**PART 1 – GENERAL**

**1.00 SUMMARY**

 A. Section Includes:

 1. Support structures.

 2. Tables frames.

 3. Shelves.

 4. Suspended base cabinets/wall cases.

 B. Related sections:

 1. Section 11610 - Laboratory Fume Hoods are a part of the work of this section.

 2. Section ‑ : Furnishing and installation of plumbing utilities and final connections.

 3. Section ‑ : Furnishing and installation of exhaust ductwork and equipment, and final connection to fume hood(s).

 4. Section ‑ : Furnishing and installation of electrical utilities and final connections.

**1.01 ALTERNATE PROPOSALS**

 Proposals are invited from alternate manufacturers only if they comply with the minimum design requirements and the minimum performance requirements. A notarized letter stating full compliance must be included in alternate proposals signed by an officer of the manufacturer to ensure compliance.

**1.02 SYSTEM DESIGN REQUIREMENTS**

 A. Modular dimensioned system of vertical upright support structures and cantilevered support frames.

 B. Heavy-duty Support base with Vertical Uprights: Support structure for tables, storage units and shelves, and service chase for all cabling.

 1. Modular units shall be suitable for wall, peninsula or island configurations.

 2. Mobile support frames can be ganged side-to-side and back-to-back.

 3. Equipped with locking Bi-directional casters and levelers that allow the work surface to be leveled and the equipment rack to be height-adjusted.

 C. Tables: Modular, interchangeable work surface support structures in adjustable height configurations.

 1. Adjustable height table frames support cantilever configurations.

 2. Caster and leveler options are available on all adjustable height equipment rack frames.

 D. System requirements:

 1. Independently support work surfaces, undercounter cabinets, and overhead storage components.

 2. Structural components are essentially self-supporting and independent of the building structure. Table frames, worksurface supports and horizontal structural base frame to be all welded construction.

 3. Cabinet fastening devices cannot be accidentally released from framing system. Intentional release can be easily accomplished without disturbing the cabinet contents by simply loosening two bolts.

 4. Support frames shall be equipped with access ports that allow integration of cabling within the vertical support structure.

 5. Suspended base cabinets can be removed without removal of the work surface and/or shelf.

 6. Wall cabinets are adjustable vertically and laterally and can be removed with the use of simple hand tools.

 7. Suspended base cabinets can be relocated while fully loaded and installed in any position between table frames.

* 1. Vertical height of table work surfaces, wall cases and shelves can be adjusted with simple, but positive mechanisms.
	2. All work surfaces are reconfigurable by the user or maintenance personnel with removable and reinstallation of 8 positive mechanical attachments per support assembly.
	3. Bi-directional casters allow precise movement at 90 degrees with little effort. Casters are lockable with a foot brake mechanism and can be locked into two travel directions.
	4. Storage cabinets can be suspended from both cantilevered table frames and cantilevered shelf frames.
	5. Removable lower worksurface shall allow for 24.5” clear usable space below the worksurface within the same plane as the main worksurface for equipment clearance.
	6. Overall equipment rack height shall not exceed 7’6” for free access though a standard door frame.
	7. Units of all sizes are tested and certified to hold 2600 pounds, plus the rack weight, distributed over four worksurfaces while maintaining full mobility. Unit tested for greater loads as worst case scenarios.
	8. All equipment racks shall be ADA compliant.

**1.03 SUBMITTALS**

*Include number of each type of submittal required if this information is not covered in Division 1 or elsewhere.*

 A. Shop Drawings: Provide 3/4"=1'-0" scale elevations of all components, cross sections, rough‑in and anchor placements, tolerances and clearances. Provide 1/4"= 1'-0" rough-in plan drawings for coordination with trades. Rough in shall show free area.

**1.04 QUALITY ASSURANCE**

 A. Single source responsibility: Casework, work surfaces, laboratory fume hood and equipment and accessories shall be manufactured or furnished by a single laboratory furniture company.

 B. **All casework construction and performance characteristics shall be in full compliance with SEFA 8 – 1999 standards.** At the owner’s request, independent, third part testing must be submitted validating compliance and adheres to the architectural specifications.

 C. Manufacturer's qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:

 1. Five years or more experience in manufacture of laboratory casework and equipment of type specified.

 2. Ten installations of equal or larger size and requirements.

 D. Installer's qualifications: Factory trained and/or certified by the manufacturer.

 E. Cabinet identification: Equipment racks and cabinets are identified on drawings by manufacturer's catalog numbers. Unless otherwise modified on drawings or in specifications, catalog description constitutes specific requirements for each type of cabinet.

* 1. **REFERENCE STANDARDS**
1. All casework, work surface and service fixture construction and performance characteristics shall be in full compliance with SEFA (Scientific Equipment and Furniture Association) standards. At the owner’s request, independent, third party testing must be submitted validating compliance and adheres to the architectural specifications.
	1. SEFA 2.3 – Installation of Scientific Laboratory Furniture and

Equipment.

* 1. SEFA 3 – Work Surfaces
	2. SEFA 7 – Laboratory and Hospital Fixtures
	3. SEFA 8 – Laboratory Furniture

**1.06 DELIVERY, STORAGE AND HANDLING**

 A. Schedule delivery of laboratory furniture system so that spaces are sufficiently complete that material can be installed immediately following delivery.

 B. Protect finished surfaces from soiling or damage during handling and installation.

**1.07 PROJECT CONDITIONS**

 A. Do not deliver or install equipment until the following conditions have been met:

 1. Windows and doors are installed and the building is secure and weather tight.

 2. Ceiling, overhead ductwork and lighting are installed.

 3. All painting is completed and floor tile is installed.

**PART 2 – PRODUCTS**

**2.01 MANUFACTURER**

 A. Design, materials, construction and finish of equipment racks and casework specified are the minimum acceptable standard of quality for adaptable/mobile laboratory equipment racks. The basis of this specification is Hamilton Laboratory Solutions, 825 East Albert Drive, Manitowoc, WI 54220.

**2.02 EQUIPMENT RACKS**

1. General requirements for tables:
2. Vertical structural support: 11-gauge cold rolled vertical shall integrate five cable management grommets, in each vertical, for ease running cabling.
3. Equipment rack base: 7-gauge cold rolled horizontal base shall incorporate bi-directional casters and levelers that enables the end-user to extended the leveler support foot to prevent any moment from equipment or personnel.
4. Table/shelf support frame: 11-gauge cold rolled steel tubing. Cabinet support channels: 14 gauge cold rolled steel. Weld members using the inert gas process.
5. Support arms:

Cantilever support arms: 11 gauge cold rolled steel.

Lower shelf support: 11 gauge rolled steel.

1. Cable Management Grommets: Flame resistant ABS plastic, color is black.
2. Finish: Chemical resistant powder paint finish in manufacturer's standard color to be selected.

 B. Cantilever Table/Shelf Frame:

 1. Nominal table frame dimensions:

 a. Width: [36"] [48"] [60"]

 b. Depth: [18”] [29"].

 c. Height: [7"].

 2. Capable of vertical adjustment in one-inch increments.

 3. Support arm bracket: Support frame of 11 gauge cold rolled steel that incorporates four mechanically fastened machine bolts that interlock into a machine trended welded lock nut.

 4. Cantilever table frame shall provide support channels from which suspended cabinets can be hung and adjusted horizontally.

 5. Suspended cabinets must clear the top support arm for full width applications.

 6. Weight capacity:
Total equipment rack plus 2600 pounds.

 Work surface plus 925 pounds.

 Shelf unit plus 550 pounds.

1. Worksurface and shelf materials shall be available in phenolic resin, hard plastic laminate and epoxy resin options.

**2.03 SUPPORT STRUCTURES**

 A. General requirements for equipment rack and cantilevered type support structures:

1. Riser uprights: 11 gauge rolled steel supplied with two parallel rows of machine treaded welded nuts that accept bolts that positively engage the table and shelf frames.
2. Frames: Rolled steel, resistance welded. Frame members and tie rail brackets: 11 gauge; corner gussets: 11 gauge.

 3. Bottom shelf rails: 11 gauge cold rolled steel.

 4. Base cover: 18 gauge cold rolled steel.

 5. Slotted adjustment machined into riser upright: punched for one-inch adjustment of components supported off riser upright.

 6. Wire retaining rods at the back and side of worksurfaces for loading safety and visual and physical load barriers. Upper shelves can accommodate retaining on both sides, back and front edges,

**2.04 SHELVES**

 A. General requirements for shelves:

 1. Shelves are supported with a fully welded cantilevered frame with separate retaining rods: 11 gauge rolled steel. Capable of suspending wall cases.

 2. Shelf brackets: 11 gauge rolled steel.

 3. Vertical shelf adjustment: One inch increments.

 4. Depth and weight capacity: [18" = 550 lbs.]

 B. Outside Shelf:

 1. Nominal dimensions:

 a. Length: [36"] [48"] [60"]

 b. Depth: [18"]

 2. Shelf shall be capable of being locked into position.

 C. Shelf materials shall be available in phenolic resin, hard plastic laminate and epoxy resin options.

**2.05 SUSPENDED BASE CABINETS/WALL CASES**

 A. Design requirements, performance requirements, materials, fabrication and hardware shall comply in all respects with fixed wood and/or steel casework specifications in this section.

 B. Suspended cabinet hardware: Provide a system of steel C-channels and brackets attached to the casework frames, enabling the installation and removal of suspended base cabinets without the use of special tools.

 C. Suspended wall case hardware: Provide a system of steel hanger rails attached to the casework frames, to be vertically adjustable on two inch increments. Installation and removal of suspended wall cases to be accomplished without the use of tools.

**2.06 FINISHES**

A. Metal finish:

 1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pre-treat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.

 2. Application: Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thickness: **Liquid, dipped, solvent based finishes are not and will not be acceptable.**

 a. Exterior and interior exposed surfaces: 1.5 mil average and 1.2 mil min.

 b. Backs of cabinets and other surfaces not exposed to view: 1.2 mil average.

B. Cabinet Surface Finish Tests:

 **All casework construction and performance characteristics shall be in full compliance with SEFA 8 standards.** At the owner’s request, independent, third party performance testing must be submitted validating compliance and adheres to the finish specifications.

## Chemical Spot Test

###  1.1 Purpose of Test

 The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

 **Note:** Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

###  1.2 Test Procedure

 Obtain one sample panel measuring 14" x 24" (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein.

 Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73+ 3F (23(+ 2(C) and 50+ 5% relative humidity. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods:

**Method A –** Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a one-ounce (29.574cc) bottle and inverting the bottle on the surface of the panel.

 **Method B –** Test volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of **one hour.** Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73±3°F (23°±2°C) and 50±5% relative humidity using the following rating system:

**Level 0 –** No detectable change.

**Level 1 –** Slight change in color or gloss.

**Level 2 –** Slight surface etching or severe staining.

**Level 3 –** Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

 **Test No. Chemical Reagent Test Method**

 1. Acetate, Amyl A

 2. Acetate, Ethyl A

 3. Acetic Acid, 98% B

 4. Acetone A

 5. Acid Dichromate, 5% B

 6. Alcohol, Butyl A

 7. Alcohol, Ethyl A

 8. Alcohol, Methyl A

 9. Ammonium Hydroxide, 28% B

 10. Benzene A

 11. Carbon Tetrachloride A

 12. Chloroform A

 13. Chromic Acid, 60% B

 14. Cresol A

 15. Dichlor Acetic Acid A

 16. Dimethylformanide A

 17. Dioxane A

 18. Ethyl Ether A

 19. Formaldehyde, 37% A

 20. Formic Acid, 90% B

 21. Furfural A

 22. Gasoline A

 23. Hydrochloric Acid, 37% B

 24. Hydrochloric Acid, 48% B

 25. Hydrogen Peroxide, 3% B

 26. Iodine, Tincture of B

 27. Methyl Ethyl Ketone A

 28. Methylene Chloride A

 29. Mono Chlorobenzene A

 30. Naphthalene A

 31. Nitric Acid, 20% B

 32. Nitric Acid, 30% B

 33. Nitric Acid, 70% B

 34. Phenol, 90% A

 35. Phosphoric Acid, 85% B

 36. Silver Nitrate, Saturated B

 37. Sodium Hydroxide, 10% B

 38. Sodium Hydroxide, 20% B

 39. Sodium Hydroxide, 40% B

 40. Sodium Hydroxide, Flake B

 41. Sodium Hydroxide, Saturated B

 42. Sulfuric Acid, 33% B

 43. Sulfuric Acid, 77% B

 44. Sulfuric Acid, 96% B

 45. Sulfuric Acid, 77% and Nitric

 Acid, 70%, equal parts B

 46. Toluene A

 47. Trichloroethylene A

 48. Xylene A

 49. Zinc Chloride, Saturated B

###  1.3 Acceptance Level

Results will vary from manufacturer to manufacturer. **Laboratory grade finishes should result in no more than four Level 3 conditions.** Suitability for a given application is dependent upon the chemicals used in a given laboratory.

## Hot Water Test

### 2.1 Purpose of Test

 The purpose of this test is to insure the coating is resistant to hot water.

###  2.2 Test Procedure

 Hot water, 190°F to 205°F (88°C to 96°C), shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.44cc) per minute on the surface, which shall be set at an angle of 45-degrees, for a period of five minutes.

### 2.3 Acceptance Level

 After cooling and wiping dry, the finish shall show no visible effect from the hot water.

##  3. Impact Test

### 3.1 Purpose of Test

 The purpose of this test is to evaluate the ductility of the coating.

###  3.2 Test Procedure

 A one-pound ball approximately 2" (50.8mm) in diameter shall be dropped from a distance of 12" (304.8mm) onto a flat horizontal surface, coated to manufacturer’s standard manufacturing method.

###  3.3 Acceptance Level

 There shall be no visible evidence to the naked eye of cracks or checks in the finish due to impact.

##  4. Paint Adhesion on Steel Test

### 4.1 Purpose of Test

 The paint adhesion test is used to determine the bond of the coating to steel. This does not apply to non-steel products.

### 4.2 Test Procedure

This test is based on ASTM D2197-86 “Standard Method of Test for Adhesion of Organic Coating”. Two sets of eleven parallel lines 1/16" (1.587mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush for one minute. Examine under 100-foot candles of illumination.

### 4.3 Acceptance Level

 Ninety or more of the squares shall show finish intact.

##  5. Paint Hardness on Steel Test

### 5.1 Purpose of Test

 The paint hardness test is used to determine the resistance of the coatings to scratches.

### 5.2 Test Procedure

 Pencils, regardless of their brand, are valued in this way: 8-H is the hardest, and next 11 order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which are softest).

The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one, that is the hardest pencil that will not rupture the film, is then used to express or designate the hardness.

###  5.3 Acceptance Level

 The paint shall have a hardness of 4-H minimum.

# 2.07 CABINET SURFACE FINISH TESTS

##  1. Chemical Spot Test

###  1.1 Purpose of Test

 The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

 **Note:** Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

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### 5.3 Acceptance Level

 The paint shall have a hardness of 4-H minimum.

##### PART 3 – EXECUTION

**3.01 INSTALLATION**

 A. Furniture system installation:

 1. Install system in strict accordance with manufacturer's instructions.

 2. Set system components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.

 B. Install suspended casework, work surfaces, sinks and accessory items per Section 12345.

**3.02 ADJUSTING**

 A. Repair or remove and replace defective work, as directed by [Architect] [Owner] upon completion of installation.

**3.03 CLEANING**

 A. Clean shop finished laboratory furniture system surfaces and touch up as required.

**3.04 PROTECTION OF FINISHED WORK**

 A. Provide all necessary protective measures to prevent exposure of laboratory furniture system and attached components from exposure to other construction activity.

 B. Advise contractor of procedures and precautions for protection of material, installed laboratory furniture system, casework and fixtures from damage by work of other trades.

####  END OF SECTION