SECTION 01 43 39
MOCK-UPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Build each of the indicated mock-ups on site for review and approval before proceeding with any construction that may be affected by the construction represented by a corresponding mock-up.

1.2 PROCEDURE FOR MOCK-UP CONSTRUCTION:

A. Extent, size, form and primary components are indicated on the drawings or in the specification section pertaining to the corresponding work.

B. Mock-up shall be located where indicated on the drawings or, if not indicated, shall be located where directed by the Owner/Architect.

C. Mock-up shall not be provided until corresponding product data, shop drawings, samples and other preparatory submittals are approved.

D. Mock-up shall be rebuilt as necessary until approved by Owner/Architect.

E. After approval, mock-up shall remain and serve as the standard for judging the acceptance or rejection of the appearance characteristics and workmanship of corresponding construction.

F. After completion and acceptance of the corresponding construction, mock-up shall be removed when directed by the Architect unless approved mock-up has been located as part of the permanent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials used in the initial mock-up construction shall comply as specified in the applicable sections for the work and as approved by submittal reviews.

B. Materials may be modified only to the extent required for mock-up approval by the Architect.
   1. Modified materials shall comply with the specified requirements but may differ in appearance characteristics, such as color and texture.

C. Materials used in the construction of approved mock-up construction shall be used in the corresponding permanent construction upon final approved and acceptance.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Provide initial mock-up construction by methods proposed for the corresponding permanent construction.
   1. Comply with installation and application requirements for each component as specified in the section applicable for the work.

B. Methods of construction may be modified only to the extent required for mock-up approval by the Architect.
1. Modified methods of construction shall comply with the specified requirements as well as approved details of workmanship.

C. Methods of construction used for the approved mock-up construction shall be used in the corresponding permanent construction.

3.2 LABORATORY WOOD CASEWORK MOCK-UP

A. Provide mock-up of one 3-foot section of Laboratory Classroom wood base cabinet for each designation of type B36C, WG3613A and B36B.

B. Mock-up shall include, at a minimum, the following features:
   1. All drawer and Door configurations as shown and indicated by QL drawings and associated specification sections.
   2. All hardware.
   3. One 6-foot section of countertop.

C. Sections specifying components of this mock-up include but are not necessarily limited to the following:
   1. Section 12 35 53, Laboratory Casework and Other Furnishings.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. This Project is encouraged to include goals for proactive measures for waste management participation by all parties to the contract.
1. The purpose of this program is to make all parties aware that during the course of the Project all diligent means should be made available to pursue practical and economically feasible waste management and recycling options.
2. Waste disposal to landfills shall be minimized.

B. Definitions:
1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
9. Landfill: Any public or private business involved in the practice of trash disposal.
10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.2 PERFORMANCE GOALS AND REQUIREMENTS

A. General: Develop voluntary waste management goals that strive to results in End-of-Project rates for salvage/recycling of a minimum of 75 percent by weight of total waste generated by the Work.

B. Salvage/Recycle: Owner’s goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
1. Demolition Waste:
   a. Concrete.

C. Construction Waste:
1. Masonry and CMU.
2. Lumber.
4. Wood trim.
5. Metals.
6. Roofing.
7. Insulation.
8. Carpet and pad.
11. Electrical conduit.
12. Packaging: Regardless of salvage/recycle goal indicated above, salvage and recycle 100 percent of the following uncontaminated packaging materials:
   a. Paper.
   b. Cardboard.
   c. Boxes.
   e. Polystyrene packaging.
   f. Wood crates.
   g. Plastic pails.

1.3 CONSTRUCTION WASTE MANAGEMENT PLAN

A. General: A waste management plan is highly encouraged to be established at the highest level achievable. Develop a voluntary plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone number.
   3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
   4. Recycled Materials: Assign recycling to recycling subcontractor, or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility. List hazardous material waste and disposal separately.
   6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Waste Management Plan should include locations of sorting and waste storage facilities on project. Coordinate waste storage with building manager.
PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION:

A. Implement waste management plan by providing containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Suggesting the following procedures:
   1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
   2. Separate construction waste by type at Project site to the maximum extent practical.
   3. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
   4. Do not mix recyclable materials.
   5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   6. Store materials away from construction area. Do not store within drip line of remaining trees.
   7. Store components off the ground and protect from weather.
   8. Remove construction waste off Owner’s property and transport to appropriate receiver or processor.

B. Hazardous Wastes: Store in secure areas and comply with the following:
   1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
      a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
      b. Disposal of fluorescent tubes to open containers is not permitted.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
   1. Distribute waste management plan to everyone concerned within seven days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas for separating materials that are to be salvaged, recycled, reused, donated, and sold.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:
   1. Clean Salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.
C. Salvaged Items for Owner’s Use:
   1. Clean Salvaged items.
   2. Pack or create items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner’s storage area designated by Owner.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper, cardboard, and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only. Available recycling receivers and processors include, but are not limited to, the following:
   1. Eco-Cycle 303-444-6634.
   4. Western Disposal Services 303-444-2037.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill for incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials on site.

C. Burning: Burning of waste materials will be permitted only at designated areas on Owner’s property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are fully extinguished.

D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner’s property.

E. Disposal: Transport waste materials off Owner’s property and legally dispose of them.

END OF SECTION
SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION
A. This section includes Through Penetration Firestop Systems for penetrations through the following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
   1. Floor assemblies.
   2. Walls and partitions.
   3. Smoke barriers which also call for a fire rating.
   4. Construction enclosing compartmentalized areas.
   5. Existing, fire and smoke-rated elements.
   6. Not included: Non-rated walls and smoke-tight partitions which do not call for a fire rating: Do not require Through Penetration Firestop assemblies.
B. This section includes Fire-Resistive Joint Assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including the following types of joints:
   1. Head-of-Wall joint created where walls intersect with overhead roof or floor structure (slabs, decking, beams, etc).
      a. Fire-rated Walls: Select agency-approved assemblies and employ materials specified in this section.
      b. Non-fire rated partitions (including Smoke Partitions): Seal to structure with Acoustical Sealant specified in Section 09 29 00.

1.2 QUALITY ASSURANCE
A. Provide Firestop Systems that comply with the following requirements and those specified in “Performance Requirements” Article:
   1. Firestopping tests, performed by a qualified, testing and inspection agency.
      a. Qualified testing and inspection agency: UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to local authorities having jurisdiction.
   2. Firestop System products bear classification marking of qualified testing and inspection agency.
   3. Applications that exist for which no tested system is available through a manufacturer: Provide engineering judgment derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
      a. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.
B. Installer Qualifications:
   1. Certified, licensed or otherwise qualified by the Firestopping Manufacturer as having the necessary training to install firestop products per specified requirements.
   2. Licensed by the State or local authority, where applicable.
   3. Shown to have successfully completed not less than 5 comparable scale projects.
C. Single-source: Obtain Firestop Systems for each type of penetration and construction condition indicated from a single manufacturer.
D. Fire Test Requirements:
   1. Underwriters Laboratories, Inc. (UL):
a. UL 1479, Fire Tests of Through Penetration Firestops.
d. UL 723, Surface Burning Characteristics of Building Materials.

   a. ASTM E814, Fire Tests of Through Penetration Fire Stops.
   d. ASTM E84, Surface Burning Characteristics of Building Materials.

E. References:
   c. Fill, Void or Cavity Materials (XHHW).
   d. Firestop Devices (XHJI).
   e. Forming Materials (XHKU).
   f. Wall Opening Protective Materials (CLIV).
2. Building Code as locally adopted and amended.
   b. NFPA 70: “National Electrical Code.”
4. Firestop Contractors International Association (FCIA):
5. International Firestop Council (IFC):
   a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)
   b. Ref. 2 Inspectors Field Pocket Guide

F. Identification Labels for Firestop Assemblies:
1. Install labels which identify each Firestop installation.
2. Label shall be pre-printed by supplier and include the following:
   a. Name of supplier of Firestopping system.
      1) Include manufacturer’s representative and phone number.
   b. UL Design Number or other approved testing agency.
   c. Date of installation.
   d. Name of firestopping installer.
3. Identification labels may be in the form of self-adhering stickers, tie-on ID tags, or combination of both as appropriate for permanent identification of firestop assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.

B. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.

C. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
   1. Provide products appropriately tested for the thickness and type of insulation utilized.

D. Cabling (i.e. voice, data and video cabling, etc) where frequent cable moves, add-ons, and changes are likely to occur in future:
1. Where Cable Trays are used to convey such cabling: Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.

2. Where Cable Trays are not used: Utilize Fire-rated Cable Pathway devices. Where not practical, re-enterable products specifically designed for retrofit may also be used.

E. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall.
   1. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words “Chase Wall Optional.”

F. Fire Resistive Joint Sealants:
   1. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.
   2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E1399, ASTM E1966 or UL 2079.
   3. Provide fire-resistive joint systems subjected to an air leakage test conducted in accordance with Standard, UL 2079 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1.4 SUBMITTALS

A. Project Information:
   1. UL reports with illustration of systems and system numbers.
   2. Contractor Certification (per FM 4991).

B. Contract Closeout Information:
   1. Letter stating that installed Through Penetration Firestop Systems have been labeled.

C. LEED Credit EQc4.1, Low-Emitting Materials, Adhesives and Sealants:
   1. Provide product data and material safety data sheets (MSDS) for adhesives and sealants used inside the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened containers.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes.

1.6 PROJECT CONDITIONS

A. Do not install when ambient or substrate temperatures are outside limitations recommended by manufacturer.

B. Do not install when substrates are wet due to rain, frost, condensation, or other causes.

C. Do not use materials that contain flammable solvents.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that Firestopping Systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate Through Penetration Firestop Systems.

C. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Firestopping Materials (including fillers, sealants and other items):
      a. Base:
         1) Hilti.
      b. Optional:
         1) Specified Technologies, Inc (STI).
         2) 3M.
         3) Tremco.
         4) Grace.
   2. Forming Materials:
      a. Base:
         1) Thermafiber.
      b. Optional:
         1) Roxul Inc.
         2) IIG Minwool.
         3) Rock Wool Manufacturing.
   3. Other manufacturers, that have UL-listed systems for conditions indicated, desiring approval comply with Section 00 26 00.
      b. Systems that are not UL-approved for conditions will not be accepted.

2.2 FIRESTOPPING – GENERAL REQUIREMENTS

A. Selection Responsibility:
   1. Contractor is responsible to select systems which are approved for conditions encountered and when installed, will maintain required fire separations.

B. Provide firestopping systems and materials that are compatible with one another, with the substrates forming openings, and with penetrating items, under conditions of service and application.

C. Provide components for each firestopping system that are needed to install fill materials.

D. Materials shall be provided by a single firestopping products manufacturer as far as possible.

E. All materials used shall be the specific items named in the UL assemblies being installed.

F. All materials must be UL-approved for the designated fire-resistance-rated systems.

G. Use only products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, void width, movement capabilities, and fire-rating involved for each separate instance.

2.3 MATERIALS

A. Latex Sealants:
   1. Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.
      a. Through Penetration Firestop Systems:
         1) Base Products: “FS-ONE,” “CP604,” and “CP606” by Hilti.
         2) Optional Products:
            a) “SpecSeal Series SSS and LCI Intumescent Sealants,” “SpecSeal Series LC Endothermic Sealant,” and “SpecSeal Series AS Elastomeric Spray” by STI.
            b) “IC15WB+”, “CP25WB+”, “FireDam 150+” by 3M.
      b. Fire-resistive Joints:
         1) Base Products: “CP606” and “CP672” by Hilti.
2) Optional Products:
   a) “SpecSeal Series ES and AS Elastomeric Sealants” by STI.

2. LEED Credit EQc4.1 Low-Emitting Materials, Adhesives, and Sealants:
   a. Material shall contain VOC content as certified.

B. Firestop Devices:
   1. Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
   2. Base Products: “SpecSeal Series SSC and LLC Firestop Collars” by STI.
   3. Optional Product: “Fire Barrier Ultra Plastic Pipe Device” by 3M.

C. Intumescent Pads (Wall Opening Protective Materials):
   1. Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes, medical gas outlets, and other items recessed in to face of fire rated walls.
   2. Base Products: “FS-ONE” and “CP643N” by Hilti.
   3. Optional Products:
      a. “SpecSeal Series SSP Firestop Putty Pads” and “SpecSeal Series EP PowerShield Insert Pads” by STI.
      b. “Interam Ultra GS Wrap Strip”, “3M Fire Barrier Moldable Putty+ pads”, “3M Fire Barrier Moldable Putty Stix” by 3M.

D. Fire-rated Cable Pathways:
   1. Usage:
      a. Cables passing through fire-rated floors or walls shall pass through Fire-rated Cable Pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.
   2. Product Description and Requirements:
      a. Pathway device modules comprised of steel raceway and intumescent foam pads.
      b. F-Rating equal to the rating of the barrier in which the device penetrates.
      c. Pathway devices shall be capable of allowing a 0 to 100% fill of cables.
      d. Size to accommodate the quantity and size of electrical wires and data cables indicated plus 100% expansion.
      e. Wire devices to be provided with steel wall plates allowing for single or multiple devices to be ganged together.
   3. Base Product: “EZ-PATH Fire Rated Pathway” by STI.
   4. Optional Product: “3M Fire Barrier Pass-Through Devices” by 3M.

E. Firestop Putty:
   1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
   2. Base Product: “CP618” and “CP619” by Hilti.
   3. Optional Products:
      a. “SpecSeal Series SSP Firestop Putty” by STI.
      b. “3M Fire Barrier Moldable Putty+ pads”, “3M Fire Barrier Moldable Putty Stix” by 3M.
   4. LEED Credit EQc4.1 Low-Emitting Materials, Adhesives, and Sealants:
      a. Material shall contain VOC content as certified.

F. Wrap Strips:
   1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
   2. Base Products: “CP645” and “CP648” by Hilti.
   3. Optional Products:
      a. “SpecSeal Series RED Wrap Strip” and “SpecSeal Series BLU Wrap Strip” by STI.
      b. “Interam Ultra GS Wrap Strip”, “3M Fire Barrier FS 195+ Wrap Strip” by 3M.

G. Firestop Pillows:
1. Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
2. Base Product: “CP647” by Hilti.
3. Optional Products:
   a. “SpecSeal Series SSB Firestop Pillows” by STI.
   b. “3M Fire Barrier Pillows”, “3M Fire Barrier Self-Locking Pillows”, by 3M.

H. Mortar:
1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
3. Optional Products:
   a. “SpecSeal Series SSM Firestop Mortar” by STI.
   b. “3M Fire Barrier Mortar” by 3M.

I. Silicone Sealants:
1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag).
3. Optional Products:
   a. “Pensil 300 Silicone Sealant” and “Pensil 300 SL Self-Leveling Silicone Sealant” by STI.
4. LEED Credit EQc4.1 Low-Emitting Materials, Adhesives, and Sealants:
   a. Material shall contain VOC content as certified.

J. Silicone Foam:
1. Multi-component, silicone-based, liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
3. Optional Products:
   a. “Pensil 200 Silicone Foam” by STI.
   b. “3M Fire Barrier 2001 RTV Foam” by 3M.

K. Forming Materials:
1. Materials listed as components in laboratory-approved designs.
2. Mineral Wool:
   a. Base Products: “Type SAF’ by Thermafiber or similar products specifically named as components in laboratory-approved designs.
   b. Optional Product: “3M Fire Barrier Packing Material PM4” by 3M.

L. Perimeter Fire Containment: Specified in Section 07 84 53.

2.4 THROUGH PENETRATION FIRESTOP SYSTEMS

A. General:
1. The schedules below identify requirements for acceptable Through Penetration Firestop Systems based on barrier type, fire-resistive rating, and penetrant type. It is a guide. Ultimately each system must comply with Building Code and Fire Code as locally adopted and amended.
2. Requirements for “single-membrane” penetrations and Through Penetration Firestops are identical. (Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.)
3. Select each Firestop System based on actual field conditions, including penetration type, shape, size(s), quantities and physical position within opening.
4. Refer to Plans for indication of the required ratings of Fire-resistive wall, floor, and roof assemblies.
5. Indicated ratings are minimum and may be exceeded.
6. Firestop Assemblies at Fire-Rated Walls:
   a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
   b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
   c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM/SF.
   d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.

7. Firestop Assemblies at Fire-Rated Floors and Roofs:
   a. The minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors (or roofs) shall equal the hourly rating of the floor (or roof) being penetrated, but not less than 1-HR.
      1) Exception 1: The T-rating may equal zero when the portion of the penetrant which is above the floor is contained within a wall.
      2) Exception 2: Firestops are not required for floor penetrations that are within a 2-hour rated shaft enclosure.

B. Voids in wall (no penetrating items):
   1. Fill with approved Through Penetration Firestopping System.
   2. Contractors Option: Patch void in wall with like construction and complete by sealing gaps between patch and wall with approved firestopping.

C. Penetrating Ducts with Dampers:
   1. Utilize only firestop materials which are included in the damper’s classification.
   2. Do not install Firestop Systems that might hamper the performance of fire dampers.

D. Cable Trays and similar devices:
   1. Openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products (e.g. Firestop Pillows) specifically designed for removal and re-installation.

E. Electrical and Electrical Devices recessed in to face of rated walls:
   1. Items included: Switches, receptacles, J-boxes, medical gas outlets, and similar items recessed in to the face(s) of fire rated walls.
   2. Where such devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally: Install Intumescent Pads over back of devices in approved manner.
## Guide to Through Penetration Firestop Systems - WALLS

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- <Note 11>
- <Note 10 & 11>
- <Notes 9 & 11>
### Guide to Thru Penetration Firestop Systems - FLOORS AND ROOFS

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<thead>
<tr>
<th>Penetrant Description</th>
<th>Criteria</th>
<th>Framed Structure</th>
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<td>&lt;Note 8&gt;</td>
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<tr>
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<td>Multiple Penetrants</td>
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</tbody>
</table>

**Footnotes:** (applicable to Walls AND Floors/Roofs)

1. Examples of systems that operate between 32 to 122 DegF: Chilled Water Supply & Return, Heat Pump Water Supply & Return, Domestic Cold Water, Domestic Hot Water and Recirculation systems < 122 DegF.


3. This Guide's data apply only to penetrations w/out dampers. For dampered penetrations: Refer to Section 23 31 13. Where dampers occur, do not apply firestop materials which are not included in the damper's classification.

4. Examples of other recessed items: Medical Gas Zone Valves, Medical Gas Outlets, Fire Valve Cabinets, Fire Hose cabinets, Fire Extinguisher Cabinets, Unit Heaters, Fire Fighter's Phone, Central Vacuum Outlets, Electrical Panels, Elevator Hall Calls and Lanterns, etc.

5. Optional: Seal opening using barrier's original construction.
Where an appropriate Series 8000 classified system is not available for multiple penetrants; install penetrants singly with appropriate firestop system.

For systems which operate below 32 DegF or above 122 DegF: Comply with the following additional requirements: 1) Select a Firestop system which utilizes an intumescent elastomeric wrap strip as the fill/void/cavity material; AND 2) Series 8000 systems shall not be used. Install penetrants singly with appropriate firestop system.

Where UL-classified systems are not available for other recessed devices: Maintain continuity of rated barrier around back of recessed item.

A classified Firestop assembly is not required in Concrete or Masonry assemblies when all of the following are met: 1) The penetrant is steel, ferrous or copper conduit, pipe, tube or vent with a diameter less than 6 IN; 2) The gross void has a maximum area of 144 SQ IN; AND 3) The annular space is completely filled with concrete, grout or mortar for the full thickness of the floor/wall barrier.

A classified Firestop assembly is not required when all of the following are met: 1) Electrical Box is UL listed; 2) The face area of individual boxes does not exceed 16 SQ IN; 3) The aggregate area of openings does not exceed 100 SQ IN in any 100 SF of wall area; 4) Outlet boxes on same side of wall are separated by a distance equal to the depth of the wall and the wall cavity is filled with mineral wool, or other approved, non-combustible blocking; AND 4) Outlet boxes on opposing sides of the wall are separated by a distance of at least 24 IN.

Openings accommodating non-combustible conduits, pipes and tubes through single membranes which are part of a fire-rated wall are permitted, provided the aggregate area of the membrane opening do not exceed 100 SQ IN in any 100 SF of wall area.

This row also includes wires and cables with steel jackets.

### 2.5 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

**A. General:**
1. Where joint will be exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.

**B. Head-of-Wall Assemblies:**
1. General:
   a. Use at top of fire-rated and smoke-rated walls and partitions where they abut floor and roof structures above.
   b. Select systems with “D” designation (rated for dynamic movement capability.)
   c. Select systems that can accommodate deflection of structure above.
   d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 0.00775 M³/Sec per lineal meter @ 7.47 Pa 5 CFM per lineal FT @ 0.30 IN of water.
   e. Sound-control walls and Smoke Partitions which are not stipulated to include fire-resistance rating. Seal with Acoustical Sealant, specified in Section 09 29 00.

**2. Minimum F- and T-ratings:**
   a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
   b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.

**3. Acceptable Systems:**
   a. Metal Stud and Drywall Walls: Select system from UL HW-D-0000 Series.
   b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

**A. Examination of Conditions:** Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

**B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.**

**C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.**

**D. Do not proceed until unsatisfactory conditions have been corrected.**
3.2 INSTALLATION

A. General:
1. Install firestop systems in accordance with “PERFORMANCE REQUIREMENTS” Article and in accordance with the conditions of testing and classification as specified in the published design.
2. Seal openings or voids made by penetrations to ensure an air and water resistant seal.
3. Install in accordance with manufacturer’s instructions, to maintain fire separations per UL listing.
4. Comply with manufacturer’s installation instructions.
5. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
6. Protect materials from damage on surfaces subjected to traffic.

B. Identification Labels.
1. General:
   a. Identify each Firestop Assembly as defined in “Quality Assurance.”
   b. Do not locate ID labels/tags on finished surfaces or where they will be exposed to view by public occupants.
2. Through Penetration Firestop Assemblies:
   a. Where items penetrate walls above ceiling:
      1) Place one self-adhesive on each side of walls.
      2) Tie-on ID tags, tied small penetrants may be used also.
   b. Where items penetrate floors/roofs:
      1) Place a tie-on ID tag to small penetrating items on underside of slab only.
      2) Large penetrants may be identified by self-adhering label.
3. Fire-resistive Joint Assemblies:
   a. Locate ID labels at terminal ends of joint and not more than 50 FT on center thereafter.
   b. Utilize self-adhesive type labels on both sides of walls.

3.3 FIELD QUALITY CONTROL

A. Keep areas of work accessible until inspection by authorities having jurisdiction.

B. Where deficiencies are found, repair or replace assemblies so they comply with requirements.

3.4 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean surfaces adjacent to sealed openings to be free of excess materials and soiling as work progresses.

C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION
SECTION 09 22 16
NON-LOAD BEARING METAL STUD FRAMING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:
   1. Where fire resistance classifications are indicated for walls or partitions: Provide studs and accessories of type tested and listed for construction indicated.
   2. Products proposed for use in fire-rated assemblies shall be approved by nationally-recognized testing laboratory.

B. ASTM Reference Standards:
   2. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.2 PERFORMANCE REQUIREMENTS

A. Select steel studs in accordance with the manufacturer's standard load tables and following Design Pressures and Maximum Deflections:

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<thead>
<tr>
<th>Use Condition 2</th>
<th>Design Pressure</th>
<th>Maximum Deflection 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall enclosing stairs, elevator hoistways, and other vertical shafts</td>
<td>10 LBS/FT 2</td>
<td>L/120</td>
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<tr>
<td>Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions</td>
<td>15 LBS/FT 2</td>
<td>L/240</td>
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<tr>
<td>Walls scheduled with Cementitious Backer Board, Moisture-resistant, or Abuse-Resistant Gypsum Wallboard</td>
<td>15 LBS/FT 2</td>
<td>L/360</td>
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<td>Walls scheduled to receive Tile, lath and plaster, or veneer plaster. 4</td>
<td>5 LBS/FT 2</td>
<td>L/240</td>
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<tr>
<td>Typical Interior Walls/Partitions (those not listed above)</td>
<td>5 LBS/FT 2</td>
<td>L/360</td>
</tr>
<tr>
<td>Interior Ceilings, Soffits and Bulkheads</td>
<td>5 LBS/FT 2</td>
<td>L/360</td>
</tr>
</tbody>
</table>

Footnotes:
1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking.
2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.

1.3 SUBMITTALS

A. Project Information:
   1. Manufacturer of listed products.
B. **LEED Credit MRc4.1 and Credit MRc4.2, Recycled Content:**
   1. Provide list of proposed materials with recycled content. Indicate separate percentages, by weight, of pre-consumer and post-consumer recycled content per unit of product. Also include material costs, excluding cost of installation.

C. **LEED Credit MRc5.1 and Credit MRc5.2, Local/Regional Materials:**
   1. Provide list of proposed regional materials. Indicate location of manufacturing facility including name, address and distance indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs, excluding cost of installation.

**PART 2 - PRODUCTS**

### 2.1 MATERIALS

**A. Acceptable manufacturers:**

1. **Non-load Bearing Framing components:**
   a. **Base:**
      1) Dietrich Industries (Worthington Industries).
   b. **Optional:**
      1) ClarkWestern Building Systems.
      2) California Expanded Metal Products Co. (CEMCO).
      3) Allied Studco.
      4) Custom Stud Inc.
      5) MarinoWARE.
      6) The Steel Network.

2. Other manufacturers desiring approval comply with Section 00 26 00.

**2.2 MATERIAL DESCRIPTION**

**A. General:**

1. Products proposed for use in fire-rated assemblies shall be approved by nationally-recognized testing laboratory.

**B. Metal Studs (non-load-bearing type):**

1. C-shaped studs and tracks; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM C645.
3. Stud Depths: As indicated by Wall Types.
4. Minimum Flanges Width: 1 1/4 IN.
5. Minimum thickness: 18 mil (25 GA), except as follows:
   a. Provide heavier thickness(es) as required to comply with PERFORMANCE REQUIREMENTS.
   b. Upgrade framing members to minimum 30 mil (20 GA) studs at the following conditions:
      1) One or both sides of partition will be faced with any of the following:
         a) Tile backing board.
         b) Adhered stone.
         c) Plaster.
         d) Moisture-resistant.
         e) Abuse-resistant wallboard.
         f) Lead-backed gypsum wallboard.
      2) Where partitions are not extended to overhead structural deck, and are without supporting diagonal bracing, or horizontal stiffeners.
   c. Provide heavier gauge thickness where specifically indicated.
6. In lieu of heavier stud thickness, the design may employ diagonal braces (kickers) above the ceiling to reduce the overall span and thus stiffen the wall frame. Coordinate locations with building services items.
   a. Do not employ studs with stud thickness less than allowed by Fire Resistance-rated assemblies.

7. Base Products:

C. Head-of-Wall Accessories:
1. General Criteria:
   a. Configure to permit deflection of overhead superstructure while maintaining structural integrity, fire and smoke-resistance, and sound control as required by each wall.

2. Basis of Design - Slotted Top Track (a.k.a. deflection Track):
   a. Deep leg, vertically slotted track for all walls which extend to structure.
   b. Minimum Thickness: 20 GA.
   c. Width: As required for studs sizes indicated.
   d. Depth: Minimum 2 1/2 IN down-standing legs with 1/4 IN wide by 1 1/2 IN high slots spaced 1 IN on center.
   e. Material: Cold-formed sheet steel; galvanized; ASTM A653, .
   f. Base Product: “SLP-TRK” by Sliptrack Systems, Dietrich, Clarkwestern, etc.
   g. Accessories:
      1) Include fasteners suitable for attachment to superstructure elements.
      2) Include Z-bars, cold-rolled channels or similar clips to accommodate thickness of Spray-applied Fire-Resistive Materials (SFRM).
   h. Additional components where walls are fire-rated:
      1) Include fasteners, clips and other items necessary to secure wall frame to building superstructure according to UL-listed designs.
      2) Select systems tested in accordance with UL-2079 for conditions.
   i. Firestopping Sealants, Sprays and Forming Materials: Specified in Section 07 84 00.

3. Alternative top track configurations may be considered by Architect for approval.
   a. Proposed systems must be configured to accommodate deflection of superstructure without inducing axial loading on the partition wall.
   b. Proposed systems must be tested for fire resistive requirements indicated.
   c. Contractor is obligated to demonstrate to Architect that proposed system complies with project requirements.

D. Shaftwall Framing: C-H shaped studs with U or J shaped tracks.
   2. Minimum Thickness: 20 GA.
   3. Minimum Size: 2 1/2, 4, and 6 IN as indicated.
   4. Stud Spacing: 24 IN.
   5. Structural Design Criteria:
      a. Select stud with properties necessary to limit deflection to L/240 deflection at load of 10 PSF.
      b. Use larger size and gauge if required to satisfy span and deflection criteria.

6. Shaftwall assembly with gypsum wallboard specified in Section 09 29 00:
   a. Fire resistance rating: 2 hours in accordance with ASTM E119.
   b. Sound transmission class: Minimum STC 47 in accordance with ASTM E90.


E. Z-Bar stand-off clips:
   a. Galvanized steel, minimum 20 GA thickness, 2 x 2 x 2 IN size by length required, unless otherwise indicated to accommodate beam and deck fireproofing:
   b. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
   c. Length:
a. At structural steel member: Length equal to flange width of structural steel member.
b. At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
c. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.


F. Furring Channels (hat-channels):
1. Hat-shaped sections.
3. Sizes: 7/8 and 1 1/2 IN, as indicated.
4. Minimum Thickness: 20 GA; Use heavier gauge as dictated by conditions.

G. Z-Furring:
1. Z-shaped sections, attached to structural parent wall.
3. Sizes: 1, 1 1/2, 2 and 2 1/2 IN, as indicated.
4. Minimum Thickness: 25 GA; Use heavier gauge as dictated by conditions.
5. XPS Foam Insulation: Specified in Section 07 21 00.

2.3 ACCESSORY ITEMS

A. Wire ties:
1. 18 GA soft annealed, galvanized.

B. Fasteners for tracks:
1. Power driven type, to withstand minimum 190 LB shear when driven.

C. Closure:
1. When continuous vapor retarder is required, provide continuous 20 GA galvanized closure angle to receive vapor retarder and vapor retarder tape.

D. Isolation Strip Material:
1. Non-absorbent, foam padding as required to prevent direct contact between metal framing member and exterior concrete or masonry parent walls.
2. Minimum thickness: 0.40 mil.

E. Backing:
2. Minimum Backing Height: 6 IN.
3. Minimum Flange Width: 1 1/4 IN.
4. Minimum Thickness: 20 GA.
6. Coordinate additional backing requirements with lab casework.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine supporting structure and conditions under which system will be installed.
B. Correct conditions detrimental to proper installation.
C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

A. General:
1. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
   a. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.
2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
3. Install bracing at terminations in assemblies.
4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
5. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
6. Extend framing full height to structural supports. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
   a. Continue framing around ducts and similar items which penetrate partitions.
7. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
   a. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.

B. Size floor tracks and head track assemblies to match studs.
1. Align floor track and deflection track accurately.
2. Secure floor track and deflection track to structure in accordance with manufacturer’s instructions and referenced regulatory requirements.
3. Secure at corners and at ends.

C. Position studs vertically engaging floor track and head-of-wall deflection track.
1. Space studs maximum 16 IN on center.
   a. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
   b. Positively anchor studs to floor tracks with 3/8 IN self-tapping pan head screws, or stud clinching tool on both flanges of each stud.
   c. Positively anchor studs to deflection track with wafer-head screws on both flanges of each stud.

D. Fire rated partitions: Anchor as required by fire resistance design, and Firestopping design.

E. Align stud knock-outs to facilitate running of wires and conduit.

F. Where partitions abut vertical structural elements, provide perimeter relief.
1. Gypsum Association GA-600, Figure 9.

G. Head-of-Wall:
1. Provide slotted top track for all walls that go to structure.
2. Secure top track to superstructure with 0.145 IN x 1 IN powder actuated fasteners located 16 IN on center (max).
   a. Pre-fit forming material that may be required as a part of a fire-resistive joint system.
3. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
   a. Install Z-bar to underside of steel beams and steel deck before sprayed fireproofing is applied.
   b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.
   c. Attach each Z-bar with two 0.145 IN x 1 IN powder actuated fasteners located minimum 1 IN from ends of Z-bar.
   d. After fireproofing, secure top track to Z-bars with No. 8 x 9/16 IN waferhead framing screws spaced maximum 16 IN on center.
4. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 2 IN beyond width of head-of-wall.
a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.

5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
   a. Secure vertical studs to top track with No. 8 x 9/16 IN waferhead framing screw at each stud flange, screwing through track slots for positive stud connection.

6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.

7. Prepare wall for installation of seals and/or firestopping:
   a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
   b. Non-fire rated partitions (including Smoke Partitions): Prepare for Acoustical Sealant specified in Section 09 29 00.

H. Furring Channels:
1. Install furring channel systems, directly attached to parent walls, as indicated.
2. Install channels at maximum 16 IN OC.
3. Provide additional framing at openings, cutouts, corners and control joints.
4. Fasten to masonry walls with cut nails.
5. Fasten to concrete with power driven fasteners.
6. Space fasteners not more than 24 IN OC, staggered on opposite flanges of hat channels.

### 3.3 FRAMING AT OPENINGS

A. General:
1. Control Joints (CJ): Provide for control joints at all openings.
   a. Install additional stud, maximum 1/2 IN from jamb studs.
   b. Do not fasten extra stud to track or jamb stud.
   c. Refer to specification Section 09 29 00 for control joint locations.
2. Prefabricated headers, jambs, and sill framing systems (optional):
   a. Proprietary opening framing systems may be considered as an alternative to conventionally fabricated framing.
   b. Pre-approved Products: “HDS Framing System” by Dietrich.
   c. Submit propose alternative systems to Architect for review.

B. Door Openings:
1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
3. Jamb Studs:
   a. Install two studs, toe-to-toe, at each jamb, unless otherwise indicated.
   b. Minimum thickness of jamb studs: 20 GA at all openings.
   c. Securely attach jamb studs to door frames.
4. Headers:
   a. Openings less than 4 FT wide:
      1) Cut-to-length section of floor runner above and below wall openings.
      2) Split flanges and bend webs at ends.
      3) Overlap and screw attach jamb studs to frames.
   b. Openings over 4 FT wide:
      1) Cut-to-length, horizontal box beam studs above and below wall openings.
      2) Design for actual span and loading.
   c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
5. Control Joints at head of Jambs:
   a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.

C. Other Framed Openings:
1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
2. Install framing below sills of openings to match framing required above door heads.
3. Headers and Sills:
   a. Openings less than 4 FT wide:
      1) Cut-to-length section of floor runner above and below wall openings.
      2) Split flanges and bend webs at ends.
      3) Overlap and screw attach jamb studs to frames.
   b. Openings over 4 FT wide:
      1) Cut-to-length, horizontal box beam studs above and below wall openings.
      2) Design for actual span and loading.
   c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
4. Cripple Studs:
   a. Install cut-to-length intermediate (vertical) studs above and below openings.
   b. Spacing: As indicated for typical (full-length) studs.

3.4 BLOCKING / BACKING

A. Locate backing where any of the following items will be secured to walls:
   1. Casework, millwork, cabinets, shelving, wardrobes and bookcases.
   2. Steel, wood or plastic handrails.
   3. Wall-mounted door stops.
   4. Crash rails, chair rails, wall bumpers and similar wall protection devices.
   5. Contractor or Owner-furnished equipment which is to be wall-mounted.
   6. Toilet accessories which do not include proprietary backing devices.
   7. Toilet Partitions and Lockers.
   8. Markerboards, Tackboards and Chalkboards.
   9. Other items backing is indicated by details or specification.

B. Coordinate mounting height, location and coverage with item to be supported.
C. Determine material width according to item to be supported.
D. Install Backing material to “Interior” stud walls (specified herein) and “Exterior” stud walls (specified in Section 09 21 27) alike.
E. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

END OF SECTION
SECTION 09 29 00
GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. ASTM Standards:
   2. ASTM C475: Joint Treatment Materials for Gypsum Wallboard.
   3. ASTM C557: Adhesives.
   4. ASTM D3273: Mold-resistant Gypsum Board.
   5. ASTM C840: Application and Finishing of Gypsum Board.
   6. ASTM C841: Installation of Interior Lathing and Furring.
   7. ASTM C1002: Steel Drill Screws for Application of Gypsum Board or Metal Plaster Bases.
   12. GA-216 Recommended Specifications.
   13. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.

B. Fire-Resistance-Rated Assemblies:
   1. For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
   2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.

C. STC-Rated (sound-rated) Assemblies:
   1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.2 SUBMITTALS

A. Project Information:
   1. Manufacturer exposure limitations for wallboard installation prior to building being weather-tight;
   2. Manufacturer name of listed products.

B. LEED Credit MRc4.1 and Credit MRc4.2, Recycled Content:
   1. Provide list of proposed materials with recycled content. Indicate separate percentages, by weight, of pre-consumer and post-consumer recycled content per unit of product. Also include material costs, excluding cost of installation.

C. LEED Credit MRc5.1 and Credit MRc5.2, Local/Regional Materials:
   1. Provide list of proposed regional materials. Indicate location of manufacturing facility including name, address and distance indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs, excluding cost of installation.

D. LEED Credit EQc4.1, Low-Emitting Materials, Adhesives and Sealants:
   1. Provide product data and material safety data sheets (MSDS) for adhesives and sealants used inside the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.
1.3 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes.
   1. Stack panels flat to prevent sagging.

1.4 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Avoid installation of interior wallboard products until installation areas are enclosed and conditioned.
   1. Temporarily protect un-enclosed spaces from effects of weather.
   2. Do not install panels that are wet, moisture-damaged or contaminated by mold.
   3. Remove installed items that have been damaged by moisture or are contaminated by mold.
      a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
      b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

C. During gypsum wallboard installation and finishing: Maintain temperatures between 50 and 70 DegF.

D. Coordinate installation with other trades to allow time for correct installation of their work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Gypsum Wallboard and accessories:
      a. Base:
         1) Georgia Pacific (GP).
      b. Optional:
         1) United States Gypsum (USG).
         2) National Gypsum Company (NGC).
         3) Certainteed.
         4) American Gypsum.
      c. LEED MRe4: Recycled Content
         1) Include recycled content in material.
      d. LEED MRe5: Local/Regional Material
         1) Manufacturing facilities Local and Regional.
            a) Georgia Pacific in Lovell, WY.
            b) American Gypsum in Gypsum, CO.
   2. Acoustically-enhanced Gypsum Wallboard Composite:
      a. Base:
         1) National Gypsum Company.
      b. Optional:
         1) QuietRock.
         2) Supress.
      c. LEED MRe4: Recycled Content
         1) Include recycled content in material.
   3. Specialty Drywall Trim:
      a. Base:
         1) Pittcon Industries.
b. Optional:
   1) Fry Reglet Corp.
   2) Gordon, Inc.
4. Foam tape:
   a. Base:
      1) Norton Performance Plastics.
5. Sound Attenuation Batts (SAB):
   a. Base:
      1) Owens-Corning.
   b. Optional:
      1) Johns Manville.
      2) Knauf Insulation.
      3) Guardian.
      4) Certainteed.
      5) Thermafiber.
6. Acoustical sealants:
   a. Base:
      1) USG.
   b. Optional:
      1) Tremco.
      2) Pecora.
      3) Grabber.
      4) BOSS.
      5) STI.
7. Suspended ceiling system:
   a. Base:
      1) United States Gypsum (USG).
   b. Optional:
      1) United States Gypsum (USG).
      2) Chicago Metallic.
8. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 GYPSUM WALLBOARD (GWB) SCHEDULE

A. General:
   1. Utilize the following, in conjunction with Wall Types, Details and Finish Schedule to
determine types of wallboard appropriate to each condition.
   2. Furnish in maximum available lengths, consistent with installation requirements.
      a. Long Edge: Tapered.
      b. Short Ends: Square.
   3. Upgrade the listed types to fire-rated equivalent products when used in fire-rated
      assemblies.
   4. Upgrade the listed GWB products to mold-resistant types, where wallboard is installed in
      Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations
      where wallboard is installed prior to building being weather-tight.

B. Exterior Gypsum Sheathing (walls, ceilings, and soffits):
   1. Specified in Section 09 21 27.

C. Interior face of Exterior Walls:
   1. Mold-resistant (with facer):
      a. Application: In-board face of exterior stud walls.
      b. Thickness: 5/8 IN.
      c. Mold-resistance score: 10 per ASTM D3273.
      d. Base Product: “DensArmor PLUS Interior Guard” and “DensArmor PLUS Interior
         Guard Fireguard” by Georgia Pacific.
      e. Optional Products:
1) “XP Wallboard” and “Fire-Shield XP Wallboard” by National Gypsum;
2) “Mold Tough” and “Mold Tough Firecode” by USG.
3) “ProRoc Moisture & Mold Resistant Gypsum” and “ProRoc Moisture & Mold Resistant Gypsum Type X” by Certainteed.

f. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.

b. 5/8 IN Fire-rated board (conventional, Type X core, with paper facers):
   a. Applications: Use for fire rated walls, fire rated ceilings and joint backing at fire rated ceilings.
   b. Thickness: 5/8 IN.
   d. Optional Product: “ProRoc Type X” by Certainteed.

d. Optional Products:
   1) “XP Wallboard” and “Fire-Shield XP Wallboard” by National Gypsum;
   2) “Mold Tough” and “Mold Tough Firecode” by USG.
   3) “ProRoc Moisture & Mold Resistant Gypsum” and “ProRoc Moisture & Mold Resistant Gypsum Type X” by Certainteed.

g. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.

4. Tile Backer Board (TBB)
   a. Applications:
      1) Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
      2) Provide TBB at non-tile walls that will be continuously wet.
   b. Description: Moisture-resistant treated gypsum core, glass mats (both sides), and vinyl, water barrier coating on finished side.
      1) Conventional cement-board and “green-board” products are not acceptable.
   c. Thickness: 5/8 IN.
      1) Include Level 5 finish at non-tiled portions.
   e. Optional Product (uniform composition):
      1) “Fiberock Interior Panel, Aqua-Tough” by USG.
      2) “GlasRoc Tile Backer” by Certainteed.

5. Acoustically-enhanced Gypsum Wallboard Composite:
   a. Description: 2 plies of high-density, mold-resistant, paper-faced gypsum wallboard laminated together with viscoelastic dampening polymer.
   b. Composite Thickness: 5/8 IN.
   c. Applications: Use where specifically indicated “Wall Types”.

6. Abuse-Resistant Gypsum Wallboard (AR GWB):
   a. Thickness: 5/8 IN with fire resistant core at rated assemblies.
   b. Nail pull resistance for 1/2 IN board not less than 120 FT/Lb.
c. Screw pull resistance for 1/2 IN board not less than 90 FT/Lb.
d. Flexural strength for 1/2 IN board in any direction not less than 110 FT/Lb.
e. Upgrade metal studs to 20 GA minimum where used with ARGWB.
f. Finish as recommended by wallboard manufacturer.
g. Applications: Use where specifically indicated “Wall Types”.
   1) Optional: “Hi-Abuse Brand XP Fire-Shield Wallboard” by National Gypsum; “Fiberock Brand Panels - Abuse-Resistant” by USG.

E. Shaftwall Liner Panel (fire-rated):
   1. Thickness: 1 IN x 24 IN wide.
   2. Fire-rated Type X core.
   3. Mold and moisture resistant:
      a. Tested in accordance with ASTM E136.
      b. Fiberglass coated glass mats, both faces.

2.3 TRIM ACCESSORIES

A. General Interior Trim:
   1. General:
      b. Material for general, interior uses: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet
      c. Material for wet and exterior areas: Zinc.
   2. Shapes:
      a. Corner bead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Expansion (control) joint.
      f. Curved-Edge Corner bead: With notched or flexible flanges.
      g. Other items as indicated.

B. Specialty Trim (where specifically indicated):
   1. General:
      a. Profiles and dimensions indicated.
      b. Material: 6063-T5 Aluminum.
      d. Flanges to be embedded: Corrosion-resistant primer compatible with joint compound and finish materials specified.
   2. Base Products:

2.4 JOINT TREATMENT MATERIALS

A. General:

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile-backing Panels: As recommended by panel manufacturer.

C. Joint Compounds for Interior Gypsum Wallboard:
   1. Ensure products are compatible with other compounds applied previously or on successive coats.
### Required Compound Types

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Additional Description</th>
<th>Compound Type Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-filling</td>
<td>For filling open joints and voids</td>
<td>Setting-type, Taping Compound</td>
</tr>
<tr>
<td>Embedding and First Coat</td>
<td>For embedding tapes &amp; first coat over joints, fasteners, and trim flanges</td>
<td>Setting-type, Taping Compound</td>
</tr>
<tr>
<td>Fill Coat</td>
<td>For second coat</td>
<td>Setting-type, Sand-able Topping Compound OR Drying-type, All-purpose Compound.</td>
</tr>
<tr>
<td>Finish Coat</td>
<td>For third coat</td>
<td>Drying-type, All-purpose Compound.</td>
</tr>
<tr>
<td>Skim Coat</td>
<td>For final coat of Level 5 finish, where a Level 5 finish is specified</td>
<td>Setting-type, Sand-able Topping Compound OR Drying-type, All-purpose Compound. OR High-build, spray-applied coating product designed to produce Level 5 finish (without traditional, trowel-applied skim coat.)</td>
</tr>
</tbody>
</table>

**Notes:**
1. Above table applies to conventional, paper-faced, interior wallboard. For paperless wallboard panels: Use compounds recommended by panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer. Use compounds recommended by panel manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
5. Provide dust control products in occupied areas or adjacent to occupied areas. Base Product: “Sheetrock Brand Dust Control Joint Compound” by USG.

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D. Laminating Adhesive:
1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

### 2.5 ACOUSTICAL MATERIALS

A. General:
1. Provide where indicated.
2. Minimum Nominal Thickness: As required to achieve STC indicated for wall systems.
3. Density: As required to achieve STC indicated for wall systems.

B. Sound Attenuation Batts (SAB):
1. Material: Glass or Mineral Fiber.
2. Commercial sound blanket, ASTM C665, Type I (un-faced) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
3. Surface burning characteristics (per ASTM E84):
   b. Maximum Smoke developed: 10.
4. Fire-Resistance-Rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
5. Acoustically-rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
6. Base Product: “QuietZone Sound Attenuation Batts” by Owens-Corning;

C. Acoustical Sealants:
1. Flexible, non-hardening.
2. Base Product: “Acoustical Sealant” by USG.

3. Spray-applied, expanding foam sealants will not be allowed.

4. LEED Credit EQc4.1 Low-Emitting Materials, Adhesives, and Sealants:
   a. Material shall contain VOC content as certified.

2.6 MISCELLANEOUS ITEMS

A. Firestopping Sealants and Forming Materials:
   1. Specified in Section 07 84 00.

B. Thermal Insulation:
   1. Specified in Section 07 21 00 and other Division 07 sections.

C. Screws:
   1. ASTM C1002, unless otherwise indicated.
   2. Self-tapping, bugle head, length to penetrate framing member minimum 5/8 IN.
   3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
   4. Screws used to secure wallboard panels to Metal Studs: Comply with ASTM C954.
   5. Screws used with cementitious backer boards: As recommended by panel manufacturer.

D. Sealants:
   1. Other than acoustical sealant below, see Section 07 92 16.

E. Foam tape:
   1. PVC 1/2 x 1/4 IN: With pressure sensitive adhesive; Norseal.
   2. EPDM 1/2 x 1/4 IN: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.

F. Backing for control and expansion joints:
   1. Fire rated board.

G. Suspension wire: Soft annealed, galvanized.
   1. Thickness: 8 GA.

H. Tie wire: Soft annealed, galvanized 18 GA.

I. Carrying channels: Cold rolled 1 1/2 IN.

J. Furring channels and metal studs: See Section 09 22 16.

K. Metal furring channel ceiling system.
   1. Suspension wire, 8 GA.
   2. Tie wire.
   3. Carrying channel.
   4. Furring channel.
   5. Provide trim pieces to trim out exposed gypsum wallboard edges at light penetrations.

L. Metal studs; framing ceiling system (non-load-bearing type):
   1. C-shaped studs; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM C645.
   3. Stud Depths: 4 IN minimum, unless otherwise indicated.
      a. Use wider stud sections if ceiling span and support requires.
   4. Minimum flange width: 1 1/4 IN.
   5. Minimum stud thickness: 20 gauge.
   6. Suspension wire, 8 GA.
   7. Tie wire.
   8. Carrying channel.

M. Sealer for moisture-resistant gypsum wallboard.
1. Manufacturer's standard compound.
2. Use at joints, cut edges and screw penetrations.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine supporting structure and conditions prior to wallboard installation.
B. Correct unsatisfactory conditions.
C. Start of installation assumes responsibility for shielding integrity of system.
D. Verify areas scheduled to receive radiation shielding are suitable for installation.

3.2 INSTALLATION – GENERAL

A. General Requirements:
   2. Install products per manufacturer’s specific installation instructions.
   3. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
   4. Install wallboard vertically with edges over metal stud framing members and similar
      framing support members.
   5. Secure to each support or framing member with screws.
   6. Bring boards into contact but do not force into place.
   7. Fit neatly and carefully.
   8. Stagger edge joints on opposite side of partition so they occur on different framing
      members.
   9. Proceed with attachment from board center toward ends and edges.
   10. Make cuts neatly.
   11. Install with 1/4 IN gap between gypsum board and floor.
   12. Seal ends, cutouts and screw penetrations of moisture resistant boards with sealer.
   13. Install wallboard over metal framing studs and similar framing support members at interior
       face of exterior walls full height from floor to structure above.

B. Wallboard installation prior to building being weather-tight:
   1. This is intended to allow early installation of wallboard in critical path areas such as:
      Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations.
      a. Notify Architect and Owner where such early installation is proposed.
   2. Where wallboard is installed prior to building being weathertight: Upgrade the scheduled
      GWB products to their mold-resistant counterparts.
      a. Products proposed are subject to Architect approval.
   3. Exposure time shall be limited by manufacturer requirements.

C. Sound Insulation:
   1. Install sound insulation in walls from floor to structure above, where sound rated walls are
      indicated.
   2. Install in thicknesses and densities necessary to achieve sound rating.
   3. Pack spaces around electric boxes and other penetrations to maintain full sound rating.
      a. Utilize Acoustical Sealants to fill small voids that remain

D. Acoustical Sealant:
   1. General:
      a. Apply Acoustical Sealant at joints, voids, and penetrations through wallboard to
         maximize sound control.
      1) Seal wallboard edges to adjacent construction at perimeters, behind control joints,
         and at openings and penetrations with a continuous bead of acoustical sealant.
      2) Install acoustical sealant at both faces of partitions at perimeters and through
         penetrations.
3) Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   b. Upgrade to proper firestopping where required in Fire-rated. Refer to Section 07 84 00 for Firestopping of Thru-wall Penetrations.
2. Base-of-Walls:
   a. Provide a continuous bead of Acoustical Sealant to bottom edge of Gypsum Wallboard where it meets the floor. Do so at “all” walls regardless of fire rating.
3. Head-of-Walls:
   a. Apply Acoustical Sealant to top edge of wallboard where meets the superstructure.
      1) Exception: Use Firestopping (Specified in Section 07 84 00) at head condition of “fire-rated walls”.
E. Curved Partitions:
   1. Space studs or furring to prevent flat areas between framing at curved surfaces.
F. Wall Reveals:
   1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.
G. Changes in Material:
   1. Install corner bead where partition or ceiling abuts structural element or dissimilar wall or ceiling.
H. Installation Wallboard around Metal Door and Window Frames:
   1. Contract Documents call for hollow metal frames to be rigorously aligned at time of their original installation.
      a. Notify frame installer of specific frames that are noticeably out of alignment before wallboard work commences.
      b. Take care not to unduly disturb their original alignment when installing adjacent wall board.
      c. Notify frame installer of specific frames that become misaligned during the installation of wallboard.
   2. Upon completion of wallboard work, notify frame installer to return to site and check openings to for proper alignment.
   3. Work with frame installer to correct misalignment issues before proceeding.

3.3 INSTALLATION - SINGLE LAYER SYSTEM
A. Set screws between 3/8 to 1/2 IN from edges.
   1. Space maximum 8 IN OC at edges and, 12 IN OC in field of board.
   2. Where wallboard butts at wall/ceiling juncture, hold screws back 6 IN from edges.
   3. Use closer screw spacing if required by UL.
B. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.

3.4 INSTALLATION - TWO LAYER SYSTEM
A. Space screws in base layer maximum 8 IN OC at edges, and 12 IN OC in field of board.
B. Screw apply finish layer.
C. Stagger joints not less than one support from first layer.

3.5 INSTALLING TRIM ACCESSORIES
A. General:
   1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
B. Control Joints:
1. Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. Bullnose Bead: Use at outside corners.
   3. Bullnose Bead: Use at outside corners where indicated.
   4. LC-Bead: Use at exposed panel edges.
   5. L-Bead: Use where indicated.
   6. U-Bead: Use at exposed panel edges where indicated.
   7. Curved-Edge Cornerbead: Use at curved openings.

D. Specialty Trim: Install in locations indicated.

3.6 INSTALLATION - SHAFTWALL

A. Install shaft walls in compliance with UL and Gypsum Association description.
B. Provide shaft wall systems permitting entire erection procedure from outside shaft.
C. Provide special metal runner angles and channels, and studs or splines spaced per manufacturers requirements.
D. Provide number, type and thickness of wallboard layers including air spaces and insulation to achieve indicated ratings for fire resistance and sound reduction.
E. Comply with requirements for thickness of metal and thickness of wall, for heights of wall indicated.
F. Use maximum practical board lengths.
G. Bring boards into contact but do not force into place.
H. Fit neatly and carefully.
I. Seal perimeter and openings with firestopping.

3.7 PROJECTIONS IN ELEVATOR HOISTWAYS

A. Inspect elevator shafts to determine if projections greater than 4 IN exist.
B. Where such projections exist:
   1. Install GWB bevels sloping at 75 degrees from horizontal.
   2. Utilize metal studs of strength necessary.

3.8 INSTALLATION - CEILING

A. Install in compliance with manufacturer's recommendations.
   1. Furring ceiling support system.
   2. Gypsum wallboard.
B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
C. Access Panels and Doors: Locate where required by Sections 15010 and 16010, or where indicated. See Section 08 31 16 for product description.

3.9 CONTROL JOINTS

A. General:
   1. Install Control Joints in location indicated and as described in this article.
   2. Comply with additional requirements of ASTM C840, GA-216, and GA-234.
   3. Where Control Joints pass behind Rubber, Resilient Vinyl, Wood or other Wall Base:
      a. Caulk Control Joint using a color which matches the color of the Base, prior to installing Base.
4. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.

B. Partitions:
1. Provide vertical Control Joints (on both wall faces) which align with door frames, window frames, and similar opening as follows:
   a. Single Doors and Cased Opening:
      1) Locate CJ’s at both jambs, from head of opening to top of partition.
   b. Pair doors:
      1) Locate CJ’s at both jambs, from head of opening to top of partition.
      2) Exception: Control Joints are not required where partition forms a “cross-corridor” condition.
   c. Doors with adjacent sidelights:
      1) Locate CJ’s at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
   d. Sliding Doors:
      1) Locate CJ’s at both jambs, from head of opening to top of partition.
   e. Punched Windows (less than 30 FT in width):
      1) Both jambs from head of opening to top of partition, and from sill edge to floor.
   f. Ribbon Windows (more than 30 FT in width):
      1) Both jambs from head of opening to top of partition, and from sill edge to floor.
      2) Locate additional intermediate CJ’s (constructed similarly) so that maximum distance between CJ’s does not exceed 30 FT apart.
2. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening-related CJ’s (listed above), or from corners.
3. Provide horizontal Control Joints at partitions which are more than one story in height:
   a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
   b. Align control joint with floor line, unless otherwise indicated.

C. Ceilings:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
   a. Ceilings with perimeter relief:
      1) Subdivide so that no area exceeds 2500 FT², and no area has a length which exceeds 50 FT.
         a) Exception where Ceiling occurs at Exterior: Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
   b. Ceilings without perimeter relief:
      1) Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
   c. Locate Control Joints at transitions between areas of different shapes.

D. Soffits:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
   a. Exterior Subdivide so that no area exceeds 900 FT², and no area has a length which exceeds 30 FT.
   b. Locate Control Joints at transitions between areas of different shapes.
   c. Continue lines of soffit Control Joints vertically to top of fascia.

3.10 WALLBOARD FINISHING

A. General:
1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
2. Promptly remove residual joint compound from adjacent surfaces.

B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.
C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Where wallboard abuts dissimilar surfaces: Securely attach continuous trim beads in accordance with manufacturers directions.

E. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.

F. Apply Joint Compound and Tape in accordance with fire-rated design.
   1. Apply joint treatment compound in accordance with manufacturer's directions.
   2. Fill joints, screw heads and internal corners with compound.
   3. Extend joint system vertically from floor to extent described as follows:
      a. Fire Walls, Barriers and Partitions: Extend to full height of wall.
      b. Smoke Barriers and Partitions: Extend to full height of wall.
      c. Interior face of exterior wall (non-rated): Extend to full height of wall.
      d. Other interior partitions (non-rated): Extend to 6 IN above ceiling.
   4. Refer to Drawings for indication of partition heights.

G. Level 4 Finish:
   2. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
   3. Draw down final coat of compound to a smooth even plane.
   4. Locations:
      a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
      b. All other locations, unless noted otherwise.

H. Level 5 Finish:
   2. After irregularities have been eliminated, a thin skim coat of joint compound or material manufactured specifically for this purpose shall be trowel applied to the entire surface of the board and joints, and excess compound removed leaving a thin film covering the surface.
   3. Avoid ridges or tool marks that might show through finishes.
   4. Lightly sand or sponge where required to assure a smooth, even, and level surface.
   5. Locations:
      a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
      b. Long hallways or corridors.
      c. Atriums, Lobbies, Auditoriums and similar large spaces.
      d. Multi-story spaces.
      e. Wall-board scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
      f. Surfaces using MRB or other wallboard types with a glass mat facer on finished side.
      g. Exceptions: Revert to Level 4 where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.

I. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

J. Cementitious Backer Units: Finish according to manufacturer's written instructions.

K. Repairs:
   1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
   2. If wallboard is damaged, or surfaces are roughened, repair, or remove and replace, to satisfaction of Architect, at no additional cost to Owner.
3.11 PARTITION IDENTIFICATION

A. Identify partitions indicated on Drawings as having a required fire or smoke rating.
   1. Identification: Same as indicated on drawing legend.
   2. Location: 10 FT on center but not less than once per wall segment, both sides of partition, above ceiling line.
      a. Above access panels in hard ceiling.
   3. Lettering: 2 IN Helvetica, painted with aid of stencils.

3.12 PROTECTION

A. Protect installed wallboard from water damage during construction.
B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
D. Prior to finishing, walls shall be inspected for visible mold growth.
   1. Replace affected portions.

END OF SECTION
SECTION 10 11 00
MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY
A. Furnish labor, materials, tools, equipment, and services for Markerboards and Tackboards, as indicated, in accordance with provisions of Contract Documents.
B. Completely coordinate with work of other trades.

1.2 SUBMITTALS
A. Shop Drawings:
   1. Include dimensional plans, elevations and details, large-scale sections of typical members, and other components.
   2. Show anchors, grounds, reinforcement and layout, and indicate finishes.
   3. Include setting drawings, templates, and directions for installing anchor bolts and other anchorages to be installed as a unit of Work in other Sections.
B. Project Data:
   1. Provide copies of manufacturer’s specifications and installation instructions for each type of material and accessory required.
   2. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
   3. Include data required to show specification compliance.
C. Samples:
   1. Manufacturer's color charts showing full range of colors and textures for board and sheet finishes.
   2. Aluminum trim and accessories: 4 IN long sections of extrusions.
   3. Sheet materials: 8 IN x 10 IN samples.
D. Project Information:
   1. Installer qualifications.
E. Contract Closeout Information:
   1. Maintenance data.
   2. Warranty.

1.3 WARRANTY
A. Lifetime warranty against fading, crazing, cracking and delamination for markerboards.
B. Warranty signed jointly by manufacturer and Contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Markerboards, Tackboards and Chalkboards:
   1. Base:
      a. Claridge Products & Equipment.
   2. Optional:
      a. ADP Lemco.
2.2 MATERIAL

A. Furnish Markerboards, Tackboards and chalkboards by one manufacturer for project.

B. Markerboard, metal (MB):
1. Balanced, high pressure laminated, 3-ply laminated construction, with facing sheet, core, and backer.
   a. MB-1: 18 IN high x 24 IN wide.
2. Finish:
   a. Type A porcelain enamel over ground coat on writing surface with seal coat on reverse side.
   b. Comply with Porcelain Enamel Institute Specifications.
3. Face sheet:
   a. Enamed steel.
   b. 22 GA, minimum.
   c. Finish to accommodate dry and liquid markers without residual staining.
4. Core:
   a. Minimum 1/4 IN thick plywood or hardboard.
5. Backer:
   a. Minimum 26 GA zinc plated steel, 28 GA random porcelain coil, or 0.015 IN aluminum sheet.
6. Backing panel:
   a. Moisture resistant plywood or hardboard 1/4 IN thick, with 1/4 IN backing; or, one piece 1/2 IN thick.

C. Chalkboards, natural slate (CB):

D. Tackboards, vinyl fabric faced (TB):
2. Comply with F.S.CCC-W-408, Type II, Class 2, laminated to 1/4 IN cork sheet.
4. Laminate under pressure to minimum 1/4 IN thick treated plywood or hardboard backing.

E. Frames and trim:
1. Minimum 0.062 IN thick aluminum.
2. Size and shape as indicated.
3. Single length units to minimize joints.
4. Miter corners with hairline closure.
6. Manufacturer's standard narrow trim, 1/2 IN nominal width.
7. Provide structural support accessories required to provide necessary support.

F. Troughs:
1. Continuous, for each board.
2. Box type, with slanted front and cast aluminum end closures.

G. Display rail, install at top of each unit with:
1. Continuous 2 IN with integral cork strip.
2. End stops: Each end.
3. Display hooks: One per 2 FT of rail.
4. Display hooks with flexible metal clips: 1 per 2 FT of display rail or fraction thereof.

2.3 FABRICATION

A. Deliver completely assembled whenever possible.
B. When dimensions require delivery in separate units, prefilt at factory and disassemble for delivery.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.
B. Insure that adequate Wall Backing has been installed.
   1. Metal Wall Backing: Specified in Section 09 22 16.
   2. Coordinate and direct installation of backing where required.
C. Correct unsatisfactory conditions.
D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and recommendations.
B. Locate with top 6 FT AFF if board is 36 IN high or less.
C. Locate with top 7 FT AFF if board is greater than 36 IN high.
D. Provide additional backing as indicated or necessary to properly stiffen and support boards.
E. Install with concealed hangers, plumb and level.
F. Provide trim at joints between Markerboards and Tackboards.
G. Trim vertical joints with aluminum H type divider bars.
H. Coordinate job assembled units with grounds, trim, and accessories.
I. Join parts with neat, precision fit.

END OF SECTION
SECTION 11 53 53
BIOLOGICAL SAFETY CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Biological Safety Cabinets.

1.02 UNDIVIDED RESPONSIBILITY
A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

1.03 REFERENCES
A. Biological safety cabinets:
   1. NSF/ANSI 49: Class II (Laminar Flow) Biohazard Cabinetry.

1.04 DESCRIPTION
A. Provide equipment complete with accessories as described herein and shown on Laboratory Furnishings drawings.
B. Work of this Section requires close coordination with Work of Divisions 22, 23 and 26 as well as installation of Owner furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.

1.05 SUBMITTALS
A. Submit as specified herein and under provisions of Section 01 33 00.
B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, fittings, duct connections, and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blueline prints are not acceptable.
D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements.
   1. Biological safety cabinets and laminar flow benches shall be designed and anchored in accordance with IBC 2000 Seismic Design Category requirements for local jurisdiction.
E. Certification:
1. Submit certification by an independent testing company stating that equipment is installed per applicable and referenced codes and standards, adjusted and balanced for design operations, and is complete and ready for intended function.
2. Certify that each Class II unit meets or exceeds National Sanitation Foundation #49 requirements.

F. Operations/Maintenance Manuals: Accompanying certification, submit for Architect’s review and Owner’s use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, and closest factory representative for components and service.

1.06 SPECIAL APPROVAL

A. Prior to contract award, final Owner-approval must be obtained, based on Owner's risk assessment of his operations, the particular agents intended for use and the selection of equipment. This approval applies to the manufacturer specified as the design standard as well as substitutions.

1.07 QUALIFICATIONS

A. Work in this Section shall be performed by a firm having a minimum five years documented experience, and 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 equipment required 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 equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

1.08 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, provide 12 months full maintenance service by skilled, competent employees of equipment installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required to maintain specified or normal operation. Use only parts and supplies as used in the manufacturer and installation of the original equipment.

B. Perform maintenance, including emergency callback service during normal working hours.

PART 2 PRODUCTS

2.01 BIOLOGICAL SAFETY CABINETS (E-22a, E-22b, E-23)

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All biological safety cabinets specified shall be provided by a single manufacturer.

2. NuAire, Inc., 2100 Fernbrook Lane, Plymouth, MN 55447 Tel: 800 328-3352. website: http://www.nuaire.com/
3. Thermo Electron Corporation, Box 649, Marietta, OH 45750 Tel: 866 984-3766. website: http://www.thermo.com/
4. Substitutions are not permitted.
B. Class II, Type A2 Vertical Laminar Flow, 30% Exhausted, Biological Safety Cabinets. (E-22a & E-22b)

1. Basis of Design: Baker SterilGARD SG403A-HE and SG603A-HE, as specified herein, with the following characteristics or modifications.
   a. Equipment #E-22a is standard cabinet with exhaust into room. #E-22b is to be supplied with canopy exhaust connection (CEC) option.
   b. 70 percent of air recirculated in cabinet; 30 percent of air filtered and exhausted from common plenum.
   c. Interior Work Height: 28-1/2 inches (724mm), nominal.
   d. Cabinet Height (less base): 63 inches (1600mm), nominal.
   e. Factory Testing: Each unit shall be factory-tested for Class II requirements. A copy of factory test shall be provided with unit for the Owner’s records.

2. Materials:
   a. Work Surface: 16 gauge (1.6mm), Type 304 stainless steel, with No. 4 finish. Reinforced with stainless steel channels.
   b. Liner/Interior Sidewalls: 16 gauge (1.6mm), minimum, Type 304 stainless steel, with No. 4 finish.
   c. Cold rolled steel: 16 gauge (1.6mm), minimum. Exterior finish: white baked enamel.
   d. Glass: 1/4 inch (6.35mm) safety glass. There shall be no permanent etchings on glass.

3. Construction:
   a. Cabinet: Work surface and interior wall and rear panels shall be welded, monolithic, sealed structure or integral one-piece construction. All corners coved. Provide exterior removable side panels and enclosure of cold rolled steel to conceal service piping. Each cabinet component shall be welded, gasketed or assembled with air-tight, hermetically sealed joints to provide a gas- and soap bubble-tight sealed assembly.
   b. Positive pressure plenum within negative pressure surround.
   c. Provide high velocity return air slots at each end of the front access opening.
   d. Base:
      1) Motorized height adjustment. Work surface height shall be adjustable between 30 inches and 36 inches (762mm and 914mm) above finished floor.
   e. Work Surface Height:
      1) Initial height position for adjustable height work surface shall be at 30 inches (762mm) above finished floor.
   f. Screen Style: Vertical or slanted sliding viewscreen. Full-open viewscreen shall be 18 1/2 inches (470mm) high for equipment access and cleaning.
   g. Access Opening: 10 inches (254mm) access opening with face velocity of 100 to 110 fpm (0.50m/s to 0.56m/s).
   h. Airfoil: Airfoil should be provided at lower front work area to improve access opening containment capability.
   i. Drain Pan: Provide stainless steel ball valve for effective drainage of drain pan.
   j. Provide stainless steel air diffuser and filter protector in work area.
   k. Provide air balancing damper in filter housing area to compensate for changing resistance of exhaust and supply filters.

4. Utility Requirements: Refer to Biological Safety Cabinet Schedule.

5. Features:
   a. Service Fittings: Provide ball valve fitting with single lever handle mounted on the work area side wall, factory-installed and complete with all gaskets, grommets, and sleeves. Provide removable serrated hose end. Fitting manufacturer shall be the same as providing the Laboratory Fittings specified under Section 11 53 43. Petcock not acceptable.
   b. Lighting: Level of 90 foot-candles (968lx) at the work surface.
c. Electrical: Provide one GFI-protected duplex receptacle with covers and stainless steel faceplate in each sidewall, connected to a separate circuit breaker. Provide 10 foot (3048mm), minimum, power cord with NEMA 5-20P plug.

d. Blower: Provide with safety switch to automatically shut off blower in the event of exhaust failure. Blower/motor combination shall be capable of producing constant air volume with increased resistance caused by filter loading with no more than 10% decrease in the rate exhaust volume.

e. Airtight damper: Provide stainless steel exhaust duct section with manual controlled stainless steel air tight damper assembly to prevent leakage of gas during decontamination of cabinet including flexible boots and clamping rings for connection to the fume exhaust duct system by Division 23.

f. Filters: Front-loading, HEPA 99.99 percent, efficient on all particles 0.3 micron by DOP test (both exhaust and supply). Filters shall be front-loaded. A removable and reusable neoprene gasket shall provide an airtight seal between the filter assembly and the metal plenum.

g. (E-22a) Unit shall recirculate HEPA filtered exhaust air to room; connection to building exhaust system is not required. Refer to Laboratory Furnishings drawings for locations.

h. (E-22b) Exhaust connection: Provide manufacturer-furnished canopy exhaust connection (CEC) device for connection to the fume exhaust duct system by Division 23. Refer to Laboratory Furnishings drawings for size and locations. Refer to Exhaust Schedule on drawings.

i. Provide 3 inch (76mm) diameter sidewall port to pass tubing and/or electrical cords the outside of the cabinet. Port shall have resilient gasket to prevent air from escaping the cabinet and disrupting cabinet functionality.

j. Control panel shall be electronic type and shall include:
   1) Control functions shall be centered at eye-level.
   2) Monitor and display airflow system performance with flow guard pressure monitor with high/low alarm set points.
   3) Control blower, lights, and receptacles with solid state membrane switches.
   4) Control blower motor with solid state regulator with potentiometer.
   5) Disable alarm switch with ring back function.

k. Access Opening Alarm: Provide audible alarm to sound when viewscreen is above its proper operating access opening height.

l. Adjustable, stainless steel footrest.

m. Disposable foam armrest pad. Pad shall be closed cell foam and be applied with self-adhesive tape.

n. For E-22b: Flexible duct connection shall allow for work surface height adjustment within specified range, and without the use of tools. Flexible duct connection shall be attached to thimble device and be connected to ductwork under Division 23 work.

o. Flexible, braided stainless steel hose connection(s) shall allow for work surface height adjustment within specified range, and without the use of tools. Flexible hose connection(s) shall be attached to cabinet factory-installed piping and be connected to building piping under Division 23 work.

p. Seismic restraint.

6. Listings:
   a. Unit must be listed by NSF International as meeting NSF/ANSI Standard #49.
   b. Underwriters Laboratories.

7. See drawings for cabinet length. SG403A-HE is nominal 4’ BSC; SG603A-HE is nominal 6’ BSC.

C. Class II, Type B2 Vertical Laminar Flow, 100% Exhausted Biological Safety Cabinets. (E-23)

1. Basis of Design: Baker SteriGARD SG403A-TX and SG603A-TX, as specified herein, with the following characteristics or modifications.
1. Systems Biotechnology Building – Academic Classroom Build-Out

BIOLOGICAL SAFETY CABINETS

115353-5

a. 100 percent of air filtered and exhausted from common plenum to fume exhaust system.
b. Interior Work Height: 25-1/2 inches (648mm), nominal.
c. Cabinet Height (less base): 61 inches (1550mm), nominal.
d. Factory Testing: Each unit shall be factory-tested for Class II requirements. A copy of factory test shall be provided with unit for the Owner’s records.

2. Materials:
a. Construction: Cabinet work zone shall be constructed from 16 gauge (1.6mm), Type 304 stainless steel with reinforcing channels, with No. 4 finish, forming an all-welded, monolithic, sealed structure.
b. Cold rolled steel: 12 gauge and 14 gauge (2.64mm and 2.0mm). Exterior finish: white baked enamel.
c. Glass: 1/4 inch (6.35mm) safety glass. There shall be no permanent etchings on glass.

3. Construction:
a. Cabinet: Interior wall and rear panels, and cabinet bottom shall be welded, monolithic, sealed structure or integral one-piece construction. All corners coved. Provide exterior removable side panels and enclosure of cold rolled steel to conceal service piping. If single-walled, provide removable decorative side panels. Each cabinet component shall be welded, gasketed or assembled with air-tight, hermetically sealed joints to provide a gas- and soap bubble-tight sealed assembly. Work tray shall have removable work tray with coved corners.
b. Cabinet shall have positive pressure plenums surrounded by vacuum relative to the room.
c. Provide high velocity return air slots at each end of the front access opening.
d. Base: Telescoping legs. If legs adjust to preset positions, positions shall be at 1 inch (25mm) increments. Work surface height shall be adjustable between 30 inches and 36 inches (762mm and 914mm) above finished floor.
e. Work Surface Height:
   1) Initial height position for adjustable height work surface shall be at 30 inches (762mm) above finished floor.
f. Screen Style: Vertical sliding viewscreen shall operate from fully closed to fully opened. Full-open viewscreen shall be 18-1/2 inches (470mm) high for visibility, equipment access and cleaning.
g. Access Opening: 8 inches (203mm) access opening with face velocity of 100 to 110 fpm (0.50 to 0.56 m/s).
h. Airfoil: Airfoil should be provided at lower front work area to improve access opening containment capability.
i. Drain Pan: Provide stainless steel ball valve for effective drainage of drain pan beneath work tray.
j. Provide air balancing damper in filter housing area to compensate for changing resistance of exhaust and supply filters.

4. Utility Requirements: Refer to Biological Safety Cabinet Schedule.

5. Features:
a. Service Fittings: Provide ball valve fitting with single lever handle mounted on the work area side wall, factory-installed and complete with all gaskets, grommets, and sleeves. Provide removable serrated hose end. Fitting manufacturer shall be the same as providing the Laboratory Fittings specified under Section 115343. Petcock not acceptable.
b. Lighting: Level of 80 foot-candles (860lx) at the work surface.
c. Electrical:
   1) Cabinet shall have two internal circuits: one for lights and blower, and one for duplex receptacle.
   2) Provide one GFI-protected duplex receptacle with covers and stainless steel faceplate in each sidewall, connected to a separate circuit breaker.
3) Provide 10 foot (3048mm) minimum power cord with NEMA 5-20P plug.

d. Blower: Provide with safety switch to automatically shut off blower in the event of exhaust failure. Blower/motor combination shall be capable of producing constant air volume with increased resistance caused by filter loading with no more than 10 percent decrease in the rate exhaust volume.

e. Airtight damper: Provide stainless steel exhaust duct section with manual controlled stainless steel air tight damper assembly to prevent leakage of gas during decontamination of cabinet including flexible boots and clamping rings for connection to the fume exhaust system by Division 23.

f. Filters: HEPA 99.99 percent, efficient on all particles 0.3 micron by DOP test (both exhaust and supply). Filters shall be front-loaded without disassembly of control panel or viewscreen assembly. A removable and reusable neoprene gasket shall provide an airtight seal between the filter assembly and the metal plenum.

1) Supply HEPA filter shall be protected by a perforated stainless steel diffuser covering the entire top of the work zone. Supply HEPA filter shall be of the full cabinet work zone, width and depth.

2) Air velocity from the supply filter shall average 55 to 65 fpm with no single point outside of the 20 percent average range measured in a horizontal plane defined by bottom edge of viewscreen.

3) Exhaust HEPA filter shall be bag-in/bag-out type.


3) Provide 10 foot (3048mm) minimum power cord with NEMA 5-20P plug.

d. Blower: Provide with safety switch to automatically shut off blower in the event of exhaust failure. Blower/motor combination shall be capable of producing constant air volume with increased resistance caused by filter loading with no more than 10 percent decrease in the rate exhaust volume.

e. Airtight damper: Provide stainless steel exhaust duct section with manual controlled stainless steel air tight damper assembly to prevent leakage of gas during decontamination of cabinet including flexible boots and clamping rings for connection to the fume exhaust system by Division 23.

f. Filters: HEPA 99.99 percent, efficient on all particles 0.3 micron by DOP test (both exhaust and supply). Filters shall be front-loaded without disassembly of control panel or viewscreen assembly. A removable and reusable neoprene gasket shall provide an airtight seal between the filter assembly and the metal plenum.

1) Supply HEPA filter shall be protected by a perforated stainless steel diffuser covering the entire top of the work zone. Supply HEPA filter shall be of the full cabinet work zone, width and depth.

2) Air velocity from the supply filter shall average 55 to 65 fpm with no single point outside of the 20 percent average range measured in a horizontal plane defined by bottom edge of viewscreen.

3) Exhaust HEPA filter shall be bag-in/bag-out type.

g. Noise Level: Noise level shall not exceed 67 dbA measured 15 inches (380mm) above the work surface and 12 inches (305mm) in front of the viewscreen.

h. Exhaust: Refer to Exhaust Schedule on drawings.

i. Exhaust Connection: Provide hard-ducted exhaust connection device/boot. Connection to the fume exhaust ductwork shall be by Division 23. Refer to Laboratory Furnishings drawings for size and locations.

j. Provide 3 inch diameter sidewall port to pass tubing and/or electrical cords the outside of the cabinet. Port shall have resilient gasket to prevent air from escaping the cabinet and disrupting cabinet functionality.

k. Control panel shall include:

1) Control functions shall be centered at eye-level.

2) Monitor and display airflow system performance through dual thermister probes.

3) Control blower, lights, and receptacles with solid state membrane or toggle switches.

4) Control of blower motor.

5) Alarm set point high/low for error conditions.

6) Remote contacts and interlock features.

7) Complete diagnostic functions.

l. Access Opening Alarm: Provide audible alarm to sound when viewscreen is above its proper operating access opening height.

m. Airflow Rate Alarm: Provide audible and visual alarm if the mass airflow in the duct should decrease below the set rate.

n. Adjustable, stainless steel foot rest.

o. Disposable foam armrest pad. Pad shall be closed cell foam and be applied with self-adhesive tape.

p. Telescoping duct connection shall allow for work surface height adjustment within specified range, and without the use of tools. Telescoping duct connection shall be attached to exhaust collar and be connected to ductwork under Division 23 work.

q. Flexible, braided stainless steel hose connection(s) shall allow for work surface height adjustment within specified range, and without the use of tools. Flexible hose connection(s) shall be attached to cabinet factory-installed piping and be connected to building piping under Division 22 work.

r. Seismic restraint.

6. Listings:

a. Unit must be listed by NSF International as meeting NSF/ANSI Standard #49.
b. Underwriters Laboratories.

7. See drawings for cabinet length; SG403A-TX is nominal 4’ BSC; SG603A-TX is nominal 6’ BSC.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence. For any exhausted biological safety cabinets, verify that exhaust duct terminations are in place.

B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer’s recommendations.

C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION

A. Work in this Section requires close coordination with Work specified in Divisions 11, 22, 23 and 26, as well as installation by Owner of Owner furnished components. Coordinate all Work to ensure an orderly process in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.

B. Coordinate location and alignment of biological safety cabinets for proper connection of all piping and duct work.

C. Install all equipment in accordance with applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.

3.03 FIELD TESTING

A. Balance, test and certify each Class II biological safety cabinet in accordance with Annex F Field Tests appended to National Sanitation Foundation (NSF) Standard 49 “Class II (Laminar Flow) Biohazard Cabinetry”.

B. Class II biological safety cabinet field tests shall be performed by an independent NSF-accredited testing company. Balancing of the system is in the scope of work of Division 23.

3.04 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.

B. Adjust all moving or operating part to function within their design parameters.

C. Clean equipment, touch up as required.

D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.
END OF SECTION
SECTION 11 53 63
LABORATORY STERILIZERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Laboratory Sterilizers (Autoclaves): Small.
B. Laboratory Sterilizers (Autoclaves): Medium.
C. Laboratory Sterilizers (Autoclaves): Bulk.

1.2 UNDIVIDED RESPONSIBILITY

A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

1.3 REFERENCES

A. Standards:
   5. National Electrical Code (NEC), NFPA 70, current edition, for clearances at electrical equipment,
   6. ASME Code, Section VIII, Division 1, for unfired pressure vessels.

1.4 DESCRIPTION

A. Furnish and install all laboratory sterilizers with necessary components and accessories required to ensure a complete installation and ready for intended use as specified herein and shown on the Laboratory Furnishings Drawings.

B. Work of this section requires close coordination with work of Division 22 and 26 as well as installation of Owner furnished components and work specified in other Sections. Sequence all work to assure an orderly progress in the project without removal of previously installed work and so as to prevent damage to finishes and products.

C. Refer to General Laboratory Equipment Schedule.

D. For units serviced with building steam:
   1. Manufacturer’s unit-mounted valves, pressure reducing valves, safety relief valves, strainer, joints, fittings, flanges, unions, and piping shall be in compliance with Section 23 20 10. Provide union connections for pipe sizes 1.5 inches (38mm) and smaller, and flange connections for pipe 2 inch (51mm) and larger pipe sizes.
   2. Manufacturer’s unit-mounted steam pressure gauges shall be provided with gage cock with siphon loop in compliance with Section 22 05 19.
E. Utility Requirements: Mechanical and electrical services have been designed for the services and loads as described for individual equipment items herein. If a manufacturer requires services in excess of those indicated, either of type, size, quantity or quality, that cost will be borne by the Contractor and shall not be justification for a change order.

F. Equipment Pits: Equipment pits shall be designed around standard pit of successful bidder. Manufacturer shall submit certified pit drawing within 30 days of Award of Contract from Owner to Contractor. Manufacturer shall provide height adjustments, thresholds, and other items required to finish off machines for pit mounted arrangement.

1.5 SUBMITTALS

A. Submit as specified herein and under provisions of Section 01 33 00.

B. Materials List/Product Data: For each type of sterilizer, submit for review a complete materials list, including catalog data and performance data of all materials, equipment, and products for work in this Section.

C. Shop Drawings:
   1. Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, finished and materials dimensions, and schedules. Show relationship to adjoining materials, and construction and requisite service, operating and installation clearances (width, depth, and height). Layout shall include relationship to light fixtures and ventilation registers, grilles and diffusers.
   2. Provide piping, wiring, and/or control diagrams, indicating all connection points and sizes to building services and systems. Provide flow rates, pressure drops, temperature and pressure requirements, voltage and amperage, etc. Provide clear identification where equipment requirements deviate from the service/utility provisions identified in the Construction Documents. Indicate service requirements, loads, and rough-in locations of all piped services and electrical connections.
   3. Verify that component parts and assembly of each item will support superimposed loads, without deflection detrimental to function, appearance and safety.
   4. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11 inches x 17 inches (A3) in size. Blueline or blackline prints are not acceptable.

D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer to show compliance with the applicable Building Code seismic restraint requirements.
   1. Sterilizers shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.

E. Informational Submittals:
   1. Statement of installer qualifications.
   2. Notice of factory testing.

F. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, including non-proprietary parts, and closest factory representative for components and service. Manual shall include non-proprietary list of all valves and other serviceable components.

1.6 SUBSTITUTIONS

A. Substitution shall not affect dimensions shown on Drawings.

B. The Contractor shall pay for changes to the building design, including engineering design, detailing, utility and service requirements, and construction costs caused by the requested substitution. Change orders generated by substitutions will not be accepted.
C. Substitutions shall have no adverse affect on other trades, the construction schedule, or specified warranty requirements.

D. Maintenance and service parts shall be locally available for the proposed substitution.

1.7 QUALIFICATIONS

A. Manufacturer’s Qualifications: Manufacturer shall specialize in manufacture of products specified herein with minimum ten years experience.
   1. Manufacturer shall provide, upon request of Owner or Architect, three references of similar installations.

B. Installer Qualifications:
   1. Contractor for work in this section shall have an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the installation of the type of equipment 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 equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.
   2. Firm specializing in installation of products specified, with minimum five years experience, and authorized by manufacturer to install product.
   3. Firm having replacement parts, tools, equipment, apparatus, devices and other items required for normal and emergency maintenance, and employees fully skilled in equipment maintenance, within 2 hours arriving time of project site.
   4. Installer shall provide, upon request of Owner or Architect, three references of similar installations.

1.8 REGULATORY REQUIREMENTS

A. Specified products, materials, or systems for Project may include engineering or on file standards required by the Regulatory Agency. Contractor’s substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with Regulatory Agency requirements or both. Contractor shall provide all Agency approvals or other additional information required and pay for additional costs required Architect’s services made necessary by the substitution at no increase in Contract Sum or schedule time, and as a part of substitution proposal.

B. When applicable, comply with:
   1. Underwriters Laboratory Standards.

1.9 PRODUCT HANDLING

A. Schedule: Schedule delivery of steam sterilizers only after wet operations in building are completed.

B. Logistics: Provide receiving, distribution, and storage areas of sufficient size and capacity to accommodate crated equipment.

C. Storage: Store steam sterilizers in a ventilated place, protected from the weather, with relative humidity therein of 50 percent or less at 70 degrees F (21.1 °C).

D. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades. Keep covered with polyethylene film or other protective covering.
E. Replacement: Any damage as a result of this contractors work will be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.

F. Sequencing: At no time shall tradesmen use the steam sterilizer equipment as a workbench, scaffolding, or other uses. Protect steam sterilizer equipment from debris, paint, damage in the course of construction.

1.10 SPECIAL WARRANTY

A. Warrant each pressure vessel against failure under normal operating conditions for 10 years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Furnish routine preventative and emergency maintenance service for two years from final acceptance. Maintenance service shall supplement warranty requirements.

B. Include periodic examination, adjustment, and maintenance of equipment. Repair or replace worn parts, using only standard parts produced by equipment manufacturer.

C. Furnish 7-day-a-week emergency service during maintenance period, providing maintenance personnel on site within 24 hours, should a shutdown or emergency develop between regular examinations.

1.12 MAINTENANCE MATERIALS

A. Provide two additional rolls of printer paper with each sterilizer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory sterilizers specified in this section shall be the provided by a single manufacturer.

1. Steris Corporation, 5960 Heisley Road, Mentor, Ohio 44060 Tel: 440 354-2600. website: http://www.steris.com/

2. GetingeUSA, Inc., 1777 East Henrietta Road, P.O. Box 93070, Rochester, NY 14692 Tel: 800 541-5569. website: http://www.getingeusa.com/

3. Prometco BMT, 7429 W. Bostian Road, Woodinville, WA 98072 Tel: 425 368-1330. website: http://www.prometcobmt.com/

4. Substitutions are not permitted.

2.2 LABORATORY STERILIZER (AUTOCLAVE): SMALL (E-1)

A. Description: Vertical sliding door sterilizers using steam under pressure and mechanical air removal or gravity displacement principles; designed for sterilization of hard goods, porous loads, liquid loads in vented containers, and laboratory animal caging systems.

B. Basis of Design: Steris Lab Series Small Sterilizer, as specified herein.

C. Chamber Size (nominal):

1. Chamber size: 20 inches x 20 inches x 38 inches (508mm x 508mm x 965mm).

D. Configuration:
1. Steam source: Building steam. Sterilizer shall connect to a single point of connection to building steam.

3. Arrangement: Arrange chamber and service/equipment space as indicated on the drawings.
4. Process:
   a. Prevacuum process is for the sterilization of porous and non-porous heat- and moisture-stable goods, sterilization of liquids and media in borosilicate glass containers with vented closures, and decontamination of supplies after laboratory procedures. Prevacuum sterilizers shall be equipped with prevacuum, gravity, liquid, leak test, and daily air removal test cycles.

E. Pre-programmed Cycle Descriptions:
2. Liquid Cycle: Provided on gravity and prevacuum sterilizers for the sterilization of liquids and media in vented borosilicate glass or metal containers at 212-254 degrees F (100-123° C). Liquid cycle utilizes the optimal solution cooling feature, during exhaust (cooling) phase, to control the exhaust rate.
3. Prevacuum Cycle: Provided only on prevacuum sterilizers for the efficient, high-volume sterilization of porous, heat- and moisture-stable materials at 250-285 degrees F (121-141°C). Prevacuum cycle utilizes a mechanical air-evacuation system
4. Leak Test Cycle: Provided only on prevacuum sterilizers for verification of chamber integrity. Cycle parameters shall be preprogrammed and fixed. The acceptable maximum leak rate is 1 mm Hg/min over a 10-minute period following a fixed stabilization time.
5. DART (Daily Air Removal Test or Bowie-Dick) Test Cycle: Provided on prevacuum sterilizers; is used to conduct a Bowie-Dick test on the sterilizer.

F. Control system:
1. Allen-Bradley PLC microcomputer control system that monitors and controls all phases of each sterilizing cycle.
   a. Programmed with six default cycles, minimum.
   b. Adjustable cycle values and operation features.
   c. Control system shall be housed within a sealed compartment to protect components from moisture and heat generated during sterilization processes. Provide a cooling fan with filter in the housing compartment to maintain positive pressure within the compartment, keeping components cool and dust-free.
   d. System shall include help screens for programming and troubleshooting alarm conditions.
   e. System shall conduct automatic check on control program and cycle data.
   f. Emergency Stop Button shall be located at sterilizer door(s), returning values to safe condition and halt cycle processing when activated. After activation, operator shall have ability to abort or continue cycle operation.
   g. Security Access Codes shall provide restricted access of unauthorized users:
      The following password levels shall be available:
      1) Operator: Permits user to select and start a cycle, acknowledge alarms, view cycle parameters, print reports.
      2) Supervisor: allows user Operator permissions, and ability to edit cycle parameters, edit Proportional Integral Derivative (PID) parameters.
3) Calibrator: allows user Supervisor permissions, and ability to calibrate instruments.
4) Service: allows user Calibrator permissions, and ability to view inputs, system diagnosis, activate/deactivate outputs, edit common settings, change date/time.
5) Administrator: allows user Service permissions, and ability to configure user names and edit passwords.

h. Calibration: Provide for all temperature and pressure calibration through the control panel through the operating end touch screen. Control system shall be capable of providing printed record of all calibration data for comparison to current readings.

2. Operator Interface: Provide at operating (load, non-sterile) end, adjacent to the chamber.
   a. Touch-sensitive color screen with graphic display area. Screen shall display sterilizer functions, alarm conditions, and be used for cycle configuration and initiation. Displayed messages shall be in complete phrases with no cross-referenced codes. Screen shall be a minimum of 5 inches x 4 inches (132mm x 99mm).
   b. Thermal printer to provide record of all cycle data.

3. Internal Battery: Battery shall be used to back-up all cycle memory for up to ten years. Controller shall require complete restart of cycle upon interruption of power.

G. Construction:
1. Shell assembly: Double walled, insulated, Type 316L stainless steel, all welded sterilizer vessel. Shielded steam entry inside chamber.
   a. End Frame(s): Type 316L stainless steel, welded to door end.
   b. Vessel: ASME rated at 50 psig (3.2bar).
   c. Baffle: Shield steam supply opening inside chamber by a Type 316L stainless steel baffle.
   d. Hinged front cabinet panel to access sterilizer piping and control board housing.
   e. Equipment Stand: Support sterilizers on height-adjustable stainless or carbon-steel stand, shop-coated for corrosion protection.
   f. Door assembly: Formed from a single sheet of Type 316L stainless steel, insulated. Provide safety lock to prevent door opening when chamber pressure exceeds 2 psi (14 kPa). Door shall be vertical sliding with foot pedal activation.
      1) Door shall have replaceable, one-piece, compressed air-activated polymer gasket. Upon completion of cycle, gasket shall retract under vacuum into a machined groove in the end frame of the sterilizer.
   g. Insulation: 1 inch (25 mm) thick, fiberglass insulation sleeve, sealed and held in place with hook-and-loop-type closures. Insulation shall be asbestos- and chloride-free, silicone impregnated, oil- and water-resistant.

2. Piping Valves, Switches, and Gauges: Brass, including steam strainer, shutoff valve, and brass pressure regulator.
   a. All valves shall be non-proprietary.
   b. Solenoid valves with DIN connectors, air operated, or piston valves located in manifold.
   c. All piping connections shall terminate within the confines of the sterilizer.
   d. Manual Steam Shutoff: Pressure-rated at 125 psig (862kPa) for saturated steam. Valve handles shall be low heat conducting-type.
   e. Pressure Reducing Valves (PRV): Provide pressure reducing valves to reduce incoming steam, water and compressed air to manufacturer-recommend operating pressures.
   f. Utility Shut-Off Valves: Provide utility shut-off valves for incoming piped utilities
g. Safety Relief Valve: Provide ASME-certified and labeled safety relief valve (SRV) to protect vessel, jacket, and heat exchanger (where applicable), from pressure build-up beyond the equipment's maximum rated pressure. Coordinate relief valve discharge with Mechanical installer for vent piping to the exterior of the building. Manufacturer shall pipe multiple steam safety relief valves on a unit to a single point for field connection.

h. Pressure gauges shall be in a location visible to the operator.

i. Steam Valve Interlock: Provide steam valve interlock to prevent steam valve from opening when door is open.

j. Pressure Interlock: Provide pressure interlock to prevent opening of door when the unit is above or below atmospheric pressure.

k. Chamber Float Switch Alarms: Provide with chamber float switch to indicate alarm that water is in chamber.

l. Check Valves: Provide check valves on water feed piping.

3. Electrical Connections:
   a. Provide lighted DIN Connectors.
   b. All electrical connections shall terminate within the confines of the sterilizer.

4. Vacuum System (Prevacuum units only): Water ejector to reduce chamber pressure during the prevacuum and post-drying phase. Air to be drawn from the chamber through the vacuum system. Following the dry phase, chamber vacuum to be relieved to atmospheric pressure by admitting air through a bacteria-retentive filter.

H. Features:
1. Resistance Temperature Detectors (RTD): Installed in chamber drain line and chamber jacket to sense and control temperature variations within the chamber.
2. Jacket Temperature Control: Separate jacket RTD installed in the jacket drain line to allow control of jacket temperature, for optimal cycle performance.
3. Steam Bleed: Constant steam flow supplied across chamber RTD to assure even temperature distribution and temperature control.
4. Steam Purge: To assist in air removal and to preheat load.
5. RS-232 Interface Port: For downloading cycle information to user-furnished data acquisition system.
6. Electronic Water Saving Control: To control the amount of water used in condensing exhausted chamber steam.
7. Optimal Solution Cooling: To safely cool various liquids in vented, borosilicate glass containers with minimum liquid loss due to boil-over, and to keep normal evaporation loss below 5 percent.
8. Automatic Steam Shutoff to Jacket: For liquid cycles; to allow operation of cycles at lower temperatures and more efficient load cooling.
10. Control Lockout Switch: Limit switch on chamber door to prevent cycle from starting unless door seal is tight against the door.
11. Chamber Drain System: To prevent pollutants from entering into the water supply system and sterilizer. Automatic stainless steel plate-type condensing system to convert chamber steam to condensate and to dispose it to waste. Provide non-clogging chamber drain line.
13. Effluent Temperature Control System: System shall not discharge effluent until it has cooled to less than 140 degrees F (60°C).
14. RTD Load Probe and F₀ Sterilization: To measure load temperature during processing; allows control system to start and terminate cycles based on recorded data.
15. Exterior Enclosure: Type 304 stainless steel side and rear panels with louvered stainless steel top panel with No. 3 finish to enclose sterilizer body and piping for freestanding units or where extends into finished space.
16. Seismic Tie Down Kit: Designed and selected to meet jurisdictional seismic codes.
17. Utility Requirements: Refer to Laboratory Equipment Schedule.

I. Accessories required for each unit:
1. Loading Rack and Shelves: Provide rack and two shelves.

2.3 LABORATORY STERILIZER (AUTOCLAVE): SMALL (E-2)

A. Description: Vertical sliding door sterilizers using steam under pressure and mechanical air removal or gravity displacement principles; designed for sterilization of hard goods, porous loads, liquid loads in vented containers, and laboratory animal caging systems.
B. Basis of Design: Steris Lab Series Small Sterilizer, as specified herein.
C. Chamber Size (nominal):
1. Chamber size: 16 inches x 16 inches x 26 inches (406mm x 406mm x 660mm).
D. Configuration:
1. Steam source: Building steam. Sterilizer shall connect to a single point of connection to building steam.
3. Arrangement: Arrange chamber and service/equipment space as indicated on the drawings.
4. Process:
a. Prevacuum process is for the sterilization of porous and non-porous heat- and moisture-stable goods, sterilization of liquids and media in borosilicate glass containers with vented closures, and decontamination of supplies after laboratory procedures. Prevacuum sterilizers shall be equipped with prevacuum, gravity, liquid, leak test, and daily air removal test cycles.

E. Pre-programmed Cycle Descriptions:
2. Liquid Cycle: Provided on gravity and prevacuum sterilizers for the sterilization of liquids and media in vented borosilicate glass or metal containers at 212-254 degrees F (100-123°C). Liquid cycle utilizes the optimal solution cooling feature, during exhaust (cooling) phase, to control the exhaust rate.
3. Prevacuum Cycle: Provided only on prevacuum sterilizers for the efficient, high-volume sterilization of porous, heat- and moisture-stable materials at 250-285 degrees F (121-141°C). Prevacuum cycle utilizes a mechanical air-evacuation system
4. Leak Test Cycle: Provided only on prevacuum sterilizers for verification of chamber integrity. Cycle parameters shall be preprogrammed and fixed. The acceptable maximum leak rate is 1 mm Hg/min over a 10-minute period following a fixed stabilization time.
5. DART (Daily Air Removal Test or Bowie-Dick) Test Cycle: Provided on prevacuum sterilizers; is used to conduct a Bowie-Dick test on the sterilizer.

F. Control system:
1. Allen-Bradley PLC microcomputer control system that monitors and controls all phases of each sterilizing cycle.
a. Programmed with six default cycles, minimum.
b. Adjustable cycle values and operation features.
c. Control system shall be housed within a sealed compartment to protect components from moisture and heat generated during sterilization processes. Provide a cooling fan with filter in the housing compartment to maintain positive pressure within the compartment, keeping components cool and dust-free.
d. System shall include help screens for programming and troubleshooting alarm conditions.
e. System shall conduct automatic check on control program and cycle data.
f. Emergency Stop Button shall be located at sterilizer door(s), returning values to safe condition and halt cycle processing when activated. After activation, operator shall have ability to abort or continue cycle operation.
g. Security Access Codes shall provide restricted access of unauthorized users:
The following password levels shall be available:
1) Operator: Permits user to select and start a cycle, acknowledge alarms, view cycle parameters, print reports.
2) Supervisor: allows user Operator permissions, and ability to edit cycle parameters, edit Proportional Integral Derivative (PID) parameters.
3) Calibrator: allows user Supervisor permissions, and ability to calibrate instruments.
4) Service: allows user Calibrator permissions, and ability to view inputs, system diagnosis, activate/deactivate outputs, edit common settings, change date/time.
5) Administrator: allows user Service permissions, and ability to configure user names and edit passwords.
h. Calibration: Provide for all temperature and pressure calibration through the control panel through the operating end touch screen. Control system shall be capable of providing printed record of all calibration data for comparison to current readings.

2. Operator Interface: Provide at operating (load, non-sterile) end, adjacent to the chamber.
   a. Touch-sensitive color screen with graphic display area. Screen shall display sterilizer functions, alarm conditions, and be used for cycle configuration and initiation. Displayed messages shall be in complete phrases with no cross-referenced codes. Screen shall be a minimum of 5 inches x 4 inches (132mm x 99mm).
   b. Thermal printer to provide record of all cycle data.

3. Internal Battery: Battery shall be used to back-up all cycle memory for up to ten years. Controller shall require complete restart of cycle upon interruption of power.

G. Construction:
1. Shell assembly: Double walled, insulated, Type 316L stainless steel, all welded sterilizer vessel. Shielded steam entry inside chamber.
   a. End Frame(s): Type 316L stainless steel, welded to door end.
   b. Vessel: ASME rated at 50 psig (3.2bar).
   c. Baffle: Shield steam supply opening inside chamber by a Type 316L stainless steel baffle.
   d. Hinged front cabinet panel to access sterilizer piping and control board housing.
   e. Equipment Stand: Support sterilizers on height-adjustable stainless or carbon-steel stand, shop-coated for corrosion protection.
   f. Door assembly: Formed from a single sheet of Type 316L stainless steel, insulated. Provide safety lock to prevent door opening when chamber pressure exceeds 2 psi (14 kPa). Door shall be vertical sliding with foot pedal activation.
1) Door shall have replaceable, one-piece, compressed air-activated polymer gasket. Upon completion of cycle, gasket shall retract under vacuum into a machined groove in the end frame of the sterilizer.

g. Insulation: 1 inch (25 mm) thick, fiberglass insulation sleeve, sealed and held in place with hook–and-loop-type closures. Insulation shall be asbestos- and chloride-free, silicone impregnated, oil- and water-resistant.

2. Piping Valves, Switches, and Gauges: Brass, including steam strainer, shutoff valve, and brass pressure regulator.
   a. All valves shall be non-proprietary.
   b. Solenoid valves with DIN connectors, air operated, or piston valves located in manifold.
   c. All piping connections shall terminate within the confines of the sterilizer.
   d. Manual Steam Shutoff: Pressure-rated at 125 psig (862kPa) for saturated steam. Valve handles shall be low heat conducting-type.
   e. Pressure Reducing Valves (PRV): Provide pressure reducing valves to reduce incoming steam, water and compressed air to manufacturer-recommend operating pressures.
   f. Utility Shut-Off Valves: Provide utility shut-off valves for incoming piped utilities
   g. Safety Relief Valve: Provide ASME-certified and labeled safety relief valve (SRV) to protect vessel, jacket, and heat exchanger (where applicable), from pressure build-up beyond the equipment’s maximum rated pressure. Coordinate relief valve discharge with Mechanical installer for vent piping to the exterior of the building. Manufacturer shall pipe multiple steam safety relief valves on a unit to a single point for field connection.
   h. Pressure gauges shall be in a location visible to the operator.
   i. Steam Valve Interlock: Provide steam valve interlock to prevent steam valve from opening when door is open.
   j. Pressure Interlock: Provide pressure interlock to prevent opening of door when the unit is above or below atmospheric pressure.
   k. Chamber Float Switch Alarms: Provide with chamber float switch to indicate alarm that water is in chamber.
   l. Check Valves: Provide check valves on water feed piping.

3. Electrical Connections:
   a. Provide lighted DIN Connectors.
   b. All electrical connections shall terminate within the confines of the sterilizer.

4. Vacuum System (Prevacuum units only): Water ejector to reduce chamber pressure during the prevacuum and post-drying phase. Air to be drawn from the chamber through the vacuum system. Following the dry phase, chamber vacuum to be relieved to atmospheric pressure by admitting air through a bacteria-retentive filter.

H. Features:
   1. Resistance Temperature Detectors (RTD): Installed in chamber drain line and chamber jacket to sense and control temperature variations within the chamber.
   2. Jacket Temperature Control: Separate jacket RTD installed in the jacket drain line to allow control of jacket temperature, for optimal cycle performance.
   3. Steam Bleed: Constant steam flow supplied across chamber RTD to assure even temperature distribution and temperature control.
   4. Steam Purge: To assist in air removal and to preheat load.
   5. RS-232 Interface Port: For downloading cycle information to user-furnished data acquisition system.
   6. Electronic Water Saving Control: To control the amount of water used in condensing exhausted chamber steam.
7. Optimal Solution Cooling: To safely cool various liquids in vented, borosilicate glass containers with minimum liquid loss due to boil-over, and to keep normal evaporation loss below 5 percent.

8. Automatic Steam Shutoff to Jacket: For liquid cycles; to allow operation of cycles at lower temperatures and more efficient load cooling.


10. Control Lockout Switch: Limit switch on chamber door to prevent cycle from starting unless door seal is tight against the door.

11. Chamber Drain System: To prevent pollutants from entering into the water supply system and sterilizer. Automatic stainless steel plate-type condensing system to convert chamber steam to condensate and to dispose it to waste. Provide non-clogging chamber drain line.


13. Effluent Temperature Control System: System shall not discharge effluent until it has cooled to less than 140 degrees F (60°C).

14. RTD Load Probe and F0 Sterilization: To measure load temperature during processing; allows control system to start and terminate cycles based on recorded data.

15. Exterior Enclosure: Type 304 stainless steel side and rear panels with louvered stainless steel top panel with No. 3 finish to enclose sterilizer body and piping for freestanding units or where extends into finished space.

16. Seismic Tie Down Kit: Designed and selected to meet jurisdictional seismic codes.

17. Utility Requirements: Refer to Laboratory Equipment Schedule.

I. Accessories required for each unit:
   1. Loading Rack and Shelves: Provide rack and two shelves.

2.4 LABORATORY STERILIZER (AUTOCLAVE): SMALL (E-3)

A. Description: Vertical sliding door sterilizers using steam under pressure and mechanical air removal or gravity displacement principles; designed for sterilization of hard goods, porous loads, liquid loads in vented containers, and laboratory animal caging systems.

B. Basis of Design: Steris Lab Series Small Sterilizer, as specified herein.

C. Chamber Size (nominal):
   1. Chamber size: 20 inches x 20 inches x 38 inches (508mm x 508mm x 965mm).

D. Configuration:
   1. Steam source: Building steam. Sterilizer shall connect to a single point of connection to building steam.

   2. Doors/installation: Double doors, recessed through one wall, cabinet enclosed.

   3. Arrangement: Arrange chamber and service/equipment space as indicated on the drawings.

   4. Process:
      a. Prevacuum process is for the sterilization of porous and non-porous heat- and moisture-stable goods, sterilization of liquids and media in borosilicate glass containers with vented closures, and decontamination of supplies after laboratory procedures. Prevacuum sterilizers shall be equipped with prevacuum, gravity, liquid, leak test, and daily air removal test cycles.

   E. Pre-programmed Cycle Descriptions:
2. Liquid Cycle: Provided on gravity and prevacuum sterilizers for the sterilization of liquids and media in vented borosilicate glass or metal containers at 212-254 degrees F (100-123°C). Liquid cycle utilizes the optimal solution cooling feature, during exhaust (cooling) phase, to control the exhaust rate.


4. Leak Test Cycle: Provided only on prevacuum sterilizers for verification of chamber integrity. Cycle parameters shall be preprogrammed and fixed. The acceptable maximum leak rate is 1 mm Hg/min over a 10-minute period following a fixed stabilization time.

5. DART (Daily Air Removal Test or Bowie-Dick) Test Cycle: Provided on prevacuum sterilizers; is used to conduct a Bowie-Dick test on the sterilizer.

F. Control system:

1. Allen-Bradley PLC microcomputer control system that monitors and controls all phases of each sterilizing cycle.
   a. Programmed with six default cycles, minimum.
   b. Adjustable cycle values and operation features.
   c. Control system shall be housed within a sealed compartment to protect components from moisture and heat generated during sterilization processes. Provide a cooling fan with filter in the housing compartment to maintain positive pressure within the compartment, keeping components cool and dust-free.
   d. System shall include help screens for programming and troubleshooting alarm conditions.
   e. System shall conduct automatic check on control program and cycle data.
   f. Emergency Stop Button shall be located at sterilizer door(s), returning values to safe condition and halt cycle processing when activated. After activation, operator shall have ability to abort or continue cycle operation.
   g. Security Access Codes shall provide restricted access of unauthorized users:
      The following password levels shall be available:
      1) Operator: Permits user to select and start a cycle, acknowledge alarms, view cycle parameters, print reports.
      2) Supervisor: allows user Operator permissions, and ability to edit cycle parameters, edit Proportional Integral Derivative (PID) parameters.
      3) Calibrator: allows user Supervisor permissions, and ability to calibrate instruments.
      4) Service: allows user Calibrator permissions, and ability to view inputs, system diagnosis, activate/deactivate outputs, edit common settings, change date/time.
      5) Administrator: allows user Service permissions, and ability to configure user names and edit passwords.
   h. Calibration: Provide for all temperature and pressure calibration through the control panel through the operating end touch screen. Control system shall be capable of providing printed record of all calibration data for comparison to current readings.

2. Operator Interface: Provide at operating (load, non-sterile) end, adjacent to the chamber.
   a. Touch-sensitive color screen with graphic display area. Screen shall display sterilizer functions, alarm conditions, and be used for cycle configuration and initiation. Displayed messages shall be in complete phrases with no cross-referenced codes. Screen shall be a minimum of 5 inches x 4 inches (132mm x 99mm).
b. Thermal printer to provide record of all cycle data.

3. Non-Operating End Control Panel:
   a. Touch-sensitive screen with graphic display area, showing same messages as operating end display.

4. Internal Battery: Battery shall be used to back-up all cycle memory for up to ten years. Controller shall require complete restart of cycle upon interruption of power.

G. Construction:
1. Shell assembly: Double walled, insulated, Type 316L stainless steel, all welded sterilizer vessel. Shielded steam entry inside chamber.
   a. End Frame(s): Type 316L stainless steel, welded to door end.
   b. Vessel: ASME rated at 50 psig (3.2bar).
   c. Baffle: Shield steam supply opening inside chamber by a Type 316L stainless steel baffle.
   d. Hinged front cabinet panel to access sterilizer piping and control board housing.
   e. Equipment Stand: Support sterilizers on height-adjustable stainless or carbon-steel stand, shop-coated for corrosion protection.
   f. Door assembly: Formed from a single sheet of Type 316L stainless steel, insulated. Provide safety lock to prevent door opening when chamber pressure exceeds 2 psi (14 kPa). Door shall be vertical sliding with foot pedal activation.
      1) Door shall have replaceable, one-piece, compressed air-activated polymer gasket. Upon completion of cycle, gasket shall retract under vacuum into a machined groove in the end frame of the sterilizer.
   g. Insulation: 1 inch (25 mm) thick, fiberglass insulation sleeve, sealed and held in place with hook-–and-loop-type closures. Insulation shall be asbestos- and chloride-free, silicone impregnated, oil- and water-resistant.
2. Piping Valves, Switches, and Gauges: Brass, including steam strainer, shutoff valve, and brass pressure regulator.
   a. All valves shall be non-proprietary.
   b. Solenoid valves with DIN connectors, air operated, or piston valves located in manifold.
   c. All piping connections shall terminate within the confines of the sterilizer.
   d. Manual Steam Shutoff: Pressure-rated at 125 psig (862kPa) for saturated steam. Valve handles shall be low heat conducting-type.
   e. Pressure Reducing Valves (PRV): Provide pressure reducing valves to reduce incoming steam, water and compressed air to manufacturer-recommend operating pressures.
   g. Safety Relief Valve: Provide ASME-certified and labeled safety relief valve (SRV) to protect vessel, jacket, and heat exchanger (where applicable), from pressure build-up beyond the equipment’s maximum rated pressure. Coordinate relief valve discharge with Mechanical installer for vent piping to the exterior of the building. Manufacturer shall pipe multiple steam safety relief valves on a unit to a single point for field connection.
   h. Pressure gauges shall be in a location visible to the operator.
   i. Steam Valve Interlock: Provide steam valve interlock to prevent steam valve from opening when door is open.
   j. Pressure Interlock: Provide pressure interlock to prevent opening of door when the unit is above or below atmospheric pressure.
   k. Chamber Float Switch Alarms: Provide with chamber float switch to indicate alarm that water is in chamber.
   l. Check Valves: Provide check valves on water feed piping.
3. Electrical Connections:
a. Provide lighted DIN Connectors.
b. All electrical connections shall terminate within the confines of the sterilizer.

4. Vacuum System (Prevacuum units only): Water ejector to reduce chamber pressure during the prevacuum and post-drying phase. Air to be drawn from the chamber through the vacuum system. Following the dry phase, chamber vacuum to be relieved to atmospheric pressure by admitting air through a bacteria-retentive filter.

H. Features:
1. Resistance Temperature Detectors (RTD): Installed in chamber drain line and chamber jacket to sense and control temperature variations within the chamber.
2. Jacket Temperature Control: Separate jacket RTD installed in the jacket drain line to allow control of jacket temperature, for optimal cycle performance.
3. Steam Bleed: Constant steam flow supplied across chamber RTD to assure even temperature distribution and temperature control.
4. Steam Purge: To assist in air removal and to preheat load.
5. RS-232 Interface Port: For downloading cycle information to user-furnished data acquisition system.
6. Electronic Water Saving Control: To control the amount of water used in condensing exhausted chamber steam.
7. Optimal Solution Cooling: To safely cool various liquids in vented, borosilicate glass containers with minimum liquid loss due to boil-over, and to keep normal evaporation loss below 5 percent.
8. Automatic Steam Shutoff to Jacket: For liquid cycles; to allow operation of cycles at lower temperatures and more efficient load cooling.
10. Control Lockout Switch: Limit switch on chamber door to prevent cycle from starting unless door seal is tight against the door.
11. Chamber Drain System: To prevent pollutants from entering into the water supply system and sterilizer. Automatic stainless steel plate-type condensing system to convert chamber steam to condensate and to dispose it to waste. Provide non-clogging chamber drain line.
13. Effluent Temperature Control System: System shall not discharge effluent until it has cooled to less than 140 degrees F (60°C).
14. Door Interlocks (Double Door units only): To allow only one door to be opened at a time, and to prevent non-operating end door from being opened until a satisfactory cycle is complete.
15. Air Differential Seal (Double Door units only): Air differential seal shall be provided to maintain room air differential pressure; provide on load end of sterilizer. Seal shall be fabricated from Type 304 stainless steel. Air differential seal shall also serve as vermin-proof seal.
16. RTD Load Probe and $F_0$ Sterilization: To measure load temperature during processing; allows control system to start and terminate cycles based on recorded data.
17. Exterior Enclosure: Type 304 stainless steel side and rear panels with louvered stainless steel top panel with No. 3 finish to enclose sterilizer body and piping for freestanding units or where extends into finished space.
18. Gasket: Synthetic neoprene or silicone on sterilizer sub-frame to ensure tight fit between cabinet end panels, and wall partitions, if provided.
19. Seismic Tie Down Kit: Designed and selected to meet jurisdictional seismic codes.
20. Utility Requirements: Refer to Laboratory Equipment Schedule.

I. Accessories required for each unit:
1. Loading Rack and Shelves: Provide rack and two shelves.
2.5 LABORATORY STERILIZER (AUTOCLAVE): MEDIUM (E-4)

A. Description: Medium chamber sterilizers using steam under pressure as the sterilizing agent; designed for sterilization of certain materials used in laboratories and research facilities.

B. Basis of Design: Steris AMSCO Century Medium Steam Sterilizer, as specified herein.

C. Chamber Size (nominal):
1. Chamber size: 26 inches x 37-1/2 inches x 48 inches (660mm x 953mm x 1219mm).

D. Configuration:
1. Steam source: Building steam. Sterilizer shall connect to a single point of connection to building steam.
2. Doors/installation: Single door, cabinet enclosed unit. Occurs in C345 Central Glasswash
3. Doors/installation: Double doors, recessed through two walls. Occurs in A1B88 Clean Cage Assembly
4. Arrangement: Arrange chamber and service/equipment space as indicated on the drawings.
5. Process:
   a. Prevacuum process is for the sterilization of porous and non-porous heat- and moisture-stable goods, sterilization of liquids and media in borosilicate glass containers with vented closures, and decontamination of supplies after laboratory procedures. Prevacuum sterilizers shall be equipped with prevacuum, gravity, liquid, leak test, and daily air removal test cycles.

E. Pre-programmed Cycle Descriptions:
1. Gravity Cycle: Provided on prevacuum sterilizers for the sterilization of heat- and moisture-stable goods at 212-285 degrees F (100-141 °C), and decontamination of bagged laboratory wastes. Gravity cycle utilizes the gravity air-displacement principle.
2. Liquid Cycle: Provided on prevacuum sterilizers for the sterilization of liquids and media in vented borosilicate glass or metal containers at 212-254 degrees F (100-123° C). Liquid cycle utilizes the optimal solution cooling feature, during exhaust (cooling) phase, to control the exhaust rate.
4. Leak Test Cycle: Provided on prevacuum sterilizers for verification of chamber integrity. Cycle parameters shall be preprogrammed and fixed. The acceptable maximum leak rate is 1 mm Hg/min over a 10-minute period following a fixed stabilization time.
5. DART (Daily Air Removal Test or Bowie-Dick) Test Cycle: Provided on prevacuum sterilizers; is used to conduct a Bowie-Dick test on the sterilizer.

F. Control system:
1. Allen-Bradley PLC microcomputer control system that monitors and controls all phases of each sterilizing cycle.
   a. Programmed with five default cycles, minimum.
   b. Adjustable cycle values and operation features.
   c. Control system shall be housed within a sealed compartment to protect components from moisture and heat generated during sterilization processes. Provide a cooling fan with filter in the housing compartment to maintain positive pressure within the compartment, keeping components cool and dust-free.
   d. System shall include help screens for programming and troubleshooting alarm conditions.
e. System shall conduct automatic check on control program and cycle data.

f. Emergency Stop Button shall be located at sterilizer door(s), returning values to safe condition and halt cycle processing when activated. After activation, operator shall have ability to abort or continue cycle operation.

g. Security Access Codes shall provide restricted access of unauthorized users:
The following password levels shall be available:
1) Operator: Permits user to select and start a cycle, acknowledge alarms, view cycle parameters, print reports.
2) Supervisor: allows user Operator permissions, and ability to edit cycle parameters, edit Proportional Integral Derivative (PID) parameters.
3) Calibrator: allows user Supervisor permissions, and ability to calibrate instruments.
4) Service: allows user Calibrator permissions, and ability to view inputs, system diagnosis, activate/deactivate outputs, edit common settings, change date/time.
5) Administrator: allows user Service permissions, and ability to configure user names and edit passwords.

h. Calibration: Provide for all temperature and pressure calibration through the control panel through the operating end touch screen. Control system shall be capable of providing printed record of all calibration data for comparison to current readings.

2. Operator Interface: Provide at operating (load, non-sterile) end, adjacent to the chamber.
   a. Touch-sensitive color screen with graphic display area. Screen shall display sterilizer functions, alarm conditions, and be used for cycle configuration and initiation. Displayed messages shall be in complete phrases with no cross-referenced codes. Screen shall be a minimum of 5 inches x 4 inches (132mm x 99mm).
   b. Thermal printer to provide record of all cycle data.

3. Non-Operating End Control Panel (in double-door units):
   a. Touch-sensitive screen with graphic display area, showing same messages as operating end display.

G. Construction:

1. Shell assembly: Double walled, insulated, Type 316L stainless steel, all welded sterilizer vessel. Shielded steam entry inside chamber.
   a. End Frame(s): Type 316L stainless steel, welded to door end.
   b. Vessel: ASME rated at 45 psig (3.1bar).
   c. Baffle: Shield steam supply opening inside chamber by a Type 316L stainless steel baffle.
   d. Hinged front cabinet panel to access sterilizer piping and control board housing.
   e. Equipment Stand: Support sterilizers on height-adjustable stainless or carbon-steel stand, shop-coated for corrosion protection.
   f. Door assembly: Type 316L stainless steel, insulated. Provide safety lock to prevent door opening when chamber pressure exceeds 2 psi (14kPa).
      1) Door shall have replaceable, one-piece, compressed air-activated polymer gasket. Upon completion of cycle, gasket shall retract under vacuum into a machined groove in the end frame of the sterilizer.
      2) Hinge Door (26 inch x 37 ½ inch chamber) (660mm x 953mm chamber): Manually operated, 60 degree turn door handle actuation required to lock or unlock door.
2. Insulation: 1 inch (2mm) thick, fiberglass insulation sleeve, sealed and held in place with hook-and-loop-type closures. Insulation shall be asbestos- and chloride-free, silicone impregnated, oil- and water-resistant.

3. Piping, Valves, Switches, and Gauges: Brass, including steam strainer, shutoff valve, and brass pressure regulator.
   a. All valves shall be non-proprietary.
   b. Solenoid valves with DIN connectors, air operated, or piston valves located in manifold.
   c. All piping connections shall terminate within the confines of the sterilizer.
   d. Manual Steam Shutoff: Pressure-rated at 125 psig (862kPa) for saturated steam. Valve handles shall be low heat conducting-type.
   e. Pressure Reducing Valves (PRV): Provide pressure reducing valves to reduce incoming steam, water and compressed air to manufacturer-recommend operating pressures.
   g. Safety Relief Valve: Provide ASME-certified and labeled safety relief valve (SRV) to protect vessel, jacket, and heat exchanger (where applicable), from pressure build-up beyond the equipment’s maximum rated pressure. Coordinate relief valve discharge with Mechanical installer for vent piping to the exterior of the building. Manufacturer shall pipe multiple steam safety relief valves on a unit to a single point for field connection.
   h. Pressure gauges shall be in a location visible to the operator.
   i. Steam Valve Interlock: Provide steam valve interlock to prevent steam valve from opening when door is open.
   j. Pressure Interlock: Provide pressure interlock to prevent opening of door when the unit is above or below atmospheric pressure.
   k. Chamber Float Switch Alarms: Provide with chamber float switch to indicate alarm that water is in chamber.
   l. Check Valves: Provide check valves on water feed piping.

4. Electrical Connections:
   a. Provide lighted DIN Connectors.
   b. All electrical connections shall terminate within the confines of the sterilizer.

5. Vacuum System: Provide a vacuum system that is energy efficient with water conservation features. System shall utilize a pump in lieu of a water ejector in order to reduce the overall consumption of the sterilizer including condenser requirements.
   a. Manufacturer shall submit documented experience in the design and operation of such system with references.
   b. Vacuum system shall not be affected by fluctuations in water pressure or water temperature being fed to the pump for use in attaining vacuum.
   c. Water conservation must reduce the overall consumption of the sterilizer by 50%, or more, as compared to a liquid ring vacuum pump and separate condenser design.
   d. Vacuum system shall be sized to attain 28 inches of Hg vacuum in under 5 minutes.
   e. Chilled water shall not be a requirement for the vacuum system in order to ensure peak performance on a year-round basis.

H. Features:
1. Resistance Temperature Detectors (RTD): Installed in chamber drain line and chamber jacket to sense and control temperature variations within the chamber.
2. Jacket Temperature Control: Separate jacket RTD installed in the jacket drain line to allow control of jacket temperature, for optimal cycle performance.
3. Steam Bleed: Constant steam flow supplied across chamber RTD to assure even temperature distribution and temperature control.
4. Steam Purge: To assist in air removal and to preheat load.
5. RS-232 Interface Port: For downloading cycle information to user-furnished data acquisition system.
6. Electronic Water Saving Control: To control the amount of water used in condensing exhausted chamber steam.
7. Optimal Solution Cooling: To safely cool various liquids in vented, borosilicate glass containers with minimum liquid loss due to boil-over, and to keep normal evaporation loss below 5 percent.
8. Automatic Steam Shutoff to Jacket: For liquid cycles; to allow operation of cycles at lower temperatures and more efficient load cooling.
10. Control Lockout Switch: Limit switch on chamber door to prevent cycle from starting unless door seal is tight against the door.
11. Chamber Drain System: To prevent pollutants from entering into the water supply system and sterilizer. Automatic stainless steel plate-type condensing system to convert chamber steam to condensate and to dispose it to waste. Provide non-clogging chamber drain line.
13. Effluent Temperature Control System: System shall not discharge effluent until it has cooled to less than 140 degrees F (60 °C).
14. RTD Load Probe and F0 Sterilization: To measure load temperature during processing; allows control system to start and terminate cycles based on recorded data.
15. Exterior Enclosure: Type 304 stainless steel side and rear panels with louvered stainless steel top panel with No. 3 finish to enclose sterilizer body and piping for freestanding units or where extends into finished space.
16. Seismic Tie Down Kit: Designed and selected to meet jurisdictional seismic codes.
17. Utility Requirements: Refer to Laboratory Equipment Schedule.

I. Accessories required:
   1. Thermocouple Feed-Through Assembly: Tri-clamp chamber penetration allowing a minimum 12 thermocouple feed through assembly into the chamber.
   2. Loading cart, transfer carriage, and chamber track assembly.

2.6 LABORATORY STERILIZER (AUTOCLAVE): BULK (E-5)

A. Description: Large chamber sterilizer using steam under pressure as the sterilizing agent; designed for sterilization of certain materials used in laboratories and research facilities.
B. Basis of Design: Steris Life Sciences Research (LSR) Steam Sterilizer, as specified herein.
C. Chamber Size (nominal):
   1. Chamber size: 37 inches x 85 inches x 85 inches (950mm x 2150mm x 2150mm), nominal.
D. Configuration:
   1. Steam source: Building steam. Sterilizer shall connect to a single point of connection to building steam.
   2. Doors/installation: Double doors, recessed through two walls.
   3. Pit-mounted.
   4. Arrangement: Arrange chamber and service/equipment space as indicated on the drawings.
5. Prevacuum process is for the sterilization of porous and non-porous heat- and moisture-stable goods, sterilization of liquids and media in borosilicate glass containers with vented closures, and decontamination of supplies after laboratory procedures. Prevacuum sterilizers shall be equipped with prevacuum, gravity, liquid, leak test, and daily air removal test cycles.

E. Pre-programmed Cycle Descriptions:
2. Liquid Cycle: Provided on prevacuum sterilizers for the sterilization of liquids and media in vented borosilicate glass or metal containers at 212-254 degrees F (100-123° C). Liquid cycle utilizes the optimal solution cooling feature, during exhaust (cooling) phase, to control the exhaust rate.
4. Leak Test Cycle: Provided for verification of chamber integrity. Cycle parameters shall be pre-programmed and fixed. User may use default values or configure specific leak rate test parameters.
5. DART (Daily Air Removal Test or Bowie-Dick) Test Cycle: Provided on prevacuum sterilizers; is used to conduct a Bowie-Dick test on the sterilizer.

F. Control system:
1. Allen-Bradley PLC modular microcomputer control system that monitors and controls all phases of each sterilizing cycle. Controller shall include operator interface and printer, both housed in a stand-alone cabinet. Provide completely programmed and documented control for the unit. Operator-programmable key cycle parameters.
   a. Eighteen-Cycle Capability: Control system shall store a minimum of 18 cycles in memory.
   b. Adjustable cycle values and operation features.
   c. Control system shall be housed within a sealed compartment to protect components from moisture and heat generated during sterilization processes. Provide a cooling fan with filter in the housing compartment to maintain positive pressure within the compartment, keeping components cool and dust-free.
   d. System shall include help screens for programming and troubleshooting alarm conditions.
   e. System shall conduct automatic check on control program and cycle data.
   f. Emergency Stop Button and Door Safety Edge Sensor shall be located at sterilizer door(s), returning values to safe condition and halt cycle processing when activated. After activation, operator shall have ability to abort or continue cycle operation.
   g. Security Access Codes shall provide restricted access of unauthorized users: The following password levels shall be available:
      1) Operator: Permits user to select and start a cycle, acknowledge alarms, view cycle parameters, print reports.
      2) Supervisor: allows user Operator permissions, and ability to edit cycle parameters, edit Proportional Integral Derivative (PID) parameters.
      3) Calibrator: allows user Supervisor permissions, and ability to calibrate instruments.
      4) Service: allows user Calibrator permissions, and ability to view inputs, system diagnosis, activate/deactivate outputs, edit common settings, change date/time.
5) Administrator: allows user Service permissions, and ability to configure user names and edit passwords.

h. Calibration: Provide for all temperature and pressure calibration through the control panel through the operating end touch screen. Control system shall be capable of providing printed record of all calibration data for comparison to current readings.

2. Operator Interface: Provide at operating (load, non-sterile) end, adjacent to the chamber, unless remote location is indicated on drawings.

a. Touch-sensitive color screen with graphic display area. Screen shall display sterilizer functions, alarm conditions, and be used for cycle configuration and initiation. Displayed messages shall be in complete phrases with no cross-referenced codes. Screen shall be a minimum of 5 inches x 4 inches (132mm x 99mm).

b. Thermal printer to provide record of all cycle data.

3. Non-Operating End Control Panel:

a. Touch-sensitive screen with graphic display area, showing same messages as operating end display.

4. Internal Battery: Battery shall be used to back-up all cycle memory for up to ten years. Controller shall require complete restart of cycle upon interruption of power.

G. Construction:

1. Chamber Assembly:

a. Fabricate pressure vessel, including chamber, jacket and doors, to meet ASME requirements for unfired pressure vessels. The vessel shall be stamped, and ASME Form U-1 shall be furnished by the manufacturer.

b. Chamber shall be Type 316L stainless steel, and the jacket shall be Type 304 or 316L stainless steel.

c. Shell and door shall be designed to withstand working pressure of 45 psig (3.1bar).

d. Shell and jacket shall withstand operation from full vacuum to 45 psig (3.1bar).

f. Horizontal Sliding Door: Chamber door(s) shall be of Type 316L stainless steel, insulated with mineral, and have a stainless steel cover. Door(s) shall be electrically- or pneumatically-operated from main control panel button. Provide door sensing device to automatically stop door from closing if an obstruction is detected.

1) Door shall have replaceable, one-piece, compressed air-activated polymer gasket. Upon completion of cycle, gasket shall retract under vacuum into a machined groove in the end frame of the sterilizer.

g. Fascia Panel: Provide Type 304 stainless steel with No.3 finish front fascia panel enclosing sterilizer framework. Provide at both ends of double door units.

h. Insulation: 2 inches (51mm) mineral wool insulation, ASTM 795, sealed and held in place by aluminum sheet metal covering.

2. Piping, Valves, Switches, and Gauges: Process piping for steam and sterile air to chamber and for drain piping up to the first valve shall be Type 316L stainless steel. Piping connections shall terminate within the confines of the sterilizer and shall all be accessible from one side of the unit. All stainless steel piping shall utilize sanitary clamp, threaded, or welded construction. Type 316L stainless steel, air-actuated valves shall be used to control the process. Utility piping and components may be copper, brass, or stainless steel, and may utilize sanitary clamp, threaded, or brazed construction. Sterilizer feedwater piping and valves shall be stainless steel.

a. Utility piping and components may be copper, brass, or stainless steel, and may utilize sanitary clamp, threaded, or brazed construction.

b. All valves shall be non-proprietary.
c. Valves: Air operated, piston, or solenoid valves with lighted DIN located in manifold.
e. Diaphragm Valves: Provide diaphragm valves.
f. Manual Steam Shutoff: Pressure-rated at 125 psig (86kPa) for saturated steam. Valve handles shall be low heat conducting-type.
g. Chamber and jacket pressure gauges shall be mounted in service area. Chamber and jacket pressure shall be referenced on control panel(s).
h. Pressure Reducing Valves (PRV): Provide pressure reducing valves to reduce incoming steam, water and compressed air to manufacturer-recommend operating pressures.
j. Safety Relief Valve: Provide ASME-certified and labeled safety relief valve (SRV) to protect vessel, jacket, and heat exchanger (where applicable), from pressure build-up beyond the equipment’s maximum rated pressure. Coordinate relief valve discharge with Mechanical installer for vent piping to the exterior of the building. Manufacturer shall pipe multiple steam safety relief valves on a unit to a single point for field connection.
k. Pressure gauges shall be in a location visible to the operator.
l. Steam Valve Interlock: Provide steam valve interlock to prevent steam valve from opening when door is open.
m. Pressure Interlock: Provide pressure interlock to prevent opening of door when the unit is above or below atmospheric pressure.
n. Chamber Float Switch Alarms: Provide with chamber float switch to indicate alarm that water is in chamber.
o. Check Valves: Provide check valves on water feed piping.
a. Provide cooling water saving package to reduce water consumption. Initial charge of vacuum pump water shall be cooled and recirculated through a heat exchanger to a break tank, and cool the chamber effluents with a heat exchanger.
b. Air Filter Inlet: Hydrophobic, replaceable with pore size measuring 0.01 micron.

H. Features:
1. Temperature Sensor: Resistive Temperature Device (RTD) to sense and control temperature variations within the chamber and control sterilization process.
2. Jacket Temperature Control: Separate jacket RTD installed in the jacket drain line to allow control of jacket temperature, for optimal cycle performance.
3. Steam Bleed: Steam bleed shall provide constant steam flow supplied across chamber RTD to assure even temperature distribution and temperature control.
4. Steam Purge: To assist in air removal and to preheat load.
5. RS-232 and Ethernet Interface Ports: For downloading cycle information to user-furnished data acquisition system.
6. Chamber Penetration: 2 1/2 inch (63mm) chamber penetration with tri-clamp connectors for validation purposes.
7. Automatic Utilities Startup/Shutdown: To shut off all utility valves, permitting slow cooling of the entire vessel and load. Programmed and manual restart options.
8. Control Lockout Switch: Limit switch on chamber door to prevent cycle from starting unless door seal is tight against the door.
9. Chamber Drain System: To prevent pollutants from entering into the water supply system and sterilizer. Automatic stainless steel plate-type condensing system to convert chamber steam to condensate and to dispose it to waste. Provide non-clogging chamber drain line.
10. Effluent Temperature Control System: System shall not discharge effluent until it has cooled to less than 140 degrees F (60°C).
11. Door Interlocks (Double Door units only): To allow only one door to be opened at a time, and during processing, to prevent both doors from being opened until sterilization cycle is complete.

12. Air Differential Seal (Double Door units only): Air differential seal shall be provided to maintain room air differential pressure; provide on load end of sterilizer. Seal shall be fabricated from Type 304 stainless steel.

13. RTD Load Probe and F₀ Sterilization: To measure load temperature during processing; allows control system to start and terminate cycles based on recorded data.

14. Gasket: Synthetic rubber on sterilizer sub-frame to ensure tight fit between cabinet end panels, and wall partitions, if provided.

15. Seismic Tie-Down Kit: Designed and selected to meet jurisdictional seismic codes.

16. Utility Requirements: Refer to Laboratory Equipment Schedule.

I. Accessories required for each unit:

   1. Loading cart on fixed casters, fabricated of Type 316L, electro-polished stainless steel with removable, adjustable shelves. Provide two half-length carts for chambers greater than 73 inches (1850mm) long.
      a. Provide chamber track located on the floor of the chamber for easier loading of the loading cart
      b. Provide three perforated shelves for loading cart.

2.7 ACCESSORIES

   A. Stainless Steel Trim: Provide Type 304 stainless steel trim for closure of spaces between equipment and adjacent wall surfaces, to provide a neat, uniform appearance. Use attachment methods to securely attach trim without any exposed fasteners. Make all joints in trim flush and hairline, seal minor gaps between trim and wall surface with appropriate sealant. Provide trim for all sterilizers where they penetrate walls.

2.8 MODULAR WALL/EQUIPMENT ENCLOSURE PANELS

   A. Refer to Section 11 53 00.

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Site Conditions:
      1. Prior to installation of steam sterilization equipment, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.
      2. Discrepancies: In the event of discrepancy, immediately notify the Architect.

   B. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirements governing substrate construction prior to start of work.

   C. Verify that surfaces, prepared openings, or support structures are ready to receive work.

   D. Verify field measurements and opening dimensions are as instructed by manufacturer.

   E. Inspect and verify that the required utilities are available, in proper locations and ready for use, prior to equipment installation.
3.2 PREPARATION

A. Coordinate with Divisions 22, 23, and 26 for location, size, and type of mechanical, power and communications services required.

B. Before shipping, equipment shall be cleaned inside and outside, be free of rust, loose scale, and other deposits. Finished surfaces shall be protected to prevent shipping and/or storage damage. All threaded connections, flanges, and couplings shall be protected.

C. Delivery and installation shall be coordinated so that equipment can be positioned in-place prior within the sequence of construction: Contractor shall verify the delivery route through building is adequate for equipment.

D. Equipment to be securely crated and/or packaged to prevent damage during shipment. Loose parts shipped inside of the unit shall be secured.

E. The vendor shall be responsible for delivery of the unit(s) to the job site, setting the equipment in place, unpacking and reassembly.

F. The vendor shall verify that required utilities are available, in proper locations, and ready for use.

G. Beginning of installation means acceptance of existing conditions by the vendor.

H. Upon unpacking of the equipment, the vendor shall remove all debris, crating material and packaging from the location.

3.3 WORK REQUIRED OF OTHER SECTIONS PRIOR TO INSTALLATION

A. Install shutoff valves on service lines.

B. Install fused disconnect switches (with lockout in OFF position) in electric supply lines near the equipment.

C. Provide building service lines supplying specified pressures and flow rates.

D. Provide illumination of service area, with provision of convenience outlet for maintenance.

3.4 INSTALLATION

A. General:
   1. Install all equipment per manufacturer’s printed instructions and the reviewed submittals.
   2. Installation shall be with manufacturer certified, approved, trained, or provided personnel.
   3. Properly align and position all equipment.
   4. Refer to Section 01 45 00 for Quality Control of Installation.
   5. Manufacturer’s Field Services:
      a. Refer to Section 01 45 00.
      b. Provide manufacturer’s field services to supervise installation.
   6. Repair or remove and replace defective Work as directed by the Architect.

3.5 START UP AND TESTING

A. Test, clean, and adjust equipment and apparatus installed to ensure performance meets specified requirements.

B. Operate each unit and test full range of cycles over a continuous period. Record test data.

C. Adjust and re-test any units not meeting requirements.
3.6 SYSTEM VALIDATION
   A. Refer to Section 01 75 00.

3.7 CLEANING
   A. Packaging and debris and other waste resulting from installation of equipment shall be removed.
   B. Clean finished equipment, touch up as required and remove and refinish damaged or soiled areas.
   C. Prior to final acceptance by the customer, any external soiled surfaces shall be cleaned.

3.8 DEMONSTRATION AND INSTRUCTIONS
   A. Refer to Section 01 79 00 for equipment specified in Part 2.
   B. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
   C. Provide demonstration of equipment operation and instruction of Owner's personnel.
   D. Demonstration operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.
   E. Engage services of qualified instructor to instruct and train Owner's operating and maintenance personnel in operation, service, and maintenance of equipment.

3.9 PROTECTION
   A. All equipment shall be protected before, during and after installation. Damage to material due to improper protection shall be cause for rejection.

END OF SECTION
SECTION 12 35 53
LABORATORY CASEWORK AND OTHER FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wood Laboratory Casework and Tables.
   B. Specialty Metal Cabinets
   C. Stainless Steel Laboratory Casework and Tables.
   D. Cabinet Hardware.
   E. Laboratory Work Surfaces.
   F. Shelving Assemblies.
   G. Cylinder Restraint Assemblies.
   H. Overhead Service Carriers.
   I. Laser Shelf.
   J. Drying Rack.
   K. Distillation Rack Assembly.
   L. Task Light Fixtures.
   M. Blackout Curtain and Track Assembly.
   N. Wood Finish Application and Performance Requirements.
   O. Metal Fabrications and Finish Requirements.
   P. Stainless Steel Fabrications:
      1. Work Surfaces.
      2. Laboratory Sinks and Cup Sinks.
   Q. Gowning Bench.
   R. Mop Holder.
   S. Slotted Channel Framing (Strut).
   T. Sealant.
1.02 UNDIVIDED RESPONSIBILITY

A. Unless specified otherwise, because of special coordination requirements, the supplier of the scope of work described in this Section shall also provide the scope of work described in the following Sections:

1. Section 11 53 00 - Laboratory Equipment.
3. Section 11 53 43 - Laboratory Service Fittings and Fixtures.
5. Section 11 53 63 - Laboratory Sterilizers.
6. Section 13 21 14 - Controlled Environment Rooms.

1.03 REFERENCES

A. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:

1. SEFA 2 - Installation.
2. SEFA 3 - Work Surfaces.
3. SEFA 7 - Fixtures.
4. SEFA 8 W - Laboratory Grade Wood Casework.
5. SEFA 8 M – Laboratory Grade Metal Casework.


C. American National Standards Institute:

2. ANSI A208.2-1999 – MDF Plywood.

1.04 SUBMITTALS

A. Submit as specified herein and under provisions of Section 01 33 00.

B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.

1. Provide certification and chain of custody documentation showing that wood based materials came from Forest Stewardship Council certified sources. (LEED MRc7: Certified Wood)
2. Provide documentation from the manufacturer identifying VOC and chemical component limits for all wood glues and sealants. (LEED EQc4: Low-Emitting Materials)
3. Provide documentation from the manufacturer showing that all composite wood products provided do not contain urea-formaldehyde resin. (LEED EQc4: Low-Emitting Materials)

C. 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 reproducibles or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blueline prints are not acceptable.

1. Indicate surface grain directions on wood casework.

D. Submit chain of custody and/or other documentation as required by the Environmental Compliance criteria in this Section. Chain of custody number shall be submitted at time of bid; failure to submit will result in disqualification of bid.
E. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements.

   1. Casework shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.

F. Samples: Accompanying Materials List, submit two (2) samples of each of the following items for Architect's approval:

   1. 4 inch by 4 inch (102mm x 102mm) sample of each laboratory work surface specified.
   2. 3 inch by 5 inch (76mm x 127mm) sample of each available standard paint color, stain with finish, or laminate, as is applicable.
   3. Hardware: pulls, locks, hinges, padlock hasps, label holders, as specified.

G. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service.

H. Informational Submittals:

   1. Statement of Installer Qualifications.
   2. Load Tests: Provide on request, load test results certified by an independent testing laboratory for cabinet box, drawers, doors, suspensions slides, and unit shelving as identified in SEFA 8.
   3. Certificates:
      a. Certify that factory tests specified for mechanical service fixtures have been performed and that products or systems meet or exceed specified requirements.
      b. As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.

1.05 PRODUCT HANDLING

A. Contractor shall schedule the delivery of casework and furnishings when spaces are sufficiently complete so materials can be installed immediately following delivery.

B. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.

C. 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.

1.06 QUALIFICATIONS

A. Work in this section shall be performed by a company having a minimum of eight years documented experience in this type of work and must be the manufacturer with in-house production capability and facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of laboratory furniture and equipment required, 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 equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

B. Casework installers shall be approved in writing by the casework manufacturer for the installation of specified products.
1.07 DESIGN AND PERFORMANCE CRITERIA

A. Dimensions: Cabinets match depth dimensions indicated on the Drawings.

1.08 MOCK-UP:

A. Refer to Section 01 45 00.

B. Provide full size casework installation, complete with cabinets, shelving, hardware, laboratory fittings and fixtures, electrical devices, fume hoods, etc. as indicated in the drawings. Include base as indicated in Finish Schedule.

C. Approved mock-up may be relocated to the project and reinstalled. Scratches, blemishes, dents, holes, etc. resulting from disassembly and reassembly shall not be acceptable.

PART 2 PRODUCTS

2.01 WOOD LABORATORY CASEWORK AND TABLES

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All wood laboratory casework and tables shall be provided by a single manufacturer.

1. Mid Canada Millwork, 78 PHT 52 W, Steinbach, Manitoba, Canada, R5G 1X8, Tel: (877-626-9663, website: http://www.midcanadamillwork.com/index.html
2. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: http://www.kewaunee.com/
3. CIF Lab Solutions, 53 Courtland Avenue, Vaughan, Ontario, Canada L4K 3T2, Tel: 905-738-5821. Website: http://cifsolutions.com
4. Diversified Casework, 300 S Krueger Street, Suring, WI 54174, Tel: 877-348-9663. Website: http://www.diversifiedcasework.com/
5. Substitutions are not permitted.

B. Design Requirements:

1. Door and Drawer Design: Square edged, full flush overlay design with 1/8 inch (3mm) reveal between doors, door to drawer, and drawer to drawer, and 1/16 inch (1.5mm) vertical reveal between doors or drawers and cabinet ends. Provide applied panels in areas such as sink cabinets and knee spaces with apron panels to provide a full flush overlay appearance. To achieve the required tolerances hinges must be mortised into the door side. Wall cabinets with hinged doors shall meet the same tolerances as base cabinets.

2. Casework width and depth dimensions shall be within 1/2 inch (13mm) of dimensions indicated on the drawings.

3. Pulls on doors shall be mounted vertically and on drawers horizontally.

4. All tall storage cabinets to have toe space to match base units.

5. All cabinets shall be rigid, self-supporting units constructed and finished to be suitable for use as stand-alone units or in assembly and to permit future rearrangement without the need for additional parts or finish or field application of finished cabinet sides.

6. Flush interiors: Set cupboard bottom flush with front-end facers. Surface mounted bottoms and offsets caused by front face frames that interfere with ease of cleaning are not acceptable.

7. Widths of drawers in knee opening rails shall not be less than 24 inches (610mm) or the width of the rail whichever is the lesser.
8. Structural Requirements: Work shall conform to the recommended structural requirements and testing of Scientific Equipment and Furniture Association, except as superseded by this specification.

C. Materials:

1. Environmental Compliance:
   a. Environmental Compliance applies to plywood core material only.
   b. Wood Products for Laboratory Casework: All wood products used in the fabrication shall comply with the FSC’s (Forest Stewardship Council’s) Percentage-Based Claims Policy Green Rating System. All wood/fiber products shall come from FSC “certified” sustainable managed forestry sources. The building contractor and/or manufacturer must submit documentation (i.e., “Source of Materials”, Invoices) for lumber products purchased for this project providing that each source of wood product is certified for sustainability contents. The Chain-of Custody Certificate shall be submitted to Architect for approval at time of bid submittal.
      1) Sustainable Managed Forests shall mean forests that are being managed through a professionally administered forestry management plan in which timber growth equals or exceeds harvesting rates in both quality and quantity. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, and fair compensation to the local population.
      2) Chain-of-Custody Certified Manufacturer: Fabricator shall provide documentation (Validation/Certification Number) that provides a system for tracking certified wood from the forest, through each stage of production and distribution, to the point of sale. This tracking system shall provide assurance to the customer that all wood products bearing the Forest Conservation Program Label, is produced from an FSC certified “Well Managed” forest. Manufacturing fall-off shall not enter the solid waste system and/or become a product of landfill space. The customer/buyer shall request a manufacturing audit once the participant signs the Chain-of-Custody contract.
      3) Combining Solid and Chip and Fiber Components in an Assembled Product: Because assembled and chip and fiber products can carry two different percentage claims, there shall be two options for calculating a percentage claim, on an assembled product that uses both types:
         a) The entire product must meet a 70 percent by volume content threshold (FSC Certified Sustainable), or
         b) If the chip and fiber and solid wood components can individually meet their respective threshold by volume or weight, then the assembled product made from these components can carry the FSC label.
      4) Acceptable Certifiers: Certifiers shall be the SmartWood program administered by the Rainforest Alliance or a FSC accredited equivalent.

2. Wood:
   a. Definition of cabinet components by surface visibility:
      1) Exposed Surfaces:
         a) Surfaces exposed when doors and drawers are closed.
         b) Surfaces visible when behind glass doors.
         c) All exterior surfaces of suspended casework.
         d) Interior surfaces of open units, including tops and bottoms of shelves.
         e) Bottoms of cabinets 42 inches (1067mm) or more above finished floor.
         f) Tops of cabinets if less than 78 inches (1981mm) above finished floor, or visible from an upper floor, platform, or staircase after installation.
         g) Front edges of all shelving.
         h) Front rail of web frames.
      2) Semi-exposed surfaces:
a) Surfaces that are visible when solid (opaque) doors are open or drawers are extended, including backs of doors.

b) Bottoms of cabinets 30 inches to 42 inches (762mm to 1067mm) above finished floor.

3) Unexposed surfaces:
   a) Surfaces not normally visible after installation with doors open and drawers extended.
   b) Bottoms of cabinets less than 30 inches (762mm) above finished floor.
   c) Tops of cabinets over 78 inches (1981mm) above finished floor and not visible from an upper level.
   d) Stretchers, blocking, components concealed by drawers.

b. Wood Species and Veneer Cut: Provide materials that are selected and arranged 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.

c. Steamed Beech:
   1) Lumber:
      a) Exposed and semi-exposed: Plain sawn Steamed Beech, AWI QSI Grade I.
      b) Unexposed: Select grade hardwood of a species suitable for the specified purpose.
      c) All lumber shall be clean and free of defects; kiln and air dried to uniform moisture content of 6 percent.
   2) Veneer:
      a) Exposed plywood: Book matched, centered across door and drawer fronts, plain sliced beech, HPVA Grade AA. Thickness: 1/50 inch (0.5mm), minimum.
         (1) Plywood 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.
      b) Semi-Exposed Plywood: Plain sliced beech, HPVA Grade A.
      c) Unexposed Plywood: Plain sliced beech, HPVA Grade 1.

d. Book match and center balance match contiguous casework elevations (sequence matching of elevation not required). All grain shall be vertical. Grain pattern for shelving and exposed tops and bottoms of cabinets shall run with the width of the surface.

e. Hardwood Veneer Plywood Cores
   1) M3 Particleboard (NAF: No Added Urea Formaldehyde):
      a) Description: 3-ply, FSC Certified, 100 percent recycled wood fiber particleboard with no urea formaldehyde added during the manufacturing process.
      b) Formaldehyde Emissions: 0.00 to 0.01 ppm.
      c) Reference Standards: Average density of 47 pounds per cubic foot (689kg/m³), meeting or exceeding ANSI Standard A208.1-1999 M3 PB Standard specifications.
      d) Resin: Panels shall be manufactured with Phenol formaldehyde resin. Resin shall be urea formaldehyde-free and produce no Volatile Organic Compounds (VOC's).
      e) Thickness: 3/4 inch (19mm).
      f) Moisture Content: less than 8 percent.
      g) Modulus of Rupture: 2,393 psf (114kPa).
      h) Modulus of Elasticity: 398,900 psf (19,099kPa).
      i) Internal Bond: 80 psi (551kPa).
      j) Face Screw Holding Strength: 247 lbf (1000N).
      k) Edge Screw Holding Strength: 225 lbf (899N).
      l) Hardness: 500 lbf (2224N).
m) Thickness Tolerance: ±0.005 inches (±0.127mm) from panel average.

n) Flame spread: ASTM E84 Class 3 or C.

2) Veneer Core Hardwood Panel for Cabinet Shelves and Toe Kicks: 9-ply hardwood plywood manufactured in accordance with ANSI/HVPA HP-1 with K+ face veneers, 1 inch (25mm) thick. Product shall consist of FSC certified veneers.

3. Hardboard:
   a. Tempered hardboard designed for strength and moisture resistance, consisting of wood fibers, highly compressed into a hard, dense, 1/4 inch (6mm) thick, homogenous sheet using natural resins and other binders.
   b. Physical Properties:
      1) Average modulus of rupture: 5300 psi (36,540kPa).
      2) Density: 50 to 60 lb/ft³ (800kg/m³ to 960kg/m³).
      3) Tensile strength: 3500 psi (24,100kPa).

4. Glass: Framed glass doors:
   a. 7/32 inch (5.5mm) nominal laminated glass with 0.060 inch (0.15mm) clear vinyl interlayer, ANSI Z97.1, ASTM C1036 or C1048.
   b. Without imperfections or marred surfaces.
   c. Cut or drill to receive hardware.

5. Dowels: 8mm diameter, minimum, hardwood, laterally fluted with chamfered ends.

6. Glue: Type II or Type IIII water resistant glue with gluing done in clamps and jigs.

D. Construction:

1. General:
   a. Each unit shall be complete, with finished, edgebanded sides and bottoms, so that units can be relocated at any subsequent time without requiring field application of finished ends or other such parts.
   b. Knee Space/Opening Panels: Provide 3/4 inch (19mm) panels where indicated and in spaces between base cabinets on Drawings where no cabinet is indicated.
   c. Filler Panels: Provide 3/4 inch (19mm) 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. Maximum filler panel width is 1-1/2 inches (38mm), and should be balanced on each end of wall-to-wall elevations.
   d. Joinery: 32mm doweled joinery system, glued, clamped, and screwed. Dowel spacing shall be in compliance with Architectural Woodwork Institute (AWI) and Woodwork Institute (WI) standards.
   e. Exposed fasteners are not allowed without prior approval of the Architect.

2. Base, Wall, Upper, and Tall Cabinets:
   a. Cabinets Ends/Sides and Exposed Backs: 3/4 inch (19mm) thick hardwood veneer plywood, as specified, with edgeband on front, side and bottom edges. Provide glued dowels or mortise and tenon joints, secured with countersunk screws, for security panels, rails and four rows of shelf support holes.
   b. Cabinet Back, Exposed and Semi-Exposed: 1/4 inch (6mm) veneered MDF plywood, recessed 7/8 inch (22mm) from top, bottom, and sides edges, sealed with hot melt glue around the entire perimeter.
   c. Cabinet Back, Unexposed:
      1) Cupboard unit backs shall be removable one-piece 3/16 inch (4.75mm) hardboard.
      2) Sink base back shall be full half-height construction to allow for plumbing and sink waste connection. Exposed finished back panels, where required, shall be 3/4 inch (19mm) thick.
3) Provide removable split back on drawer cabinets.
4) Vertical Back Rails: 3/4 inch by 3-3/4 inches (19mm x 95mm) hardwood secured to cabinet ends. Provide to rear rail.

d) Shelves: 1 inch (25mm) thick full depth, hardwood veneer core plywood.
   1) Front edge of shelves shall be edgebanded with same wood edgebanding as used on cabinetry.
   2) Exterior adjustable shelves, those not in cabinets, shall be equipped with a ¼ inch (6.35mm) diameter, 2 inch (50.8mm) high anodized aluminum rail at the front of the shelf. Rail lengths shall not exceed 36” (914mm) in nominal length (provide two 24” (609.6mm) long nominal rails for 48’ (1219mm) shelves). Rails shall be fastened to the shelf in a similar manner as wire pulls are fastened to drawers and doors. Stainless steel screws to be accessible from underside of shelf. Press fit rails are acceptable.
   3) All shelves shall be full-depth
   4) Shelf adjustment:
      a) Wall units: All shelves shall be adjustable on 32mm centers.
      b) General purpose tall units: One fixed shelf. All others shall be adjustable on 32mm centers.
   5) Pull-Out Shelves: Cabinet shall be provided with a 3/4 inch (19mm) thick core material shelf, factory-finished to match cabinet interior, screwed directly to the bottom edges of the drawer box. Shelf shall be mounted on a pull-out slide.
      a) Shelf shall be edged with 1/2 inch (12mm) thick hardwood. The back and sub-front are doweled and glued into the sides.

e) Doors and Drawer Heads:
   1) Door and drawer heads shall be 3/4 inch (19mm) thick hardwood veneer plywood with edgeband. Drawer heads shall be screwed to drawer box. Edges shall be slightly eased.
   2) Framed-glazed doors: Hardwood construction, 3/4 inch by 2-3/4 inch (19mm x 70mm) machined to accept glass. Provide extruded vinyl retaining molding on interior designed so glass can be replaced without tools.

3. Base Cabinets:
   a. Cabinet Bottom: 3/4 inch (19mm) thick hardwood veneer plywood as specified. Set flush and join to cabinet end panels. Front and bottom edges shall be edgebanded. Bottoms of suspended units shall be 1 inch (26mm).
   b. Cabinet Base: Each cabinet shall be mounted on four levelers. Shims will not be acceptable. Provide 3/4 inch by 3-3/4 inches (19mm x 95mm) high front hardwood veneer core plywood toe space rail, attached to levelers, forming a 4 inch high by 3 inch (102mm x 76mm) deep toe space. Toe space rail shall be continuous for length of contiguous casework and scribed to floor. Top set resilient base at all exposed casework and all knee spaces to be provided under Division 09.
   c. Cabinet Top: 1 inch by 2-1/4 inches (25mm x 57mm) hardwood horizontal front top and side rails, with 1 inch by 2-1/4 inch (25mm x 57mm) vertical rear top rail, or 3/4 inch (19mm) full hardwood veneer plywood subtop. Secure and glue to cabinet ends.
   d. Drawer construction:
      1) Drawer box back, front and sides shall be of 1/2 inch (13mm) solid birch, 9-ply Veneer Core Panel for Exposed Edge Finish as specified above, with eased top edge, finished as specified elsewhere in this section for Wood Finish Requirements. Sides shall be full height with 1/2 inch (13mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.
      2) Acceptable drawer joinery options:
         a) Dowel: Glued under pressure; 32mm, minimum, dowel spacing to 4 inches (102mm) high, 64mm dowel spacing above 4 inches (102mm).
         b) Lock Joint: Glued and pin nailed.
         c) Dovetail: Multiple dovetail, all four corners.
3) Drawer bottom shall be 6mm white PVC-clad hardboard. Bottom shall be grooved into the 4 sided drawer box and sealed with hot melt glue process around entire drawer bottom perimeter. Tempered hardboard not allowed.

4) Drawer interior grooved for future drawer divider system.

e. Flush Panels: Provide 3/4 inch (19mm) fixed flush panels at sink cabinets, opening drawer units, filler panels, and elsewhere, so that all finished panels are in the same plane as cabinet doors and drawers to provide a true flush overlay appearance.

f. Vertical Dividers: Full height dividers shall be 1-1/2 inch (38mm) thick plywood. Edgeband exposed edge.

g. Pullboards: 1 inch (26mm) panel with balanced laminated faces and 1 inch by 1-1/2 inch (26mm x 38mm) hardwood front edge

4. Add-A-Drawer Mobile Base Cabinets

a. Add-A-Drawer Base Cabinets: Cabinets with casters or otherwise noted must incorporate “Add-A-Drawer” design to allow casework to be used in both standing and sitting height configuration and shall be constructed as follows:

b. Base cabinet shall be nominally 31”(750mm) high. Top of the base cabinet shall be plastic laminate (color selected by Architect) with 3/4” (19mm) wide x 1/8” (3 mm) thick edge banding on four sides. Base cabinets shall have a finished 12 gage metal plate across the full bottom face of the cabinet through which casters shall be attached. Interior bolt heads for casters shall be countersunk.

c. Where noted on the drawings, cabinets with casters shall be constructed without toe spaces. The cabinet shall be constructed with a reinforced base capable of supporting a 4" (100mm) high caster assembly in each corner. Casters shall be swivel, locking type on front and swivel, non-locking type on rear, rated for minimum 250 pounds (113.4 KG) load each. Casters shall be equal to Algood Model S5033-SRG, soft rubber wheeled casters. The entire assembly shall be reinforced to permit mobility without twisting and achieve an industry standard height of 31” or 37” (725 mm or 925 mm) including the flush 1” (25 mm) counter top. Casters shall be through-bolted through bottom of cabinet at all four bolts and interior bolt heads shall be countersunk to conceal bolt heads. Allow sufficient clearance between top of cabinet and underside of countertop or apron to facilitate movement. Cabinets with casters shall be completely finished on four sides and top since surfaces are considered exposed. Cabinets shall have a minimum 45 lbs. counterweight in the rear of the cabinet to help prevent tip over of the cabinet.

d. A 6”(150 mm) high, fully enclosed drawer box made same width as cabinet below, shall sit on top of each base cabinet to create a standing height cabinet. Top of the apron shall be plastic laminate (color selected by Architect) with 3/4” (19mm) wide x 1/8” (3 mm) thick edge banding on four sides.

e. Apron shall be aligned with two (2) threaded zinc pins that engage cabinet’s top rail through pre-drilled holes with full diameter threaded zinc metal inserts. In addition (1) camlock mechanism (Hafele #261059902/993/984) shall be located at the rear of the base cabinet to lock the add-a-drawer apron to the cabinet. No exceptions to this product will be allowed.

f. Table height, to top of counter top, shall be set at either 31” or 37” to allow a refrigerator to be installed below. The table shall have a 2” solid apron front and 7” solid apron on sides and back.

g. Drawer units must be equipped with a drawer interlock mechanism so that only one drawer in a vertical stack can be opened at one time. Interlock unit shall be integral part of the drawer slide unit equal to Acuride Model 3641 and companion slide Model 3642. Drawer units shall have a minimum 45 lbs. counterweight in the rear of the unit to help prevent tip over of the cabinet.

h. All mobile file-type cabinets (denoted on Drawings as MBL_K) shall have lockable drawers operated from one cylinder.

i. All mobile cabinets to have 4mm edgeband on bottom of side and back panels to resist moisture infiltration.
5. Wall, upper and tall cases:
   a. Cabinet Top: 1 inch (25mm) thick hardwood veneer plywood with front edge edgebanded.
   b. Cabinet Bottom:
      1) Wall and Upper Cabinets: 1 inch (25mm) thick hardwood veneer plywood with 5mm front edge edgeband top and bottom and 3mm edgeband on the sides.
      2) Tall Cabinets: Tall case hardwood veneer plywood bottoms 3/4 inch (19mm) thick with 5mm front edge edgeband and bottom and 3mm edgeband on the sides. Bottom hardwood kick rail on tall cases to match height of base cabinets, joined to cabinet sides with dowels or mortised and tenoned. Stained and finished to match exposed surfaces.

6. Wood-Framed Laboratory Tables
   a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
   b. Movable tables shall be constructed as indicated on the Drawings.
   c. Movable tables shall have 2" solid apron front and 7" solid apron on sides and back. It shall have 1" x 1" (25mm x25mm) tubular stainless steel telescoping legs drilled at 1inch (25mm) increments inside a 2-1/2inch square wood leg lined with a plastic tube for the adjustable leg to slide in. Provide a stainless steel 3/8-16 thread stainless steel machined nut and 2-1/4inch long stainless steel slot flat head screw in each leg. Each leg shall be fitted with a 1-1/2” diameter adjustable non-marring floor glides with 1” micro-adjustment capability complete with grater clip and 3/8-16 thread hex lock nut.
   d. Moveable tables shall have the ability to be adjusted in height from 30" to 37" (750mm to 939.8mm) in 1” (25mm) increments inclusive of 1” (25 mm) thick counter top.
   e. Movable tables shall be installed at height indicated on Drawings. Fixed wood section of leg shall be set at height appropriate for a 30” high table top. Coordinate the under-counter clearance with casework and refrigerators.
   f. Movable tables shall be reinforced with a deep welded steel channel frame and corner brackets appropriate for the load bearing requirements and concealed by wood elements. Load capacity of tables shall be 1,000 lb. (453.6kg) uniformly loaded and support a 250 lb. (113.4kg) concentrated load at mid-space with deflection not to exceed 1/8” (3.18mm).
   g. Vibration absorbing isolation: Provide a continuous wide bead of clear sealant to the top of all supporting rails. Allow complete cure before attachment of the work surface.
   h. Electrical receptacles: Where indicated on the Laboratory Electrical drawings provide cutouts for electrical receptacles as work of this Section and coordinate with Division 26.
   i. Cord and plug shall be provided under the work of Division 26.
   j. Table Drawers: Where indicated on the drawings, provide front and back rails; drawer unit, hardware and suspension same as specified for casework base unit drawers.
   k. Low level shelf: If shown on Laboratory Furnishing drawings shall be of 1 inch (25mm) hardwood veneer core plywood with face veneers to match table frame finish.
   l. For microscope tables as designated on plans, provide a continuous wide bead of clear sealant to the top of all supporting rails. Allow complete cure before attachment of the work surface.
7. Apron drawers: Where indicated on the Laboratory Furnishing drawings, provide support rails; drawer unit, hardware and suspension as specified for base unit drawers. Widths of drawers in knee opening rails shall not be less than 24 inches (600mm) or the width of the rail whichever is the lesser.
   a. Width of drawer heads shall match width of knee opening in flush overlay applications

E. Hardware: As specified elsewhere in this Section.
F. Wood Finish: Refer to Wood Finish Application and Performance Requirements elsewhere in this Section.

2.02 SPECIALTY CABINETS

1. Fume Hood Cabinets: Purpose-designed wood cabinet with fixed panel above door to conceal cup sink and plumbing. Construction shall match other wood cabinets.

2. Corrosives Storage Cabinets:
   a. Purpose-designed wood cabinet completely lined with a polypropylene liner with sealed or seamless intersections between panels.
      1) Construction shall match other wood cabinets.
      2) Provide 5-knuckle stainless steel hinge.
   b. Shelf: Removable, polypropylene shelf.
   c. 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.
   d. Locks: Provide key locks for cabinet doors.
   e. Venting:
      1) Cabinets below or adjacent to fume hoods: Provide and install 2 inch (51mm) polypropylene vent pipe to extend 4 inches (102mm) above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant.
      2) Cabinets not below or adjacent to fume hoods: Provide and install 2 inch (51mm) polypropylene vent pipe to run horizontally in the chase space behind the casework to nearest pipe drop enclosure and rise vertically to 6 inches (153mm) above ceiling level. Connection to exhaust duct system shall be by Division 23.
   f. Provide hole through fume hood work surface above the corrosives storage cabinet to accommodate 2 inch (51mm) diameter vent pipe.

3. Flammable Liquid/Solvent Storage Cabinets:
   a. Purpose-designed wood cabinet for the storage of flammable, combustible and solvent liquids. Cabinet shall be similar to other wood casework, with exceptions as noted herein.
   b. Panel Thickness: Cabinet bottom, top, door(s), back and sides shall be 1 inch (26mm) thick veneer core plywood. All joints shall be rabbetted and shall be fastened in two directions with wood screws into hardwood blocking from the interior of the cabinet, or as tested and approved by independent testing agency.
   c. Cabinet shall have gaskets to receive door(s) and a keyed astragal, for two door units, to seal the cabinet interior.
   d. Floor pan: Provide a 2 inch (51mm) deep, removable, powder coated steel, liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
   e. Cabinet Back: Back panel shall be removable.
   f. Cabinet Doors:
      2) Door design shall be inset overlay to create a tight (near airtight) seal around face of cabinet when closed. Door(s) shall have edgeband.
      3) Hinges: Provide 5-knuckle stainless steel hinge.
      4) Door sill shall be raised at least 2 inches (51mm) above cabinet bottom to retain spills within the cabinet.
      5) For cabinets with more than one door, doors shall by not less than 5/8 inch (16mm).
   g. Label: "FLAMMABLE - KEEP FIRE AWAY" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match that of the Corrosives Storage Cabinet label.
   h. Locks: Provide key locks for cabinet doors.
   i. Shelves: Provide adjustable 3/4 inch (19mm) veneer plywood shelf (shelves).
j. Casters: Provide cabinets with locking casters where indicated on the Laboratory Furnishing drawings or specifications and as specified under Cabinet Hardware.

k. Standards:
   1) Cabinet shall be in compliance with the requirements of:
      a) OSHA: 29 CFR 1910.106
   2) Cabinets shall be Underwriters Laboratories (UL) Listed.

l. Flammable liquid/solvent storage cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.

m. Electrical grounding:
   1) Provide each flammable liquid/solvent storage cabinet with an externally mounted grounding conductor screw terminal for up to #8 AWG conductor, mounted at the top of the cabinet.
   2) Connection from the equipment grounding bus at the lab branch circuit panel to the storage cabinet terminal shall be by Division 26.

4. Vacuum Pump Cabinets:
   a. Purpose-designed cabinet with interior top, sides, rear, and door lined with sound absorbing material. Provide louver in door for airflow.
      1) Cabinet shall be provided with a 1/2 inch (13mm) inch solid phenolic (Trespa Athlon, Pionite Thick Phenolic Core, or approved substitution) shelf with 1/2 inch by 1 inch (13mm x 25mm) high shelf edge to contain spills. Shelf shall be mounted on a pull-out slide.
      2) Sound Absorbing Material: Closed-cell soundproofing foam.
         a) Thickness: 1 inch (25mm) flat sheet.
         b) Insulating mat shall be fire retardant, mold resistant, and designed to block and absorb sound. Material shall be HCFC- and CFC-free.
         c) Color: Black.
      3) Pull out slides shall be mounted to 2 inch by 1-1/2 inch by 3/16 inch (51mm x 38mm x 4.76mm) steel angle that is mounted on neoprene vibration mounts secured to the cabinet bottom.
   4) Vibration Mount:
      a) Manufacturers: Products complying with this specification may be provided by the following manufacturers.
         (2) M. W. Saussé & Co. Inc. 25590 Avenue Stanford, Valencia, CA 91355 Tel: 661 257-3311. website: http://www.mwsausse.com/
         (3) California Dynamics Corporation, 5572 Alhambra Avenue, Los Angeles, CA 90032 Tel: 323 223-3882. website: http://www.caldyn.com/
         (4) Substitutions are permitted subject to Section 01 63 00.
      b) Description: Double deflection neoprene mount to prevent noise and high frequency vibration. All metal surfaces shall be neoprene-covered to prevent corrosion. Mount shall have friction pads, top and bottom and be provided with bolt holes on the bottom and cap screw and washer on top: Mason Industries Type ND-A-Black, or equal.
   b. Electrical: Provide NEMA 5-20R receptacle mounted to inside back of cabinet and activated by a remote pilot light toggle switch with stainless cover plate mounted on front blank panel of cabinet. Switch shall be hard wired to receptacle. Power to cabinet shall be provide under Electrical scope of work.
   c. Venting: Cabinets below or adjacent to fume hoods:
      1) Provide and install 2 inch (51mm) polyolefin or polypropylene vent pipe to extend 2 inches (51mm) above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant. In cabinet, pipe shall terminate with open end.
Also within cabinet, pipe shall have a 1 inch (25.4mm) ‘tee’ for connection pump discharge connection by Owner and a drip leg with threaded cap. Provide flange to secure pipe to cabinet.

(4) Substitutions are permitted subject to Section 01 63 00.
   a) Dimensions: 6-3/4 inches by 6 inches by 1-1/2 inches (172mm x 150mm x 38mm), nominal.
   b) Power: 115V/60Hz.
   c) Airflow: 212 cfm (100l/s), nominal.
   d. Top of cabinet and work surface shall be drilled and furnished with a 1-1/2 inch (38mm) diameter black polyolefin or polypropylene sleeve from work surface into cabinet for vacuum hoses, connecting Owner-furnished vacuum pump to Owner-furnished equipment. Hoses shall be provided by Owner. Provide flange to secure pipe in work surface and bushing to terminate piping.

2.03 STAINLESS STEEL LABORATORY CASEWORK AND TABLES

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All stainless steel laboratory casework and tables shall be provided by a single manufacturer.

1. Stainless Steel Laboratory Casework:
   a. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241, Tel: 920 793-1121. website: http://www.hamiltonlab.com/
   b. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. – website: http://www.alc-corp.com
   c. BEDCOLAB, 2305 Francis Hughes, Laval, Quebec, Canada, H7S 1N5, Tel: (514) 384-2820 website: http://bedcolab.com/home.html
   d. Mid Canada Millwork, 78 PHT 52 W, Steinbach, Manitoba, Canada, R5G 1X8, Tel: (877) 626-9663. website: http://www.midcanadamillwork.com/index.html
   e. Substitutions are not permitted.

2. Stainless Steel Corrosives and Flammable Liquid/Solvent Storage Cabinets:
   a. Manufacturers of metal laboratory casework.
   c. Eagle Manufacturing Company, 2400 Charles St., Wellsburg, WV 26070 Tel: 304 737-3171. website: http://www.eagle-mfg.com/
   d. Substitutions are not permitted.

B. Design Requirements:

1. Door and drawer front design: Square edged, inset door and drawer flush front construction with all front surfaces above the toe space in the same plane. Front width of end panels shall be 3/4 inch (19mm) and front height of top and bottom members shall be 1 inch (25mm).

2. Pulls on doors shall be mounted vertically and on drawers horizontally.

3. All tall cases shall be provided with toe space to match base units.

4. 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.

5. Widths of drawers in knee opening rails shall not be less than 24 inches (610mm) or the width of the rail whichever is the lesser.

6. Structural Requirements: Work shall conform to the recommended structural requirements and testing of Scientific Equipment and Furniture Association, except as superseded by this specification.
   a. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for the disabled.
Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment. Anchor attachment shall not void UL listing.

C. Materials:
   1. In general, all materials shall be the best of their respective kinds for the intended purpose.
   2. Stainless sheet steel: Type 304, with exposed surfaces ground and polished to a No. 4 satin finish.
   3. Minimum sheet metal thickness: 18 gauge (1.3mm), except as follows:
      a. 20 gauge (1.0mm thick): Solid door interior panels, drawer fronts, scribe strips, filler panels, enclosures, drawer bodies, shelves, security panels, and sloping tops.
      b. 16 gauge (1.6mm thick): Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
      c. 14 gauge (2.0mm thick): Drawer suspensions, door and case hinge reinforcements, and front corner reinforcements.
      d. 12 gauge (2.8mm): Table leg corner brackets and gussets for leveling screws.
   4. Glass: Framed glass doors:
      a. 7/32 inch (5.5mm) nominal laminated glass with 0.060 inch (0.15mm) clear vinyl interlayer, ANSI Z97.1, ASTM C1036 or C1048.
      b. Without imperfections or marred surfaces.
      c. Cut or drill to receive hardware.

D. Construction:
   1. General:
      a. 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.
      b. Exterior corners: shall be spot and arc welded with gussets at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
      c. Units less than 49 inches (1245mm) tall: Provide internal reinforcing and rear posts for end panels and cabinet backs.
      d. Units 49 inches (1245mm) tall and greater: Provide formed end panels with front and rear reinforcing posts. Back shall be formed steel panel, recessed 3/4 inch for mounting purposes.
      e. Posts: Front post fully closed with full height reinforcing upright to facilitate cleaning.
      f. Shelf adjustment posts shall be perfectly aligned for level setting, with holes for shelf adjustment at 1/2 inch (12.7mm) on center.
      g. The front edge shall be formed to provide a strike for doors and drawers, and shall be pre-drilled for intermediate rails and hinge screws.
      h. Intermediate Vertical Uprights: shall be furnished to enclose cabinets when used in a unit in combination with a half width bank of drawers. However, to allow storage of large or bulky objects, no upright of any type shall be used at the center of double door cupboard units.
      i. End Uprights shall be formed into not less than a channel formation at top, bottom, back and front.
      j. An upright filler shall be screwed in place in all cupboard units to close the back of the channel at front of the upright and to provide a smooth interior for the cupboard to facilitate cleaning.
      k. The upright filler shall be perforated with shelf adjustment holes at no more than 1/2 inch (12.7mm) centers.
      l. The inside front of the upright shall be further reinforced with a full height 14 gauge (2.0mm thick) hinge reinforcement angle.
      m. Wall and Tall Case Top: One-piece, with front edge formed into front rail.
      n. 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. When wall hung cabinets are installed to ceiling, provide continuous metal filler between top of cabinet and ceiling, to permit door to swing clear of ceiling.

Exposed fasteners are not allowed without prior approval of the Architect.

2. Base, Wall, Upper, and Tall Cabinets:
   a. Cabinet Base:
      1) Case bottom and bottom rail shall be formed of one piece of metal except in corner units and shall have both sides and back formed up or down and shall be rabbeted in front for drawers and swinging doors.
      2) Toe Space Rail: Provide 3 inches (76mm) deep and 4 inches (102mm) high formed steel base with corner gussets. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend back 4-1/2 inches (115mm). Provide 3/8 inch (9.5mm) diameter leveling screw with integral bottom flange of minimum 0.56 in² (3.6 cm²) area at each corner, accessible through openings in toe space.
   b. Removable Cabinet Back, Unexposed: Cabinet back shall consist of a top and bottom rail, channel formed for maximum strength and welded to back and top flange of end uprights, with space between left open for access to plumbing lines. All units shall be provided with removable back panels.
   c. Knee Space Service Strip Cover Panels where specified, shall be 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.
   d. Shelves: shall be full depth formed down 3/4 inch (19mm), back 7/8 inch (22mm) and up 1/4 inch (6mm) at front and rear and formed down at ends 3/4 inch (19mm). Shelves over 36 inches (914mm) in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable.
      1) Pull-Out Shelves: Provide pull-out shelves in cabinet or locations indicated.
   e. Doors and Drawer Heads:
      1) Doors: Doors shall be readily removable and hinges easily replaceable. Hinges shall be applied to the case and door with screws. Welding of hinges to either case or door will not be acceptable.
      2) Door and Drawer Heads (metal): shall be a two-piece sheet steel assembly of 3/4 inch (19mm) overall thickness to consist of an inner pan formed as an extension of the drawer body, an outer pan having a channel formation on all four sides welded and ground to eliminate exposure of sharp raw edges, and the interior space filled with a non-organic sound deadening material at the time of assembly. Welds shall be ground smooth. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
      3) Framed Glazed Doors: Framed glazed door construction shall match construction and quality of solid panel doors. Inner head shall include top, bottom, and side framing members which are removable for installation and replacement of glass. Continuous vinyl retainer shall be provided to receive glass.
      4) Framed Sliding Doors: Design for tilt-out removal after removal of bottom guide. Doors shall be hung with nylon-tired sleeve bearing rollers in formed steel top track and shall close against rubber bumpers.
      5) Unframed Sliding Glass Doors: Glass with ground edges shall be set in extruded aluminum shoe with integral pulls, wheel assemblies and top and bottom extruded aluminum track. Provide rubber bumpers at fully opened and closed door position.
   f. 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 1/2 inch (13mm) clearance to frame opening. Drawers shall be a minimum of 18 inches front to back.

2) Drawer stops shall be provided to insure smooth, quiet operation at point of contact with cabinet front.

g. Rails:
1) Top Horizontal Rail: Provide on base units 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.

2) Intermediate Rails: Provide such that rail 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.

h. Security Panels: Provide security panels where keyed different locks are specified.

3. Stainless Steel-Framed Laboratory Tables
a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.

b. Vibration absorbing isolation: Provide a continuous wide bead of clear sealant to the top of all supporting rails. Allow complete cure before attachment of the work surface.

c. Casters: Where indicated on Laboratory Furnishing drawings or specifications, as specified under Cabinet Hardware.

d. Table Drawers: Where indicated on the drawings, provide front and back rails; drawer unit, hardware and suspension same as specified for casework base unit drawers.

e. Aprons and Rails: Not less than 1-1/2 inch by 4-1/2 inch 16 gauge (38mm x 114mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment. Provide 1-1/2 inch2 inch 16 gauge (38mm x 52mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment, where no drawers are required.

f. Legs: Not less than 2 inch2 inch 16 gauge (50mm x 50mm x 1.6mm) square tubular stainless steel sections with welded leg brackets.

1) Table legs shall be telescoping to allow vertical height adjustment of work surface from 30 inches to 36 inches (762mm to 914mm) above finished floor.

g. Leg rails and spreader rail: Not less than 1-1/4 inch by 2-1/2 inch 16 gauge (32mm x 63mm x 1.6mm) steel sections, reinforced as necessary for leg attachment.

h. Low level shelf: If shown on Laboratory Furnishing drawings shall be of 20 gauge (1.0mm thick) stainless steel sheet with perimeters formed

4. Apron: Not less than 1-1/2 inch by 4-1/2 inch by 16 gauge (38mm x 114mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg or panel attachment. Provide 1-1/2 inch by 2 inch by 16 gauge (38mm x 52mm x 1.6mm) channel stainless steel sections, reinforced as necessary for leg attachment, below work surfaces set at 32 inches (819mm) above finished floor, or less.

5. Corner Base Guards: 4 inch (102mm) high Type 304 stainless steel corner guards with No. 4 finish.

6. Stainless Steel Fume Hood Cabinets: Purpose-designed stainless steel cabinet with fixed panel above door to conceal cup sink and plumbing.

7. Stainless Steel Corrosives Storage Cabinets:
  a. Purpose-designed stainless steel cabinet completely lined with a polypropylene liner with sealed or seamless intersections between the panels.

  b. Shelf: Removable, polypropylene shelf.
c. 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.
d. Locks: Provide key locks for cabinet doors.
e. Venting:
   1) Cabinets below or adjacent to fume hoods: Provide and install 2 inch (51mm) polypropylene vent pipe to extend 4 inches (102mm) above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant.
   2) Cabinets not below or adjacent to fume hoods: Provide and install 2 inch (51mm) polypropylene vent pipe to run horizontally in the chase space behind the casework to nearest pipe drop enclosure and rise vertically to 6 inches (153mm) above ceiling level. Connection to exhaust duct system shall be by Division 23.
f. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for the disabled. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment.

8. Flammable Liquid/Solvent Storage Cabinets:
a. Purpose-designed double-walled metal cabinet for the storage of flammable, combustible and solvent liquids.
b. Cabinet doors: Well fitting, self-closing and self-latching
c. Label: "FLAMMABLE - KEEP FIRE AWAY" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match that of the Corrosives Storage Cabinet label.
d. Locks: Provide key locks for cabinet doors.
e. Floor pan: Provide a 2 inch (51mm) deep liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
f. Shelves: Provide heavy-duty shelf (shelves) with reinforced edges and underside.
g. Standards:
   1) Cabinet shall be in compliance with the requirements of:
      a) OSHA: 29 CFR 1910.106
   2) Cabinets shall be Factory Mutual (FM) Approved or Underwriters Laboratories (UL) Listed.
h. Flammable liquid/solvent storage cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.
i. Electrical grounding:
   1) Provide each flammable liquid/solvent storage cabinet with an externally mounted grounding conductor screw terminal for up to #8 AWG conductor, mounted at the top of the cabinet.
   2) Connection from the equipment grounding bus at the lab branch circuit panel to the storage cabinet terminal shall be by Division 26.
j. Seismic Anchor: Provide seismic anchor for freestanding cabinets and cabinets located below fume hoods designated to be removable for access for the disabled. Seismic anchors may be floor or wall attachments, but shall not attach to adjacent casework or work surfaces. Seismic anchors shall be accessible without removal of laboratory casework, furnishings, or equipment. Anchor attachment shall not void UL listing.

2.04 CABINET HARDWARE

A. General: Special metal cabinets, such as corrosives storage, flammable liquid and solvent storage, rock storage, map storage, museum storage, radioisotope storage, and narcotics
locker, may be provided with the manufacturer’s standard hardware, except that all door and drawer pulls shall match, regardless of type of casework, except for polypropylene casework.

B. Hinges:

1. 3-Knuckle Hinges:
   a. Manufacturers:
      1) Richelieu Hardware Ltd., 1-800-619-5446
      2) Substitutions are not permitted.
   2. 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 (1219mm) high; three hinges for doors over 48 inches (1219mm) high.
   3. Type: 3-knuckle hinge assembly Richelieu MB-20 series #’s 200180, & 581180. To achieve the required tolerances hinges must be mortised into the door side. Wall cabinets with hinged doors shall meet the same tolerances as base cabinets.

C. Shelving Standards and Clips:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Knape & Vogt Manufacturing Co., 2700 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616 459-7620.
   b. Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232, Tel: 718 499-9422.
   c. The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
   d. Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746, Tel: 310 329-6373.
   e. Bainbridge Manufacturing, Inc., P. O. Box 487, 237 W 3rd, Waterville, WA 98858, Tel: 800 255-4702.
   f. Substitutions are permitted subject to Section 01 63 00.
   2. Adjustable shelf supports: Adjustable plastic shelf support with lockdown clips with slotted standard.

D. Ball Bearing Drawer Slides:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 562 903-0200. website: www.accuride.com/
   b. Waterloo Furniture Components Inc., 501 Manitou Dr., Kitchener, Ontario, Canada N2C 1L2, Tel: 519 748-5060.
   c. Fulterer USA, 542 Townsend Ave., High Point, NC 27263, Tel: 800 395-4646.
   d. Substitutions are permitted subject to Section 01 63 00.
   2. Full extension, 100 lb/pr. (45kg/pr.) capacity: Accuride 3832, or equal.
   3. File drawers shall be equipped with rail mounted with overtravel, 150 lb/pr. (68 kg/pr.) capacity: Accuride 4034, or equal.
   4. Pull-out shelf suspension: 100 lb/pr. (45kg/pr.) capacity pull-out shelf slide: Accuride 322, or equal.
   5. Base Metal:

E. Hanging File Suspension System:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
   b. Hettich America L. P., 6225 Shiloh Rd., Alparetta, GA 30005, Tel: 800 438-8424.
c. Substitutions are permitted subject to Section 01 63 00.

2. Blum Metafile, Hettich MultiTech Hanging File Frame Kit, or equal. File hangers shall be fastened and secured to drawer construction and shall not be freestanding units set inside the drawer. Provide in all file drawers.

F. Sliding Door Hardware:

1. Framed Glass and Solid Doors:
   a. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
      1) Hettich America L. P., 6225 Shiloh Rd., Alparetta, GA 30005, Tel: 800 438-8424.
      2) Substitutions are permitted subject to Section 01 63 00.
   b. Sliding framed glazed doors shall have extruded aluminum track with top hung nylon rollers. Hardware shall be designed so doors cannot ‘jump’ track. Rocker arm carriers shall insure constant track contact: Hettich (Grant) 73-034, or equal.

G. Locks:

1. Swinging Doors and Drawers:
   a. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
      1) National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662, Tel: 864-297-6655.
      2) Illinois Lock Company, 301 West Hintz Rd., Wheeling, IL 60090, Tel: 847 537-1800.
      3) Substitutions are permitted subject to Section 01 63 00.
   b. Sliding Doors:
      a. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
         1) National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662, Tel: 864-297-6655.
         2) Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746, Tel: 310 329-6373.
         3) The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
         4) Substitutions are permitted subject to Section 01 63 00.
   2. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings. Provide chain bolts 3 inches (75mm) long, with an 18 inch (450mm) pull and an angle strike to secure inactive door on cabinets over 72 inches (1829mm) in height. Five (5) or eight (8) tumbler locks are acceptable. Locks shall have be provided with removable cores and stamped with identifying numbers. Locks shall have satin nickel or satin chrome finish.
   3. Keys: Stamped brass keys available from manufacturer or locksmith and supplied in the following quantities, unless otherwise specified:
      a. Provide two (2) keys for each different lock.
      b. Provide three (3) keys for each group keyed alike locks.
      c. Provide two (2) keys for each master key system.
   4. Keying: Keyed differently with up to 2000 primary key changes. Master key one level with built in flexibility to accommodate, if required, three levels, one grandmaster, 59 master groups, and 70 sub-master groups with 13 primary changes under each.
   6. Framed sliding door locks shall be plunger type.

H. Roller Catch:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
a. The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
b. Amerock, 6350 Stevens Forest Road, Suite 200, Columbia, MD 21046, Tel: 800 435 6959.
c. Ives, 2720 Tobey Drive, Indianapolis, IN 46219, Tel: 877 613-8766.
d. Substitutions are permitted subject to Section 01 63 00.

2. Roller Catches: Roller catches shall be adjustable, spring-loaded polyethylene roller with a steel strike plate.

I. Elbow Catch:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. The Engineered Products Company (Epco), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
   b. Substitutions are permitted subject to Section 01 63 00.

2. Heavy-duty, adjustable, spring-type elbow catch and strike plate shall be used on left hand doors of double door cases and shall be brass or steel with bright chrome finish.

J. Levelers:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
   b. Camar, distributed by Peter Meier Inc., 1255 South Park Drive, Kernersville, NC 27284, Tel: 336 996-7774.
   c. Häfele America Co., 3901 Cheyenne Drive, Archdale, NC 27263, Tel: 800 423-3531.
   d. Hettich America LLP, 6225 Shiloh Road, Alpharetta, GA 30005 Tel: 770 887-3733.
   e. Substitutions are permitted subject to Section 01 63 00.

2. Provide levelers consisting of sockets and levelers rated at 330 lbs (150kg), minimum capacity. Provide a minimum of four levelers per cabinet. Levelers shall be accessible through a hole in bottom of cabinet. Provide plastic cap for each leveler hole. Provide clip or other hardware for attachment of toe kick.

K. Casters:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   a. Algood Casters Limited, 605 Fenmar Drive, Toronto, Canade, M9L 2R6, Tel: 800-254-6633
   b. Caster Technology Corporation, 3265 Whipple Rd., Union City, CA 94587, Tel: 510 429-6727.
   c. Acorn Industrial Products Co., 7 Union Hill Dr., W. Conshohocken, PA 19428, Tel: 800 523-5474.
   e. Substitutions are permitted subject to Section 01 63 00.
   f. Where indicated on Laboratory Furnishing drawings or specifications, provide sets of 4 inch (102mm) diameter wheels with self-lubricating precision roller- or ball-bearings. Casters shall be swivel, locking type on front and swivel, non-locking type on rear, rated for minimum 250 pounds (113.4 KG) load each. Casters shall be equal to Algood Model S5033-SRG, soft rubber wheeled casters. The entire assembly shall be reinforced to permit mobility without twisting and achieve an industry standard height of 31” or 37” (725 mm or 925 mm) including the flush 1” (25 mm) counter top. Casters shall be through-bolted through bottom of cabinet at all four bolts and interior bolt heads shall be countersunk to conceal bolt heads. Caster Housing: Casters shall be heavy gauge cold rolled steel with bright zinc plating.
L. Pulls:
   1. Drawer and hinged door: 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 (711mm). Plastic pulls or other types subject to breakage are not acceptable.
      a. Type:
         1) Pulls shall be round “wire.”
      b. Material and Finish:
         1) Stainless steel with US32D satin finish.
      c. Length: 4 inches (102mm) center to center of screw holes.
      d. Diameter: 1/4 inch (6mm).
   2. Sliding door pulls: Rectangular or oval, flush (recessed) design stainless steel pulls with recessed finger pull.

M. Drawer Stops: All regular drawers shall be equipped with integral stops or drawer bumpers on each side of drawer body to prevent drawer head impact with cabinet body.

N. Cabinet Door Bumper Pads: Non-staining, non-marring, clear polyurethane pads with pressure-sensitive, adhesive backing for sound and vibration dampening, preventing direct contact between door and cabinet. Pad should have raised tip in middle of pad. Provide at top and bottom corners along pull edge of doors 36 inches (914mm) and less in height. Provide at top and bottom corners and at an intermediate location along pull edge of doors greater than 36 inches (914mm) in height.

O. Door Stops: Provide chain door stops for any tall cabinet door, which will strike an obstruction when opened between 90° and 135°.
   1. Provide #30 zinc-plated steel sash chains; cut to length to allow door to open 1-1/2 inch (40mm) from obstruction.

P. Label holders: Provide 1 inch by 2 to 2-1/2 inches (25mm x 50mm to 63mm), nominal, steel label holders, pinned in place. Stick-on holders not acceptable. Label holders shall be provided at all file drawers.
   1. Satin chrome or nickel finish.

Q. Glides: Non-marring material, 1 inch (25mm) diameter, minimum, with at least 5/8 (16mm) vertical adjustment. Provide on movable tables, unless otherwise indicated.

R. Leveling devices: Provide each table leg with 3/8 inch (10mm) minimum diameter leveling bolt and floor clip.

S. Leg shoes: Leg shoes shall be provided on all legs and table legs to conceal leveling devices, except for tables with casters. Shoes shall be 2-1/2 (63mm) inch high and of black rubber or pliable black vinyl material. Use of a leg shoe which does not conceal leveling device is not acceptable.

T. Table-to-table and table-to-wall clips: Provide pivoting hooks and eyelets to attach movable tables to each other and/or to walls.

2.05 LABORATORY WORK SURFACES

A. Epoxy Resin:
   1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All epoxy resin work surfaces shall be provided by a single manufacturer.
a. Durcon Inc., 206 Alison Drive, Taylor, TX 76574, Tel: 512 595-8000. website: http://www.dltinc.com
b. Epoxyn Products, 500 E. 16th Street, Mountain Home, AR 72653, Tel: 870 425-4321. website: http://www.epoxyn.com/
c. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: http://www.kewaunee.com/
d. Substitutions are permitted subject to Section 01 63 00.

2. Thickness:
a. Typical work surface: 1 inch (25mm).
b. Fume hood work surfaces: Tops shall be 1-1/4 (32mm) inches thick at outer edge, indented 1/4 inch (6mm) to provide a raised rim around all exposed edges 1 inch (25mm) wide, minimum, or as to allow for the fume hood sash. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded or chamfered to a 1/8 inch (3mm) radius. The juncture between the raised rim and the top surface shall be coved or chamfered to a 1/4 inch (6mm) radius.

3. Color:
a. Dark Khaki #20 (as supplied by Epoxyn Products or similar).

4. Provide the following:
a. Drip Grooves: Provide under all work surface exposed edges, unless noted otherwise on the Laboratory Furnishing Drawings. Drip grooves shall be 1/2 inch (13mm) from the front edge where the top overhangs 1 inch (25mm) and 1/4 inch (6mm) from the edge where the edge overhangs 1/2 inch (13mm).
b. Edge profile: All exposed upper edges and corners shall have 1/8 inch (3mm) bevel.
c. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 inch (25mm) wide and 1/4 inch (6mm) high with chamfered or radiused transition to and be an integral part of the work surface.
d. Indented areas: Where indicated on the Laboratory Furnishing Drawings, shall be 1/4 inch (6mm) deep with chamfered or radiused sides. Internal and external corners shall have 1/4 inch to 1/2 inch (6 to 13mm) radius. Marine edges formed around indented areas shall not be less than 1 inch (25mm) wide.
e. Sink Mounting:
   1) 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 (3mm) below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 inch (3mm) bevel. Ensure that there shall be no gaps between the installed sink rim and work surface.

f. Curbs and Splashes:
   1) Curbs and Splashes: 1 inch (25mm) thick.
   2) Height: 4 inches (102mm), unless noted otherwise on Laboratory Furnishing Drawings.
   3) Bonded to the surface of the top to form a square joint.

g. 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 (3mm). 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.

5. Physical Properties:
a. Chemical resistance:
   1) 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.
2) 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.

3) 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:

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

4) Test results:

<table>
<thead>
<tr>
<th>Test chemical</th>
<th>Concentration</th>
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<th>Light gray</th>
<th>Beige</th>
</tr>
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<tbody>
<tr>
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<td>2</td>
<td>2</td>
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<tr>
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<td>Acetic acid (glacial)</td>
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<tr>
<td>Oleic acid</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Phenol solution</td>
<td>5%</td>
<td>0</td>
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<tr>
<td>Ammonium hydroxide</td>
<td>10%</td>
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<tr>
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<tr>
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<tr>
<td>Sodium hypochlorite sol.</td>
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<tr>
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<tr>
<td>Benzene</td>
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<td>1</td>
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<td>1</td>
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<td>Carbon tetrachloride</td>
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<tr>
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<td>1</td>
<td>1</td>
<td>0</td>
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<td>Heptane</td>
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### Test chemical concentrations

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<th>Beige</th>
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<td>Kerosene</td>
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<tr>
<td>Methyl alcohol</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Toluene</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aniline</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Olive oil</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soap solution 1%</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Transformer oil</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Turpentine</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

b. **Heat resistance:**

1) **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.

2) **Flame test:** A 3/8 inch (10mm) Bunsen burner is adjusted to a quiet flame with a 1-1/2 inch (38mm) inner cone, overturned on the test material, and allowed to stay for 5 minutes. Result: no observable surface deformation.

c. **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, 122
- Specific density: ASTM D792, 122.4 lb/ft³ (1960 kg/m³)
- Water absorption: ASTM D570, 0.01%
- Fire Resistance: ASTM D635, ATB (sec)=0
- Heat deflection @ 264 psi: ASTM D648, 342°F (172°C)

**B. Chemical Resistant High-Pressure Decorative (Plastic) Laminate Tops:**

1. **Manufacturers/Facing material:** Products complying with this specification may be provided by the following manufacturers. All chemical resistant plastic laminate worksurfaces shall be the product of a single manufacturer.
   a. Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX, 76503 Tel: 800 433-3222.
   b. Approved substitution (no known equal).

2. **Basis of Design:** Wilsonart Chemsurf, or equal (no known equal).

3. **Substrate Thickness:**
   a. Typical work surface: 1 inch (25mm).
   b. Curbs and Splashes: 3/4 inch (19mm).

4. **Color:** Light Grey.

5. **Description:**
   a. High-pressure decorative laminate consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers.
impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories.

b. Finish: Fine beaded “crystal” texture to minimize smudges and finger marks, and to provide optimum scratch resistance.

c. Core material:
   1) M3 Particleboard (NAF: No Added Urea Formaldehyde):
      a) Description: 3-ply, FSC Certified, 100 percent recycled wood fiber particleboard with no urea formaldehyde added during the manufacturing process.
      b) Formaldehyde Emissions: 0.00 to 0.01 ppm.
      c) Reference Standards: Average density of 47 pounds per cubic foot (689kg/m³), meeting or exceeding ANSI Standard A208.1-1999 M3 PB Standard specifications.
      d) Resin: Panels shall be manufactured with Phenol formaldehyde resin. Resin shall be urea formaldehyde-free and produce no Volatile Organic Compounds (VOC’s).
      e) Thickness: 3/4 inch (19mm).
      f) Moisture Content: less than 8 percent.
      g) Modulus of Rupture: 2,393 psf (114kPa).
      h) Modulus of Elasticity: 398,900 psf (19,099kPa).
      i) Internal Bond: 80 psi (551kPa).
      j) Face Screw Holding Strength: 247 lbf (1000N).
      k) Edge Screw Holding Strength: 225 lbf (899N).
      l) Hardness: 500 lbf (2224N).
      m) Thickness Tolerance: ±0.005 inches (±0.127mm) from panel average.

d. Grommets:
   1) Manufacturers: Products complying with this specification may be provided by the following manufacturers.
      a) Doug Mockett & Company, Inc., Box 3333, Manhattan Beach, CA 90266, Tel: 800 523-1269.
      b) Häfele America Inc., 3901 Cheyenne Dr., P. O. Box 4000, Archdale, NC 27263, Tel: 336 889-2322.
      c) Substitutions are permitted subject to Section 01630.
   2) Provide 2-3/8 inch (60mm) O.D. plastic grommets, Doug Mockett and Co., Inc. Model No. TG-3, or equal, complete with removable slotted plastic cover. Color to be selected by Architect. Refer to plans for location.

e. Physical Properties:
   2) Minimum Thickness: 0.038 inches ± 0.005 inches (0.97mm ± 0.13mm).
   3) Cleanability: 10 cycles (NEMA LD3 test method 3.4).
   4) Boiling Water Resistance: No effect (NEMA LD3 test method 3.5).
   5) High Temperature Resistance: Slight effect (NEMA LD3 test method 3.6).
   6) Scratch Resistance: 4.5 Newtons (NEMA LD3 test method 3.7).
   7) Ball Impact Resistance: 60 inches (1524mm) (NEMA LD3 test method 3.8).
   9) Dimensional change:
      a) Machine direction: 0.50 percent (NEMA LD3 test method 3.11).
      b) Cross direction: 0.80 percent (NEMA LD3 test method 3.11).
   10) Wear resistance: 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).
12) Stain Resistance Performance Test Results: The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid</td>
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<tr>
<td>Aqua regia</td>
<td>0</td>
</tr>
<tr>
<td>Chromic trioxide (Chromic acid cleaning solution)</td>
<td>1</td>
</tr>
<tr>
<td>Glacial acetic acid</td>
<td>99% 0</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>All 0</td>
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<tr>
<td>Hydrofluoric acid</td>
<td>48% 0</td>
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<tr>
<td>Formic acid</td>
<td>All 0</td>
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<tr>
<td>Nitric acid</td>
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<tr>
<td>Sulfuric acid</td>
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<tr>
<td>Perchloric acid (concentrated)</td>
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<td>Phosphoric acid</td>
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<tr>
<td>Picric acid</td>
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<td>Tannic acid (saturated)</td>
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<td>Uric acid (saturated)</td>
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Acids

<table>
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<td>Picric acid</td>
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Alkalis

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Solvents

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<td>Tetrahydrofuran</td>
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<td>Trichlorethane</td>
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<td>Xylene</td>
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<table>
<thead>
<tr>
<th>General Reagents</th>
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<tbody>
<tr>
<td>Alconox (lab detergent)</td>
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</tr>
<tr>
<td>Aluminon</td>
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<tr>
<td>Ammonium phosphate</td>
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<tr>
<td>Aromatic ammonia</td>
<td>0</td>
</tr>
<tr>
<td>Benedicts solution</td>
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<tr>
<td>Calcium hypochlorite (concentrated)</td>
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<tr>
<td>Camphorated parachlorophenol</td>
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</tr>
<tr>
<td>Cellosolve</td>
<td>0</td>
</tr>
<tr>
<td>Copper sulfate</td>
<td>0</td>
</tr>
<tr>
<td>Ethylene glycol</td>
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<tr>
<td>Eucalyptol</td>
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<td>Formalin</td>
<td>0</td>
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<td>Gasoline</td>
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<td>Hydrogen peroxide</td>
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<td>Iodine</td>
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<tr>
<td>Karl Fisher Reagent</td>
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<tr>
<td>Kerosene</td>
<td>0</td>
</tr>
<tr>
<td>Lactated ringers</td>
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<td>LysoL</td>
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<td>Methyl methacrylate</td>
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<tr>
<td>Mineral Oil</td>
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<td>Monsel’s solution (Ferric subsulfate)</td>
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<tr>
<td>Naphtha</td>
<td>0</td>
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<td>Petroleum jelly</td>
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<td>Phosphate buffered saline (PBS)</td>
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<td>Pine oil</td>
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<td>Potassium permanganate</td>
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<td>Povidone iodine</td>
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<td>Procaine</td>
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General Reagents
Quaternary ammonia compounds 0
Silver nitrate 0
Sodium azide 0
Sodium chromate 0
Sodium hypochlorite 5% 0
Sodium thiocyanate 0
Sucrose 50% 0
Thymol & Alcohol 0
Tincture of Iodine 0
Tincture of Mercurochrome 0
Tincture of Merthiolate 0
Trisodium phosphate 30% 0
Urea 0
Vegetable oils 0
Water 0
Zephiran chloride 0
Zinc chloride 0
Zinc oxide ointment 0

Stains and Indicators
Ag Eosin Bluish 5% in Alcohol 0
Bromothymol Blue 0
Cresol Red 0
Crystal Violet 0
Gentian Violet 1% 0
Gram Stains 0
Malachite Green 0
Methyl Orange 0
Methyl Red 0
Methylene Blue 0
Nigrosine 0
Safranin O 0
Sudan III 0
Thymol Blue 0
Wright’s Blood Stain 0

C. Stainless Steel: Refer to Stainless Steel Fabrications section of this specification.

2.06 SHELVING ASSEMBLIES

A. High-Pressure Decorative (Plastic) Laminate Shelving:

1. Chemical Resistant High-Pressure Decorative Laminate:
   a. Manufacturers/Facing material: Products complying with this specification may be provided by the following manufacturers. All chemical resistant plastic laminate shall be provided by a single manufacturer.
   1) Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX 76503 Tel: 800 433-3222.
   2) Approved substitution (no known equal).
b. **Basis of Design:** Wilsonart Chemsurf, or equal (no known equal).

c. **Description:** High-pressure decorative laminate consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories.

1) Laminate shall be applied to top and bottom surfaces.

2) Finish: Fine beaded “crystal” texture to minimize smudges and finger marks, and to provide optimum scratch resistance.

3) Color: To be selected by the Architect.

d. **Physical Properties:**

1) **Reference Standard:** Plastic laminates shall meet or exceed ANSI/NEMA Specification LD3-2000 as specified herein.

2) **Minimum Thickness:** 0.038 inches ± 0.005 inches (0.97mm ± 0.13mm).

3) **Cleanability:** 10 cycles (NEMA LD3 test method 3.4).

4) **Boiling Water Resistance:** No effect (NEMA LD3 test method 3.5).

5) **High Temperature Resistance:** Slight effect (NEMA LD3 test method 3.6).

6) **Scratch Resistance:** 4.5 Newtons (NEMA LD3 test method 3.7).

7) **Ball Impact Resistance:** 60 inches (1524mm) (NEMA LD3 test method 3.8).

8) **Radiant Heat Resistance:** 200 sec (NEMA LD3 test method 3.10).

9) **Dimensional change:**
   a) **Machine direction:** 0.50 percent (NEMA LD3 test method 3.11).
   b) **Cross direction:** 0.80 percent (NEMA LD3 test method 3.11).

10) **Wear resistance:** 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).

11) **Blister Resistance:** 70 sec (NEMA LD3 test method 3.15).

12) **Stain Resistance Performance Test Results:** The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Stain Resistance Performance Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No effect – No detectable change in the material surface.</td>
</tr>
<tr>
<td>1</td>
<td>Excellent – Slight detectable change in color or gloss but no change in function or life of the surface.</td>
</tr>
<tr>
<td>2</td>
<td>Good – A clearly discernable change in color or gloss but no significant impairment of surface life or function.</td>
</tr>
<tr>
<td>3</td>
<td>Fair – Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.</td>
</tr>
<tr>
<td>4</td>
<td>Failure – Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.</td>
</tr>
</tbody>
</table>

**Acids**

<table>
<thead>
<tr>
<th>Acetic acid</th>
<th>Concentration</th>
<th>Rating</th>
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## Acids

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<td>Glacial acetic acid</td>
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<td>Hydrochloric acid</td>
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<td>Tannic acid (saturated)</td>
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## Alkalis

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## Solvents

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<td>Butyl alcohol</td>
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<tr>
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<td><strong>Benedicts solution</strong></td>
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<td><strong>Karl Fisher Reagent</strong></td>
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<td><strong>Kerosene</strong></td>
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<td><strong>Lactated ringers</strong></td>
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<td><strong>Mineral Oil</strong></td>
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<td><strong>Monsel's solution (Ferric subsulfate)</strong></td>
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<td></td>
<td><strong>Naphtha</strong></td>
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<td></td>
<td><strong>Petroleum jelly</strong></td>
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<td><strong>Phosphate buffered saline (PBS)</strong></td>
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<td></td>
<td><strong>Pine oil</strong></td>
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<td><strong>Potassium permanganate</strong></td>
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<td><strong>Procaine</strong></td>
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<td><strong>Quaternary ammonia compounds</strong></td>
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<td><strong>Silver nitrate</strong></td>
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<td><strong>Sodium azide</strong></td>
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<td><strong>Sodium chromate</strong></td>
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<td><strong>Sodium hypochlorite</strong></td>
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<td><strong>Sodium thiocyanate</strong></td>
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<tr>
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<td><strong>Sucrose</strong></td>
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<td><strong>Thymol &amp; Alcohol</strong></td>
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<td><strong>Tincture of Iodine</strong></td>
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<td><strong>Tincture of Mercurochrome</strong></td>
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<td><strong>Tincture of Merthiolate</strong></td>
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<td><strong>Zinc chloride</strong></td>
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<td></td>
<td><strong>Zinc oxide ointment</strong></td>
</tr>
</tbody>
</table>
2. Plastic laminate adhesive: High-pressure decorative laminate shall be bonded to core with thermosetting resorcinol, phenol-resorcinol, or urea formaldehyde adhesive, or as recommended by the manufacturer for the application, at temperature above 65 degrees F (18.3 degrees C) at a pressure no less than 15 pounds per square inch. Laminate core is not to exceed 10 percent moisture content and is to be laminated and cured in a controlled environment between 45 percent and 60 percent RH.

3. Core material: 9-ply hardwood plywood manufactured in accordance with ANSI/HVPA HP-1 with K+ face veneers, 1 inch (25mm) thick. Product shall consist of FSC certified veneers.

4. Safety Edging and Edge Banding:
   a. All edge banding shall be set in hot melt adhesive with a minimum softening point of 150 degrees F (65.5 degrees C). Apply primer to substrate when recommended by adhesive manufacturer. Contact cement is not acceptable.
   b. Edge Band Materials.
      1) Edge banding shall be 4mm hardwood edgebanding to match edgebanding used on casework drawers and doors.
      2) Retainer Rail: 1/4 inch (6mm) diameter stainless steel retainer rail, as indicated on the drawings
   c. Adjustable wall shelving:
      1) Edge banding shall be 4mm hardwood edgebanding to match edgebanding used on casework drawers and doors.
      2) Retainer Rail: 1/4 inch (6mm) diameter stainless steel retainer rail, as indicated on the drawings
   d. Heavy-duty adjustable shelving: Similar to adjustable wall shelving above.

B. Adjustable Wall Shelves:

1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
2. Double Slot Shelf Standards:
   a. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All adjustable shelf standards shall be the product of a single manufacturer.
      2) Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232 Tel: 718 499-9422.
      3) Substitutions are permitted subject to Section 01 63 00.
b. Basis of Design: Knape & Vogt 85 ANO series uprights, or equal. Length as indicated on the drawings.
3. Shelf standards shall be slotted channel framing as specified elsewhere in this Section.
4. Shelf Brackets: 16 gauge (1.6mm thick) bookend type, as detailed on drawings.
5. Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.

C. Heavy Duty Wall Shelves:
1. Shelving: High-Pressure Decorative Laminate shelving as specified above. All shelves to be one piece continuous full length of assembly.
2. Heavy duty shelf standards: Slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
3. Heavy duty shelf brackets:
   a. Shelf Brackets: Cold-formed steel, slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
4. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.

D. Heavy Duty Freestanding Shelves:
1. Shelving: High-Pressure Decorative Laminate shelving as specified above. All shelves to be one piece continuous full length of assembly.
2. Heavy duty shelf standards: Slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
   a. Shelf Brackets: Cold-formed steel, slotted channel framing type. Refer to slotted channel framing specifications elsewhere in this Section.
3. Provide 16 gauge (1.6mm thick) ceiling escutcheon when vertical channel penetrates finished ceiling. Finish: Provide epoxy powder coating for all cold-formed framing components and trim. Color: White.
4. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.

E. Stainless Steel Shelving System
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All stainless steel shelving system components shall be the product of a single manufacturer.
   a. InterMetro Industries Corporation, 651 North Washington St., Wilkes-Barre, PA 18705, Tel: 800 992-1776. Manufacturer of Metro products. website: http://www.metro.com/
   b. Eagle Group, 100 Industrial Blvd., Clayton, DE 19938, Tel: 302 653-3000. website: http://www.eaglegrp.com/
   d. Substitutions are permitted subject to Section 01 63 00.
2. Basis of Design: Metro Super-Erecta stainless steel shelf system, floor mounted post supported, or equivalent.
   a. Posts: Floor mounted stainless steel posts, grooved at 1 inch (25mm) increments and numbered at 2 inch (51mm) increments for shelf adjustment, length as shown on drawings, Metro PS series or equal.
   b. Shelves:
      1) Open Wire: Stainless steel wire.
   c. Provide diagonal bracing for lateral stability at freestanding applications.
   d. 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 (25mm) high stainless steel wire, Metro No. LxxN-1S or equal, sized to match shelf.

4) **Wire management device:** Black epoxy coated wire, Metro No. CWM or equal. Provide at 8 inches on center.

3. **Basis of Design:** Metro Super Erecta stainless steel shelf system, wall mounted post supported, or equivalent.
   a. **Post-Type Wall Mount:**
      1) **Posts:** Wall mounted stainless steel posts, grooved at 1 inch (25mm) increments for shelf adjustment, length as shown on drawings, Metro PDF series or equal.
      2) **Wall Mounting Brackets:** Provide two end brackets, Metro No. BES, and one intermediate bracket, stainless steel, Metro No. BCS, per post.
      3) **Shelf Supports:** Single supports at end posts, and double supports at intermediate posts, stainless steel wire.
   b. **Shelves:**
      1) **Open Wire:** Stainless steel wire.
   c. **Accessories:**
      1) **Hole plugs:** Provide chrome-plated hole plugs for all open holes.
      2) **Shelf Ledges:**
         a) 1 inch (25mm) high stainless steel wire, Metro No. LxxN-1S or equal, sized to match shelf.
   d. **For controlled environment room applications:** Secure to concealed blocking in prefabricated wall with stainless steel fasteners to support a 100 lb. load (45kg) for each linear foot (0.3 m) of shelf.

2.07 **CYLINDER AND DEWAR RERAINT ASSEMBLIES**

A. **Manufacturers:** Products complying with this specification may be provided by the following manufacturers.
   b. Spectra Gases, Inc., 3434 Route 22 West, Branchburg, NJ 08876, Tel: 800 932-0624. [website](http://www.spectragases.com)
   c. Matheson Tri-Gas, 166 Keystone Drive, Montgomeryville, PA 18936, Tel: 215 648-4000. [website](http://www.matheson-trigas.com)
   d. USA Safety Solutions., Tel: 608-630-1572. [website](http://www.usasafety.com/)
   e. Substitutions are permitted subject to Section 01 63 00.

B. **Cylinder Rack Assembly (Steel Tube Assembly):**
   1. **Basis of Design:** Safe-T-Rack Model 2421 and 1432. Provide in quantities and configurations as shown on drawings.
   2. **Frame members:** 2 inches by 2 inches by 1/8 inch (50 by 50 by 3 mm) square steel tube.
   3. **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.
   4. **Chain:** Provide restrainers of 1/4 inch (6.35 mm)diameter, Type 304 stainless steel welded chain fitted one threaded connector chain link at one end and one harness clip at the other end; two chains per cylinder at high and low points. Frame shall have welded chain link or similar hardware for attachment for each end of chain.
   5. **Cylinder racks components** shall be factory-finished. Color to be selected by the Architect.

C. **Gas Cylinder Bench Mount Bracket:**
   1. **Bench top edge mounted cylinder bracket.** 11 ga hot-rolled steel with powder coated finish. Color to be selected by the Architect.
2. Basis of Design: USA Model #GB150FS
3. Provide in quantity and locations as shown on drawings.

2.08 OVERHEAD SERVICE CARRIERS

A. Description: Overhead Service Carriers (OSC) are structurally supported frames constructed of steel framing members as delineated on the drawings. OSC's are designed as a means to distribute utilities to movable tables/benches in the laboratory and to provide support for adjustable shelving. Electricity, data, voice, gas, air, vacuum are utilities commonly found on these carriers. On non-removable OSC's these utilities are piped or wired from above the ceiling down through the primary vertical support members and terminated in raceways or on service fittings. Where OSC's are noted as removable, these utilities will be brought to a ceiling service panel (CSP) as delineated in the drawings and then connected to the carrier with twist-lock, quick-disconnect or other devices attached to insulated cables, hoses or tubes.

B. The entire OSC assembly, including vertical and horizontal supports, diagonal braces, shall be securely and rigidly fastened to structural slab above or to a structural grid where provided. Embed plates will be provided and installed by the structural design and ready for installation of the OSCs by the Laboratory Furniture Contractor. All OSC's and components shall be designed to the appropriate seismic zone standards for the location. The Laboratory Furniture Contractor shall supply final shop drawings along with structural design drawings and structural calculations which are stamped and wet-signed by a structural engineer who is registered in the State of Colorado.

C. Paint assembly with color selected by the Architect.

2.09 LASER SHELF

A. Framing System: Slotted channel framing as specified elsewhere in this Section and as detailed on the drawings.

B. Shelf:
   1. 1 inch plastic laminate shelving as specified above for adjustable wall shelving.
   2. Safety Edging: 2 inches (51mm) high by 3mm thick PVC band applied to all sides with hot melt glue. Contact cement is not acceptable.

2.10 DRYING RACK

A. Stainless Steel Drying Rack with White Polypropylene Pegs:
   1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All stainless steel drying racks shall be the product of a single manufacturer.
      b. Substitutions are permitted subject to Section 01 63 00 (no known equal).
      a. Drying rack bodies shall be of one-piece design and of not less than 20 gauge (1.0mm thick) Type 304 stainless steel with a No. 4 finish. The top shall have two 90-degree bends, and sides to have one 90 degree bend.
      b. Each rack shall have an integral full-width 20 gauge (1.0mm thick), Type 304 stainless steel drip trough with stainless steel drain tube. Drip trough shall be continuously welded.
      c. The trough shall have a full-length, Type 304 stainless steel wire mesh screen insert. Screen insert shall be turned down on all four sides to provide a clean and finished appearance.
      d. Each rack front shall be dimensioned and punched with T-shaped holes to accommodate the peg arrangement shown on the drawings.
   3. Pegs shall fit into the punched holes in the rack front. A T-shaped protrusion on the base of the pegs shall allow easy removal and replacement without the need for tools. The
T-shaped holes shall be designed to fit the protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks or pipette holders. Pegs shall be of injection-molded white polypropylene.

4. Provide wall hangers for each rack, designed to enable the removal and replacement of the entire rack for cleaning without the need for tools.
5. Provide stainless steel fixing screws of appropriate type for attachment to support structure.
6. Provide clear, tight-fitting hose to drain from drip trough drain tube into sink.
7. Provide finished stainless steel back panel when any portion of the back of drying rack is exposed.

2.11 DISTILLATION RACK ASSEMBLY

A. Frame Assembly: Provide stainless steel slotted channel framing frame assembly with end caps, as specified elsewhere in this Section, and as shown on Drawings.

B. Rack Assembly: Provide 1/2 inch (13mm) diameter stainless steel rods with stainless steel connectors for lattice rod assemblies as shown on drawings.

2.12 TASK LIGHT FIXTURES

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All task lights shall be the product of a single manufacturer.

1. Alkco, 11500 Melrose Ave., Franklin Park, IL 60131-8139, Tel: 847 451-0700
2. Peerless Lighting Corporation, Box 2556, Berkeley, CA 94702-0556, Tel: 510 845-2760.
3. Substitutions are permitted subject to Section 01 63 00.

B. Basis for Design: Alkco Little Inch², or equal, as specified herein.

C. Description: Fluorescent fixture for undershelf or undercabinet mounting. Provide task lights at locations indicated on the drawings.

D. Construction:

1. Dimensions: Fixture shall nominally cover the entire underside of the length of shelf.
2. Housing: 20 gauge (1.0mm) cold rolled steel with neatly formed corners and de-burred exposed edges. No exposed fasteners.
3. Finish: Baked-on polyester resin powder coat finish in color selected by the Architect.
5. Electrical: Pre-wired with a single circuit. Fixture shall be controlled by fixture-mounted rocker switch. Fixture shall be furnished with 36 inch (900mm), maximum, grounded cord and NEMA 5-15P or 5-20P plug. Fixture shall be provided with white, ground convenience receptacle to enable task lights to be "daisy chained."
6. Ballast: Electronic, high power factor, thermally protected, Class P.
7. Lamps: T-5, 3500K.
8. Labels: Fixture shall be U.L. listed and bear an IBEW label.

E. Sizes:

1. Use appropriate size task light fixture for shelf length.
2. Shelf length and fixture model:
   a. 24" shelf: Model L2F2HO
   b. 32" shelf: Model L2F2HO
   c. 36" shelf: Model L2F3HO
   d. 44" shelf: Model L2F3HO
   e. 48" shelf: Model L2F4HO
2.13 BLACKOUT CURTAIN AND TRACK ASSEMBLY

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All blackout curtains and tracks shall be provided by a single manufacturer.

1. Darkrooms USA, Inc. 193 Rocky Point Landing Road, Rocky Point, NY 11778 Tel: 631 821-5948.
2. Blackout Curtains, 8527 Westmoreland, Suite 111, Minneapolis, MN 55426 Tel: 866 252-2568.
3. Cubicle Curtain Factory, 2956 Jog Road, Greenacres, FL 33467 Tel: 1-800-588-9296. Website: http://www.cubiclecurtainfactory.com/
4. PL Systems INC., 747 Middle Neck Road, Great Neck, NY 11024-1950, (800) 422-0101
5. Substitutions are permitted subject to Section 01 63 00.

B. Curtain Materials and Fabrication:

1. The blackout curtain material shall be of the following fabric composition: 38 percent SEF Modacrylic, 30 percent Saran Flat Monofilament, 26 percent Viscose Rayon and 6 percent Polyester. Material shall have a double-vinyl black color laminated back for opacity (samples must be submitted).
2. The curtain shall be sewn flat with 10% fullness. The seams shall be sewn French-style (no raw edges visible). The curtain top shall have brass grommets on 8 inch (200mm) centers. Provide a heavy gauge fabric-reinforcing strip inserted in the top hem to provide addition strength for the insertion of grommets. The bottom edge shall be weighted and overlap the floor approximately 2 inches (51mm). All sewing shall be done in a manner so that fabric is not pierced in a way that will allow light through the needle holes.
3. The outside vertical edges shall be supplied with “Velcro” quick-seal strips to facilitate “light-trap” overlaps for easy light-tight attachment to walls.
4. Curtain shall be supplied with minimum 11 inch (280mm) high front and rear light-trap valances. The valances shall be made of the same black-out curtain materials, sewn flat (no fullness) with a sewn-on Velcro strip, and shall be mounted to the curtain track assembly using the “Light-Trap-Interface”. Curtain shall be designed with a 2 inch floor overlap to maintain a light-proof environment.
5. Blackout curtain must be flame-retardant or made of non-combustible materials. Fabric must pass the flame resistance requirements specified by the State of California test, and be in accordance with the National Fire Protection Association Standard No. 701-99 test methods 1 and 2. Submit certificate of passage to tests.

C. Track Material and Assembly:

1. Construct of satin anodized extruded aluminum box-channel 1-3/8 inches by 3/4 inch (35mm x 18mm) slotted on the underside to receive two wheeled carriers designed for surface mounting to the underside of the ceiling. The track shall also serve as an integral part of the valance assembly; valance shall be fastened to track at not more than 18 inches on center. Supply with hook carriers, end-caps, snap-outs, and connectors, of the sleeve type. Hooks are formed of rustproof wire and bead chain riding on a carrier with non-wearing nylon wheels. Corners, where required, shall be one-piece, 12 inch (305mm) radius 90 degree track sections.
2. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

2.14 WOOD FINISH APPLICATION AND PERFORMANCE REQUIREMENTS

A. Applicability: This section applies to wood fabrications, including, but not limited to, wood casework, wood laboratory tables, wood-framed balance tables, wood-framed pegboards.

B. Chemically Resistance Finish: Finish for all exposed and semi-exposed wood products shall be environmentally friendly, highly chemically resistant, water-based, HAPs (Hazardous Air
Pollutants) free, laboratory-grade finish with built-in U.V. blocker and stain that satisfies the requirements specified herein for chemical and durability resistance. A letter from a third-party testing agency, verifying independent test results, shall be submitted to the Architect for approval prior to award of contract. Solvent-applied coatings are not be acceptable and will not be considered.

1. 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.

C. Application:

1. Finish Systems: The finishing shall result in a highly chemical resistant finish that is equally suitable for an AWI premium finish application. A minimum of three pass exposed and two pass semi exposed is required along with appropriate steps for minimizing barber pole effect and glue line exposure to assure a high quality veneer appearance. The finishing technology utilized shall be either 100 percent solids UV, water borne compression spray UV or water borne traditional compression spray.

2. Finish Application: Finish application shall consist of the following steps.

   a. Preparation: All dust and debris shall be thoroughly removed from the panel prior to finish application.

   b. 400 grit cross-belt sanding (not required for plain sliced red oak) at a 30 degree angle to minimize ‘barber pole’ and component glue line exposure.

   c. 180 grit wide belt sanding in the direction of grain, all surfaces to be stained or finished.

   d. 220 grit wide belt sanding in the direction of grain, all surfaces to be stained or finished.

   e. Staining, if required. Apply stain of color selected by Architect to all exposed casework surfaces. Apply in a manner to achieve a match with the selected color sample upon completion of application of the finish.

   f. Fill coat required for open grain species, such as oak, ash, etc.: approximately 0.2mm thickness or as required to fill the grain of the selected species. Fill coat shall be gelled to a minimum of 50 percent cure prior to top coat application.

   g. First top coat. Cure 100 percent with dual ultraviolet light or heated oven for traditional spray systems.

   h. 320 grit scuff sanding.

   i. Second top coat.

   j. 320 grit scuff sanding.

   k. Third top coat.

   l. Repeat process as many times as required to satisfy chemical resistance requirements. Finish material thickness shall be a minimum of 1.25 mils for ultraviolet coatings and 2.0 mils for compression spray systems.

D. Finish Performance Requirements:

1. Chemical Resistance: Wood finish shall be high performance and chemical resistant in compliance with the performance requirements for Cabinet Surface Finish in SEFA 8 W.

   a. No complete failure or Level 3 rating is allowed for chemicals tested.

   b. A maximum of four Level 1 ratings, one of which can be a Level 2 rating is allowed.

2. Moisture Resistance:

   a. There shall be no visible effects on the finish after exposure to a water-soaked sponge for 100 continuous hours.

   b. There shall be no visible effects on the finish after exposure to a 195 degrees F (90.5 degrees C) trickle of water for 5 minute duration with the panel at a 45 degree angle.

3. Impact Resistance: There shall be no visual evidence to the naked eye of cracks or checks in the finish caused by the impact of a 1 lb. (454g) ball dropped from a height of 12 inches (305mm) onto a flat horizontal surface.
2.15 METAL FABRICATIONS AND FINISH REQUIREMENTS

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, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.

B. Materials:

1. All steel used in the product fabrication shall comply with the LEED II (Leadership in Energy and Environmental Design) Green Building Rating System.
2. The manufacturer shall submit documentation (i.e., “Source of Materials”, Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
3. Cold rolled sheet steel:
   a. Sheet Steel: All “Cold Rolled” sheet steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall have a minimum of 20% recycled steel content.
   b. Recycled Steel Content: Of this 20 percent recycled content, 60 percent shall be purchased scrap (i.e., old cars, appliances) with the remaining 40 percent from generated in-house scrap and manufacturing fall-off.
   c. Fabricators Scrap: Fabricators shall provide documentation that manufacturing fall-off is recycled to respective steel mills and neither enters the solid waste system nor becomes a product of landfill space.
   d. Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects.

C. Finish Requirements:

1. Chemical Resistant Finish: Painted finish shall be chemical resistant, dry powder coated finish complying with SEFA 8 M casework specifications for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted to the Architect for approval at time of bid submittal.
2. Operator Protection: Paint application shall be convenient and easily mastered through robotic application plus manual detailing. The painting process shall be contained and have no solvent odor and be performed in an air conditioned room.
3. Overspray: Powder overspray shall be captured and resprayed. Efficiency shall be 99 percent effective in coating usage, reducing waste generated. A closed collection system shall be used for overspray that is not reused. Powder overspray, which cannot escape the facility, shall be collected in bulk, eliminating the need for daily replacement/disposal of filter media.
4. VOC Emissions: Powder paint shall be sprayed and baked with a near zero (0.29 lbs. per gallon maximum) VOC (Volatile Organic Compounds) emissions. All powder coats shall comply with the GS (Green Seal Standard) 11 allowable emissions.
5. Offgassing: After all steel powder coated parts 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.

D. Metal Casework Color: As selected by the Architect from manufacturer’s full color line and complying with finish requirements described above.

2.16 STAINLESS STEEL FABRICATIONS

A. Material: Unless otherwise noted stainless steel for work surfaces, canopy hoods, low slotted exhaust, drying racks, shelves, sinks and scullery sinks shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
B. Finish: All fabrications shall have exposed surfaces ground and polished to a No. 4 satin finish.

C. All stainless steel nuts, screws, bolts, and rivets, etc., shall be of the same type stainless as in the sheet material and shall have a tumbled finish closely resembling that of a No. 4 finish.

D. All stainless steel welding material shall be of type similar to the sheet material or a richer quality. All welds shall be made without discoloration and shall be ground, polished, and passivated to blend harmoniously with a Number 4 satin finish. All joints in stainless steel tops and work surfaces shall be welded.

E. Work Surfaces:
   1. Thickness: 16 gauge (1.6mm).
   2. Fabrication:
      a. Edges: Flanged down the same dimension as the adjacent non-stainless top, if any, with 1 inch (25mm) being a minimum and returned over a 16 gauge (1.6mm) perimeter metal frame to simplify securing top material to cabinet or structural frame, insure rigidity and prevent buckling, warping, or oil canning.
      b. Reinforcement: Under-surface shall be reinforced with full length 16 gauge (1.6mm) structural metal channels at rear and middle top to insure rigidity and prevent buckling, warping, or oil canning. Where bench-mounted fittings are indicated on the drawings, provide top reinforcement to allow for rigid, secure mounting of fittings.
      c. Undercoating: Underside of top shall have a heavy mastic agent coating providing sound deadening.
      d. Stainless steel sides and back-splashes, where indicated, shall be integrally welded to top and finish as indicated above. The back side of exposed backsplashes shall be finished to match front and sides.
      e. 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 (3mm). After sawing, rout and file cutouts to ensure smooth, crack-free edges with no burrs.
      f. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 inch (25mm) wide and 1/4 inch (6mm) high with chamfered or radiused transition to and be an integral part of the work surface. Marine edges shall be seamless die-formed.
   3. Tops with Sinks: Tops and sinks shall be integral, fabricated with a marine edge and shall be pitched to sink bowl for proper drainage.
   4. Flat Stainless Steel Work Surfaces (without marine edge or sink): Provide an integrally coved back splash and bull-nose at front of work surface.
   5. Wall-Supported Benchtop
      a. Benchtops shall be fabricated as per construction section of this specification with stainless steel wall support and bracket angles all as per Laboratory Furnishings Drawings.
      b. Unit shall be designed to support 200 pounds per square foot (976.5kg/m²), completely wall supported with no legs or support members extending to the floor.

F. Cup Sink: All cup sinks in stainless steel work surfaces and fume hoods shall be integral one piece construction with top. Cup sinks at fume hoods shall have 1/4 inch (6mm) high lip.

G. Laboratory Sink: Integral one piece construction with stainless steel work surface.
   1. Thickness: 16 gauge (1.6mm), unless otherwise noted.
   2. Construction: Sink units shall be designed and fabricated with sufficient reinforcement to prevent oil canning. All sink joints shall be butt-welded, ground smooth by the heliarc welding process. Inside radii shall be 1 inch (25mm). Bottoms shall be pitched to the
H. Scullery Sink: Stainless steel top with integral sink bowls in sizes as shown. The requirements for stainless steel tops and sinks described above shall govern in its entirety. Backsplash, marine edge and drain boards shall be provided as indicated in Laboratory Furnishings plans.

1. Thickness: 14 gauge (2.0mm).
2. Construction: Front, bottom and back of sink compartments shall be formed of one sheet of material with integral 1-1/2 inch (40mm) roll rim, extending full length at front and ends of compartments and drain boards. Compartment ends and partitions shall be electrically welded into place. Drain boards shall pitch from 2 inches at rolled rim and ends to 2-1/2 inches (65mm) below rim at compartments. Bottoms shall be pitched to the drain indent. Sink units shall be designed and fabricated with sufficient reinforcement to prevent oil canning. All sink joints shall be butt-welded, ground smooth by the heliarc welding process. Inside radii shall be 1 inch (25mm). No soldering will be permitted in connection with sink construction. Sink bowl dimensions on drawings are inside dimensions. Underside shall have a heavy mastic agent coating providing sound deadening. Provide apron panel in front of sink basin(s).

3. Legs: Sinks shall be supported on stainless steel square tube legs with stainless steel leveling guides.

4. Accessories: Provide Elkay LK-86-RT, or approved, waste fitting at each compartment of stainless steel construction with strainer, overflow and lever handle. Provide tailpiece compatible with laboratory waste piping system. Refer to Division 23 for piping requirements.

I. Canopy Hood (by division 23): Provide stainless steel canopy with all hangers and miscellaneous hardware at locations and sizes as indicated on the Laboratory Furnishing drawings.

1. Thickness: 18 gauge (1.3mm).
2. Construction: Provide reinforcing necessary to prevent "oil canning" or deflection of panel between supports. All corners and joints shall be welded, ground smooth and free of all defects. Welded joints with visible burn marks will not be accepted. Form with condensation gutter. Provide welded exhaust collar with no open seams.

3. Accessories: Provide stainless steel hangers and miscellaneous support hardware as required for a complete installation.

4. Light fixtures and wiring shall be provided under Division 26. Holes for electrical work shall be made by canopy hood fabricator.

5. Provide exhaust duct transition piece for mechanical connection above the ceiling. Refer to Exhaust Schedule for exhaust rate and size.

2.17 GOWNING BENCH:

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.


3. Substitutions are permitted subject to Section 01 63 00.


C. Description:

1. Top: 3/8 inch (9.5mm) solid rod on 1 inch (25mm) centers.
2. Bootie Rack: 1/4 inch (6.3mm) solid rod on 2 inch (51mm) centers.
3. Type 304 stainless steel construction, electropolished square or round tube.
4. Class 1 environment design.
5. Leveling glides.

2.18 MOP HOLDER

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers.
   1. Life Science Products, Inc., 115 S. Lynchburg St., Chestertown, MD 21620, Tel: 800 638-9874. website: http://www.lspinc.com
   2. Substitutions are permitted subject to Section 01 63 00.

B. Basis of Design: Life Science Products, Inc. Broom Stow or equivalent, as specified herein.

C. Description: 1/4 inch thick by 4 inch high frame of clear anodized extruded aluminum, alloy 6061-T6, or Type 304 stainless steel with No. 4 finish. Top and bottom shall have 1/8 inch (3mm) radius eased edges. Mop holder frame shall project from wall 1 ¾ inches (44mm) and have radiused bends returning to wall for fastening. Design shall minimize opportunity for the collection of dust, dirt, debris, etc., and facilitate cleaning. Mop holder shall be 24 inches long and hold three cleats for mop handles. Cleat shall be replaceable, black, high-impact plastic with dense foam-covered, gravity/pinch type cleat mounted to frame with stainless steel hardware. Frame shall be mounted to wall with stainless steel mounting hardware appropriate for wall construction.

D. Mop holder shall be mounted with top edge 72 inches (1829mm) above finished floor.

2.19 SLOTTED CHANNEL FRAMING

A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All slotted channel framing components shall be the product of a single manufacturer.
   1. Unistrut, 35660 Clinton Street, Wayne, MI 48184, Tel: 800 521-7730. website: http://www.unistrut.com/
   3. Kumar Industries, 4881 Chino Ave., Chino, CA 91710, Tel: (909) 591-0722.
   4. Cooper B-Line Inc. (B-Line), 509 West Monroe St., Highland, IL 62249, Tel: (618) 654-2184.
   5. Substitutions are permitted subject to Section 01 63 00.

B. Materials: Channel and framing members shall be fabricated from steel conforming to the following requirements:

   1. Framing Members:
      b. Exposed Framing Members and Fittings: ASTM A446 GR A with zinc coating conforming to ASTM A525.
      c. Stainless Steel Framing Members and Fittings: ASTM A240 (Type 304), where indicated.

   2. Fittings:
      a. Concealed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307.
b. Exposed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307. Exposed fittings shall receive zinc coating conforming to ASTM A525.

c. Stainless Steel Fittings and Hardware: Sintered Nuts shall be of ASTM B783 (Type 316N2-33) stainless steel and fittings shall be of ASTM A240 (Type 304) stainless steel. Stainless steel fittings and hardware shall be used with stainless steel framing members, or where indicated.

3. Thickness: 12 gauge (2.8mm), unless noted otherwise.
4. Size: 1 5/8 inch by 1 5/8 inch cross-section, unless noted otherwise.

C. Components:

1. The following components shall be provided, unless otherwise noted:
   a. Framing Channel: 1 5/8 inch by 1 5/8 inch by 12 gauge (2.8mm): Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
   b. Suspended Framing Channel, 3-1/4 inch by 1-5/8 inch by 12 gauge (2.8mm): Unistrut P5000, Powerstrut PS 100, Kumar Industries N-150, B-Line Systems, Inc. B11, or equal.
   c. Slotted Hole Framing Channel, 1-5/8 inch by 1-5/8 inch by 12 gauge (2.8mm) framing channel with 13/32 inch by 3 inch slotted holes, 4 inches on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S.
   d. Slotted Framing Channel for installation in Chemical Fume Hoods, 1 5/8 inch by 13/16 inch by 16 gauge (1.6mm) Type 316 stainless steel framing channel: Unistrut P4000 SS, Powerstrut PS 560 SS, Kumar Industries, B-Line Systems, Inc.
      1) Attach channel to side of fume hood with 2-5/8 inch by 1-7/8 inch by 1/8 inch, 4 hole, stainless steel 90 degree fitting: Unistrut P6325 SS, Powerstrut, Kumar Industries, B-Line Systems, Inc.
   e. Vertical Posts: 3-1/4 inch by 1-5/8 inch by 12 gauge (2.8mm), double channel section: Unistrut P1001, Powerstrut PS 200 2T3, Kumar Industries N-200-A, B-Line Systems, Inc. B22A, or equal.
   h. 90 Degree Angle Fitting: 4-1/8 inch by 3-1/2 inch by 1/4 inch with two holes, each leg: Unistrut P1325, Powerstrut PS 607, Kumar Industries N-1123, B-Line Systems, Inc. B104, or equal.
   i. 135 Degree Angle Fitting: 3 inch by 2-5/16 inch by 1/4 inch with one hole, each leg: Unistrut P1546, Powerstrut PS 633-45°, Kumar Industries N-1425, B-Line Systems, Inc. B154, or equal.
   k. Wing Shape Fitting, 9-5/32 inch by 3-7/8 inch ten holes, two holes in each wing section and two holes in each of three channel section sides: Unistrut P2347, Powerstrut PS 913, B-Line Systems, Inc. B273.
m. End Caps: 0.06 inches thick for framing channel: Unistrut P1280, Powerstrut PS 707, Kumar Industries N-2500, B-Line Systems, Inc. B205, or equal. Provide end caps for all exposed horizontal framing channels.

n. Ceiling Escutcheon: Provide 18 gauge (1.3mm) steel, finished to match framing members, as indicated on the Laboratory Furnishing drawings, at ceiling penetrations.

o. 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 (1.6mm), 13/16 inch by 1-5/8 inch cold-formed framing uprights: Unistrut P4000, Powerstrut PS 560, Kumar Industries N-400, B-Line Systems, Inc. B56, or equal. Uprights shall be provided at 48 inches, maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
   b. U-shaped spreaders: 12 gauge by 1-1/2 inch (2.8mm x 45mm) 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 (1220mm) on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 inches (1220mm) on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 23 and 26. Provide all bolts, expansion sleeves, and fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 23 and 26 installers.

3. Heavy Duty Wall Shelving:
   a. Shelf Standards: Framing channel, spaced equally, 36 inches on center, maximum. Secure to wall. Provide all bolts and fastening devices for a complete assembly.
   b. Brackets: Cold-formed framing channel brackets, as required for maximum cover of shelf depth:
      1) Shelves at least than 9 inches and less than 11 inches deep: Unistrut P1769, Powerstrut PS 732-8, B-Line Systems, Inc. B187, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
      2) Shelves at least than 11 inches and less than 13 inches deep: Unistrut P1771, Powerstrut PS 732-10, B-Line Systems, Inc. B541, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
      3) Shelves at least 13 inches and less than 15 inches deep: Unistrut P1773, Powerstrut PS 732-12, B-Line Systems, Inc. B289-12, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
      4) Shelves at least 15 inches and less than 17 inches deep: Unistrut P1775, Powerstrut PS 732-14, B-Line Systems, Inc. B289-14, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.

4. Adjustable Wall Shelving:
   a. Shelf Standards: Framing channel, spaced equally, 36 inches (915mm) on center, maximum. Provide all bolts and fastening devices for a complete assembly.
   b. Brackets: Cold-formed framing channel brackets, as required for maximum cover of shelf depth:
      1) Shelves at least than 9 inches and less than 11 inches deep: Unistrut P1769, Powerstrut PS 732-8, B-Line Systems, Inc. B187, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
      2) Shelves at least than 11 inches and less than 13 inches deep: Unistrut P1771, Powerstrut PS 732-10, B-Line Systems, Inc. B541, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.
3) Shelves at least 13 inches and less than 15 inches deep: Unistrut P1773, Powerstrut PS 732-12, B-Line Systems, Inc. B289-12, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.

4) Shelves at least 15 inches and less than 17 inches deep: Unistrut P1775, Powerstrut PS 732-14, B-Line Systems, Inc. B289-14, or equal. Secure to steel uprights and underside of shelf with removable bolt fasteners.


5. Suspended Adjustable Shelf:
   a. Vertical members: Telescoping 12 gauge (2.8mm) tube or strut, 1-5/8 inch by 1-5/8 inch and 1-7/8 inch by 1-7/8 inch, with 9/16 inch diameter pre-punched holes at 1-7/8 inch on center: Unistrut “Telestrut System”, Allied Tube & Conduit “Square-Fit” telescoping channel, or approved substitution.
   b. Provide fittings designed to connect and attach telescoping tubing.
   c. Gravity pins shall be used to connect telescoping members.

6. Cylinder and Dewar Restraint:
   a. Swivel Hanger: 1-3/4 inch long by 3/8 inch diameter link welded to threaded stud; provide two per cylinder: Unistrut M2350, Powerstrut PS205, Kumar N-2911, B-Line 446B.

7. Laser Shelf:
   a. Vertical members: Telescoping 12 gauge (2.8mm) tube or strut, 1-5/8 inch by 1-5/8 inch and 1-7/8 inch by 1-7/8 inch, with 9/16 inch diameter pre-punched holes at 1-7/8 inch on center: Unistrut “Telestrut System”, Allied Tube & Conduit “Square-Fit” telescoping channel, or approved substitution.
   b. Provide fittings designed to connect and attach telescoping tubing.
   c. Gravity pins shall be used to connect telescoping members.

8. Overhead Support Grid

D. 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.
   c. Exposed Framing Members and Fittings: Factory applied epoxy powder coat. Color: To be selected by the Architect.

2.20 SEALANT

A. Refer to Section 07 92 00.

B. Sealant shall be installed by installer of the work of this Section.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Inspection:
1. Prior to installation of the work of this Section, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that all work may be installed in complete accordance with the original design, reviewed submittals, and the manufacturer's recommendations.

B. Project Conditions: Casework and furnishings shall not be delivered and installed prior to completion of the followings items:

1. Windows and doors shall be installed and the building shall be weather-tight.
2. Finished ceilings, if specified, overhead ductwork, piping, electrical, and lighting work shall be installed.
3. Painting shall be complete.
4. Flooring shall be installed.
5. Interior building temperature can be maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C), and ambient relative humidity can be maintained between 25 percent and 55 percent prior to delivery and during and after installation. Frequent and/or excessive changes in temperature and/or humidity levels during casework installation, or once casework is installed, must be avoided to prevent damage to materials.

C. Discrepancy: In the event of discrepancy, immediately notify the Architect.

3.02 INSTALLATION

A. Installation of items specified in this Section shall be performed by installers experienced in the installation of the respective item as determined by the respective manufacturer.

B. Coordinate work with any Owner furnished and/or installed components indicated on drawings.

C. Set casework items plumb, level, and true. Shim as required, using concealed shims for a plumb, level, true and straight installation. All items shall be securely anchored.

D. 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 (1.5mm).

E. Provide matching filler pieces where casework abuts walls or columns, or should be closed off.

F. Field weld joints in stainless steel tight, without open seams. Finish material to match adjacent to weld.

G. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.

H. Suspended Casework, Wall Cabinets, and Shelving:

1. Securely fasten to solid supporting material; not plaster, lath, or wallboard. Anchor, adjust, and align suspended casework, wall cabinets, and shelving supports as specified for base cabinets.

2. Blocking and backing in cavity wall construction for suspended casework, wall cabinets, and shelving shall be as specified under Division 09, and shall be installed under the scope of work of other Sections. General Contractor shall coordinate the location of in-wall blocking and backing using the shop drawings provided under this Section. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.

I. Laboratory Tops:

1. Scribe tops as necessary for close and accurate fit.
2. 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.

3. 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.

J. Laboratory Sinks: Sinks shall be set in work surface with chemical-resisting sealing compound, secured and supported in accordance with manufacturer’s instructions.

K. Miscellaneous Furnishings and Accessories: Install in accordance with manufacturer’s instructions. Tighten screws to seal flat; do not drive.

L. Sealant:
   1. Caulk edges of tops, backsplashes and side splashes to adjacent wall surface, and around all work surface penetrations, with sealant.
   2. Sealant application shall be in accordance with manufacturer’s published recommendations.

M. Repair or remove and replace defective work as approved by the Architect at no additional cost to the Owner.

N. Adjustable Laboratory Furniture System:
   1. Support system locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with installation.
   2. Installation of support system shall be coordinated with the trades to maintain the integrity of the installed system.
   3. Support system assemblies, ancillary components and accessories shall be installed with the supervision of the manufacturer’s authorized representative and according to manufacturer’s recommendations.

3.03 CLEANING AND PROTECTION

A. Clean finished units, touch up as required, and remove and refinish damaged or soiled areas.

B. Cover tops with Kraft paper or polyethylene sheeting after installation for protection against scratching, soiling, and deterioration during remainder of construction period. Remove protection prior to final cleaning.

C. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

END OF SECTION
PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Comply with all standards and requirements listed.
B. Welding and welders:
   1. Utilize skilled and qualified welders.
   2. Weld in conformance with AWS welding code.

1.2 SUBMITTALS

A. Samples:
   1. Metal and wood finishes.
   2. Fabric samples.
B. Contract Closeout Information:
   1. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
C. LEED Credit EQc4.1, Low-Emitting Materials, Adhesives and Sealants:
   1. Provide product data and material safety data sheets (MSDS) for adhesives and sealants used inside the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.

   D. **Complete Seat Plan:** Submit drawings fully describing the seat plan developed from architect’s prints of the building. Include details of all chairs, sizes, widths, anchorage and accessories.

PART 2 - PRODUCTS

2.1 SEATING

A. Acceptable Manufacturers:
   1. Base:
      a. **American Seating Company.**
   2. Optional:
      a. _________
      b. _________
   3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PRODUCT LINES

   A. Description 'Focus Action Swing Away'-Fixed Tables and Seating:
      1. The product is a pedestal support table with upholstered chair toppers. The tables are designed to be used in connecting table sections to form continuous curved rows. Moldings shall only be applied to the perimeter of each row. The table supports shall be attached to the floor and have up to two armless chairs, each mounted on cantilevered beams with a self-return pivot mechanism. Each chair is supported by height adjustable cylinders with 360 degree rotation which returns to the original position when unoccupied.
      2. Tables provided are to be 18” deep from finished edge to finished edge.
B. Construction:

1. **Frame:** The frame shall be formed of 14 gage (.083") welded seam, cold rolled, A.K.D.Q. steel tubing. A steel inner reinforcement tube 11 3/4" long 16 gage shall extend from the center of the arms to 4 ½" above the seat pan. Two side frame halves shall be joined with 3" long inner reinforcement tubes welded in place. A separate formed tubular frame section shall be welded to the side frame providing support to the front area of the seat forming a lateral cross brace under the seat between the frame halves.

2. **The support consists of an 11 gage flat oval steel tube 1.60" x 3.89" welded to a 1/4" thick steel floor attachment plate 8" x 5.5". The upper portion of the tube shall be canted forward at approximately 30 degrees. Die-formed steel adjustable top brackets shall be bolted to the top end of the tube allowing for final field adjustment. A cast ductile iron pivot bracket shall be inserted into the lower vertical section of the table leg and securely fastened by two heavy machine screws. Up to two cantilevered tubular steel chair support arms with steel pivot housings at one end shall be attached, using 0.75" solid steel pins, to the cast iron pivot bracket. The opposite end of the cantilever arm has a tubular steel tapered sleeve welded to the arm which accepts a height adjustable 360 degree swivel cylinder with self-return-to-center feature. The cylinder will adjust in height and automatically raises the chair to its highest and centered position when unoccupied providing a consistent appearance. The pivot mechanism provides smooth accurate forward storage of the chairs when unoccupied.

3. **Table Top:**
   a. Tables shall be custom manufactured to the specific room size for each project. Table end corners shall have 1.5" radius (with extruded vinyl edge banding with barbed insert) or 0.12" radius (for all other edges).
   b. The table top shall be 1-1/4" thick consisting of a 45 lb/cu ft density particle board core to which a .050" high pressure laminate has been bonded to the top surface with a .050" backing sheet bonded to the bottom surface for a balanced construction. One exception is the Molded Urethane edge table top, which consists of a 0.40" high pressure laminate and backing sheet.
   c. Edges shall be 1” radius wood in the species and finish selected from the manufacturer’s standard offering.
   d. Wood spline and tight joint fasteners shall be used to join adjacent table surfaces forming a continuous table top.

C. Finish:

1. **Wood Edges:** All exposed surfaces shall be coated with lacquer of sufficient film depth to afford adequate protection in use colors as selected.

2. **Steel Parts:** Steel parts shall be provided with a hybrid epoxy powder coat in one of manufacturer's standard colors using the following procedure:
   a. Pre-powder coat cleaning in a 7-stage bonderizing process
   b. Powder coat finishing of parts in an electrostatic system.
      1). Parts shall be coated with a thermosetting epoxy powder.
      2). Cured powder coat to have dry film thickness of 1.0 to 2.0 mils.
      3). Parts shall be high temperature cured in a gas fired convection oven.
4). Cured powder coat must pass: ASTM D3363-74 Hardness 2H, ASTM D2794-69 Impact Resistance 120 in-lbs without cracking, ASTM D522-60 Flexibility no cracking or loss of adhesion, ASTM B117-73 Salt Spray 144 hours with no corrosion, ASTM D1654-79a Salt Spray maximum 1/8” creep from scribe line, ASTM D3359-83 Adhesion 5B, ASTM G53-96 Light Resistance 48 hour exposure with no chalking, 75% gloss retention and color change less than 1.5 deltaE CIE and Hoffman Scratch Hardness Tester no substrate appearance with 1,000 gram load.

2.3 FABRICATION
A. Units may be single or multiple mounted to fit layout radii.
B. Supplier shall provide complete layout plan showing seating, mounting, accessories, electrical rough-in points, etc.
C. Maintain 5 percent surplus stock of upholstery fabric.

2.4 ADDITIONAL FEATURE REQUIREMENTS
A. The wood veneer modesty panel [65 Seat and 122 Seat Classroom] shall consist of 1/2” A/B grade plywood core with 0.020” thick hardwood veneer bonded to the front and back surface. Exposed edges are finished with veneer edge banding. Modesty panels are 15” in height. Panel is secured to the table top with steel brackets. Back side of curved modesty panels are kerf cut to accommodate curved rows. The wood veneer modesty front surface is provided in finishes from the manufacturer’s standard finish selection.
B. Power and data raceway [65 Seat and 122 Seat Classroom]: The power and data raceway houses a UL/CUL listed manufactured wiring system. The wiring system is a 4-wire, 2-circuit, 20 amps per circuit distribution with a 15 amp duplex receptacle located between every other chair. The electrical wiring is distributed by in-feeds and jumpers used between duplex receptacles. Jumpers use plug and play modular connections and flexible metal conduit that provides NFPA 70 approved separation between electrical wiring and communications cabling. The in-feed is hardwired to the building by a licensed electrical. Data jacks shall be provided, and all communications wiring or cables and connections are provided by the contractor. Raceway is constructed of black PVC with individual 20 gage powder coated steel covers at electrical receptacle/data jack locations. Steel covers are provided with duplex receptacle access openings and optional data jack openings for two Category 5e or 6 in-line couplers (jacks). Raceway is attached with steel mounting brackets bolted to the cast iron chair standards underneath the seat pivot landing. Raceway fits straight and curved rows with a minimum 23’ radius. Raceway is compatible with end standards. Outside dimension is 3” x 2” with an inside dimension of 1.62” x 2.50”. Raceway provides communication distribution capacity of up to 34 CAT 6 cables. Provide power/data in-feed box 4” x 6” x 8” housing obtained from the supplier for power and data connections from the floor.
C. Aisle Lighting [122 Seat Classroom Only]: Provide modular surface mounted aisle lighting on privacy end panels at aisle step locations both ends of table rows.

2.5 TEST PROCEDURES AND REQUIREMENTS
A. Drop Impact Test to Top
Table pedestals shall be securely anchored to the floor. A 200 lb. sand bag shall be dropped from a 2” height onto the center of the table top midway between adjacent pedestals, with deflection not to exceed 1/4” with the load remaining on the top. With the load removed, there shall be no permanent deflection or damage to the top or supporting structure.
B. Vertical Static Load to Cantilevered Top
A 300 lb. static load shall be applied to the end of a cantilevered top 27" from the pedestal. There shall be no permanent distortion of the top, the structure or loosening of fasteners.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.
B. Installation assumes responsibility for performance.

3.2 INSTALLATION

A. Comply fully with manufacturer's layout plan, shop and erection drawings, and installation recommendations.
B. Set units plumb, level and true to line.
C. Anchor securely in place.
D. Set bases in a bed of sealant.

3.3 CLEANING AND PROTECTION

A. Clean promptly after installation.
B. Exercise care to avoid damage to finishes.
C. Protect work and take other precautions required to ensure that work will be without damage at time of acceptance.

END OF SECTION