

**SECTION 12 35 53
LABORATORY CASEWORK AND OTHER FURNISHINGS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Metal Laboratory Casework, and Casework Systems
 - 1. Metal Laboratory Casework
 - 2. Mobile Workstation
- B. Cabinet Hardware
- C. Laboratory Work Surfaces
- D. Shelving Assemblies
- E. Cylinder Restraint Assembly
- F. Overhead Service Ceiling Tile
- G. Overhead Service Ceiling Column
- H. Pipe Drop Enclosure
- I. Drying Rack
- J. Cable Grommet
- K. Task Light Fixtures
- L. Finish for Miscellaneous Wood Items
- M. Metal Fabrications
- N. Stainless Steel Fabrications
 - 1. Work Surfaces
 - 2. Laboratory Sinks
- O. Slotted Channel Framing (Strut)
- P. Sealant
- Q. Sustainable Design Requirements: Provide the Work and submit documentation as necessary for compliance with sustainable requirements specified in Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS.

1.2 RELATED WORK

- A. Division 01 - MOCKUPS
- B. Division 09 – FLOORING (Wall Base)
- C. Section 11 53 13 – FUME HOODS AND OTHER AIR CONTAINMENT UNITS
- D. Section 11 53 43 – LABORATORY SERVICE FITTINGS AND FIXTURES
- E. Division 22 – PLUMBING
- F. Division 23 – HEATING, VENTILATED, AND AIR-CONDITIONING
- G. Division 26 – ELECTRICAL

- D. Replacement: Any damaged work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.
- E. Work in this section shall be manufactured by and installed by a company/companies having a minimum of eight years documented experience providing and installing products similar to those specified in laboratory applications; an established organization; and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of products specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified work of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.4 ENVIRONMENTAL COMPLIANCE

- A. Composite Wood Products – Composite wood products shall comply with the California Code of Regulations: Title 17, Section 93120: Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.
 - 1. The definition of composite wood products, as applied to this requirement, shall be those as defined in the regulation cited.
 - 2. Comply with the limitations scheduled for enforcement at the time of sale and manufacturing, accounting for the grace periods allowed by the regulation.
 - 3. Provide documentation, certification, and labelling as required by the regulation.
- B. Certified Wood: All wood products used in the fabrication shall comply with the FSC's (Forest Stewardship Council's) Principles and Criteria as required to contribute towards USGBC LEED 3.0 Credit MR7.
 - 1. All lumber shall come from forestry sources that are certified under the Forestry Stewardship Council's (FSC) Forest Management Certification program.
 - 2. The casework manufacturer must have FSC Chain-of-Custody (COC) Certification.
 - 3. Documentation:
 - a. Provide manufacturer's Chain of Custody Certification.
 - b. Provide documentation of the cost, volume, and weight of all wood products provided for this project, including any non-FSC wood products or components.
 - c. Provide documentation of the cost, volume, and weight of FSC wood products provided for this project.
 - d. In the case of assemblies where some components are FSC-certified and other components are not – provide separate cost, volume, and weight information for each assembly component.

- C. Low-Emitting Materials – Composite Wood and Agrifiber Products: Composite wood and agrifiber products used in casework products shall contain no added urea-formaldehyde resins, as required to meet USGBC LEED 3.0 Credit EQ4.4.
1. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
 2. Provide certification as required.
- D. Wood products as listed below shall contain recycled content to contribute towards achievement of the USGBC LEED Green Building Rating System MR Credits 4.1 and/or 4.2.
1. Recycled wood products:
 - a. Particleboard plywood cores.
 2. The manufacturer shall submit documentation (i.e. “Source of Materials”, Invoices, Third Party Validation, etc.) for specified wood products purchased for this project providing recycled content.
 - a. Where assemblies contain both recycled and non-recycled wood products, provide documentation of the weight of recycled wood products relative to the total weight of each assembly.
 - b. Provide documentation of the cost of each component or assembly which contains recycled wood products. Provide percentages (by weight) and costs of post-consumer recycled material and pre-consumer recycled material within each component.
- E. All steel used in the product fabrication shall comply with the recycled steel content requirements to contribute towards achievement of the USGBC LEED Green Building Rating System MR Credits 4.1 and/or 4.2.
1. All steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall have a minimum of 40% recycled steel content, as defined by ISO 14021-1999, calculated as follows:
 2. $(\% \text{ of Post Consumer Recycled Steel Content by Weight}) + 0.5 \times (\% \text{ of Pre-Consumer Recycled Content by Weight}) \geq 40\%$
 3. Documentation:
 - a. The manufacturer shall submit documentation (i.e. “Source of Materials”, Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content.
 - b. Provide documentation of the cost of each component which contains recycled steel.
 - c. Provide percentages (by weight) and costs of post-consumer recycled material and pre-consumer recycled material within each component.
- F. All epoxy resin used in the project shall contain recycled content to contribute towards achievement of the USGBC LEED Green Building Rating System MR Credits 4.1 and/or 4.2.

1. All epoxy resin used in the project shall have a minimum of 10% post-consumer recycled content by weight, as defined by ISO 14021-1999.
2. Documentation:
 - a. The manufacturer shall submit documentation (i.e. "Source of Materials", Invoices, Third Party Validation, etc.) for epoxy resin purchased for this project providing recycled content.
 - b. Provide documentation of the cost of each component which contains recycled material.
 - c. Provide percentages (by weight) of post-consumer recycled material within each component as provided for this project

1.5 SUBMITTALS

- A. Refer to General Conditions and Division 1 "Submittal Procedures" for submittal requirements. In addition to these requirements, provide submittal requirements specified herein.
- B. Submittal requirements:
 1. Submittal shall be prepared individually for this specification section. Arrange product data, drawings and information for submission in a complete set for this specification section.
 - a. Shop drawings and product data as applicable for required mockups may be submitted separately and should be expedited for submittal as soon as the contract is awarded.
 - b. Shop drawings may be submitted on a floor-by-floor basis. However, product data and details shall not be submitted redundantly with each submission.
 2. Submittal shall contain complete data for all items of this specification section. Periodic or partial submittals of individual components within this specification section will be returned as incomplete and rejected.
 3. Submittals shall be organized by specification sequence with section and paragraph number identified.
 4. Equipment and components being proposed shall be clearly labeled with all options and accessories indicated and shall be for this specific project. All non-applicable items shall be deleted or struck.
 5. Product data submittals provided in PDF format shall consist of fully collated PDF files allowing for collated printing from a single file.
- C. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.
 1. Product data shall not be duplicative or redundant with shop drawings. Do not include drawings in the product data submittal that are included in the shop drawings.
- D. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible, PDF files, or photocopies, to

- F. Scientific Equipment and Furniture Association: SEFA 3-2007 SEFA Recommended Practices for Work Surfaces.
- G. Scientific Equipment and Furniture Association: SEFA 8W-2007 Recommended Practices for Laboratory Grade Wood Casework.
- H. Scientific Equipment and Furniture Association: SEFA 8M-2007 Recommended Practices for Laboratory Grade Metal Casework.
- I. United States Green Building Council: USGBC, LEED Reference Guide for Green Building Design and Construction For the Design, Construction, and Major Renovations of Commercial and Institutional Buildings Including Core & Shell and K-12 School Projects 2009 Edition.

PART 2 - PRODUCTS

2.1 METAL LABORATORY CASEWORK, AND CASEWORK SYSTEMS

A. Metal Laboratory Casework

1. Design Requirements:

- a. Door and drawer front design at units below fume hoods: Square edged flush front inset metal construction with all front surfaces above the toe space in the same plane, at all metal locations per laboratory furnishings plans.
- b. Door and drawer front design: Flush overlay wood construction with eased edges and fronts overlaying the case unit ends, top and bottom rails.
 - 1). Door and drawer design: Square edged full flush overlay design with 5/16 inch (8mm) top and bottom reveal and 5/32 inch (4mm) reveal horizontal and vertical and 1/16 inch (2mm) vertical reveal on ends of cabinets. Applied panels may be required in areas such as sink cabinets and knee spaces with pencil drawers to complete the flush construction.
- c. Grain Pattern:
 - 1). Vertical Matched Grain Pattern: Grain pattern on flush panels, and door and drawer fronts shall be vertical, book matched, or slip matched. Entire cabinet front must be cut from a single panel.
- d. Pulls on doors shall be mounted vertically and on drawers horizontally.
- e. All tall cases shall be provided with toe space to match base units.
- f. All cabinets shall be constructed and finished to be suitable for use as stand-alone units and to permit future rearrangement without the need for additional parts or finish.
- g. Full-Flush Construction and Installation: All finished panels shall be in the same plane to provide a true flush overlay appearance.
 - 1). Filler panels:
 - a). Provide metal filler panels at inside corners, end-of-run conditions, and other similar locations, aligned with the face of adjacent metal cabinet bodies.

- 2). Outside corners:
 - a). At outside corners, align the side panel of cabinet with the cabinet body of adjacent cabinet.
2. Materials:
 - a. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
 - 1). Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
 - 2). All gauges indicated are to be U.S. standard.
 - b. Maple Door and Drawer Fronts:
 - 1). Lumber:
 - a). Plain sawn Maple, NHLA Grade FAS.
 - b). All lumber shall be clean and free of defects; kiln and air dried to uniform moisture content of 6 percent.
 - 2). Veneer:
 - a). Plain sliced white select maple, grade AA. Thickness: 1/50 inch (0.5 mm), minimum.
 - (1). Color and Matching:
 - (a). 100% sapwood, no heartwood allowed.
 - (b). Slight color streaks or marks.
 - (c). Slight color variation.
 - (d). No sharp contrast at veneer joints.
 - (2). Natural Characteristics:
 - (a). Small conspicuous burls: combined average not to exceed 2 per 10 square feet (1 m²).
 - (b). Conspicuous burl size: ¼ inch (6.4 mm), maximum.
 - (c). Conspicuous pin knots, scattered sound repair knots, bark pockets: not allowed.
 - (d). Slight mineral streaks, worm tracks, cross bars and vine marks.
 - (3). Manufacturing Characteristics:
 - (a). Rough cut or ruptured grain is not allowed.
 - (b). Blended repaired tapering hairline Splits: two 1/32 inch (0.8 mm) x 3 inch (76 mm) on end panels only.
 - (c). Repairs: very small blending allowed.
 - (4). Flitch Width, Face Components: 6 inches minimum, except for outside components.

- b). Veneer shall be hand selected for uniformity of color and grain prior to fabrication of cabinet faces. The resulting selection shall provide a pleasing uniform appearance and shall not allow darker and lighter panels in the same area or room after installation.
- c. Wood Door and Drawer Fronts:
 - 1). Plywood: ANSI A208.1 M3 Grade Industrial Particleboard Core Plywood.
 - a). Product shall be provided with hardwood face veneers as specified above.
 - b). Thickness: $\frac{3}{4}$ inches.
 - c). Screwholding: 250 lbs at face, 225 pounds at edge.
 - d). Modulus of rupture: 2,400 lb/in².
 - e). Modulus of elasticity: 400,000 lb/in².
 - f). Hardness: 500 lbs.
 - 2). Edgeband/Facer: 1/8" (3 mm) hardwood; species as described above. Edgeband all sides.
 - 3). Finish for Wood Laboratory Components:
 - a). Finish processes (stains and finishes) shall be by means of compression spray, providing high-transfer efficiency low waste generation. Solvent applied coatings are not acceptable and will not be considered. Manufacturer shall supply documentation that waste generated during the finishing process, is a non-hazardous material, eliminating liquid waste disposal in landfills.
 - (1). Chemically Resistance Finish: Finish for all wood products shall be environmentally friendly, highly chemically resistant, water-borne, laboratory-grade finish that satisfies the requirements specified herein for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted to the Architect for approval prior to award of contract.
 - (2). Operator Protection: The application shall be convenient and easily mastered, in a custom spray booth. The finish process shall be cleanly contained and shall have no solvent odor, and shall be applied in an air-conditioned room.
 - (3). VOC Emissions: Water-borne finishes shall be sprayed and cured with a near zero (2.0 lbs. per gallon for 'clean finish') VOC (Volatile Organic Compounds) emissions.
 - (4). Offgasing: After all wood products have cooled from the curing ovens, the coating shall be firm and stable. No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature.

- b). Manufacturer may use either of the following finish systems:
 - (1). Customized, high-solids, cross-linked, ultraviolet light (UV)-cured coating developed for durability, including abrasion, chemical, impact, and scratch resistance, for flat-line applications. Coatings shall have little or no VOCs.
 - (2). Chemical-resistant modified acrylic urethane finish with built-in UV blocker, or equal, applied over permanent wood stain.
- c). Stain Color:
 - (1). To be selected by Architect from manufacturer's full published color range.
- d). Application:
 - (1). Finish application and sequence shall be as recommended and designed by the manufacturer for a high quality, laboratory-grade wood casework finish.
 - (2). Preparation: Sand exposed and semi-exposed surfaces smooth, free from dirt and defects.
 - (3). Stain application: Apply stain of color selected to all exposed and semi-exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.
 - (4). Finish application: Apply chemical resistant top finish to all stained surfaces. Finished surfaces shall be even, water-clear and bright. Cloudy or muddy finishes carrying tinting pigments will not be acceptable.
- d. Glass: Framed glass doors:
 - 1). 1/8 inch (3mm) to 7/32 inch (5.5 mm) nominal tempered glass.
 - 2). Without imperfections or marred surfaces.
 - 3). All glass should have etched safety information, readable from outside the cabinet.
- 3. Base, Wall, Upper, and Tall Cabinets:
 - a. General:
 - 1). Exterior corners: shall be spot and arc welded with heavy back up reinforcement at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
 - 2). All units shall have a cleanable smooth interior. Front and rear posts, reinforcing members or channel uprights shall be enclosed full heights on all cabinet openings.
 - 3). End Uprights shall be formed into not less than a channel formation at top, bottom, back and front.
 - 4). The edge of the vertical uprights shall be formed to provide a strike for doors and drawers, and shall be perforated for the support of drawer channels, intermediate rails and hinge screws.

- to eliminate exposure of sharp raw edges, and the interior space filled with a non-organic sound deadening material at the time of assembly. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
- 2). Wood:
 - a). As specified above.
 - b). Select and arrange fronts for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - g. Drawer Construction:
 - 1). Drawer bodies shall be made in one-piece construction including the bottom, two sides, back and inner front. They shall be fully coved at interior bottom on all four sides for easy cleaning. Sides shall be full height with $\frac{1}{2}$ inch (13 mm) clearance to frame opening. Drawers shall be a minimum of 18 inches (450 mm) front to back.
 - 2). Drawer Suspension: Refer to Drawer Slides under Hardware section.
 - 3). Drawer stops: shall be provided to insure smooth, quiet operation at point of contact with cabinet front.
 - 4). Provide light-tight drawers where indicated, consisting of:
 - a). A fixed 20-gage horizontal metal panel at the back half of the drawer welded to the drawer sides and back.
 - b). A horizontally-sliding 20-gage metal panel set into a track $\frac{1}{2}$ " below the top of the drawer box. Provide track at the front edge of the drawer box to receive the panel in the closed position.
 - c). Provide a $\frac{3}{8}$ " bent upstand $\frac{1}{2}$ " back from the front edge of the horizontally-sliding panel to allow for grasping of the panel.
 - d). With the light-tight assembly In the closed position, light-tight drawers shall be sealed from the penetration of stray light when the drawer is open.
 - h. Top Horizontal Rail: Provide on base cabinets such that rail shall interlock within the flange at top of end panels for strength, but shall be flush at face of unit. Reinforcements shall be provided at all front corners for additional welded strength between vertical and horizontal case members.
 - i. Intermediate Rails: Provide on base cabinets such that rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. When required, intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.
 - j. Intermediate Vertical Uprights: allow storage of large or bulky objects, no upright of any type shall be used at the center of double door cupboard units.

- k. Knee Space Service Strip Cover Panels where specified, shall be 18 gauge (1.3 mm thick) steel, of the same finish as cabinets, and shall be furnished at open spaces under counter top where no cabinets occur. They shall be easily removable and shall cover piping from underside of top of service ledge to floor.
 - l. Provide filler panels where required between cabinets, at corner intersections of cabinets, between cabinets and walls and wherever else required for a complete finished installation. For tall cabinets, filler panels shall be provided for vertical face and top. For wall cabinets, filler panels shall be provided for vertical face, top and bottom.
4. Corrosives Storage Cabinets:
- a. Purpose-designed lined metal cabinet.
 - b. Lining: Cabinet shall be complete lined with a polypropylene or polyethylene liner with sealed or seamless intersections between panels. No metal of any type shall be exposed within the lined interior of the cabinet. Screw-heads, if required, shall be covered with hinged-type (not snap-on) plastic screw-head covers.
 - 1). Shelf: Removable full-depth polypropylene or polyethylene shelf.
 - c. Lining: All interior surfaces of the cabinet shall be coated with a 100% seamless non-porous flame-coated thermoplastic liner. Liner shall be applied to all interior walls, ceiling, sump, door interiors, and shelving. Basis of design: Justrite Chemcor. No known equal.
 - 1). Shelf: Removable adjustable full-depth metal shelf coated with lining material.
 - d. Label: "CORROSIVES" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match the Flammable Liquid/Solvent Storage Cabinet label. Lettering shall be 2 ½ inches (63 mm) tall. Color of lettering shall be red. If cabinet color is red, lettering shall be yellow.
 - e. Locks: Cabinet doors shall be lockable.
 - f. Venting:
 - 1). Cabinets below or adjacent to fume hoods: Provide and install 2 inch (50 mm) diameter schedule 40 PVC vent pipe and PVC fittings. Termination of vent pipe maybe one of the following:
 - a). Extend vent pipe 4 inches (100 mm) above dished worktop, behind the baffle in the hood, as shown on the drawings. Provide hole through fume hood work surface above the corrosive storage cabinet to accommodate 2 inch (50 mm) diameter vent pipe. Seal gap around penetration with clear silicone sealant.
 - b). Extend vent pipe up within the fume hood side wall and vent through the hood side wall liner behind the upper portion of the fume hood baffle.

- b. System to be self-supporting and independent of the building structure.
 - c. All welds shall be continuous and ground smooth.
 - d. The vertical framework shall be designed to allow for piped utility service fixtures, electrical/data outlets and supply pipework/cablings lines utilizing the vertical frame system as a utility chase.
 - e. The vertical height of work surfaces shall be adjustable from 30" high to 37" (750-940 mm)high, in 1" (25 mm) increments.
 - f. The upper shelving units shall be adjustable in 1" increments.
 - g. The bench system shall ship complete with minimal final assembly. Assembly shall be accomplished with simple hand tools.
2. Vertical Framework: Support structure for worksurface table frames and shelves; and service chase for all service lines, data and electrical cables.
- a. Vertical framework shall be fabricated as one fully-welded assembly and painted as one piece.
 - b. Vertical uprights shall allow for internal plumbing, electrical and data cabling.
 - 1). Single frame uprights shall be 11 gauge tubular steel, nominal 2 inch outside diameter.
 - 2). Shared rear frame upright shall be 11 gauge cold-rolled steel formed to a nominal 2 inch X 6 inch member.
 - 3). Gas piping and high/low voltage cabling shall be separated in opposite and separate vertical members.
 - 4). Cabled vertical upright shall have two channels to separate low voltage from high voltage cabling.
 - 5). Uprights shall include removable panels to allow access to piping and electrical services.
 - 6). Removable panel shall be on the inside of the frame.
 - c. Frames exceeding 48 inches (1200 mm) in width shall have a center top vertical support to accommodate split shelving.
 - d. Fully welded caps shall be provided at the top and bottom of the vertical support members, with penetrations only as required for levelers and for service connections as indicated.
 - e. Uprights shall have tapped holes to allow for attachment of worksurface table frames. The uprights shall incorporate machined inserts at these locations for stability and durability.

- f. Upright to have slots punched on 1 inch (25 mm) increments starting at nominal 55 inches (1400 mm) above the floor to the top of the uprights. Pattern shall match Knape & Vogt 85 ANO series uprights.
- g. Upper and lower horizontal cross rails shall be 11 gauge for single frames and 14 gauge for shared frames.
 - 1). Lower horizontal cross rail shall serve as an integral power/data raceway with removable bottom cover. Bottom cover shall be held in place with screws. Provide metal dividers within raceway between power and data cabling compartments.
 - 2). Upper horizontal cross rail may be used for routing of power and electrical cables. Provide metal dividers between power and data cabling compartments. Upper horizontal cross rail shall be provided with a top enclosure panel secured with screws.
- h. Provide piped utilities, power, and data services at each unit as shown on the drawings.
 - 1). All utility services (plumbing, power, phone and data) shall terminate at one end of the top of the vertical framework.
 - 2). Piped services shall comply with the requirements of Division 22.
 - a). Vertical framework shall be dimensionally able to accommodate up to three piped gas services.
 - b). Provide service fittings as scheduled and as specified in section 115343, complete with all gaskets, grommets, and sleeves.
 - c). Provide gas service fixture mounting penetrations only for those services shown at each workstation.
 - d). Unless noted otherwise, internal plumbing lines shall be ¼ inch (6 mm) OD wall copper tubing terminating at a quick disconnect attached to the tube with compression fittings at the top of the upright. Refer to section 115343 for quick disconnect valve specifications.
 - e). All burning gases internal piping shall be ¼ inch (6 mm) #316 stainless steel.
 - f). Provide whip or patch cord for each utility. Refer to the drawings and specification section 115343.
 - 3). Electrical power devices shall comply with the requirements of Division 26.
 - a). Units shall be listed under UL 61010A-1: Electrical Equipment for Laboratory Use.
 - b). Power services shall have a restrained cord and plug extending 4 feet (1200 mm) above the top of the upright. Plug end to be twist lock, appropriate for the quantity of circuits at each workstation as shown on the drawings.
 - 4). Data devices and wiring shall comply with the requirements of Division 27.

- a). Internal CAT 6 data wiring shall extend 4 feet (1200 mm) above the upright and terminate with a male connector.
 - b). Provide a female plug mounted into the top of the workstation. Provide a 4 feet (1200 mm)-long patch cord.
3. Worksurface Table Frames: Table framework units that attach to the vertical framework units to support work surfaces.
- a. Worksurface table frames shall be fabricated as one fully-welded assembly and painted as one piece.
 - b. Legs: 2 inch (51 mm) outside diameter or 2-inch square 11 gauge cold rolled steel with 1 $\frac{3}{4}$ inch (44 mm) diameter or square inner telescoping #304 stainless-steel leg to allow for height adjustment.
 - 1). Height adjustment of inner leg shall be accomplished with a hole and pin system.
 - c. Worksurface frame shall be 11 gauge formed steel. Rear corners shall have 2 $\frac{1}{4}$ inch diameter X 6 inch (57 mm x 150 mm) high 11 gauge collar. The front half of the collar shall be welded to the worksurface frame with supporting gussets and the back half mechanically fastened to the rear uprights with socket head button cap and bolt.
 - d. A back stop angle with full length rubber bumper shall be located under the worksurface frame so that the mobile base cabinets units are aligned 1 inch behind the front edge of the worksurface. Back stop angle shall overlap mobile cabinets vertically by no more than 3 inches (75 mm).
4. Levelers: Provide levelers at the bottom of each frame member.
- a. Levelers to be $\frac{3}{8}$ inch diameter, 2 $\frac{1}{2}$ inch (9 mm x 64 mm) long.
 - b. Provide two levelers per shared vertical framework upright.
 - c. Provide one leveler per workstation framework table frame leg.
5. Load rating:
- a. 100 lbs per linear foot (150 kg/m) of width to maximum of 800 lbs (363 kg).
 - b. With 800 lbs (363 kg) of uniformly distributed load the maximum allowable deflection shall be 0.125 inch (3 mm) measured at the front center rail.
6. Work Surfaces:
- a. As specified elsewhere in this section.
7. Adjustable Shelving
- a. 1" (25 mm) epoxy resin or phenolic resin as specified elsewhere in this section.
 - b. Shelf depth: 12" (300 mm), unless otherwise indicated.
 - c. Shelf Brackets: 11 gauge (1.6 mm thick) bookend type, as detailed on drawings.
 - d. Safety edging:
 - 1). Front Edge: Retainer rail.

- 2). Rear Edge: removable metal angle.
 - e. Load capacity: System shall support a minimum of 35 pounds per square foot (170 kg/m²) applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.
8. Privacy Panels:
- a. Perforated metal panel, finish to match bench frame.
 - b. Frame panel in 14 gauge channel-shaped steel frame, ½ inch (12 mm) tall.
- C. Hardware: As specified elsewhere in this Section.
- D. Metal Casework Color: As selected by the Architect from manufacturer's full color line and complying with finish requirements described below.
- E. Metal Casework Finish Requirements:
1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
 - a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.
 - b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
 - c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
 - d. Offgasing: No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature from installed finished parts.
 2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.
 3. Application: Electrostatically apply 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 thicknesses:

- a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 µm) film thickness with a minimum 1.2 mil (30 µm) film thickness and shall have smooth satin luster.
- b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 µm) film thickness.
- 4. All drawer bodies to be finished in matching color.
- 5. Concealed interior parts shall receive corrosion-resistant treatment.
- 6. Finish must be UV stable.

F. Chemical Spot Test Performance Requirements:

- 1. Chemical resistance: Contractor shall provide verification of metal finish performance. Testing to be performed by independent testing agency.
- 2. Test procedure: A clean, dry, test panel shall be laid flat and level on a horizontal surface. Ambient temperature of 70°F to 76°F (20°C to 22°C) and relative humidity of 45% to 55% shall be maintained for 48 hours. After a test period of one hour, chemicals shall be flushed away with cold water and the surface washed with warm water, detergent, and naphtha and rinse with deionized water. Dry with towel and evaluate after 24 hours, maintaining ambient conditions. Test using one of the following methods:
 - a. Place a reagent-saturated cotton ball in the mouth of a one ounce (30 cc) bottle and inverting the bottle on the surface of the panel.
 - b. Chemical spot tests shall be made by applying 5 drops (approximately 0.5 mL) of reagent to the surface to be tested, covered with a 24 mm watchglass, convex side down.
- 3. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	Slight surface etching or severe staining.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, swelling or erosion of the surface. Obvious and significant deterioration.

- 4. Minimum acceptable results of chemical resistance test:

Reagent	% by wt.	Rating
Acetic acid	98%	0
Acetone		0
Acid dichromate	5%	0
Ammonium hydroxide	28%	0
Amyl acetate		0
Benzene		0
Butyl alcohol		0

Carbon tetrachloride		0
Chloroform		0
Chromic acid	60%	0
Cresol		0
Dichloroacetic acid		1
Dimethylformamide		0
Dioxane		0
Ethyl acetate		0
Ethyl alcohol		0
Ethyl ether		0
Formaldehyde	37%	0
Formic acid	90%	0
Furfural		0
Gasoline		0
Hydrochloric acid	37%	0
Hydrochloric acid	48%	1
Hydrogen peroxide	3%	0
Methyl alcohol		0
Methyl ethyl ketone		0
Methylene chloride		0
Mono chlorobenzene		0
Naphthalene		0
Nitric acid	20%	0
Nitric acid	30%	0
Nitric acid	70%	1
Phenol	90%	0
Phosphoric acid	85%	0
Silver nitrate, saturated		0
Sodium hydroxide	10%	0
Sodium hydroxide	20%	0
Sodium hydroxide	40%	0
Sodium hydroxide, flake		0
Sodium hydroxide, saturated		0
Sulfuric acid	33%	0
Sulfuric acid	77%	0
Sulfuric acid/Nitric acid, equal parts	77%/70%	1
Tincture of Iodine		2
Toluene		0
Trichloroethylene		0
Xylene		0
Zinc chloride, saturated		0

G. Hot Water Test

1. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
2. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.

H. Paint Adhesion on Steel Test

1. Test Procedure: Test shall be based on ASTM D2197-86 "Standard Method of Test for Adhesion of Organic Coating." Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart

shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.

2. Acceptance Level: Ninety or more of the squares shall show finish intact.

I. Impact Test

1. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer's standard manufacturing method.

2. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.

J. Paint Hardness on Steel Test

1. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.

2. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

K. Wood Finish Performance Requirements:

1. Chemical resistance: Contractor shall provide verification of wood finish performance. Testing to be performed by independent testing agency.

a. Procedure: Finished panels shall be oriented horizontally and vertically during exposure to the test chemicals. Chemical concentrations shall be adjusted by the volume method. Ambient temperature and chemical temperature shall be 68°F to 72°F (20°C to 22°C). At the end of the test period, the surface shall be washed with detergent and warm water. Areas exposed to solvents shall be cleaned with a cloth dampened with the respective solvent. Prior to the evaluation, 16 - 24 hours after the chemicals have been removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

1). Horizontal Test: Apply five (5) drops of the acid, base or salt substance to the correspondingly numbered areas of the surface to be tested. Position a 1 inch (25.4 mm) diameter watch glass in the liquid, convex side downward. Solvents shall be applied by saturating a 1 inch (25 mm) ball of cotton, then covering with an inverted 2 ounce (56.7 g) wide-mouth bottle. Test duration shall be one hour.

2). Vertical Test: The test surface shall be marked to indicate divisions; 12 inches (305 mm) high, ¾ inch (19 mm) wide, and numbered to identify the chemicals. Five (5) drops of each substance shall be applied to its respective numbered area in a vertical track pattern to prevent crossover. Test duration shall be two hours.

b. Evaluation ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.

2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

c. Minimum acceptable results of chemical resistance test:

Reagent		Horizontal Test Rating	Vertical Test Rating
Acetic Acid	50%	1	1
Acetic Acid	75%	2	1
Hydrochloric Acid	20%	1	1
Hydrochloric Acid	37%	2	1
Hydrogen Peroxide	30%	1	1
Nitric Acid	10%	1	1
Nitric Acid	25%	2	2
Phosphoric Acid	50%	1	1
Phosphoric Acid	75%	1	1
Sulfuric Acid	25%	1	1
Sulfuric Acid	50%	2	1
Glycerin		1	1
Potassium Hydroxide	40%	1	2
Potassium Hydroxide	45%	1	2
Sodium Hydroxide	25%	1	1
Sodium Hydroxide	35%	1	1
Sodium Hydroxide	40%	1	1
Sodium Hydroxide	50%	1	1
Sodium Chloride	Saturated	1	1
Sodium Carbonate	Saturated	1	1
Sodium Hypochlorite	5.25%	1	1
Zinc Chloride	Saturated	1	1
Acetone	50%	2	1
Butyl Alcohol		1	1
Ethyl Acetate		2	1
Ethyl Alcohol		1	1
Ethyl Ether		2	1
Kerosene		1	1
Methyl Alcohol		1	1
Methyl Ethyl Ketone		2	1
Naphthalene		1	1
Toluene		2	1
Xylene		2	1

2.2 CABINET HARDWARE

- A. General: Special cabinets, such as corrosives storage, flammable liquid and solvent storage, may be provided with the manufacturer's standard hardware.
 1. All door and drawer pulls shall match, regardless of type of casework, except for:
 - a. Flammable liquid/ solvent storage cabinets, which should use manufacturer's standard latch handles as required to satisfy requirements of regulatory approvals.

2. All hardware shall be compliant with the ADA Standards for Accessible Design (28 CFR Part 36).
- B. Drawer and Hinger Door Pulls:
1. Drawer and door pulls shall attach to door or drawer with machine screws. Two (2) pulls shall be furnished on drawers wider than 28 inches (711 mm). Plastic pulls or other types subject to breakage are not acceptable.
 2. Type: Rectangular box style.
 - a. Cast aluminum with finish as follows:
 - 1). BHMA 628 Satin Clear Anodized (Previously US28).
 - b. Length: 4 inches (100 mm) center to center of screw holes.
- C. Hinges:
1. General: Hinges shall be attached to both door and case with three screws through each leaf. Provide two hinges for doors up to 48 inches (1219 mm) high; three hinges for doors over 48 inches (1219 mm) high.
 2. Type: Institutional with a five-knuckle bullet-type barrel. Characteristics:
 - a. Height: 2½ inches (63 mm), nominal.
 - b. Material:
 - 1). Stainless steel with stainless steel screws.
 - 2). Finish:
 - a). BHMA 630 Satin (Previously US32D).
- D. Shelf Hardware:
1. Shelf Supports:
 - a. Adjustable shelf supports: 13 gauge (2.4 mm thick) steel angle with 5 mm diameter x 3/8 inch (10 mm) long pin, bright zinc-plated finish, and all edges rounded.
- E. Catches:
1. Roller Catches:
 - a. Materials: Roller catches shall be chrome-plated or zinc-plated steel with adjustable tension ball catch. Plastic type catches are not acceptable.
 - b. Application: Provide roller catches at top of all non-locked cabinet doors.
 2. Elbow catches: Heavy-duty, adjustable, spring-type elbow catch and strike plate.
 - a. Material: Brass or steel with bright chromium plated finish.
 - b. Application: Elbow catches shall be used on left hand doors of locked double door cabinets, including tall cabinets.
 - 1). At tall cabinets, elbow catch shall latch to fixed center shelf. Latching devices using chains or strings are not acceptable.
- F. Drawer slides:

1. Typical: Ball bearing slides:
 - a. Material:
 - 1). Clear, zinc-coated steel.
 - b. Full extension, 100 lb/pr. (45 kg/pr.) capacity.
 - c. File drawers shall be equipped with rail mounted with overtravel, 150 lb/pr. (68 kg/pr.) capacity.
- G. Drawer Stops: All regular drawers shall be equipped with integral stops to prevent drawer head impact with cabinet body.
- H. Door Stops: Provide door stops for any cabinet door, which will strike an obstruction when opened between 90° and 135°.
 1. Stop to be:
 - a. Coated cable.
 - 1). Seven-strand, 7-wire-per-strand, stainless steel cable with clear nylon coating.
 - 2). Wire diameter: 0.047 inches.
 - 3). Composite diameter with coating: 0.063 inches.
 - 4). Terminations: Number 10 stake eye on both ends. Attach to door/cabinet with screws. Through-bolting not allowed.
 - b. Engineer stop to length to allow door to open 1 ½ inch (40 mm) from obstruction.
- I. Hanging File Suspension System: Hangers shall be fastened and secured to drawer construction and shall not be freestanding units set inside the drawer. Provide in all file drawers.
- J. Locks:
 1. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings. Provide chain bolts 3 inches (75 mm) long, with an 18 inch (450 mm) pull and an angle strike to secure inactive door on cabinets over 72 inches (1829 mm) in height. Five (5) or eight (8) tumbler locks are acceptable. Locks shall have satin nickel or satin chrome finish.
 2. Keying:
 - a. Keyed differently and master keyed.
 3. Key engraving:
 - a. Keys to be engraved with an identification number corresponding to the layout of unique keys on the project. All identical keys shall be engraved with the same number.
- K. Glides: Non-marring material, 1 inch (25 mm) diameter, minimum, with at least 5/8 (16 mm) vertical adjustment. Provide on movable tables, unless otherwise indicated.
- L. Leveling devices: Provide each table leg with 3/8 inch (10 mm) minimum diameter leveling bolt and floor clip.

where the top overhangs 1 inch (25 mm) and ¼ inch (6 mm) from the edge where the edge overhangs ½ inch (13 mm).

4. Edge profile: For all exposed upper edges and corners:
 - a. Bevel eased: 1/8 inch (3 mm) machined bevel with blended radius corners.
5. Sink Mounting:
 - a. Drop-in Sink Cutouts: Cutouts shall be profiled to provide support for the sink, and to ensure that the rim of the installed sink is 1/8 inch (3 mm) below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 inch (3 mm) bevel. Ensure that there shall be no gaps between the installed sink rim and work surface.
6. Curbs and Splashes:
 - a. Height: 4 inches (100 mm), unless noted otherwise on Laboratory Furnishing Drawings.
 - b. Bonded to the surface of the top to form a square joint.
7. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 inch (3 mm). After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the manufacturer.

D. Physical Properties:

1. Chemical resistance:
 - a. Organic solvents: A cotton ball, saturated with the test chemical, is placed in a one ounce bottle with a reservoir of liquid above the ball. The container is inverted on the test material surface for a period of 24 hours. Test temperature: 23°C ±2°C.
 - b. Other test chemicals: Five drops (1/4 cc) of the test chemical are placed on the test material surface. The chemical is covered with a 1 inch diameter watch glass for a period of 24 hours. Test temperature: 23°C ±2°C.
 - c. Evaluation: After 24 hours exposure, exposed areas are washed with water, then a detergent solution, finally with naphtha, then rinsed with distilled water, dried with a cloth, and rated as follows:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in

		deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

d. Test results:

Test chemical	Concentration				
		Black	Dark gray	Light gray	Beige
Chromic acid	40%	3	2	2	2
Hydrochloric acid	10%	0	0	0	0
Hydrochloric acid (conc.)	37%	0	0	0	0
Nitric acid	40%	0	0	0	0
Nitric acid (conc.)	70%	0	0	0	0
Sulfuric acid	60%	0	0	0	0
Sulfuric acid (conc.)	96%	4	4	4	4
Acetic acid	5%	0	0	0	0
Acetic acid (glacial)		0	0	0	0
Citric acid	1%	0	0	0	0
Oleic acid		0	0	0	0
Phenol solution	5%	0	0	0	0
Ammonium hydroxide	10%	0	0	0	0
Sodium carbonate sol.	20%	0	0	0	0
Sodium hydroxide sol.	60%	0	0	0	0
Sodium hypochlorite sol.	4%	0	0	0	0
Acetone		1	1	1	1
Benzene		1	1	1	1
Carbon tetrachloride		1	1	0	0
Diethyl ether		0	0	1	1
Dimethyl formamide		0	0	0	0
Ethyl acetate		0	1	1	0
Ethyl alcohol	95%	0	0	0	0
Ethylene dichloride		0	0	0	0
Heptane		0	0	1	0
Isooctane		0	0	0	0
Kerosene		0	0	0	0
Methyl alcohol		0	0	0	0
Toluene		0	0	0	0
Aniline		0	0	0	0
Mineral oil		0	0	0	0
Olive oil		0	0	0	0
Soap solution	1%	0	0	0	0
Transformer oil		0	0	0	0
Turpentine		0	0	0	0

2. Heat resistance:

- a. High temperature test: A porcelain crucible is heated to a dull red color, placed on the test material, and allowed to cool to ambient temperature. Result: No observable surface deformation.

- b. Flame test: A 3/8 inch (10 mm) Bunsen burner is adjusted to a quiet flame with a 1½ inch (38 mm) inner cone, overturned on the test material, and allowed to stay for 5 minutes.
Result: no observable surface deformation.

3. Physical properties:

Compressive strength	ASTM D695	31,400 psi (216 MPa)
Tensile strength	ASTM D638	8,000 psi (55 MPa)
Flexural strength	ASTM D790	11,700 psi (81 MPa)
Rockwell hardness "M"	ASTM D785	105-110
Specific density	ASTM D792	122.4 lb/ft ³ (1960 kg/m ³)
Water absorption	ASTM D570	0.01%
Fire Resistance	ASTM D635	ATB (sec)=0
Heat deflection @ 264 psi (1.82 MPa)	ASTM D648	342°F (172°C)

- E. Stainless Steel: Refer to Stainless Steel Fabrications section of this specification.

2.4 SHELVING ASSEMBLIES

- A. Adjustable Reagent Shelving: 1" (25mm) epoxy resin or phenolic resin shelves. Provide 16 gauge bookend brackets. Rear of bracket shall be profiled to fit into slots of shelf support. Refer to detail on Laboratory Furnishings Drawings.

B. Adjustable Wall Shelves:

1. Shelving: 1" (25 mm) epoxy resin or phenolic resin.
2. Double Slot Shelf Standards:
 - a. Basis of Design: Knape & Vogt 85 ANO series uprights.
3. Shelf Brackets: 16 gauge (1.6 mm) bookend type, as detailed on drawings.
4. Safety edging:
 - a. Front Edge:
 - 1). Retainer rail, ¼" diameter aluminum rod, as detailed on drawings.
5. Load capacity: System shall support a minimum of 35 pounds per square foot (170 kg/m²) applied at all shelves simultaneously. Maximum deflection shall be 0.35 inches (9mm) under load.
6. Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.

C. Stainless Steel Shelving System

1. **Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be the provided by a single manufacturer.**
 - a. **InterMetro Industries Corporation, 651 North Washington St., Wilkes-Barre, PA 18705 Tel: 800 992-1776. Manufacturer of Metro product range.**
 - b. **Eagle Group, 100 Industrial Blvd., Clayton, DE 19938 Tel: 302 653-3000.**

- c. **Nexel Industries Inc., March Equipment Inc., US Highway 206, Box 18, Flanders, NJ 07836 Tel: 973 584-4269.**
- d. **Approved substitution.**
- 2. **Floor Mounted Stainless Steel Shelving Systems**
 - a. **Basis of Design: Metro Super-Erecta stainless steel shelf system, floor mounted post supported, or equivalent.**
 - b. **Posts: floor mounted stainless steel posts, grooved at 1 inch (25 mm) increments and numbered at 2 inch (50 mm) increments for shelf adjustment, length as shown on drawings, Metro PS series or equal.**
 - c. **Shelves:**
 - 1). **Open Wire: stainless steel wire.**
 - d. **Provide diagonal bracing for lateral stability at freestanding applications.**
 - e. **Accessories:**
 - 1). **Foot Plate: stainless steel with adjustable leveling bolt, Metro No. 9993S or equal.**
 - 2). **Post Clamps: Zinc-plated, to join adjacent posts, Metro No. 9994Z or equal.**
 - 3). **Shelf Ledges:**
 - a). **1 inch (25 mm) high stainless steel wire, Metro No. LxxN-1S or equal, sized to match shelf.**

2.5 CYLINDER AND DEWAR RESTRAINT ASSEMBLY

- A. Cylinder Rack Assembly:
 - 1. Frame members: 2 inches x 2 inches x 1/8 inch (50 x 50 x 3 mm) square steel tube.
 - 2. Construction: All welded. Weld cover plates to close exposed tube ends. Grind and polish all welds to produce smooth surface with no visible evidence of welding when painted. Drill 9/32 inch (7 mm) diameter holes in top rails for retaining rods, as shown on the Laboratory Furnishing drawings.
 - 3. Retainer Rods: Provide ¼ inch (6 mm) diameter steel retainer rods with turned down ends.
- B. Cylinder and Dewar Chain Assembly:
 - 1. Framing channel, Fittings, Swivel Hangers, and End Caps: Slotted channel framing as specified elsewhere on this Section. Provide two swivel hangers per cylinder or dewar per wall bracket
 - 2. Chain: Provide restrainers of 5/16 inch diameter, Type 304 stainless steel welded chain fitted with stainless steel snap shackle with swivel clevis and split ring for each bracket.
 - 3. Cylinder racks and restraint components shall be factory-finished. Color to be selected by the Architect.

solvent. Prior to the evaluation, 16 - 24 hours after the chemicals have been removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

- 1). Horizontal Test: Apply five (5) drops of the acid, base or salt substance to the correspondingly numbered areas of the surface to be tested. Position a 1 inch (25.4 mm) diameter watch glass in the liquid, convex side downward. Solvents shall be applied by saturating a 1 inch (25 mm) ball of cotton, then covering with an inverted 2 ounce (56.7 g) wide-mouth bottle. Test duration shall be one hour.
 - 2). Vertical Test: The test surface shall be marked to indicate divisions; 12 inches (305 mm) high, ¾ inch (19 mm) wide, and numbered to identify the chemicals. Five (5) drops of each substance shall be applied to its respective numbered area in a vertical track pattern to prevent crossover. Test duration shall be two hours.
- b. Evaluation ratings:

0	No effect	No detectable change in the material surface.
1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	A clearly discernable change in color or gloss but no significant impairment of surface life or function.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.

- c. Minimum acceptable results of chemical resistance test:

Reagent		Horizontal Test Rating	Vertical Test Rating
Acetic Acid	50%	1	1
Acetic Acid	75%	2	1
Hydrochloric Acid	20%	1	1
Hydrochloric Acid	37%	2	1
Hydrogen Peroxide	30%	1	1
Nitric Acid	10%	1	1
Nitric Acid	25%	2	2
Phosphoric Acid	50%	1	1
Phosphoric Acid	75%	1	1
Sulfuric Acid	25%	1	1
Sulfuric Acid	50%	2	1
Glycerin		1	1
Potassium Hydroxide	40%	1	2
Potassium Hydroxide	45%	1	2
Sodium Hydroxide	25%	1	1
Sodium Hydroxide	35%	1	1
Sodium Hydroxide	40%	1	1
Sodium Hydroxide	50%	1	1
Sodium Chloride	Saturated	1	1
Sodium Carbonate	Saturated	1	1

Reagent		Horizontal Test Rating	Vertical Test Rating
Sodium Hypochlorite	5.25%	1	1
Zinc Chloride	Saturated	1	1
Acetone	50%	2	1
Butyl Alcohol		1	1
Ethyl Acetate		2	1
Ethyl Alcohol		1	1
Ethyl Ether		2	1
Kerosene		1	1
Methyl Alcohol		1	1
Methyl Ethyl Ketone		2	1
Naphthalene		1	1
Toluene		2	1
Xylene		2	1

2.13 METAL FABRICATIONS

- A. Applicability: This section applies to metal fabrications, including, but not limited to, pipe drop enclosures, radioisotope storage cabinets, shelving support systems, metal-framed laboratory tables, metal-framed balance tables, cylinder racks, utility ceiling tiles, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.
- B. Materials:
 - 1. Steel: Cold-rolled furniture stock sheet steel, prime grade, roller leveled.
 - a. Steel shall be treated at the mill to be free of scale, ragged edges, deep scratches, or other injurious effects.
 - b. All gauges indicated are to be U.S. standard.
- C. Finish Requirements:
 - 1. Paint finish for steel laboratory products shall utilize a dry coating process with minimal waste generation. Liquid-applied coatings shall not be acceptable. Manufacturer shall supply documentation that waste generated during the painting process, is a solid, non-hazardous material.
 - a. Pretreatment: Finish process shall incorporate a phosphate conversion coating during the pretreatment/cleaning operation.
 - b. Operator Protection: The painting process shall be cleanly contained, have no solvent odor and be performed in an air-conditioned room.
 - c. VOC (Volatile Organic Compounds) emissions shall not exceed 0.29 lbs per gallon (35 g/L).
 - d. Offgasing: No further emissions or “Offgasing/Decomposition” vapors shall occur at room temperature from installed finished parts.
 - 2. Preparation: After the units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish to the metal

and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a heated cleaner/phosphate solution and pretreated with iron phosphate spray followed by a neutral final seal prior to application of final finish. The strength of each solution shall be monitored by filtration to insure consistent quality. All treated parts shall be immediately dried in heated ovens and gradually cooled before application of the finish. Treated metal parts shall be clean and properly prepared to provide optimum adhesion of finish and resistance to corrosion.

3. Application: Electrostatically apply 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 thicknesses:
 - a. All surfaces, exterior or interior, exposed to view, shall receive sufficient powder coat to achieve an average 1.5 mil (38 μm) film thickness with a minimum 1.2 mil (30 μm) film thickness and shall have smooth satin luster.
 - b. Backs of cabinets and other surfaces not exposed to view shall have sufficient powder coat to achieve an average 1.0 mil (25 μm) film thickness.
 4. All drawer bodies to be finished in matching color.
 5. Concealed interior parts shall receive corrosion-resistant treatment.
 6. Finish must be UV stable.
 7. Color: As selected by the Architect.
- D. Chemical Spot Test Performance Requirements:
1. Chemical resistance: Contractor shall provide verification of metal finish performance. Testing to be performed by independent testing agency.
 2. Test procedure: A clean, dry, test panel shall be laid flat and level on a horizontal surface. Ambient temperature of 70°F to 76°F (20°C to 22°C) and relative humidity of 45% to 55% shall be maintained for 48 hours. After a test period of one hour, chemicals shall be flushed away with cold water and the surface washed with warm water, detergent, and naphtha and rinse with deionized water. Dry with towel and evaluate after 24 hours, maintaining ambient conditions. Test using one of the following methods:
 - a. Place a reagent-saturated cotton ball in the mouth of a one ounce (30 cc) bottle and inverting the bottle on the surface of the panel.
 - b. Chemical spot tests shall be made by applying 5 drops (approximately 0.5 mL) of reagent to the surface to be tested, covered with a 24 mm watchglass, convex side down.
 3. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

0 No effect No detectable change in the material surface.

1	Excellent	Slight detectable change in color or gloss but no change in function or life of the surface.
2	Good	Slight surface etching or severe staining.
3	Fair	Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
4	Failure	Pitting, cratering, swelling or erosion of the surface. Obvious and significant deterioration.

4. Minimum acceptable results of chemical resistance test:

Reagent	% by wt.	Rating
Acetic acid	98%	0
Acetone		0
Acid dichromate	5%	0
Ammonium hydroxide	28%	0
Amyl acetate		0
Benzene		0
Butyl alcohol		0
Carbon tetrachloride		0
Chloroform		0
Chromic acid	60%	0
Cresol		0
Dichlor acetic acid		1
Dimethylformamide		0
Dioxane		0
Ethyl acetate		0
Ethyl alcohol		0
Ethyl ether		0
Formaldehyde	37%	0
Formic acid	90%	0
Furfural		0
Gasoline		0
Hydrochloric acid	37%	0
Hydrochloric acid	48%	1
Hydrogen peroxide	3%	0
Methyl alcohol		0
Methyl ethyl ketone		0
Methylene chloride		0
Mono chlorobenzene		0
Naphthalene		0
Nitric acid	20%	0
Nitric acid	30%	0
Nitric acid	70%	1
Phenol	90%	0
Phosphoric acid	85%	0
Silver nitrate, saturated		0
Sodium hydroxide	10%	0
Sodium hydroxide	20%	0
Sodium hydroxide	40%	0
Sodium hydroxide, flake		0
Sodium hydroxide, saturated		0
Sulfuric acid	33%	0
Sulfuric acid	77%	0

Sulfuric acid/Nitric acid, equal parts	77%/70%	1
Tincture of Iodine		2
Toulene		0
Trichloroethylene		0
Xylene		0
Zinc chloride, saturated		0

E. Hot Water Test

1. Test Procedure: 190°F to 205°F (88°C to 96°C) hot water shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces (177.5 cc) per minute) on the finished surface, which shall be set at an angle of 45°, for a period of 5 minutes.
2. Acceptance Level: After cooling and wiping dry, the finish shall show no visible effect from the hot water.

F. Paint Adhesion on Steel Test

1. Test Procedure: Test shall be based on ASTM D2197-86 "Standard Method of Test for Adhesion of Organic Coating." Two sets of eleven parallel lines 1/16 inch (1.587 mm) apart shall be cut with a razor blade to intersect at right angles thus forming a grid to 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush surface lightly with a soft brush for one minute. Examine under 100 fc (1076 lux) of illumination.
2. Acceptance Level: Ninety or more of the squares shall show finish intact.

G. Impact Test

1. Test Procedure: Drop a 1 lb (0.4536 kg) ball (approximately 2 inch (50.8 mm) diameter from a distance of 12 inches (305 mm) onto a flat horizontal surface, coated to manufacturer's standard manufacturing method.
2. Acceptance Level: No visual evidence to the naked eye of cracks in the finish due to impact.

H. Paint Hardness on Steel Test

1. Test Procedure: Paint film shall be tested with pencils of various hardnesses. Pencils shall have a wide, sharp edge. Pencils shall be pushed across surface in a chisel-like manner.
2. Acceptance Level: Finish film shall not rupture from a sharpened 4H pencil.

2.14 STAINLESS STEEL FABRICATIONS

- A. Applicability: This section applies to stainless steel fabrications, including, but not limited to, work surfaces, shelves, autoclave/equipment enclosure walls and panels, utility ceiling tiles, sinks and scullery sinks, stainless steel pipe drop enclosures, and other miscellaneous brake-formed and shop fabricated stainless steel components and trim as shown on the drawings.
- B. Material: Unless otherwise noted stainless steel shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
- C. Finish: All fabrications shall have exposed surfaces ground and polished to a Number 4 satin finish.

- i. Diagonal Brace Supports: Framing Channel, 1 5/8 inch x 1 5/8 inch (39 mm x 39 mm) x 12 gauge.
 - j. Closure Strip: 0.04 inches thick snap-in cover for framing channel. Provide closure strips over all exposed vertical post sections.
 - k. End Caps: 0.06 inches (1.5 mm) thick for framing channel. Provide end caps for all exposed horizontal framing channels.
 - l. Ceiling Escutcheon: Provide 18 gauge steel, finished to match framing members, as indicated on the Laboratory Furnishing drawings, at ceiling penetrations.
 - m. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
2. Service Struts and Ledging:
- a. 16 gauge, 13/16 inch x 1 5/8 inch (20 mm x 41 mm) cold-formed framing uprights. Uprights shall be provided at 48 inches (1200 mm), maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
 - b. U-shaped spreaders: 12 gauge by 1½ inch (45 mm) wide by length required, galvanized steel.
 - c. Locations:
 - 1). Provide to support tops at pipe service chase space, support drain troughs, under fume hood superstructures, and other abnormal loads.
 - 2). Support struts with U-shaped spreaders shall be provided at 48 inches (1220 mm) on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 inches (1220 mm) on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 15 and 16/ Divisions 22, 26, and 27. Provide all bolts, expansion sleeves, and fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 15 and 16/ Division 22, 26, and 27 installers.
3. Cylinder and Dewar Restraint:
- a. Swivel Hanger: 1 ¾ inch long by 3/8 inch diameter link welded to threaded stud; provide two per cylinder.
4. Finish:
- a. Provide finish coating for all cold-formed framing components, except for stainless steel components.
 - b. Concealed Framing Members and Fittings: Rust inhibiting acrylic enamel paint applied by electrostatic deposition, after cleaning and phosphating, and thoroughly baked. Finish shall withstand a minimum of 400 hours salt spray when tested in accordance with ASTM B117. Color: Green.

3. Where floor conditions require shimming of more than $\frac{3}{4}$ " (19 mm) at any point, do not install casework in those locations. Notify the contractor and design team that remedial measures will be required to bring the floors closer to a level situation.
- C. Installation materials:
1. Installation of wood casework may involve the use of shims, spacers, cleats, straps and other such items of either metal or wood composition.
 2. Installation of metal casework shall use shims, spacers, cleats, and straps of galvanized steel, epoxy-coated steel, or stainless steel. No wood materials of any sort shall be part of the permanent installation of metal casework.
 3. Installation of stainless-steel casework, counters, and scullery sinks shall use shims, spacers, cleats, and straps of stainless steel of the type specified for the casework construction. No wood materials of any sort shall be part of the permanent installation of stainless steel casework.
- D. Scribe tops as necessary for close and accurate fit.
- E. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining units to a tolerance of 1/16 inch (1.5 mm).
- F. Wall Units: Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.
- G. Laboratory Tops:
1. Field Joints: Factory-prepared and identical to factory joints, locate only where indicated on approved Shop Drawings. Field processing of top and edge surfaces is not acceptable, except as described by manufacturer in approved Submittal Data. Provide full length, one-piece tops and backsplashes wherever possible, and keep field joints to an absolute minimum.
 2. Abut top and edge surface in one true plane, with internal supports placed to prevent any deflection. Joints in top units shall be flush and the narrowest for the respective materials of construction. Cement joint in accordance with the manufacturers' specifications.
- H. Sealant:
1. Caulk edges of tops, backsplashes and side splashes to adjacent wall surface with silicone sealant.
 2. At animal facility rooms, caulk perimeter of all casework furnishings and fixtures mounted to the wall or ceiling surfaces, including but not limited to wall mounted shelving brackets, fixed casework, service fittings and fixtures, autoclave/equipment enclosure panels, mop holders, and exam lights.

