

PART 1 - GENERAL

- 1.1 REFERENCES**
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).
 - .2 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASTM International
 - .1 ASTM B62-15, Standard Specification for Composition Bronze or Ounce Metal Castings.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS**
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

- 2.1 MATERIALS**
- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
 - .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: screwed ends to ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ASME B16.18.
 - .3 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ASME B1.20.1 and with hexagonal shoulders solder ends to ASME.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

PART 3 - EXECUTION

- 3.1 INSTALLATION**
- .1 Remove internal parts before soldering.
 - .2 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES**
- .1 National Research Council Canada (NRCC)
 - .1 NRCC NBCC-2010, National Building Code of Canada 2010.
- 1.2 DEFINITIONS**
- .1 Priority Two (P2) Buildings: buildings in which life safety is of paramount concern. It is not necessary that P2 buildings remain operative during or after earthquake activity.
 - .2 SRS: acronym for Seismic Restraint System.
- 1.3 DESCRIPTION**
- .1 SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified elsewhere.
 - .2 Structural, mechanical, electrical design of project.
 - .2 Systems, equipment not required to be operational during and after seismic event.
 - .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
 - .4 Designed by Professional Engineer specializing in design of SRS and registered in Province of Ontario.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS**
- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .3 Submit design data including:
 - .1 Full details of design criteria.
 - .2 Design calculations (including restraint loads resulting from seismic forces in accordance with National Building Code, detailed work sheets, tables).
 - .3 Separate shop drawings for each SRS and devices for each system, equipment.
 - .4 Identification of location of devices.
 - .5 Schedules of types of SRS equipment and devices.
 - .6 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - .7 Installation procedures and instructions.
 - .8 Detailed design of SRS including complete working drawings prepared to same standard of quality and size as Contract Documents, materials lists, design calculations, schematics, specifications.
 - .4 Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.

PART 2 - PRODUCTS

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| <u>2.1 SRS
MANUFACTURER</u> | .1 | SRS from one manufacturer regularly engaged in SRS production. |
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| <u>2.2 GENERAL</u> | .1 | SRS to provide gentle and steady cushioning action and avoid high impact loads. |
| | .2 | SRS to restrain seismic forces in every direction. |
| | .3 | Fasteners and attachment points to resist same load as seismic restraints. |
| | .4 | SRS utilizing cast iron, threaded pipe, other brittle materials not permitted. |
| | .5 | Attachments to RC structure: |
| | .1 | Use high strength mechanical expansion anchors. |
| | .2 | Drilled or power driven anchors not permitted. |
| | .6 | Seismic control measures not to interfere with integrity of firestopping. |

PART 3 - EXECUTION

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| <u>3.1 MANUFACTURER'S
INSTRUCTIONS</u> | .1 | Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet. |
| | | |
| <u>3.2 INSTALLATION</u> | .1 | Attachment points and fasteners: |
| | .1 | To withstand same maximum load that seismic restraint is to resist and in every direction. |
| | .2 | Install SRS at least 25 mm from equipment, systems, services. |
| | | |
| <u>3.3 FIELD QUALITY
CONTROL</u> | .1 | Manufacturer's Field Services. |
| | .2 | Inspection and Certification: |
| | .1 | SRS: inspected and certified by Seismic Engineer upon completion of installation. |
| | .2 | Provide written report to Departmental Representative with certificate of compliance. |
| | .3 | Commissioning Documentation: |
| | .1 | Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-built" conditions. |

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5-2013, Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22-2013, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - .4 ASME B18.2.1-2012, Square and Hex Bolts and Screws Inch Series.
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B837-10, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
 - .2 CSA B149.1-15, Natural Gas and Propane Installation Code Handbook.

- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

- 2.1 PIPE
- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
 - .1 NPS 1/2 to 2, screwed.
 - .2 NPS 2-1/2 and over, plain end.

- .2 Copper tube: to ASTM B837.

- 2.2 JOINTING MATERIAL
- .1 Screwed fittings: pulverized lead paste.
 - .2 Welded fittings: to CSA W47.1.
 - .3 Flange gaskets: nonmetallic flat.
 - .4 Brazing: to ASTM B837 .

- 2.3 FITTINGS
- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.

<u>2.3 FITTINGS</u> (Cont'd)	.1	(Cont'd)
	.2	Steel pipe flanges and flanged fittings: to ASME B16.5.
	.3	Welding: butt-welding fittings.
	.4	Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
	.5	Bolts and nuts: to ASME B18.2.1.
	.6	Nipples: schedule 40, to ASTM A53/A53M.
	.2	Copper pipe fittings, screwed, flanged or soldered:
	.1	Cast copper fittings: to ASME B16.18.
	.2	Wrought copper fittings: to ASME B16.22.
<u>2.4 VALVES</u>	.1	Provincial Code approved, ball type.
<u>PART 3 - EXECUTION</u>		
<u>3.1 MANUFACTURER'S INSTRUCTIONS</u>	.1	Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
<u>3.2 PIPING</u>	.1	Install in accordance with applicable Provincial/Territorial Codes, CSA B149.1, supplemented as specified.
	.2	Install drip points:
	.1	At low points in piping system.
	.2	At connections to equipment.
<u>3.3 VALVES</u>	.1	Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
	.2	Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES**
- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .2 ASTM International
 - .1 ASTM A480/A480M-16, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

PART 2 - PRODUCTS

- 2.1 FITTINGS**
- .1 Fabrication: to SMACNA.
 - .2 Radiused elbows:
 - .1 Round: smooth radius, centreline radius: 1.5 times diameter.
 - .3 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- 2.2 STAINLESS STEEL**
- .1 To ASTM A480/A480M, Type 304.
 - .2 Finish: number 4.
 - .3 Thickness, fabrication and reinforcement: to ASHRAE & SMACNA.
 - .4 Joints: to be continuous inert gas welded.
- 2.3 HANGERS AND SUPPORTS**
- .1 Hangers and Supports:
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to ASHRAE and SMACNA.
 - .3 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps.

PART 3 - EXECUTION

- 3.1 GENERAL**
- .1 Do work in accordance with ASHRAE & SMACNA.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE & SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

END OF SECTION

PART 1 - GENERAL1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASHRAE 110-1995, Method of Testing Performance of Laboratory Fume Hoods.
 - .2 ANSI/AIHA Z9.5-2012, Laboratory Ventilation.
- .2 ASTM International
 - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A1008/A1008M-15, Standard Specification for Steel, sheet. Cold Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .3 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .4 ASTM E84-15b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1-M90, Tempered and Laminated Safety Glass.
- .4 CSA International
 - .1 CAN/CSA-C22.2 No.61010-1-12, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.
 - .2 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC MD15128 2013, Laboratory Fume Hoods.
- .6 Scientific Furniture and Equipment Association (SEFA)
 - .1 SEFA 1-2010, Recommended Practices for Laboratory Fume Hoods.
 - .2 SEFA 2-2010, Recommended Practices for Installations.
 - .3 SEFA 3-2010, Recommended Practices for Laboratory Work Surfaces.
 - .4 SEFA 7-2010, Recommended Practices for Fixtures.
- .7 Underwriter Laboratories of Canada (ULC)
 - .1 UL 723, Tests for Surfaces Burning Characteristics of Building Materials.

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for fume hood components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit list of fume hood materials, components and accessories to be incorporated into Work.
 - .3 Include product names, types and series numbers for fume hood components and accessories.

<u>1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)</u>	.2	(Cont'd)
	.4	Include contact information for manufacturer for fume hood components and accessories used on this Project.
	.3	Site Visit:
	.1	Manufacturer's representative to inspect hood installations after each phase. Allow for four (4) inspections. Allow for separate site visit for test and evaluation at time directed by Client.
	.4	Test and Evaluation Reports:
	.1	Submit detailed performance reports in accordance with PWGSC MD15128, fume hood design criteria and materials thickness. Include hood superstructure details.
<u>1.3 QUALITY ASSURANCE</u>	.1	Indicate exhaust air flow rate.
	.2	Indicate pressure drop through fume hood.
	.3	Perform smoke test.
	.5	Field reports: submit manufacturer's field reports within 3 days of manufacturer representatives' site visit.
	.6	Submit detailed seismic anchorage and attachment drawings and calculations complying with requirements and regulations for seismic restraint.
	.1	Certification: submit catalogued or published certified ratings obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying performance capabilities, including "As Manufactured (AM)" tests in accordance with PWGSC MD15128.
<u>1.4 DELIVERY, STORAGE AND HANDLING</u>	.2	Repeat AM tests if requested in presence of Departmental Representative.
	.1	Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
	.1	Upon arrival and before installation, demonstrate that fume hood is consistent with prototype and product data, and has not been damaged in transit.
	.2	Ensure fume hood bears CSA label.
	.3	Inspect fume hood and record condition using approved check sheet.
	.4	Departmental Representative will supply check sheet.
<u>1.5 WARRANTY</u>	.5	After check of fume hood inspection has been carried out have Departmental Representative sign sheet and submit sheet as part of record documentation.
	.2	Storage and Handling Requirements:
	.1	Store and protect fume hood, components and accessories from nicks, scratches, and blemishes.
	.2	Replace defective or damaged materials with new.
	.1	Project Warranty: refer to Contract Conditions for project warranty provisions.

PART 2 - PRODUCTS2.1 DESCRIPTION

- .1 Laboratory fume hood: ventilated, enclosed work space, designed for continuous use to capture, confine and exhaust fumes, vapours and particulates generated within fume hood cavity.
- .2 Factory fabricated package, piped and wired for single connections to exhaust system, electrical power, laboratory services, water supply, and laboratory drainage system.
- .3 Fume hood to be constant volume but be capable of converting to variable air volume by blocking off of bypass grille.

2.2 DESIGN CRITERIA

- .1 Fume hood, controls and alarms: ULC labelled.
- .2 Fume hood face velocity: 0.50 m/s.
 - .1 Design sash position (normal operating sash height) at 450 mm.
- .3 Seismic: ensure fume hood manufacturer supplies anchor bolts and templates.
 - .1 Ensure anchor bolts are sized to withstand seismic zone acceleration and velocity requirements for location.
- .4 Meet performance criteria in PWGSC MD15128.
- .5 Construct to SEFA 1 Recommended Practices for Laboratory Fume Hoods.

2.3 CONSTANT AIR
VOLUME (CAV) BYPASS
FUME HOODS

- .1 For detailed requirements refer to schedules on drawing.
 - .1 Width: 1200 or 1500 mm nominal as indicated.
 - .2 Height: 1500 mm nominal.
 - .3 Depth: 840 mm nominal.
- .2 Sash: 6 mm thick minimum tempered safety glass to CAN/CGSB-12.1 in corrosion resistant PVC track with provisions for raising and lowering sash.
 - .1 Sash handle: type 316 stainless steel with #4 satin finish, designed to eliminate eddies in plane of sash opening and thin enough in profile to minimize interference with line-of-sight of fume hood user.
 - .2 Clear openable height to 700 mm.
- .3 Sash opening: normal operating position to:
 - .1 Form part of fume hood design criteria.
 - .2 Ensure normal operating position is labelled on front.
 - .3 Ensure opening is restricted by sash stop.
 - .4 Normal operating position of sash:
 - .1 450 mm opening above airfoil.
- .4 Bypass grille: construct from same material as exterior panels, located on front face of hood, designed to permit air entry as sash is lowered, and to close off air entry as sash is raised.

2.3 CONSTANT AIR
VOLUME (CAV) BYPASS
FUME HOODS
(Cont'd)

- .4 (Cont'd)
- .1 Size to ensure air flow rate and face velocity remains within the requirements of PWGSC MD15128.
- .2 Low-resistance to air flow.
- .5 Counterbalance mechanism: use single counterweight, chain and sprocket design or stainless steel multi-strand wires, 39 mm minimum diameter nylon-tired ball-bearing pulley assembly, cable retaining device, assembled to prevent creep or tilting of sash during operation.
- .1 Sash to move easily and quietly with one finger operation, and remain in place where it is stopped.
- .2 Spring counterbalance mechanisms not acceptable.
- .3 Sash to open and close against rubber bumper stops, installed to ensure user can readily adjust sash opening when moving sash from either end.
- .4 In event of failure of counterbalance mechanism, sash must remain 50 mm minimum above lowest part of airfoil.
- .5 Sash guides; full length corrosion resistant extruded PVC tracks.
- .6 Sash stop: include physical stop to prevent sash from opening beyond normal operating position under regular working conditions.
- .1 Allow sash to open beyond normal operating position when placing apparatus in hood.
- .2 Ensure sash automatically resets to normal operating limit.
- .7 Horizontal air-foil:
- .1 1.9 mm type 316 stainless steel with #4 satin finish, installed 25 mm above raised portion of work surface and designed for eddy-free air entry.
- .2 Project into fume hood beyond edge of sash.
- .3 Design airfoil to eliminate reverse flow within 75 mm of plane of sash.
- .8 Work surface: recess 316 stainless steel work surface 12 mm minimum to contain spills and include coved corners and raised edges. Construct to SEFA 3.
- .1 Ensure joints with interior panels are sealed.
- .2 Adhere 50 mm minimum line of yellow PVC tape to work surface 150 mm inside plane of sash for full width of work surface.
- .9 Interior panels:
- .1 Stainless steel: to ASTM A167 1.2 mm thick minimum, type 316 with #4 satin finish with 12 mm minimum radius interior corners and welds ground smooth.
- .1 Flexural strength: 96.5 MPa.
- .2 Flame spread: 25 or less to UL 723 and ASTM E84.
- .2 Interior access panels: gasketed, removable and replaceable without use of special tools.
- .10 Fastenings: ensure fastenings inside fume hood are corrosion resistant and remain unaffected by repeated manipulations.
- .11 Baffles: construct baffles from same material as interior panels.
- .1 Design baffles to provide multiple exhaust slots to minimize variations in face velocity across sash opening when sash is in normal operating position.
- .2 Set baffles at manufacturer's plant on basis of prototype testing, and permanently mark setting.

**2.3 CONSTANT AIR
VOLUME (CAV) BYPASS
FUME HOODS
(Cont'd)**

- .12 Exhaust duct collar: 305 mm diameter, integral with top panel and constructed from stainless steel, with bell-mouthed entry, and flanged to accept exhaust duct.
 - .1 Exhaust duct collar size: to provide exhaust flow rate of 5.0 - 7.5 m/s minimum.
- .13 Exterior panels:
 - .1 Cold rolled steel to ASTM A1008/A1008M finished with powder coating procedure, fastened using concealed stainless steel screws and devices.
 - .1 Do not use external screws.
 - .2 Ensure panels are easily removable to allow access to services.
 - .2 Top closure panels: of same material and finish as exterior panels and designed to enclose ductwork up to ceiling.
 - .1 Ceiling heights as indicated.
 - .3 Finish: electrostatically applied urethane powder coat of selected colour and baked in controlled high temperature oven to assure a smooth, hard satin finish.
 - .1 Ensure surfaces have a chemical resistant, high-grade laboratory furniture quality finish with thicknesses as follow:
 - .1 Exterior surfaces exposed to view: 0.0375 mm average and 0.03 mm minimum.
 - .2 Backs of hood and other surfaces not exposed to view: 0.025 mm average.
 - .3 Colour selected from manufacturer's standard range by Departmental Representative.
- .14 Superstructure: rigid self-supporting unit consisting of double wall construction with outer metal shell and inner lining of corrosion-resistant material.
 - .1 Panels must be attached to full frame construction, minimum 1.9 mm galvanized members.
 - .1 Attach panels and brackets to eliminate screw heads and metallic brackets from hood interior.
 - .2 Double wall to house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms, and complete with:
 - .1 Include levelling screws.
- .15 Vertical side posts of fume hood face: angled or radiused airfoil shape to reduce eddies and promote smooth entry of air into hood.
 - .1 Ensure service fixtures do not disturb air flow pattern.
 - .2 Incorporate removable panels to provide access to service valves as indicated.
 - .3 Ensure unit is capable of accepting 5 minimum plumbing and laboratory services and one duplex electrical receptacle on each side of opening.
 - .4 Include light switch.
- .16 Light fixture: CSA approved or ULC listed and labelled. T8 two-tube fluorescent, rapid start, with electronic sound-rated ballasts, mounted on exterior of fume hood roof with safety lens and approved sealant to isolate fixture from fume hood interior.
 - .1 Sealant to be approved by Departmental Representative.
 - .2 Include bulbs with fixtures.
 - .3 Interior illumination at work surface: 860 lux minimum.
 - .4 Accessible for maintenance from fume hood exterior.
 - .5 Include flush-mounted switch on side post of fume hood.
- .17 Factory wire electrical outlets and switches and terminate in box on roof of fume hood to CAN/CSA-C22.2 No.61010-1.
 - .1 Only ULC listed or CSA approved electrical devices are acceptable.
 - .2 Provide switch for light.

2.4 LABORATORY
SERVICES

- .1 To SEFA 7.
- .2 Remote controls:
 - .1 Brass body, bolted and flanged and with chromium plated finish to ASTM B456, service condition SC 4, coating classification CuNi30dCr.
 - .2 Gas: CGA approved.
 - .3 Install remote controls on vertical side posts of fume hood face, located to avoid interference with smooth entry of air into hood.
 - .4 Include needle valves on all services except gas service.
 - .5 Equip remote controls with universal joints, wall flanges, couplings and tailpieces for connection to services.
- .3 Outlets:
 - .1 Forged or cast brass body complete with tailpiece for connection to service piping.
 - .2 Turrets and handles to be of forged brass.
 - .3 Finish: inside fume hood powder coating corrosion-resistant fluorocarbon.
- .4 Electrical: 2 duplex receptacles 120 V, 20 amp, CSA approved or ULC listed and labelled, GFI, hospital grade, mounted in side posts, stainless steel cover plate.
 - .1 Connect electrical service to each fume hood to dedicated electrical circuit.
- .5 Plumbing: include domestic hot and cold water service.
 - .1 Isolating valves: include remote controlled valves located within end panels, controlled by handles projecting through side posts of fume hood.
 - .2 Locate to avoid interference with smooth entry of air into fume hood.
- .6 Fixtures: fixtures exposed within fume hood to have chemical-resistant metallic bronze finish.
 - .1 Ensure portions exposed to fume hood exterior are chrome plated.
- .7 Cup sinks: 75 x 150 mm oval (or nearest standard), rigidly clamped in approved manner to work surface, with approved acid-resisting seal, 38 mm drain with cross strainer debris catcher.
 - .1 Standing waste and overflow with 76 long minimum PVC tailpiece.
 - .1 Install with rim above work surface to prevent spills entering waste system.
 - .2 Finish welds smooth and polished.
 - .2 Hot and cold water faucets: deck mounted with rigid gooseneck of heavy duty 10 mm brass pipe with integral backflow preventer upstream from serrated nozzle and remote control on exterior panel.
- .8 Gas: single straight serrated nozzle outlet with flange, mounted on side panel inside fume hood.
 - .1 Remote control on exterior panel.
- .9 Compressed air: single straight serrated nozzle outlet with flange, mounted on side panel inside fume hood.
 - .1 Remote control on exterior panel.

2.4 LABORATORY
SERVICES
(Cont'd)

- .10 Identify service fixtures using colour coding as follows:
- | Service | Letter
Coding | Colour
Coding |
|----------------|------------------|------------------|
| Cold water | CW | Green |
| Hot water | HW | Green |
| Vacuum | VAC | Yellow |
| Compressed air | AIR | Orange |
| Natural gas | NG | Yellow-orange |
- .11 Access to services:
- .1 Ensure fume hood manufacturer includes 5 cut-outs per side post.
 - .2 Cap unused openings with cap plugs of same material as exterior panels.
 - .3 Ensure service connections are accessible from fume hood exterior through removable access panels.
 - .4 Include isolating valves on building side of services.
 - .5 Where two or more fume hoods are installed side by side, use interior access panels of same material as interior panels, with bevelled edges, moulded PVC gaskets, and secured with non-corrosive fasteners set flush with face of access panel.
- .12 Corrosion resistant label:
- .1 Provide corrosion-resistant label permanently attached to fume hood exterior with abbreviated information relating to sash position and recommended location of apparatus and accessories when placed within the fume hood.

2.5 AIRFLOW MONITOR
ALARM

- .1 Audible and visual airflow alarm with digital air speed display shall be provided with fumehood.
- .2 Airflow alarm to activate on high and low ventilation as based on face velocity.
- .3 Airflow monitor alarm to have I/O terminal points to allow for connection to BAS to show alarms at the operators station and allow for alarm disable.
- .4 Airflow monitor alarm to have constant power with battery back-up.

2.6 FABRICATION

- .1 Do welding to CSA W48 or utilize automated welding.

2.7 SOURCE QUALITY
CONTROL

- .1 Testing to be performed by third party retained by fume hood manufacturer.
- .2 "As Manufactured" Testing Equipment: to PWGSC MD15128.
- .1 Data logger:
 - .1 Recording interval: 10 Hz or better.
 - .2 Memory: sufficient to allow data collection for duration of test.
 - .2 In-duct flow sensor to measure flow response:
 - .1 Speed: 10 Hz.
 - .2 Range: 95 L/s to 950 L/s.

2.7 SOURCE QUALITY CONTROL

(Cont'd)

- .2 (Cont'd)
 - .2 (Cont'd)
 - .3 Accuracy: $\pm 5\%$.
 - .3 Thermal anemometer:
 - .1 Mounting: on stand with probe fixed at each traverse grid location.
 - .2 Include: averaging function over 20 second period for each location or output recorded for 20 seconds minimum at a rate of 1 reading/second on data logger.
 - .3 Accuracy:
 - .1 Below 0.50 m/s: ± 0.025 m/s.
 - .2 0.50 m/s and over: $\pm 5\%$.
 - .4 Detector for tracer gas containment:
 - .1 Type: continuous reading.
 - .2 Minimum Detectable Level (MDL): 0.01 ppm.
 - .3 Accuracy:
 - .1 Concentrations below 0.1 ppm: $\pm 25\%$.
 - .2 Concentrations above 0.1 ppm: $\pm 10\%$.
 - .5 Smoke generator:
 - .1 Use smoke generator and diffuser complying with PWGSC MD15128.
- .3 Conduct "as manufactured" (AM) tests in manufacturer's testing facility to ANSI/ASHRAE 110 and PWGSC MD15128 procedures before transportation to site.
- .4 Conduct "AM" tests as follows:
 - .1 With fume hood empty.
 - .2 With fume hood loaded to simulate apparatus in hood.
 - .1 Locate simulated apparatus 150 - 250 mm behind plane of sash in manner approved by Departmental Representative as follows:
 - .1 1 - 3.8 litre paint cans.
 - .2 1 - 300 x 300 x 450 mm cardboard box.
 - .3 4 - 150 x 150 x 300 mm cardboard boxes.
 - .3 With simulated cross-drafts:
 - .1 Challenge with 0.25 m/s using 620 mm recirculation fan under conditions as follows:
 - .1 Air directed horizontally at 45 degrees to plane of sash.
- .5 Witnessing "AM" Tests:
 - .1 Perform "AM": tests in presence of Departmental Representative.
 - .2 Notify Departmental Representative 2 weeks minimum before start of testing.
- .6 Conduct "As Manufactured" (AM) Fume Hood Performance Tests as follows:
 - .1 Visualization (smoke) tests: meet or exceed performance criteria of PWGSC MD15128.
 - .2 Face velocity and flow tests: to PWGSC MD15128.
 - .1 Average face velocity: 0.5 m/s, with variation allowed for individual readings; maximum $\pm 20\%$.
 - .2 CAV bypass effectiveness at 150 mm sash opening: 1.25 m/s maximum average face velocity.
 - .3 Tracer gas tests: to PWGSC MD15128.
 - .1 Conduct tests at target average face velocity.
 - .2 Use approved tracer gas.
 - .3 Perform tests with probes at heights of 560 mm above work surface.
 - .4 Leakage with sash at normal operating position:
 - .1 Average leakage: 0.025 ppm maximum.

2.7 SOURCE QUALITY
CONTROL
(Cont'd)

- .6 (Cont'd)
 - .3 (Cont'd)
 - .2 Peak reading: 0.100 ppm.
 - .5 Leakage with sash in fully open position:
 - .1 Average leakage: 0.05 ppm maximum.
 - .2 Peak reading 0.25 ppm.
 - .6 Peripheral scan:
 - .1 Record significant peak readings and their locations.
 - .2 Record 30 second rolling averages.
 - .3 Maximum 0.25 ppm for any 30 second rolling average.
 - .4 Include readings in test report.
 - .7 Sash movement effect (SME), to determine potential for escape after movement of sash to ANSI/ASHRAE 110 procedures.
 - .1 Maximum 45 second rolling average: 0.05 ppm

PART 3 - EXECUTION3.1 INSTALLATION

- .1 Install to SEFA 2.
- .2 Install plumb, with work surface level to within 1.5 mm in 3000 mm by adjusting base unit levelling screws.
- .3 Secure fume hood to base furniture using stainless steel fasteners spaced at 750 mm maximum on centre maximum, 3 minimum per side.
 - .1 Use 4 minimum for each fume hood.
- .4 Secure fume hood to meet seismic criteria.
- .5 Connect plumbing, laboratory services, electrical services and exhaust system to fume hood.

3.2 ADJUSTING

- .1 Adjust operable hardware for correct function.
- .2 Ensure sash does not bind while opening and closing.

3.3 PROTECTION

- .1 Protect installed fume hood components from damage during construction.
- .2 Repair damage to adjacent materials caused by fume hood installation.

END OF SECTION