

[Section 11010](#)

Tie Back and Life Line Roof Anchors

[Section 11600](#)

Laboratory Safety Equipment

[Section 11610](#)

Fume Hoods

1.0 GENERAL

1.1 Related UBC Guidelines

- .1 UBC Technical Guidelines

1.2 Co-ordination Requirements

- .1 Coordinate requirements with all trades and Owner's Maintenance Personnel through the UBC Properties Trust Development Manager or the UBC Project Manager.

1.3 Description

- .1 The design, supply and installation of tie-back and life line anchors as roof fall protection for maintenance personnel (particularly when parapets are less in height than required for guards), and for window washing equipment and personnel.
- .2 Meet all requirements of the Province of British Columbia Industrial Health and Safety Regulations pursuant to WorkSafe BC.
- .3 Be responsible for determining the location and types of anchorages required to provide a complete system.

1.4 Performance Standards

- .1 Province of British Columbia Industrial Health and Safety Regulations pursuant to WorkSafe BC.
- .2 CAN/CSA-Z91-M90 Safety Code for Window Cleaning Operations.
- .3 Engineer to design a complete fall protection system to prevent a worker from falling according to WorkSafe BC requirements.

1.5 Quality Control and Assurance

- .1 Submittals
 - .1 Shop Drawings
 - .1 The Design Engineer's seal, signature and a statement assuring code compliance must appear on each shop drawing.
 - .2 At completion, submit as-built drawings and 2 copies of a reduced plastic laminated as-built shop drawing showing anchor locations and details, to be supplied to the UBC Development Manager for posting near roof entrances.
- .2 Quality Assurance
 - .1 Work to be carried out by a company specializing in the type of safety equipment required.
 - .2 All components to be designed and certified by a professional engineer registered in the Province of British Columbia.
 - .3 Roofing penetrations to conform to roofing membrane.

- .4 Manufacturers and roofing inspector's recommendations.
- .3 Quality Control
 - .1 Design Engineer to carry out site reviews and submit a Letters of Assurance certifying that the anchors meet the performance requirements of CSA Z91M.

2.0 MATERIAL and DESIGN REQUIREMENTS

2.1 Prescriptive Requirements

- .1 All miscellaneous metal work shall have the minimum standards described in Section 05500.
- .2 All roofing work and roof repair work shall be in accordance with Section 07500 - Membrane Roofing.
- .3 Components
 - .1 Cast-in-place material: stainless steel type 304.
 - .2 Exposed anchor surfaces and exposed structural components: stainless steel type 304.
 - .3 Rotating heads are not allowed on campus, as they make safety inspections more difficult.
 - .4 Anchors must be certified that they meet the performance requirements of CSA Z91M.

2.2. UBC Guidelines for Rooftop "Fall Protection System" Design

- .1 **Overview**
 - .1 UBC requires that all new buildings, major renovations, and roof replacement projects incorporate the design of a permanent, engineered, fall protection system. The system shall incorporate the use of rust resistant (e.g. galvanized metal), railing anchors, horizontal life lines, signage, etc.
 - .2 The lead design consultant is responsible for the functional requirements of the system design. The "Fall Protection System" design is more than a rooftop anchor installation design.
- .2 **Buildings or Rooftop Surfaces less than 10 feet above Grade**
 - .1 Fall protection design is not typically required unless the hazard of falling is greater than the hazard of impacting a flat surface. Consideration must be given to what periodic maintenance is required to be performed while on these surfaces to ensure that safe access is achievable using ladders, et.al.
- .3 **Buildings or Surfaces greater than 10 feet but less than 25 feet above Grade**
 - .1 A fall protection system design is required for use by employees for the purpose of fall restraint and fall arrest. Design for window cleaning is only required on buildings where access is not practical from the ground via extension poles or a mobile lift.

.4 Buildings or Surfaces greater than 25 feet above Grade

- .1 A fall protection system design is required for use by employees for the purpose of fall restraint, fall arrest, and window cleaning via a bosun's chair. Attachment mechanisms for swing stage or other roof supported maintenance equipment should only be designed if specifically required for the project; like a high-rise building. A wall stabilization anchoring system is to be provided to prevent the working platform from dangerously swaying in the wind while suspended, where required by code or deemed necessary due to the combination of building height and wind speeds.

.5 Fall Protection System Designs Shall Include:

- .1 Adherence to WorkSafe BC guidelines and regulations required.
- .2 Adherence to applicable latest building codes required.
- .3 Signed and sealed by a Professional Engineer
- .4 Window cleaning anchor design must allow for separate anchors for the person (safety line) and the bosun's chair (suspension line).
- .5 Drawing(s) indicating the anchoring locations and instructions for use regarding angles and tie off locations. Indicate ground areas requiring pedestrian protection while the bosun's chair is being used for maintenance; over doorways, etc. The drawing shall be printed on a durable medium and mounted at each rooftop access location.
- .6 The drawings shall include instructions on any protection requirements for the building parapet walls and / or flashings to ensure that the ropes do not damage the building components and so that the building components do not damage the ropes.
- .7 Imposed loads on the parapet walls shall be identified on the drawings and the information provided to the project lead designer, normally the Architect, to ensure that parapets are designed accordingly.
- .8 The designer must ensure that rooftop mounted equipment, ducting, skylights, piping, vent stacks, etc. are accounted for and do not impact the operation of the system. Modify the design as required to ensure that the system is fully functional once the building is occupied.
- .9 Areas of the roof that are accessible to the general public shall use guardrails to ensure protection against falls because they will not have the training and equipment required for using the anchoring system.
- .10 An annual inspection checklist indicating each anchor shall be developed. Every anchor on the roof shall be uniquely identified, and the checklist will correspond to these identifiers. The checklist shall be prepared on 8.5" x 11" sheets. A copy of the checklist will be left in a mounted pouch at the entrance of the rooftop for review by personnel accessing the roof.
- .11 Anchor design and load rating drawings shall be provided for each type of anchor in the system.
- .12 Anchor fastening details must be provided for each type of fastening. The fastener load ratings must be indicated.

- .13 Avoid adhesive anchors due to load testing inspection requirements.
 - .14 Anchor manufacturer's shop drawings, installation instructions, and inspection / testing requirements.
 - .15 Anchor inspection detailed descriptions to be comprehensive enough to allow anchors and fastening mechanisms to be inspected by third party personnel.
 - .16 A copy of all components of the anchor system design shall be bound in a three ring binder complete with a stamped and sealed cover letter from the Professional Engineer describing the system. The binder shall include all drawings, shop drawings, anchor detail drawings, fastener detail drawings and specifications, inspection checklists, instructions for inspections, testing requirements and frequency, letter of initial system certification stamped and sealed by a Professional Engineer. The contents of this manual will be scanned into UBC's records system for permanent record and future reference.
- .6 **Commissioning**
- .1 Roof anchor designer/manufacturer to provide a comprehensive seminar to UBC's maintenance staff and Contractor personnel, on the purpose and nature of the tie-back and lifeline anchoring system.

1.0 **GENERAL**

1.1 **Related UBC Guidelines**

- .1 UBC Technical Guidelines
- .2 UBC Standard Details - Standard Flammable Liquid Storage

1.2 **Coordination Requirements**

- .1 Section 06400 - Architectural Woodwork.
- .2 Section 12300 - Laboratory Casework.

1.3 **Description**

- .1 Flammable Liquid Storage Cabinets.
- .2 Acid Storage Cabinets.

1.4 **Performance Standards**

- .1 Construct flammable liquid storage cabinets in accordance with the requirements of the B.C. Fire Code and the referenced UBC detail drawing. Storage capacity must comply with the B.C. Fire Code. The UBC Fire Department must approve the cabinet size and exact location for each installation.
- .2 Acid storage cabinets: the final design must be approved by the chemical safety officer, Department of Health, Safety & Environment.
- .3 Construction to be similar to the requirements for flammable liquids storage cabinets except as noted below.
- .4 Requirements of Section 06400 - Architectural Woodwork apply to this section.
- .5 Seismic restraints and anchorages shall be engineered to the BC Building Code, Table 4.1.9.1.D.

1.5 **Quality Control and Assurance**

- .1 Submittals
 - .1 Shop drawings.
- .2 Quality Assurance
 - .1 The work to conform to AWMAC Manual of the Architectural Woodwork Association of Canada
<http://www.awmac.com/bcchapters.php>
http://www.aibc.ca/member_resources/doc_index/COCTA/TTT007Woodwork.pdf
 - .2 Professional Engineer registered in BC, engaged by manufacturer, to seal shop drawings and carry out site reviews, confirmed by Letters of Assurance, for seismic restraints including anchorage.
- .3 Quality Control
 - .1 Same as Section 06400.
- .4 Warranties
 - .1 Same as Section 06400.

2.0 **MATERIALS**

2.1 **Prescriptive Requirements**

- .1 Material
 - .1 Products (UBC Mandatory, approved, or not approved for UBC projects - typ.).
- .2 Components
 - .1 Flammable Liquid Storage Cabinet
 - .1 No UBC standards are available.
 - .2 Acid Storage Cabinet
 - .1 Construction similar to the requirements for Flammable Liquids Storage Cabinets except as follows:
 - .1 Interior lined with glass reinforced cement board.
 - .2 One fixed shelf shall be provided.
 - .3 Bottom shall be liquid tight to contain spills.
 - .4 Vents shall be provided in doors.
 - .5 Hinges shall be corrosion resistant and surface mounted.
 - .6 Exterior Caution Label; A 300 mm x 175 mm blue plastic plate with 38 mm white letters stating CAUTION ACIDS CORROSIVE will be provided by Building Operations. This plate is to be screwed to the cabinet by the manufacturer.
- .3 Finishes
 - .1 Factory finish.
 - .2 Refer to UBC Refer Standard Details - Standard Flammable Liquid Storage Cabinet for details.

1.0 **GENERAL**

1.1 **Related UBC Guidelines**

- .1 UBC Technical Guidelines
- .2 Section 12300 - Laboratory Casework
- .3 Section 15880 - Fume Hood Exhaust Systems

1.2 **Co-ordination Requirements**

- .1 Design development protocols will be issued by Fume Hood Safety Committee to the Consultant defining in detail the laboratory function, requirements, and systems to be provided.
- .2 Review design intent and additional requirements with UBC Health Safety and Environment (HS&E). Co-ordinate with HS&E early in the design process.
- .3 The selection of fume hoods and biological safety cabinets is to be made in consultation with the UBC biological safety officer and principal researcher to ensure that the scientific, safety and engineering concerns are properly addressed.
- .4 Operable windows are not to be installed in labs in order to allow negative pressures to be maintained relative to adjacent spaces and to prevent draft conditions.

1.3 **Description**

- .1 Factory-manufactured fume hoods and biological safety cabinets designated for biohazard containment levels:
 - .1 Containment Level 1.
 - .2 Containment Level 2.
 - .3 Containment Level 3.
 - .4 Containment Level 4.

2.0 **MATERIAL AND DESIGN REQUIREMENTS**

2.1 **Design Requirements**

- .1 All fume hoods and exhaust systems shall conform to Part 30 Laboratories, of the Occupational Health and Safety (OHS) Regulation under the inspection jurisdiction of WorkSafeBC, and the latest edition for CSA-Z- 316.5 Fume Hoods, and Associated Exhaust Systems, and show evidence of being performance tested in accordance with ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods.

2.2 **Certification and Commissioning Requirements**

- .1 Fume hood installations must be certified by a professional engineer. To certify the installation of a laboratory fume hood, a professional engineer is required to conduct an assessment of OHS Regulation requirements related to the installation of the fume hood, duct work, exhaust system, lab requirements, make-up and air balance requirements.
- .2 Following installation of the fume hood and before it is used, the installation must be fully tested to confirm all air flow requirements are met, including face velocity, containment, balancing and makeup air. Face velocity requirements are as per current Work Safe BC / OHS requirements.

- .3 It must be demonstrated to the UBC Project Manager, and UBC-HSE that the fume hoods have been designed and installed to meet all requirements of the UBC Technical Guidelines.

2.3 Performance Standards

- .1 Fume hoods shall conform to the following function-specific requirements, including as applicable:
 - .1 Laboratory Bio-Safety Guidelines, (latest revision), published Public Health Agency of Canada.
 - .2 Containment Standards for Veterinary Facilities, Canadian Food Inspection Agency, Publication 1921/E.
 - .3 Canadian Nuclear Safety Commission Standard R-52, Design Guidelines for Basic and Intermediate Level Radioisotope Laboratories.
 - .4 NSF (National Science Facilities) standards: for all biosafety cabinets; fully reticulating HEPA filters typical.
 - .5 CSA: including requirement for flow sensors.
 - .6 WCB: including requirement for outside controls.
 - .7 UBC-HSE (Health Safety & Environment) to determine additional regulatory and construction standards.
 - .8 Biological Safety Cabinets to conform to CSA Z 316.3 Biological Containment Cabinets (Class I and II). Installation and Field Testing shall meet the requirements of NSF 49.
 - .9 Performance.
 - .1 Life Cycle Costing is to be calculated based on a 15 year life.

2.4 General Requirements

- .1 Set the fume hood sash at 15" (375 mm).
- .2 The correct operating height of the sash must be clearly marked on the cabinet frame.
- .3 A fume hood must be connected to a local exhaust ventilation system which will provide air velocities over the operational face area of the hood that meet the current Work Safe BC / OHS Requirements.
- .4 New fume hoods shall have flow sensors as per CSA standards.
- .5 Design of building structure to accommodate the provision of shielded radio isotope hoods (UBC to establish which hoods).
- .6 Whenever a project permits, conform to the most stringent Containment Level requirements to allow flexibility of use.
- .7 Hoods intended for use with Perchloric acid shall be specifically designed for that use and shall be reviewed with UBC HS&E and Building Operations, Technical Services. Material that is

resistant to Perchloric Acid must be used for the fume hood, duct work, fans and stacks. Stainless steel is not an acceptable material for this service.

2.5 Seismic Restraint Requirements

- .1 A professional engineer registered in BC, shall be engaged by manufacturer, and shall seal shop drawings, confirmed by Letters of Assurance, for seismic restraints including anchorage.
- .2 Means for attachment for seismic restraint to be incorporated in the manufacture of fume hoods and bio-safety cabinets. Restraints and anchorage shall be designed to the BC Building Code.

2.6 Components

- .1 Fume hoods to be either stainless steel lined or epoxy lined. All fume hood materials must be non flammable. Radioisotope hoods to be of stainless steel construction.
- .2 Hoods intended for use with radioisotopes to have a reinforced work surface capable of supporting 500 kg.
- .3 Window sash to be equipped with a tempered safety glass.
- .4 Majority of bio-safety cabinets will be Class II Type A2. UBC HS&E to determine if Class II Type B1 or B2 cabinets are required at a meeting between the Consultants and UBC HSE.
- .5 Fume Hoods to be variable volume type.
- .6 Fume Hoods to be equipped with occupancy sensor to allow reduce air flow when equipment is unoccupied.
- .7 *As per BCOHS regulation 30.21; an exhaust duct wash down system shall be part of the design in Perchloric Acid fume hoods.*

2.7 Finishes

- .1 All fittings or trim in fume hoods to be non-corrosive. Chrome-plated or similar types of 'non-corrosive' finishes are not acceptable.

2.8 Fabrication

- .1 The fume hood must be double walled construction permitting mechanical and electrical service fittings to be mounted on the vertical front stiles.
- .2 Heavy duty galvanized steel framework as well as the service fixture valves and boxes must be housed and concealed within the service chase on both sides of the hood.
- .3 Exterior or interior panels must be independently mounted and easily removable, complete with panels required completing service connections. Exterior service panels are preferred where the installation permits.
- .4 The exterior panels and front stiles must be minimum 1.2 mm powder coated epoxy steel. Air foil must be Type 316L 1.5 mm gauge stainless steel, number 4 finish.

2.9 Materials

- .1 Consult with UBC Building Operations for UBC Mandatory, approved, or not approved products and materials.
- .2 Type 316L 16 gauge stainless steel number #4 finish and be of seamless one piece construction with all corners coved and radii.
- .3 All welds ground smooth and polished. A liner must be bolted and cemented to the steel framework forming a rigid and completely sealed chamber.
- .4 The duct stub must be 316L stainless steel.
- .5 Hood baffles are required with top and bottom ventilation slots. These must be fully adjustable and of the same material as the hood liner.
- .6 The vertical sliding sash must be full view type with 6 mm thick tempered safety glass panel and stainless steel pull, and be counter balanced for smooth operation. Sash shall latch when fully open and when released shall automatically close by gravity.
- .7 Fume hoods and biological safety cabinets shall be equipped with a positive lockable latching system. *The locking system must allow for the addition of a tradesman's lock that complies with lockout procedures.*
- .8 For a stainless steel liner, hood work surface must be type 316L 16 gauge stainless steel, seamless welded and integral with liner. The work surface must have 6 mm high marine type edge. The underside of the work surface must have a 20 mm thick plywood sheet bonded to it for rigidity and sound deadening.
- .9 For an epoxy lined hood, the hood work surface must be 20 mm solid black epoxy sealed to the hood liner with a 6 mm high marine type edge sealed to the hood liner.
- .10 A recess mounted electronic air monitor shall be mounted on the front face of the hood, indicating high, normal and low air flows, complete with audio and visual alarms.
- .11 Where provided, the hood accessories must conform to the following specifications:
 - .1 Provide outside controls for all fume hoods as per OHS requirements.
 - .2 Sinks must be integrally welded to the work top or, if epoxy, sealed and recessed into the counter with 38 mm tail pieces.
 - .3 Flush type electrical receptacle consisting of a box 120 volt 15 amp U ground duplex stainless steel face plate must be located on the exterior of the fume hood preferably on the vertical stile.
 - .4 A flush mounted stop/start blower switch must be located in the fume hood front stile. The switch must be suitable for the specified horsepower characteristics of the fan and be labeled as to its function and status.
 - .5 The fume hood must be prewired and CSA approved.
 - .6 The hood must be equipped with a vapor proof lamp and light switch and all wired to a junction box on top of the hood.

2.10 Service Connection to Biological Safety Cabinets

- .1 Natural Gas
 - .1 *Natural gas connections to Biological Safety Cabinets are no longer permitted by the Public Health Agency of Canada (PHAC).*
- .2 Water, Drain and Vacuum Services
 - .1 Water, drain, air and vacuum are normally not recommended. In instances where users request any of these services, the Consultant to discuss and obtain approval from the UBC Senior Advisor, Occupational and Research Safety, or designate.
- .3 Electrical
 - .1 A duplex outlet is required adjacent to each cabinet supplied from two separate circuits.

2.11 Labelling

- .1 Fume Hoods and Biological Safety Cabinets to be labeled in accordance with the requirements of Technical Services, and this labeling must be coordinated with the similar identification number of the related fan located on the roof.
- .2 Commissioning
 - .1 It must be demonstrated to the UBC Development Manager or Project Manager, and UBC-HSE that the fume hoods have been designed and installed to meet all requirements of the UBC Technical Guidelines.