed 7/16" (11mm) wide x ¾" (19mm) deep.
- 5. All rail connections shall have interlock steel rail connectors. All sub-rail connections shall

have interlock steel sub-rail connectors. All track connections shall be designed to provide horizontal and vertical continuity between rail/sub-rail sections, to gradually transfer the concentrated wheel point load to and from adjoining sections. To insure vertical and horizontal stability, tongue-and-groove connections are not permitted.

6. Tracks shall be layered and staggered to ensure a smooth weight transfer from one track to the other. Top-to-bottom track shall be without joints to support continuously the top steel rail at the junction point and provide greater structural rigidity. One-piece rails with tongue-and-groove joints and connections are not permitted.
 7. Rail shall be located and positioned properly, leveled and grouted, allowing at least ¼" (6mm) for grout under high point. Anti-slip grooves under sub-rail shall prevent track to slip when grout is poured. Grout shall infiltrate inside the grooves to anchor the sub-rail to the cement. Grout to be worked under rail, any voids completely filled and trimmed upsides and flush with rails. This allows proper weight distribution from rail to existing slab.
 8. Levelness of rails: 3/32" (2mm) maximum variation from true level within any system; 1/16" (1.5mm) maximum variation between adjacent rails, perpendicular to rail direction; 1/32" (0.76mm) maximum variation in 10' 0" (3.05m) of rail length, along any rail.
 9. Rails to be verified for integrity of position and levelness, as well as anchored into structural concrete slab, using anchors in sizes and quantities as determined by manufacturer.
 10. Sub-rail section shall be a minimum of 12' foot (3.66m) each and rail section shall be provided in shorter section of 10' foot (3.07m). Shorter sections are used to complete each individual rail assembly
 11. [(Optional) Built-in anti-tip device sub-rail shall be provided to meet local building code and high height-to-width ratio.]
- B. Floor/Ramp (Choose 1 or 2):
1. [Surface Mounted Floor / Ramp]:
 - a. Finished elevation of the raised floor shall be flush with the top of the rails.
 - b. The ramp shall not extend beyond the end of the carriages and shall have a maximum slope of nine (9) degrees. The vertical transition from the ramp edge to the floor shall be a maximum of 1/8". Ramps shall extend under all movable and stationary ranges except as noted differently. Ramps shall be made of 12-gauge steel.
 - c. Floor panels shall be constructed of a minimum [5/8" (16mm)] or [¾" (19mm)] thick, underlayment grade plywood. Floor panels must be provided between all rails the full-width of systems, except under stationary platforms.
 - d. Floor panels shall be provided with built-in floor anchor to provide a continuous leveled floor surface.
 - e. The floor and ramp shall be constructed in a manner preventing any warping or deformation of the floor panels in a normal operating environment.
 - f. Floor covering is to be installed and supplied by [the Owner] [others].
 2. [Recessed]:
 - a. Finished elevation of the raised floor shall be flush with the top of the rails.

- b. Track shall be protected with steel covers during the pouring process.
- c. Concrete topping shall be poured in order to fill the gap between existing slab and top of the track (NIC).

C. Carriages:

- 1. All carriages shall be riveted-bonding construction for flexibility and potential reconfiguration. Welded carriages or carriages with formed lips are unacceptable. Carriages and stationary platforms shall be constructed of a full "C" shape profiles 1 ½" (38mm) deep x 5" (127mm) high, minimum 12-gauge steel, with 1,000 pounds (1385kg/m) per linear foot maximum capacity. Wheel support sections shall be minimum 12-gauge steel and shall be riveted between the main support face sections, one per aisle assembly. Support sections shall be embossed to eliminate the need of filler plates between the shelving/cabinet and the C shape supports.
- 2. Stationary carriages, as shown on the drawings, shall be of same construction and height as the mobile carriages and anchored to rails. Setting of shelving on floor at ends of mobile runs is unacceptable.
- 3. Necessary carriage splices shall be bolted type designed to maintain proper unit alignment and weight load distribution.
- 4. Carriage face sections shall provide a smooth, clean appearance without any assembly holes or protruding hardware.
- 5. Carriage straightness shall have no more than ¼" (6.35mm) maximum deviation from a true straight line. There shall be no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- 6. Carriage construction shall be designed to allow the shelving uprights to be secured to the carriage frame with two assembly kits per upright of vibration-proof graded 5" bolt, nut, and clamp anchor assemblies and so that there is no visible hardware on carriage face. Recess design carriages are not permitted. Self-drilling screw attachment is not acceptable method of attachment shelving units to the carriage. No shelving or cabinet attachment hardware shall be visible on exterior face of carriages
- 7. Each carriage shall have two wheels per rail.
- 8. Carriages shall have powder coat (1.5 mil) finish on all surfaces. Color selection by the [Owner] [Architect] [Architect/Engineer] [Engineer/Architect] [Engineer] [Designer] to match shelving. Powder coat paint finish is required for finish durability and elimination of any off gassing. Finish shall be inert, with no volatiles present in finished product. Visible galvanized steel structural carriage components are unacceptable.

D. Drive/Guide System:

- 1. Direct-Drive System: Provide with full-length drive shaft which prevents carriage whipping, binding and excessive wheel and rail wear under normal operation. All wheels shall be direct-driven at every rail location on one side of carriage. Synchronized drive with multiple chains, trolleys, and drive shafts are not acceptable.
- 2. Torque-Resistant Tubular Drive Shaft: Minimum of 1 5/16" (33mm) outside diameter by maximum 1 1/8" (29mm) inside diameter. Solid steel rod is not acceptable.
- 3. Dual-Flange Wheels: Provide positive guidance and tracking. Guidance requiring cam followers and ball bearings running on either side of the rail is unacceptable.
- 4. Narrow Guidance Channels: Provide a maximum 3/8" (9.5mm) between sub-rail and rail sections to reduce tripping hazards, allow carts to easily roll over, prevent debris

accumulation, and facilitate cleaning.

5. Module shall operate on 115 Volts 50/60 Hertz, 15 or 30 Amp dedicated circuit, depending on the quantity of carriages.
6. Obstruction-Free Aisle: Provide ground embedded wire track including the following:
 - a. Electrical system shall include two conduits made of 6063-T5 aluminum extrusions integrated in the sub-floor underneath the carriages. Conduits shall be located next to a rail and run the full-length of the module. Extrusions shall be leveled and interconnected to the aluminum sub-rail by means of anchor bolts to ensure proper integrity. Overhead scissor arm pantographs are not permitted.
 - b. All the wiring carrying the 12V communication cables and the 120V power cables between the carriages shall run into the aluminum conduits.
 - c. Communication cables shall be RJ45 retractable type and shall run in the ¾" (19mm) diameter circular aluminum conduit.
 - d. Cables shall run through a protective pipe that shall be anchored to the structure of the moveable carriage.
 - e. Flexible sealing strips shall close the openings to protect the wires during and after the carriage movement

E. Wheels:

1. Wheels shall be constructed of solid minimum 1045 cold rolled steel (CRS) for smooth operation. Minimum load capacity per wheel 3,200 pounds (1,452kg) Wheels shall be precision ground, balanced. All bearings shall be permanently shielded and lubricated
2. All wheels shall be minimum 5" (127mm) diameter (outside dimension). They shall be dual-flanged and sloped to insure efficient guidance. Load wheels shall have spherical surface to reduce friction and facilitate ease of use; drive wheels shall be flat. Single center flanged wheels are not acceptable.
3. Due to carriage length and shelving heights, guide wheels shall be at all wheel locations.

F. Motors:

1. Each carriage shall be equipped with a minimum of one (1) 90 VDC current limited, fractional horsepower gear motor.
2. Gear motor shall be connected to a full-length shaft at all rail locations to avoid potential distortion.

G. Face Panels:

1. Materials: All exposed face panels shall be steel. Face panels shall be located on all operating ends of ranges as shown on drawings.
2. Finishes: [Selected from manufacturer's standard available colors and patterns.] [(Optional) Selected by the [Architect] [Architect/Engineer] [Engineer] [Designer].]
3. Face panels must cover the full height and width of shelving.

H. Control Boards:

1. Control boards shall offer capability to be upgraded with new generations of software.

2. TCP/IP protocol connectivity shall be provided with control boards

I. Movement Controls:

1. [Simple LCD Controls and a PIN-Code Module Access Control: Provide a Simple Control with LCD display on the accessible (open) end of each mobile carriage. Provide one 10-digit PIN-Code Keypad Control for each powered module.
 - a. Simple Controls with LCD Display shall include two arrow shaped OPEN backlit buttons, and a STOP backlit button. Provide a 32-character display for module status and additional safety. Display shall be permanently backlit. The multilingual LCD display messages shall be available in at least 3 languages (English, Spanish, French).
 - b. The PIN-code control shall have a 32-character permanently backlit LCD Display, and digits from 0 to 9. The 32-character display shall provide status of the module at any time. 4-digit PIN access code can be programmed and reprogrammed by the user. The multilingual LCD display messages shall be available in at least 3 languages (English, Spanish, French). The PIN-Code Control shall display date and time (available).
2. [PIN-Code Aisle Access Controls: Provide a 10-digit keypad control at each secured carriage.
 - a. The PIN-code access control shall have a 32-character permanently backlit LCD Display, and digits from 0 to 9. The 32-character display shall provide status of the mobiles at any time. 4-digit PIN access code can be programmed and reprogrammed by the user. The multilingual LCD display messages shall be available in (English, Spanish, French). PIN-code aisle access controls shall display date and time (available).
 - b. Simple Controls with LCD Display shall include two arrow shaped OPEN backlit buttons, and a STOP backlit button. Provide a 32-character display for mobile status and additional safety. Display shall be permanently backlit. The multilingual LCD display messages shall be available in at least 3 languages (English, Spanish, French). (Remote System Monitoring Software mandatory.)
 - c. Simple Controls shall include two arrow shaped OPEN backlit buttons, and a STOP backlit button. (Remote System Monitoring Software mandatory.)
 - d. The PIN-code aisle access controls shall have a 32-character permanently backlit LCD Display, and digits from 0 to 9. The 32-character display shall provide status of the module at any time. 4-digit PIN access code can be programmed and reprogrammed by the user. The multilingual LCD display messages shall be available in (English, Spanish, French). PIN-Code Module Access Control shall display date and time (available).
3. Each carriage shall have a control centered on the face panel and located at 41" (1041mm) (from the base of the carriage to the base of the control).
4. All controls and indicator lights shall be solid state and shall provide visual indication of safety module operation. Controls shall offer illuminated feature on the stop and the arrow buttons for additional feedback to the user, and allow easy visual status from across the room. Only the safe and available operational functional shall be the illuminated functional options for the user. Controls shall feature a module error backlit indicator light in case of any abnormality.
5. The control's housing shall be zinc and impact-resistant
6. Sealed membrane control technology to ensure maximum life duration of controls.

Mechanical push button controls or membrane activating mechanical push button controls are not acceptable. Membrane controls shall be sealed for water and dust penetration, as well as chemical-resistant.

7. Automatic Aisle Reset: Upon confirmation there are no users or objects in the aisle, the module shall reset automatically and the LED-friendly backlit arrows on the control panel shall display a constant blue indicating the available aisle. Systems requiring manual reset shall not be acceptable.
8. Infrared Distance Measuring Sensors: Provide each aisle with a distance sensor programmable with the PIN-code controls main menu [and] [(Optional) remote monitoring software]. Proximity sensors shall be provided to easily adjust aisle spacing between closed carriages and adjust individual carriages to provide necessary clearance to accommodate, and protect objects that are overhanging the shelves. Mechanical plungers are not acceptable, as well as manual adjustment of proximity sensors or the necessity of a computer connected to a control board to adjust aisle spacing
9. [(Optional) The control housing shall be available in [one] [two] other additional colors provided by the manufacturer.] (In lieu of standard black.)
10. [(Optional) Smartphone Wi-Fi Remote Control: Provide Smartphone mobile device to operate the powered system.] (Only specific Smartphone can be utilized.)

J. Safety Features:

1. Infrared Foot-Level Safety Beam: Every potential aisle can be protected with an infrared foot-level safety beam mounted on one side [(Optional) both sides] of each moveable carriage, $\frac{3}{4}$ " (19mm) from floor. Safety sweep using mechanical switches are not acceptable.
2. Safety Lock Out: Red STOP indicator shall signal occupation on each side of the aisle and prevent selection of a new aisle until open aisle is cleared. LED-friendly visual directional arrows shall provide verification that carriages are in locked or unlocked mode, and display only the safe available choices for carriage movement. There shall be no Reset or Stop/Reset to override the safety system. Controls with a RESET or STOP/RESET button are unacceptable.
3. Multilingual Audio Feedback: Provide additional safety when pressing any button on the control and shall confirm a command has been received (i.e. "Ready to Use" or "Moving" or "Aisle in Use"). Sound volume shall be adjustable or off. Audio feedback shall be multilingual and available in [English] [Spanish] [French] [Specify Language]. Sound volume shall be adjustable or off.
4. Fail-Safe Technology: Safety system shall be fail-safe design and prevent any carriage movement should the system fail.
5. Electronic Overload Protection: Shall shut off power to the motor when excessive pressure is applied against a carriage. [(Optional) Pressure sensitivity shall be programmable and adjustable with [PIN-Code Control] [Remote Monitoring Software].
6. Aisle-Entry People Counter: Shall monitor users entering and exiting an aisle. Data shall interface with remote monitoring and configuration software.
7. [(Optional) Automatic Lock/Relock Timer Active Safety: Shall be programmed for a predetermined period to automatically lock or relock the module if inactive for more than the determined period.]
8. [(Optional) Remote System Monitoring Software: Provide PC-based diagnostic system for monitoring and configuring all mobile system's safety, power, and functionality processes. Monitoring system shall automatically notify specified service personnel of abnormalities

with system operation or safety systems.]

K. Security Features:

1. [(Optional) PIN-Code Control Controlled Access: HIPAA compliant PIN-code controlled access shall provide security for confidential documents or materials. Each carriage can be easily locked simply by using PIN-code control, not requiring the utilization of a computer. Different PIN codes can be allocated, allowing access to specific modules only. The PIN-code control shall have digits from 0 to 9. 4-digit PIN controlled access code can be programmed and reprogrammed by the user. PIN-code control shall feature a padlock backlit indicator light indicating locked aisle or locked module. LCD display shall indicate to "ENTER PIN".]
2. [(Optional) Magnetic Card Access Reader Capability: Users can operate the module with a card swipe access.]
3. [(Optional) Automatic Brake: Provide an automatic security brake on each powered carriage.]
4. [(Optional) Controlled Access Mechanical Lock: Provide a mechanical lock to make the whole module locked.]
5. [(Optional) Building Interface: Provide the powered mobile to interface with the building's fire alarm system, lighting system, power generator or building management system for security [Module Security Park] and fire protection [Module Fire Park].]
6. [(Optional) Environmental Monitoring Sensors: Provide [humidity and temperature] [water] sensors to monitor the environmental conditions at the location of the powered mobile module. The module shall move automatically depending on the preset ranges of temperature and/or humidity or when water is detected.] Select [Auto-Cycle] [Auto-Closing/Security Park] [Auto-Spacing/Ventilation Park] [Automatic Priority Aisle].]

L. Carriages Movement:

1. Each carriage shall provide controlled acceleration and deceleration to protect stored books or objects. Each motor shall have a dynamic braking system (with programmable stop distance) that will stop the carriage whenever a safety feature is activated.
2. Controls shall provide movement with a controlled running speed of 3" (76mm) per second. Speed parameters for gentle start-up, cruising speed, and braking movements shall be programmable with the [PIN-Code Control] [Remote Monitoring Software].
3. Module movement shall start carriages [sequentially to minimize power demands] [by block to move all carriages at once.] Capability to change easily from Sequential Movement to Block Movement with the [PIN-Code Control] [Remote Monitoring Software]. Module movement must not require any modification to the module configuration and without the use of an external device such as a computer.
4. Multi-Tasking Aisles: Carriages movement shall be initiated while other carriages are already moving and completing their move cycle.
5. [Automatic Carriage Reversal: System must be programmable to allow automatic carriage reversal upon safety activation when entering a closing aisle.]
6. [Automatic Priority Aisle: Module shall be programmed to automatically reposition the system to predetermined aisle(s). Module shall be programmed so the most frequently used aisle(s) is always opened by default after a predetermined period of inactivity.]
7. [Module Auto-Closing: Module shall be preprogrammed to close all ranges after a predetermined period of inactivity to protect stored material from sprinkler systems, light,

dust, etc. This feature shall close the module at specific times or after work hours to prevent unauthorized access.]

8. [Module Auto-Spacing/Ventilation Park: Once activated, aisle spacing shall be evenly distributed for ventilation. The sequence shall be activated by an internal timer (preset time), a key switch located on the master panel, or a dry contact from the customer building interface.]
9. [Mobile-Static Carriage Interchangeability: Permits modifications to make one or multiple carriages into a stationary carriage and vice-versa. Provide to create additional aisles per module.]
10. [Keyless Override Mode: Carriage movement shall move one at a time with reduced speed using a 4-digit PIN code. Systems requiring a key to override the system are not acceptable permitted.]

M. Auxiliary Override:

1. Mechanical Ratchet Backup: Each carriage shall be equipped with a mechanical ratchet device connected directly to the full-length drive shaft to ensure complete accessibility in case of primary power failure, no operational downtime, simplified system installation, and easy relocation. Provide a mechanical ratchet tool to operate each carriage manually. Ratchet tool shall be easily connected to the mechanical ratchet device without removing the face panel. Removable plastic-molded cap shall be installed at each bottom right corner of each face panel.
2. [(Optional) Automatic Built-In Battery Backup: Powered mobile system shall be always operational even during power failures. Provide one battery backup per module. Battery must always be recharging. All preprogrammed functionalities, standard and optional safeties, and speed shall remain operational.] Handheld portable battery backup requiring the use to hold and move the carriages one by one is not acceptable.

N. Accessories:

1. [(Optional) Hinged Face Panel: Every electrical mobile carriages shall be equipped with an electrical panel with hinges in order to have access to electronic board from the front. The panel is made of 18 gage steel and requires a key to be opened.]
2. Hinged Face Panel : Every electrical mobile carriages shall be equipped with an electrical panel with hinges in order to have access to electronic board from the front. The panel is made of 18 gage steel and requires a key to be opened. This panel shall be mandatory with ground embedded wire track.
3. [(Optional) Dual Controls: Provide additional control panel at end of each powered carriage for accessing from either end of the aisles.]
4. [(Optional) Automatic Overhead Aisle Lighting: Each aisle shall be equipped with automatic lighting. Lighting system shall illuminate upon opening or entering a selected aisle, turn off when the aisle is exited, contributing to energy conservation (LEED).]

2.4. MANUFACTURED COMPONENTS – CANTILEVER SHELVING

- A. Column Uprights: Formed of 16-gauge steel into a channel shape with 1/2" stiffening flanges, the channel to measure 2" in the web and 1 5/16" at the front and rear faces. They present a smooth, closed box shape 2" x 2 5/8" in cross section with eight right angle bends when bolted to the adjoining column of the next unit, or bolted to an end cover. When bolted to adjacent welded frames, exposed open channels of uprights are unacceptable. Each column is perforated full-height on both faces with a row of slots spaced 1" on vertical centers to receive hooks and lugs of shelf brackets, thus permitting 1" adjustment of shelves. In adjoining columns, the rows of slots are 5/8" on lateral centers. Columns are marked every three (3) inches to facilitate visual

positioning and adjustment of shelves. Corresponding holes for bolting columns into ranges are provided. Two (2) uprights are required for each section of a range, since no adjacent sections may share a common upright and be truly modular. Bolted column uprights must create a vertical concealed chase for wiring and cabling.

- B. Top Spreader Tube: The top spreader is a fully closed tube of 16-gauge, 2" x 2" square. This tube is securely electric welded with continuous welds to the upright columns to permit unit arrangements and maximum non-sway capabilities. The length of this tube is variable for any unit width (36" standard). The top spreader is tubular to assure a closed surface where books or patrons may come in contact with the tube and visually pleasing from the top on low units and from the bottom on high units. This closed tubular shape additionally provides a chase for wiring and cabling. Field modifications to accommodate potential wiring or cabling are unacceptable.
- C. Bottom Spreader Channel: To be channel shaped, open to the floor, of minimum 14-gauge steel. This spreader is electric welded on the two (2) vertical faces with continuous welds to the upright columns at a height to assure continuous through shelving on the base shelves. The length of the channel shall be as above for the top spreader. Slots in bottom spreader channel are provided to perform leveling function at the column, without having to remove base shelf. The above top and bottom spreaders are electrically welded to the uprights with a full-bead of each of the four (4) joints to form a rectangular frame of one (1) piece construction without the use of nuts, bolts or any other type of fastener. The completed frame is rigid without the use of sway braces, gusset plates, angle braces, or any other device that will obstruct the use of any or all shelves anywhere in the bookstack.
- D. Levelers: An 11-gauge steel threaded clip is welded to each of the frame uprights below the bottom channel spreader. Such clip accommodates a 5/16" – 18 gauge leveling glide with optional neoprene cap. Such glides allow for maximum leveling on irregular floor conditions. Base brackets will be leveled when anchoring to the floor. Each initial double face section in a range must receive six (6) levelers. Each initial single faced section in a range must receive four (4) levelers. All sections, single or double face must receive levelers at every upright.
- E. Base Shelf (LwwddBSA): Made of 18-gauge steel and formed with front and rear faces formed 3/4" high & box formed with no less than four (4) 90-degree bends. The surface of the bottom shelf is flush with the top surface of the bottom spreader, presenting a continuous storage surface. Side flanges of the base shelf will engage formed lugs in the base shelf support neatly and securely to render full-support to the side surfaces of the shelf. Two (2) piece base shelves are used for double face units to provide flexibility for future rearrangement from double face to single face. Base shelves must provide flush and uniform surface without the use of "fillers". Base shelves are designed to carry book loads of 50 pounds per square foot without deflection in excess of 3/16". In addition, an 18-gauge adjustable separate recessed kick strip 3" high is provided with return flanges at the top & bottom for stiffening. Kick strip is painted black in color or matching shelving color. Slotted flanges at both ends engage with a slot in the base shelf supports to allow for adjustability and presentation of a neat closed appearance with the surface of the floor. For maximum flexibility, base shelves must have capability to be exchanged or interchanged with adjustable shelves. Base shelves may not be unique or otherwise limited in placement or usage.
- F. Base Shelf Bracket (LddBSKLA or LddBSKRA): Made of 16-gauge steel with front and top faces flanged on a 5/16" radius and the exposed corner smoothly rounded. Brackets will have three (3) projections at the rear, two (2) hooks at the top and right-angle tab at the bottom with a hole to accept a 5/16" bolt. With the bottom tab bolted to the column, the hook shall tightly engage its slot in the column. Adjoining base shelf brackets shall be bolted together to preserve alignment, with bolts, placed in indentations deep enough to prevent damage to books on the base shelf. Two (2) right-hand and two (2) left-hand base shelf brackets shall be used on double face units to provide flexibility for future rearrangement from double face to single face. Compact (high density) units do not require base brackets as standard adjustable shelves are used with gussets.
- G. Adjustable Shelf (LswddA): Made of 18-gauge steel and formed with front and rear faces formed 3/4" high and box-formed with no less than four (4) 90-degree bends (i.e. down 3/4", return 5/8", return 3/8" and return 5/16"). They shall present a smooth, closed appearance on

both faces inside as well as outside with all sharp edges eliminated, yet formed to receive book supports and label holders. Adjustable book shelves are designed to carry books loads of 50 pounds per square foot without deflection in excess of 3/16". The nominal depth of bookshelves is 1" greater than the actual depth from face of column to front of shelf. The shelves should be reversible, front to back, for maximum shelf life.

- H. Adjustable Shelf Bracket (LSddR or LSddL): Made of 16-gauge steel with front, top and bottom faces flanged with an approximate 5/16" return. Brackets have three (3) projections at the rear, two (2) hooks and two (2) safety lugs, to engage the column slots and permit easy adjustment of shelves with maximum possible protection against dislodgment. Brackets are fastened to the shelves with tabs. An impression is furnished to serve as an automatic bracket spacer, eliminating the possibility of adjacent bracket overlap. The bracket design allows for shelf adjustment upward or downward (i.e. walking the shelf) without disturbing adjacent shelves.
- I. Gusset (G90ddSF or G90ddDF): Made of (1) piece 16-gauge steel, 32" or 48" high, triangular 2" at the top and depth of base at the bottom. A 1 1/2" bend with holes will allow anchoring to the floor. Provide minimum (3) gussets per double face range unless shelving height and seismic zone dictates otherwise. 2-piece Gusset with butt joint is unacceptable.
- J. Canopy Top (LwwddUCTA or LwwddUCTLA): When required, canopy top shall be provided for all sections, one (1) for single-faced sections and two (2) for double-faced sections, in order that any rearrangement of sections at a later date may be accomplished without requiring new parts. Note that on lower height units such as 42", 48", 54" or 66" a one (1) piece top shall be used for double-faced sections, if canopy top is required. Canopy top shall be of 18-gauge steel. The faces of the canopy top shall be 1 1/2" high. Inverted type bracket supports for canopy top shall be formed of 12-gauge steel. A suitable hole shall be provided on either side of the canopy top so that adjacent tops may be bolted together for uniform alignment.
- K. Bracket for wood top or plastic laminate top: Inverted type bracket supports for canopy tops shall be formed of 12-gauge steel. Brackets shall have four (4) projections at the rear, two (2) hooks and one (1) safety lug, to engage the column slots and permit easy adjustment of top with maximum possible protection against dislodgment. Brackets shall be fastened to the top with zinc plated steel angles.
- L. End Panels (LhhddEPA-PAT): When required, end panel is provided at exposed ends. They are formed of 18 gauge patterned steel with 1 1/2" faces, a returned 3" stiffening flange inside each face, and suitable stiffening flanges top and bottom. Double face finished ends are further reinforced by a full-vertical hat shaped channel. Panels are also available in plain steel (non-patterned) and/or perforated designs as specified.
- M. Findable Book Support (LMhS): Shall be 16-gauge steel, one (1) piece construction, 6" or 9" high, with a 6 1/4" long "T" shaped base. The top and side faces shall be flanged and have a 1/4" radius. Sides shall be taper-flanged 7/8" at base to 5/16" at top for added strength.
- N. Wire Book Support (LdW): Shall be formed of 6-gauge (.203) bright basic steel wire, plated, and shall be held in place by the front and back flanges of the adjustable shelf above.
- O. Options:
1. Universal Display Shelf (LSwwddUDA): Shall be dual purpose. Shelf when used in flat position provides 8" storage with a 5 1/2" integral back. In 55-degree sloped position, shelf shall be bolted to side bracket and shall provide 5 1/2" storage with 8" integral back. All universal shelves must be interchangeable with conventional shelves. Shall be formed with front and rear faces formed 3/4" high and box formed with no less than four (4) 90 degree bends (i.e. down 3/4", return 9/16", return 3/8" and return 5/16"). They shall present a smooth, closed appearance on both faces inside as well as outside with all sharp edges eliminated, yet be arranged to receive book support and label holder.
 2. Universal Display Base Shelf (LwwddUDBSA): Shall be dual purpose (same description than LSwwssUDA). In 55 degree sloped position, the shelf should sit on the 4" kick strip at

the front, and the side flange of the shelf should insert between the base bracket and the special shim, at the back. This base shelf is then easy to change from one (1) position to the other without the use of hardware or tools. All universal display base shelves must be interchangeable.

3. Adjustable Divider Shelf (FswdddA): Shall be formed of not less than 18-gauge steel, with front face formed $\frac{3}{4}$ " high and box formed with no less than four (4) 90 degree bends (i.e. down $\frac{3}{4}$ ", return $\frac{9}{16}$ ", return $\frac{3}{8}$ ", and return $\frac{5}{16}$ "). The rear of the shelf shall be formed with a vertical flange $4 \frac{9}{16}$ " high, a $\frac{5}{16}$ " return to the rear, a $\frac{1}{4}$ " return down. They present a smooth, closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf surface and rear vertical flange shall be punched on 1" horizontal centers for three-point reception of adjustable divider lugs. The shelf shall carry a load of 50 pounds per square foot without deflection in excess of $\frac{3}{16}$ ". Letter-size shelves shall be $10 \frac{3}{4}$ " actual depth and legal size shelves shall be $13 \frac{3}{4}$ " actual depth.
4. Divider Base Shelf (FwdddBSA): Shall be formed of no less than 18-gauge steel. The front face shall be the same as the adjustable divider type shelf. The shelf surface, slots, rear vertical flange and all other features of the base shelf shall be the same as the specification for adjustable shelf. Side flanges of the base shelf shall engage formed lugs in the base shelf bracket neatly and securely to render full-support to the side surfaces. In addition a kick strip shall be provided as specified under closed base shelf.
5. Shelf Divider (Fhdd): Shall be formed of 20-gauge (until 14" deep) or 18-gauge steel (15" deep and more) with one (1) lug at the top rear side and two (2) lugs on the bottom to engage slots in the shelf for easy adjustment on 1" horizontal centers. The front top corner of the divider shall be neatly rounded with an approximate 2" radius. Exposed edges of the divider shall be smooth and free from burrs.
6. Storage Shelf (LwdddUA): 8", 9", 10", 11", 12" and 16" nominal shelf depth. Shall be formed of not less than 18-gauge steel with front and rear faces formed $\frac{3}{4}$ " high and box-formed with no less than four (4) 90-degree bends (i.e. down $\frac{3}{4}$ ", return $\frac{5}{8}$ ", return $\frac{3}{8}$ " and return $\frac{5}{16}$ "). The front face shall present a smooth closed appearance inside as well as outside, with all sharp edges eliminated. Adjustable storage shelf shall be designed to carry loads of 40 pounds per square foot without deflection in excess of $\frac{3}{16}$ ". The nominal depth shall be 1" greater than the actual shelf depth, which is from face of column to front face of shelf. The rear face shall be notched at both ends to allow clearance for the 12-gauge inverted support brackets. The shelves shall have $\frac{11}{16}$ " side flanges formed down and shall be punched for fastening to the inverted shelf bracket slots with two (2) $\frac{1}{4}$ " - 20 x $\frac{1}{2}$ " cadmium R.H.M.S. with hex nuts.
7. Deep Storage Shelf (UwdddA): 16", 17", 18", 22" and 24" nominal shelf depth. The nominal depth shall be 1" greater than the actual shelf depth measuring from face of column to front face of shelf and shall be formed of not less than 18-gauge steel with front and rear faces formed at $1 \frac{1}{8}$ " high and box-formed with no less than four (4) 90-degree bends (i.e. down $1 \frac{1}{8}$ ", return $\frac{1}{2}$ ", return $\frac{3}{8}$ " and return $\frac{1}{4}$ "). The front face shall present a smooth closed appearance inside as well as outside, with all sharp edges eliminated. The rear face shall be notched at both ends to allow clearance for the 12 gauge inverted support brackets. The shelves shall have $1 \frac{1}{8}$ " side flanges formed down and shall be punched for fastening to the inverted shelf bracket slots with two (2) $\frac{1}{4}$ " - 20 x $\frac{5}{8}$ " cadmium R.H.M.S. with hex nuts. A 20 gauge steel hat shaped stiffener $2 \frac{1}{16}$ " in width and $\frac{5}{8}$ " in height after forming, shall be spot welded to the underside of the shelf surface. The stiffener shall extend the length of the shelf, except that it shall allow clearance for the horizontal leg of the shelf support brackets.
8. Inverted Storage Shelf Support Bracket (LddU): 8", 9", 10", 12" and 16" nominal shelf depth. Shall be of not less than 12-gauge steel. All exposed edges shall be rounded. Bracket shall have three (3) projections at the rear, one (1) hooks and one (1) safety lug to engage the column slots. The horizontal leg of the bracket shall be of 1" minimum and provided with two (2) $\frac{9}{32}$ " x $\frac{5}{8}$ " slots. The vertical leg shall be a minimum of $1 \frac{1}{2}$ " wide by $3 \frac{5}{8}$ " long. The length of the bracket shall be approximately 1" less than the nominal

depth of the shelf.

9. Inverted Storage Shelf Support Bracket (Udd): 18", 22" nominal shelf depth. Shall be of not less than 12-gauge steel. All exposed edges shall be rounded. Bracket shall have three (3) projections at the rear, two (2) hooks and one (1) safety lug to engage the column slots. The horizontal leg of the bracket shall be of 1" minimum and provided with two (2) ¼" x 2" slots. The vertical leg shall be a minimum of 1 ½" wide by 3 5/8" long. The length of the bracket shall be approximately 1" less than the nominal depth of the shelf.
10. Low Profile Adjustable Shelf (LSwwddLPA).
11. Microfilm Shelf (LwwddMF): 4" or 6" nominal depth shall be formed of not less than 18 gauge steel with the front face formed ¾" high and box formed with no less than four (4) 90 degree bends (i.e. down ¾", return 5/8", return 3/8" and return 5/16"). The actual shelf depth shall be 3 ½" or 5 ½", with a 1" high rear flange formed upward to provide a backstop for the microfilm, and the shelf shall have 11/16" end flanges formed downward. The shelf bracket shall be of not less than 14 gauge steel and is spot-welded to the shelf and flanges. The exposed corner of the bracket is smoothly rounded, and there shall be three (3) projections at the rear to engage the column slots. The brackets shall have a bottom flange to provide additional shelf support. All sharp edges on shelves or brackets shall be eliminated.
12. Sloped Microfilm Shelf (LwwddMFS): 4" or 6" nominal depth shall be formed of not less than 18 gauge steel with the front face formed 1" high and box formed with no less than four (4) bends (i.e. down 1", return ½", return 3/8" and return ¼"). The shelf shall be sloped at approximately 8 degrees and the actual shelf depth shall be 3 ½" or 5 ½", with a 7/8" high rear flange formed upward at 90 degrees from the sloped surface to provide a backstop for the microfilm. The shelf shall have ½" end flanges formed downward. The shelf bracket shall be of not less than 14 gauge steel and is spot-welded to the shelf and flanges. The exposed corner of the bracket is smoothly rounded, and there shall be three (3) projections at the rear to engage the column slots. The brackets shall have a bottom flange to provide additional shelf support. All sharp edges on shelves or brackets shall be eliminated.
13. Microfilm / Cassette Shelf (LwwddTTSA): Shall be formed of not less than 18 gauge steel with front face formed ¾" high and box formed with no less than three (3) 90 degree bends (i.e. down ¾", return ½" and a return of 3/8"). The rear of the shelf shall be formed with a vertical flange 3" high, a ¼" return to the rear, a 3/8" return down, and ¼" side flanges returned to the rear. They shall present a smooth closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf shall carry a load of 50 pounds per square foot without deflection in excess of 3/16". The front face of the shelf shall be formed to receive label holders.
14. Integral Backstop Shelf (FSwwddNSA).
15. Paperback Display Shelf (LP2A): Shall be formed of not less than 18 gauge steel, with front face formed 1 ½" high with no less than (4) four bends: one (1) 82-degree bend (down 1 ½") and three (3) 90-degree bends: returns of ½", 3/8" and ¼". The rear of the shelf shall be formed with a vertical 5" high flange a ¼" return to the rear, a ¼" return down, and ¼" side flanges returned to the rear. They present a smooth, closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf surface and rear vertical flange shall be punched on 1" horizontal centers for three-point reception of adjustable divider lugs. The shelf carries a load of 50 pounds per square foot without deflection in excess of 3/16". The shelf shall be welded to the side brackets to create an 8° sloped area. The shelf storage area is 9 7/8" Deep. A label holder shall be welded to the front of the shelf. It shall be 35 ¼" wide with a 1 3/8" high front flange. It shall be designed to fit snugly to the front return of the adjustable shelves with no encroachment on storage surface.
16. Sliding Reference Shelf (LwwddSRA): Shall be 11" deep and be made of minimum 20

gauge steel reinforced on each side with steel angles for securing to slides. All neatly welded and grinded to remove all sharp edges and corners. The shelf shall operate on double extension ball-bearing slides equipped with rubber bumpers on each end of travel. The assembly shall be securely attached to a standard adjustable shelf with 14 gauge "Z" brackets and at least two (2) screws at each end. This shelf is easy to change from one (1) position to the other without the use of hardware or tools

17. Fixed Periodical Display Shelf (LwwddPF): The display shelf shall be formed of not less than 18 gauge steel, and shall be 10 29/32" in actual depth. The front face shall be formed 1" high to retain display material, with the top edge having a 3/8" hem bend formed to the outside to give added strength and provide a smooth clean seam. The side flanges shall be 1" and formed down. The back flange shall be formed down 3/4" with the bottom edge having a 3/8" hem bend formed to the inside to give added strength and provide a smooth clean surface. Shelf end bracket plates shall be of 16 gauge steel having a height of 7 7/8" and a base projection dimension of 10 1/8". The bracket plates shall be sheared to provide a slope of 55 degrees. The bracket shall have three (3) projections at the rear, two (2) hooks and two (2) safety lugs to engage the column slots. All edges shall be deburred and have a smooth clean finish. The bracket plates shall be attached to the inside of the display shelf side flanges to conceal the sloped edge of the bracket and to provide a smooth display surface. The shelf end bracket shall be securely bolted to the shelf.
18. Fixed Periodical Display Base Shelf (LwwddPFBA).
19. Hinged Periodical Display Shelf (LSwwddPHA): With 12" nominal depth storage shelf; shall be 14" actual depth, formed of not less than 18 gauge steel. The front face shall be formed 1" high with the top edge having a 3/8" hem bend on the outside surface to give added strength and to provide a smooth clean seam. The sides are formed up 1". The back flange is 1/2" and formed downward to provide a smooth flush surface for display material. A 16 gauge pivot is provided on the underside of the shelf at each side, located so that the display shelf will rest unaided in a horizontal position. The pivot is secured to the storage shelf bracket with a 1/4" - 20 shoulder bolt and lock nut. The 18 gauge storage shelf and the 16 gauge storage shelf brackets are 12" nominal depth (11" actual) and are constructed similar to the standard 18 gauge adjustable shelf and 16 gauge adjustable shelf bracket except that the shelf brackets are punched to receive the shoulder bolts for attaching the pivots. Specification for 16" nominal depth (15" actual) hinged periodical display adjustable shelf similar to above.
20. Hinged Periodical Display Base Shelf (LwwddPHBA): With 12" nominal closed base storage shelves. The hinged shelf shall be of the same construction as the hinged periodical display adjustable shelf except that the 12" nominal (11" actual) storage portion will be constructed similar to the standard 18 gauge closed base shelf and 16 gauge closed base shelf bracket except that the shelf bracket shall be punched to receive the shoulder bolts for attaching the pivots.
21. Divider Type Hinged Periodical Display Shelf (LSwwddPHA-DVdd).
22. Divider for Hinged Periodical Display Shelf (FHhdd): Shall be formed of 18 gauge steel with one (1) lug at the top rear side and two (2) lugs on the bottom to engage slots in the shelf for easy adjustment on 1" horizontal centers. The front top corner of the divider shall be sloped at 45 degrees to prevent any obstruction with the hinged periodical shelf. Exposed edges of the divider are smooth and free from burrs.
23. Hinged Periodical Display Shelf with Plexiglas Cover (LSwwddPHA-dd-P).
24. Sloped Display Shelf with Front Edge 3" (LwwddLPF): Shall be formed of 18-gauge steel. The back of the shelf is bent 3/4" down at 90 degrees with a flat hem of 3/8". The front of the shelf is formed to obtain a 3" lip with a flat hem of 3/8". The sides are formed down 1" and have holes to fix the shelf to the side brackets with 1/4" diameter truss head screws. The side brackets are 7 5/8" high and made of 16 gauge flat steel. They are cut out to create a 27-degree sloped shelf. The overall dimension of the shelf assembly is 12 11/16" from the

face of the upright frame to the edge of the lip.

25. Periodical Display Tilt-up Shelf (LSwdddPDTU): Shall be formed of not less than 18 gauge steel and is 15" nominal depth and 14" actual depth. The front face shall be formed 1" high with the top edge having a ½" hem bend on the outside surface to give added strength and to provide a smooth clean seam. The sides shall be formed up 7/8". The back flange shall be 7/16" and formed downward to provide a smooth flush surface for display material. The tilt-up display shall be supported with two (2) side brackets 16-gauge. Each bracket shall be assembled with two (2) ball bearing wheels at the front portion and 1 rubber stop at the rear. These bracket guides include a road pivot ¼" "O" to secure the pull-out and tilt-up movement.
26. Picture Book Shelf (LSwdddBRAA): Shelf shall be made of a 18-gauge steel, with a 3-inch high front lip (20-gauge) welded to the ¾" box formed edge of the shelf, a self-hanging removable 10-inch high inclined back (20 gauge) and two 16-gauge shelf supports, 7-3/8" high, designed to provide a 5-degree slope to the shelf.
27. Media Shelf Single Tier (FSwdddMSA).
28. Media Base Shelf Single Tier (FwdddMSBA).
29. Media Shelf Double Tier (FSwdddMSA).
30. Divider for Media Shelf (FMS67).
31. Adjustable Sloped Shelf (FSwdddSNSA): Shall be formed of not less than 18 gauge steel with front face formed ¾" high and box formed with no less than four (4) 90-degree bends (i.e. down ¾", return 9/16", return 3/8" and return 5/16"). The rear of the shelf shall be formed with a vertical flange 5 ½" high, a ¾" return to the rear, a 3/8" return down, and 11/16" side flanges returned to the rear. They present a smooth, closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf carries a load of 50 pounds per square foot without deflection in excess of 3/16". This shelf is sloped 11 degrees.
32. Sloped Base Shelf (FwdddSNSBSA): Shall be formed of not less than 18-gauge steel. The front face is formed ¾" high with no less than four (4) 90-degree bends. The rear of the shelf shall be formed with a vertical flange 5" high, 5/16" return to the rear, and a ¼" return down. Side flanges of the base shelf engages formed lugs in the base shelf support brackets neatly and securely to render full-support to the side surfaces of the shelf. In addition a kick strip shall be provided as specified under closed base shelf. This shelf is sloped by the insertion of two (2) lateral plate supports 20-gauge at the end bracket hook support. These lateral plates provide 5 degree slope to base shelf.
33. Adjustable Divider Sloped Shelf (FSwdddSA): Shall be formed of not less than 18 gauge steel, with front face formed ¾" high and box formed with no less than four (4) 90-degree bends (i.e. down ¾", return 9/16", return 3/8", and return 5/16"). The rear of the shelf shall be formed with a vertical flange 5" high, a ¼" return to the rear, a ¼" return down, and ¼" side flanges returned to the rear. They present a smooth, closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf surface and rear vertical flange shall be punched on 1" horizontal centers for three-point reception of adjustable divider lugs. The shelf carries a load of 50 pounds per square foot without deflection in excess of 3/16". Letter size shelf is 10 ¾" actual depth and legal size shelf is 13 ¾" actual depth. This shelf is sloped 5 degrees by the insertion of two (2) 20 gauge lateral plate supports at the end bracket hook support.
34. Divider Sloping Base Shelf (FwdddSBSA): Shall be formed of no less than 18 gauge steel. The front face shall be the same as the adjustable divider type shelf. The shelf surface, slots, rear vertical flange and all other features of the base shelf shall be the same specification as the adjustable shelf. Side flanges of the base shelf shall engage formed lugs in the base shelf support neatly and securely to render full-support to the side

surfaces. In addition a kick strip is provided as specified under closed base shelf. This shelf is sloped 5 degrees by the insertion of two (2) 20 gauge lateral plate supports at the end bracket hook support.

35. Fixed Media Browsing Box Shelf (FwwddFDA): Browser box for CD's, videocassettes, paperback books, audio tapes and various computer tape cartridges. Units shall be cantilever type, freestanding steel multimedia shelving. Each browser configuration shall be offered in a fixed style and a pull-out version. The single tier browser boxes shall be 33 13/16" wide x 10" deep x 5" high. A rubber mat longitudinally corrugated is installed on the shelf and will act as a non-skid surface. All browser box formations in both fixed and pull-out versions shall be formed of 18 gauge steel, with ends bolted to the formed box. Ends are 16 gauge steel on all boxes, and on fixed browser boxes are formed as brackets for attaching to shelving frames. The box formations have a 2 1/2" high front face. All browser boxes shall have a sloping back support angled back at approximately 15 degrees from vertical. A 3/4" x 13/16" U-shaped cross-member shall be mechanically attached between ends and in line with front boxing on browser unit. A series of 1/4" diameter holes shall be aligned along the inside facing horizontal center line of this tube, and matching holes shall be inserted at the same elevation along the sloped back support. Front to back compartment dividers shall be installed by inserting 1/4" diameter steel rods into the hole placements, and are to be adjustable with ease. The fixed browser box versions shall be 35 5/16" wide.
36. Pull-out Media Browsing Box Shelf (FwwddSDA): The pull out browser box versions shall be 33 13/16" wide, and shall have a saddle type support structure of 18 gauge steel. The saddle shall produce a fixed, fully closed bottom to the assembly, and the continuous formed ends shall be formed as brackets for attaching to shelving frames. The pull-out box portion shall operate on full-extension ball bearing slide mechanisms 10", mounted to box and the saddle end brackets at each end. The design of all browser box versions shall produce a clean finished appearance. No sharp edges or exposed assembly hardware shall be acceptable.
37. Sliding Drawer with Single Tray (FwwddSTDA).
38. Sliding Drawer with Double Tray (FwwddDTDA).
39. Adjustable Integral Back Shelf (FSwwddLBA): Shall be formed of not less than 18 gauge steel with front face formed 3/4" high and box-formed with no less than four (4) 90-degree bends (i.e. down 3/4", return 5/8", return 3/8" and return 5/16"). The rear of the shelf shall be formed with a vertical flange 1 1/2" high, and a 5/16" return to the rear. The integral back shall be designed to receive a sliding wire book support. They shall present a smooth, closed appearance on both faces, inside as well as outside, with all sharp edges eliminated. The shelf carries a load of 50 pounds per square foot without deflection in excess of 3/16".
40. Base Shelf with Integral Back (FwwddLBBSA): Shall be formed of not less than 18 gauge steel. The front face shall be formed 3/4" high with no less than four (4) 90 degree bends (i.e. down 3/4", return 5/8", return 3/8" and return 5/16"). The rear of the shelf shall be formed with a vertical flange 1 1/2" high, 5/16" return to the rear, and an 11/16" return down. The integral back is designed to receive a sliding wire book support. Side flanges of the base shelf shall engage formed lugs in the base shelf bracket neatly and securely to render full-support to the side surface of the shelf. In addition a kick strip shall be provided as specified under closed base shelf.
41. Sliding Wire Book Support (L8-9LBWB).
42. Shelf Backstop (LwwX or LwwRX): Shall be formed of not less than 18 gauge steel. The top and bottom edges shall have a 5/16" return formed at 90 degrees and a 3/16" return formed down. The front face shall be 3" high after forming. The backstop shall be formed at both edges with two (2) hooks that will engage into upright slots, allowing for backstops to be installed after shelves and bases are installed.

43. Base Bracket Cover (LddSC): When required, the base bracket cover shall be provided at exposed range ends to finish off the exposed ends of base shelf bracket. They shall be fabricated in the same manner as base shelf bracket, and of the same gauge, except that shelf supporting lugs and bottom flange shall be eliminated.
44. Wall Angle (LWAA): Shall be of at least 11-gauge and measuring at least 3" x 2" x 1" wide and shall be provided for all single faced sections in the quantity of one (1) per section
45. Floor Anchor Angle (19.200.026.01).
46. Transverse Top Bracing (TTS92): Shall be channel shaped made of 16-gauge and measuring at least 1 5/8" in the web and 1 1/8" at the flanges. When required they are provided in quantity of one (1) length of at least eight feet for every three (3) sections of double faced bookstack on all open base installations or any installation where the base shelf is the same depth as the adjustable shelves. Transverse top bracing should only be omitted where base shelves are at least 2" deeper than adjustable shelves, or where the base shelf supports are securely fastened to the floor on both sides through the outermost hole in the bottom flange, and the base plates are fastened to the floor at least every other section.
47. Range Finder Double Face Aluminum (L2RFA): Shall be formed "V" shaped of one (1) piece construction of either .025 aluminum or 22-gauge steel. The four (4) horizontal edges shall be designed to accept a 3" x 5" card on both vertical exposed faces.
48. Card Holder (L2CHA): Shall be polished aluminum designed to accept 3" x 5" card.
49. Label Holder Snap-on (LwLHP): Shall be 24 gauge aluminum (anodized finish) 5" wide with a 3/4" high front flange. It shall be designed to fit snugly to the front return of the adjustable shelves with no encroachment on storage surface. Also available in clear acrylic plastic.
50. Sloped Base for Periodical Display (DUBwwA): The display is made of four (4) components: a display back plate, a support angle, two foot base brackets and a kickplate. The whole assembly makes a 10degree inclined display where shelves shall be added. The display back plate is made of 18-gauge steel. It is perforated on both extremities by increments of 1" in order to admit shelf bracket's hooks. The support angle made of 16-gauge steel is "L" shaped at 100degrees and has inserts. It is fixed to the shelving frame with hardware, and the back plate's upper end is bent to be fixed to the angle for integral support. The bottom of the back plate is fixed to the foot base bracket, which are made of 16-gauge steel and fixed to the bottom of the shelving frame to give stability. The kickplate is made of 18-gauge steel and is used to provide an aesthetic look.
51. T-Base with wheels (WTPxxSA for starter, WTPxxAA for adder). T-Base shall have a minimum depth of 18" and shall made for double face units. T-Base assembly shall be 17.5" high (without wheels), 23-1/16" with wheels and is made of three (3) main parts: base, upright and wheels. The base is a 16 gauge steel tube 1" x 2.5" and shall be perforated to allows wheels insertion and fixation. Open ends are protected by platis caps. The upright shall be welded to the base and is made of two (2) components welded together. For a starter, it is two (2) pieces 14 gauge steel bent in U and welded to create a cavity in which the shelving upright is inserted. For an adder, a 16 gauge steel 1" x 1 1/2" tube is welded. Each T-Base shall have two (2) 5" diameter swivel wheels.
52. Browsing Box (LwwddBBA): Made of 18 gauge steel, the box is 6 1/4" high inside. The front wall is vertical and has four (4) 90-degree bends to protect both user and content. A reinforcement is welded at the botom of the box and it can admit a book support. The rear wall is tilted 102 degrees backward, so that books can lean attractively. A black rubber mat is placed at the bottom of the box to prevent the contents from sliding. 6 5/1" high pupport brackets made of 16 gauge steel close the side of the box and are welded to it. Bracket shall have two (2) hooks and two (2) safety lug to engage the column slots.

DIVISION 10 - SPECIALTIES

53. Paperback Zig Zag Backstop (LwwPDA): This display unit is made of 18 gauge steel and has a zig zag shape. It shall be 5" high and is placed vertically on an existing shelf. Bends have an alternate width of 4.5" and 5.25". It shall be available in 3 formats: 5 peaks for 36" wide shelf, 4 peaks for 30" wide shelf and 3 peaks for 24" wide shelf. Returns of 0.625" at the bottom help for equilibrium and allow to fix the display with double face tape.

2.5. FINISH SPECIFICATIONS

- A. Shall be the finest of their respective kinds and those best adapted to the construction for which they are employed to meet ISO 9001:2008 quality standards. All steel shall be superior quality mild, cold rolled, pickled, and double annealed, free from scale and buckle. All plating used on exposed parts shall be metallic furniture stock. All gauges are U.S. standard. The design of all parts shall be such that the completed installation shall present a neat and finished appearance and shall be free from exposed sharp edges or projections. All other special materials shall be as hereinafter specified.
- B. All components shall be painted with an electrostatically applied powder coat finish. All steel parts shall be machined smooth and thoroughly cleaned by a process of completely washing in a phosphatizing solution to insure removal of oil, grease or other foreign material which in any way would interfere with the adhesion of the priming coat. Following the cleaning process, all parts shall be coated and confirming every part is thoroughly and completely covered with fine powder coat, and baked to the paint manufacturer's recommendation. The finish for powder coat shall be medium gloss, giving a reading of 50 to 60 degrees on a standard gloss meter and must be capable of withstanding severe hammer and bending test without flaking. The finish for epoxy-polyester hybrid powder coat shall be a minimum 1.2 mil thickness capable of resisting methyl ethyl ketone, salt spray, abrasion and printing, and all normal usage resistant requirements of a good finish. In addition, powder coat shall not be off gassing to prevent deterioration of collection and other stored materials. Colors to be selected by owner.

PART 3 - EXECUTION

3.1. EXAMINATION

- A. Examine subfloor surfaces, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of mobile storage units.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION

- A. Install components and accessories after finishing operations, including painting, have been completed. Install shelving units to comply with final layout drawings, in strict compliance with manufacturer's printed instructions and structural calculations. Position unit's level and plumb at proper location relative to adjoining units and related work.
- B. Field Quality Control: Remove and replace components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.
- C. Adjust: Adjust components and accessories to provide smoothly operating, visually acceptable installation.
- D. Cleaning: Immediately upon completion of installation, clear components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.
- E. Protection: Protect system against damage during remainder of construction period. Advise

DIVISION 10 - SPECIALTIES

Owner of additional protection required to ensure shelving units will be without damage or deterioration at time of substantial completion.

3.3. DEMONSTRATION/CUSTOMER TRAINING

- A. Provide complete training to end-user's staff. Training shall include general safety and operation instructions, and basic preventative maintenance procedures.

END OF SECTION