
PWGSC ONTARIO
REGION PROJECT
NUMBER R.079554.001

SPECIFICATION
TITLE SHEET

SECTION 00 00 00
PAGE 1
2019-11-08

2620 SPEAKMAN DRIVE
MISSISSAUGA, ONTARIO
L5K 2L1

NRC - MISSISSAUGA
RESEARCH AND
DEVELOPMENT PILOT PLANT
FACILITY

SP - 17-37 W2

Project Number R.079554.001

Project Date 2019-11-08

END OF SECTION

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END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.
- .11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, MS Project and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 5 working days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.

- .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit three hard copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit three hard copies and one electronic copy of manufacturers' instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 45 00.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit photographic documentation in accordance with Section 01 32 00.

1.6 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

- .4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Safety Authority (ESA).

PART 2- PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION OVERVIEW

- .1 Green Globes requirements and procedures

1.2 RELATED SECTIONS

- .1 Division 3 Concrete
- .2 Division 4 Masonry
- .3 Division 6 Wood, Plastics and Composites
- .4 Division 7 Thermal and Moisture Protection
- .5 Division 8 Openings
- .6 Division 9 Finishes
- .7 Division 10 Specialties
- .8 31 25 00 Temporary Erosion and Sediment Control
- .9 01 74 19 Construction and Demolition Waste Management
- .10 01 81 19 Indoor Air Quality Requirements

1.3 DEFINITIONS

- .1 Green Globes: A third-party verification online green building rating and certification tool.
- .2 Volatile Organic Compounds (VOCs): Organic chemicals that produce vapors readily at room temperature and normal atmospheric pressure (e.g. gasoline, solvents, etc.). VOCs react with sunlight and nitrogen to form ground-level ozone, a chemical that has detrimental effect on human health, agricultural crops, forests, soil, groundwater and ecosystems.
- .3 Urea-Formaldehyde (UF): A combination of urea and formaldehyde that readily decomposes at room temperature. It is found in some glues/resins used to manufacture furniture, composite woods (e.g. particle board), agrifiber products and laminated assemblies. UF has detrimental effect on human health and may include symptoms such as eye, nose, and throat irritation, wheezing and coughing, fatigue, skin rash and severe allergic reaction.

- .4 Volatile Organic Compounds (VOCs): Volatile organic compound (VOC) emissions from consumer and commercial products are a significant contributing factor in the creation of air pollution in urban areas. These emissions contribute to the formation of ground-level ozone and fine particulate matter, which form smog.

1.4 REFERENCES

- .1 Chemical Abstracts Service (CASRN): cas.org/
- .2 Canadian VOC Concentration Limits for Architectural Coatings: ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=117
- .3 CARB 93120 ATCM: arb.ca.gov/toxics/compwood/compwood.htm
- .4 California Department of Public Health (CDPH) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers CA/DHS/EHLB/R-174, July 14, 2004 with Addendum 2004-01, October 19, 2004: services.ul.com/service/cdph-standard-method-for-voc-emissions/
- .5 Cradle-to-Cradle Certified Product Standard: c2ccertified.org/product_certification
- .6 EcoLogo: industries.ul.com/environment/certificationvalidation-marks/ecologo-product-certification
- .7 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008): greenguard.org
- .8 Green Seal: greenseal.org
- .9 Indoor REL developed by the California Office of Environmental Health and Hazard Assessment (OEHHA). <https://oehha.ca.gov/>
- .10 SCS Indoor Advantage Gold: www.scsglobalservices.com/indoor-air-quality-certification
- .11 SCS EC10.2 -2007, Environmental Certification Program-Indoor Air Quality Performance, May, 2007: <https://www.scs-certified.com/docs/SCS-EC10.2-2007.pdf>
- .12 South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011., Architectural Coatings: <http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1113.pdf>
- .13 South Coast Air Quality Management District (SCAQMD) Amendment to South Coast Rule 1168, July 1, 2005, Adhesive and Sealant Applications: <http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1168.pdf>

1.5 OBJECTIVES

- .1 Construct a building that uses land, water, energy and material resources appropriately and efficiently and provides a safe, comfortable and productive indoor environment for building occupants in accordance with Green Globes requirements.
- .2 No single manufacturer, fabricator, or subcontractor can fulfill the total requirements for Green Globes certification for the project. Green Globes certification requires the cooperation and diligence of all project participants for a successful application and acceptance for Green Globes certification.
- .3 Source and select materials that materials that meet sustainable criteria detailed herein

1.6 DESCRIPTION OF WORK

- .1 The Green Globes requirements in this section and the related sections shall apply to all Sections and Work for this Project, whether specifically indicated or not.
- .2 Compliance with requirements needed to obtain targeted Green Globes credits will be used as one criterion to evaluate requests for substitutions or alternates.

PART 2 - PRODUCTS

2.1 SECTION OVERVIEW

- .1 Product requirements for attempting Green Globes credits.

2.2 PAINTS

- .1 All paints applied on site for wet applied products must comply with the following criteria:

PRODUCT TYPE	VOC LIMIT [g/L LESS WATER]
Paints - Interior Latex Coatings Flat	50
Paints - Interior Latex Coatings Non Flat	150
Untreated Masonry or Concrete	N/A

2.3 ADHESIVES AND SEALANTS, WALL, CEILING, INSULATION AND FLOOR MATERIAL

.1 All adhesives and sealants, wall, acoustic ceilings, insulation and floor covering material shall comply with either requirement:

.1 Have a VOC content less than the limits outlined in the South Coast Air Quality Management District (SCAQMD) Amendment to South Coast Rule 1168

.1 The VOC content limits of SCAQMD Rule 1168 are as follows:

ARCHITECTURAL APPLICATIONS	VOC LIMIT [g/L LESS WATER]
Carpet / Carpet Pads	50
Wood Flooring Adhesives	100
Rubber Flooring Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT & Asphalt Adhesives	50
Drywall & Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single-ply roof membrane	250
SPECIALITY APPLICATION	VOC LIMIT [g/L LESS WATER]
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250

SUBSTRATE SPECIFIC	VOC LIMIT [g/L LESS WATER]
Metal to Metal	30
Plastic Foams	50
Porous Material (except wood)	50
Wood	30
Fiberglass	80
SEALANTS	VOC LIMIT [g/L LESS WATER]
Architectural	250
Nonmembrane roof	300
Single-ply roof membrane	450
SEALANT PRIMERS	VOC LIMIT [g/L LESS WATER]
Architectural, nonporous	250
Architectural, porous	775
Other	750

- .2 Or a product that has passed the testing methods and holds certification in the following product certifications such as:
 - .1 Green Label Plus® (Carpet & Carpet Adhesive) - Carpet and Rug Institute
 - .1 Carpet Policy & Procedure Manual - GLCm_071809Ver0
 - .2 Adhesive Policy & Procedure Manual - GLAm_062509Ver0
 - .2 Green Label® (Carpet Cushion) - Carpet and Rug Institute
 - .1 EcoLogo (Paints & Adhesives) - Environmental Choice
 - .2 EcoLogo Standard for Adhesives - CCD-046
 - .3 EcoLogo Standard for Paints - Architectural Surface Coatings CCD-047
 - .4 EcoLogo Standard for Recycled Paints - Architectural Surface Coatings - Recycled Water-bourne CCD-048
 - .3 Green Seal® (Paints & Adhesives)
 - .1 Green Seal Environmental Standard for Paints and Coatings, GS-11
 - .2 Green Seal Environmental Standard for Commercial Adhesives, GS-36
 - .4 FloorScore® (Resilient Flooring) - Resilient Floor Covering Institute
 - .1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174), JULY 15, 2004 with Addendum 2004-01
 - .2 SCS - EC10.2 -2007, Environmental Certification Program- Indoor Air Quality Performance. May, 2007
 - .5 GREENGUARD Children & Schools - GREENGUARD Environmental Institute
 - .1 "Program Manual For GREENGUARD Product Certification Programs" GG.PM.01 2009
 - .2 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008)
 - .6 Indoor Advantage Gold TM - Scientific Certification Systems

- .1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174, JULY 15, 2004 with Addendum 2004-01)
- .2 SCS - EC10.2 -2007, Environmental Certification Program- Indoor Air Quality Performance, May, 2007

PART 3 - EXECUTION

- .1 NOT USED

END OF SECTION

1.1 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2015 (NBC):
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2015 (NFC):
 - .1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .4 Province of Ontario:
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.
- .5 Treasury Board of Canada Secretariat (TBS):
 - .1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316§ion=text.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.

- .3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
- .4 Contractor's and Sub-contractors' Safety Communication Plan.
- .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with Emergency Response requirements and procedures provided by Departmental Representative.
- .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 30 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 10 days after receipt of comments from Departmental Representative.
- .7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .8 Submit names of personnel and alternates responsible for site safety and health.
- .9 Submit records of Contractor's Health and Safety meetings when requested.
- .10 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .12 Submit copies of incident and accident reports.
- .13 Submit Material Safety Data Sheets (MSDS).
- .14 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.
- .15 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel, in accordance with O. Reg. 490, prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.4 WORK PERMIT

- .1 Obtain building permits related to project prior to commencement of Work.

1.5 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

- .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.10 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.11 UNFORSEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have working knowledge of occupational safety and health regulations.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .4 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 Material Safety Data Sheets.
 - .9 Written Emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

- .1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

1.16 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.17 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required have been submitted.
 - .5 Operation of systems have been demonstrated to Departmental Representative.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

- .1 In accordance with Section 01 74 11.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey.

1.2 RELATED SECTIONS

- .1 Section 01 91 00 - Commissioning - General Requirements.
- .2 Section 01 79 00 - Demonstration and Training.

1.3 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

- .8 Pay costs of transportation.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, MS Project and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project; date of submission; names, addresses, and telephone numbers of Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
- .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .6 Training: Refer to Section 01 79 00.

1.6 AS-BUILTS AND SAMPLES

- .1 Maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Amendments and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.8 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 and 01 91 00.
- .15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.14 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.15 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-2016, Particleboard.
- .2 American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE Standard 110-2016, Methods of Testing Performance of Laboratory Fume Hoods.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A240/A240M-18, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .2 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .3 ASTM A879/879M-12(2017), Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass of Each Surface.
 - .4 ASTM A1008/A1008M-18, 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.
 - .5 ASTM C1048-18, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - .6 ASTM C1172-19, Standard Specification for Architectural Flat Glass.
 - .7 ASTM F593-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - .8 ASTM F594-09(2015), Standard Specification for Stainless Steel Nuts.
 - .9 ASTM F1941/1941M-16, Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.
- .4 Canadian Standards Association
 - .1 CSA O325-16, Construction Sheathing
- .5 International Organization for Standardization (ISO)

- .1 ISO 19069-1:2015, Plastics - Polypropylene (PP) moulding and extrusion materials - Part 1: Designation System and Basis for Specifications.
- .6 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA LD 3-2005, High-pressure Decorative Laminates.
- .7 Underwriter's Laboratory of Canada (ULC)
 - .1 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-installation meeting prior to commencement of installation work.
- .2 Coordination:
 - .1 Work of this section is closely integrated with laboratory work of other sections. Coordinate work of this section with work of:
 - .1 Laboratory service fittings and accessories under Section 11 53 43.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's product data sheets for products proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Submit engineered shop drawings.
 - .2 Shop Drawings: For laboratory fume hoods, including plans, elevations, and attachment details.
 - .1 Indicate types and configurations of laboratory fume hoods.
 - .2 Include plans, elevations, sections, and attachment details.

- .3 Indicate details, including locations of blocking and other supports.
- .4 Indicate locations and types of service fittings together with associated service supply connection required.
- .5 Indicate connections for ducts, electrical, and access panel locations.
- .6 Include roughing-in information for mechanical, plumbing, and electrical connections.
- .7 Show adjacent building construction, laboratory casework, and other laboratory equipment. Indicate clearances from the above items.
- .8 Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
- .9 Include coordinated dimensions for laboratory casework and service carriers specified in other Sections.
- .3 Coordinate shop drawings with requirements of:
 - .1 Laboratory service fittings and accessories under Section 11 53 43.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
- .4 Coordinate shop drawings for fume hoods with Divisions 21, 22, and 23 and Divisions 26, 27, and 28.
- .4 Samples:
 - .1 Provide samples for each type of fume hood exterior finishes, interior lining material, sink material, and worktop (countertop) material, in manufacturer's standard sample sizes.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 and 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Submit as-built drawings recording actual site conditions.

1.5 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Coordinate and Provide mock-ups in accordance with the work of sections:
 - .1 Laboratory service fittings under Section 11 53 43.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Refer to mock-up requirements in Section 12 35 53.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery, storage, and handling of products in accordance with manufacturer's written requirements.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this section for a period of 5 years.
 - .1 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to Owner.
 - .2 Defects include, but are not limited to:
 - .1 Ruptured, cracked, or stained coating.
 - .2 Discoloration or lack of finish integrity.
 - .3 Cracking or peeling of finish.
 - .4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - .5 Weld or structural failure.
 - .6 Warping or unloaded deflection of components.
 - .7 Failure of hardware.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL REQUIREMENTS

- .1 Green Globe Requirements:

- .1 Comply with the requirements of Section 01 33 29 as applicable.

2.2 PERFORMANCE REQUIREMENTS

- .1 Structural performance: Provide overhead laboratory service carriers, fasteners and utility service connections capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of components.
- .1 Seismic performance: Laboratory fume hood attachments to other work, shall withstand the effects of earthquake motions determined according to the building code.
- .2 Project seismic design category: as indicated on Structural Drawings.
- .2 Containment: Provide fume hoods that have been tested and comply with ANSI/ASHRAE Standard 110, (if not otherwise indicated below).
- .3 Corrosion control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 MATERIALS

- .1 Source restriction: Provide laboratory fume hoods, accessories and service fittings from same manufacturer, unless otherwise indicated.
- .2 Particleboard: ANSI A208.1, Grade M-2; ANSI A208.1, Grade M-2 or comparable standard, exterior glue at worktops (countertops).
- .3 Oriented strand board (OSB): CSA O325 or DOC PS 2, Exposure 1 or comparable standard.
- .4 Phenolic resin panels: Compact, solid grade laminate in thicknesses from 6-20 mm, complying with NEMA LD 3, Grade CGS, or comparable standard.
- .5 Melamine-faced panels: Particleboard or medium-density fiberboard faced with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, or comparable standard.
- .6 Adhesives: Containing no urea formaldehyde.
- .7 Edging for melamine-faced panels: 2 mm thick, polypropylene edging matching melamine-faced panels.
- .8 Sheet metal, general: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

- .9 Steel sheet: Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed.
- .10 Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666 or comparable standard, Type 316, stretcher-leveled standard of flatness.
- .11 Glass-fibre-reinforced polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces, and having a flame-spread index of 25 or less according to CAN/ULC S102.
- .12 Polypropylene (if not molded): Extruded to moulding compound standard according to ISO 19069-1; Food compliance by FDA.
- .13 Glass: Provide manufacturer's standard glass, complying with the following requirements.
 - .1 Surface Compression: In range of 85 to 100 MPa.
 - .2 Mechanical (Bending) Strength: 120 MPa.
 - .3 Glass Types:
 - .1 Tempered: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3 or comparable standard; not less than 5 mm thick.
 - .2 Laminated: Clear laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3 or comparable standard; with two plies not less than 5 mm thick and with clear, polyvinyl butyral interlayer.
 - .4 Grind smooth and polish exposed glass edges and corners.
 - .5 Safety glass shall be permanently marked with certification label of certification agency acceptable to authorities having jurisdiction.
- .14 Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 - .1 Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction.
 - .2 Structural Anchor Materials:
 - .1 Zinc-Plated: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - .2 Stainless Steel:

- .1 Interior Stainless Steel: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- .3 Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems as recommended by manufacturer for installed condition.
- .15 Casework, Worktop (Countertop), Bench Frame and Sink Material Characteristics: Per requirements of Section 12 35 53 - Laboratory Casework.
- .16 Stoneware:
 - .1 Non-porous heat treated ceramic, extremely high chemical and heat resistance, impervious to scratches and does not discolour when exposed to acids, bases and or solvents. It can withstand temperature attaining 800°C and has a scratch abrasion resistance of 6.5 (Mohs hardness).
 - .2 Locations:
 - .1 Lining of Acid Digestions and Perchloric acid Fume Hood.
 - .2 Fume hood worktop.

2.4 FABRICATION

- .1 General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 37.8-by-79-inch (960-by-2007-mm) door opening.
- .2 Steel Exterior: Apply chemical-resistant, powder coat finish to interior and exterior surfaces of component parts before assembly.
- .3 Phenolic Resin: (UL approved) - Compact solid grade laminate in thicknesses from 6-20 mm with white decorative layer, having a flame-spread index of 5 or less, and a smoke developed index of 20 or less, according to UL 723 (ASTM E84).
- .4 Fiberglass Exterior: Trim edges of panels with EPDM extrusion. Limit removable parts to access panels, front fascia, and airfoil.
- .5 Interior Lining: Phenolic Resin unless stainless steel is noted.
- .6 Lining Assembly: Unless otherwise indicated, assemble with zinc plated steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
- .7 Punch fume hood lining side panels constructed of polypropylene, to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings, where indicated on Drawings.

- .8 Unless otherwise indicated, the supply of services in the fume hood shall be designed in a modular way and shall be upgradable with easy means.
- .9 The valves shall be produced as gate valve and outlet nozzle. The gate valve with shut-off function is installed in a service panel. The outlet nozzle is installed in a module in the fume hood demountable panel. Provide pressure regulators integrated in the service panel as per drawings and fixtures schedule.
- .10 The drip cups for fume cupboards with water fittings shall be arranged outside the working level at the panel by means of a module in such a way that the sink and water fittings are flush with the panel, unless otherwise indicated. The sink and water fittings may not exceed the panel and project into the fume hood interior, unless otherwise indicated.
- .11 Electrical Receptacles, when installed inside the working area, shall be operated by an external switch in an outside service panel. Explosion proof data and power receptacles as per drawings, schedules.
- .12 Stainless-Steel Lining Assembly: Welded, where indicated, Unit consisting of side panels, back panel, top, and countertop; reinforced to form a rigid assembly to which exterior is attached. Min. 1.2mm (18 gauge) thick, Type 316 stainless steel, No. 4 finish, coved corners with nominal 19mm radius.
- .13 Light Fixtures: Provide in center of ceiling a completely wired and antiglare light shall be installed as an led fixture and lamp, and with a pressure relief device in case of an explosion. Provide light fixture compatible with explosion proof fume hood where noted.
- .14 Countertops: Comply with requirements of Section 123553 - Laboratory Casework and individual fume hood descriptions herein.
- .15 Filler Strips: Provide as needed to close spaces between fume hoods and adjacent building construction. Fabricate from same material and with same finish as fume hoods.
- .16 Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.
- .17 Comply with requirements in other Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.

2.5 COMPONENTS - CONTROL AND MONITORING

- .1 Provide the below-listed control and monitoring components, as indicated in individual fume hood descriptions.

- .2 Airflow-Controller (AC): Fume hood with variable airflow ventilation (VAV) system.
 - .1 Control and Monitoring System (basis of design - AC 3 Compact): Microprocessor-based electronic control unit controlling air volume to rapidly and precisely adjust air exchange rate to suit the set value using defined control behavior (predictive and adaptive).
 - .1 System Requirements:
 - .1 Control parameters adaptively optimized on-line.
 - .2 Standard tolerances predictively corrected using theoretical process model.
 - .3 Controls position of the motorized damper.
 - .4 Floating Time: 5 seconds adjusted; 3 seconds 80-percent of the set value.
 - .5 Integrated Pressure Sensor: 0-0.036 psi (0-250 Pa); pressure resistant up to 0.363 psi (2500 Pa).
- .3 Basis of design - Secuflow (applies to all fume hoods other than the Explosion Proof Walk-in Fume Hoods): Technology where supportive air is systematically directed into the internal workspace from the aerodynamically designed sill on both side frames and also along the work surface of the front sill. Directed air flow prevents turbulences and stabilizes how room air enters the fume hood by changing the laminarity of room air entering the hood, enhancing the fume hood's containment.
- .4 Sash Controller (SC): Motorized assist when fume hood operator slightly move the sash. (Does not apply in the case of explosion-proof fume hoods).
 - .1 Sash Controller Operation:
 - .1 Sash electronics close fume hood sash using a motor when fume hood is not in use.
 - .2 Use detection: Area in front of the fume hood monitored by a motion detector. When no movement is detected in front of fume hood for defined period of time, the sash shall automatically close. Closing delay is user-definable for period between thirty seconds to fifteen minutes.
 - .3 Photo-electric barrier integrated in bottom edge of sash detects obstacles in path of sash and stops closing process.

2.6 BENCH-TOP FUME HOODS

- .1 General: Ultra low-flow design. Ducted extraction of fumes, aerosols and dusts from internal workspace, with service outlets in back of wall (baffle) of internal workspace and operating controls located externally across the front of unit (traverse).
- .2 Configurations: Provide in the following configurations, as indicated on Drawings.
 - .1 Supporting structure: H-frame with pushed-in under-bench units.
 - .2 Airflow control: AC.
- .3 Operational features: Units shall include the following.
 - .1 Automatic sash.
 - .2 Airflow indicator and alarm.
 - .3 Supplementary fan to provide supportive air for reliable reduction of airflow. Technology where supportive air is systematically directed into the internal workspace from the aerodynamically designed sill on both side frames and also along the work surface of the front sill. Directed air flow prevents turbulence and stabilizes how room air enters the fume hood by changing the laminarity of room air entering the hood, enhancing the fume hood's containment.
 - .4 Sash alarm.
 - .5 Sash stops, with manual override.
- .4 Bench-top fume hood characteristics:
 - .1 Sizes: As indicated on Drawings.
 - .1 Width(s) and corresponding (Approximate) weights (with liner phenolic resin): 1500 mm by 390 kg.
 - .2 Interior Effective Width: 1450 mm.
 - .3 Depth: 900 mm.
 - .4 Height: 2700 mm, from the floor.
 - .5 Interior Effective Height: 1550 mm.
 - .6 Working Height: 900 mm.
- .5 Performance:

- .1 The term ULTRA LOW FLOW can only be attributed to a fume hood that can guarantee proper containment (level of cross contamination) equal or superior to the highest standards published by the ASHRAE 110 protocol with a maximum face velocity of 60 feet per minute (0.3 m/s) at a sash position of 18 inches. This coming from AI «As Installed» or AU «As Used» tracer gas containment testing results. AM «As Manufactured» testing will not to be considered nor accepted because this type of testing does not consider any environmental conditions of the lab space in question.
- .2 Hood to operate safely and contain fully at face velocities as low as 0.2 m/s and with 0.3 m/s being the maximum allowed face velocity all according to ASHRAE 110 testing protocol. The manufacturer must provide the below testing certificates. Without proof of these two (2) certificates, no fume hood will be considered:
 - .1 PWGSC MD15128*** "AM Testing" at 60 feet per minute
 - .2 ASHRAE 110 "AM Testing" at 40 and 60 feet per minute
 - .1 *** Following Public Works and Government Services Canada MD15128-2013 protocol "Velocity and Flow Tests: High Performance Fume Hoods" at 0.3 m/s.
- .6 Construction:
 - .1 Material Facing:
 - .1 Worktop: Stoneware.
 - .2 Internal Lining: Phenolic Resin.
 - .2 Sashes: Glass, vertical sash with combination horizontal sash panels. Vertical sliding. Fixed, upper window sash.
 - .3 Control Panel: AC.
 - .4 Side Panel Options: Glazed side panel, on both sides Cable pass-through, on both sides
 - .5 Removable front filler panel.
 - .6 Maximum Receptors for Scaffold Points: 9 each 1500 mm wide units.
 - .1 Scaffold Rod Diameter: 12 mm nominal.
 - .2 Maximum Load per Scaffold Point with Scaffold Rod Length of 300 mm: 5 kg.
 - .3 Service Modules: 2 each at 1500 mm wide units.
- .7 Services
 - .1 Electrical (Coordinate with building electrical infrastructure):

- .1 Power and data outlets on the exterior service panels and interior service modules.
 - .2 Outlets pre-wired to junction box on top of hood. Final connection by electrical trade.
 - .3 SC sash controller.
 - .4 Electrical devices to comply with base building electrical specifications.
- .2 Plumbing supply (Coordinate with building mechanical infrastructure):
- .1 Service module with fittings gas and water with integrated polypropylene cupsink (as described in drawings and schedules).
 - .2 Pre-plumbed by manufacturer to connection point above fume hood.
 - .3 Mechanical devices to comply with base building electrical specifications.
- .3 Airflow controller, monitor & exhaust valve
- .1 Microprocessor-controlled airflow damper and monitoring system designed to control and regulate exhaust air flow for fume hoods with a variable extract air volume.
 - .2 The VAV airflow damper included is in accordance with ASHRAE and is to fulfil the following characteristics:
 - .1 Speed of response time is within 1 second.
 - .2 Complete valve range, 0-100% is attained within 3 seconds.
 - .3 Measurement error of the air exchange rate <5% from the actual value.
 - .4 Cyclical automatic self-monitoring and zero point balancing.
 - .5 Actuator with integrated level detection for position control and air exchange rate identification.
 - .6 Valve and manifold made completely of Polypropylene.
 - .7 Airflow measuring range of 100 to 1500m³/h.
 - .8 Full function in system primary pressure between 100 and 600 Pa.
 - .9 Detection of sash position.
 - .10 Detection of horizontal sash notch.

- .11 Cable-break detection (motor, pressure sensor and sash detection).
- .3 The control and display panels must perform the following functions:
 - .1 Operation: On/Off, constantly reduced air quantity, constantly increased air quantity, log-on to night operation, acoustic alarm acknowledgement. It must be possible to lock each individual function.
 - .2 Display function: ventilation function (no malfunction: green, malfunction: red, including acoustic signal) operating mode message (variable, reduced, increased), supply unit power failure, logged on to the night operation.
 - .3 Overstepping of the permissible sash opening (500mm) is effected via a visual (yellow LED) and acoustic warning signal. The acoustic alarm signal should be designed in a way that it can be acknowledged.
 - .4 The visual alarm signal disappears by itself when the sash opening height under-runs 500mm.
 - .5 Relay outputs should be made available for transmitting the operating message (on / off), the alarm message and the extent of air exchange rate (0-10V).
 - .6 Incoming signals on / off, reduced operation, increased operation and constant load must be converted and transferred.
 - .7 Relay outputs: Operating message (on/off), night operation, alarm message.
 - .8 Control inputs: Daytime operation, night operation, decommissioning/off.
 - .9 Data exchange capabilities between Fume Hood Exhaust Air Valve Control Unit and the Building Automation System via BACnet, Analogue I/O.
 - .10 Malfunction of the supportive fan should be displayed via a visual (red LED) and acoustic alarm signal. The acoustic alarm signal should be designed in a way that it can be acknowledged. The visual alarm signal disappears by itself when the malfunction no longer exists. The extract air volume is increased if the supportive flow technology fails. The supportive flow fan is automatically disconnected when the fume cupboard sash is closed.
 - .11 Variable Airflow Regulator System: AC (Airflow controller) - VAV

2.7 BARRIER-FREE FUME HOODS (WITH HEIGHT ADJUSTABLE COUNTERTOP, SIDE MOUNTED SERVICE MODULES)

- .1 General: Ultra Low-Flow Design. Ducted extraction of fumes, aerosols and dusts from internal workspace, with service outlets in side wall of internal workspace and operating controls located on the side posts adjacent to the sash.
- .2 Configurations: Provide in the following configurations, as indicated on Drawings.
 - .1 Supporting Structure: Fume hood supported by an electrically-actuated, height-adjustable frame.
 - .2 Airflow Control: AC
- .3 Operational features: Units shall include the following.
 - .1 Automatic sash.
 - .2 Airflow indicator and alarm.
 - .3 Supplementary fan to provide supportive air for reliable reduction of airflow. Technology where supportive air is systematically directed into the internal workspace from the aerodynamically designed sill on both side frames and also along the work surface of the front sill. Directed air flow prevents turbulence and stabilizes how room air enters the fume hood by changing the laminarity of room air entering the hood, enhancing the fume hood's containment.
 - .4 Sash alarm.
 - .5 Sash stops, with manual override.
- .4 Bench-top fume hood characteristics:
 - .1 Sizes:
 - .1 Width: 1500 mm
 - .2 Interior Effective Width: 1240 mm.
 - .3 Depth: 35.43 inches (900 mm).
 - .4 Height: as described in drawings
 - .5 Interior effective height: 61.02 inches (1550 mm).
 - .6 Working height: Worktop working height minimum 675mm - maximum 905mm above floor
 - .2 Performance:

- .1 The term ULTRA LOW FLOW can only be attributed to a fume hood that can guarantee proper containment (level of cross contamination) equal or superior to the highest standards published by the ASHRAE 110 protocol with a maximum face velocity of 60 feet per minute (0.3 m/s) at a sash position of 18 inches. This coming from AI «As Installed» or AU «As Used» tracer gas containment testing results. AM «As Manufactured» testing will not to be considered nor accepted because this type of testing does not consider any environmental conditions of the lab space in question.
- .2 Hood to operate safely and contain fully at face velocities as low as 0.2 m/s and with 0.3 m/s being the maximum allowed face velocity all according to ASHRAE 110 testing protocol. The manufacturer must provide the below testing certificates. Without proof of these two (2) certificates, no fume hood will be considered.
 - .1 PWGSC MD15128*** "AM Testing" at 60 feet per minute
 - .2 ASHRAE 110 "AM Testing" at 40 and 60 feet per minute
 - .1 *** Following Public Works and Government Services Canada MD15128-2013 protocol "Velocity and Flow Tests: High Performance Fume Hoods" at 0.3 m/s.
- .3 Construction:
 - .1 Material facing:
 - .1 Worktop: Stoneware.
 - .2 Internal lining: Phenolic resin.
 - .2 Sashes: Glass, vertical sash with combination horizontal sash panels. Fixed upper window sash.
 - .3 Control panel: AC.
 - .4 Removable front filler panel.
 - .5 Maximum receptors for scaffold points: 9 each
 - .1 Scaffold rod diameter: 12 mm nominal.
 - .6 Maximum load per scaffold point with Scaffold Rod Length of 300 mm: 5 kg.
 - .7 Service modules: on inside of each side wall
- .5 Services
 - .1 Electrical (Coordinate with building electrical infrastructure):
 - .1 Power outlets on the exterior service panels and interior service modules.

- .2 Outlets pre-wired to junction box on top of hood. Final connection by trades.
- .3 SC sash controller.
- .4 Height adjustment controls located at the bottom of the fume hood side post for easy user access. 120 V supply.
- .5 Electrical devices to comply with base building electrical specifications.
- .2 Plumbing supply (Coordinate with building mechanical infrastructure):
 - .1 Service module with fittings for gas and water with integrated polypropylene cupsink, as described in drawings and schedules. (as shown on drawings).
 - .2 Pre-plumbed by manufacturer to connection point above fume hood
 - .3 Drip cup drain connections to include flexible adapters with sufficient tolerance to accommodate the full range of fume hood height adjustability.
 - .4 Mechanical devices to comply with base building electrical specifications.
- .3 Ventilation:
 - .1 Airflow controller, monitor & exhaust valve
 - .1 Microprocessor-controlled airflow damper and monitoring system designed to control and regulate exhaust air flow for fume hoods with a variable extract air volume.
 - .2 The VAV airflow damper included is in accordance with ASHRAE and is to fulfil the following characteristics:
 - .1 Speed of response time is within 1 second.
 - .2 Complete valve range, 0-100% is attained within 3 seconds.
 - .3 Measurement error of the air exchange rate <5% from the actual value.
 - .4 Cyclic automatic self-monitoring and zero point balancing.
 - .5 Actuator with integrated bevel detection for position control and air exchange rate identification.
 - .6 Valve and manifold made completely of Polypropylene.
 - .7 Airflow measuring range of 100 to 1500m³/h.

- .8 Full function in system primary pressure between 100 and 600 Pa.
- .9 Detection of sash position.
- .10 Detection of horizontal sash notch.
- .11 Cable-break detection (motor, pressure sensor and sash detection).
- .3 Airflow damper to include a flanged, polypropylene, accordion duct adapter to allow for full range of height adjustment.
- .4 The control and display panels must perform the following functions:
 - .1 Operation: On/Off, constantly reduced air quantity, constantly increased air quantity, log-on to night operation, acoustic alarm acknowledgement. It must be possible to lock each individual function.
 - .2 Display function: ventilation function (no malfunction: green, malfunction: red, including acoustic signal) operating mode message (variable, reduced, increased), supply unit power failure, logged on to the night operation.
 - .3 Overstepping of the permissible sash opening (500mm) is effected via a visual (yellow LED) and acoustic warning signal. The acoustic alarm signal should be designed in a way that it can be acknowledged.
 - .4 The visual alarm signal disappears by itself when the sash opening height under-runs 500 mm.
 - .5 Relay outputs should be made available for transmitting the operating message (on / off), the alarm message and the extent of air exchange rate (0-10V).
 - .6 Incoming signals on / off, reduced operation, increased operation and constant load must be converted and transferred.
 - .7 Relay outputs: Operating message (on/off), night operation, alarm message.
 - .8 Control inputs: Daytime operation, night operation, decommissioning/off.
 - .9 Data exchange capabilities between Fume Hood Exhaust Air Valve Control Unit and the Building Automation System via BACnet, Analogue I/O.

- .10 Malfunction of the supportive fan should be displayed via a visual (red LED) and acoustic alarm signal. The acoustic alarm signal should be designed in a way that it can be acknowledged. The visual alarm signal disappears by itself when the malfunction no longer exists. The extract air volume is increased if the supportive flow technology fails. The supportive flow fan is automatically disconnected when the fume cupboard sash is closed.

2.8 EXPLOSION PROOF WALK-IN (FLOOR-MOUNTED) FUME HOODS WITH SERVICES ON SIDE WALLS

- .1 General: Ducted extraction of fumes, aerosols and dusts from internal workspace, with service outlets in service module of side walls of internal workspace and operating controls located externally at the side service panels.
 - .1 Suitable for barrier-free entering of the internal workspace.
 - .2 Suitable for high experimental setups.
- .2 Hazardous area classification requirement;
 - .1 Explosion proof fume hoods to be designed to comply with electrical hazardous classification of; Class I, Division 2.
- .3 Configurations: Provide in the following configurations, as indicated on Drawings.
 - .1 Supporting Structure: Floor-mounted.
 - .2 Airflow Control: AC.
- .4 Operational features: Units shall include the following.
 - .1 Airflow indicator and alarm.
 - .2 Sash alarm.
 - .3 Explosion proof Floor-mounted fume hood with service on side wall characteristics:
 - .4 Sizes: As indicated on drawings.
 - .1 Width(s) and Corresponding (Approximate) Weights (phenolic resin liner): 2100 mm by 510 kg
 - .2 Interior Effective Width: 2150 mm.
 - .3 Depth: 1500 mm
 - .4 Height: 106.3 inches (2700 mm) from the floor.
 - .5 Interior Effective Height: 96.46 inches (2450 mm).

- .5 Construction:
 - .1 Material facing:
 - .1 Internal Lining: Phenolic resin.
 - .2 Sashes: Glass, 2 vertical sashes with combination 3 horizontal-sliding sash panels.
 - .3 Control panel: Explosion proof control panel located on side post.
 - .4 Removable front filler panel.
 - .5 Maximum receptors for scaffold points: 12 each.
 - .1 Scaffold Rod Diameter: 12 mm nominal.
 - .6 Maximum Load per Scaffold Point with Scaffold Rod Length of 300 mm: 5 kg.
 - .7 Service modules: As indicated on drawings.
- .6 Services
 - .1 Electrical (Coordinate with building electrical infrastructure):
 - .1 Explosion proof power and data outlets on the exterior side walls (as shown on drawings). Service panels and interior service modules.
 - .2 Outlets directly wired by trades.
 - .3 Electrical devices to comply with base building electrical specifications.
 - .2 Plumbing supply (Coordinate with building mechanical infrastructure):
 - .1 Service module with fittings for gas and water with integrated polypropylene cupsink as indicated on drawings.
 - .2 Pre-plumbed by manufacturer to connection point above fume hood
 - .3 Mechanical devices to comply with base building electrical specifications.
 - .3 Ventilation:
 - .1 Airflow controller, monitor & exhaust valve
 - .1 Explosion proof rated microprocessor-controlled airflow damper and monitoring system designed to control and regulate exhaust air flow for fume hoods with a variable extract air volume.

- .2 The VAV airflow damper included is in accordance with ASHRAE and is to fulfil the following characteristics:
 - .1 Speed of Response time is within 1 second.
 - .2 Complete valve range, 0-100% is attained within 3 seconds.
 - .3 Measurement error of the air exchange rate <5% from the actual value.
 - .4 Cyclic automatic self-monitoring and zero point balancing.
 - .5 Actuator with integrated bevel detection for position control and air exchange rate identification.
 - .6 Valve and manifold made completely of Polypropylene.
 - .7 Airflow measuring range of 100 to 1500m³/h.
 - .8 Full function in system primary pressure between 100 and 600 Pa.
 - .9 Detection of sash position.
 - .10 Detection of horizontal sash notch.
 - .11 Cable-break detection (motor, pressure sensor and sash detection).
- .3 The control and display panels must perform the following functions:
 - .1 Operation: On/Off, constantly reduced air quantity, constantly increased air quantity, log-on to night operation, acoustic alarm acknowledgement. It must be possible to lock each individual function.
 - .2 Display function: ventilation function (no malfunction: green, malfunction: red, including acoustic signal) operating mode message (variable, reduced, increased), supply unit power failure, logged on to the night operation.
 - .3 Overstepping of the permissible sash opening (500mm) is effected via a visual (yellow LED) and acoustic warning signal. The acoustic alarm signal should be designed in a way that it can be acknowledged.
 - .4 The visual alarm signal disappears by itself when the sash opening height under-runs 500mm.

- .5 Relay outputs should be made available for transmitting the operating message (on / off), the alarm message and the extent of air exchange rate (0-10V).
- .6 Incoming signals on / off, reduced operation, increased operation and constant load must be converted and transferred.
- .7 Relay outputs: Operating message (on/off), night operation, alarm message.
- .8 Control inputs: Daytime operation, night operation, decommissioning/off.
- .9 Data exchange capabilities between Fume Hood Exhaust Air Valve Control Unit and the Building Automation System via BACnet, Analogue I/O.

2.9 EXPLOSION PROOF BENCH-TOP FUME HOODS WITH SERVICES ON SIDE WALLS

- .1 General: Ducted extraction of fumes, aerosols and dusts from internal workspace, with service outlets in side wall of internal workspace and operating controls located on the side posts adjacent to the sash.
- .2 Hazardous area classification requirement;
 - .1 Explosion Proof fume hoods to be designed to comply with electrical hazardous classification of; Class I, Division 2.
- .3 Configurations: Provide in the following configurations, as indicated on Drawings.
 - .1 Supporting structure: H-Frame
 - .2 Airflow control: AC
- .4 Operational features: Units shall include the following.
 - .1 Airflow indicator and alarm.
 - .2 Sash alarm.
 - .3 Sash stops, with manual override.
- .5 Bench-top Fume hood characteristics:
 - .1 Sizes:
 - .1 Width(s) and corresponding (Approximate) weight: 2100 mm by 410 kg.
 - .2 Interior effective width: 1840 mm
 - .3 Depth: 900 mm.

- .4 Height: 2400 mm, from the floor.
- .5 Interior effective height: 1345 mm.
- .6 Working height: 900 mm.
- .2 Construction:
 - .1 Material facing:
 - .1 Worktop: Stoneware.
 - .2 Internal lining: Phenolic Resin.
 - .2 Sashes: Glass, vertical sash with combination horizontal sash panels. Fixed upper window sash.
 - .3 Control panel: AC.
 - .4 Removable front filler panel.
 - .5 Maximum receptors for Scaffold Points: 9 each
 - .1 Scaffold rod diameter: 12 mm nominal.
 - .6 Maximum load per scaffold point with scaffold rod length of 300 mm: 5 kg.
 - .7 Service modules: on inside of each side wall
- .3 Services
 - .1 Electrical (Coordinate with building electrical infrastructure):
 - .1 Explosion proof power and data outlets on the exterior side walls (as shown on drawings).
 - .2 Outlets directly wired by trades.
 - .3 Electrical devices to comply with base building electrical specifications.
 - .2 Plumbing Supply (Coordinate with building mechanical infrastructure):
 - .1 Service module with fittings for gas and water with integrated polypropylene cupsink as indicated on drawings.
 - .2 Pre-plumbed by manufacturer to connection point above fume hood
 - .3 Mechanical devices to comply with base building electrical specifications.
 - .3 Ventilation:

- .1 Airflow controller, monitor & exhaust valve
 - .1 Explosion proof microprocessor-controlled airflow damper and monitoring system designed to control and regulate exhaust air flow for fume hoods with a variable extract air volume.
 - .2 The VAV airflow damper included is in accordance with ASHRAE and is to fulfil the following characteristics:
 - .1 Speed of response time is within 1 second.
 - .2 Complete valve range, 0-100% is attained within 3 seconds.
 - .3 Measurement error of the air exchange rate <5% from the actual value.
 - .4 Cyclic automatic self-monitoring and zero point balancing.
 - .5 Actuator with integrated bevel detection for position control and air exchange rate identification.
 - .6 Valve and manifold made completely of Polypropylene.
 - .7 Airflow measuring range of 100 to 1500m³/h.
 - .8 Full function in system primary pressure between 100 and 600 Pa.
 - .9 Detection of sash position.
 - .10 Detection of horizontal sash notch.
 - .11 Cable-break detection (motor, pressure sensor and sash detection).
 - .3 The control and display panels must perform the following functions:
 - .1 Operation: On/Off, constantly reduced air quantity, constantly increased air quantity, log-on to night operation, acoustic alarm acknowledgement. It must be possible to lock each individual function.
 - .2 Display function: ventilation function (no malfunction: green, malfunction: red, including acoustic signal) operating mode message (variable, reduced, increased), supply unit power failure, logged on to the night operation.

- .3 Overstepping of the permissible sash opening (500mm) is effected via a visual (yellow LED) and acoustic warning signal. The acoustic alarm signal should be designed in a way that it can be acknowledged.
- .4 The visual alarm signal disappears by itself when the sash opening height under-runs 500mm.
- .5 Relay outputs should be made available for transmitting the operating message (on / off), the alarm message and the extent of air exchange rate (0-10V).
- .6 Incoming signals on / off, reduced operation, increased operation and constant load must be converted and transferred.
- .7 Relay outputs: Operating message (on/off), night operation, alarm message.
- .8 Control inputs: Daytime operation, night operation, decommissioning/off.
- .9 Data exchange capabilities between Fume Hood Exhaust Air Valve Control Unit and the Building Automation System via BACnet, Analogue I/O.
- .10 Malfunction of the supportive fan should be displayed via a visual (red LED) and acoustic alarm signal. The acoustic alarm signal should be designed in a way that it can be acknowledged. The visual alarm signal disappears by itself when the malfunction no longer exists. The extract air volume is increased if the supportive flow technology fails. The supportive flow fan is automatically disconnected when the fume cupboard sash is closed.

2.10 PERMANENT ENCLOSURES

- .1 General: Enclosure for extraction of thermal loads, gases, fumes, aerosols or dust from interior of the housing and sound transmission reduction.
 - .1 For combination with service wall ducts, shorten back wall for usage of services. Refer to drawings for dimensions.
- .2 Configurations: Provide in the following configurations, as indicated on drawings.
- .3 Enclosure Characteristics:
 - .1 Sizes: as indicated on drawings.

- .2 Width: 1500 mm.
- .3 Depth: 715 mm.
- .4 Height including extract air connection: 1550 mm.
- .5 Height including extract manifold: 1750 mm.
- .4 Construction:
 - .1 Material facing: Safety glass.
 - .2 Sash: 3 horizontal at 1500 mm wide units.
 - .3 Optional lighting with LED light.
 - .4 Cable pass-through: Located in the left and/or right fume hood panes, as indicated. Pass through on both sides at all fume hoods.
 - .5 Air extraction system: Extract air connection attached to on-site exhaust air system. Two-position damper valve to control on-off function based on local control panel.
- .5 Ventilation:
 - .1 Extract air connection height: 1550 mm.
- .6 LABORATORY SERVICE FITTINGS
 - .1 Provide in configurations indicated on drawings and schedules.
 - .2 Refer to Section 11 53 43 - Laboratory Service Fittings for service fitting requirements.

2.11 OPERATIONAL FEATURES

- .1 Provide the following operational features, as indicated in individual laboratory fume hood descriptions and as indicated on Drawings.
- .2 Window sash handle with air exhaust function: When sash is open, air flows into workspace preventing pollutant backflow out of fume hood. Sash operating mechanism, including release of sash stop, can be operated with one hand at any point along the sash.
- .3 Automatic sash: Sash closes automatically when there is nobody present at the fume hood after a programmable time limit. A photo-electric barrier stops the closing process if there are objects protruding from inside the workspace.
- .4 Airflow indicator and alarm: Manufacturer's standard airflow indicator with audible and visual alarm that activates when airflow sensor reading is outside of preset range.

- .5 Sash alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
 - .1 Provide with silence and test switches.
- .6 Sash stops: Provide fume hoods with sash stops to limit hood opening to 18 inches (according to ASHRAE 110). Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.

2.12 FABRICATION

- .1 Factory assembly: Preassemble laboratory service carriers in manufacturer's factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- .2 Coordinate dimensions and attachment methods of laboratory service carriers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
- .3 Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install laboratory service carriers.

2.13 FINISHES

- .1 Steel powder coat finish:
 - .1 Clean steel components in accordance with powder coating manufacturer's instructions.
 - .2 Dry immediately in temperature-controlled environment.
 - .3 Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.
- .2 Powder-coat finish steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt	Type B Polyester and Epoxy based resin - gloss	Type C Polyester and Epoxy based resin - high chemical resistance	Type D ECTFE coating
	(Duramix 33) SCALA light grey	Duramix 39 Anthrazit	Duraguard Anthrazit	Halar Black
thickness	3.1 mils (80 µm)	3.1 mils (80 µm)	3.1 mils (80 µm)	15.7 mils (400 µm)

Bottom unit Panels frame	X X			
Head unit of fume hood (not SI3-TA) Panels (under Benchtop) Profiles/ sash/ Panels (Panels on side) Airfoil	X	X	X	
Head unit pf Special appl. Fume Hood for acid digestion/ Perchloric Acid/ HF Panels (under Benchtop) Profiles/ sash Airfoil	X	X		X

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Take measurements of construction at site to which work of this section must conform, and through which access must be made, before work of this section are delivered to site.
- .2 Before installation commences, ensure that mounting devices, members and surfaces are satisfactory for fitting and adequate for securing of equipment; and that services are adequate and located correctly.
- .3 Installation is not to proceed until completion of floor finishes so that flooring is continuous below floor supported assemblies, unless otherwise specified.

3.2 INSTALLATION

- .1 Install work of this section in accordance with manufacturer's written requirements and in compliance with reviewed shop drawings.
- .2 Install true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation, and coordinated with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

3.3 CLOSEOUT ACTIVITIES

- .1 Demonstration:
 - .1 Demonstrate in presence of Departmental Representative's representatives operation of equipment following installation. Give minimum 48 hours advance notice in writing of demonstration date.
 - .2 Demonstrations shall be made:
 - .1 When installation is completed.

- .2 When work is turned over to Departmental Representative.
- .3 Responsible representatives of manufacturers and installers of equipment being tested shall be present at demonstrations.
- .4 Provide on-site instructions to Departmental Representative's designated representatives in operation and maintenance of installed equipment.

3.4 COMMISSIONING OF FUME HOODS

- .1 On-site commissioning of fume hoods shall be in accordance with ASHRAE 110 test and EN 14175 test or NIH Specification Section 15992-On Site Testing-VAV Fume Hoods and as follows:
 - .1 Exhaust System Stability Test: The coefficient of variation (COV) of the exhaust system static pressure or duct velocity should not exceed 10 percent. Tuning, repair, or redesign of the system should be done prior to performing fume hood testing if the system is unstable.
 - .2 Low-Volume Smoke Test and High Volume Smoke Test: The test results should be Good or Fair as defined by the following:
 - .1 Fail: Smoke observed escaping from the hood.
 - .2 Poor: Reverse flow of smoke near opening. Lazy flow into opening along boundary. Observed potential for escape.
 - .3 Fair: Some reverse flow, not necessarily at the opening. No visible escape. In addition, in High Volume Test, there shall be limited turbulent vortex in hood with all smoke captured and cleared readily.
 - .4 Good: No reverse flow. No visible escape. Active flow streams into hood around boundary. In addition, in High Volume Test, there shall be limited hood roll vortex with good capture and quick clearance.
 - .3 Face Velocity Test: 0.3 m/s \pm 20 percent.
 - .4 Turbulence Test: Average of the standard deviations of all traverse point velocities normalized by the mean velocity should not exceed 10 percent.
 - .5 Profile Test: The standard deviation of all traverse point average velocities normalized by the mean velocity should not exceed 15 percent.
- .2 Instruments used shall have been calibrated within the last year or within the time period specified by the instrument manufacturer.
- .3 Calibration gases used shall have certificates of analysis.

- .4 Fume hoods shall be commissioned by a technician certified to perform the specified tests.
- .5 Factory test certificate on each type of fume hood supplied and as part of on-site testing of every fume hood following commissioning room HVAC systems.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Standard of Sanitary Engineering:
 - .1 ASSE 1035-2008, Performance Requirements for Laboratory Faucet Backflow Preventers.
- .2 American Society of Mechanical Engineers:
 - .1 ASME A112.18.1-2018/CSA B125.1-2018 - Plumbing Supply Fittings.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-installation meeting prior to commencement of installation work.
- .2 Coordination
 - .1 Work of this section is closely integrated with laboratory work of other sections. Coordinate work of this section with work of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.
 - .3 Coordinate layout and installation of framing and reinforcements for support of laboratory service carriers and service fittings and accessories.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's product data sheets for products proposed for use in the work of this section.
- .3 Shop Drawings:

- .1 Submit shop drawings of specified fittings and accessories with performance charts of finishes.
- .2 Coordinate drawings with requirements of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
- .4 Samples:
 - .1 Provide samples of each type of service fitting.
 - .2 Coordinate and Provide sample submissions in accordance with the work of sections:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 and 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Coordinate and Provide mock-ups in accordance with the work of sections:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service carriers under Section 12 35 10.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.

- .2 Refer to mock-up requirements in Section 12 35 53.

1.6 DELIVERY, STORAGE, AND HANDING

- .1 Delivery, storage, and handling of products in accordance with manufacturer's written requirements.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this section for a period of 5 years.
 - .1 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to Owner.
 - .2 Defects include, but are not limited to:
 - .1 Ruptured, cracked, or stained coating.
 - .2 Discoloration or lack of finish integrity.
 - .3 Cracking or peeling of finish.
 - .4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - .5 Weld or structural failure.
 - .6 Warping or unloaded deflection of components.
 - .7 Failure of hardware.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL REQUIREMENTS

- .1 Green Globe Requirements:
 - .1 Comply with the requirements of Section 01 33 29 as applicable.

2.2 PRODUCTS

- .1 Refer to 1603-02 Canadian Centre for Advanced Materials - Lab Service Fixtures Level 1 for list of products.

2.3 MATERIALS AND FABRICATION

.1 General:

- .1 Fittings shall be CSA and CGA approved.
- .2 Use minimum 60% copper forging brass or 81% copper casting brass for valve bodies. Make handles and turrets of brass forgings. Use solid brass bar stock or specially selected alloys for assembly components and operating parts such as valve stems, renewable seats and needle cones.
- .3 Completely enclose spring mechanisms. Design compression and needle valve stems to operate inside which shall be renewable for replacement.
- .4 Renewable seats shall be fabricated of stainless steel or brass with a "double chromium plate finish." Conical, self-centering needle valves shall be fabricated of stainless steel or Celcon.
- .5 Valve bodies, handles (except three-arm Bakelite) and turrets shall be fabricated in one-piece construction from brass sand castings or brass forgings.
- .6 Service fitting outlets shall be mounted on turrets with lugs or projections on the bottom to lock bodies in position eliminating twisting.
- .7 Provide fittings with wall flanges, shanks, locknuts, coupling nuts and tailpieces.
- .8 Compression valves for hot and cold water shall be sand castings or brass forgings with stems operating inside a cap nut sleeve so that all parts subject to wear may be easily replaced.
 - .1 Water faucets shall meet or exceed the following approvals and standards: ASME A112.18.1/CSA B125.
 - .2 Vacuum breakers (in line) shall meet or exceed the following approvals and standards: ASSE 1035, Lab Faucet Vacuum Breakers listed by IAPMO.
- .9 Needle valve fittings:
 - .1 Refer to 1603-02 Canadian Centre for Advanced Materials - Lab Service Fixtures Level 1.
- .10 Recirculating pure water faucet, polypropylene-lined, with full epoxy coated colour coded finish for DI water or treated water faucet outlets. Faucet valves shall be non-lubricated, and manually operated for flow control.
 - .1 Refer to 1603-02 Canadian Centre for Advanced Materials - Lab Service Fixtures Level 1.
- .11 Maximum testing pressure and recommended operating ranges.

Valve Type	Maximum Testing Pressures
Ball	862 kPa (125 psi) at 21°C
Needle	662 kPa (96 psi) at 21°C
Compression	880 kPa (128 psi)
Distilled Water	414 kPa (60 psi)

.12 Recommended Operating Range.

Service	Recommended Operating Range
Gas	1.4 to 5.2 kPa (.2 to .75 psi)
Air	103 to 172 kPa (15 to 25 psi)
Vacuum	62 to 97 kPa (9 to 14 psi)
Oxygen	103 to 172 kPa (15 to 20 psi)
Steam	103 to 140 kPa (15 to 20 psi)
Water	345 to 552 kPa (50 to 80 psi)
Argon	70 to 103 kPa (10 to 15 psi)
Nitrogen	70 to 103 kPa (10 to 15 psi)
Hydrogen	7 to 34 kPa (1 to 5 psi)
Distilled Water	140 to 278 kPa (20 to 40 psi)

2.4 COLOUR CODED INDEX (SEFA COLOUR INDEX)

- .1 When specified, identify fittings as to type of service with colour-coded plastic removable index buttons with engraved lettering filled with enamel corresponding to the following standards:

Service	English	French	Colour Coding
Cold Water	CW	EF	Dark Green
Hot Water	HW	EC	Red
Distilled Water	DW	ED	White
Type II Water	IIW	IIW	White
Deionized Water	DI	DI	White
Demineralized Water	DM	DM	White
Vacuum	VAC	VIDE	Yellow
Air	AIR	AIR	Orange
Gas	GAS	GAZ	Dark Blue
Propane	PROP	PROP	Chrome
Oxygen	OXY	OXY	Light Green
Nitrogen	N	N	Grey
Argon	A	A	White
Hydrogen	H	H	Pink
Helium	HE	HE	Chrome
Carbon Dioxide	CO2	CO2	Chrome
Steam	ST	VAP	Black

2.5 FINISHES

- .1 Full colour coded epoxy finish shall be supplied as the standard finish on laboratory service fittings, unless specified otherwise.

2.6 CONNECTION ADAPTERS AND ACCESSORIES:

- .1 Service fittings, except for Type II, Distilled water faucets, and those located to interior of fume hoods; complete with standard brass shanks 10 mm NPS locknuts and tailpieces 6 mm NPT, preassembled.
- .2 Service fittings with standard rigid/swivel goosenecks; shipped with goosenecks separate in same package, ready for assembly and installation.
- .3 Service fittings installed on interior of fume hoods shall be complete with brass shanks, measuring approximately 60 mm from base of turret to end of shank 10 mm NPS, and include locknuts, preassembled.
- .4 Distilled or Type II water faucet connection devices; provide connectors for 19 mm sanitary "tri-clamp" ends.

2.7 ACCESSORIES

- .1 Exhaust arm:
 - .1 Telescopic, wall mounted, fume extraction arm, with gas springs, moveable angle joints, 360° swivel, flexible suction unit, and air tight damper.
 - .2 Performance:
 - .1 Airflow: minimum 40 L/s.
 - .2 Static pressure drop: 110 Pa at 40L/s.
 - .3 Nozzle air velocity: 10 m/s.
 - .3 Length: 1100 mm.
 - .4 Diameter: 75 mm.
 - .5 Components:
 - .1 Metal components: powdercoated plate steel.
 - .2 Plastic components: polypropylene.
 - .3 Tubes: anodized aluminum.
 - .4 Hose: PVC-coated polyamide fabric.

- .5 Hood: powdercoated aluminum.
- .2 Coat hooks:
 - .1 Surface-mounted coat rack constructed of Type 304 stainless steel backplate and hooks.
 - .1 Material thicknesses:
 - .1 Backplate: 0.79 mm.
 - .2 Hooks: 1.98 mm.
 - .2 Finish: exposed surfaces, satin finished.
 - .3 Fasteners: purpose made mounting screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Service fittings:
 - .1 Install service fittings and connection adapters for setting, connecting and sealing to counter tops, service strips fume hood linings and the like.
 - .2 Bases of turrets shall be set in a bed of specified clear silicone sealant, with excess sealant removed.
 - .3 Give on-site instructions as required.
- .2 Fume extraction arm:
 - .1 Install work of this section in accordance with manufacturer's written requirements and in compliance with reviewed shop drawings.
 - .2 Install true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation, and coordinated with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.
- .3 Coat hooks:
 - .1 Install work of this section in accordance with manufacturer's written requirements.
 - .2 Install true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.

3.2 CLOSEOUT ACTIVITIES

- .1 Demonstration, fume extraction arm:
 - .1 Demonstrate in presence of Departmental Representative's representatives operation of equipment following installation. Give minimum 48 hours advance notice in writing of demonstration date.
 - .2 Demonstrations shall be made:
 - .1 When installation is completed.
 - .2 When work is turned over to Departmental Representative.
 - .3 Responsible representatives of manufacturers and installers of equipment being tested shall be present at demonstrations.
 - .4 Provide on-site instructions to Departmental Representative's designated representatives in operation and maintenance of installed equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Nickel Steel Plate, Steel, and Strip.
 - .3 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .4 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
 - .5 ASTM A312/A312M-18a, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .6 ASTM A500/A500M-18, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .7 ASTM A879/879M-12(2017), Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass of Each Surface.
 - .8 ASTM A1008/A1008M-18, 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.
 - .9 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes (Metric).
 - .10 ASTM B633-19, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - .11 ASTM C635/C635M-17, Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - .12 ASTM F593-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - .13 ASTM F594-09(2015), Standard Specification for Stainless Steel Nuts.
 - .14 ASTM F1941/1941M-16, Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric.

- .2 Underwriter's Laboratory of Canada (ULC)
 - .1 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-installation meeting prior to commencement of installation work.
- .2 Coordination
 - .1 Work of this section is closely integrated with laboratory work of other sections. Coordinate work of this section with work of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's product data sheets for products proposed for use in the work of this section.
- .3 Shop drawings:
 - .1 Submit engineered shop drawings.
 - .2 Shop Drawings: For laboratory service carriers and ceiling support system, including plans, elevations, and attachment details.
 - .1 Indicate types and configurations of service carriers.
 - .2 Indicate layout and details for ceiling support system.
 - .3 Indicate locations and types of service fittings.
 - .4 Indicate locations of blocking and reinforcements required for service carriers.

- .5 Include details showing supports for service carriers, conduits and piping.
- .6 Include details of exposed conduits, if required, for service fittings.
- .7 Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory casework and equipment.
- .8 Include details showing anchoring for ceiling support system to structure.
- .9 Include coordinated dimensions for laboratory equipment specified in other Sections.
- .3 Coordinate drawings with requirements of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
- .4 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.
- .5 Coordinate layout and installation of framing and reinforcements for support of laboratory service carriers and service fittings and accessories.
- .4 Samples:
 - .1 Provide samples of each type of service carrier.
 - .2 Coordinate and provide sample submissions with the work of sections:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 and 01 78 00.
- .2 Operation and maintenance data:

- .1 Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.
- .3 Submit as-built drawings recording actual site conditions.

1.5 QUALITY ASSURANCE

- .1 Mock-ups:
 - .1 Coordinate and Provide mock-ups in accordance with the work of sections:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory casework under Section 12 35 53.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Refer to mock-up requirements in Section 12 35 53.

1.6 DELIVERY, STORAGE, AND HANDING

- .1 Delivery, storage, and handling of products in accordance with manufacturer's written requirements.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this section for a period of 5 years.
 - .1 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to Owner.
 - .2 Defects include, but are not limited to:
 - .1 Ruptured, cracked, or stained coating.
 - .2 Discoloration or lack of finish integrity.
 - .3 Cracking or peeling of finish.
 - .4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - .5 Weld or structural failure.
 - .6 Warping or unloaded deflection of components.
 - .7 Failure of hardware.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL REQUIREMENTS

- .1 Green Globe Requirements:
 - .1 Comply with the requirements of Section 01 33 29 as applicable.

2.2 PERFORMANCE REQUIREMENTS

- .1 Structural performance: Provide overhead laboratory service carriers, fasteners and utility service connections capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of components.
- .2 Seismic performance: Laboratory service carriers and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to the building code.
- .3 Project seismic design category: as indicated on Structural Drawings.
- .4 Corrosion control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 MATERIALS

- .1 Provide laboratory service modules, service columns, cover plates, removable partitions, ceiling support systems, service fittings, and accessories from casework manufacturer, unless noted otherwise.
- .2 Sheet metal, general: Where exposed to view on finished units, Provide sheet metal without pitting, seam marks, roller marks, stains, discolourations, or other imperfections.
- .3 Extruded aluminum framing: Extrusions complying with ASTM B221M or comparable standard, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper as recommended by manufacturer.
- .4 Steel sheet: Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed.
- .5 Steel framing:

- .1 Steel plates, shapes, and bars: ASTM A36/A36M or comparable standard. Steel Tubing: ASTM A500/A500M or comparable standard, cold-formed steel tubing.
- .6 Stainless steel materials; Type 316 unless otherwise indicated:
 - .1 Stainless steel tubing: to ASTM A269, Commercial Grade, seamless welded.
 - .2 Stainless steel sheet and plate: to ASTM A167.
 - .3 Stainless steel bar and angle: to ASTM A276.
 - .4 Stainless steel seamless pipe: to ASTM A312.
- .7 Oriented strand board (OSB) Shelving: Provide in accordance with requirements of Section 12 35 53 and Section 12 35 54, and as specified herein.
- .8 Glass shelving: Provide in accordance with requirements of Section 12 35 53 and Section 12 35 54, and as specified herein.
- .9 Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 - .1 Structural anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction.
 - .2 Non-structural anchors: For applications not indicated to comply with design loads, provide fastener systems as recommended by manufacturer for installed condition.
 - .3 Anchor materials:
 - .1 Zinc-plated: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - .2 Stainless steel: Interior Stainless Steel: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
 - .3 Plastic Anchors: Manufacturer's standards, as required for installed condition.

2.4 SERVICE MODULES

- .1 Service wall ducts: Modular service panel supply of services and duct add-on parts (accessories) at laboratory workstation.
 - .1 Sizes:

- .1 Widths: As indicated on Drawings.
 - .2 Depth: 195 mm.
 - .3 Total height: 252 mm.
 - .4 Panel size: 300 mm. Provide end filler panels as indicated on Drawings.
- .2 Construction:
- .1 Service panels shall be capable of being installed and removed without tools.
 - .2 Service module: With ingress protection rating (IP) of 44 per IEC 60529.
 - .3 Cover over panel: Removable plastic enclosure with solid grade laminate 5 mm thick or glass plate, as indicated herein.
 - .4 Pre-plumbed by manufacturer to connection point.
 - .5 Pre-wired by manufacturer to junction box above ceiling, unless otherwise indicated.
- .3 Panel Variations:
- .1 Plumbing/Gas: Panel with fittings for compressed air and lab gasses
 - .1 Maximum number of valves per panel: 5
 - .2 Maximum number of pressure regulators per panel: 3.
 - .2 Electrical:
 - .1 Supply: Receptacles in service panel.
 - .2 Maximum number of 120V duplex outlets per panel: 3
 - .3 Maximum number of 208V duplex outlets per panel: 3
 - .4 Maximum number of automatic circuit breakers per Panel: 7 with AFDD.
 - .3 Communications:
 - .1 Supply: blank face plate in service panel for fit-out by Client.
 - .2 Maximum number of data blank face plates per panel: 3

2.5 SERVICE COLUMN

- .1 General:
 - .1 Overhead services supply via the ceiling for laboratory benches, laboratory equipment on mobile tables, and floor-mounted equipment.
- .2 Service column configurations: Provide in configurations as indicated on Drawings.
 - .1 One-sided service columns.
 - .2 Two-sided service columns.
 - .3 Service columns suspended from ceiling support system.
 - .4 Wall-mounted service columns.
 - .5 Pairs of service columns with horizontal mounting rails for between columns suspended cabinets and accessories.
- .3 Service column characteristics:
 - .1 Sizes:
 - .1 Width: 205 mm.
 - .2 Depth, single-sided: 140 mm.
 - .3 Depth, double-sided: 240 mm.
 - .4 Maximum height of supporting construction: As indicated on Drawings.
 - .5 Service panel (W,H): 200 mm by 300 mm.
 - .6 Storage width (Pairs of columns with horizontal mounting rails): as indicated on Drawings
 - .7 Storage depth: as indicated on Drawings.
 - .2 Construction:
 - .1 Column enclosure and service panels: Powder-coated steel, with service fitting configurations as indicated.
 - .2 Maximum number of service panels per side: 5
 - .3 Column enclosure attachment (Attachment to horizontal framing members of ceiling support system): Direct attachment to framing members. Provide cover plate at face of service ceiling framing.

- .4 Horizontal mounting rails for accessory mounting:
Vertically-adjustable aluminum extrusion attachment rails with anchor plates at ends for mounting on service column enclosures. Provide with the following accessories, where indicated.
 - .1 Suspended (overhead) cabinets and shelves.
 - .2 Exhaust arm support brackets.
 - .5 Maximum load per scaffold point with scaffold rod length of 300 mm: 5 kg.
 - .6 Manually sliding columns: distance and direction indicated on drawings, key system, provide brush insertion slots in ceiling for conduit
- .4 Electrical services: Supplied from above. Coordinate with building electrical infrastructure.
 - .1 Electrical supply: Receptacles (sockets) in panels.
 - .2 Receptacle type and quantity as indicated on Drawings.
 - .3 Coordinate electrical connections to building electrical system. Ensure enough extra length is provided to suit extent of sliding column.
- .5 Plumbing services: Supplied from above. Coordinate with building plumbing infrastructure.
 - .1 Service panel with control valves, pressure regulators, and fittings for lab gasses as indicated on Drawings.
 - .2 Coordinate plumbing connections to building plumbing system. Ensure enough extra length is provided to suit extent of sliding column.

2.6 COVER PLATE

- .1 Sizes:
 - .1 As indicated on Drawings.
- .2 Construction:
 - .1 Cover plate: Powder-coated steel.
 - .2 Provide support framing for cover plate as indicated and/or required to support cover plate.
 - .3 Provide lift-out slotted panel as indicated on Drawings
- .3 Use:

- .1 Conceal exposed vertical mechanical duct runs as indicated on drawings.

2.7 REMOVABLE PARTITIONS

- .1 Use:
 - .1 The Removable Partition System with integrated door is to be easily connected to the underside of structural slab, Ceiling Support System, Laboratory Casework, and braced on the finished floor slab. Installation and removal of the Removable Partition System should be easily done with the use of simple hand tools, no cutting of any material is acceptable. The Removable Partition System is to be designed to be installed and removed periodically. The Removable Partition System is to provide a physical and visual division between adjacent Lab Modules above and below the ceiling line. Removable Partition System is to be designed to be disassembled down to each individual component for ease of storage and transportation.
- .2 Construction:
 - .1 Framing members: to match Ceiling Support System Grid, dimensions, sizes and internal reinforcement as required to support the partition system dimensions. Internally reinforce framing members as required to accommodate the door, hardware, and partition dimensions.
 - .2 Panels: to match Laboratory Casework cabinet construction (Thermoset melamine panels), thickness to suit partition requirements (min. 19mm thick).
 - .3 Door: Single-leaf door with aluminum / metal profile system, finish to match framing members, Glass - 6 mm tempered as guard glass double glazed unit with frosted film, two-way hinge, door handle and lock to match existing buildings system. Refer to drawings for size and details.
 - .4 Fasteners: removable fasteners as recommended by manufacturer, colour match exposed fasteners to framing members.
 - .5 Accessories:
 - .1 Aluminum skirting board: finish to match framing members.
 - .2 Retractable closure plate: to bridge gap between partition system and exterior wall envelope, finish to match framing members.
 - .3 Anchor plates to underside of structure; as required to support top of removable partition system.

- .6 Refer to Drawings for Removable Partition System plans, elevations, and details.

2.8 CEILING SUPPORT SYSTEM

- .1 General: The ceiling support system is comprised of a suspended extruded aluminum frame system that supports the ceiling finish (acoustic ceiling tiles), Service Columns, vertical supports for upper cabinet supports, light fixtures, mechanical services, electrical services, and the Removable Partition System. Adequate supports (vertical and horizontal) and internal reinforcement are to be provided to ensure the structural integrity of the system and components supported.
- .2 Ceiling Support System Characteristics;
- .1 Layout: Refer to Drawings.
- .2 Construction:
- .1 Rectangular Aluminum Framing Profiles: Provide as required to support grid loading and as indicated on drawings.
- .1 Vertical Support hangers: 50 mm x 100 mm minimum profiles or as required to provide required support.
- .2 Primary frame: 100 mm x 100 mm min. profiles or as required to provide required support.
- .3 Secondary frame: 50 mm x 100 mm min. profiles or as required to provide required support.
- .4 Cabinet Mounting Rails; 50 mm x 100 mm min. profiles or as required to provide required support.
- .5 Maximum Load Capacity; 500 kg per square meter.
- .2 Acoustic Ceiling Tiles and Suspension System;
- .1 Acoustic Ceiling Tiles (ACT1); mineral fibre 24.4 mm thick, flat, square edge, white colour, fissured pattern, maximum flame spread rating 25 to CAN/ULC-S102, detail. Tile dimensions as indicated on drawings.
- .2 Suspension System; Intermediate duty system with integral gasket to ASTM C635/C635M, designed specifically for clean rooms, non-fire rated, chemical resistant, 15/16" co-extruded aluminum two directional exposed tee bar grid, including wall moulding.
- .3 Metal infill panels, colour: white.
- .4 Hangers: 3.6 mm galvanized soft annealed steel wire.

- .5 Accessories: splices, clips, wire ties, retainers and wall moulding to complement suspension system components, as recommended by system manufacturer.
- .6 Hold down clips; purpose made clips to secure tile to suspension system,
- .7 Trim rings; provide at all vertical penetrations through acoustic ceiling tiles, dimensions to suit penetrations, material to match acoustic ceiling tile suspension system.
- .3 Fasteners and Anchors;
 - .1 As recommended by manufacturer.
- .4 Accessories:
 - .1 Aluminum closures; provide at perimeter of ceiling support system to close gap between system and perimeter walls / partitions, material to match rectangular aluminum framing profiles
 - .2 Brush slotted panel; provide at service column locations to allow for horizontal repositioning of service column, brush slot to accommodate service column mechanical and electrical lines, length as per drawings.
- .3 Maximum load capacity: 500 kg/m².

2.9 ELECTRICAL AND COMMUNICATION SERVICE FITTINGS

- .1 Service fittings, General: Provide units complete with metal housings, receptacles, switches, pilot lights, voice and data communication outlets, cover plates, accessories, and gaskets required for mounting on laboratory casework.
- .2 Receptacles (Sockets):
 - .1 Refer to base building electrical drawings and specifications for requirements.
- .3 Voice and data communication outlets: provide infrastructure for data and communication cabling as per the base building electrical drawings and specifications. Provide blank face plate for data and communication outlet locations.

2.10 ACCESSORIES

- .1 Suspended (Overhead) storage cabinets: For mounting on vertical columns attached to the service ceiling grid system above.

- .1 Provide in accordance with requirements of Section 12 35 53 and Section 12 35 54 and as specified herein.
- .2 Widths: As indicated on Drawings.

2.11 FABRICATION

- .1 Factory Assembly: Preassemble laboratory service carriers in manufacturer's factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- .2 Fabricate service carriers to permit future modifications of utility services without the use of special tools and without disrupting laboratory operations.
- .3 Fabricate service carriers to minimize connections to utility services on-site.
- .4 Coordinate dimensions and attachment methods of laboratory service carriers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
- .5 Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install laboratory service carriers.

2.12 FINISHES

- .1 Clean steel components in accordance with powder coating manufacturer's instructions.
- .2 Dry immediately in temperature-controlled environment.
- .3 Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.
- .4 Powder-coat finish steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt
	(Duramix 33) SCALA light grey
thickness	3.1 mils (80 µm)

Service Modules	
- Panels	X
- Profiles	X
- Accessories	X

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SERVICE MODULES

- .1 Install in accordance with manufacturer's written instructions.

3.3 INSTALLATION OF LABORATORY ACCESSORIES

- .1 Install accessories according to approved Shop Drawings and manufacturer's written instructions.
- .2 Suspended Cabinets: Fasten to cabinet framing (scaffolding) or substrate as required to conform to seismic performance requirements.
- .3 Where accessories are partition-braced, securely fasten to partition framing, wood blocking, or reinforcements in partitions.
- .4 At service modules, coordinate accessory cut-outs and attachment to service duct panels.

3.4 INSTALLATION OF SERVICE FITTINGS

- .1 Pre-install service fittings to the greatest extent possible.
- .2 Install fittings according to approved Shop Drawings and manufacturer's written instructions.

3.5 CLEANING AND PROTECTING

- .1 Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- .2 Protect laboratory service carriers during construction with 0.15-mm plastic or other suitable water-resistant covering.
- .3 Touch minor finish damage as required to match original finish. Remove and replace laboratory service carrier components if finish cannot be repaired to eliminate evidence of damage.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Nickel Steel Plate, Steel, and Strip.
 - .3 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .4 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
 - .5 ASTM A312/A312M-18a, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .6 ASTM A500/A500M-18, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .7 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .8 ASTM A879/879M-12(2017), Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass of Each Surface.
 - .9 ASTM A1008/A1008M-18, 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.
 - .10 ASTM C1048-18, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - .11 ASTM C1172-19, Standard Specification for Laminated Architectural Flat Glass.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-2016, Particleboard.
- .3 International Code Council (ICC)
 - .1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 30-2018, Flammable and Combustible Liquids Code.

- .5 Underwriter's Laboratory of Canada (ULC)
 - .1 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-installation meeting prior to commencement of installation work.
- .2 Coordination
 - .1 Work of this section is closely integrated with laboratory work of other sections. Coordinate work of this section with work of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
 - .4 Steel laboratory casework under Section 12 35 54.
 - .2 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's product data sheets for products proposed for use in the work of this section.
- .3 Shop Drawings:
 - .1 Submit engineered shop drawings.
 - .2 For laboratory casework. Including plans, elevations, and attachment details.
 - .1 Indicate types and sizes of cabinets.
 - .2 Indicate locations of hardware and keying of locks.
 - .3 Indicate locations and types of service fittings.
 - .4 Indicate locations of blocking and reinforcements required for installing laboratory casework.
 - .5 Include details of utility spaces showing supports for conduits and piping.

- .6 Include details of exposed conduits, if required, for service fittings.
- .7 Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
- .8 Include coordinated dimensions for laboratory equipment specified in other Sections.
- .3 Coordinate shop drawings with requirements of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
- .4 Samples:
 - .1 Provide samples for each type of cabinet finish and each type of countertop, in manufacturer's standard sample sizes.
- .5 Product test reports for countertop surface material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating physical properties of laboratory countertop surface materials including chemical and physical resistance.

1.4 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Provide mock-up of one complete unit comprising of a cross section of wall storage and base units in location as directed by the Departmental Representative.
 - .2 Mock-up to include items as specified in:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
 - .3 Mock-up shall demonstrate construction and finishes.
 - .4 Reviewed mock-up may remain as part of the final installation, subject to approval by the Departmental Representative.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 and 01 78 00.

- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Submit as-built drawings recording actual site conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace products to prevent damage or distortion of equipment in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings or equivalent protection. Utilize temporary skids under large or heavy units.
- .2 Deliver equipment to location at building site designated by Contractor.
- .3 Do not deliver products to site until conditions are such that no damage will occur to them while in storage.
- .4 The casework manufacturer and the Contractor shall be jointly responsible to make certain that casework is not delivered until the building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in moisture content.
- .5 Do not deliver casework until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this section for a period of 5 years.
 - .1 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to Owner.
 - .2 Defects include, but are not limited to:
 - .1 Ruptured, cracked, or stained coating.
 - .2 Discoloration or lack of finish integrity.
 - .3 Cracking or peeling of finish.
 - .4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - .5 Weld or structural failure.
 - .6 Warping or unloaded deflection of components.
 - .7 Failure of hardware.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL REQUIREMENTS

- .1 Green Globe Requirements:
 - .1 Comply with the requirements of Section 01 33 29 as applicable.

2.2 PERFORMANCE REQUIREMENTS

- .1 Seismic performance: Laboratory casework and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to the building code.

2.3 REGULATORY REQUIREMENTS

- .1 Flammable liquid storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- .2 Electrical components, devices, and accessories: CSA approved.
- .3 Accessibility requirements: Where accessible workstations are indicated, comply with applicable provisions of ICC A117.1 and AODA.

2.4 MATERIALS

- .1 Source Restriction: Provide laboratory casework, worktops (countertops), accessories and service fittings from casework manufacturer, unless otherwise indicated.
- .2 Particleboard: ANSI A208.1, Grade M-2; ANSI A208.1, Grade M-2 or comparable standard, exterior glue at worktops (countertops).
- .3 Phenolic resin: Compact solid grade laminate in thicknesses from 6 mm - 20 mm with both black and white decorative layer, having a flame-spread index of 5 or less, and a smoke developed index of 20 or less, in accordance with CAN/ULC S102.
- .4 Adhesives: Containing no urea formaldehyde.
- .5 Edging for phenolic resin panels: 2 mm thick, polypropylene edging matching melamine-faced panels.
- .6 Stainless steel materials; Type 316 unless otherwise indicated:
 - .1 Stainless steel tubing: to ASTM A269, Commercial Grade, seamless welded.

- .2 Stainless steel sheet and plate: to ASTM A167.
- .3 Stainless steel bar and angle: to ASTM A276.
- .4 Stainless steel seamless pipe: to ASTM A312.
- .7 Glass: Provide manufacturer's standard glass, complying with the following requirements.
 - .1 Surface Compression: In range of 85 to 100 MPa.
 - .2 Mechanical (Bending) strength: 120 MPa.
 - .1 Tempered safety glass shall be permanently marked with certification label of certification agency acceptable to authorities having jurisdiction.
 - .3 Glass Types:
 - .1 Tempered: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3 or comparable standard; not less than 5 mm thick.
 - .2 Laminated: Clear laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3 or comparable standard; with two plies not less than 5 mm thick and with clear, polyvinyl butyral interlayer.
 - .3 Grind smooth and polish exposed glass edges and corners.
- .8 Sheet metal, general: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- .9 Steel sheet: Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed.
- .10 Steel Framing:
 - .1 Steel plates, shapes, and bars: ASTM A36/A36M. Steel Tubing: ASTM A500, cold-formed steel tubing, or comparable standard.
 - .2 Finish: Powder-coated, as specified herein.
- .11 Trespa Solid Phenolic Resin:
 - .1 Description:
 - .1 Self-supporting solid phenolic resin composite flat panel, manufactured from thermosetting resins, homogeneously reinforced with cellulose fibers and manufactured under high heat and pressure.

- .2 Panels fabricated with pigmented resin and electron beam cured decorative surface for chemical and bacterial resistance. Anti-bacterial activity of 99.99-percent reduction after 24 hours using testing method based on JIS Z 2801: 2000.
- .3 Critical substances: Acids in concentrations greater than 10-percent.
- .4 Damaging substances: Concentrated hydrochloric acids, nitric acid, and heated sulfuric acid.
- .2 Basis of design:
 - .1 Trespa 'TopLab Plus (Toplab+)'.
 - .1 Thickness: 20 mm (3/4").
 - .2 Color: Slate Grey T70.0.0.
 - .3 Core: Solid grey.

2.5 CABINET CONSTRUCTION

- .1 Cabinet design type: Flush overlay.
- .2 Cabinet panel facing: Thermoset melamine panels, unless otherwise noted.
 - .1 Colors: As indicated.
 - .2 Custom color to match sample.
- .3 Panel edging, exposed edges: Polypropylene edgebanding, exposed edges of cabinet panels and shelving.
- .4 Utility-space framing: As specified herein.
- .5 Removable backs: Provide backs that can be removed from within cabinets at utility spaces, and locations where indicated on Drawings.
- .6 Filler and closure panels: Provide where indicated and as needed to close spaces between cabinets and abutting surfaces. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.
 - .1 Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 - .2 Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

2.6 HARDWARE

- .1 3-Knuckle, partially-concealed hinges (European Type): 270 degrees of opening, self-closing. Provide two for doors 1200 mm high or less, and provide three for doors more than 1200 mm high.
- .2 Handles (Pulls):
 - .1 Door and drawer handles (Pulls): Provide the following pulls, unless otherwise indicated herein.
 - .1 Stainless-steel, back-mounted, 'U' pulls.
- .3 Drawer front panel latches: Latching mechanism to permit hinged release of drawer front from side panels to facilitate drawer cleaning.
- .4 Drawer slides: Side mounted, self-closing; designed to prevent rebound when drawers are closed, with catch-release to permit drawer removal without tools. Heavy-duty, ball bearing hinges with sheet metal dust cover over slide assembly.
- .5 Locks: Cam type with five-pin tumbler, brass with chrome-plated finish. Provide in locations, as indicated. Keying as determined per Keying Conference.
 - .1 Provide minimum of two keys per lock and two master keys.
 - .2 Master Key System: All locks operable by master key.
 - .3 Individual key lock for mobile cabinets, shared key lock by lab module, for the rest.
- .6 Casters: Heavy-duty, swiveling-type, locking and non-locking, as indicated. Load capacity 70 kg, each caster, unless otherwise indicated.
- .7 Cabinet shelf supports: Line-bore and metal shelf pin supports.

2.7 LABORATORY BENCHES

- .1 General: Bench frame with worktops for work and storage areas for laboratory work.
- .2 Bench with H-Frame:
 - .1 Size: As indicated on Drawings.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: as indicated on drawings and schedules.
 - .3 Working height: minimum 750 mm and maximum 900 mm.
 - .2 Construction:

- .1 Table frame: Steel frame section; 60 mm by 25 mm with 2 mm wall thickness.
- .2 Worktop: Trespa Solid Phenolic Resin, unless otherwise noted.
- .3 Height-adjustable feet: Plastic.
- .3 Load Capacity: 200 kg/m².
- .3 Bench with cantilever frame: For permanent installation on a wall or a wall-mounted service spine.
 - .1 Size: as indicated on drawings and schedules.
 - .2 Width(s): as indicated on drawings and schedules
 - .3 Depth: as indicated on drawings and schedules
 - .4 Working height: as shown on drawings, frame not to exceed countertop height when installed at maximum height.
 - .5 Construction:
 - .1 Table frame: Steel frame section; 70 mm by 25 mm with 3 mm wall thickness.
 - .2 Worktop: Trespa Solid Phenolic Resin, unless otherwise noted
 - .3 Height-adjustable feet: Plastic.
 - .6 Load capacity: 200 kg/m².
- .4 Bench with supporting under-bench units: Self-supporting under-bench units on plinth (base) and varying worktops.
 - .1 Size(s): As indicated on Drawings and schedules.
 - .1 Maximum worktop width: 3000 mm.
 - .2 Width(s): as indicated on drawings and schedules.
 - .3 Depth: as indicated on drawings and schedules
 - .4 Working height: minimum 750 mm and maximum 900 mm.
 - .2 Construction:
 - .1 Under-bench units: Refer to requirements for under-bench units on plinth (base), herein.
 - .2 Worktop: Trespa Solid Phenolic Resin, unless otherwise noted.
 - .3 Provide intermediate frame when countertop spans for more than 1500 mm between supports.
 - .3 Load Capacity - Tables: 38 kg/m².
- .5 Mobile benches: Refer to "Special Tables and Benches" below.

2.8 UNDER-BENCH UNITS (BASE CABINETS)

- .1 Under-bench units on plinth (Base):
 - .1 Sizes: As indicated on Drawings and schedules.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: 550 mm.
 - .3 Height: as indicated on drawings and schedules.
 - .4 Drawer heights: 150 mm, 200 mm, and 400 mm. Optional full-height drawers, where indicated.
 - .5 Plinth (Base) height: 110 mm.
 - .2 Construction: Provide with doors, drawers, or in open-front configurations, as indicated on Drawings.
 - .1 Hinged doors with 270° swing hinges.
 - .2 Fully extendable drawer compartments and change pull-out.
 - .3 Move-in damper for drawer compartments.
 - .4 Open top; detachable rear wall.
 - .5 Adjustable-height shelves.
 - .6 Adjustable-height feet: 4 each.
 - .7 Air extract stub for duct connection: Provide where indicated.
 - .8 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
 - .3 Load capacity, Per Shelf/Drawer Compartment: 30 kg.
- .2 Under-bench units on casters:
 - .1 Sizes: As indicated on Drawings and schedules.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: 550 mm.
 - .3 Height: as indicated on drawings and schedules.
 - .4 Drawer heights: 150 mm, 200 mm, and 350 mm. Optional full-height drawers, where indicated.
 - .5 Caster height: 110 mm.
 - .2 Construction: Provide with doors, drawers, or in open-front configurations, as indicated on Drawings.

- .1 Hinged doors with 270° swing hinges.
- .2 Fully extendable drawer compartments with latching, swing-down drawer fronts for cleaning access, and change-pull-out catches.
- .3 Move-in damper for drawer compartments.
- .4 Covered top; fixed cabinet back.
- .5 Adjustable-height shelves.
- .6 Casters: 4 each swiveling casters; front casters lockable.
 - .1 Non-locking, 95 kg capacity caster, non-marking type polyurethane tires, grey colour.
 - .2 Locking 95 kg capacity caster, non-marking type polyurethane tires, grey colour, with built-in foot pedal brake.
- .7 Extract air duct: Provide where indicated.
- .8 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
- .3 Load capacity, per shelf/drawer compartment: 30 kg.

2.9 SELF-SUPPORTING UNDER BENCH UNIT FOR FUME HOODS

- .1 Pushed-In Under-Bench Unit for Fume Hoods
 - .1 Sizes: as indicated on Drawings and schedules.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: 550 mm.
 - .3 Height:
 - .1 At pushed-in under-bench unit for bench-mounted fume hood, with services on baffle: 640 mm.
 - .2 At pushed-in under-bench unit for bench-mounted fume hood, with services on side walls: 716 mm.
 - .4 Drawer heights: 150 mm, 200 mm, and 400 mm.
 - .5 Plinth (Base) Height: 110 mm.
 - .2 Construction:
 - .1 Hinged doors with 270° swing hinges.
 - .2 Tops:

- .1 Service panel top for fume hoods with services on baffle
- .2 Covered top; detachable rear wall.
- .3 Adjustable-height shelves.
- .4 Adjustable-height feet: 4 each.
- .5 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
- .6 Load capacity, per shelf/drawer compartment: 30 kg.

2.10 SUSPENDED (OVERHEAD) CABINETS

- .1 Suspended cabinets for storage of instruments and chemicals.
 - .1 Configuration(s):
 - .1 Glazed hinged doors at rectangular units.
 - .2 Solid hinged doors at rectangular units.
 - .2 Sizes: As indicated on Drawings.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: 350 mm.
 - .3 Height: as indicated on drawings and schedules.
 - .3 Construction: Provide in door and drawer configurations, as indicated on Drawings.
 - .1 Hinged doors with 270° swing hinges, solid and glazed doors, as indicated.
 - .2 Height-adjustable shelves, counts as indicated on drawings.
 - .3 Lock: Provide one lock for each door; keyed as determined at keying conference.
 - .4 Pulls: As specified herein for doors and plastic handle affixed to glass at sliding glass doors.
 - .4 Load capacity, per shelf/drawer Compartment: 30 kg.
 - .5 Total Load Capacity: 60 kg.

2.11 LABORATORY CABINETS

- .1 Full-height (tall) cabinets: Storage of laboratory instruments and chemicals.

- .1 Configuration(s): Provide in configurations as indicated on Drawings, including the following:
 - .1 Solid hinged doors.
 - .2 Glazed hinged doors.
- .2 Sizes: As indicated on drawings and schedules
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: as indicated on drawings and schedules.
 - .3 Total Height: as indicated on drawings and schedules.
 - .4 Plinth (Base) Height: 110 mm.
- .3 Construction: Provide in door and drawer configurations, as indicated on Drawings.
 - .1 Hinged doors with 270° swing hinges, solid and glazed doors, unless otherwise indicated.
 - .2 Fully-extendable drawer compartments, in locations where indicated.
 - .3 Height-adjustable shelves.
 - .4 4 each, height-adjustable feet.
 - .5 Move-in damper for drawer compartments.
 - .6 Optional air extract stub for duct attachment, where indicated.
 - .7 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
- .4 Load capacity, per shelf/drawer compartment: 30 kg.

2.12 EXHAUST/SPECIALITY STORAGE CABINETS

- .1 Under-bench units for fume hoods for storage of acids and bases: Pushed-in or self-supporting under-bench unit for bench-mounted fume hoods, for storage of limited quantities of acids and bases, connected to permanently operating ventilation system.
 - .1 Configurations:
 - .1 Pushed-in under-bench units.
 - .2 Self-supporting under-bench units for fume hoods with services on baffle.

- .3 Self-supporting under-bench units for fume hoods with services on side walls.
- .2 Sizes: As indicated on Drawings.
 - .1 Widths (Self-supporting): as indicated on drawings and schedules.
 - .2 Widths (Pushed-in): as indicated on drawings and schedules.
 - .3 Depth: 550 mm.
 - .4 Height (Pushed-in under-bench units for bench-mounted fume hood, services on baffle): 640 mm.
 - .5 Height (Pushed-in under-bench units for bench-mounted fume hood, services on side walls): 716 mm.
 - .6 Height (Self-supporting under-bench units for bench-mounted fume hood, services on baffle or side walls): 710 mm.
 - .7 Plinth (Base) height: 110 mm.
- .3 Construction:
 - .1 Hinged doors.
 - .2 Corrosion-resistant coated fittings.
 - .3 Shelves: 2 extendable shelves with polypropylene collecting trays.
 - .4 Adjustable-height feet: 4 each.
 - .5 Labels identifying type of chemicals.
 - .6 Lock: Provide one lock for each door; keyed as determined at keying conference.
- .4 Load capacity, per extendable shelf: 20 kg.
- .5 Ventilation Data:
 - .1 Volume flow: 30 m³/h.
 - .2 Ventilation connection diameter to ascending duct: 90 mm.
- .2 FWF 90 under-bench unit for fume hoods for the storage of flammable liquids: Pushed-in under-bench unit for bench-mounted fume hoods for storage of limited quantities of flammable liquids, connected to permanently operating ventilation system and connected to grounding line with potential equalization.to meet ULC standards
 - .1 Sizes: as indicated on Drawings.
 - .1 Width(s) and Weights: as indicated on drawings and schedules.
 - .2 Depth: 600 mm.

- .3 Total Height: 635 mm.
- .4 Plinth (Base) Height: 110 mm.
- .2 Construction:
 - .1 Exterior: Powder-coated steel exterior, color; light gray RAL 7035.
 - .2 Hinged door.
 - .3 Drawer.
 - .4 Perforated sheet metal basin bed.
 - .5 Fusible-link locking, in case of fire.
 - .6 Ventilation connection: Polyphenylene sulfide (PPS).
 - .7 Labels
 - .8 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
 - .9 Pulls: Stainless steel U handle.
- .3 Load capacity:
 - .1 Fixed shelf: 30 kg.
 - .2 Drawer: 25 kg.
- .4 Ventilation data:
 - .1 Volume flow: 30 m³/h.
 - .2 Ventilation Connection Diameter to Ascending Duct: 90 mm.
- .3 FWF 90 laboratory cabinet for the storage of flammable liquids: Tall cabinet for storage of limited quantities of flammable liquids, connected to permanently operating ventilation system and connected to grounding line with potential equalization.
 - .1 Sizes: As indicated on Drawings.
 - .1 Width(s) and Weights: as indicated on drawings and schedules.
 - .2 Depth: 600 mm, nominal.
 - .3 Total height: 2000 mm, nominal.
 - .4 Plinth (Base) Height: 80 mm, nominal.
 - .2 Construction:
 - .1 Exterior: Powder-coated steel exterior, color; light gray RAL 7035.

- .2 Hinged door(s).
- .3 Perforated sheet metal basin bed, 3 each, height-adjustable.
- .4 Adjustable-height feet: 4 each.
- .5 Fusible-link locking, in case of fire.
- .6 Ventilation connection: Galvanized steel.
- .7 Labels
- .8 Lock: Provide one lock for each door or drawer; keyed as determined at keying conference.
- .3 Ventilation Data:
 - .1 Volume flow: 30 m³/h.
 - .2 Ventilation connection diameter to ascending duct: 75 mm.
- .4 Vacuum Pump Cabinets:
 - .1 Sizes: As indicated on Drawings.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth: as indicated on drawings and schedules.
 - .3 Total height: 730 mm.
 - .2 Construction:
 - .1 Exterior: Powder-coated steel exterior, color; light gray RAL 7035.
 - .2 Interior insulated with 25.4 mm of acoustic foam contained within inner steel frame.
 - .3 Hinged door(s).
 - .4 Removable back access panel.
 - .5 Pull-out tray and removable access panel at back of cabinet.
 - .6 Pump hose connection and 120V/15 amp duplex receptacle at back of cabinet.
 - .7 Vented holes.

2.13 WORKTOPS (COUNTERTOPS)

- .1 Solid phenolic resin: Trespa Solid Phenolic Resin.
 - .1 Provide 75 mm diam. grommets as per drawings and schedules.

- .2 Stainless Steel:
 - .1 Stainless-steel bars and shapes: ASTM A276, or comparable standard, Type 316L.
 - .2 Stainless steel sheet: ASTM A666 or comparable standard, Type 316 (UNS S31600), acid resistant stainless steel, stretcher-leveled standard of flatness.
 - .3 Critical substances: Cadmium, lactic acid, oxalic acid.
 - .4 Damaging Substances: Compounds containing chlorine and bromine, formic acid, and sulfuric acid.
- .3 Provide 19 mm return splash sides where end of tops butt against wall blank side of cupboard sides, fume hood, service columns, or cover plates enclosure.

2.14 SPECIALTY BENCHES AND TABLES

- .1 Mobile Rack: Mobile, flexible storage shelving mounted on support frame.
 - .1 Size: As indicated on Drawings.
 - .1 Width(s): 900 mm.
 - .2 Unit depth: 600 mm.
 - .3 Height: 1790 mm.
 - .4 Shelving depth(s): 600 mm.
 - .2 Construction:
 - .1 Rack Frame: Slotted steel section.
 - .2 Shelves: Trespa Solid Phenolic Resin, 20mm thick; fixed bottom shelf and adjustable height shelves, adjustable in grid of 45 mm; in configurations as indicated on Drawings.
 - .3 Casters:
 - .1 4 each heavy-duty, 2 lockable.
 - .3 Rack load capacity:
 - .1 Total: 150 kg/m².
 - .2 Shelf: 30 kg/m².
- .2 Height-adjustable tables: Bench frame with height-adjustable support legs.
 - .1 Size: as indicated on Drawings and schedules

- .1 Width(s): as indicated on drawings and schedules.
- .2 Depth(s): as indicated on drawings and schedules.
- .3 Height: as indicated on drawings and schedules, adjustable in 25 mm increments.
- .4 Manually height adjustable.
- .5 Electrically height adjustable - where indicated on drawings and schedules;
 - .1 Benchtop supported by an electrically-actuated, height-adjustable frame.
 - .2 Actuator to be powered by 120V power supply, plugged into a local receptacle.
 - .3 Height adjustment controls located on a panel located below the worktop for easy user access.
 - .4 Worktop working height minimum 675mm to maximum 905mm above floor.
- .2 Materials:
 - .1 Table frame: Steel 'H'-frame section; 60 mm by 25 mm with 2 mm wall thickness.
 - .2 Worktop: Trespa Solid Phenolic Resin, unless otherwise noted.
 - .3 Height-Adjustable Feet: Plastic.
- .3 Load Capacity: 200 kg/sq. m.
- .3 Mobile tables: Caster-mounted bench frame with worktops.
 - .1 Size: As indicated on Drawings.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth(s): as indicated on drawings and schedules.
 - .3 Height(s): as indicated on drawings and schedules.
 - .2 Materials:
 - .1 Table frame: Steel section; 60 mm by 25 mm by 2 mm thick.
 - .2 Worktop: Trespa Solid Phenolic Resin, unless otherwise noted.
 - .3 Casters:
 - .1 4 each heavy-duty, 2 lockable.
 - .3 Load Capacity: 110 kg.
 - .4 Table Load Capacity: 150 kg.

- .5 Option: Extendable shelf, where indicated on Drawings.
- .4 Cylinder Storage Racks
 - .1 Size: As indicated on Drawings.
 - .1 Width(s): as indicated on drawings and schedules.
 - .2 Depth(s): as indicated on drawings and schedules.
 - .3 Height(s): as indicated on drawings and schedules.
 - .4 Maximum cylinder size: 254 mm.
 - .2 Construction:
 - .1 Welded steel rack.
 - .2 Non-kink zinc plated steel chain.
 - .3 Anchored with 12.7 mm steel anchor bolts.

2.15 LABORATORY SERVICE FITTINGS

- .1 Provide in configurations indicated.
- .2 Refer to Section 11 53 43 - Laboratory Service Fittings for service fitting requirements.

2.16 ACCESSORIES

- .1 Under-bench exhaust: Exhaust extraction from under-bench safety cabinets in service spines and fume hoods. Coordinate with Section 11 53 13 - Laboratory Fume Hoods.
 - .1 Ventilation pipe material: Polyphenylene sulfide (PPS).
 - .2 Volume flow: 40 m³/h.
 - .3 Ventilation pipe connector (ascending duct) Diameter: 90 mm.
 - .4 Provide ventilation slots at plinth (base), as required.

2.17 FINISHES

- .1 Steel powder coat finish:
 - .1 Clean steel components in accordance with powder coating manufacturer's instructions.
 - .2 Dry immediately in temperature-controlled environment.

- .3 Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.
- .2 Powder-coat finish steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt
	(Duramix 33) SCALA light grey
thickness	3.1 mils (80 µm)
Casework Metals	
Panels	X
Frame	X
Accessories	X

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

- .1 Install in accordance with manufacturer's written instructions and as specified herein.
- .2 Install level, plumb, and true; using adjusting hardware as required to not exceed the following tolerance requirements:
 - .1 Variation of tops of workbenches from level: 1.5 mm in 3 m.
 - .2 Variation of suspended (Overhead) cabinets: 3 mm in 3 m.
 - .3 Variation in alignment of adjacent door and drawer edges: 1.5 mm.
- .3 Under-bench units, non-push-in: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 400 mm o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

- .1 Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 600 mm o.c. and at sides of cabinets with not less than two fasteners per side.
- .4 Suspended cabinets: Fasten to cabinet framing (scaffolding) or substrate as required to conform to seismic performance requirements.
- .5 Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- .6 Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

- .1 Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where indicated on approved Shop Drawings.
- .2 Fastening:
 - .1 Secure countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
- .3 Provide required holes and cutouts for service fittings.
- .4 Seal unfinished edges and cutouts in melamine resin-clad or solid grade laminate countertops with heavy coat of polyurethane varnish or silicone sealant.

3.4 INSTALLATION OF LABORATORY ACCESSORIES

- .1 Install accessories according to approved Shop Drawings and manufacturer's written instructions.
- .2 Where accessories are partition-braced, securely fasten to partition framing, wood blocking, or reinforcements in partitions.
- .3 At service modules, coordinate accessory cut-outs and attachment to service duct panels.

3.5 INSTALLATION OF SERVICE FITTINGS

- .1 Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

- .2 Install fittings according to approved Shop Drawings and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.

3.6 CLEANING AND PROTECTING

- .1 Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- .2 Protect worktop surfaces during construction with 0.15-mm plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 1200 mm o.c.

3.7 CLOSEOUT ACTIVITIES

- .1 Demonstration:
 - .1 Demonstrate in presence of Departmental Representative's representatives operation of equipment following installation. Give minimum 48 hours advance notice in writing of demonstration date.
 - .2 Demonstrations shall be made:
 - .1 When installation is completed.
 - .2 When work is turned over to Departmental Representative.
 - .3 Responsible representatives of manufacturers and installers of equipment being tested shall be present at demonstrations.
 - .4 Provide on-site instructions to Departmental Representative's designated representatives in operation and maintenance of installed equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A879/879M-12(2017), Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass of Each Surface.
 - .2 ASTM A1008/A1008M-18, 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 C1048-18, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - .4 ASTM C1172-19, Standard Specification for Laminated Architectural Flat Glass.
 - .5 ASTM D2197-16, Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
- .2 International Code Council (ICC)
 - .1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 30-2018, Flammable and Combustible Liquids Code.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-installation meeting prior to commencement of installation work.
- .2 Coordination
 - .1 Work of this section is closely integrated with laboratory work of other sections. Coordinate work of this section with work of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
 - .4 Laboratory casework under Section 12 35 53.

- .2 Coordinate with work of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

1.3 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 Product data sheets:
 - .1 Submit manufacturer's product data sheets for products proposed for use in the work of this section.
- .3 Shop Drawings:
 - .1 Submit engineered shop drawings.
 - .2 For laboratory casework. Including plans, elevations, and attachment details.
 - .1 Indicate types and sizes of cabinets.
 - .2 Indicate locations of hardware and keying of locks.
 - .3 Indicate locations and types of service fittings.
 - .4 Indicate locations of blocking and reinforcements required for installing laboratory casework.
 - .5 Include details of utility spaces showing supports for conduits and piping.
 - .6 Include details of exposed conduits, if required, for service fittings.
 - .7 Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
 - .8 Include coordinated dimensions for laboratory equipment specified in other Sections.
 - .3 Coordinate shop drawings with requirements of:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
- .4 Samples:
 - .1 Provide samples for each type of cabinet finish and each type of countertop and sink material, in manufacturer's standard sample sizes.

- .5 Product test reports for countertop surface material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating physical properties of laboratory countertop surface materials including chemical and physical resistance.

1.4 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Provide mock-up of one complete unit comprising of a cross section of wall storage and base units in location as directed by the Departmental Representative.
 - .2 Mock-up to include items as specified in:
 - .1 Laboratory fume hoods under Section 11 53 13.
 - .2 Laboratory service fittings under Section 11 53 43.
 - .3 Laboratory service carriers under Section 12 35 10.
 - .3 Mock-up shall demonstrate construction and finishes.
 - .4 Reviewed mock-up may remain as part of the final installation, subject to approval by the Departmental Representative.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit closeout submittals in accordance with Section 01 77 00 and 01 78 00.
- .2 Operation and maintenance data:
 - .1 Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- .3 Submit as-built drawings recording actual site conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Package or crate, and brace products to prevent damage or distortion of equipment in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings or equivalent protection. Utilize temporary skids under large or heavy units.
- .2 Deliver equipment to location at building site designated by Contractor.
- .3 Do not deliver products to site until conditions are such that no damage will occur to them while in storage.

- .4 The casework manufacturer and the Contractor shall be jointly responsible to make certain that casework is not delivered until the building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in moisture content.
- .5 Do not deliver casework until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas.

1.7 EXTENDED WARRANTY

- .1 Warrant work of this section for a period of 5 years.
 - .1 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to Owner.
 - .2 Defects include, but are not limited to:
 - .1 Ruptured, cracked, or stained coating.
 - .2 Discoloration or lack of finish integrity.
 - .3 Cracking or peeling of finish.
 - .4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - .5 Weld or structural failure.
 - .6 Warping or unloaded deflection of components.
 - .7 Failure of hardware.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL REQUIREMENTS

- .1 Green Globe Requirements:
 - .1 Comply with the requirements of Section 01 33 29 as applicable.

2.2 PERFORMANCE REQUIREMENTS

- .1 Steel casework construction performance:
 - .1 Base cabinets shall be constructed to support at least a uniformly distributed load 91 kg per square foot of cabinet top area, including working surface without objectionable distortion of interference with door and drawer operation.

- .2 Base cabinet leveling bolts shall support 227 kg per corner, at 38 mm projection of the leveling bolt below the cabinet bottom.
 - .3 Each adjustable and fixed shelf 120mm or shorter in length shall support an evenly distributed load of 18Kg per square foot up to a maximum of 91 kg, with nominal temporary deflection, but without permanent set.
 - .4 Full extension soft-close, self-closing ball bearing zinc plated drawer slide shall be rated for 45 kg loads.
 - .5 Swinging doors on floor-mounted inset style casework shall support 91 kg suspended at a point 305 mm from hinged side, with door swung through an arc of 160 degrees. Weight load test shall allow only a temporary deflection, without permanent distortion or twist. Door shall operate freely after test and assume a flat plane in a closed position.
- .2 Steel paint system finish and performance specification:
- .1 Steel paint system finish:
 - .1 After cold rolled steel component parts have been completely welded together and before finishing, they shall be given a pre-treatment before paint to provide excellent adhesion of the paint to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing in an automated conveyORIZED 5 stage pre-treatment system. Where the system will clean the parts and apply a complex Zirconium (Zr) metallic coating to provide a uniform surface that shall provide both an excellent bond for the powder finish and enhance the protection provided by the finish against humidity and corrosive chemicals.
 - .2 After the Zirconium pre-treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.
 - .3 The completed finish system in standard colors shall meet the performance test requirements specified under PERFORMANCE TEST RESULTS.
 - .2 Performance test results (Chemical spot tests):
 - .1 Testing procedure:

.1 Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 32 mm diameter watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2 ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of $25^{\circ}\text{C} \pm 1.7^{\circ}\text{C}$. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

.2 Test evaluation:

.1 Evaluation shall be based on the following rating system.

.1 Level 0: No detectable change.

.2 Level 1: Slight change in color or gloss.

.3 Level 2: Slight surface etching or severe staining.

.4 Level 3: Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

.2 After testing, panel shall show no more than three (3) Level 3 conditions.

.3 Test reagents:

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	Cotton ball & bottle
2.	Acetate, Ethyl	Cotton ball & bottle
3.	Acetic Acid, 98%	Watch glass
4.	Acetone	Cotton ball & bottle
5.	Acid Dichromate, 5%	Watch glass
6.	Alcohol, Butyl	Cotton ball & bottle
7.	Alcohol, Ethyl	Cotton ball & bottle
8.	Alcohol, Methyl	Cotton ball & bottle
9.	Ammonium Hydroxide, 28%	Watch glass
10.	Benzene	Cotton ball & bottle
11.	Carbon Tetrachloride	Cotton ball & bottle
12.	Chloroform	Cotton ball & bottle
13.	Chromic Acid, 60%	Watch glass
14.	Cresol	Cotton ball & bottle
15.	Dichlor Acetic Acid	Cotton ball & bottle
16.	Dimethylformamide	Cotton ball & bottle

17.	Dioxane	Cotton ball & bottle
18.	Ethyl Ether	Cotton ball & bottle
19.	Formaldehyde, 37%	Cotton ball & bottle
20.	Formic Acid, 90%	Watch glass
21.	Furfural	Cotton ball & bottle
22.	Gasoline	Cotton ball & bottle
23.	Hydrochloric Acid, 37%	Watch glass
24.	Hydrofluoric Acid, 48%	Watch glass
25.	Hydrogen Peroxide, 3%	Watch glass
26.	Iodine, Tincture of	Watch glass
27.	Methyl Ethyl Ketone	Cotton ball & bottle
28.	Methylene Chloride	Cotton ball & bottle
29.	Mono Chlorobenzene	Cotton ball & bottle
30.	Naphthalene	Cotton ball & bottle
31.	Nitric Acid, 20%	Watch glass
32.	Nitric Acid, 30%	Watch glass
33.	Nitric Acid, 70%	Watch glass
34.	Phenol, 90%	Cotton ball & bottle
35.	Phosphoric Acid, 85%	Watch glass
36.	Silver Nitrate, Saturated	Watch glass
37.	Sodium Hydroxide, 10%	Watch glass
38.	Sodium Hydroxide, 20%	Watch glass
39.	Sodium Hydroxide, 40%	Watch glass
40.	Sodium Hydroxide, Flake	Watch glass
41.	Sodium Sulfide, Saturated	Watch glass
42.	Sulfuric Acid, 33%	Watch glass
43.	Sulfuric Acid, 77%	Watch glass
44.	Sulfuric Acid, 96%	Watch glass
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46.	Toluene	Cotton ball & bottle
47.	Trichloroethylene	Cotton ball & bottle
48.	Xylene	Cotton ball & bottle
49.	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

.3 Performance test results (Heat resistance):

.1 Hot water (88°C - 96°C) shall be allowed to trickle (with a steady stream at a rate not less than 0.18 L per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

.4 Performance test results (Impact resistance):

.1 A one-pound ball (approximately 50 mm diameter) shall be dropped from a distance of 305mm onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close visual examination.

.5 Performance test results (Bending test):

- .1 A 1.2 mm steel strip, finished as specified, when bent 180° over a 50 mm diameter mandrel, shall show no peeling or flaking off of the finish.
- .6 Performance test results (Adhesion):
 - .1 Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1.5mm apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. Note: This test is based on ASTM D2197.
- .7 Performance test results (Hardness):
 - .1 The test sample shall have a hardness of 4 H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8 H is the hardest, and next in order of diminishing hardness are 7 H, 6 H, 5 H, 4 H, 3 H, 2 H, F, HB, B (soft), 2 B, 3 B, 4 B, 5 B (which is the softest).
 - .2 The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel like manner until one is found that will cut or scratch the film. The pencil used before that one, that is, the hardest pencil that will not rupture the film, is then used to express or designate the hardness.

2.3 REGULATORY REQUIREMENTS

- .1 Flammable liquid storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- .2 Electrical components, devices, and accessories: CSA approved.
- .3 Accessibility requirements: Where accessible workstations are indicated, comply with applicable provisions of ICC A117.1 and AODA.

2.4 MATERIALS

- .1 Source Restriction: Provide laboratory casework, worktops (countertops), accessories and service fittings from casework manufacturer, unless otherwise indicated.
- .2 Sheet metal, general: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

- .3 Steel sheet: Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed.
 - .1 Minimum gauges:
 - .1 Drawer bodies, shelves and sloping tops: 0.8 mm.
 - .2 Door fronts, ends, backs, and access panels, exterior/interior drawer fronts, interior door panels, scribing strips, filler panels, enclosures, security panels: 1.0 mm.
 - .3 Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails, stretchers, case tops, bottoms, bases: 1.2 mm.
 - .4 Vertical posts, uprights, Drawer suspensions, drawer brackets, door and case hinge reinforcements and front corner reinforcements: 1.6 mm.
 - .5 Table leg corner brackets and gussets for leveling screws: 3.0 mm.
- .4 Glass: Provide manufacturer's standard glass, complying with the following requirements.
 - .1 Surface Compression: In range of 85 to 100 MPa.
 - .2 Mechanical (Bending) strength: 120 MPa.
 - .1 Tempered safety glass shall be permanently marked with certification label of certification agency acceptable to authorities having jurisdiction.
 - .3 Glass Types:
 - .1 Tempered: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3 or comparable standard; not less than 5 mm thick.
 - .2 Laminated: Clear laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3 or comparable standard; with two plies not less than 5 mm thick and with clear, polyvinyl butyral interlayer.
 - .3 Grind smooth and polish exposed glass edges and corners.
- .5 Hardware and trim:
 - .1 Drawer and door pulls: per Section 12 35 53 - Laboratory Casework.
 - .2 Hinges:
 - .1 Overlay concealed 170° swing

- .2 Fully concealed hinges with a matte nickel finish. Hinge shall have three dimensional adjustment and provide up to 170° opening. It shall incorporate an integrated catch to keep the door closed without the use of additional catch hardware. Doors under 920 mm in height shall be hung on one pair of hinges, and doors over 920 mm in height shall be hung on three hinges.
- .3 Drawer slide:
 - .1 Heavy duty, full extension, soft-close, self-closing, zinc plated, ball bearing slides, rated for 45 kg loads
- .4 Locks: per Section 12 35 53 - Laboratory Casework.
- .5 Shelf adjustment clips:
 - .1 Die formed, nickel-plated steel.
- .6 Base moulding: provided by others.
- .7 Support struts:
 - .1 Consist of two 2 mm channel uprights fastened top and bottom by two adjustable 3 mm "U" shaped spreaders, each, 38 mm x length required, formed from galvanized steel. Struts shall be furnished to support drain troughs, and to support worktop at plumbing space under fume hood superstructures or other heavy loads. Support struts can be furnished with hangers at extra cost when specified, to support mechanical service piping and drain lines.

2.5 CABINET CONSTRUCTION

- .1 Steel cabinet construction:
 - .1 Steel furniture shall be of modern design and constructed in accordance with the best practices of the Scientific Laboratory Equipment Industry. Laboratory Grade casework shall be insured by the use of sound engineering design, proper machinery, tools, dies, fixtures and skilled workmanship to meet the intended quality and quantity for the project.
 - .2 Cabinet bodies shall be flush front construction with intersection of vertical and horizontal case members, such as end panels, top rails, bottoms and vertical posts in same plane without overlap. Exterior corners shall be spot welded with heavy back up reinforcements.
 - .3 Each cabinet shall be complete so that units can be relocated at any subsequent time without requiring field application of finished ends or other such parts.

- .4 Case openings of overlay style cabinets shall be rabbeted on all four sides for both hinged and sliding doors to provide a dust resistant case.
 - .5 All cabinets shall have a cleanable smooth interior. Bottoms shall be formed down on sides and back to create easily cleanable corners with no burrs or sharp edges.
 - .6 Cabinets shall be designed using a standardized grid pattern to allow reconfiguration of doors and drawers.
- .2 Base cabinets:
- .1 End uprights shall be formed into not less than an L formation at top, bottom, back and a 19 mm wide front C formation. A pilaster shall be added to the inside front of the upright for cabinet and hinge reinforcement and shall be perforated for the support of drawer channels, intermediate rails, hinge screws, and shelf adjustment holes.
 - .2 A 22 mm high top horizontal rail shall interlock with the flange at top of end panels for strength, but shall be flush at face of unit. Top rails not flush with face of end uprights are not acceptable.
 - .3 Intermediate rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. Intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.
 - .4 Intermediate vertical uprights shall be furnished to enclose cupboards when used in a unit in combination with a half width bank of drawers.
 - .5 Cabinet bottom shall be formed of one piece of steel, except in corner units, and shall be formed down on sides and back to create a square edge transition welded to cabinet end panels. Front edge shall include a C formation to form a 22 mm high bottom front rail and shall be flush with face of end uprights. Cabinet bottom front rails not flush with face of end uprights are not acceptable.
 - .6 Toe space rail shall extend up and forward to engage bottom panel to form a smooth surfaced fully enclosed toe space, 76 mm deep x 102 mm high.
 - .7 Back construction shall be fully welded for maximum strength and welded to top and bottom and end uprights.
 - .8 Each bottom corner of base cabinets shall have a 9.5 mm leveling bolt, 65 mm long capable of supporting 227 kg. Access to the leveling bolts shall be through plug buttons in the cabinet bottom. Access to leveling bolts through toe space or leveling bolts requiring special tools to adjust are not acceptable.

- .9 Adjustable shelves shall be formed down 19mm, returned back 22 mm and up 6 mm into a channel formation front and rear and formed down 19 mm at each end. Shelves over 1050 mm long shall be further reinforced with a channel formation welded to underside of shelf. Shelves shall be adjustable on not more than 25 mm increments.
- .10 Steel door assembly (two piece) for solid panel swinging doors shall consist of an inner and outer door pan. Outer door pan shall be formed at all four sides. The corners on the pull side of the outer door pan shall be welded and ground smooth to prevent exposure of sharp edges of steel at these critical points. Inner door pan shall be flanged at all four sides with hinge reinforcements welded in place. The door assembly shall be 19mm thick and contains sound deadening material. Door assemblies shall be painted prior to assembly, and shall be punched for attaching pulls. Inner pan formation of door shall be indented for in field installation of locks when required.
- .11 Doors shall be readily removable and hinges easily replaceable. Hinges shall be applied to the cabinet and door with screws. Welding of hinges to either cabinet or door will not be acceptable.
- .12 Drawer assemblies:
 - .1 Drawer bodies shall be made in one piece construction including the bottom, two sides, back and front. They shall be fully coved at interior bottom on all four sides for easy cleaning. The top front of the inner drawer body shall be offset to interlock with the channel formation in drawer head providing a 19mm thick drawer head.
- .13 Knee space panels, where shown or specified, shall be 1.0 mm, finished same as casework cabinets, and easily removable for access to mechanical service areas.
- .3 Upper cabinet construction:
 - .1 Upper cabinets shall have a completely finished interior same as exterior and shall be designed so that no mounting hardware is visible when installed.
 - .2 End uprights shall be formed at front, bottom and back to provide maximum strength and rigidity. Front edge of end upright shall be 19 mm wide. A pilaster shall be added to the inside front of the upright for cabinet and hinge reinforcement and shall be perforated for hinge screws, and shelf adjustment holes.
 - .3 Cabinet tops shall be formed with a 22 mm high C formation at the front edge and turned down at the back to engage a wall hanging rail.
 - .4 Cabinet flush bottoms shall be formed with a 22 mm high C formation at the front edge.

- .5 Cabinet false bottoms shall be formed down on all four edges and shall be removable.
- .6 Cabinet backs shall be welded to the top, bottom and ends. Backs shall be perforated for shelf adjustment holes. Holes shall be enclosed by end uprights.
- .7 Adjustable shelves shall be formed down 19 mm, returned back 22 mm, and up 6 mm into a channel formation front and rear, formed down 19 mm at each end. Shelves over 1000 mm long shall be further reinforced with a channel formation welded to underside of shelf. Shelves shall be adjustable on not more than 25 mm increments.
- .8 Glazed doors shall be 19 mm thick and consist of an inner and outer door pan welded together to form a single unit. Outer door pan shall be 1.2 mm steel, formed into a channel or flanged shape at all four sides. It shall be pierced and formed to create a 75 mm wide frame with a beveled edge around the glass opening in the center of the door. Inner door pan shall be 1.2 mm steel, flanged at all four sides, and pierced for a glass opening in center of the door. Glass shall be held in place by a rubber or vinyl gasket around the entire edge of the glass. Doors shall be glazed with: (Choose one)
 - .1 6 mm clear float glass (framed).
 - .2 6 mm safety glass, laminated (framed).
 - .3 6 mm safety glass, tempered (unframed).
- .9 Solid panel doors shall consist of an inner and outer door pan. Outer door pan shall be formed into a channel or flanged shape at all four sides. The corners on the pull side of the outer door pan shall be welded and ground smooth to prevent exposure of sharp edges of steel at these critical points. Inner door pan shall be flanged at all four sides with hinge reinforcements welded in place. The door assembly shall be 19 mm thick and contains sound deadening material.
- .10 Sliding doors shall be suspended from the top in a roll formed steel track fastened to the cabinet top and shall glide on nylon rollers. Track shall be so designed to prevent accidental removal of doors.
- .11 Swinging doors under 900 mm high shall be hung on one pair of hinges, doors over 900 mm high shall be hung on three hinges.

- .12 Plate glass doors shall operate on an extruded aluminum track at the bottom of the cabinet, and in an extruded aluminum channel at the top. The bottom of each glass door shall be furnished with a continuous aluminum shoe the full length of the door, which shall be equipped with two nylon rollers that operate on the extruded aluminum track. The aluminum shoes on the bottom of the plate glass doors shall be equipped with pulls for operation of the doors, and also to prevent bypassing of the doors. Plate glass doors shall close against rubber bumpers. Plate glass doors shall be: (Choose one)
- .1 6 mm clear float glass (framed).
 - .2 6 mm safety glass - laminated (framed).
 - .3 6 mm safety glass - tempered (unframed).
- .4 Apron and leg assembly construction:
- .1 In general, freestanding tables and/or apron and leg assemblies consist of welded leg assemblies connected to aprons by mechanical fasteners.
 - .2 Table apron rails shall be formed of 1.6 mm steel. The rails shall be 200 mm high, formed top and bottom into a channel formation. Where drawers occur, the apron rails shall provide the required opening.
 - .3 Table legs shall be 50 mm square welded tubing. Securely welded to bottom end shall be a 2.0 mm die formed gusset with four flanges. A threaded clinch nut shall accommodate a 9.5 mm x 65 mm long leveling bolt. Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling bolts. Use of leg shoe which does not conceal leveling device will not be acceptable.
 - .4 Stretchers shall be constructed of 1.2 mm steel and furnished where indicated on drawings. They shall be formed into a 55 mm x 38 mm channel formation, and secured to table legs by a die formed clip of 1.6 mm steel. Clips shall be welded at ends of channel.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

- .1 Install in accordance with manufacturer's written instructions and as specified herein.
- .2 Install level, plumb, and true; using adjusting hardware as required to not exceed the following tolerance requirements:
 - .1 Variation of tops of workbenches from level: 1.5 mm in 3 m.
 - .2 Variation of suspended (Overhead) cabinets: 3 mm in 3 m.
 - .3 Variation in alignment of adjacent door and drawer edges: 1.5 mm.
- .3 Under-bench units, non-push-in: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions, with fasteners spaced not more than 400 mm o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - .1 Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 600 mm o.c. and at sides of cabinets with not less than two fasteners per side.
- .4 Suspended cabinets: Fasten to cabinet framing (scaffolding) or substrate as required to conform to seismic performance requirements.
- .5 Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- .6 Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF LABORATORY ACCESSORIES

- .1 Install accessories according to approved Shop Drawings and manufacturer's written instructions.
- .2 Where accessories are partition-braced, securely fasten to partition framing, wood blocking, or reinforcements in partitions.
- .3 At service modules, coordinate accessory cut-outs and attachment to service duct panels.

3.4 INSTALLATION OF SERVICE FITTINGS

- .1 Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

- .2 Install fittings according to approve Shop Drawings and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.

3.5 CLEANING AND PROTECTING

- .1 Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Departmental Representative.

3.6 CLOSEOUT ACTIVITIES

- .1 Demonstration:
 - .1 Demonstrate in presence of Departmental Representative's representatives operation of equipment following installation. Give minimum 48 hours advance notice in writing of demonstration date.
 - .2 Demonstrations shall be made:
 - .1 When installation is completed.
 - .2 When work is turned over to Departmental Representative.
 - .3 Responsible representatives of manufacturers and installers of equipment being tested shall be present at demonstrations.
 - .4 Provide on-site instructions to Departmental Representative's designated representatives in operation and maintenance of installed equipment.

END OF SECTION