

SECTION 11610
LABORATORY EQUIPMENT

PART 1 - GENERAL

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary Conditions and Division 1 - General Requirements, apply to work specified in this Section.

1.02 SUMMARY

- A. This Section includes the following:

1. General purpose bench-top fume hoods with epoxy work surfaces and polypropylene sinks.
2. Metal base cabinets.
3. Plumbing and electrical fixtures, piping, wiring, fittings and devices in fume hoods, including pre-piping and wiring to a single point of connection.
4. Fume hood ceiling enclosures.
5. Installation of some Owner furnished laboratory equipment; refer to the Equipment Data Matrix in the Project Manual for description and quantities of equipment to be installed under this Section.

- B. Related Work Specified in Other Sections:

1. Resilient base applied to base cabinets: Section 09650.
2. Fume hood duct and flammable liquid storage cabinet vent connections: Division 15 Section.
3. Hood exhaust, including air flow monitoring and alarms: Division 15 Sections.
4. Connecting piped utilities: Division 15 Sections.
5. Electrical connection of fume hoods: Division 16 Sections. Wiring for service fittings within fume hoods up to point of connection is specified in this Section.

- C. Work by Owner:

1. On-site testing and certification of hoods. Refer to 15950, "Testing, Adjusting and Balancing."
2. Furnishing and installing some laboratory equipment. Refer to the Equipment Matrix at the end of this Section for description and quantities of equipment furnished and installed by the Owner.
 - a. Under Section 06100, provide blocking for support of equipment furnished or furnished and installed by Owner.
 - b. Under Division 15 provide piped utilities required for equipment furnished or furnished and installed by Owner.
 - c. Under Division 16 provide electrical power to equipment furnished or furnished and installed by Owner.

1.03 PERFORMANCE REQUIREMENTS

- A. Containment: Provide fume hoods with the following performance ratings at a face velocity of 60 fpm (0.34 m/s) and a release rate of 8.0 L/min. when tested according to ASHRAE 110:
 - 1. As-Manufactured Rating: AM 0.05 (0.05 ppm).
 - 2. As-Installed Rating: AI 0.10 (0.10 ppm).
- B. Fume Hood shall operate safely with an average face velocity between 50 FPM and 60 FPM through the fully opened vertical sash.
- C. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section.
- D. Fume hood shall be designed to minimize static pressure loss and noise with adequate slot area and bell shaped exhaust collar configuration.

1.04 SUBMITTALS

- A. Product Data: For each type of laboratory fume hood specified.
- B. Shop Drawings: For laboratory fume hoods. Include plans indicating location of fume hoods and dimensional plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate locations of blocking and other supports required for installing fume hoods.
 - 2. Indicate locations and types of service fittings, together with associated service connections required.
 - 3. Indicate plumbing connections, duct connections, electrical connections, and locations of access panels.
 - 4. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 5. Show adjacent ceilings, walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
 - 6. Include coordinated dimensions for laboratory equipment furnished or furnished and installed by Owner.
- C. Samples for Initial Selection: Samples in the form of color chips on metal substrate showing the full range of colors and sheens available for fume hood exterior, cabinets, and worktop.
- D. Samples for Verification: 6-inch-square samples for metal finish and worktop material.
- E. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of fume hoods with requirements based on comprehensive testing of hoods.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain laboratory fume hoods through one source from a single manufacturer.
- B. Fume Hood Standard: Provide fume hoods complying with the requirements of SEFA 1.1, "Laboratory Fume Hoods - Recommended Practices."
- C. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201 for Category II materials.
- D. Installer Qualifications: Engage an experienced Installer certified by the fume hood equipment manufacturer and who has a minimum of five year's experience in the installation of fume hoods similar in design and extent to those required for this project and whose work has resulted in a record of successful in-service performance.

1.06 PRODUCT HANDLING

- A. Coordinate delivery of fume hoods with delivery of other laboratory casework components.
- B. Package and ship fluorescent lamps separately, to protect them against breakage during shipping and installation.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.07 COORDINATION

- A. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

1.08 WARRANTY

- A. Fume Hood Warranty: Submit a written warranty, executed by the fume hood manufacturer, agreeing to repair or replace units that fail to meet specified performance within the specified warranty period of 2 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Laboratory Fume Hoods: Subject to compliance with requirements, provide one of the following products:
 - 1. Lab Crafters, Inc., "Air Sentry Fume Hood."
 - 2. Kewaunee Scientific Corp.; Laboratory Division; "Dynamic Barrier Fume Hood."
- B. Polypropylene Sinks and Cupsinks: Subject to compliance with requirements, provide products by one of the following: Orion Fittings, Inc. Kansas City, KS; Town and Country Plastics; R&G Sloane.

- C. Plumbing Service Fittings: Subject to compliance with requirements, provide products by one of the following: Chicago Faucet Co.; T&S Brass; Water Saver.

2.02 FUME HOOD EQUIPMENT SUMMARY

- A. Products: High performance bench top fume hood with automatically adjusting baffle; Lab Crafters Models listed below or equal by one of the other name manufacturers:

1. FH1: 4'-0" wide by 4'-6" high by 3'-3" deep
 - a. Hood: "Air Sentry" HBASV4
 - b. Work Top: Epoxy with polypropylene sink.
 - c. Base Cabinets: Acid Storage
 - d. Design Exhaust Flow: 350 cfm.
 - e. Type: Constant volume (bypass)
 - f. Design Sash Height: 22 inches.
2. FH3: 6'-0" wide by 4'-6" high by 3'-3" deep
 - a. Hood: "Air Sentry" HBASV6
 - b. Work Top: Epoxy with polypropylene sink.
 - c. Base Cabinets: Metal cabinets.
 - d. Design Exhaust Flow: 600 cfm.
 - e. Type: Constant volume (bypass)
 - f. Design Sash Height: 22 inches.

- B. Summary of Components and Features:

1. Epoxy resin liner
2. Pre-wired/UL Listed
3. T8 fluorescent light ballast with vapor proof light.
4. 2 x 120 VAC, 20 amp GFI receptacles.
5. Combination sash with frameless safety glass and stainless steel sash handle.
6. Tissue screen.
7. Stainless steel duct collar with bell-mouth fitting.
8. Epoxy resin work top.
9. Metal base cabinets listed and labeled for flammable solvent storage.
10. Service Fittings: Cold water, compressed air, propane gas.
11. Polypropylene Cup Sink: 3 inches x 6-inches x 4 inches (minimum)deep.
12. Preplumb hoods for cold water, compressed air and vacuum services, and provide fittings for gas service which will be added later.

2.03 MATERIALS

- A. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet, complying with ASTM A 366 (ASTM A 366M); matte finish; suitable for exposed applications; and stretcher leveled or roller leveled to stretcher-leveled flatness.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher leveled, No. 4 finish.
- C. Epoxy: Factory-molded, modified, epoxy-resin formulation, uniform mixture throughout, full thickness with smooth, nonspecular finish.

1. Physical Properties: Comply with the following minimum requirements:
 - a. Flexural strength: 15,000 psi (100 MPa).
 - b. Compressive strength: 30,000 psi (200 MPa).
 - c. Hardness (Rockwell M): 100.
 - d. Water absorption (24 hours): 0.02 percent (maximum).
 - e. Heat distortion point: 350 deg F (177 deg C).
 - f. Thermal-shock resistance: Highly resistant.

2. Flame Spread: 25 or less per ASTM E 84.

3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, test procedure 3.9.5:
 - a. Acetone: Moderate effect.
 - b. Acetic acid (98 percent): No effect.
 - c. Hydrochloric acid (37 percent): No effect.
 - d. Nitric acid (70 percent): No effect.
 - e. Phosphoric acid (85 percent): No effect.
 - f. Sulfuric acid (33 percent): No effect.
 - g. Benzene: No effect.
 - h. Butyl alcohol: No effect.
 - i. Carbon tetrachloride: No effect.
 - j. Ethyl acetate: No effect.
 - k. Ethyl ether: No effect.
 - l. Formaldehyde: No effect.
 - m. Phenol (85 percent): No effect.
 - n. Xylene: No effect.
 - o. Ammonium hydroxide (28 percent): No effect.
 - p. Sodium hydroxide (50 percent): Moderate effect.
 - q. Zinc chloride: No effect.

D. Polypropylene: ASTM D4101, Type 110 (homopolymer, general purpose) or Type 210 (random copolymer, general purpose), chemical resistant propylene plastic material suitable for injection molding and extrusion; reinforcement, Grade and detail requirements as determined by the manufacturer for forming and performance.

1. Physical Properties (based on Orion literature):

a. Density at 23°C:	0.902 gm/ml
b. Low temperature brittle point:	+10°F
c. Tensile strength:	4500 psi
d. Yield strength:	4000 psi
e. Elongation:	300%
f. Modulus of stiffness	2×10^5 psi
g. Maximum service temperature:	230°F or greater.
h. Coefficient of thermal expansion:	3.8×10^{-5} in/in/°F
i. Deflection temperature:	220 - 240°F

2. Chemical Resistance: Resistance to the chemicals listed in ASTM F1412, Paragraph 8.3, as determined by testing in accordance with ASTM D543; "resistance" shall mean no effect observed after exposure. Chemicals listed in ASTM F1412 are as follows:

	<u>Chemical</u>	<u>Percent in water</u>
a.	Acetic acid	5% by volume
b.	Acetone	100% (glacial)
c.	Methyl alcohol	100%
d.	Ammonium hydroxide	10% by volume
e.	Nitric acid	40% by volume
f.	Sodium hydroxide	10% by weight

3. Color: Black

E. Laminated Safety Glass: ASTM C 1172, Kind LT; Kind FT, Condition A, Type I, Class I, Quality q3 lites with clear, polyvinyl butyral interlayer.

2.04 FUME HOOD FABRICATION

A. Bypass Fume Hoods: Provide bypass fume hoods. Provide sufficient bypass capacity so that face velocity with sash opening of 6 inches (150 mm) does not exceed three times the face velocity with sash fully open.

B. Steel Exterior: Fabricate from steel sheet, 0.0478 inch (1.2 mm) thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil, and to allow access to plumbing lines and service fittings. Apply finish to interior and exterior surface of component parts before final assembly.

C. Ends: Double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

D. Interior Lining: Fiberglass-reinforced polyester; white color. Provide end panels, back panel, and top fastened together with cleats or steel angles to form a rigid assembly to, which exterior is attached.

1. Punch fume hood lining side panels to receive remote controls and service fittings as indicated. Furnish removable plug buttons for holes not used for indicated fittings.

E. Rear Baffle: Provide adjustable baffle, of same material as fume hood lining, at rear of hood designed to permit automatic adjustment of airflow through hood.

1. Provide stainless steel tissue screen, mounted above the safety slot at the back of the hood, to prevent tissue and other light material from being swept up behind the upper baffle and into the exhaust system.

F. Sash: Combination sash with panels that move both vertically and horizontally.

1. Horizontal sliding sash supported on top-hung rollers, in two tracks, with a mechanism that allows sash to move below the counter top; to open to a maximum of 28", with an additional 7-inch high, clear glass panel integrated as part of hood lintel, to provide clear vision height to at least 34" above countertop.

2. Vertical operation of sash by means of manufacturer's standard counterbalance system, with stainless steel cables, rubber bumper stops at top and bottom of sash; tested to at least 100,000 cycles without signs of fatigue.
 3. Glass: 1/4" thick clear, laminated safety glass, with full width formed stainless steel handle.
- G. Lights: Vaporproof, 2-tube, rapid-start, fluorescent light fixture, of longest practicable length, complete with tubes at each fume hood. Shield tubes from hood interior by 1/4-inch-thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Set units so fluorescent tubes are easily replaceable from outside of hood.
1. Provide fluorescent tubes with a color temperature of 3500 K and a minimum color rendering index of 85.
 2. Illumination: Minimum of 80 foot candles at the top of the bench.
- H. Work Surfaces: Epoxy sheet, 3/4 inch thick, fabricated with front overhang of 1 inch over base cabinets, with raised marine edge and continuous drip groove on underside 1/2 inch from edge. Provide factory-molded openings for sinks. Provide 1-inch curb at vent penetrations.
1. Color: Black.
- I. Sinks: Molded polypropylene cup sinks with strainers and tailpieces; black color to match work surface, and as follows:
1. Size: 3 inches x 6-inches x 4 inches deep.
 2. Sink Fabrication: 1/2-inch minimum thickness, molded in one piece with coved corners and bottom sloped to outlet.
 3. Outlets: 1-1/2-inch NPS (DN40) outlets with strainers and tailpieces a minimum of 6 inches (150 mm) long, of the same material as sink.
- J. Filler Strips: Metal, to match adjoining surfaces. Provide as necessary to close openings between fume hood base cabinet or hood exterior and adjacent building construction.
- K. Fasteners: Provide stainless-steel fasteners where exposed to fumes in hood.
- L. Complete internal piping and wiring to a point 8" outside the hood, for connection to building services; except that piping may terminate flush with the face of the cabinet if a removable panel permits convenient access to piping at the point of connection.
- 2.05 FUME HOOD BASE CABINETS
- A. Base Cabinets: Provide each bench top hood with a pair of steel base cabinets complying with requirements of NFPA 30, each 36-inches wide.
1. FH1 (4'-0" wide hood): Acid storage cabinet.
 2. FH2 (6'-0" wide hood): Conventional metal storage cabinet.
- B. Fabrication: Fully welded steel shells, flush front construction, with flush interiors with posts, reinforcing, channel uprights, and similar framing members enclosed to facilitate cleaning.

Fabricate rails from minimum 16 gauge cold-rolled steel and cabinet enclosure (tops, bottoms, bases, backs, vertical posts, from minimum 18 gauge cold-rolled steel. Provide 4" high x 3" deep toe space with full return; reinforce cabinet bottom enclosing the toe space. Provide integral means for adjusting base height, such as adjustable bolts.

1. Doors: Swinging doors, 3/4" thick, double-wall construction with honeycomb core, minimum 18 gauge cold-rolled steel exterior face and 20 gauge cold-rolled steel inner face. Provide rubber bumpers (silencers) in pre-punched holes in jambs.
 - a. Hinges: 11 gauge stainless steel, heavy-duty pivot hinges with nylon bushings.
 - b. Pulls: Chemically resistant ABS.
 - c. Door catches: Spring-actuated with nylon roller; self-adjusting.
 - d. Locks: Provide locks on fume hood base cabinet doors, keyed the same as the laboratory casework in the same room. Furnish 2 change keys per lock.
2. Provide acid-resistant liner in the acid storage cabinet.

2.06 ELECTRICAL SERVICE FITTINGS

- A. Provide one electrical 120V, AC, 20 amp, GFI single duplex outlet on each side of fume hood.
- B. Provide one 20 amp light switch wired to control fume hood lights.

2.07 BAFFLE CONTROL AND AIR FLOW MONITOR

- A. General: Equip each fume hood with a factory-installed control system that automatically monitors air flow and adjusts the baffle to maintain containment performance specified in Article 1.03. Include baffle actuator, controller/low flow alarm, and sensor.
- B. Basis of Specification: The "Air Sentry" mechanism which is the basis of this specification, is integral to the fume hood superstructure and includes a baffle/slot control, to enhance containment based upon maintenance of the vortex roll inside the hood. Slots in the hood baffle are adjusted by an automated baffle positioning control to maintain containment in response to variables such as sash movement, hood loading, cross-drafts, and personnel movement.
- C. In addition to maintaining the vortex airflow pattern, the hood airflow monitor shall alert the user when the average face velocity falls below Owner set point and shall provide a digital readout of the velocity or an alpha text message of the hood condition, LED's indicating normal and alarm conditions and an audible horn when in alarm mode. Furnish a controller/monitor which has the ability to digitally communicate with the existing building automation system.
 1. Coordinate operation of hood with HVAC system I/O points.
- D. Provide rechargeable back-up battery to maintain hood air flow in the event of a power failure.

2.08 PLUMBING SERVICE FITTINGS

- A. General: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other

installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

- B. Material and Finish: Fabricate service fittings from cast or forged red brass, unless otherwise indicated. Finish exposed surfaces, including fittings, escutcheons, and trim, with a polished chrome plating, unless otherwise indicated.
- C. Water Valves and Faucets: Provide units complying with ASME A112.18.1M, with renewable seats, designed for working pressure up to 125 psig (860 kPa). Provide vacuum breakers on water fittings with serrated outlets.
- D. Remote-Control Valves: Ground key cock valves, angle type.
- E. Valve Handles: 4-arm, forged-brass handles.
- F. Service-Outlet Identification: Color-coded plastic discs, to match color of outlet in hood, with embossed identification. Secure to each service-fitting handle in tamperproof manner.
- G. Products: Furnish the listed products by Chicago Faucet, or equal by one of the other named manufacturers.

	Model Numbers (based on Chicago Fixtures)	
	In-Hood Outlet	Remote Control Valve
Compressed Air	986-E7XT	962-VOGA
Cold Water	980-GN2B-VB-E7	962-VOA
Vacuum	986-E7XT	962-VOGA
Gas*	986-E7XT	962-VOGA

* Gas service will be added in the future; furnish fittings with hood now.

2.09 METAL FINISH

- A. Apply finish to fume hood and base cabinet steel after fabrication and welding. Clean and pretreat by washing with an alkaline cleaner, followed by spraying with metallic phosphate solution to protect the metal against corrosion and provide a good surface for bonding.
- B. Coat with manufacturer's standard chemical- and corrosion-resistant baked-on enamel finish.
- C. After the first coat has cured, apply colored topcoat to all surfaces which will be exposed to view after installation.
 - 1. Color: Architect's selection from hood manufacturer's standard colors (including white).
- D. Chemical Resistance of Paint Finish: When tested according to the chemical spot test described below, after 60 minutes exposure and 60 minutes recovery, finish shall perform as described below:
 - 1. Finish shall show "Excellent" resistance to the following chemicals (% are by weight):

a. Sulfuric acid, 25%	j. Hydrogen peroxide, 5%
b. Hydrochloric acid, 37%	k. Ether

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|----------------------------|------------------------------------|
| c. Nitric acid, 25% | l. Ethyl alcohol (volatile) |
| d. Phosphoric acid, 75% | m. Ethylene acetate (volatile) |
| e. Perchloric acid, 70% | n. Xylene (volatile) |
| f. Methylene chloride, 60% | o. Acetone (volatile) |
| g. Sodium hydroxide, 10% | p. Formaldehyde, 37% (volatile) |
| h. Sodium hydroxide, 25% | q. Carbon tetrachloride (volatile) |
| i. Ammonium hydroxide, 28% | r. Methyl ethyl ketone (volatile) |

2. Finish shall show at least "Good" resistance to the following chemicals:
 - a. Acetic acid, 98%
 - b. Sulfuric acid, 85%
3. Chemical Spot Test: Apply 10 drops (approximately 1/2 cc) of reagent to the test surface. Cover liquid with a watch glass, convex side down. Apply volatile solvents by using saturated 1-inch cotton ball, covered by inverted 2-ounce wide-mouth bottle to retard evaporation. Keep the test surface wet throughout the entire test period. Maintain temperature of 77°F ±3°F. At the end of the test period, flush test surface with cold water, scrub lightly with a soft bristle brush and soapy water, rinse, and dry. Allow sample to recover for one hour, then inspect condition of the finish film.
4. Definitions of Performance:
 - a. Excellent: No visible effect on finish film other than an increase in gloss.
 - b. Good: No effect other than slight discoloration, slight decrease in gloss, or temporary slight softening of the finish film with no loss of adhesion and film protection.

E. Physical Performance of Metal Finish Film:

1. Resistance to Bending: Take an 18 gauge steel strip to which the finish has been applied, and bend it 180° around a 1/2 inch diameter mandrel. No peeling or flaking off of finish.
2. Adhesion: With a razor blade, cut two sets of 11 parallel lines 1/16" apart at right angles to form a grid of 100 squares. Make cuts just deep enough to go through the coating, but not into the substrate. Brush lightly with a soft brush. Examine under 100 foot candles illumination. 90 or more squares shall remain coated.
3. Hardness: 4H using the pencil hardness test.

2.10 SOURCE QUALITY CONTROL TESTING OF FUME HOODS

- A. Submit a test report, for each type and size of hood, for the standard product previously tested, if the product is identical to equipment being provided for this project.
- B. Evaluation of standard product shall have been conducted in the manufacturer's test facility in accordance with the method prescribed in ANSI/ASHRAE 110-1995 or latest published edition. Hood test shall take place in the manufacturer's test facility with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer. Recommended gas analyzer is Infrared type device rather than an Electron capture device. Test parameters shall deviate from the ASHRAE Standard in the following manner:

1. For all tests, the mannequin's breathing zone shall be located 18" above the fume hood work surface.
 2. For all tests, the tracer gas release rate shall be 8.0 liters per minute.
 3. A test shall be performed in the center position with simulated hood loading. Objects must be placed within the fume hood chamber, located even with the tracer gas ejector and behind the tracer gas ejector to simulate equipment and apparatus in the fume hood.
 4. A test shall be performed in the center location with a walk-by challenge 24 inches behind the test mannequin for the duration of the test.
 5. A test shall be conducted with a hotplate behind the tracer gas ejector set for 1000 watt output.
- C. Hoods shall achieve a rating of 8.0 AM 0.01 or better.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install laboratory equipment according to approved Submittals and manufacturer's written instructions. Install plumb, level, aligned, and securely anchored to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where hoods abut other finished work, apply filler strips and scribe for accurate fit with fasteners concealed where practical.
- B. Comply with requirements of Division 15 and 16 Sections for installing water and laboratory gas service fittings, ductwork, piping, electrical devices, and wiring. Install according to approved Shop Drawings and manufacturer's written instructions. Securely anchor fittings, piping, and conduit prior to connecting to fume hoods and casework.
- C. Install fume hoods complete with sinks, service fittings, lights, and other accessories installed and secured, for single point connections to utilities by the sub-contractors performing work specified in Division 15 and 16.
 1. Unpack and install fluorescent lamps. Test, and replace lamps which do not operate properly.
- D. Install fume hood ceiling enclosure. Seal to the ceiling above and hood below with acoustical sealant.

3.02 FIELD QUALITY CONTROL

- A. After installation, laboratory hoods will be tested and commissioned by the Owner's Agent.
- B. Hoods will be tested according to ASHRAE 110 and Owner's protocols to verify performance.
 1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.

- C. Subsequent to commissioning, hoods will be certified by the Owner.
- D. Refer to Section 15950, "Testing, Adjusting and Balancing," for additional field testing related to fume hood installation.

3.03 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near-silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Repair or remove and replace defective work as directed on completion of installation.
- C. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 11610