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INTRODUCTION

The UVic Facilities & Infrastructure Technical Standards (FITS) dictates building and infrastructure standards unique to the University of Victoria Gordon Head Campus.

The University of Victoria Facilities and Infrastructure Technical Standards (FITS) are to be implemented by FMGT staff and professionals providing consulting and construction services to the University of Victoria (UVic).

FITS supplements, but does not supersede building, municipal, health and safety codes as set out by governing authorities having jurisdiction.

This document has been reformatted to reflect the Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC) MasterFormat Number and Titles. This document is not intended to act as specifications but inform those who are preparing specifications for UVIC projects.

The FITS document can be reviewed online and downloaded at:

<http://www.uvic.ca/facilities/service/projects/design.php>

00 20 00 INSTRUCTIONS FOR PROCUREMENT

00 21 00 INSTRUCTIONS

Information regarding procurement at the University of Victoria can be obtained through the University's Purchasing Department at: <http://www.uvic.ca/purchasing> or by requesting information at: purchase@uvic.ca.

01 30 00 ADMINISTRATIVE REQUIREMENTS

01 35 23 OWNER SAFETY REQUIREMENTS

Refer to Health, Safety and Environmental Handbooks for University Contractors.

http://www.uvic.ca/facilities/about/health-safety/OHSE_03685_ContractorMgmtHandbookOUTWEB.pdf

01 50 00 TEMPORARY FACILITIES AND CONTROLS

01 51 00 TEMPORARY UTILITIES

1. On a case by case basis, depending on the type of construction, project size and location, the provisions identified below may only be applicable in part and may be scaled down to suit the project.
 - i. For interior renovation projects, the Contractor's office and storage may be located within an existing facility and most utilities will be provided by the University. Confirm with the Facilities Management (FMGT) representative.
 - ii. The Consultant shall review with the FMGT representative the items listed below, confirm which conditions apply, and clearly identify requirements in the contract documents.
 - a. Sanitary facilities.
 - b. Water supply.
 - c. Temporary heating, power, and light.

01 52 13 FIELD OFFICES AND SHEDS

Temporary Facilities

1. The Contractor and Sub-contractors shall provide Construction Facilities and Temporary Accommodation as they require for the performance of the work.
1. On a case by case basis, depending on the type of construction, project size and location, the provisions identified below may only be applicable in part and may be scaled down to suit the project.
 - i. For interior renovation projects, the Contractor's office and storage may be located within an existing facility and most utilities will be provided by the University. Confirm with the Facilities Management (FMGT) representative.
 - i. The Consultant shall review with the FMGT representative the items listed below, confirm which conditions apply, and clearly identify requirements in the contract documents.
 - ii. Contractor's offices.
 - iii. Equipment, tool and materials storage sheds and/or trailers.
 - iv. First aid - refer to:
 - v. http://www.uvic.ca/facilities/about/health-safety/OHSE_03685_ContractorMgmtHandbookOUTWEB.pdf

01 54 00 CONSTRUCTION AIDS

01 54 13 TEMPORARY ELEVATORS

Contractor's Use of Elevators

1. As applicable to both new and existing facilities, the Contractor is responsible to provide adequate protection of all surfaces (use blankets, plywood liner, etc.), and strictly enforce the elevator load limit.
2. The Contractor is responsible for all construction-related damage and necessary remedies to elevators (repairs, replacement, service calls), during the course of construction.

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

1. Project Site
 - i. The Contractor shall be restricted in the use of the premises to inside the project site, which shall be defined by the project's perimeter hoarding. Site or other specific works outside the perimeter hoarding shall be authorized by the UVic FMGT Representative.
 - ii. Only commercial vehicles carrying tools or materials for the work are permitted temporarily on site. Vehicles owned by persons employed on the work shall be parked in the University general parking lots. Parking permits are available for longer term projects. Daily parking permits are also available at coin operated machines at the entrance roads. All persons employed on the work shall obey the *Traffic and University Parking Regulations*, as indicated. Refer to:
http://www.uvic.ca/universitysecretary/assets/docs/policies/BP3205_6800_.pdf
2. Access to Site
 - i. The Contractor shall not close or obstruct streets, sidewalks, lanes or other public rights of way without having first obtained required authorization from the Owner and permits from the authorities having jurisdiction.
 - ii. The Contractor shall maintain adequate means of egress from the project and shall not diminish, by his operations, adequate access/egress from the adjacent existing premises of the Owner.
3. Construction Site Hoardings
 - i. Perimeter hoarding to be minimum 2400mm high.
 - ii. Locate vehicular access lockable gates where least disruptive to street traffic. Locations shall be approved by the FMGT representative.
4. Interior Barriers and Enclosures
 - i. Coordinate location with the FMGT representative.
 - i. Provide enclosures for separating spaces in which dust-generating activities are executed, to protect workers, the public, sensitive equipment, and areas of surfaces where work has been completed.
 - ii. All work adjacent to laboratories, or other clean spaces, shall be isolated during demolition and construction work.
 - iii. The Consultant shall specify areas and required type of protections: dust, humidity, fire, smoke, sound, etc.
5. Partitions Enclosures
 - i. Partitions shall be rigid (framed) slab to slab, with dust proof sealed perimeter and joints.
6. Containment Barrier
 - i. Barriers shall consist of a plastic curtain seamlessly fixed and sealed to perimeter to fully restrict dust and particles infiltration into the clean area.
7. Site Security
 - i. The Contractor shall be responsible for construction site security.
 - i. Neither the Owner nor the Consultant will be responsible for any loss or damage to materials, property or equipment of the Contractor, Sub-contractors, or Sub-subcontractors.

- ii. Co-ordinate with the UVic FMGT Representative who will inform Campus Security Services when authorized overtime work is to take place, and inform them of any theft or damage at the site.

01 56 39 TEMPORARY TREE AND PLANT PROTECTION

1. Existing trees that are to be retained on a construction site shall be protected.
2. During demolition and construction work, the area beneath the drip line shall be enclosed and protected by a fence.
3. The protection fence shall:
 - i. Be of minimum 1.2 metres in height, be erected before construction starts and remain until the project's completion.
 - ii. Be constructed of orange snow fencing securely fastened to metal stakes, or 2 x 4 wood, driven into the ground. Other forms of protection must be discussed with the FMGT representative.
 - iii. Not be lifted or removed at any time for vehicular and equipment access, to prevent soil compaction in the root zone and air depletion. (see figure: 01 50 00-1)
4. When a fenced area is impractical, wrap tree trunks with burlap protected with 19mm x 50mm planks extending from grade to the lowest limbs. Planks shall be placed close together and secured in place with three bands of stapled wire. (see figure: 01 50 00-1)

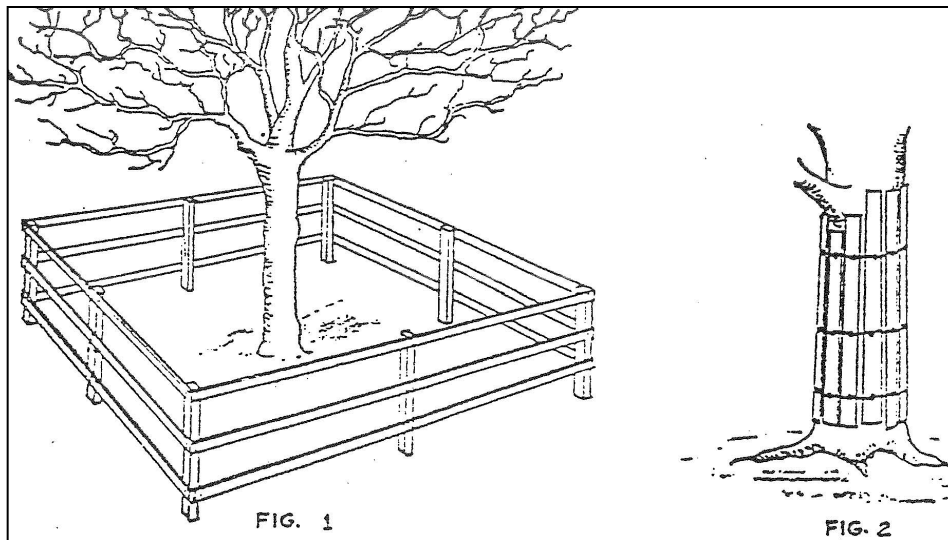


Figure: 01 50 00-1

5. Activities and storage of materials and equipment within this area are prohibited. Prevent poor drainage and excessive heat.
6. Any pruning of the branches or roots must be done by a professional Arborist, in consultation with Facilities Management Grounds (FMGR). Storage of building materials, soil or equipment is not permitted inside the protected area.

01 58 00 PROJECT IDENTIFICATION

01 58 13 TEMPORARY PROJECT SIGNAGE

1. Project Site Signage

- i. The Contractor shall, prior to commencing work on the site, supply and install a project identification sign fabricated from 19mm medium density overlay plywood, trimmed edges, suitably supported and braced.
- ii. The University Representative will provide the final signage layout in digital format for the Consultant and Contractor's use.

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

Regulatory Requirements

1. Only licensed brokerage, storage, transfer and disposal facilities which comply with the requirements of local municipal or Capital Regional District (CRD) bylaws, or those licensed or regulated by other jurisdictions shall be used by the Contractor for the recycling and disposal of waste materials.
2. For a list of compulsory materials to be recycled, and a list of materials strictly prohibited for landfill disposal, refer to the CRD website: <https://www.crd.bc.ca/service/waste-recycling>

Documentation Requirements

1. On projects that do not have a LEED waste management requirement and are valued greater than \$200,000 the Contractor must meet the following tracking and reporting requirements:
 - i. Keep copies of all weigh bills associated with the disposal of construction waste, including approximations of recycled content provided by transfer stations.
 - ii. Compile information from weigh bills in the waste tracking spreadsheet provided below.
 - iii. Submit the completed waste tracking spreadsheet and all project weigh bills at the end of the project.

Name of Project _____
Name of Contractor: _____
Project Officer: _____

Date	Weigh Scale Slip #	Type of Material	Receiving Facility	Total Landfilled (kg)	Total Recycled (kg)	Total Reused (kg)
TOTAL (TONNAGES)						

03 30 00 CAST-IN-PLACE CONCRETE**03 31 00 STRUCTURAL CONCRETE**

Structural Requirements

1. Design concrete structures targeting a design service “Long Life” as defined in the CSA-S478 (R2007) Guideline on Durability in Buildings.
2. Structural designs to conform to Part 4 of the British Columbia Building Code. Do not use Part 9 for structural references of any kind.
3. Increase live load resistances to suit UVic occupancies as required. Discuss specialized uses and occupancies with FMGT.

04 00 00 MASONRY

04 05 01 GENERAL

Performance Standards

1. Design load-bearing masonry structures targeting a design service “Long Life” as defined in the *CSA-S478 (R2007) Guideline on Durability in Buildings*.
1. Typical masonry ties to be stainless steel; 2-piece. Tie type and spacing to be identified in the specifications.
2. Masonry expansion and control joints to be identified on the drawings.
3. All structural steel masonry support to be stainless steel or hot-dipped galvanized.
4. Where galvanized sheet metal or aluminum masonry thru-wall flashings are used, provide fully reinforced, bonded sheet membrane separator between masonry and flashing.
5. Veneer masonry surfaces near grade to receive a clear anti-graffiti coating where specified by FMGT.

05 52 00 Metal Railings

1. Standard of acceptance for Handrails shall be inpro 910V
2. Metal Handrails shall be wrapped solid in color vinyl.

05 70 00 DECORATIVE METAL**05 70 01 FINISHES**

3. Typical finishes for exposed (outdoor) metal fabrications:
 - i. Hot-dip galvanized.
 - ii. Stainless steel.
 - iii. Clear anodized aluminum.

2. Where painted assemblies are required, use durable factory finish (preferred), or a marine grade system:
 - i. Electrostatic painting.
 - i. Factory pre-painted process.
 - ii. Epoxy coat and aliphatic urethane topcoat, marine grade system. For increased durability, consider galvanized steel for painted assemblies.

06 20 00 FINISH CARPENTRY

06 25 13 PREFINISHED HARDWOOD PANELLING

1. All panel products to be manufactured with no urea formaldehyde glues.
1. Medium-density fibreboard (MDF) shall meet ANSI A208.2 ratings for cabinet door and drawer front cores.
2. Particle board will not be accepted.

06 40 00 ARCHITECTURAL WOODWORK

06 40 01 PERFORMANCE REQUIREMENTS

1. Reference Standard: AWMAC Manual of the Architectural Woodwork Association of Canada.
1. Quality standards for materials and installation shall be in accordance with the definitions of terms from the current edition of the AWMAC Manual:
 - i. "Custom" grade: typical standard.
 - i. "Premium" grade: areas with enhanced architectural character, such as executive boardrooms and offices, ceremonial rooms, performing arts facilities, prestigious areas of high public use, etc.
2. The use of products from local manufacturers is preferred.
3. All Panel Products to be manufactured with no urea formaldehyde glues
4. Design of all furnishings shall primarily consider the use of standard size, pre-manufactured, freestanding modular furniture wherever possible.
5. Wall mounting pilasters, coat hooks, panels, modular furniture, etc., shall be fastened either into wall studs or suitable backing materials, for adequate load capacity and seismic restraint. Freestanding units shall be seismically restrained.
6. Consult with FMGT to confirm the following requirements:
 - i. Cabinet and Door Hardware: Provide 2% additional hardware stock of each type and finish.
 - i. Mock-ups: Provide freestanding mock-ups for large or enhanced architectural character projects.
 - ii. Surface Finishes for Specialized Uses: Provide chemical and wear resistance in labs, darkrooms, etc.

06 41 00 ARCHITECTURAL WOOD CASEWORK

Typical Cabinetry

1. Typical cabinet construction on new installations/modifications shall be 19 mm plywood with white post-form interior(s) and Formica 756-58 GP Natural Maple exterior finish. Cabinets will be constructed of 19 mm birch plywood G2S when matching to existing birch cabinetry.
1. Endangered wood species must not be used. Sustainable and certified wood species are preferred. Encouraged materials are as follows: Ash, Birch, Cherry, Cypress, Hemlock, Magnolia, Oak, Pine, Spruce, Sycamore, or Walnut.
2. Solid wood and veneer materials are acceptable; Maple or Birch. Confirm with FMGT quality requirements for specific locations.
3. The use of mechanical fasteners is preferred over adhesives.
4. Maximize recycled content.

5. Drawer construction to be minimum 12 mm (1/2") plywood with white post-form finish on both sides. When matching to existing birch cabinetry, drawers will be constructed of 12 mm (1/2") birch plywood G2S
6. Edge Banding: Typical construction - 3mm PVC Wilsonart W7911 Manitoba Maple (or equivalent) on exterior. 0.5mm white pvc on drawers and shelves. For birch cabinet construction – use 0.5mm wood veneer to match plywood finish.
7. Birch cabinet finish: Clear.

Laboratory Cabinetry

1. Wood to be used only with approval from FMGT. Preference is for pre-fabricated metal casework with factory finishes.
1. Provide a 50 mm clear plastic lip at the front of all shelving used for chemical storage to avoid spillage.
2. Design for vibration control.

Kitchen Cabinetry

2. Upper Kitchen Cabinetry to be 30" (760mm) high with a solid infill detail above the cabinets to the underside of ceiling, solid infill to run the full width of the cabinet. See sketch immediately following this section.
1. Where microwaves are to be installed provide a shelf with an overall depth of 18" as shown in Figure 06 41 00-1.

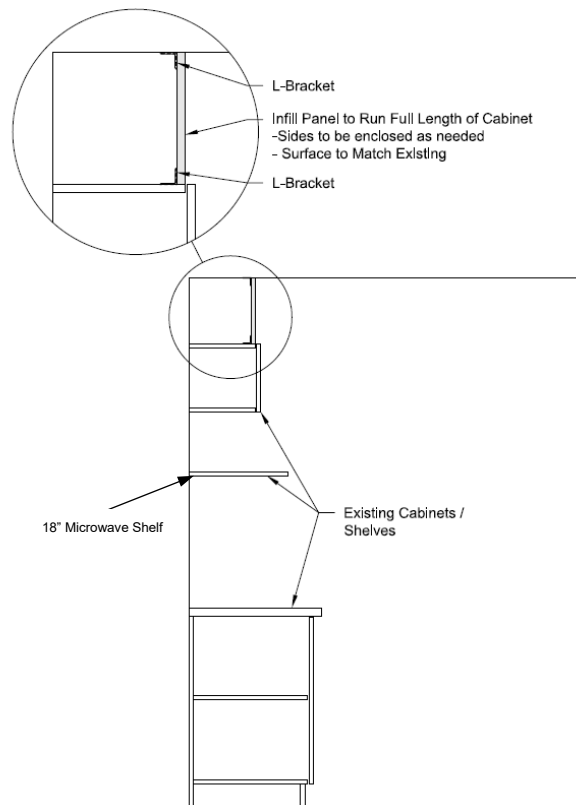


Figure 06 41 00-1

Classroom and Board Room Cabinetry

3. Where a sink is installed in a classroom or boardroom both a dispenser for hand drying waste bin shall be included (see section 10 28 00). See Figure 06 41 00-2 for cabinet to accommodate these items.

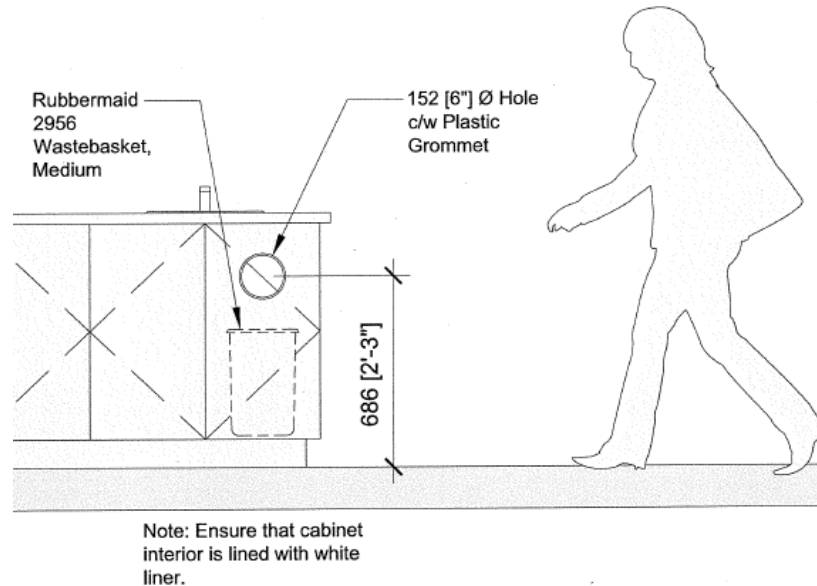
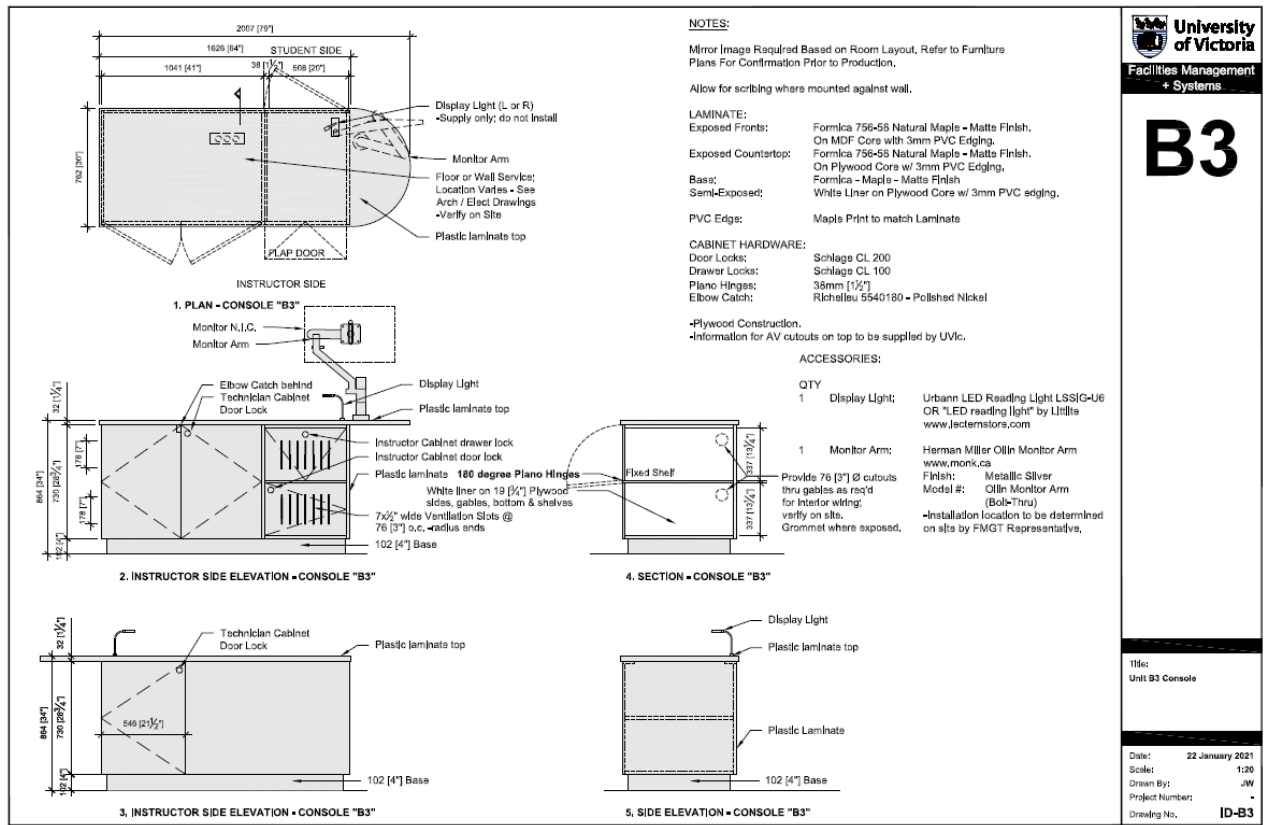


Figure 06 41 00-2

Audio Visual Cabinetry

1. Shop drawings which identify mandatory audio visual cabinetry requirements for all variations of classroom layouts have been developed. These are maintained by FMGT Drafting Services and can be obtained through the FMGT project representative. The details in these shop drawings must be integrated into project documentation. Figure 06 41 00-3 is provided as an illustrative example of one possible consol.



1. Figure 06 41 00-3

Typical Countertops / Work Surfaces – Materials

1. High pressure plastic laminates (1 1/8" min. thickness).
 - i. Application: Administration areas, staff lounges and kitchen areas, general purpose surfaces.
 - ii. General purpose or high wear to suit application:
 - a. 1.20mm thick: Flatwork, countertops.
 - b. 1.00mm thick: Vertical surfaces (backsplashes) and post-forming work.
 - c. 0.75mm thick: Backing sheets.
 - iii. Provide finished surface (or backer sheet when concealed) on all surfaces of the core.
 - iv. 1 1/8" minimum thickness.
 - v. MDF shall be the typical core material.
 - vi. Plywood core to be used in the following locations:
 - d. Countertops with plumbing.
 - e. High humidity and moisture locations.
 - f. Food service areas.
 - vii. Edging: Solid surface, laminated rolled edge, or PVC T mold edge (confirm with FMGT).
2. Stainless steel (minimum 14 ga. Grade 304).
 - i. Application: Food preparation areas.
3. Solid cast epoxy resin (ie Corian).
 - i. Application: Washrooms.

Laboratory Countertops / Work Surfaces

1. Design to minimize joints. Where possible, tops to be continuous with no open seams.
2. Surfaces to be integral with backsplash wherever possible.
3. All edges to be rounded.
4. Ensure all surfaces meet the requirements for the specified containment level.
5. Acceptable materials (confirm selection requirements with FMGT).
 - i. Solid epoxy resin.
 - i. Stainless steel (minimum 14 ga. Grade 304).
 - ii. Natural stone.
 - iii. Phenolic resin (HPL)

06 41 02 SHELVING AND STORAGE

Wall-Mounted Shelving

1. Wall-Mounted Shelving: Wall mounted shelving should not be used in projects.

Metal Storage Shelving

1. Standard of acceptance for Shelving is Ezrect Type 1 metal shelving, powder coated uprights and bracing with galvanized shelves. Height and number of shelves required in custodial rooms is project specific and this information can be obtained by collaboration with FMGT Interior Modifications Services and FMGT Custodial Services during design phase.

Coat Hooks

1. Coat hooks are typically installed on the interior wall adjacent to the hinge side of the door, mounted on a 125 mm wide birch ply panel, with the bottom edge at 1550mm above finished floor. Provide hooks spaced as indicated in the table, in the rooms identified below. Adjust spacing to fit 3 hooks on a 650mm panel and 4 hooks on an 800mm panel.
 - i. Each office shall be equipped with 2 hooks, installed as shown in table below.
 - i. Each meeting room and designated lab or seminar room, which is not served by a closet or alcove, shall be equipped with 3 to 5 hooks, installed as shown in the table below.

No. of Hooks	Centered on Panel and Spaced at (mm)	Length of Panel (mm)	Vertical Panel Edge from Corner of Room (mm)
2	450	650	200
5	150	800	100

2. Coat hooks shall be heavy-duty, metal, satin chrome or brushed aluminum finish. Acceptable products:
 - i. Bobrick B6827 (satin stainless steel).
 - ii. Bradley 9134. 1
 - iii. 140mm long 237BCV (brushed chrome)

3. Laboratory Coat Hooks: A minimum of 4 coat hooks shall be provided near all laboratory entrances. The exact number of hooks should be reviewed with project stakeholders. Surface mounting boards are not acceptable to ensure a continuous surface finish
4. Custodial Room Coat Hooks: Provide 6 coat hooks per custodial room attached to solid backing or 2X6 board in unreinforced walls. 5 mounted 8" apart as shown in figure 13 20 00-1 and one on back of door.

Tool/Mop Holders

1. Tool/Mop hangers are typically installed on an interior wall of standard custodial rooms (see section 13 20 00) adjacent to the mop basin, mounted on a 125 mm wide birch ply panel, with the bottom edge at 1550mm above finished floor. 5 total, spacing to be 150mm apart and 2 must be mounted over the floor sink to capture drips from wet mops such that the outside holder must be mounted at least 150mm from outside edge of sink.
2. Tool/Mop Hangers shall include a roller, with a high-friction surface, that automatically adjusts to the tool handle diameter. Made of high-impact plastic and rubber construction, No springs.
 - i. [Geerpres Gripit](#)

Metal Lockers

1. Metal Lockers in custodial rooms (see section 13 20 00) shall be double tier locker – 12" wide x 12" deep x 72" high
 - i. Solid steel construction – powder coated finish
 - ii. Louvers for ventilation top and bottom of each tier.
 - iii. Integrated legs 6" high (adds 6" to overall height)
 - iv. Chrome plated lift latch
 - v. Interior coat hook
 - vi. Seismic bracing to base building required.

Closets and Coat Alcoves

1. Each closet and coat alcove shall have one:
 - i. Hat shelf: 450mm wide, birch ply.
 - i. Adjustable chrome-finish hanging rod.

Note: The above assemblies are typical throughout the campus, and are normally installed by the Contractor or in special instances by FMCA.

06 41 93 CABINET AND DRAWER HARDWARE

Cabinet and Shelving Hardware

1. Use only heavy duty hardware.
2. Cabinet Locks: Schlage "CL" series or Olympus Lock 700/800 Series. In order to maintain consistent keying throughout the campus, alternates are NOT acceptable for cabinet locks. Mount flush to face of cabinetry.
 - i. Review locking and keying requirements with UVic.
 - i. Keyway to be specified by UVic and Key Schedule to be supplied by UVic.
 - ii. Door Locks: CL100PB (25mm throw bolt) c/w trim collar 36-031 and slot strike 10-052 or Olympus Lock 700LC.

-
- iii. Drawer Locks: CL200PB (19mm throw bolt) c/w trim collar 36-031 and slot strike 10-052. Or Olympus Lock 800LC.
 - iv. Finish: 626 – satin chromium plated.
 - v. Cylinder Alignment: Vertical (horizontal alignment not acceptable).
 3. Metal bolt – to be installed at the stationary door of a pair with a lockable active door.
 - i. Richelieu – B 375-180, chromium or nickel finish, complete with recessed mounted slot strike installed with countersunk screws.
 4. Hinges: Heavy-duty, concealed European design, min 105° opening, self-closing operation and secure joint to resist removal of door, c/w mounting plates. Provide hinges for full overlay and twin application, as required.
 5. Drawer Slides: Side mount, ball bearings, full extension, telescoping, trigger disconnect, chrome or zinc finish. Load rating to suit application, minimum 45kg.
 - vi. Accuride: 3832 series – 45 kg rating; 3640 series – 90 kg rating (storage drawers)
 - vii. Grant, HEG-4932 – load rating 60 kg.
 6. Latches: Magnetic touch. Product: Richelieu 9783-145.
 7. Pulls: Wire type D-pull 9mm diameter, 96mm centres, 26mm depth, chrome satin finish. Product: Gallery 945-26D, or Richelieu 2214-175.
 8. Flush Pulls for sliding glass doors: Richelieu D010127 satin chrome.
 9. Glass for cupboard doors: 6mm thick, clear, tempered.
 10. Door and Drawer Bumpers: 5mm diameter, neutral colours; 2 bumpers per door up to 1200mm in door height; 3 bumpers per door over 1200mm in door height; 2 bumpers per drawer.
 11. Adjustable Shelf Supports: (Semi)-recessed (not surface mounted) pilasters c/w seismic support clips. Products: Richelieu, Pilasters 2552G c/w clips 242762G.
 12. Grommets to suit wiring through millwork components: Cable entry plug, plastic, typical, ϕ 72mm, larger ϕ where required. Product: Rich3elieu A 60.0910-90, or larger size, as required.

Hardware Schedule

1. Consultant shall produce the Hardware Schedule, as part of project documentation

07 00 00 THERMAL AND MOISTURE PROTECTION

07 01 02 ROOFING AND WATERPROOFING

Performance Requirements

1. Roofing and waterproofing shall confirm to the requirements of the Roofing Contractors Association of British Columbia (RCABC) Standards, as outlined in the RCABC Roofing Practices Manual.
2. All new and re-roofing assemblies shall pursue the RCABC third party 5 or 10 year guarantee (RGC Guarantee). Confirm desired warranty standard for each specified project with FMGT. Close-out submittals from the Contractor shall include all warranty certificates and documentation addressed to the Owner, registered in the Owner's name, and shall include copies of all inspection and testing reports where applicable.
3. An independent roofing inspection agency shall be retained by UVic to satisfy the requirements of the RGC Guarantee. Testing will also include leak detection testing using electric conductance (detec or similar). UVic will cover all costs for inspection and testing services as required, to satisfy the RGC Guarantee. Re-inspection and testing required as a result of failures or faulty workmanship (re-work) by the Contractor shall be paid for by the Contractor. The Contractor shall be required to coordinate all roofing work in cooperation with the inspection agency to satisfy the inspection requirements of the RGC Guarantee.
4. Low slope roofs shall typically be designed as IRMA or MIRMA assemblies. Conventional roof assemblies (exposed membrane) are not preferred and shall be avoided wherever possible. Where protected (inverted) membrane assemblies are utilized, ballast and overlay materials shall be easily removable to suit maintenance and repairs. Cast-in-place concrete or asphalt overlays are not acceptable.
5. All low slope roofing shall have a minimum of 2% slope to drain.
6. Provide 1 overflow scupper per roof drain where roof parapets exceed 100mm in height. Scuppers are to be a minimum of 3" in diameter.
7. Provide walking paths from service access hatches, ladders or access stairs to all rooftop equipment which requires servicing. Walkways to typically be 2'x2'x2" precast concrete pavers on adjustable pedestals. Cast-in-place concrete or duckboards are not acceptable.
8. Performance standards for roof insulation shall be as per the minimum requirements as described in Section 07 20 00 Thermal Protection. Protection board shall be provided between all insulation and membrane layers.
9. Where conventional roof assemblies are required for special circumstances, vapor retarders shall be fully adhered modified bitumen sheet membranes.
10. Provide termination bars to mechanically secure all membrane up-turns. Provide counter-flashings as required to protect exposed leading edges.
11. Gum-lips, pitch pockets, and other sealant dependent detailing shall be avoided wherever possible. Provide drawing details showing up-stands for all penetrations.

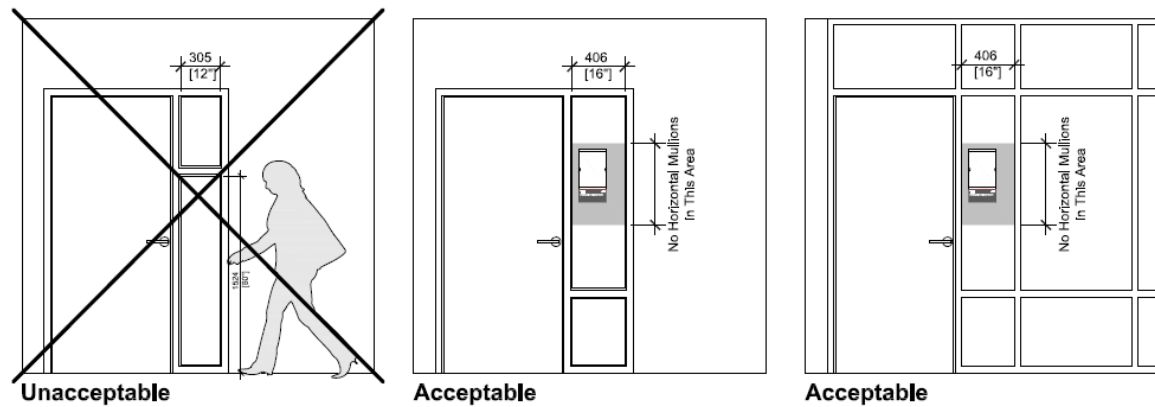
12. In re-roofing projects, all debris shall be disposed of through a contained waste chute. Debris shall never be thrown from a rooftop in any circumstance.

08 10 00 DOORS AND FRAMES

08 10 01 GENERAL

Design Considerations

1. Building entrances shall typically be aluminum, or wood when required to match an existing condition. Use steel exterior doors at locations with low public traffic (utility rooms, service access, etc.). Exterior metal doors and frames shall be thermally broken wherever possible.
2. Wood doors are typical for all interior locations. Use steel doors alternatively in high traffic applications, to satisfy required fire resistance ratings, for security purposes, or to match an existing condition.
3. Typical door sizes:
 - i. Typical thickness: 44mm.
 - i. Minimum stile and top rail width: 125mm aluminum, 150mm wood doors.
 - ii. Bottom rail: min 250mm.
 - iii. Minimum width: 900mm single and 1800mm double doors.
 - iv. Mechanical rooms: minimum width 1200mm, single or double doors. Double doors shall have the active leaf 900mm (or 915mm) wide.
4. Interior doors and windows used with modular wall partitions are desirable in office and meeting room locations to minimize the impacts of churn.
5. The University encourages the use of translucent glass panels in interior doors, to provide natural light in corridors. Frameless glass doors shall be avoided.
6. All fasteners within secured areas shall be tamper resistant torx (or pin-in-torx, or torx TR).
7. Interior door locations shall provide adequate clearance behind the door opened at 90° and the adjacent wall. The clearance between the edge of hinge side frame and adjacent wall:
 - i. 100mm – typical at offices, classrooms, labs, etc.
 - v. 650mm – typical at filing rooms, lunchrooms, office supply storage, etc.
8. Shop drilling and notching shall be specified wherever possible.
9. An uninterrupted length of wall or glazing not less than 406mm [16"] shall be provided on the exterior latch side of the door to accommodate signage. The space shall be provided adjacent to both exteriors and interiors of spaces beside doors in stairwells or any other space where signage is specified beside doors on the interior wall. See Figure 08 10 01.1.



2.

3. Figure 08 10 01.1

10. If washroom doors contain glazing elements, privacy window film shall be provided.

11. Sidelights and Glazing adjacent to doors shall conform to the following requirements:

- i. Width: 406mm [16"] and over
- ii. Mullions: Shall not be located between 1100mm [43"] and 1778mm [70"] above finished floor. If using a horizontal mullion in a sidelite, it is preferable to locate it on the lower half of the sidelite.

12. See Figure 08 10 01.2 for UVic's preferred door types

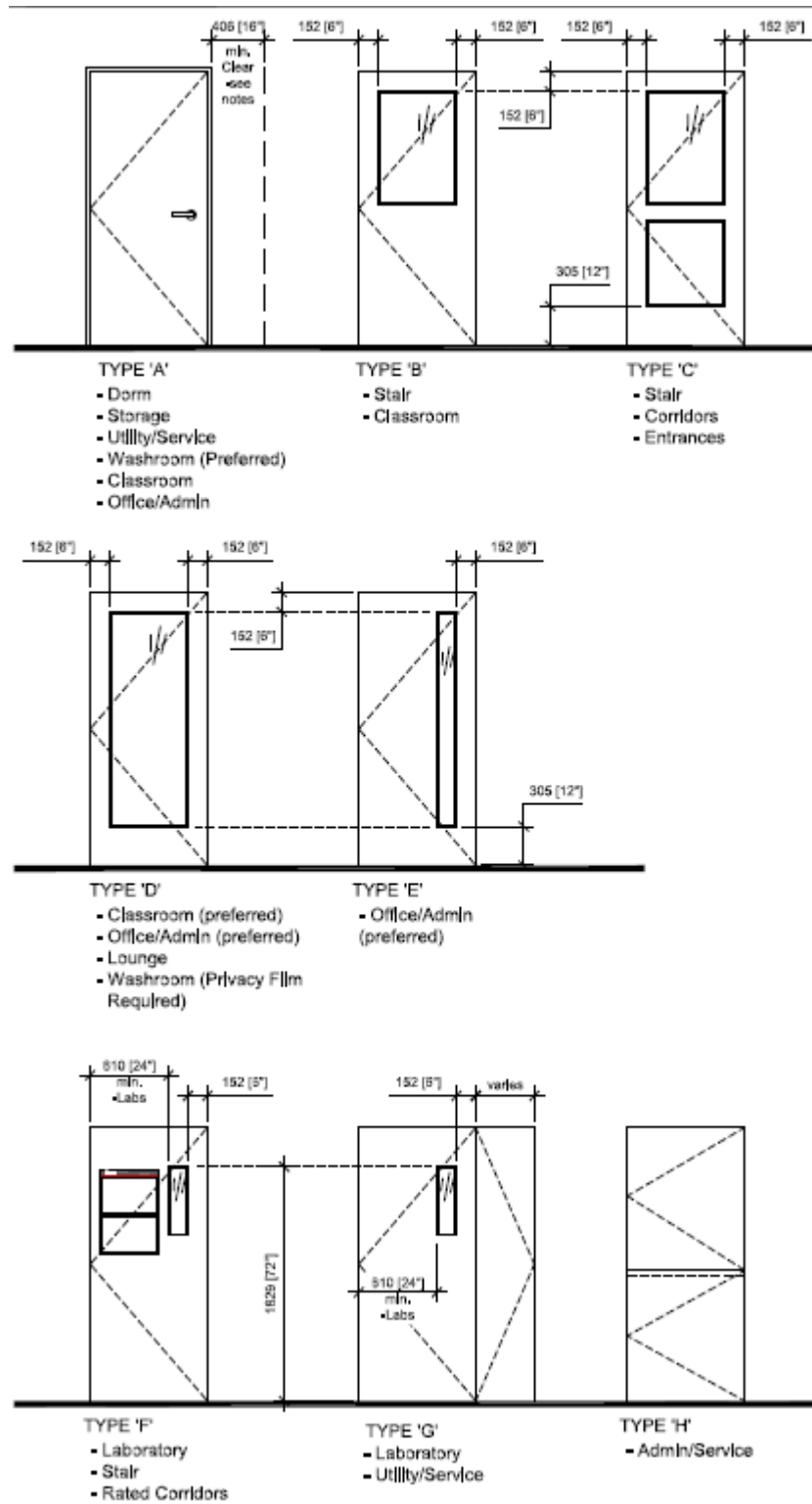


Figure 08 10 01.2

Quality Assurance

1. Exposed exterior doors, particularly glazed assemblies within curtain wall or window wall assemblies shall specify required performance criteria as outlined in Section 08 50 00 Windows.
2. Provide requirements for third party testing and verification of performance criteria as outlined in: Sections 01 40 00 Quality Requirements and 08 50 00 Windows.

08 13 00 METAL DOORS

Steel Doors

1. Use hollow core, welded assemblies (pressed seams not acceptable).
2. Thickness of materials (minimum / mm):
 - i. Face Sheet – interior doors typical 1.2 (18 gauge)
 - i. Face Sheet – exterior doors 1.6 (16 gauge)
 - ii. Top and Bottom Channels 1.2 (18 gauge)

Frames

1. Use steel frames for typical interior doors and windows.
 - i. All frames to be welded pressed steel. Knock-down steel frames are not acceptable.
 - i. Throat size to suit GWB wall construction for wrap around assembly.

08 14 00 WOOD DOORS

Faces (Rated and Non-Rated Assemblies)

2. Type 1: Hardwood Veneer:
 - i. Solid core, rotary cut sound birch or maple.
 - i. Finish: clear factory coating, satin sheen.
 - ii. Application: typical, general offices, classrooms.
3. Type 2: Hardboard, solid core, painted:
 - i. Application: residences, other locations as approved by FMGT.
4. Core: Solid wood or composite core (mineral core is not acceptable).

08 50 00 WINDOWS**08 50 01 GENERAL DESIGN REQUIREMENTS**

Windows, Curtain Wall and Glazing

Finish

1. Aluminum:
 - i. Clear anodized typical for new construction.
 - i. Other finish to match existing where necessary.
 - ii. Provide physical samples to FMGT for approval during design stage.
2. Composite: Light colours only.

Hardware

1. Premium hardware as recommended by manufacturer for compatibility.
2. Latching/locking devices shall be cam handle type (rotor operators, push bars are not acceptable).
3. Finish: to complement frames or match/complement existing in-situ products. Provide samples to FMGT for approval during design stage.

Operable Windows

1. Vents: Awning or casement outswing vents.
2. Screens: Shall not be provided, except some ground floor rooms, reviewed on a case by case basis.
3. Operable windows in laboratories and other specialty spaces are to be installed with specialized hardware to suit opening only during a mechanical system failure or shutdown.

Quality Assurance

1. Mock-up installations Windows, Doors Skylights, Curtain Walls, Storefronts, etc.for third party air and water penetration verification testing.

Sidelights and Glazing Adjacent to Doors

1. See Section 80 10 01.11

08 71 00 DOOR HARDWARE

Suppliers Qualifications: Hardware subcontractors shall:

1. Employ an Architectural Hardware Consultant (A.H.C.) with a minimum of five (5) years documented experience in managing the supply and installation on projects of similar size and complexity
2. Be certified by the hardware manufacturer to ensure compliance with warranty conditions.

Installers Qualifications: Hardware installers shall:

3. Employ qualified trades people, regularly engaged in the installation of electrified security hardware.
4. Have a minimum of five (5) years documented experience in the installation of mechanical and electrified door hardware and have completed at least two (2) projects of similar character and magnitude.
5. Be certified by the hardware manufacturer to ensure compliance with warranty conditions.

Keying: Doors, padlocks and cabinet locks shall be keyed as follows:

1. For projects with under 50 locksets: Cylinders and keys are Not in Contract (installed by FMCA). Provide sufficient notice to FMCA Locksmith for acquisition of materials.
2. For projects with over 50 locksets: Hardware supplier to supply all cylinders and keys as per UVic's Keying Schedule.
 - i. Keying shall be to the University of Victoria grandmaster and master key system, using a Schlage quad/numerical keyway.
 - ii. All cylinders must be construction keyed.
 - iii. Construction Master Keying Systems may be required on new and large projects, as designated by the FMGT Executive Director. Such systems shall be established in consultation with the FMCA Locksmith.
 - iv. Allow for the following:
 - i. 15 copies of Grandmaster key
 - ii. 10 copies of each Master key
 - iii. 10 copies of Construction master key
 - iv. 4 extractor keys
 - v. 8 keys per cylinder
 - vi. 200 key blanks
 - vii. 20 additional cylinders (10 standard cyls, 5 mortise cyls, 5 rim cyls.)
 - viii. All keys and key blanks stamped "DO NOT DUPLICATE".
3. All keys (grandmasters, masters, change keys, extractors, and key blanks) shall be shipped by registered mail or courier directly from the manufacturer to the UVic Carpenters Shop.
4. Construction plugs are removed by FMCA after substantial performance has been granted.
5. UVic FMCA shall provide a keying schedule after final hardware schedule approval.

Products

1. Use one manufacturer's products for related items. To simplify maintenance and minimize parts stock, the following are university standards for all new and existing buildings including residence suites. Alternate products will only be considered where they offer a solution to a scenario not attainable by the accepted products listed below. Alternate products must be clearly identified and brought to the attention of the project team prior to ordering. A sample of each alternate item is to be provided for evaluation by FMCA.

2. When providing hardware for existing buildings, hardware finishes and type may vary to ensure consistency and will be determined by project management.

3. Hinges:

- i. Provide 114mm x 101mm butts for doors up to 950mm and 127mm x 101mm butts for doors over 950mm wide.
- ii. Provide 3 butts per leaf for doors up to 2150 in height and one additional butt for each additional 600mm in door height.
- iii. Exterior out swinging doors shall have non-removable pins and be non-ferrous.
- iv. Refer to frame details and dimensions for conditions requiring wide throw hinges or specially swaged hinges.
- v. All aluminum doors will be required to be hung on butt hinges. Pivots or continuous hinges are not acceptable.
- vi. Acceptable products:

			New build	Match existing
I.	Ives	3CB1HW / 3CB1	630/652	613/640
II.	Stanley	CB199 / CB179	630/652	613/640

4. Locksets-Keyed:

- i. All locksets shall be provided with Schlage RHO lever design.
- ii. Where lever trim is specified on exit devices, trim shall match lever design on locks.
- iii. Refer to door and frame details and dimensions for conditions requiring special length or flat strike lips, and latch requirements for fire rated pairs of doors.
- iv. All locksets are to be "Vandalguard" functions.
- v. Acceptable products:

			New build	Match Existing
I.	Schlage	ND series (Vandalguard)	626	613

5. Locksets-Electronic:

- i. All locksets shall be provided with Schlage RHO lever design.
- ii. Refer to door and frame details and dimensions for conditions requiring special length or flat strike lips, and latch requirements for fire rated pairs of doors.
- iii. Provide a mechanical key override.
- iv. All locksets are to be "Vandalguard" functions.
- v. Acceptable products:

			New build	Match existing
I.	Schlage	ND96PDEU	626	613

6. Locksets-WiFi Electronic:

- i. All locksets shall be provided with Sargent LL lever design.
- ii. Refer to door and frame details and dimensions for conditions requiring special length or flat strike lips, and latch requirements for fire rated pairs of doors.
- iii. Provide a mechanical key override with Schlage cylinder.
- iv. Acceptable products:

			New build	Match existing
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II. Sargent IN120 10G77 626 613

7. Locksets-POE Electronic:

- i. All locksets shall be provided with Sargent LL lever design.
- ii. Refer to door and frame details and dimensions for conditions requiring special length or flat strike lips, and latch requirements for fire rated pairs of doors.
- iii. Provide a mechanical key override with Schlage cylinder.
- iv. Acceptable products: New build Match existing

III. Sargent IN220 10G77 626 613

8. Deadbolts:

- i. Acceptable products: New build Match existing
- I. Schlage B600 series 626 613

9. Exit Devices (for aluminum doors):

- i. Provide cylinder dogging unless electronic latch retraction (QEL) is being provided.
- ii. Where key access is required, provide 386-NL/990NL trim.
- iii. Provide a mechanical key override for electrified devices.
- iv. For pairs of doors, provide concealed vertical rod devices with top and bottom rods.
- v. For single doors provide rim devices.
- vi. Acceptable products: New build Match existing

I. Von Duprin 35A series (narrow stile) 628 313

10. Exit Devices (for hollow metal or wood doors):

- i. Provide cylinder dogging unless fire rated or electronic latch retraction (QEL) is being provided.
- ii. Provide a mechanical key override for electrified devices.
- iii. For pairs of doors, provide surface vertical rod devices with top rod only.
- iv. For single doors provide rim devices.
- v. Acceptable products: New build Match existing

I. Von Duprin 98 series 628 313

11. Closers:

- i. Door Closers shall be used only as required by fire ratings and where required to complete the desired function of a door (Security, Energy Loss, Sound Containment, Push/Pull doors).
- ii. Door closers must be mounted on the inside of a building and wherever possible on the inside of a room for aesthetics except for student residence rooms where closers are to be mounted on the corridor side.
- iii. All handicap washrooms must be equipped with delayed action, and reduced opening force spring door closers.
- iv. Thru-bolt mounting is required for closers on wood doors.

- v. Acceptable products: New build Match existing
- I. LCN 4040XP series 689 695

12. Stops:

- i. Avoid the use of floor stops wherever possible.
- ii. Use overhead stops where wall stops are not suitable.
- iii. Ensure overhead stops and door closers do not conflict and provide special templates and or drop plates where required.

- iv. Acceptable products: New build Match existing
- I. Ives WS401/402 (wall stops) 626 613

II. GJ 90/100 series 652/630 613/640

13. Coordinators:

- i. Avoid the use of coordinators wherever possible. Coordinators are only to be used as required by code.
- ii. Acceptable products:
 - I. Trimco 3092 BLK

14. Flush-Bolts (automatic):

- i. Avoid the use of automatic flush-bolts wherever possible. Automatic flush-bolts are only to be used as required by code.
- ii. Acceptable products:

		New build	Match existing
I.	Ives FB51P	630	613

15. Flush-Bolts (manual):

- i. Acceptable products:

		New build	Match existing
I.	Ives FB457	626	613

16. Astragals:

- i. Loose astragals are preferred to welded astragals.
- ii. Mount astragals to the keyed side of all double doors with one fixed leaf to maintain door alignment and provide security.
- iii. Acceptable products:

		New build	Match existing
I.	Pemko 357_	C	D

17. Perimeter seals (weather/smoke/sound):

- i. Adhesive seals are not acceptable.
- ii. Acceptable products:

		New build	Match existing
I.	Pemko 315_R	C	D
II.	Draftseal DS139_R	C	D

18. Sweeps:

- i. Acceptable products:

		New build	Match existing
I.	Pemko 315_N	C	D
II.	Draftseal DS138_	C	D

19. Threshold:

- i. Acceptable products:

		New build	Match existing
I.	Pemko 270_	A	D
II.	Draftseal DS4000	A	D

20. Meeting Stiles:

- i. Acceptable products:

		New build	Match existing
I.	Pemko 29324_NB	C	D
II.	Draftseal DS113_P	C	D

21. Automatic Operators:

- i. Actuators for automatic operators are to be hard-wired.
- ii. A key-switch is to be provided at exterior doors with operators.
- iii. The switch will enable/disable the outside actuator and release/retract the exit devices.
- iv. Acceptable products:

		New build	Match Existing
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I. Horton 7100 series Al Brz

22. Power Transfers:

- i. Through-wire hinges and door loops are not acceptable.
- ii. Acceptable products:

		New build	Match existing
I.	Von-Duprin EPT series	SP28	SP313
II.	Securitron CEPT series	630	613

23. Power Supplies:

- i. Ensure that the specified power supply conforms with the manufacturers requirements for product warranties.
- ii. Provide battery back-up, fire alarm release and relay boards as required by the hardware function.
- iii. Size power supplies accordingly to allow for a minimum of 25% expansion of the system.
- iv. Acceptable products:
 - I. Von-Duprin PS900 series (as required by the door hardware)

24. Cabinet Locks:

- v. Acceptable products:
 - I. Schlage CL series (1 1/8") 626

Hardware Groups:

1. These groups have been created as examples of typical scenarios and are not intended to be complete for every application. They are to be used as a guideline for product function and quality.
2. Aluminum doors and frames:

Group AO-10 - Main entry outer vestibule doors (pair) – aluminum - automatic swinging (both leaves)

6	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Exit device	VD	QEL-9947 NL
1	ea.	Ext. trim	VD	990NL-R/V
1	ea.	Cylinder	SC	Rim to suit NL trim
1	ea.	Exit device	VD	QEL-9947 EO
1	ea.	Ext. trim	VD	990DT
1	pair	Automatic operators	Horton	7100 series (full length housing)
2	ea.	Actuators		type and location to suit
1	ea.	Key switch		(enable outside actuator and latch retraction)
1	ea.	Cylinder	SC	Mortise to suit key switch
2	ea.	Power Transfers	VD	EPT-2
1	ea.	Power Supply	VD	PS902-2RS
1	ea.	Threshold		By door supplier
1	set	Perimeter seals		By door supplier
2	ea.	Door bottoms	315CN	
1	ea.	Card Reader		By UVic Systems
1	set	Meeting stiles	PK	29324CNB

 Group AO-10a - Main entry outer vestibule doors (pair) – aluminum - automatic swinging (single leaf)

6	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Exit device	VD	QEL-9947 NL
1	ea.	Ext. trim	VD	990NL-R/V
1	ea.	Cylinder	SC	Rim to suit NL trim
1	ea.	Exit device	VD	QEL-9947 EO
1	ea.	Ext. trim	VD	990DT
1	ea.	Closer	LCN	4040XP x 30 x 61 x 18PA
1	ea.	Overhead stope	GJ	100 series
1	ea.	Automatic operators	Horton	7100 series
2	ea.	Actuators		type and location to suit
1	ea.	Key switch		(enable outside actuator and latch retraction)
2	ea.	Power Transfers	VD	EPT-2
1	ea.	Power Supply	VD	PS902-2RS
1	ea.	Threshold		By door supplier
1	set	Perimeter seals		By door supplier
2	ea.	Door bottoms		315CN
1	ea.	Card Reader		By UVic Systems

Group AO-11 - Main entry inner vestibule doors (pair) – aluminum - automatic swinging (both leaves)

6	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630
2	set	Push/Pulls		
1	pair	Automatic operators	Horton	7100 series (full length housing)
1	ea.	Actuators		One shared with outside door
1	set	Perimeter seals		By door supplier

Group AO-11a - Main entry inner vestibule doors (pair) – aluminum - automatic swinging (single leaf)

6	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630
1	ea.	Closer	LCN	4040XP x 30 x 61 x 18PA
1	ea.	Overhead stope	GJ	100 series
2	set	Push/Pulls		
1	ea.	Automatic operator	Horton	7100 series
1	ea.	Actuators		One shared with outside door
1	set	Perimeter seals		By door supplier

Group AL-01 – Exit doors (single) – aluminum

3	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Exit device	VD	CD-99 NL
1	ea.	Ext. trim	VD	990NL-R/V
1	ea.	Cylinder	SC	Rim to suit NL trim
1	ea.	Cylinder	SC	1 ¼" mortise to suit CD dogging
1	ea.	Closer	LCN	4040XP x 30 x 61 x 18PA
1	ea.	Overhead stope	GJ	100 series
1	ea.	Threshold		By door supplier
1	set	Perimeter seals		By door supplier
1	ea.	Door bottom		315CN

Group AL-02 – Entry doors (single) – aluminum

3	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Exit device	VD	QEL 99 NL
1	ea.	Ext. trim	VD	990NL-R/V
1	ea.	Cylinder	SC	Rim to suit NL trim
1	ea.	Closer	LCN	4040XP x 30 x 61 x 18PA
1	ea.	Overhead stop	GJ	100 series
1	ea.	Power Transfer	VD	EPT-2
1	ea.	Threshold		By door supplier
1	set	Perimeter seals		By door supplier
1	ea.	Door bottom	PK	315CN
1	ea.	Card Reader		By UVic Systems

3. Hollow metal / Wood doors:

Group EX-01 – Exit doors (single) – Hollow metal

3	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Exit device	VD	CD-99 NL
1	ea.	Ext. trim	VD	990NL-R/V
1	ea.	Cylinder	SC	Rim to suit NL trim
1	ea.	Cylinder	SC	1 ¼" mortise to suit CD dogging
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
1	ea.	Door bottom	PK	315CN

Group ESR-01 – Exterior service doors (single) – hollow metal

3	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
1	ea.	Lockset	SC	ND96PD-RHO
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
1	ea.	Door bottom	PK	315CN

Group ESR-10 – Exterior service doors (pair) – hollow metal

6	ea.	Hinges	IV	3CB1HW 4.5 x 4.5 630-NRP
2	ea.	Flushbolts	IV	FB457
1	ea.	Lockset	SC	ND96PD-RHO
1	ea.	Closer	LCN	4040XP
2	ea.	Overhead stop/holder	GJ	100_series
2	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
2	ea.	Door bottom	PK	315CN
1	ea.	Astragal	PK	357C (applied to exterior side)

Group ST-01 – Circulation stair (single) – Hollow metal

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Exit device	VD	99L-F
1	ea.	Ext. trim	VD	996L- R/V
1	ea.	Cylinder	SC	Rim to suit L trim
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10" x width
1	set	Perimeter seals	PK	315CR

Group ST-02 – Secure stair – Card reader (single) – Hollow metal

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Exit device	VD	E99L-NL-F
1	ea.	Ext. trim	VD	E996L-NL R/V
1	ea.	Cylinder	SC	Rim to suit L trim
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10" x width
1	set	Perimeter seals	PK	315CR
1	ea.	Power Transfer	VD	EPT-2
1	ea.	Card Reader		By UVic Systems

Group ST-10 – Circulation stair (pair) – Hollow metal

6	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
2	ea.	Exit device	VD	LBR-9927L-F
2	ea.	Ext. trim	VD	996L-R/V
2	ea.	Cylinder	SC	Rim to suit L trim
2	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
2	ea.	Kickplate	IV	8400 10"
1	set	Perimeter seals	PK	315CR

Group ST-11 – Secure stair – Card reader pair) – Hollow metal

6	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Exit device	VD	E9927L-NL-F
1	ea.	Ext. trim	VD	E996L-NL R/V
1	ea.	Cylinder	SC	Rim to suit L trim
1	ea.	Exit device	VD	9927EO-F
2	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
2	ea.	Kickplate	IV	8400 10"
1	set	Meeting stiles	PK	29324CNB
1	set	Perimeter seals	PK	315CR
2	ea.	Power Transfer	VD	EPT-10
1	ea.	Power Supply	VD	PS902
1	ea.	Card Reader		By UVic Systems

Group SR-01 – Interior service doors (single) – hollow metal/wood
(Storage room)

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND96PD-RHO
1	ea.	Stop	IV/GJ	wall or overhead

Group SR-02 – Interior service doors – fire rated (single) – hollow metal/wood
(janitor, mechanical, electrical, communications, elevator machine room, etc.)

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND96PD-RHO
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR

Group SR-10 – Interior service doors (pair) – hollow metal/wood
(Storage room)

6	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
2	ea.	Flushbolts	IV	FB457
1	ea.	Lockset	SC	ND96PD-RHO
2	ea.	Stop	IV/GJ	wall or overhead
2	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
1	ea.	Astragal	PK	357C

Group SR-11 – Interior service doors – fire rated (pair) occupied spaces – hollow metal/wood
(janitor, mechanical, electrical, communications, elevator machine room, etc.)

6	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	pair	Auto flushbolts	IV	FB51P
1	ea.	Lockset	SC	ND96PD-RHO x 14-042
2	ea.	Closers	LCN	4040XP
2	ea.	Stop	IV/GJ	wall or overhead
2	ea.	Kickplate	IV	8400 10"
1	ea.	Coordinator	TR	3092
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
1	ea.	Astragal	PK	357C

Group SR-12 – Interior service doors – fire rated (pair) unoccupied spaces – hollow metal/wood (janitor, mechanical, electrical, communications, elevator machine room, etc.)

6	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
2	ea.	Flushbolts	IV	FB457
1	ea.	Lockset	SC	ND96PD-RHO x 14-042
1	ea.	Closers	LCN	4040XP
2	ea.	Stop	IV/GJ	wall or overhead
2	ea.	Kickplate	IV	8400 10"
1	ea.	Threshold	PK	270A
1	set	Perimeter seals	PK	315CR
1	ea.	Astragal	PK	357C

Group WR-01 – Washroom doors (single user) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Privacy	SC	ND97PD-RHO
1	ea.	Closer	LCN	4040XP (Parallel arm mount)
1	ea.	Stop	IV/GJ	wall or overhead
1	ea.	Kickplate	IV	8400 10"

Group WR-02 – Washroom doors – automatic– (single or multiple users) - hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Deadbolt	SC	B660
1	ea.	Push	IV	8200 4" x 16"
1	ea.	Pull	IV	8305 – 8" pull x 4" x 16" plate
1	ea.	Automatic operators	Horton	7100 series
2	ea.	Actuators	t	ype and location to suit
1	ea.	Kickplate	IV	8400 10"

Group WR-03 – Washroom doors (multiple users)– hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Deadbolt	SC	B663P
1	ea.	Closer	LCN	4040XP (Parallel arm mount)
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Push	IV	8200 4" x 16"
1	ea.	Pull	IV	8305 – 8" pull x 4" x 16" plate
1	ea.	Kickplate	IV	8400 10"

Group OF-01 – Interior office doors (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND92PD-RHO
1	ea.	Stop	IV/GJ	Wall or overhead

Group CL-01 – Interior classroom doors (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND94PD-RHO
1	ea.	Stop	IV/GJ	Wall or overhead

Group LB-01 – Interior lab doors (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND93PD-RHO
1	ea.	Closer	LCN	4040XP (where required)
1	ea.	Stop	IV/GJ	Wall or overhead

Group ECL-01 – Interior doors – Card reader - (single) – hollow metal/wood (classroom, meeting room, IT room, etc..)

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	E-Lockset	SC	ND96PDEU
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Kickplate	IV	8400 10"
1	ea.	Power transfer	VD	EPT-2
1	ea.	Card Reader		By UVic Systems

Group RS-01 – Student residence doors (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Lockset	SC	ND97PD-RHO
1	ea.	Closer	LCN	4040XP (corridor side)
1	ea.	Stop	IV/GJ	Wall or overhead
1	set	Perimeter seals	PK	315CR
1	ea.	Threshold	PK	271A

Group RS-02 – Student residence doors – card reader (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	Deadbolt	SC	B660P
1	ea.	E-Lockset	SC	RX-ND96PDEU
1	ea.	Closer	LCN	4040XP (corridor side)
1	ea.	Stop	IV/GJ	Wall or overhead
1	set	Perimeter seals	PK	315CR
1	ea.	Threshold	PK	271A
1	ea.	Power transfer	VD	EPT-10
1	ea.	Card Reader		By UVic Systems

Group PL-01 – Padlocks

1	ea.	Padlock	SC	KS23D2300
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Group CB-01 – Cabinet locks (door)

1	ea.	Cabinet lock	SC	CL100 1-1/8" (door)
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Group CB-02 – Cabinet locks (drawer)

1	ea.	Cabinet lock	SC	CL200 1-1/8" (drawer)
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Group EWL-01 – Interior doors – WiFi Card reader - (single) – hollow metal/wood
(classroom, meeting room, IT room, etc..)

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	E-Lockset	SA	IN120 10G77-BCP-B-LL
1	ea.	Cylinder	SC	Schlage To suit IN120
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Kickplate	IV	8400 10"

Group EWX-01 – Interior doors – WiFi Card reader with panic hardware - (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	E-Exit Device	SA	IN120 8877-BCP-B-ETL
1	ea.	Cylinder	SC	Schlage To suit ET trim
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Kickplate	IV	8400 10"

Group EPL-01 – Interior doors – POE Card reader - (single) – hollow metal/wood
(classroom, meeting room, IT room, etc..)

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	POE Power Transfer	ST	CEPT-C5E
1	ea.	E-Lockset	SA	IN220 10G77-BCP-B-LL
1	ea.	Cylinder	SC	Schlage To suit IN220
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Kickplate	IV	8400 10"

Group EPX-01 – Interior doors – POE Card reader with panic hardware - (single) – hollow metal/wood

3	ea.	Hinges	IV	3CB1 4.5 x 4.5 652
1	ea.	POE Power Transfer	ST	CEPT-C5E
1	ea.	E-Exit Device	SA	IN220 8877-BCP-B-ETL
1	ea.	Cylinder	SC	Schlage To suit ET trim
1	ea.	Closer	LCN	4040XP
1	ea.	Stop	IV/GJ	Wall or overhead
1	ea.	Kickplate	IV	8400 10"

08 80 00 GLAZING

08 87 23 SAFETY AND SECURITY FILMS

Interior Window Film

1. Provide window film to interior glazing that requires additional privacy for offices, meeting rooms, classrooms, labs and suites.
2. Window Film shall at a minimum the meet following requirements.
 - i. Color: White Mist
 - i. Visible Ray Transmission: 71%
 - ii. Ultraviolet Ray Transmission <1%
 - iii. Insolation Transmission: 68%
 - iv. Insolation Reflectivity: 16%
 - v. Insolation Absorbency 16%
 - vi. Shading Coefficient: 0.83
3. Figure 08 80 00-1 represents an example of a window film installation. The Facilities Management Interior Modification Services Department will collaborate and assist with film application locations and design details. Final design approvals will be made by the Manager of Interior Modification Services and/or the Director of Project Management Services.

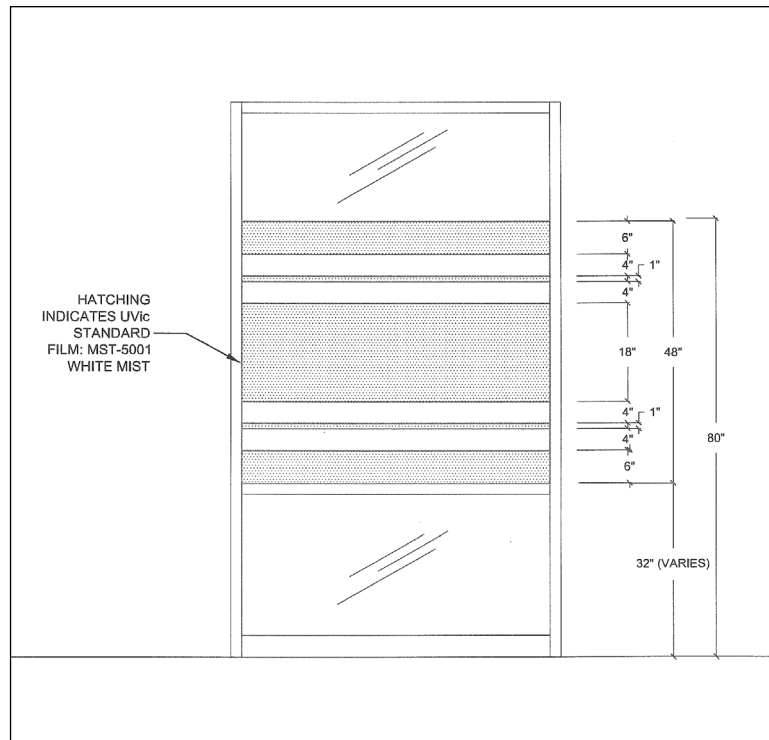


Figure 08 80 00-1

Exterior Window Film

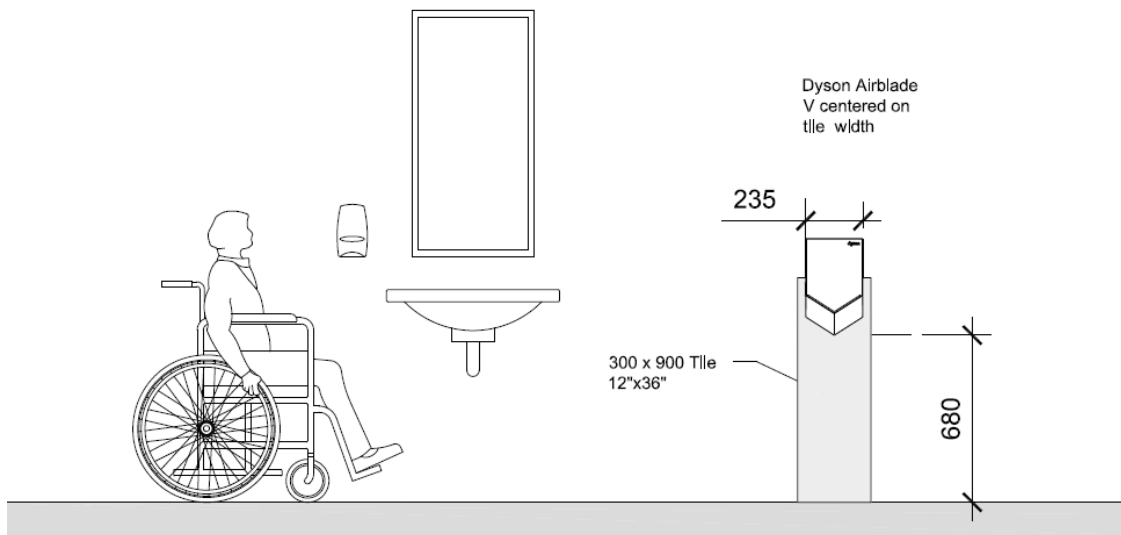
1. Is not approved for use – special consideration may be made for cooling or safety but requires prior approval from the Director of Project Management Services, Facilities Management.

09 30 00 TILING

09 30 01 GENERAL

Ceramic Tiling

1. Ceramic tile types:
 - i. Flooring tile: slip-resistant, non-glazed porcelain.
 - i. Wall tile: glazed porcelain.
2. Tile size: between 200x200 and 400x400 to minimize amount of grout lines and facilitate floor slope to drain. Other sizes (i.e. 100x200, 100x400, etc.) are acceptable for base and accent colour band applications. Small mosaic tiles are not acceptable in any application.
3. Grout: stain and/or acid resistant, where required. Avoid light coloured grout.
4. Wet spaces:
 - i. Preferred: tiling of entire wall surface.
 - ii. Acceptable (constrained budget): partial tiling, extended as follows:
 - a. Horizontally min. 200mm past the edge of showers and tubs.
 - b. Vertically to min. height of 1800mm in washrooms and 2000mm at showers/tubs.
5. Hand Dryers
 - i. Refer to sketch immediately following this section for placement of tile around hand dryers.
 - iii. Tile to be a minimum of 300mm X 900mm. Only a single large format tile will be accepted, grout joints will not be accepted.



09 34 00 WATERPROOFING-MEMBRANE TILING

Waterproofing Membrane Ceramic Tiling

1. Showers:

- i. Concrete board or waterproof drywall will not be accepted as a waterproofing material.
- i. Use a waterproofing membrane system from a single manufacturer that includes drain, shower pan and wall components.
- ii. Concrete or waterproof drywall is an acceptable substrate but must have the waterproof membrane system applied overtop.
- iii. Waterproofing system connection details shall create a continuous waterproof barrier and direct all water to drain.

09 50 00 CEILINGS

09 51 23 ACOUSTIC TILE CEILINGS

1. Gypsum panels are preferred; acoustic tiles are acceptable alternatives:
 - i. Acoustic Tile:
 - ii. Mineral fibre panel, medium texture white.
 - iii. Noise Reduction Coefficient (NRC) designation of 0.70 typical (0.55 minimum).
 - iv. Ceiling Attenuation Class (CAC rating 0 (35 minimum).
 - v. Light Reflectance (LR) of minimum 0.84.
 - vi. No Formaldehyde products will be accepted
 - vii. Products – Preferred:
 - a. Armstrong – School Zone Fissured, 19mm thick, no added formaldehyde.
 - b. CGC – Radar ClimaPlus high NRC.
 - viii. Products – Acceptable (with budget constraints and if not in conflict with LEED certification):
 - a. Armstrong Fine Fissured, 16mm thick.
 - b. CGC – RDAR ClimaPlus.
 - c. Armstrong Dune.
2. Wet Labs- When acoustic tiles are used in wet lab applications materials shall confirm with the Canadian Biosafety Standard Level 2 environment requirements. Specifically materials shall be cleanable and non-absorbent.
3. Provide self-adhesive color coded dots 6mm in diameter to delineate ceiling access for plumbing, electrical, HVAC controls etc.

09 53 00 ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

09 53 23 METAL ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

1. Provide adequate access to utilities above suspended ceilings. Ventilate ceiling spaces as required.
2. Metal T-bar suspension systems and acoustic tile units:
 - i. Prefinished baked enamel; white.
 - ii. Typical: 610x1220mm grid with 15/16" reveal.
 - iii. Custom: only where necessary to match existing layout or areas designed for enhanced architectural appeal, 610x610mm grid; regular or square lay-in; white, or other system to suit application.
 - iv. Duty: intermediate for typical ceiling tile (mineral fibre. Heavy duty for wood or GWB panels.).
 - v. Products: Armstrong Prelude; Donn; approved equivalent.

09 54 00 SPECIALTY CEILINGS

1. Specify water resistant and washable ceiling surfaces in high humidity spaces (food preparation, showers, washrooms, etc.).
2. Provide mould resistant and anti-microbial treated products where suitable such as high moisture locations, food service areas, etc.

09 60 00 FLOORING

09 60 01 GENERAL FLOORING SELECTION CONSIDERATIONS & STANDARDS

The University has standardized flooring finishes by building across campus. This information is contained in the Building Finishes Standard and provides details on flooring product by manufacturer, type, pattern and colour and is available upon request from FMGT Manager Interior Modification Services.

Flooring standards are to be maintained for each building. If a flooring product is discontinued or not identified in the Building Finishes Standard consultant must coordinate with FMGT Manager Interior Modification Services in order to change or add new product to the Building Finishes Standard.

1. Carpet Tile (Refer to Section 09 68 00 Carpeting)
 - i. Classrooms
 - i. Lecture Halls
 - ii. Computer Labs
 - iii. Seminar Rooms
 - iv. Office Spaces
 - v. Housing – Corridors
 - vi. Meeting and Conference Rooms
 - vii. Library
2. Ceramic Tile (Refer to Section 09 30 00 Tiling)
 - i. Lobbies and Entryways (extend minimum 10m from entrances)
 - viii. Washrooms, Change Rooms and Shower Rooms w/waterproof membranes (slip retardant)
 - ix. Food Service Spaces – Cafeteria and Kitchens (slip retardant)
 - x. Corridors - areas directly under water bottle stations or water fountains – transition strips to be aluminum
3. Linoleum (Refer to Section 09 65 Resilient Flooring)
 - i. Corridors (dry areas only)
 - xi. Classrooms (dry areas only)
 - xii. Library (dry areas only)
4. Sheet Vinyl (Refer to Section 09 65 00 Resilient Flooring)
 - i. Washrooms, Change Rooms and Shower Rooms (small) w/flash coving (slip retardant)
 - xiii. Laboratories (dry, wet and/or chemical exposure) w/flash coving – consider all laboratories to be wet with chemical exposure (slip retardant)
 - xiv. Janitorial / Utility (wet and chemical exposure) w/flash coving (slip retardant)
 - xv. Lounges (slip retardant)
 - xvi. Food Service Spaces – Cafeteria (slip retardant)
 - xvii. Corridors - areas directly under water bottle stations or water fountains – transition strips to be aluminum (slip retardant)
 - xviii. Ramps (slip retardant)
 - xix. Heavy traffic areas (slip retardant)
5. Acoustic Vinyl Plank
 - i. Housing – Dorms, Corridors & Lounges
 - xx. Lounges
 - xxi. Library
 - xxii. Corridors
 - xxiii. Office Spaces

6. Poured Epoxy
 - i. Commercial Kitchens
 - xxiv. Washrooms, Showers and Change Rooms
 - xxv. Laboratories
7. Polished Concrete / Terrazzo
 - i. Lobbies and Entryways
 - xxvi. Corridors
8. Hardened and Sealed Concrete
 - i. Mechanical, Electrical and Service Spaces
 - xxvii. Janitorial / Utility
 - xxviii. Engineering Laboratories, Testing Spaces
 - xxix. Equipment Rooms
 - xxx. Trades Shops

Matting

1. Walk-off Entry Mats
 - i. Institutional Grade
 - i. Extend min. 4m from entrances on slip-resistant surfaces and 6m on slippery floors.
 - a. Matting shall be installed on flush floor; mat wells (depressions) are not acceptable.
 - b. Acceptable products: min. 7.94mm thick; nylon polypropylene; vinyl backed, heavy edged and containing min. 30% recycled material:
 1. 3M Normafd 8850, or approved equivalent

09 65 00 RESILIENT FLOORING

Sheet Linoleum 2.5mm thick – Resilient Sheet Flooring

1. Applicable areas: dry areas
2. Acceptable products or approved equivalent:
 - i. Marmoleum Real – by Forbo Flooring Systems.
 - i. Linoleum Harmonium XF – by Tarkett / Johnsonite.

Sheet Vinyl – V1

1. Applicable areas: wet areas
2. Acceptable products or approved equivalent:
 - i. Tarkett iQ Optima or Granit (2.0mm homogenous).
 - i. Armstrong – Connection Corlon, wearing surface: minimum 1.27 mm.
 - ii. Tarkett – Contract Plus, 2.0 Homogenous with PUR surface treatment.
 - iii. Polyflor

Sheet Vinyl – V2 – Slip Retardant and Chemical Resistant

1. Applicable areas: wet and where chemical resistance is required
2. Acceptable products or approved equivalent:
 - i. Tarkett iQ Optima (GOOD chemical resistance).
 - i. Tarkett Acczent – Glass or Steel – (EXCELLENT chemical resistance).
 - ii. Polyflor

Sheet Vinyl – V3 – Slip Retardant

1. Applicable areas: wet areas
2. Acceptable products or approved equivalent:
 - i. Washrooms: Tarkett Safe-T Sheet.
 - i. Food service, ramps, heavy traffic areas: Altro Designer 25.
 - ii. Showers: Tarkett Granit Multisafe and Altro Marine 20 – by Altro Floors
 - iii. Locker and Change Rooms: Tarkett Safe-T Sheet
 - iv. Polyflor

Epoxy With Integrated Coved Base – Slip Retardant and Chemical Resistant

1. Applicable areas: wet areas and where chemical resistance is required

Rubber Wall Base

1. Rubber wall base is standard unless flash coving, tile or epoxy flooring has been indicated. Rubber wall base to be 101.6mm (4").
2. Acceptable products or approved equivalent:
 - i. Johnsonite

Rubber Stair Treads, Stringers and Landings

1. Stair treads with integrated riser and contrasting inserts for the visually impaired. To be flexible rubber, with wire reinforced nose. Stringers to be rubber and match colour of treads and riser. Landings to be rubber and match pattern and colour of treads and riser. Transitions to carpet tile, resilient vinyl, tile, concrete, terrazzo, linoleum or other flooring types with rubber stair landings and/or treads must provide a transition strip that deals with the variance in thicknesses on a case by case basis.
2. Acceptable product or approved equivalent:
 - i. Johnsonite

Seams

1. Heated, welded, threaded in colour to match flooring.
2. Net Fit installation requires prior approval from owner (Proof of Certified Installers Required)
3. Guarantee –Five years on labour and materials

Transition and Reducer Strips

1. Transitions between carpet tile and resilient or plank vinyl can be Net Fit where there height is equal and product lines match.
2. Reducer strips: provide at all exposed edges of flooring materials. Where flooring terminates in a door opening, center reducer under door.
3. Transition strip preference is aluminum with rubber and vinyl an acceptable alternate.

09 68 00 CARPETING

Carpet – General

Carpet tile is the preferred carpet product used on campus. Broadloom is not acceptable.

The University has standardized carpet tile by building across campus. This information is contained in the Building Finishes Standard and provides details on carpet tile product by manufacturer, type, pattern and colour and is available upon request from FMGT Manager Interior Modification Services.

Carpet tile standards are to be maintained for each building. If a flooring product is discontinued or not identified in the Building Finishes Standard consultant must coordinate with FMGT Manager Interior Modification Services in order to change or add new product to the Building Finishes Standard.

09 70 00 WALL FINISHES

09 72 00 WALL COVERINGS

Vinyl wall coverings and wallpaper are not acceptable.

09 90 00 PAINTING AND COATING**09 91 00 PAINTING**

1. The design of all paint and coating systems, surface preparation and maintenance shall be in accordance with the Master Painter's Institute (MPI) – Architectural Painting Specification Manual (Latest Edition) for new surfaces, and the MPI Maintenance Repainting Manual (Latest Edition) for re-painting and previously un-coated surfaces.
2. For projects that contain both new and existing surfaces, specify both new and existing systems as necessary (i.e. INT 9.2B (new) and RIN 9.2B).
3. For existing surfaces, DSD values shall be evaluated and specified by the Consultant. Alternately, specify minimum system requirements (including prep, priming, sealing, etc.) as described by the MPI standard.
4. All paint systems shall be MPI “premium grade”. Other materials such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an MPI listed manufacturer.
5. Approved Paint Manufacturers as per MPI approved products listings:
 - i. Preferred: General Paint, Cloverdale Paints
 - i. Acceptable: Benjamin Moore, Pratt and Lambert

09 91 13 EXTERIOR PAINTING

Metal Fabrications

1. Marine grade system, such as epoxy coat and aliphatic urethane topcoat.
2. Typical gloss level: semi-gloss for miscellaneous metals.

09 91 23 INTERIOR PAINTING

Interior Walls and Ceilings

1. All areas: latex, MPI gloss level 3 “eggshell like”.
2. Laundry rooms, public wash / shower / bathrooms / prep areas: washable latex G5 (semi-gloss) finish.
3. Public change / wash / shower rooms and “clean” or “sanitary” areas such as food preparation and laboratory areas: epoxy (tile-like) MPI gloss level 5 (semi-gloss) finish.
4. Custodial closets:
 - i. Throughout: washable latex MPI gloss level 5 (semi-gloss).
 - i. Behind and adjacent to floor sink: epoxy (tile-like) G5 (semi-gloss) finish. Extend:
 - a. Horizontally min. 200mm past the edge of floor sinks.
 - b. Vertically to min. height of 900mm.
5. Colours:
 - i. Student Family Housing only: Cloverdale 937-2W. Formula: B-3 C-25 I-0.05.
 - ii. Academic Buildings: Confirm with FMGT Project Officer.
 - c. Old standard – only to match existing: 937-2W

d. New standard – typical: 8443 – Cloverdale

Doors, Frames, Trim and Sills

1. MPI gloss level 5 (semi-gloss) finish.

09 97 13 EXTERIOR STEEL COATINGS

1. Typical finishes for exposed (outdoor) metal fabrications:
 - i. Hot-dip galvanized.
 - i. Stainless steel.
 - ii. Clear anodized aluminum.
2. Where painted assemblies are required, use durable factory finish (preferred), or a marine grade system:
 - i. Electrostatic painting.
 - iii. Factory pre-painted process.
 - iv. Epoxy coat and aliphatic urethane topcoat, marine grade system. For increased durability, consider galvanized steel for painted assemblies.

09 97 23 CONCRETE AND MASONRY COATINGS

Exposed Architectural Concrete

1. Anti-graffiti coating

10 10 00 INFORMATION SPECIALTIES

10 11 00 VISUAL DISPLAY UNITS

Area of Use

1. All lecture halls, classrooms and labs shall be equipped with Chalkboard Slider Units – black surface. Offices and boardrooms shall be equipped magnetic whiteboards, confirm overall strategy with Facilities Management.

Perimeter Trim and Fastening

1. Perimeter trim: extruded anodized aluminum channel, 1.5mm thick material, fitted around panels with closed mitred corners. Single layer, fixed units fastening to wall preparation as follows:
 - i. Offices / corridors – surface mounted fasteners: pre-punch perimeter trim at 610 o.c.
 - i. Classrooms / boardrooms – concealed clip fasteners: back fasten trim to backing sheet.

Dimensions

1. Use Standard Board Sizes
2. Chalkboards and Marker-boards (Whiteboards) follow the following table where applicable:

Fixed & Slider Panel Widths (mm)	Slider Panel Height (mm)		Overall Slider Unit Height (mm)	Fixed Panel Height (mm)
1220; 1830 or 2440	1070		1220	1220

Installation

1. Install slider and fixed units, 1220mm high boards with bottom edge of at 915 above finished floor.

Products

1. In renovations match existing blackboard and whiteboard products.
2. Chalkboards and Marker-boards (Whiteboards):
 - i. Facing sheet: 2 coats fired vitreous porcelain enamel on 24 gauge steel.
 - i. Chalkboards: porcelain enamel, colour BLACK.
 - ii. Magnetic Marker-boards (Whiteboards): porcelain enamel, magnetic, colour WHITE.
 - iii. Core material: 12.5mm high density, moisture resistant fibreboard; free of tar material.
 - iv. Provide trays of extruded aluminum, not less than 64mm wide, with ends polished and bevelled.
 - v. Horizontal 2-tracks top hung chalkboard sliders (3 layers: 2 sliders + fixed back panel). Maximize the length of sliders, within the overall chalkboard unit, to minimize vertical seams; do not exceed 2400 lengths, to prevent heavy panels and difficulty of operation.

10 14 00 SIGNAGE

10 14 01 SIGNAGE DESIGN STANDARDS, SPECIFICATIONS AND DETAILS

1. When additional signage is required by code (for example automatic door caution stickers) install so that the signage is centered on the door with the top at 1448mm.
2. Interior and exterior wayfinding signage design standards, specifications and details documents are available as follows:
3. Interior Wayfinding Signage and Safety and Information Signage Design Standards' document can be viewed and downloaded at:

<http://www.uvic.ca/facilities/assets/docs/standards/Signage%20Standards/2016%2004%2013%20Interior%20Wayfinding,%20Safety%20and%20Info%20Signage%20-%20Design%20Guidelines.pdf>

4. Interior Wayfinding Signage and Safety and Information Signage Specifications and Details' document can be viewed and downloaded at:

<http://www.uvic.ca/facilities/assets/docs/standards/Signage%20Standards/2016%2004%2013%20Interior%20Wayfinding,%20Safety%20and%20Info%20Signage%20-%20Specification%20and%20Details.pdf>

5. 'Exterior Wayfinding Signage and Safety and Information Signage Design Standards' document can be viewed and downloaded at:

<http://www.uvic.ca/facilities/assets/docs/standards/Signage%20Standards/3extwayfinding-designstandards.pdf>

6. 'Exterior Wayfinding Signage and Safety and Information Signage Specifications and Details' document can be viewed and downloaded at:

<http://www.uvic.ca/facilities/assets/docs/standards/Signage%20Standards/5extwayfinding-specsanddetsl-fullpkg.pdf>

10 20 00 INTERIOR SPECIALTIES

10 21 00 COMPARTMENTS AND CUBICLES

1. Toilet Compartments
 - i. Shall be designed for heavy traffic, shall have superior durability, reparability and be scratch-resistant, dent-resistant, graffiti-resistant, moisture-resistant and impact-resistant. Use finishes that require minimal maintenance and allow easy graffiti removal.
 - i. Design stalls size to allow adequate installation and functionality of all accessories.
2. Toilet Partition Types
 - i. All toilet partitions to be gap free with continuous hinges.
 - ii. Latches must be operable from the exterior in an emergency.
 - iii. Typical: Solid Colour Reinforced Composite (SCRC), solid phenolic, solid plastic or plastic laminate, to suit budget.
 - iv. Acceptable for non-public, limited budget projects or to match existing: powder coated steel.
3. Washroom Partitions: Floor mounted overhead braced
4. Urinal Partitions: Wall hung.
5. Each compartment to be complete with the following hardware:
 - i. Combination coat hook/door bumper. Locate at 915mm height on inside of stall door in accessible stalls.
 - v. Combination stop/latch – with emergency lift feature.
 - vi. Non-removable self-closing hinges – with emergency lift feature.
 - vii. Door d-pulls on interior and exterior of stalls for accessible compartments.
 - viii. Seat at dressing cubicles.

10 25 16 MODULAR SERVICE WALLS

1. Modular Wall Systems- Where space separation and building code requirements permit, consider modular demountable wall partition systems for all interior space division.
2. Selection of system to be based on long-term availability of components and finishes.
3. Partition System: demountable and relocate-able, unitized, non-progressive, extend in four directions at posts without disturbing other panels. Accommodate floor to ceiling height variations of up to 25mm.
4. Systems to be approved for installation in seismic areas. Installations shall include for all miscellaneous bracing to suit the seismic criteria.
5. System design to suit easy integration with furniture and case goods.
6. System to accommodate electrical outlets and switches on posts or in panels, and wiring in posts, base, cap or panels as necessary.
7. Preference should be given to GreenGuard certified products / systems.
8. Minimum STC rating of 40. Discuss sound attenuation requirements for each specific application.

9. Standard framing material: extruded aluminum or steel, clear anodized or powder coated finish.
10. Standard panel types: face mounted or glazed-in.
11. Standard panel materials: plain gypsum board (painted), pre-decorated gypsum board, wood panel, acoustic panel (fabric), steel or glass.
12. Doors and frames to be coordinated with Section 08 10 00 Doors and Frames.
13. Coordinate electrical and communications requirements and components with FMEL and University Systems (SYST) and as directed by FMGT.

10 26 13 CORNER GUARDS

1. Provide wall exterior corner guards, or other suitable means of protection at all exposed gypsum board corners susceptible to damage.
2. Minimum 1200mm above floor.

10 26 16.13 BUMPER RAILS

1. A chair rail shall be installed in all classrooms, meeting and boardrooms, waiting areas and any space that would require wall protection from furniture and/or other moving equipment.
2. Extent of coverage and height of installation to be reviewed with FMGT Interior Modification Services representative during design stage.
3. Product: 10" adhesive rubber strips, brushed silver color, suede texture.
4. Install bumper rail at 28" to the underside in rooms with table height tables and chairs. Install bumper rail at 35"-40" to the underside in rooms with counter or bar height tables and chairs.

10 26 23 PROTECTIVE WALL COVERING

1. Custodial Rooms: Where a sink or water source is included in a custodial closet ensure the surrounding walls are protected using a waterproof covering up to 42". Standard of acceptance for wall protection is Inpro Elements Patterns – Brushed Silver 5E025 (www.inprocorp.com)

10 28 00 TOILET, BATH AND LAUNDRY ACCESSORIES

General

1. Each washroom on campus shall be provided with the items listed in "Washroom Products" section below.
2. In order to maintain product consistency throughout the campus, alternates will not be considered.
3. All necessary surface/assembly preparation shall be described in the drawings and specifications.
4. Coordinate with FMGT for any items to be provided by the UVic as noted in "Washroom Products" section below.
5. Backing board to be installed to 4' above finished floor on walls adjacent to toilet, sink. Backing board to be installed to 8' above finished floor on a walls holding toilets or sinks.

Washroom Products

1. Paper Towel Slimfold Dispensers:
 - i. One dispenser per washroom, mounted at appropriate height for accessibility purposes.
 - ii. Make/Model: Kimberley Clark Professional* MOD* SLIMFOLD* Dispenser 34830 (White)
 - iii. Supplied by: UVic
 - iv. Installed by: Contractor
2. Soap Dispensers:
 - i. One dispenser for every two washbasins.
 - ii. Make/Model: GOJO ADX-12 Dispenser 8886-06 (Black)
 - iii. Supplied by: UVic
 - iv. Installed by: Contractor
3. Paper Towel Roll Dispensers:
 - i. One dispenser for every three washbasins.
 - ii. Make/Model: Kimberly-Clark Professional* SANITOUCH Hard Roll Towel Dispenser 09990 (Smoke).
 - iii. Supplied by: Contractor
 - iv. Installed by: Contractor
4. Toilet Roll Dispensers:
 - i. One dispenser for each W.C.
 - ii. Make/Model: Kimberley Clark Professional* Cored JRT Combo Unit Bathroom Tissue Dispenser 09551 (Smoke)
 - iii. Supplied by: Contractor
 - iv. Installed by: Contractor
5. Sanitary Napkin Disposal:
 - i. One disposal for each W.C. in women's and gender neutral washrooms. Mounted at consistent heights across all stalls
 - ii. Make/Model: Rubbermaid 6140 Sanitary Napkin Receptacle (White)
 - iii. Supplied by: Contractor
 - iv. Installed by: Contractor.
6. Grab Bars – Locate in each accessible toilet compartment:
 - i. One at 120°, 600mm (or 180°, 1200mm) and one at 180°, 450mm x 32mm dia. X min.
 - ii. 1.25mm wall tubing of 304 stainless steel, 76mm dia.
 - iii. Wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel backing plates and all accessories.
 - iv. Knurl bar at area of hand grips.
 - v. Grab bar material and anchorage to withstand downward pull of 2.2 kN.
7. Wall Mounted Baby Changing Station
 - i. One Baby Changing station per washroom
 - ii. Make/Model: Koala Kare KB200-SS – Horizontal Wall Mounted Baby Changing Station with stainless steel veneer
 - iii. Supplied by: Contractor
 - iv. Installed by: Contractor

Classroom/Boardroom Products

1. Paper Towel Roll Dispensers- If sink is provided in a classroom or boardroom install paper towel roll dispenser: Clark Professional* SANITOUCH Hard Roll Towel Dispenser 09990 (Smoke). Or a Kimberley Clark Professional* MOD* SLIMFOLD* Dispenser 34830 (White) when space is limited.
1. Waste bins- A waste bin will be provided by the university for each paper towel dispenser. See section 06 41 01 for details on cabinetry to accommodate waste bin

10 70 00 EXTERIOR SPECIALTIES

10 73 16 CANOPIES

Bike and Motorcycle Canopy

1. UVic has developed standardized bicycle and motorcycle canopy structures. The number of bays and bay width may vary to suit site conditions. When necessary for site design, request canopy drawings from UVic representative.

11 50 00 EDUCATIONAL AND SCIENTIFIC EQUIPMENT

11 52 00 AUDIO-VISUAL EQUIPMENT

Audio-Visual System Infrastructure – System Description

1. Provide complete conduit system, including junction boxed and pull string for the installation of an audio-visual system in lecture theatres, classrooms and video conferencing rooms. The audio-visual systems will be provided by University of Victoria forces.
2. Provide 120 volt power for audio-visual systems and components as required and as indicated.
3. Lecture theatre audio-visual infrastructure shall include:
 - i. Conduit from lectern cabinets to central dimming controls for respective spaces.
 - i. Conduit from lecture theatre control booth to lectern cabinet.
 - ii. Conduit from control booth to wall mounted and ceiling mounted speakers.
 - iii. Receptacle outlets at lectern cabinets, minimum 4 circuits and duplex receptacles.
 - iv. Data outlets at lectern cabinets.
4. Classroom audio-visual infrastructure shall include:
 - i. Conduit from ceiling overhead projector to lectern at teaching position.
 - v. Ceiling receptacles for overhead project.

11 53 13 LABORATORY FUME HOODS

Fume Hood – General

1. Design and install fume hoods to comply with recognized authorities (CSA, ASHRAE) as prescribed in Part of the BC Building Code. Perform risk assessment to determine if fume hood and/or cabinets (including bio safety) should be connected to emergency power.
2. Ductwork shall be stainless steel type 316 – 18 gauge minimum, 2B finish except No. 4 finish where in exposed occupied spaces and shall be suitable for the gas and/or vapours carried from source to exhaust fan. Strong corrosive fumes may attack stainless steel and other materials may need to be specified.
3. Ducts from fume hoods shall be routed to the roof of the building as directly as possible for discharge above the re-circulation cavity boundary of the structure.
4. Horizontal ducts shall be kept to a minimum and shall be graded up in direction of air flow.
5. Exhaust fans shall have interior surfaces in contact with the air stream coated with a chemical resistant coating.
6. Canvas or any other flexible connections are not acceptable on the discharge side of the fan.
7. Provide control handles on the exterior of the fume hood for all fume hood services.
8. New fume hoods shall have flow monitors/alarms as per CSA standards.
9. Avoid sound attenuators on fume hood exhaust fans. Select fans with lower sound level instead.

Laboratory Fume Hoods

1. Metal under-counter storage cabinets, when part of a fume hood unit, must have a removable access panel in back to permit servicing of the plumbing pipes.
2. Solvent/chemical storage cabinets which do not have removable back panels must be installed in a manner which will allow easy removal of cabinet. In this case, the fume hood must be supported independently of the storage cabinet below. Hang fume hood with threaded rod to raise and lower with turn buckle.

11 80 00 FACILITY MAINTENANCE AND OPERATION EQUIPMENT

11 80 01 EXTERIOR ACCESS FACILITIES

Rooftop Access

1. Provide Worksafe BC / OHS approved facilities to suit safe access to all roof areas for service and maintenance (i.e. fall restraint):
 - i. Parapet walls designed as guard elements (min. 1070mm height) are encouraged to serve as permanent fall restraint facilities.
 - i. Where permanent fall restraint is not achievable, provide alternate means or procedures for providing temporary fall restraint as outlined in Worksafe BC part 11 and OHS Regulation.
 - ii. Where fall restraint facilities are not achievable, provide WorkSafeBC approved fall arrest systems.
 - iii. The Consultant shall provide a roof plan demonstrating the ability of designed fall arrest or fall restraint systems to collectively provide full access to all roof areas.

Exterior Wall Access

1. Provide Worksafe BC / OHS approved facilities to suit safe access to building exterior walls for routine cleaning and maintenance (i.e. window washing) personnel.
2. Design considerations shall assume suspension access (i.e. bosons chair) to all exterior windows shall be provided where safe access to the exterior of windows cannot be achieved from the interior.
3. Permanent exterior access facilities may consider capacity for swing stages or other larger access equipment.
4. Any system that spans or cantilevers over a parapet shall be provided with adequate designated bearing surfaces. Bearing on parapet flashings or similar surfaces that may be damaged is not acceptable.

12 20 00 WINDOW TREATMENTS

12 21 00 WINDOW BLINDS

Roller Blinds – Design Considerations

1. Provide roller blinds as follows:
 - i. Windows with high sun/heat exposure to receive 1% perforation roller blinds
 - ii. Windows with medium sun/heat exposure to receive 3% perforation roller blinds
 - iii. Windows with low sun/heat exposure to receive 3-5% perforation roller blinds
 - iv. Specialized rooms i.e. classrooms, research spaces or laboratories that require blackout blinds will be identified in design stage, ensure all blackout blinds are installed with side, top and bottom channels to eliminate light infiltration
 - i. Sunscreen and blackout shades combination: typical to exterior windows (installed in residential housing) of the spaces that require blackout shades, as described above.
 - ii. Operation:
 1. Typical: Metal bead chain and sprocket roller shade manually operated action with infinite positioning.
 2. Motorized blinds are only installed where manual operation is not feasible
2. Roller blinds do not require valances unless they are blackout
3. Blinds to come with 5 year warranty on labour and materials

Roller Shade System

1. Factory assembled unit including: two end brackets, shade tube, extruded aluminum fascia, hem-bar, and fabric. Local manufacturers are required.

Sunscreen Fabric

1. Dense shade cloth, suitable for clear low “E” glazing.
5. Composition: woven, vinyl coated fiberglass (64% vinyl / 36% fiberglass core yarn), halogen free, dimensionally stable, tensioned to keep the warp ends straight and minimize or eliminate weave distortion to keep the fabric flat.
6. Weight: min 470 g/m².
7. Thickness: minimum 0.48 mm.
8. UV Blockage: minimum 95%.
9. Openness factor to be selected by Consultant:
 - i. UVic standard: 1-5% open as outlined in the design consideration section above.
 - i. Provide consistent product, colour and appearance for the entire building, irrespective of various different openness factors.
10. Colours: Where existing standard is encountered match that standard. Otherwise preferred colours are:
 - i. Oyster Pewter
 - ii. Oyster Pearl Gray
 - iii. Beige Pearl Gray

iv. Beige Pearl Gray

Blackout Fabric

1. Room darkening shade shall be 100% opaque material, 3 or 4 ply, PVC or vinyl laminated to both sides of 100% fiberglass base fabric. Washable, flame retardant treated and fade resistant.
11. Thickness: 0.45mm.
12. Mesh Weight: 340 g/m².
13. Colours: Where standard is encountered match that standard. Otherwise preferred colours are:
 - i. Bone Platinum
 - i. Gray
 - ii. Light Gray
14. Acceptable product:
 - i. Preferred colour: Q06 bone Platinum.
 - ii. Composition: Vinyl-Coated Fiberglass Fabric Laminated with a Two-Ply 100% PVC Blackout Film
 - iii. Fabric Thickness: 0.023 in (0.58mm)
 - iv. Openness Factor: Opaque
 - v. Solar Reflectance: 71
 - vi. Solar Absorptance: 0.23
 - vii. Solar Heat Gain Coefficient ¼" Clear Glass: 0.23

Accessories

1. Bottom rail: extruded aluminum hem-bar with integral grooves to accommodate fabric guide carrier at ends. Soft vinyl welt on bottom of bar.
15. Installation brackets: concealed type as required to support assembly.

12 22 13 DRAPERIES

Design Considerations

1. Draperies/curtains are not recommended unless for specialized spaces such as theaters, safety curtains in labs or for added acoustic treatments.
16. Laser Curtain use in Laboratories is limited to shield/protect against eye damage from laser equipment. Extent to be determined by space and equipment needs and to be reviewed by Project Officer, Occupational Health and Interior Modification Planner. Only products certified as laser curtains will be accepted.

Laser Curtain Fabric

1. Must meet all certification requirement and industry standards.

12 22 16 DRAPERY TRACK AND ACCESSORIES

Track and Accessories

1. All drapery track and window treatment head-rails are to be securely fastened by toggle bolts or molly anchors, not more than 610mm o.c.

Drapery Hardware

1. Hand draw system standard (pinch pleat).
17. Fling rods are not required.
18. Single channel track: Kirsch/Draco #94003 – Finish: #90 Aluminum.
19. End caps: #94141 – Finish: #61 Bright Zinc.
20. Overlap masters: RH and LH #94113 and 94114.
21. Glides/carriers: #9670 – Finish: #25 White.
22. Brackets: type shall be determined in consultation with Interior Planning Modifications and UVic Housing and be consistent with window/building design: #94140 Ceiling, #94132 Wall – Finish: #61 Bright Zinc.

12 26 00 INTERIOR DAYLIGHTING DEVICES

Interior Window Film Design Considerations

1. Provide window film to interior glazing that requires additional privacy for offices, meeting rooms, classrooms, labs and suites.

Film Material – Materials

2. Window Film shall at a minimum meet the following requirements.
 - i. Color: White Mist
 - i. Visible Ray Transmission: 71%
 - ii. Ultraviolet Ray Transmission <1%
 - iii. Insolation Transmission: 68%
 - iv. Insolation Reflectivity: 16%
 - v. Insolation Absorbency 16%
 - vi. Shading Coefficient: 0.83

Film Design

3. Figure 12 20 00-1 represents an example of a window film installation. The Facilities Management Interior Modification Services Department will collaborate and assist with film application locations and design details. Final design approvals will be made by the Manager of Interior Modification Services and/or the Director of Project Management Services.

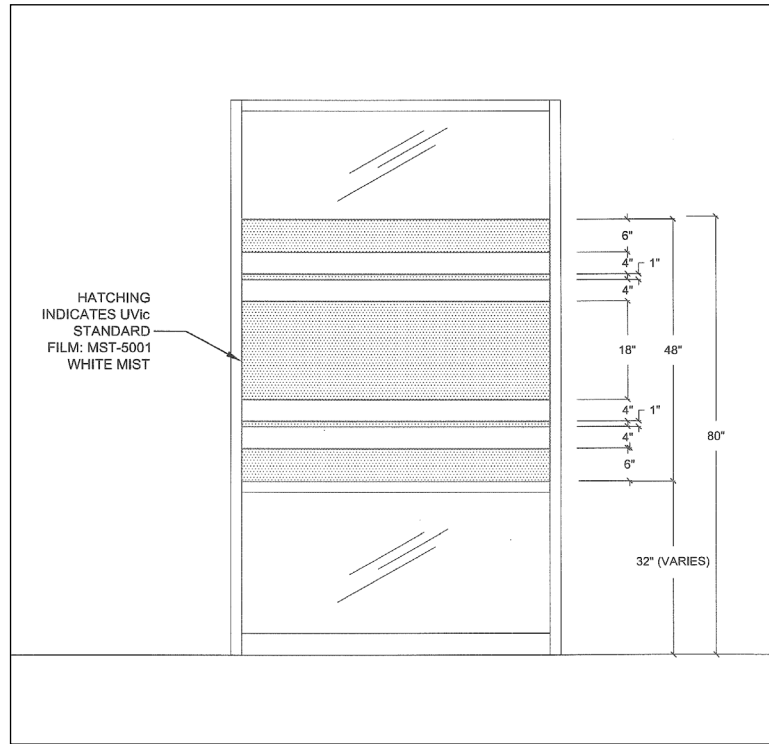


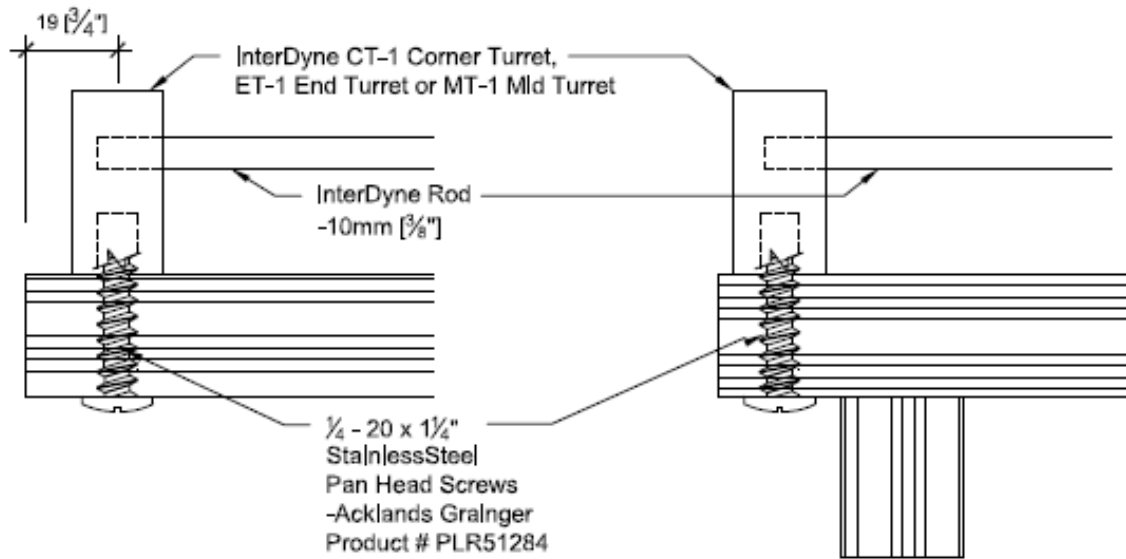
Figure 12 20 00-1

1.

12 30 00 CASEWORK

12 35 53 LABORATORY CASEWORK

1. Preference is for pre-fabricated metal casework with factory finishes in all laboratory applications.
2. All hardware and fasteners for laboratory casework shall be stainless steel.
23. Design all shelving with appropriate anti spill protection to meet all earthquake requirements.
24. Preference is for epoxy resin shelving.
25. Casework shall be white powder coated finish only.
26. Design for vibration control.
27. Fixed vs mobile casework should be confirmed with the consultant and client. Mobile lower cabinets should be considered based on application.
28. Where anti-tip rails are required see designs shall conform to figure 12 30 00-1 for new construction details and figure 12 30 00-2 for retrofits.



1. Detail - Upper Shelf

2. Detail - Lower Shelf



3. Photo (Example

Notes;

Space Turrets max. 914mm [36"] o.c.
-Use Mld Turrets as needed

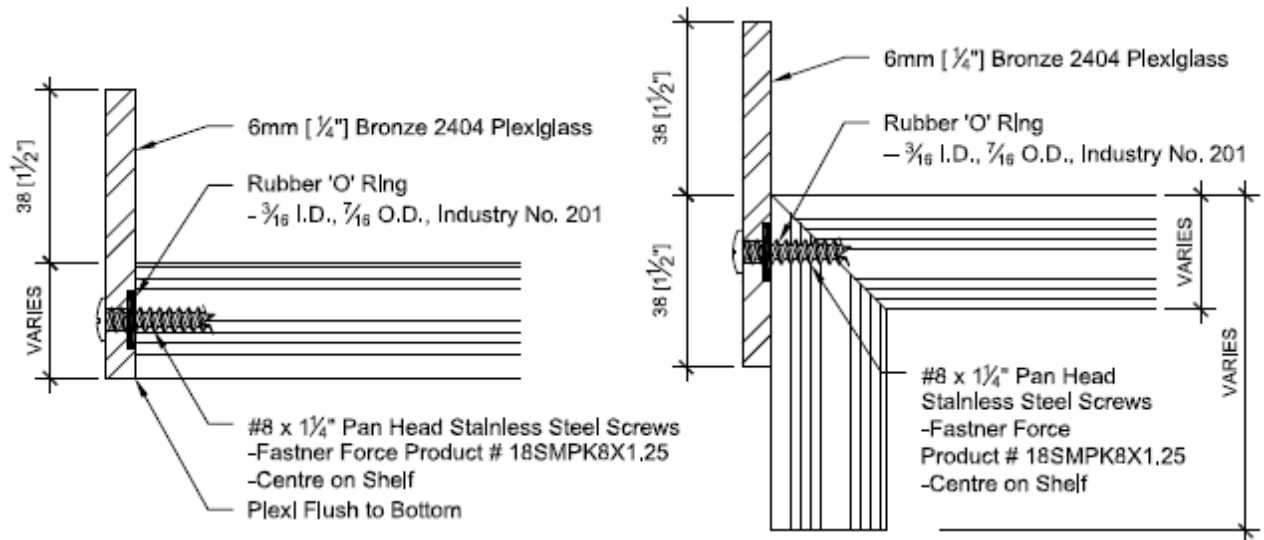
Rails to be separate on adjacent shelves
-Not to be continuous

Rails to cover sides where gap between shelves is greater than 26mm [1"] on open-sided shelves

Rails to cover sides on on open-sided shelves

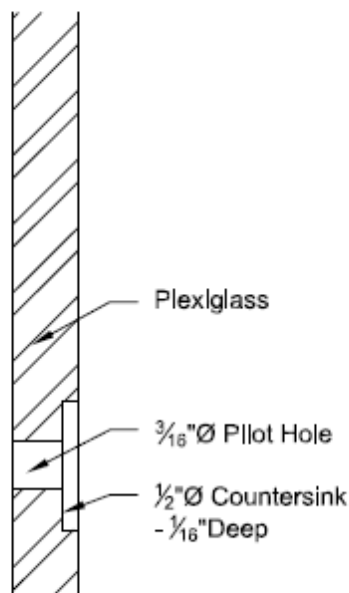
1.

2. Figure 12 30 00-1

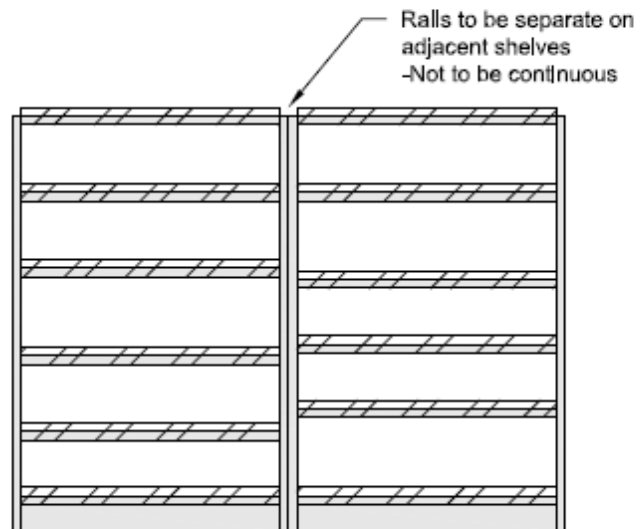


1. Detail - Upper Shelf

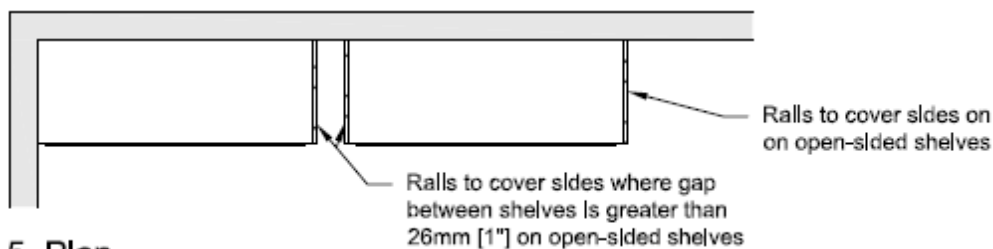
2. Detail - Flush-Mount Lower Shelf



3. Detail - Plexi



4. Elevation



5. Plan

Notes:

- Space Stainless Steel Screws min. 305mm [12\"] o.c.
- Joint & Buff all edges

3.

4. Figure 12 30 00-2

12 36 00 COUNTERTOPS

Laboratory Countertops / Work Surfaces

1. Design to minimize joints. Where possible, tops to be continuous with no open seams.
29. Surfaces to be integral with backsplash wherever possible.
30. All edges to be rounded.
31. Ensure all surfaces meet the requirements for the specified containment level.
32. Acceptable materials (confirm selection requirements with FMGT).
 - i. Solid epoxy resin.
 - i. Stainless steel (minimum 14 ga. Grade 304).
 - ii. Natural stone.
 - iii. Phenolic resin (HPL) .

13 20 00 SPECIAL PURPOSE ROOMS

Custodial Rooms

1. Standard Custodial Room: One Standard Custodial Room with a minimum size of 5.95 m² shall be provided on each floor and wing of all buildings. This room is used for the storage of the custodial cart, standard tools a small scrubber / burnisher and/or other similar-sized tools. Schematic layouts and elevations are provided in figures 13 20 00-1, 13 20 00-2 and 13 20 00-3. The room shall include the equipment and finishes as listed below.
 - ii. Floor Sink: Supplied and installed by contractor. See section 22 42 00- *Custodial Plumbing Fixtures*
 - iii. Chemical Dispenser: Supplied by UVic and installed by contractor. See section 22 24 00- *Custodial Plumbing Fixtures*
 - iv. Coat Hooks: Supplied and installed by contractor. 6 in total, 5 mounted 8" apart as shown in figure 13 20 00-1 and one on back of door. See Section 06 41 02- *Coat Hooks*
 - v. Tool/Mop Holders: Supplied and installed by contractor. Tool/Mop hangers are typically installed on an interior wall adjacent to the mop basin, mounted on a 125 mm wide birch ply panel, with the bottom edge at 1550mm above finished floor. 5 total, spacing to be 150mm apart and 2 must be mounted over the floor sink to capture drips from wet mops such that the outside holder must be mounted at least 150mm from outside edge of sink. See section 06 41 02- *Mop Holders*.
 - vi. Lockers: Supplied and installed by contractor, one double tier 12" wide x 12" deep x 72" high locker seismically braced. See section 06 41 02- *Metal Lockers*.
 - vii. Shelving: Minimum 457mm deep galvanized metal rack shelving supplied and installed by contractor to span the length of one full wall. Seismic bracing required. Standard of acceptance for Shelving is Ezrect Type 1 metal shelving, powder coated uprights and bracing with galvanized shelves. Height and number of shelves required in custodial rooms is project specific and this information can be obtained by collaboration with FMGT Interior Modifications Services and FMGT Custodial Services during design phase. See Section 06 41 02- *Metal Storage Shelving*.
 - viii. Message Board: Cork/Magnetic Whiteboard supplied and installed by UVic.
 - ix. Overhead Lighting- Must be protected (caged) and be bright white, no yellow cast (3500-4500K)
 - x. Electrical Outlets - Must be 20 AMP and GFI protected where possible.
 - xi. Ventilation - Overhead ventilation or door vent at minimum for equipment battery charging

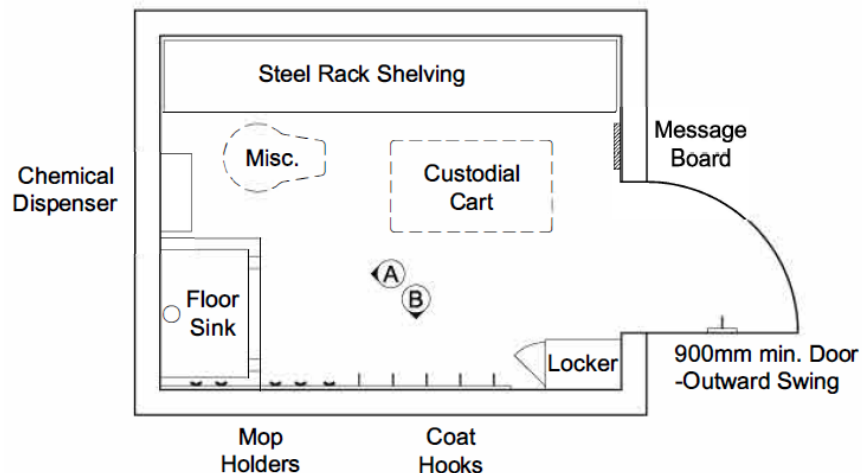


Figure 13 20 00-1: Standard Custodial Room

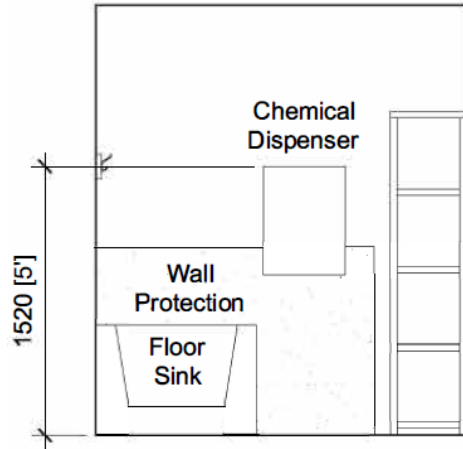


Figure 13 20 00-2: Standard Custodial Room Elevation A

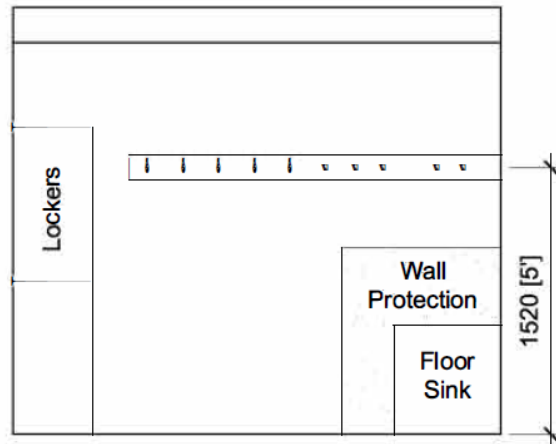


Figure 13 20 00-3: Standard Custodial Room Elevation B

2. Expanded Custodial/Supply Room: One Expanded Custodial/Supply Room with a minimum size of 9.29 m² shall be provided per building for storage of various pieces of commercial cleaning equipment, ½ yard tilt cart (approx. 59"X30"), and to receive / house the entire building's supplies before distribution to standard custodial rooms. Minimum 457mm deep steel rack shelving (see section 06 41 02-Metal Storage Shelving) with seismic bracing supplied and installed by contractor to be installed along 2 walls as per figure 13 20 00-4.

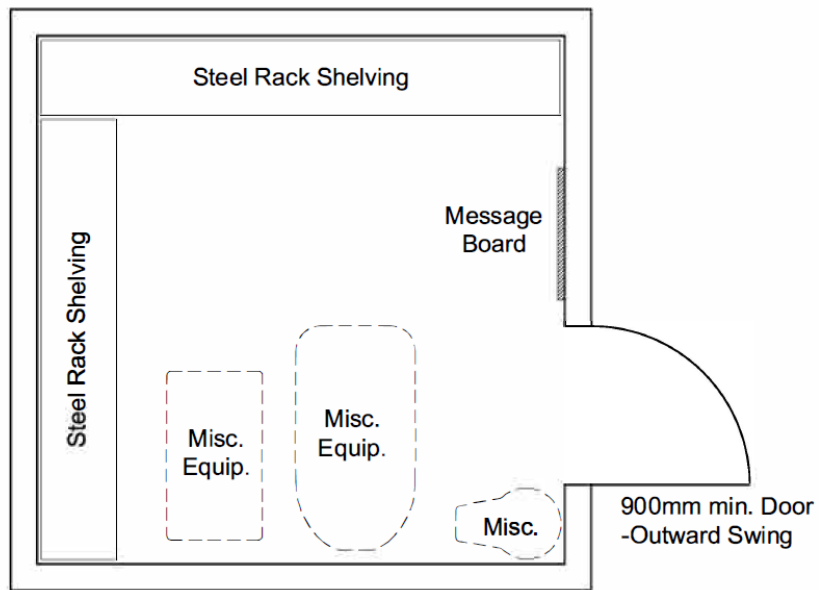


Figure 13 20 00-4: Expanded Custodial/Supply Room

14 20 00 ELEVATORS

14 20 01 GENERAL

Design Considerations

1. Typical elevator use: combined passenger and freight elevator. Design as a passenger elevator. Car shall also be capable of handling standard office furniture, equipment and supplies.
33. Elevators exclusively used for freight shall be designed and designated as freight elevators.
34. Each building shall be equipped with at least one elevator capable to transport a B.C. Ambulance Services stretcher in the prone position, and two attending paramedics.
35. Floor security may be necessary during non-working hours at each floor. Provide capability of key-operated control buttons in cab.
36. Full maintenance service for the entire warranty period of 12 months shall be specified.
37. Provide Traction Elevators in buildings with over 3 stops, or heavy traffic conditions, and Hydraulic Elevators in buildings with 2 or 3 stops, light to medium traffic. Roped elevators are prohibited.

Entrances, Equipment, Car Components and Finishes

1. Markings on both sides of entrance: conventional and Braille.
38. Elevator floor: non-slip and fire-rated; ceramic tile preferred.
39. Baseboards: 300mm high, satin stainless steel, to prevent damage from carts and wheelchairs.
40. Car front, operating panel, handrail and entrance (frame and door) finish: satin stainless steel.
41. Specify one set of cab protection blankets and mounting pins.
42. Telephone

Emergency two-way communications device (help push button) – in each elevator cab:

1. The dialer shall be installed in the analogue voice gateway, in the Telecommunications Room.
43. The help button shall be wired to a:
 - i. Junction box, in the elevator machine room in the case of conventional elevators.
 - i. Jack located in a designated panel, in the case of machine room-less elevators. Panel shall be lockable, wall recessed and located in the vicinity of the elevator.
44. Final connections to Campus Security Services shall be coordinated with UVic Telephone Services.
45. Provide long distance telephone to manufacturer for emergency response.

Emergency Power Operation

46. Elevator shall be equipped with a UPS battery system, to provide communication, travel and door opening to the nearest station in the direction of travel, or to the exiting (usually ground) floor.

UVic Identification, Operating and Maintenance Requirements

1. Elevator manufacturer shall provide full service training access to UVic and/or its service agent.
47. Elevator manufacturer shall provide original parts to any third party, for post warranty maintenance.
48. Controllers and other pieces of equipment shall be non-proprietary and fully compatible.
49. Facilities Management will assign a UVic elevator number to the unit(s).
50. The following information shall be engraved on the control station(s) panel:
 - i. Government Installation Number.
 - i. UVic Elevator Number XY.
 - ii. No Smoking.
51. Floor numbering on control stations shall match building levels. For example where building levels are 0,1 2 the same numbers shall be used on the control station. "B" or "M" shall not be used, a star may be used to identify the main floor.
 2. Exceptions will be used in the cases of mezzanines split levels and elevator landings that do not conform with building levels. In the case of mezzanines the number shall be followed by "M". In elevators that reach the same level at two points the number may be followed by "F" (front) and "R" (rear). In the case of a landing that doesn't conform to a building level a descriptor shall be used, for example, "G" to describe a ground level exit.
 3. These details must be reviewed by FMGT and may be overruled by any authorities having jurisdiction.

Acceptable Products

1. Machine room-less Eco-Space from Kone Elevator Company. Approved installer: Kone Elevator.
52. Other acceptable manufacturers:
 - i. Gen 2 by Otis Elevator.
 - i. ThyssenKrupp Elevator Co.
 - ii. Schindler Elevator Corporation – 400A Product.

21 10 00 WATER-BASED FIRE-SUPPRESSION SYSTEMS

21 10 01 FIRE PROTECTION

Coordination Requirements

1. Coordinate with the University of Victoria (UVic) Facilities Management – Plumbing Shop.
53. Contact UVic Facilities Management for water supply information from the UVic water model.
54. Coordinate verification of the sprinkler system with UVic Plumbing Shop. Contact UVic Facilities Management in advance of verification to provide opportunity for Plumbing Shop personnel to be present during verification. If a Code Consultant has been retained, coordinate design with their recommendations.

General

1. Submit to UVic, Facilities Management a design philosophy for the proposed building fire protection systems. Major components of the philosophy must be accepted in principle by Facilities before the project can proceed to construction. Consultants are expected to produce designs that meet user needs and allow Facilities Management to continue to meet those needs in the future in a safe efficient manner.
55. New buildings shall be fully sprinklered regardless of code requirements. Renovated facilities in fire sprinklered buildings shall be designed to maintain the fire sprinkler protection. Generally, renovated facilities in non-fire sprinklered buildings will not require fire sprinklers but may require roughed-in fire sprinkler piping to accommodate future building fire sprinklers.
56. UVic is largely self-insured and has a policy to manage risk and enhance the safety of its facilities to the benefit of faculty, staff, students, and visitors. Fire sprinkler protection at the University shall be consistent with standard industry practice with reasonable deviations to increase system longevity and provide flexibility for subsequent renovations.
57. Clearly determine with Facilities Management in advance whether the systems will be designed under Scenario 1 or Scenario 2 of the B.C. Building Code and whether or not the services of a Code Consultant are required.
58. NFPA Codes (latest edition) and the B.C. Building Code shall be used to determine level of protection required.
59. UVic campus straddles two jurisdictions – Saanich and Oak Bay. The specific jurisdiction that a particular building is in will be the authority having jurisdiction.
60. UVic's fire protection systems shall meet latest applicable NFPA codes and the authority having jurisdiction policies in effect.
61. All fire protection systems shall be designed by Consultant firms and Professional Engineers specializing in fire protection design. Mechanical Engineers wishing to undertake the designs must demonstrate that they possess fire protection design experience. The intent of this requirement is to ensure that designs not only meet the minimum code requirements but meet specific building requirements which can only be evaluated by an expert in the field.

62. All contract documents and “as built” drawings must meet criteria outlined in NFPA 13. All calculations must be sealed by a Professional Engineer registered in British Columbia.
63. Provide fire hydrants to meet UVic and Saanich / Oak Bay requirements.
64. Information on water supply available for fire-fighting must be obtained through UVic Facilities Management which has a model for the UVic water system (Focus Engineering).
65. Do not specify Halon Systems. Pre-action and clean agent systems shall only be provided where the need is coordinated in advance with Facilities Management.
66. Coordinate with Electrical Consultant for the fire alarm panel monitoring requirements for flow switches and valves and for heat tracing and alarming of wet pipes exposed to freezing conditions.
67. Typically conceal all piping (but not necessarily standpipe risers in stairwells). Coordinate with the Architect for chases and enclosures to conceal the piping where necessary.
68. Final Function Testing
69. Certify fire systems have been tested to meet requirements of authorities having jurisdiction.
70. Insulate or conceal work only after testing and approval by authorities having jurisdictions and the Fire Protection Design Engineer and after the Plumbing Shop has been given notice and the opportunity to review.
71. Conduct tests in presence of the Fire Protection Design Engineer and authorities having jurisdiction who wish to be present.
72. Coordinate verification of the sprinkler system with the Plumbing Shop. Contact UVic Facilities Management in advance of verification to provide opportunity for Plumbing Shop personnel to be present during verification.
73. Test fire systems in accordance with authorities having jurisdiction and as required by applicable codes.
74. Operate all control valves to verify proper operation of the valve and associated tamper switch.
75. Operate all test connections to verify water flow switch operation.
76. Provide project record drawings and maintenance manuals to Facilities Management prior to building turn-over.

21 30 00 FIRE PUMPS

21 30 01 GENERAL

Fire Pump

1. Design systems to avoid the need for a fire pump. Specify a fire pump only where the system cannot reasonably be designed without one and only after consulting with Facilities Management.
77. Where a fire pump is provided include a metered bypass for testing the fire pump.
78. When centrifugal pump is used as a fire pump is shall be installed in accordance with section 23 21 23.

Painting

1. All exposed fire protection piping and equipment shall be painted red.
79. Specify at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work (pewter gray).

System Drains

1. System drains shall be piped to drains sufficient to handle the full anticipated flow.
80. Building Fire Protection Water Service
81. Provide a single combined domestic/fire protection water service to a building unless there is a compelling reason to provide two separate services.
82. Sprinkler system drains should discharge to a sanitary sewer drain, not a storm drain.

Spare Parts and Cabinet

1. Specify spare parts to suit the critical requirements of the project.
83. Specify the following spare parts at minimum:
 - i. Sufficient numbers (minimum of 6) of spare sprinkler heads of each type used on the project.
 - i. Sprinkler wrench, recessed head socket type with ratchet, to fit all sprinkler heads.
 - ii. One set of packing and one casing joint gasket for each pump.
 - iii. Provide a red cabinet with name plate "SPARE SPRINKLERS" suitable for storing the spare sprinklers and wrenches.

Signs

1. Provide all control, drain and test valves with signs hung by a chain identifying the type of valve, the area (floor or portion of the building) affected by the valve and whether, "Normally Open" or "Normally Closed". Submit the wording to UVic Facilities Management for approval.

Pressure Gauges

1. Gauges shall be minimum 85mm (3 ½”) diameter, bourdon type pressure gauge, 0-200 psi or 0-250 psi.

Fire Sprinkler systems/Standpipes

1. Zone control valves may be concealed if a sufficiently sized access panel is provided to allow for maintenance and testing. Coordinate location with Facilities Management.
84. Provide a shut-off valve (to be easily accessible and visible) at the base of each standpipe riser. Do not locate in crawl space.
85. A building with a standpipe system shall have a flow switch monitored for trouble alarm in the main to detect flow from the standpipe.
86. Pipe shall be ferrous to NFPA 13 except drain pipe may be copper to NFPA 13. Do not use plastic piping.
87. Flexible head drops shall not be used.
88. Ring type hangers are not acceptable.
89. Snap-let type fittings are not acceptable.
90. Provide chrome plated fire hose valves in finished areas.

Sprinklers Subject to Freezing

1. Where sprinkler main piping is wet and subject to freezing, provide heat tracing connected to the fire alarm panel with high/low temperature monitoring. Coordinate with the Electrical Consultant.

Dry Pipe Alarm Valve

1. Dry pipe alarm valves, trim packages, accelerators and air maintenance devices, shall all be of the same manufacturer.

Inspector's Test and Drains

1. For each zone provide an inspector's test and drain in a lockable panel, cage or room not subject to vandalism. The discharge shall be into a drain riser on a multi-storey buildings.

22 01 01 GENERAL REQUIREMENTS

General

1. All plumbing shall comply with the B.C. Plumbing Code.
2. Avoid the use of storm pumps and sanitary sewer system pumps. Refer to 22 13 29 for details.
91. All necessary storm and sanitary pumps shall be tied into emergency power, and sump levels shall be monitored electronically through the B.A.S.
92. All sanitary sumps within buildings must have gas tight covers and be vented to outdoors.
93. Floor drains connected to sumps must have backwater valves.
94. Specify floor drains only in public washrooms and where automatic flushing devices are used. Do not use floor drains in private washrooms.
95. Review acid waste requirements with Facilities Management.
96. All plumbing equipment requiring annual or more frequent maintenance must be readily accessible. Provide minimum 900mm clearance around equipment. Do not install piping in such a way as to interfere with the removal of equipment.
97. Install curbs and housekeeping pads under equipment and around pipe penetrations in mechanical rooms.
98. Where solar collectors are planned and contemplated, consult with Facilities Management for approval of concept. Panel locations shall be readily accessible for maintenance.
99. Backflow prevention is required on all primary water supplies into buildings, for zone isolation in labs, and for point-of-use on equipment (refer to CRD requirements). Consult with FMPL for approval of locations and discuss with CRD.
100. Provide cleanouts as per the BC Plumbing Code. All cleanouts must be accessible.
101. Provide self-adhesive color coded dots 6mm in diameter to delineate ceiling access.
102. As built drawings must accurately reflect the installation of the piping and all appurtenances and not be regurgitated IFT drawings.
103. Where domestic water and fire sprinkler systems are supplied from a common main, each system will have its own shutoff valve.
104. Re-use of fixtures is not allowed.
105. All equipment must be shown to be accessible and functional.

22 10 01 GENERAL

Plumbing Piping Type

1. Domestic water piping shall be type L hard drawn copper tubing to ASTM B88 or type L copper pipe to ASTM B42.
106. Fittings shall be copper to ASTM B16.18, brass to ASTM B16.22, press type, or solder joint.
107. Do not specify flexible drainage pipe.
108. Do not specify PVC pipe under traffic areas with less than 30 in. of cover.

Piping Tests

1. Provide a hydrostatic test on all new piping at 1380 kPa (200 psig) for 3 hours.
2. Provide written proof of hydrostatic tests.

Non-Potable Water

1. Determine with Facilities Management whether the treated water, or piping for future use, should be included in the project.
2. Note: Wastewater from the Outdoor Aquatic Facility is cleaned and chlorinated and piped to a portion of the campus, where it is available for non-potable use. Facilities Management has a set of guidelines for its use and the design of the system.
If a building is designed for use with treated waste water, the design must include the ability to convert to municipal water.

If treated water is not being extended to a new building, consideration should be given to piping the water supply to the water closets and urinals, separately from the rest of the building domestic water piping, so that implementing treated water in the future does not require re-piping the building domestic water. The best use is for central heavily used washrooms
- 3.

22 11 19 DOMESTIC WATER PIPING SPECIALTIES

Cross Connection Control

1. Cross connection control shall be carried out in accordance with the Capital Regional District Bylaw No. 3516.
109. Following installation, a test report completed by a certified tester shall be submitted to the Owner, and the Capital Regional District indicating satisfactory operation of each device.
110. Tests are to be conducted well in advance of date of the date of substantial completion.
111. Provide one repair kit for every cross connection control device installed.

112. Dual premise backflow preventers are required on primary water supplies into the building. This is to facilitate annual testing without shutting down the building water supply. Equipment shall be installed in accessible locations. Isolation valves are required for backflow preventers.
113. Specify strainers with blowout valve, for all domestic water systems upstream of the premise backflow preventers.
114. The Standard of Acceptance is Watts. Epoxy coated cast iron is not acceptable.

Trap Primers

1. Provide trap priming for all floor drains and for hub drains
115. Proceeding from most preferred to least preferred:
 - i. Consider a DDC controlled control valve system of trap priming with backflow prevention for a single trap. The standard of acceptance is Zurn Z-1020.
 - i. With backflow prevention for a single trap where a regularly used plumbing fixture is close by, a trap primer with a fixed air-gap accessory is required. The standard of acceptance is Zurn Z-1022.
 - ii. For a single trap where a regularly used plumbing fixture is not close by, a trap primer that adjusts for a continuous slow drip is required. The standard of acceptance is a Precision Plumbing Products Model PO-500.
3. Locate Trap primers must be easily accessible for service. Unions and isolating valves must be used to facilitate replacement. **DO NOT** install in walls.

Cold Water Pressure Booster Systems

1. If any project requires a booster system, consult Facilities Management for water supply details.

Isolation Valves

1. Provide isolation valves as close as practical to each fixture for each group of plumbing fixtures:
 - i. At each main branch supply point.
 - i. At each piece of equipment.
 - ii. As required by the applicable codes and bylaws.
 - iii. Hose bibs
2. As built drawings must show all actual valve locations.

Drain Valves

1. Shall be specified at low points and at section isolating valves.
2. Shall be ball type, bronze, NPS 3/4 in. minimum, with male hose end, complete with cap and chain.

22 13 00 FACILITY SANITARY SEWERAGE

1. Due to the use of low/ultra low flow fixtures, the slope on all drain pipe 4 inches in diameter and under, will be 2%.
1. When finished, all sanitary lines will be inspected with a camera to ensure that they are free of debris and flowing water in the right direction. This information will be recorded and stored on a memory stick/zip drive.

2. Cleanouts must be present at the end of all branch lines.

22 13 29 SANITARY SEWERAGE PUMPS

Pumping of Sewage

1. Sewage pumping systems are undesirable and every reasonable effort must be made to design a building project that incorporates gravity sewerage systems. If, however, gravity systems are not possible then do the following:
 - i. All portions of the building that can be gravity drained shall be gravity drained.
 - i. Provide a high water alarm through the BMS.
 - ii. Where a source of emergency power is available, pumps and controls shall be connected to emergency power.
 - iii. All floor drains at or below the flood level of sewer sump pump shall have backwater valves.

Pumps Seals

1. Specify mechanical seals compatible with intended service on all pumps.

Centrifugal Pumps

1. If centrifugal pumps are used their installation shall comply with section 23 21 23.

22 14 26 ROOF DRAINS

1. Consider possible roof deflections when positioning roof drains. Do not locate drains near beams and columns which tend to become high spots on flat roofs with minimum slopes.
116. Provide minimum of 2 roof drains to all major roof areas as insurance against clogging and flooding (e.g. two at 75m diameter preferred even if 1 at 100mm diameter will do).
117. Where roof areas are enclosed by parapet walls, coordinate with Architect for provision of scuppers for relief in emergency flooding situations as per the B.C. Plumbing Code.
118. Roof drains must be located 2m from the edge of the roof. If not, then the roof design must include fall restraint in accordance with OH&S guidelines.

22 35 00 DOMESTIC WATER HEAT EXCHANGERS

1. Water heaters with storage capacity of 180L or less and heating capacities of 4.5 kW or less may be electric and shall have a drain pan piped to drain.
119. For larger tanks and heating capacity, the heat source shall be the campus heating mains. The maximum required domestic hot water temperature shall be 60°C (140°F). Where hotter domestic water is required it shall be boosted from 60°C (140°F) using a heating source other than the campus heating mains. Natural gas or other service over electric is preferred. Temporary hot water source (140°F) for low occupancy periods (i.e. summer break) should be installed to accommodate central heating plan shutdowns for maintenance service.
120. For tanks heated by campus heating mains and where interruption of domestic hot water service is particularly problematic (e.g. food services, laboratories), provide two brazed-plate, double-wall heat exchangers in parallel with isolating valves so one can be removed for cleaning while the other remains in service. Otherwise provide a single brazed-plate, double-wall heat exchanger. Consider multiple 450L glass-lined, insulated storage tanks or single stainless steel tank.

DHW Recirculation Automatic Flow Valves

1. Domestic hot water recirculation valves shall be pressure independent constant flow, factory set, stainless steel. Standard of acceptance: Griswold standard flow cartridge.
121. Select valves flow settings for minimum flow required to maintain warm water throughout the system and size the recirculation piping and pump accordingly.

DHW Recirculation

1. Provide sufficient balancing valves to ensure adequate flow through each domestic hot water recirculation branch to maintain hot water.
122. DHW recirculation pump controls on the DDC with return water temperature sensor point.

22 40 00 PLUMBING FIXTURES**22 41 00 RESIDENTIAL PLUMBING FIXTURES**

Plumbing Fixtures – Private

1. Water Closets:

- i. Tank type: Floor mounted.
- i. Capacity: 4.5 – 6 lpf, processing minimum 500g of solids.
- ii. Colour: White
- iii. Seat: Closed front; white.
- iv. Trims: Chromed Brass.
- v. Standard of Acceptance is American Standard.

2. Lavatories:

- i. Vitreous china. Standard of Acceptance is American Standard or Gerber.
- vi. Trims: Single lever, brass body. Standard of Acceptance is Moen.

123. Showers:

- i. Solid surface shall be acrylic or fibre glass.
- vii. All accessible showers and all showers in lockable rooms shall be grouted under the base to prevent deflection.
- viii. Accessible shower trim shall be compliant with CSA B651.

124. Accessible Water Closet

- i. Accessible water closets shall provide suitable back support for the user.
- ix. Water closet with tank: provide bolted connection for lid to tank and ensure tank design is suitable to act as a support.
- x. Water closet without tank: provide a toilet seat with adequately positioned wall support to provide support to the user.
- xi. Standard of Acceptance is A.S. Madera.
- xii. Where treated waste water or reclaimed water is used, select flush valves designed specifically for treated waste water. Standard of Acceptance is Sloan.

Food Services

1. Standard of acceptance for trims: T&S Brass.

Laboratory Plumbing Fixtures

1. Most existing laboratories constructed or renovated before 2009 have Tech/Cambridge Brass trim with corrosion resistant finish. More recently (when that finish was no longer available) Tech/Cambridge Brass trim with chrome finish has been used or Water Saver. This trim includes water faucets, compressed air and gases outlets both inside fume hoods and wall or counter mounted except that chrome finish has not been used in fume hoods.
125. Where a renovation requires only a very few fixtures and there are others remaining, check with the Plumbing Shop to determine if they have in stock matching trim available to be used for the renovation. If not, evaluate the relative corrosion potential for the installation and select trim to match the existing with chrome finish unless the corrosion potential is high and in that case select Water Saver with suitable finish.

126. Trim for sinks are typically hot and cold gooseneck pull down spring type with type handles, except for ADA trim which shall have blade handles, vacuum breaker and tapered, barbed nozzles except sometimes aerator type outlets for wash-up sinks. Many outlets had aspirators in the past but consideration shall be given to compressed air aspiration (check with Facilities Management). Some sinks require distilled/deionised water outlets. They are typically gooseneck type.
127. Laboratory sinks are typically 316 stainless steel with counter-top flange (although with suitable counter and where coordinated with the Architect, under-counter mount is acceptable), no ledge-back, cross strainer outlet. Standard of acceptance is Aristaline. Acceptable manufacturers are Architectural Metal Industries, Franke, and Steel Queen.

22 42 00 COMMERCIAL PLUMBING FIXTURES

Plumbing Fixtures – Public

1. All plumbing fixtures at UVic are considered “Public” except for those that are in individual residential suites. Fixtures must not be accessible through a wireless connection
128. Water Closets:
 - i. Wall Hung.
 - i. Standard of Acceptance is American Standard.
 - ii. Standard of Acceptance for seats is Bemis.
 - iii. Standard of Acceptance for trim is hands-free, chromed brass by Sloan.
 - iv. Capacity shall be 4.5 – 6 lpf, processing a minimum of 500g of solids.
129. Urinals:
 - i. Standard of Acceptance is American Standard.
 - v. Waterless urinals are not acceptable.
 - vi. Standard of Acceptance for trims is hands-free, chromed brass by Sloan.
130. Lavatories:
 - i. Vitreous China.
 - vii. Standard of Acceptance is American Standard.
 - viii. Standard of Acceptance for trims is hands-free, chromed brass by Sloan.
131. Power for the hands free controls shall be building power (on standby power where provided for that building). Battery-powered units are not acceptable even where automatic recharging is included in the fixture.
132. Showers:
 - i. Solid surface shall be acrylic or fibre glass.
 - ix. All accessible showers and all showers in lockable rooms shall be grouted under the base to prevent deflection.
 - x. Accessible shower trim shall be compliant with CSA B651.
133. All fixtures shall be white and colour-matched (there is a variety of whites) where within a single room.
134. All washroom fixtures within the building shall be of the same manufacturer.
135. Specify water conserving type of fixtures and trim.
136. Provide chrome plated, hot and cold hose outlet under the lavatory counter (preferably in the male washroom) for each group of public washrooms. Standard of acceptance: Delta 28T8183.

Custodial Plumbing Fixtures

1. Floor Mounted Sinks:
 - i. Moulded stone, concrete, resin or similar type
 - ii. 600mm x 900mm.
 - iii. Drop Front preferred.
 - iv. Where a sink or water source is included in a custodial room, ensure the surrounding walls are --protected using a waterproof covering up to 42" and ensure the wall protection extends at least 300mm past sink edge.
 - v. Standard of acceptance for the sink is [Fiat TSB3003 36" X 24" STOCKTON TERRAZZO MOP BASIN](#). Acceptable manufacturer: Williams.
2. UVic will provide an automatic J-Fill QuattroSelect cleaning solution/chemical dispenser to be installed by contractor. Provide a separate 1/2" RPBA water connection with backflow prevention for chemical soap connection. Can be attached to hot/cold faucets, or plumbed with a separate "cold only" supply line.
3. The faucet shall be reinforced and be complete with a pain hook. The mixing of hot and cold water shall be manual. Standard of acceptance for the faucet is Delta 28T-2383.

137.

22 45 00 EMERGENCY PLUMBING FIXTURES

1. Standard of acceptance for emergency eyewash/shower stations shall be: Haws 8330 SS Shower Eye/Face Wash.
2. Water supply at all emergency eyewashes shall be tempered to 22°C +/- 2°C and shall flow at the specified rate (ANSI Z358.1) for a period of > 15 minutes, with temperatures not varying outside of a range between 15°C and 30°C.
3. All piping and fittings connecting to, and in the construction of emergency eyewashes and showers, shall be stainless steel. No substitutions are allowed. Plastic components are not allowed.

138. Eyewash shall be specified as eyewash only not face and eyewash combination.

139. Emergency showers/eyewash stations:

- i. Shall have "stay open", hand-controlled valves.
- i. Shall each have a floor drain plumbed in, complete with trap primers for new construction. Existing construction is exempt.

140. Mixing valves shall be brass.

141. Temperature mixing valves:

- i. Serving individual, sink-mounted eyewashes shall be located under the sink to be accessible for service and with the temperature gauge readily visible.
- ii. Serving showers or multiple devices shall be mounted in a secure location to be accessible for service:
 - i. Height 610mm (2') to 1520mm (5').
 - ii. Recessed flush into a wall.
 - iii. Enclosed in an 18 gauge, 304 stainless steel cabinet measuring 18" x 16/5" x 7".
 - iv. Fixed with a piano-type hinge.
 - v. See Figure: 22 45 00 – 1 Temperature Mixing Valve Placement.

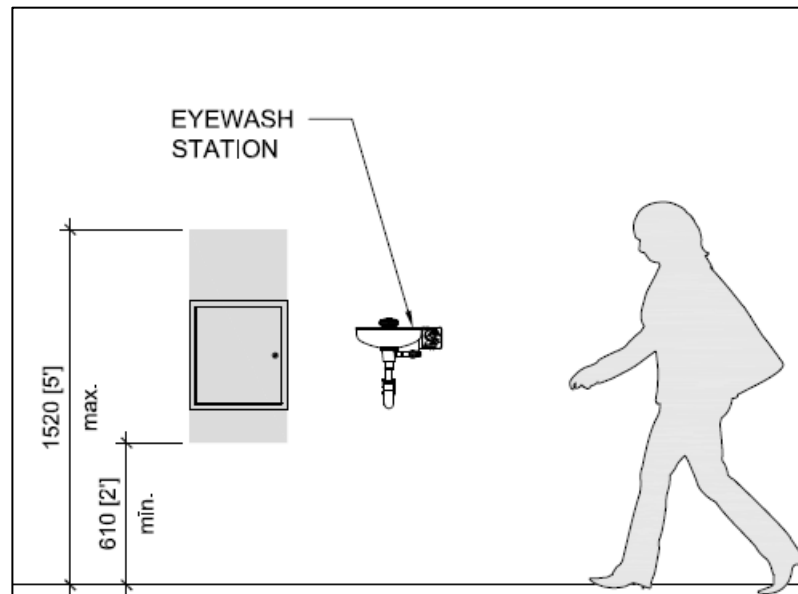


Figure 22 45 00 – 1 Temperature Mixing Valve Placement

22 47 00 DRINKING FOUNTAINS AND WATER COOLERS

1. All buildings over 600 gross square metres shall have at least one accessible drinking water fountain, located in a public area. The drinking fountain should include an appropriate fixture for filling water bottles.
142. Drinking water fountains shall not be cooled.
143. Drinking water fountains shall not have filters (no backflow preventers will be required).
144. Drinking water fountains shall only be located inside buildings at level 1 entrance lobbies and should be visible from the exterior.

22 66 00 CHEMICAL-WASTE SYSTEMS FOR LABS & HEALTHCARE FACILITIES

Acid Waste

1. The Elliott, Petch, and Cunningham Buildings each have an acid waste piping system. There is a University laboratory policy of not putting any unacceptable waste down drains. As of 2010 the issue of whether laboratory plumbing renovations should connect to that system with acid resistant piping or non-acid resistant piping is under review. In the meantime all connections to these systems shall be with materials designed for acid waste. For each project, confirm in advance of design the status of that decision.
145. Do not specify plastic piping for use in building except for acid waste systems.
146. All buried acid waste systems piping shall be glass type.

22 67 13 PROCESSED WATER PIPING FOR LABS & HEALTHCARE FACILITIES

Plumbing Specialty Piping – Distilled and Deionized Water systems

1. In each of the Elliott and the Cunningham Buildings there is a distilled water system. PVC piping shall be used to extend or modify the system.
147. In the Petch Building there is a deionised water (reverse osmosis) system. It is a loop with constantly circulating water. Extension or modification shall maintain the single loop flow. Single pipe branches to outlets shall be kept as short as practical. Modify or extend with PVC.
148. FMGT will coordinate any temporary shutdowns of the existing systems as required.
149. Where users provide purifiers, pipe the distilled water to them.
150. Used distilled water compatible with outlets/faucets.

23 01 00 OPERATION AND MAINTENANCE OF HVAC SYSTEM**23 01 01 GENERAL REQUIREMENTS**

General System Design

1. Use air systems in combination with perimeter radiation. Perimeter radiation shall be capable of being operated independent of the air system.
151. Avoid all air systems.
152. Zone mechanical systems by intended occupancy, separate interior and exterior zones.
153. Provide re-heat coils in each interior zone.
154. All air handling units shall have heating or preheat coils even if building load indicate that one is not required.
155. Proposed fan volume control schemes, based on building static pressure, must have prior approval from FMGT.
156. Do not specify variable pitch in motion fans.
157. Design all air handling units with minimum 15% spare volumetric and static pressure capacity.
158. Buildings with no mechanical cooling (typical) shall have cooling circulation air increased by minimum of 25% or have sufficient volume to meet WCB requirements with respect to maximum space temperature, whichever is greater. Consider additional costs of construction and compare to cost of adding and operating mechanical cooling.
159. Radiant heating panels shall not face windows.
160. Provide separate exhaust to all photocopier rooms or areas. Exhaust to outdoors.
161. Ensure sufficient air mixing within the occupied space on VAV systems under all operating conditions.
162. VAV systems shall have reheat coils.
163. Window mounted air conditions and exhaust fans are not acceptable.
164. All exhaust ductwork within the building shall be under negative pressure.
165. Specify separate ventilation and heat recovery systems for mechanical and electrical rooms.
166. Do not specify sidewall supply registers for classroom applications.
167. Laboratory design shall meet best practices of applicable ASHRAE design standards, and/or the equivalent CSA standard recognized by the B.C. Building Code.
168. Return and supply fans requiring volumetric tracking shall have same type devices for volume control (i.e. inlet dampers must be only used with inlet dampers, VFD's with VFD's, etc.).

169. If fume hood exhaust systems are located in mechanical penthouses they shall be located in separate self-contained areas within the mechanical penthouse.
170. Where fume hood fans are contained within mechanical penthouses, pressurize the penthouse with supply air from the building from a safe outside source to avoid the possibility of recirculation exhaust air into the service space and to provide flushing of contaminants if a minor duct leak occurs. Fumes from industrial lab process shall be removed from spaces by the use of dedicated exhaust systems (not recirculation permitted).
171. Ventilation systems shall be designed to limit bio-contamination. Spaces containing “like-risks” can share ventilation systems, while bio and chemical ventilation systems shall be separated to avoid cross contamination.
172. Humidification shall be applied to each specific zone which requires local control. Avoid upstream humidification and downstream dehumidification.

Piped Systems Cleaning

1. For the campus heating mains, process water lines or chilled water lines, retain the services of a professional cleaning agency to supervise the chemical cleaning and flushing of the new piping. FMGT Mechanical Shop will provide the subsequent chemical treatment.

23 01 30 OPERATION AND MAINTENANCE OF HVAC AIR DISTRIBUTION

Cleaning Exhaust Systems – General Requirements

1. All new ventilations systems, or those affected by the project shall be cleaned by a professional cleaning Trade Contractor with appropriate equipment and trained personnel.
173. The following air systems shall be cleaned as specified by the Mechanical Consultant:
 - i. Supply, return, relief, and exhaust.
 - i. Air conditioning.
174. All components within each new or affected system shall be thoroughly cleaned to the Consultants satisfaction.
175. On new construction, renovation, or retrofit project, the ductwork shall be cleaned before the air systems are balanced or calibrated.
176. All damper positions shall be marked before cleaning and returned to their original position unless the system is to be balanced.
177. Cleaning shall generally include high capacity power vacuum, compressed air or wire brushing. Solvent cleaning is to be avoided.

Filters

1. The Cleaning Contractor shall replace any temporary or existing filters and supply and install new filters as specified by the Consultant after the air system is cleaned.

23 07 19 HVAC PIPING INSULATION

1. Insulation shall be installed by qualified insulation fitters.
178. Insulation shall be installed in accordance with the requirements and recommendation of B.C. Insulation Contractors Association Manual.

Campus Heating Mains

1. This system may operate with up to 116°C (241°F) water.
179. Provide minimum 50mm (2") thick, mineral fibre insulation on piping (not drains) with vapour barrier jacket and where trenches or manholes provide a generous coating of water-proofing sealer.
180. Mains valves 65mm (NPS 2-1/2) and larger shall have bonnets insulated with removable insulation jackets.

Refrigeration Piping (Including Chilled Water)

1. Where installed outdoors, provide a continuous aluminum jacket finish (to prevent birds removing the insulation).
181. Provide closed-cell insulation and best industry practice to seal surface at all locations including hangers and exposed fittings.

Insulation Finish

1. Provide aluminum jacket over all outdoor insulation.
182. Provide an all service jacket and pre-fitted PVC jacketed elbows and fittings for all indoor insulated pipes with the exception of:
 - i. Provide a "Thermocanvas" type finish and pre-fitted PVC jacketed fittings on all piping in mechanical rooms and where exposed to occupant view.

23 10 00 FACILITY FUEL SYSTEMS**23 11 00 FACILITY FUEL PIPING**

Campus Heating Mains

1. All piping shall be Schedule 40 steel to ASTM A53 Grade B.
183. All piping shall be welded except manual air vent and drain valves may be screwed and piping downstream of them may be screwed.
184. Manual air vent and drain valves shall be ball valves with wing-type (not lever-type) handles.
185. There shall be no high or low point in the piping between heating mains manholes. If this cannot be avoided then air vents/drains must be provided at the high/low point.
186. Valves (other than air vent and drain valves) shall be class 150 ball valves. 150psig/400°F. $\geq 1\ 1/2$ " must be equipped with gear driven operator to slow speed to open valve. ≥ 4 " to have 3/4" gate bypass for warmup.
187. For the most part these mains run underground. Where underground they shall run in a concrete trench typical in design and construction to the existing which are designed for water-tightness and to have removable lids.
188. Mains valves, drain valves, and vents shall be in accessible manholes or in building mechanical rooms.
189. Where possible arrange take-offs for a building to be valved such that future shutdown of a section of the mains will not interrupt service to the building.

Building Heating, Heat Recovery, and Chilled Water Piping and Valves

1. Piping may be steel to ASTM A53 Grade B or type L copper, to ASTM B88M-86.
190. Connections for steel pipe shall be welded and flanged on pipe NPS 2-1/2 (65mm) diameter and larger shall be screwed on pipe NPS 2 (50mm) diameter and smaller.
191. Connections for copper pipe shall be brazed with silver base brazing alloy, 538°C (1000°F) melting point but with soldered to screwed cast bronze fittings (to ANSI B16.18) or wrought copper fittings (to ANSI B16.22).
192. Grooved mechanical couplings are not acceptable.
193. Press-fit type couplings are not acceptable.
194. Valves NPS 2-1/2 (65mm) and larger shall be flanged. Valves NPS 2-1/2 (65mm) and smaller shall be soldered or screwed.
195. Butterfly valves may only be used on heat recovery systems or chilled water systems or heating water systems where the maximum design temperature does not exceed 180°F (82°C).

196. Balance valves shall be multiple-turn, memory stop, positive shut-off with inlet and outlet pressure connections, calibrated for flow measuring. Acceptable products: Armstrong CBV, Tour & Andersen STA.

23 20 00 HVAC PIPING AND PUMPS**23 21 13 HYDRONIC PIPING**

1. All hydronic heating systems within a building must have shutoff valves on each floor, complete with drain valves and ¾ inch hose connections.

23 21 23 HYDRONIC PUMPS

General

1. Where Manufacturer's Specifications are provided, the assembly, installation, alignment, testing, calibration and lubrication, start-up and test run shall conform to the Manufacturer's Specifications, or this specification, whichever is more stringent.
2. In this section the following words shall have the meanings herein assigned to them:
 - i. *Primary equipment* shall mean the first item of machinery set into place whether or not it is a pump, a refiner, or the common drive on a multi-vacuum pump assembly.
 - i. *Drives* shall include turbines, motors, couplings of all types, reducers, sheaves, sprockets, V-belts and chains.
 - ii. *Equipment* shall include both the driver and driven items.

Care of Equipment Prior to Installation

1. Equipment with openings, such as pumps, fans, refiners, screens and similar equipment, shall have the inside examined, any foreign matter removed, and defects shall be reported to the Engineer. Any temporary or permanent covers removed for inspection shall be replaced.
2. All equipment shall be inspected in the place of storage to ensure that it is in good condition, report any damages or defects to the Engineer prior to transporting the equipment to its prescribed location.
3. If the equipment is not in good condition or requires modification, the repairs and modifications shall be done prior to transporting the equipment to its prescribed location.

General Installation Requirements

1. Washers shall be installed under all nuts and under bolt heads when slotted holes are encountered.
2. Beveled washers shall be used on tapered surfaces such as structural steel flanges.
3. Equipment bolted to frames and structures shall have the bolt heads on top of the connecting components so that the bolts will not drop out of the holes in the event of a nut working loose.
4. After tightening of nuts on bolts or studs, the length of exposed bolt shall be not less than the equivalent of two threads and not more than the thickness of one nut.
5. Machine bolts, nuts and keys shall be coated before being assembled with an Owner approved lubricant, which shall be free of potentially toxic materials and metal compounds.
6. Equipment shall not be altered or repaired, and no burning or welding will be permitted on any parts except with the written permission of the Engineer.

7. Couplings, sheaves and sprockets shall be fitted during Stage 1 "Set in Place". Unless specified otherwise, they shall be fitted as follows:
 - i. Couplings shall fit flush with the end of shaft, unless otherwise noted in "Plant Conditions".
 - i. Sheaves and sprockets shall have a shaft protrusion of ¼"
8. The hubs of couplings, sheaves and sprockets shall have interference fits with the shafts, all in accordance with ANSI B4.1 (imperial) or B4.2 (metric). The interference fits shall be recorded in the presence of the Engineer on a record sheet. Compression type hubs (taper lock) shall be mounted in accordance with manufacturer's specifications.
9. Sealing and cooling water piping discharges from equipment shall be visible.
10. Couplings shall be aligned following Stage 4 "Alignment". Tolerances shall be as per this specification.

Installation Sequence

1. To ensure that each stage of the sequence is completed by the Contractor and checked by the Engineer before the next stage commences, the Engineer shall attach a Mechanical Equipment Tag to each piece of primary equipment as it is received on site.
11. After the contractor has completed a stage he shall advise the Engineer.
12. When the Engineer is satisfied the stage is complete, both he and the contractor will sign the tag.
13. The Engineer will also maintain a separate record for each piece of equipment in case a tag is lost or damaged. The contractor will be required to sign the Engineer's record for each stage of the installation that has been completed and for which he has signed the tag.
14. On completion of the installation, the Owner's Representative will attach a green Owner Acceptance Tag to the primary equipment to signify the completion of the installation of the equipment.
15. Stage No. 1 "Set in Place"
 - i. *Equipment on Concrete Pads:* Before the equipment is placed, the surface of the foundation that is to be in contact with grout shall be cleaned of all dirt, oil, grease and loose materials, and shall be roughened with a bush hammer. When this work is complete the Contractor will notify the Engineer who will check the foundation prior to setting the equipment in place.
 - ii. *Equipment on Structural Supports or Steel Floors:* Before the equipment is placed, all surfaces to be covered shall be finish coated as per project paint specification.
 - iii. When the equipment has been set in place, the Contractor and Engineer will sign Stage 1, "Set in Place".
16. Stage No. 2 "Levelling of Primary Equipment and Baseplate"
 - i. Levelling of equipment to the location and elevation shown on the drawings shall be done with packing plates and pre-cut stainless steel slotted shims. Wedges shall not be used. Jack screws, when supplied with the equipment, may be used for vertical adjustment to achieve the tolerances specified. Jacking screws should not bear directly on concrete. The size of the packing and shims shall be approved by the Engineer and shall be large enough to provide adequate bearing on the concrete. Solid shims should be used where possible and in no case shall shims be built up to more than 3/16". The number of shims shall not be more than four.

- i. Packing and shims shall be placed on both sides of all anchor bolts within $\frac{1}{4}$ " of the bolt, except where the bolt is mounted in a sleeve, then the packing and shims shall be placed as close to the bolts as possible, leaving space, however, for the introduction of grout into the anchor bolt sleeves.
- ii. For large soleplates, additional packing and shims shall be placed between the anchor bolts where specified by the Engineer.
- iii. Primary equipment alignment shall be within the tolerances specified in this standard. Where process temperatures warrant it, thermal growth of the equipment must be taken into consideration, and proper adjustments to alignment must be done.
- iv. Jacking screws shall only be used to level the equipment and shall be backed off when the equipment is shimmed and anchor bolts have been tightened.
- v. Pumps - Set the pump without motor in place over the anchor bolts. Level to a machined surface (motor mounting surface, pump discharge flange, etc.), within limits +0.003" or -0.000" and hard shim the pump with the suction piping attached. Stress on pump casing shall be within the allowable recommendation limits specified by the vendor. The stress shall be checked by loosening the suction piping and witnessing the dial indicator, located on pump shaft end or half coupling for movement, until satisfied that the pump stress is within limits (+0.002" or -0.002"). Piping will be reattached for later pump alignment, including the discharge piping.
- vi. When the levelling of the primary equipment and baseplate is complete the Contractor shall notify the Engineer and they shall both sign Stage 2 "Levelling of Primary Equipment and Baseplate".

17. Stage No.3 "Grouting"

- i. Recheck the concrete surface to ensure it is rough and free from dirt, oil, grease and loose materials and suitable for grouting
- i. The grouted area must be protected and heated when temperatures are less than 4°C.
- ii. The concrete surface area to be grouted, shall be saturated with water from 12 to 24 hours. Any free standing water must be removed before placing the grout.
- iii. Grout shall be installed so that all voids under a hollow baseplate are filled. Open frame baseplates shall be filled with grout to the top of the frame, or as specified by vendor.
- iv. When grouting is complete, the contractor shall notify the Engineer and they shall both sign Stage 3 "Grouting".

18. Stage No. 4 "Shaft Alignment"

- i. All alignment of drives to equipment shall be done by laser alignment. The laser alignment system shall be the Optalign laser alignment equipment or equivalent, as approved by the Engineer.
- i. All connections of attachments (e.g. piping support systems) must be completed before beginning the alignment. Lugs with jacking screws may be used to assist with alignment.
- ii. Any shimming done at this stage shall be in accordance with shim specifications in Section 4.7.1.
- iii. When both halves of the coupling are rotated together in the same relative position, the soft foot flatness values, angular and parallel alignment values in both planes shall be within the tolerances specified in this standard.
- iv. Soft foot correction is to be completed, corrections made and final results recorded on Soft Foot-Check Sheet and or alignment sheet by the contractor.
- v. All alignment of equipment shall be started and completed on the same day. Following the readings, all connections and attachments must be released and readings rechecked for external loads and forces which may cause misalignment.

- vi. If the attachments cause a deviation from the recorded readings, the attachments shall be adjusted in order to eliminate the forces. (For Tolerances See 4.7.5)
- vii. When the alignment of the equipment and drive is complete, an alignment check shall be done in the presence of the Engineer. The Engineer will read and record the final results on the alignment check sheet. Contractor and Engineer shall both sign Stage 4 "Alignment".

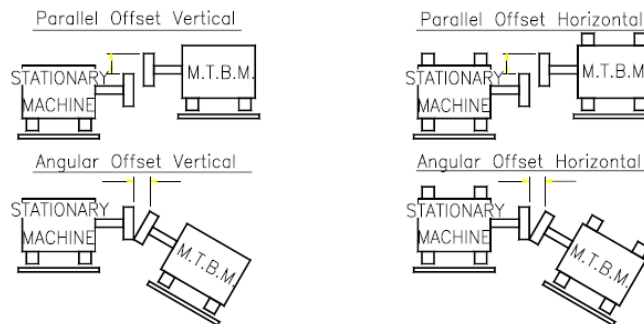
Tolerances for Shaft Alignment

1. When aligning pump shafts use the table below to determine the required tolerances. Record alignment values and submit as part of close out submittals, a template form can be provided by FMGT. Have FMGT operations representative witness and approve final alignment.

Parallel Offset		
RPM	Excellent (mils)	Acceptable (mils)
600	0.005	0.009
900	0.003	0.006
1200	0.0025	0.004
1800	0.002	0.003
3600	0.001	0.0015
7200	0.0005	0.001
Angular Offset		
RPM	Excellent (mils)	Acceptable (mils)
600	0.001	0.0015
900	0.0007	0.001
1200	0.0005	0.0008
1800	0.0003	0.0005
3600	0.0002	0.0003
7200	0.0001	0.0002

Notes:

- 1) Values are expressed in thousands of an inch (mils)
- 2) These suggested tolerances are the maximum allowable from zero or a targeted offset in each of the four parameters of misalignment illustrated below:



23 30 00 HVAC AIR DISTRIBUTION**23 31 13 METAL DUCTS**

Ductwork

1. All ductwork shall be metal, typically galvanized steel. Flexible ductwork is not acceptable.
197. Fume hood duct shall normally be 18 gauge, 316 stainless steel, continuously welded. Exceptionally corrosive situations may require more corrosion resistant materials.
198. Flexible duct of 300mm maximum length is acceptable only on a horizontal branch duct to an individual diffuser to allow alignment with the ceiling grid. It may provide a maximum of 15 degrees change in direction. No flexible duct shall be used for diffuser necks.
199. Ductwork shall be to SMACNA Standards excluding beaded, crimp joints and snaplock seams. Adjustable elbows must be the same gauge as the adjoining duct and only used if all sectional joints are sealed and secured in the installed position.
200. Ducts shall be sealed to SMACNA Seal Classification A or B as appropriate for the rated working pressure.
201. Specify access panel each side of heating coils.
202. Specify filter protection of heat recovery coils.
203. Motorized control dampers are strongly preferred over backdraft dampers.
204. Balance dampers of same material as the ductwork and shall have bushing-type bearings and a quadrant operator capable of locking the damper in a fixed position.
205. Avoid ductwork acoustical liners. Employ other methods acceptable to FMGT.

23 36 16 VARIABLE-AIR-VOLUME UNITS

1. Monitor supply air temperature downstream of every VAV box with a heating coil.

23 37 00 AIR OUTLETS AND INLETS

1. Do not specify balancing dampers at the face of air outlets and inlets. Locate balancing dampers sufficient distance into the ductwork to maintain acceptable sound level within the conditioned space (NC 3035 or less).
206. Coordinate with architectural discipline.

Outside Air Intake Louvers

1. Locate outside air intake louvers as far away as practical from all sources of contamination; avoid locating intakes at loading docks, fume hood exhausts, and generator exhausts. Outside air intake louvers are not to be located on roof tops where fume hood exhausts are located.
207. Locate outside air intake louvers as high as possible above grade and shall not be at grade level.

208. Where below grade intakes are unavoidable install bird/debris screen on outside of the louvers.
209. Where roof top parapets or screening hinder effective cross ventilation exhaust discharges, plumbing stacks and other contaminated discharges shall be elevated above air intakes at a minimum distance proscribed by code/regulation and/or good engineering practices.

Painting

1. Specify corrosion resistant primer paint to ferrous supports and site fabricated work (pewter gray).

Salvage

1. UVic does not have extensive storage facilities for salvaged material. Air conditioners, motors, and variable frequency drives in good condition have previously been considered for salvage. Occasionally a small fan or fume hood in good condition has been salvaged.
210. On renovation projects the Consultant shall submit a list of items to be considered for salvage to FMGT at the start of the design stage. The Consultant shall coordinate with FMGT to determine all materials to be salvaged which shall then be clearly specified.
211. The Mechanical Shop prefers the Contractor to remove the materials and move them to a designated storage place on campus.
212. All materials to be salvaged shall be carefully removed and handled to prevent damage and the Contractor shall obtain a signed receipt from the Mechanical Shop for all salvaged materials.

Photocopier Exhaust

1. Provide exhaust air from photocopier rooms, areas with large photocopiers (larger than a typical office copier) and areas for regular large copy production.

23 40 00 CENTRAL HEATING EQUIPMENT**23 41 00 PARTICULATE AIR FILTRATION**

Indoor Air Quality – Filters

1. Filters for service rooms, protection of heat recovery coils or for small air handling units (less than 500 l/s) shall be minimum MERV 8. Standard of acceptance is 50 mm thick AAF AM-AIR 300. Acceptable product is Farr 30/30.
213. Filters for air handling systems over 500 l/s shall be a combination of a MERV 8 pre-filter and a MERV 13 final filter unless user requirements stipulate a higher value. Pre-filter standard of acceptance: 100mm thick AAF AM-AIR 300. Acceptable product is Farr 30/30. Final filter standard of acceptance, 100mm thick AAF AM-AIR Varicell II. Acceptable product is Farr Econocell.
214. Preference for pre-filter bank to be slide-in type. Final filter bank shall be built up from gasketed, individual filter frames with spring clips.
215. Separate filter gauge for each filter bank. Standard of acceptance: Dwyer Series 2000.
216. Design for suitable access for changing filters.

23 50 00 CENTRAL HEATING EQUIPMENT**23 52 00 HEATING BOILERS**

1. Main Campus Loop – Industrial type, minimum boiler efficiency of 85%; gas fired.
217. Off Campus Loop – Condensing boiler (if supply water temperature demands permit); minimum life span – 20 years.
218. Minimum life span to exceed 25 years (industrial grade) for greater than 250,000 btu/hr burner rating (input).

23 57 00 HEAT EXCHANGERS FOR HVAC

1. Heat exchangers using campus heating water or any service over 82°C (180°F) shall be brazed plate type (not gasketed, plate-and-frame type).
219. Heat exchangers for domestic hot water heating shall be double-wall brazed plate type.
220. Heat exchangers for hydronic systems with water temperature 80°C (180°F) or below may be plate and frame or brazed plate type.
221. Heat exchangers anticipated to be in year-round service shall be installed as a pair each having 60% of design capacity and each with valves and unions so as to be removable without interfering with the operation of the other. This allows removal for replacement or cleaning. Duplex heat exchangers for domestic water heating shall only be considered where interruption of domestic hot water would be very disruptive (e.g. laboratory use, food services use).
222. Provide a two-way control valve on the campus mains return from the heat exchanger. Provide a 20mm (NPS 3/4) heat exchanger by-pass between the campus mains supply and return with a modulating control valve (c_v between 1.5 and 2.0), a throttling valve and isolation valves.
223. The building heating water pumps shall be designed either with duplex pumps or with valves and piping that can provide back-up in the event of failure of any one pump.
224. The heating coils should be on a separate heating water circuit from radiation to allow for different scheduled temperature control.
225. Provide flexible piping connectors on all piping connections. Standard of acceptance is Flextech Style FB26-TF.
226. Provide isolating valve, pressure gauge, thermometer, temperature sensor on each pipe connection.
227. Standard of acceptance is Alpha Laval Brazed Plate – Model CB200.

23 60 00 CENTRAL COOLING EQUIPMENT**23 61 00 REFRIGERANT COMPRESSORS**

Mechanical Cooling

1. Some spaces require mechanical cooling because of equipment heat gain or process driven requirements.
228. Air cooled split systems or evaporating type condensers (closed or open) using treated water for make-up may be used. Systems using municipal water or other portable water (pass through cooling) are not acceptable.
229. Packaged roof-top equipment is generally not acceptable.
230. Unit with modulating cooling capacity are preferred (e.g. Mitsubishi variable refrigerant flow, inverter compressors).
231. Consider heat pump units instead of cooling only. Multi-zone heat pump systems must have master controls that communicate with the BAS.
232. For a new builder consider a centralized cooling system with chilled water if numerous spaces (present or future) are anticipated to require cooling.
233. Refrigerants shall not be CFC or HCFC type. R134a, R407c, and R410a refrigerants are acceptable. For low temperature refrigeration R507 is acceptable.

23 70 00 CENTRAL HVAC EQUIPMENT**23 74 00 PACKAGED OUTDOOR HVAC EQUIPMENT**

Outdoor Air Handling Units

1. Select for long-life, weather tightness, and good quality.
234. Standard of acceptance: Haakon, Scott Springfield or equal.
235. On large units include a service corridor or mechanical (non-plenum) room for controls.
236. Include over-head lifting point for motors 7.5 hp and larger.
237. Variable frequency drives are required where variable volume control is required.
238. Pilot lights on plenum light switches.
239. Quality plenum door hardware.
240. Exterior doors lockable and keyed to suit appropriate UVic mechanical access key.
241. Weather louvres preferred to exterior hoods.
242. Electrical power and controls wiring in EMT conduit.
243. Typically locate air handlers in mechanical rooms. When necessary locate outdoors. Coordinate access to equipment with Architect. Typically full stairway access is required to mechanical rooms and to roof top equipment with paver walkways across roof and around equipment to protect roofing. Coordinate railings/fall protection with Architect.

Centrifugal Fans

1. Bearings: Heavy duty pillow-block, grease lubricated ball or roller self-aligning type, minimum life of AFBMA L-10 80k or AFBMA L50 400k.
244. Extend grease nipples to exterior of guards.
245. Sound power levels to AMCA 311.
246. Statically and dynamically balanced, constructed in conformity with AMCA 99.
247. Ratings: based on tests performed in accordance with AMCA 211, and ASHRAE 51.
1. Units shall bear AMCA certified rating seals.

25 00 00 INTEGRATED AUTOMATION

General

1. All work shall be consistent with these standards for controls systems including all hardware, software and graphics. The controls contractors are expected to be fully conversant with these standards and shall allow for all measures required for the specified work to meet these standards.
2. The control system shall be fully electric / electronic except for remaining existing pneumatic controls. Special applications may require pneumatic activation.
3. New controls panels shall be the MACH Series controllers designed and built by Reliable Controls Corporation. Other products used shall be manufactured by Reliable Controls Corporation or, where they do not manufacture required products, the products used shall be as recommended by Reliable Controls Corporation for incorporation into their controls system.
4. Contractors are to provide modifications to the control system complete with all necessary components and connections to achieve the specified functions.
5. Contractors are to include for any required expansion of the existing DDC system to accommodate the required additional control inputs and outputs. All new outputs shall each have an integral HOA toggle switch.
6. Controllers must be capable of communicating with RCP protocol on both, main and sub network as well as BACnet. The exception is where Mach Series Revision 8 firmware controllers are to be installed.
7. The control system and all controllers and hardware including third party devices shall be BACnet Testing Laboratories (BTL) certified.
8. All third party devices non-native to Reliable Controls shall have some sort of heartbeat or handshaking routine. When communications become unresponsive, an alarm will trigger.
9. New controllers shall have a minimum 10% spare points at each location.
10. All control panels and components (except valves, dampers and sensors) shall be located in the mechanical rooms or in service rooms or spaces as acceptable to FMGT.
11. The Mechanical Consultant shall determine with the Electrical Consultant which systems shall be hard-wired under the electrical documents to shut down in the event of detection of a fire.
12. When a new controller is added or an existing controller is modified include hard and soft copies MSet configuration to UVIC. Hard copy of Controller MSet configuration must be laminated and attached to the inside panel door of controller enclosure.
13. Transmitter configuration and calibration settings, including signal range to the DDC, are to be provided at the field device.

25 10 00 INTEGRATED AUTOMATION NETWORK EQUIPMENT

Standby Power

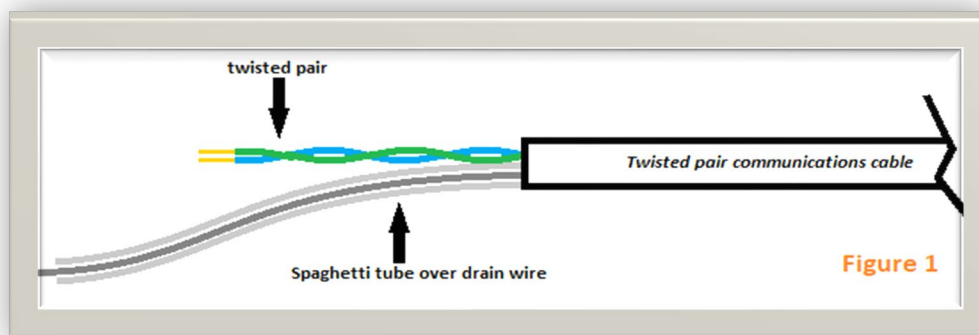
1. System designers are to determine whether the controls system should be on standby/emergency power, or UPS, when central applications are controlled or the equipment being controlled is on emergency power. The impact of power transfer to the control system needs to be considered, and whether a UPS system is appropriate.
2. Standard of Acceptance for a UPS is Eaton PW9130L700T

Electrical Components, Wiring and Conduit

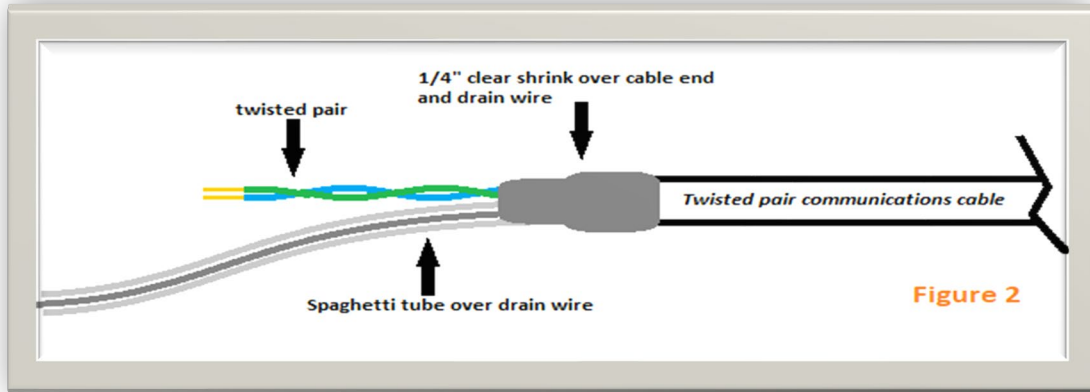
1. Standard of Acceptance for data transmission cable is Cat. 6 cable
2. Carrier System:
 - i. All wiring for 24 volts or less in mechanical service spaces, in stud walls or where exposed to view shall be run in EMT conduit except wiring to all operators and to all sensors subject to vibration shall be run in flexible metallic conduit for the final 900mm (3 feet).
 - ii. Provide conduits for all wiring between the fire alarm panel and the DDC panels.
 - iii. All wiring for over 24 volts shall be run in EMT conduit.
 - iv. Provide steel fittings with nylon throats for all conduit connections.
3. Wire:
 - i. Line voltage power or switched power wiring - #12 gauge copper wire minimum.
 - ii. Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.
 - iii. Low voltage – wire as directed by applicable electrical codes and requirements but minimum #20 gauge.
 - iv. All DDC wiring ran in ceiling spaces must be strapped every 3 feet, and not run through sharp edges or corners. Cables shall be run in a straight, organized fashion. Diagonally run cables are not acceptable.
 - v. All DDC wiring to have wire tags at both ends.
 - vi. Wires shall be organized using Panduit or similar.
 - vii. All Conduit containing control wiring should only be 75% full upon project completion
 - viii. Green wire on DDC to be used for grounding only.
4. Control Panels:
 - i. All control panel enclosures shall be accessible with 1m working distance in front, with no obstructions. Ceiling mounted enclosures shall have accessible T-Bar removable panel and room to place a ladder below.
 - ii. Panels are to be identified with a panel legend, proper wire tagging, a panel identifier on the outside of the panel, and the panels are to be maximum 75% full when complete to allow room for future expansion.
 - iii. Fiberglass or polycarbonate boxes with a Nema level 4 rating shall be used. Outdoor jcpans shall be weatherproof fiberglass type with quick release fitting and have a breather plug installed.
 - iv. Preferred Weatherproof fiberglass junction box for DDC controls outside. Quick release fittings.
 - v. All DDC controllers which are networked together must be accompanied with a network map.

5. RS-485 Communication Cabling Shielding and Drain Wires

- i. All drain wires must be installed with clear spaghetti tubing to prevent the drains from coming in contact with ground. (See figure 25 10 00-1)
- ii. All communications cables must be installed with clear heat shrink to prevent the cable shield for coming into contact with ground. (See figure 25 10 00-2)
- iii. DDC communications terminal end (eg. terminating at DDC) to have drain wire wrapped back over cable sheath cable end to be dressed with 3/8" clear heat shrink to prevent drain wire and shield from contact with ground. (See figure 25 10 00-3)
- iv. DDC controller serial drops should be installed as per the following figure below. (See figure 25 10 00-4)
- ix. The communications network needs to come into contact with ground at only one point as close as possible to the ground grid point of origin. (See figure 25 20 00-4) This network ground should be identified with a label, eg. "DDC Network Ground" etc. If more than one drain / shield points of the system come into contact with electrical equipment grounds, the difference in potential between the locations will cause sheath currents (Eddy Currents) to flow in the RS-485 network. This will cause communications errors to occur in the network.
- v. The contractor will supply a drawing of the RS-485 cable routing to each of the DDC controllers including which room(s) they reside in as well as the DDC control panel numbers. The end of line controller(s) will also need to be identified especially if a spur type topology is implemented.
- vi. Joints or splices of the cable will not be permitted throughout the entire length of the communications system. Damage to the cable sheath must be repaired properly to ensure that the shield does not come into contact with electrical ground.
- vii. Proper strain relief connectors are to be used when entering into a control enclosure. If required mechanical protection may also be required. (Conduit, flexible conduit).
- viii. The color coding of the insulation for the two Belden cable conductors shall be white with a blue tracer and blue with a white tracer. The cable conductor size of the Belden shall be 18 AWG solid. All cabling must be approved for communications application complete with cable shield and drain.

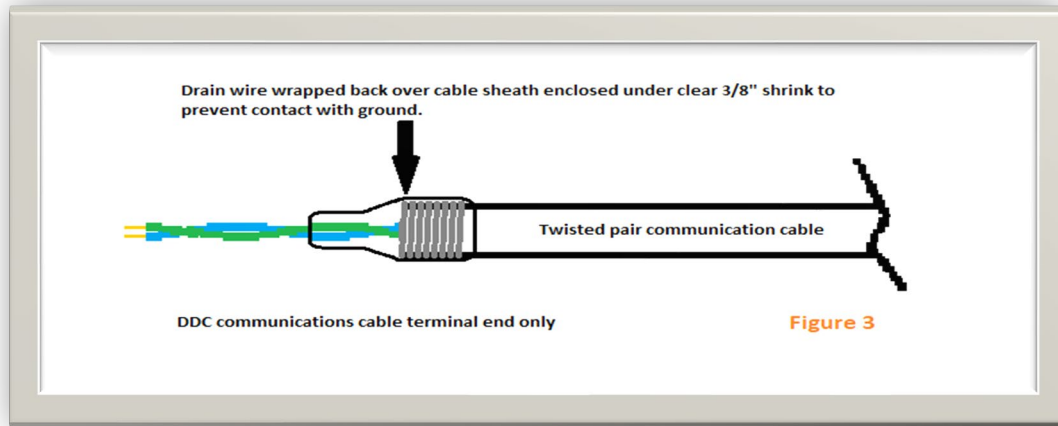


1. Figure 25 10 00-1



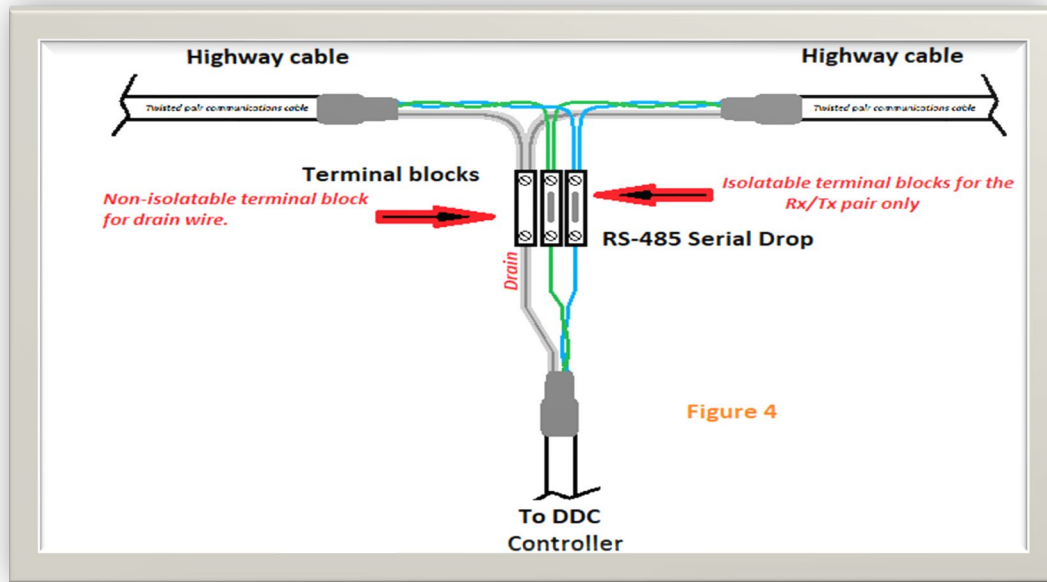
2.

Figure 25 10 00-2



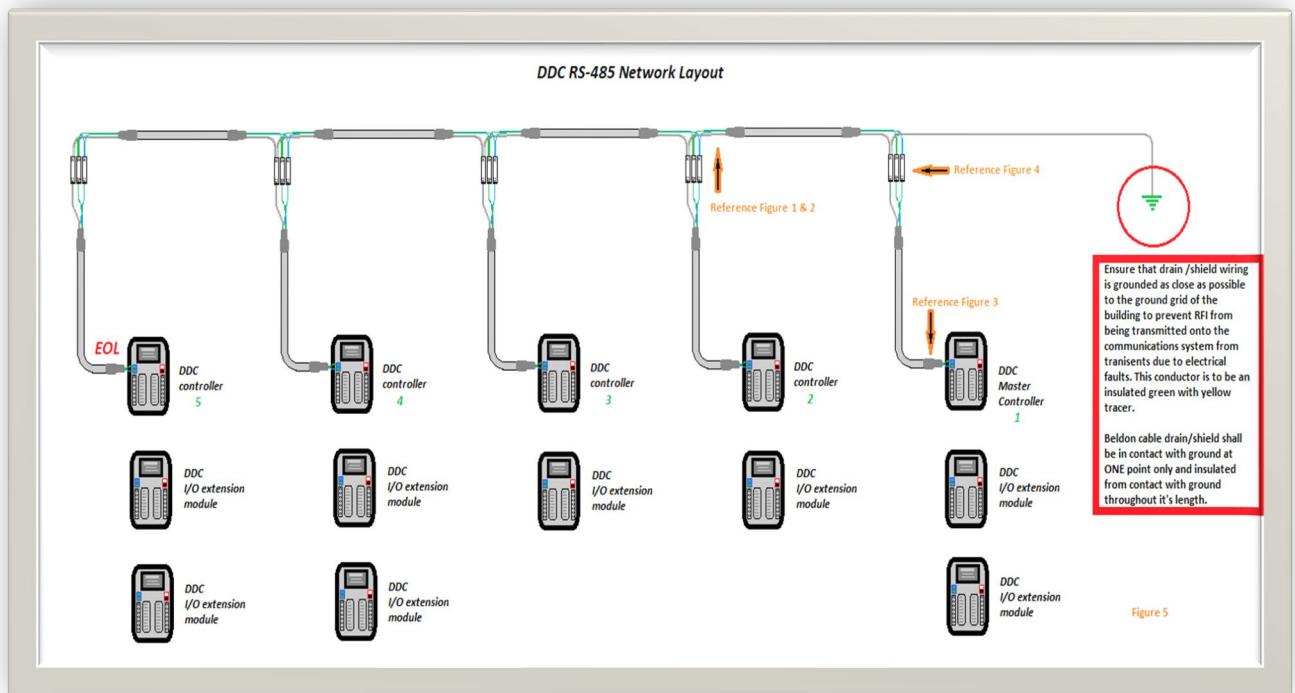
3.

Figure 25 10 00-3



4.

Figure 25 10 00-4



5.

Figure 25 10 00-5

Transformers

1. Secondary side of transformers (24VAC) side should be grounded, as directed in the Reliable Controls manuals.

Identification

1. Label and identify all panels and points with a numbering system consistent with UVic's DDC network numbering system.
2. Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metal-photo, or laminated plastic labels and secure them to, or adjacent to the control devices with key chains.
3. Paint junction box covers to UVic standard colours. For DDC Junction boxes, the colour shall be blue.
4. Use colour coded conductors, white for neutral.
5. All manual switches, unless they come with standard nameplates, shall be labelled with engraved plastic laminate nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by FMGT.
6. Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:
 - i. Point descriptor.
 - ii. Point type and channel number.
 - iii. Corresponding DDC panel number.
7. Mount an input-output legend sheet within each DDC panel. This sheet shall include the name of the points connected to each controller, the end device manufacture, part number, model number and shall describe the I/O range. If an I/O module is remotely located, a separate legend sheet for that module shall be included at both locations.
8. All Relays to be labeled and have wire tags.

25 35 16 INTEGRATED AUTOMATION SENSORS AND TRANSMITTERS

General

1. All instruments, transmitter's pressure switches, sensors, are expected to be reachable by ordinary means. All installed devices should incorporate future maintenance in mind. Mounting a device that has pipework in the way or makes it inaccessible is not permitted.
2. Occupancy sensors, temperature transmitters (sensors), CO2 detectors must be verified, an initial calibration should not be required if factory calibrated. Refer to manufactures recommendation as a minimum. If the device is not within specification, it should be noted on the commissioning documents and corrected. If a reoccurrence or drift error occurs within the warranty period, it shall be replaced.
3. All Sensors Gauges and Transmitters shall be installed to be operated within 75% of their capacity.

Current Sensors

1. Provide current sensors for all motor-driven equipment except small fan-coils, unit heaters, force flow heaters, washroom exhaust fans for individual washrooms, and other minor, non-critical equipment.

Temperature Sensors

1. Room temperature sensors in staff areas (non-student, non-public areas) – two-wire type with up/down temperature adjust.

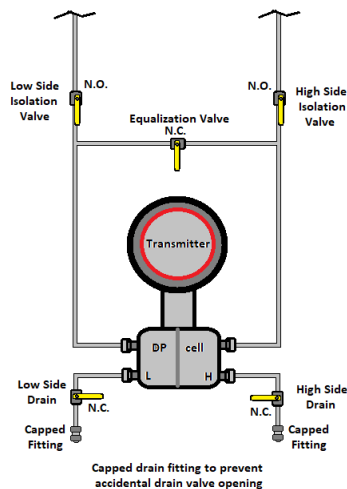
2. Room temperature sensors in student or public areas – no user interface input.
3. Room temperature sensors shall be mounted 6 inches below any other sensors to prevent false readings due to heat from these sensors.
4. The end-to-end accuracy for all DDC monitored temperature sensors shall be ± 0.5 °C unless otherwise specified.

Relative Humidity Sensors

1. Overall accuracy of +/- 3 % reading from 0 to 95 % RH unless the individual application requires higher accuracy.
2. Operating temperature range of - 20 °C. to 80 °C.
3. Long term stability with less than 1% drift per year.
4. Sensitivity of 0.5%RH.
5. Complete with built in transmitter for 4-20 mA output proportional to RH to the DDC. Sensor to be fully compatible with DDC.
6. Humidity sensor shall be replaceable.

Pressure Sensors

1. All differential pressure sensors/transmitters are to be installed as per figure 25 35 16-1 in an accessible location to allow for easy maintenance and calibration.. Transmitters to be mounted 90 degrees to the top of pipe to prevent scale and other debris from being deposited in the system. For Orifice flow installations locate flange as per figure 25 35 16-2 For probe type pressure transmitter install as per figure 25 35 16-3.



Drain fittings will allow us to flush the cell body and allow us access to puff up the cell to perform calibration checks.

1.

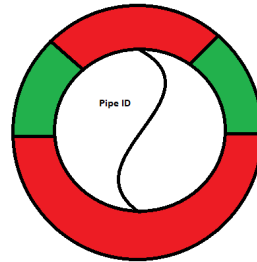
Figure 25 35 16-1

2.

Differential Pressure Transmitter Flange Tap Locations for Orifice Flows

Green indicates appropriate locations

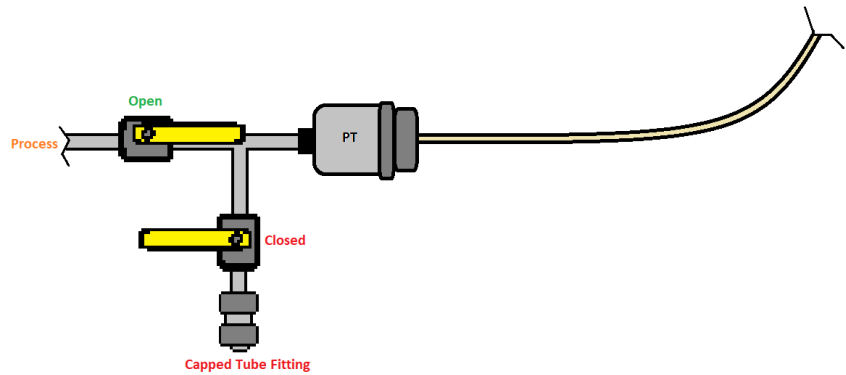
Red sections will allow entrained gas to enter the system or allow sedimentation to plug the lines.



3.

25 35 16-2

This tubing/valving layout will allow the technician to replace the transmitter, zero the transmitter, use a pressure source to calibrate and verify the transmitter.



4.

25 35 16-3

Flow Transmitters

1. All flow transmitters and flow switches are at minimum to be installed with manufactures recommended upstream and downstream piping requirements.

25 35 19 INTEGRATED AUTOMATION CONTROL VALVES

Control Valves and Actuators

1. Standard of acceptance: Belimo ball valve, B200 series with stainless steel ball and characterizing disc in the inlet of 2-way valves and in the control ports of 3-way valves.
2. Consider whether spring return or fail to last controlled position is desired for each valve.
3. Control valves on campus heating mains shall be selected to operate continuously at 121°C (250°F).
4. Acceptable Products: Johnson Controls, Honeywell, Siemens.

25 35 23 INTEGRATED AUTOMATION CONTROL DAMPERS

Control Dampers

5. Provide differential pressure, monitoring across major air filter banks.
6. Provide differential pressure or current sensors across pumps.
7. Provide an independent output for each of the return air damper, the outdoor air damper and the relief damper on mixed air systems.
8. Low leakage type with blade and frame seals.
9. Blades shall be horizontal in vertical mounted dampers.
10. Acceptable Products: Ruskin CD-36, TAMCO Series 1000 (T.A. Morrison), Johnson Controls, Honeywell.

Control Damper Actuators

1. Electric/Electronic Damper Actuators shall be direct coupled and spring return. Standard of acceptance is Belimo, or Siemens .

25 55 00 INTEGRATED AUTOMATION CONTROL OF HVAC

Existing Controls

1. Most of the older buildings have pneumatic controls but almost all have a central DDC system that was retrofitted in the 1990's. When these buildings are renovated, replace the local pneumatic controls within the renovation area and provide all new controls within the renovation area with compatible electronic sensors, actuators and control valves controlled by the DDC system. Provide additional control panel capacity as required for the controls. Note the requirement for new controls outputs to have an HOA switch on each output. Modify the controls sequence to suit. Update the controls graphics to include all new and modified controls.
2. Remove all reasonably accessible redundant pneumatic tubing and all redundant pneumatic controls components and tightly cap all remaining pneumatic tubing ends.
3. Remove all reasonably accessible redundant controls conduit, wiring and equipment.
4. The long term objective is to eliminate the pneumatic controls except where required for special applications.

Controls Points

1. Provide current sensors for all motor-driven equipment except small fan-coils, unit heaters, force flow heaters, washroom exhaust fans for individual washrooms, and other minor, non-critical equipment.
2. Monitor supply air temperature downstream of every VAV box with a heating coil.
3. Determine in advance with FMGT whether every office should have its own independent temperature control or if offices are to be grouped under a single temperature control.

4. Monitor the building incoming domestic water pressure before the premise backflow prevention and after the building PRV.
5. Provide pressure differential, monitoring across major air filter banks.
6. Provide differential pressure or current sensors across pumps.
7. Provide an independent output for each of the return air damper, the outdoor air damper and the relief damper on mixed air systems. A separate input to the DDC shall be provided from the actuator for damper position feedback. Alarm if they mismatch by more than 10%.
8. Monitor all equipment remote alarm contacts.
9. For variable frequency drives provide output to control ON/OFF and speed and monitor ON/OFF status, run speed, alarm contact.
10. Provide ON/OFF control for all motor-driven equipment unless manually operated.
11. Provide control and operating schedule for DHC recirculation pumps.
12. Provide hard wired low-temperature shutdown (freeze protection) for air handling systems and monitor its status.
13. Generally provide control of all mechanical equipment but not to override or replace integral equipment controls and safeties (e.g. boiler enable/disable but not burner ON/OFF).
14. Monitor the temperature of any electrically freeze-protected piping or equipment.
15. Monitor the status of regular/emergency/standby electrical power.
16. Monitor the status of automated glycol make-up systems and glycol tank level alarm.
17. Monitor closed pipe systems pressure at or hydraulically near the expansion tank.
18. Monitor DHW temperature. Where DHW heating is by heating water, control the heating.
19. Monitor the pneumatic controls air pressure.
20. Monitor campus heating mains water temperature to and from the building heat exchanger and monitor the flow to it to provide energy monitoring and totalization. Consider use of manufactured energy monitoring equipment.
21. Provide a campus mains two-way control valve in the return from the building heat exchanger.
22. Provide a small control valve (c_v between 1.5 and 2.0) between the campus mains supply and return pipes (prevent thermal shock if main valves closes for extended period).
23. Provide temperature monitoring of the building heating mains and of each individually pumped heating circuit.
24. Provide alternating control of duty and standby equipment.
25. Monitor all mass and energy meters provided with contacts for remote monitoring.

Alarms

1. Software alarms shall be identified as regular or critical. Critical alarms shall be connected from the DDC system to the campus alarm system for monitoring and response by Campus Traffic and Security.

Graphics

1. All graphics to be completed and fully functioning prior to turnover completion.
2. A graphics template can be provided upon request from Facilities Management, Building Automation.
3. Pumps and motors should show horsepower ratings and voltage on graphics.
4. All air handler\pump graphics to show Status, runtime, amperage, etc.
5. All pressure transmitters to be setup in kPa and all temperature sensors to utilize Celsius. SI units to be used unless otherwise designated.
6. Graphics native size to be 2219 x 1238, and Corel Draw "Canvas" size of 1664 x 928 Pixels
7. Graphics export to *.png at 96dpi which increases final image size to 2219 x 1238 Pixels
8. Use Graphic Font size 12 Point Myraid Pro regular, 22 Point Myraid for Titles
9. Underline text required for hyperlinks to be blue C:100 M:50 Y:0 K:0
10. Operator adjust values to have white background, non adjustable on Grey background
11. Annotation Font Size for sensor landing pads: 12
12. Annotation Font Size for Status landing pads: 14
13. Annotation Font Size for Runtime landing pads: 10
14. Supply Ducting shall be Blue in colour C:40 M:0 Y:0 K:0
15. Return and washroom exhaust ducting shall be Brown in colour C:0 M:40 Y:60 K:20
16. Fume hood exhaust ducting shall be Green in colour C:40 M:0 Y:100 K:0
17. System graphics shall have both ST (short term) and LT (long term) trends grouped in upper or lower right hand corner.
18. Provide a network diagram down to the sub-network level that illustrates cable routing of all DDC controllers, how they are all interconnected. Incorporate this diagram into the CAS Overview graphic. Include controller location, device ID, Device address, and terminating resistors at end of line.

Testing, Commissioning and Acceptance Procedures

1. All devices to be commissioned and calibrated to manufacturers specs and there should be a commissioning document showing that when a device is changed, or added we should have proof it was calibrated or verified.

2. Consider whether the system warrants a comprehensive seven day test.
3. All end devices must have a calibration report showing proper operation and commissioning. This report will show a minimum 3 point verification for pressure transmitters.
4. A summary print out of each group of point types for each panel shall be printed after commissioning and calibration. Each sheet shall be signed by the Controls Contractor's Commissioning Person, and FMGT Representative. If any changes are noted during spot checks they shall be manually written on the original print out with the date and signature of person noting changes.
5. All end devices to have a calibration tag, which shall include I/O information, room number, device type, date, contractor name, technician name. In the event of a room temperature sensor or an occupancy sensor, a sticker is acceptable.

Demonstration to Owner

1. The Controls Contractor shall demonstrate to FMGT's Designated Personnel the adjustment, operation and maintenance, including pertinent safety requirements, of the controls equipment and system provided to the satisfaction of FMGT's Representative.

As Built

1. All as built drawings to be stamped and signed by contractor with pertinent redline drawings on PNIDS completed. Any change made must be illustrated by a "bubble" with the represented change inside the bubble. All changes to be done in red ink for submittal, with an AS BUILT stamp, dated and signed.
2. A copy of each graphical screen page, both new and modified existing shall be signed off and dated by the Controls Contractor and the FMGT Representative. Any changes shall be noted. This signed set shall be left on site as the "record drawings".

26 01 00 OPERATION AND MAINTENANCE OF ELECTRICAL SYSTEMS**26 01 01 POWER CABLES AND OVERHEAD CONDUCTORS**

General

1. This section applies to underground primary conductors fed from the University of Victoria 15kV primary voltage infrastructure.
2. Main electric services to new buildings typically requires dual radial primary voltage feeders from the main distribution loop to each building in order to achieve a dual bump-less power transfer system.
3. The following provides technical requirements for primary voltage systems cabling, manholes, terminations and support hardware.

Rubber Insulated Cables 5001 – 15000 V

1. 15 kV cables shall be #250 MCM single-core copper, Class B stranding, with semi-conducting shield cover core conductor, 90° C rated retardant insulation of cross-linked thermosetting polyethylene material, 15 kV rated for 100% voltage level, semi-conducting insulation shield overlaid with metallic wire or tape shield as described below, separator tape over shield, and extruded PVC jacketed rates - 40°C.
2. In general, all 15kV cables to be connected to the existing underground distribution system shall have concentrically served copper wire shield made up of 14 #18 strands (or equal) to match the established University standard installation and to withstand 3000 A of ground fault current for 0.2 seconds.
3. For projects requiring total cable quantities less than 1000m, the following alternative shield construction, cable installation and grounding arrangement may be acceptable by obtaining prior written permission from the University:
 - i. Cable construction utilizing overlapping copper tape shield providing 100% coverage over the semi-conducting layer, and:
 - i. Cable installation which provides an additional #4/0 green insulated copper conductor installed in the same duct as the 3-phase conductors, and:
 - ii. Grounding arrangement which provides for the direct and effective bonding of the additional #4/0 grounding conductor to the cable shield ground leads at each end of the phase cables.
 - iii. The use of alternative shielding shall require each trefoil of feeder to have an accompanying #4/0 grounding cable in the same duct in addition to the standard duct bank grounding conductor which shall be separately installed in a 50mm duct as shown on the drawings.
4. The construction and testing of HV cables shall be in general accordance with ICEA Publication S-66-524 and AEIC Specification No. 5-71.
5. Cables shall be as manufactured by Canada Wire and Cable, CGE, Phillips, Pirelli, or Northern Electric Ltd.
6. HV cable grips for single cable or trefoil bundle: high-grade, non-magnetic tin-coated bronze strand construction. Kellems Type 022-01 (closed mesh), 022-02 (split mesh, lace closing).

7. HV cable identification tag ties: Thomas & Betts Nylon Ty-Rap #TY529M.

Concentric Neutral Power Cables 5001 – 15000 V

1. Concentric neutral power cable: to NEMA WC7-1992/ICEAS-66-524.
2. Single copper conductor, size as indicated.
3. Semi-conducting strand shield.
4. Compact round.
5. Insulation: cross-linked thermosetting polyethylene material rated 90EC and 15kV for 133% full capacity.
6. Semi-conducting insulation shield layer.
7. Copper neutral wires applied helically over insulation shield equivalent to 133% full capacity.
8. Separator tape over neutral wires.
9. Extruded PVC jacket rated minus 40EC.

Connectors and Terminations Rubber Insulated Cables

1. Copper crimp-on compression connectors as required sized for conductors.
2. All terminations 5kV and above shall meet IEEE 48.
3. Indoor 15 kV high voltage switchgear cable termination: complete with stress cones, shield grounding devices, and lugs. 3M Quick-Term II, 5620K series, Raychem HVT-152 series, or equal.
4. kV rated submersible, 600 A, elbow-type, non-load break power distribution connector: Elastimold 650 LR series complete with all necessary components, adapters, spade terminals, plugs, caps, connectors, and shield grounding devices suitable for the type and size of cable specified and compatible for connection to existing standard connectors in use at the University. The connector is to be equipped with voltage test points and all necessary bolts and hex nuts for assembling and dismantling without the use of hot-stick tools.

Manhole Cable Support Hardware

1. Hot-dipped galvanized continuous concrete pre-set inserts for mounting of steel channel supports: Cantruss RH2C or equal.
2. 41mm x 41mm hot-dip galvanized continuous concrete pre-set inserts for mounting of steel channel supports: Cantruss RH2C or equal.
3. Steel channels for mounting of cable brackets: as specified.
4. Porcelain "slip on" insulators, suitable for use with cable brackets specified: Pursley "Power-Strut" PS-1500 (for single cables) and PS-1501 (for trefoil cable bundle) or equal.
5. Heat shrink boots for cable bracket ends: T&B HSC, Raychem ESC, 3M ICEC, or equal.

Duct Allocation Signs in Manholes

1. 216mm x 216mm drawings on standard bond paper, sealed with thermally applied clear plastic laminate on both sides, sandwiched between two clear Plexiglas plates.
2. Install duct allocation signs at each duct entry location in each new and existing re-used manhole.

26 01 02 WIRE AND BOX CONNECTORS

Materials

1. Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
2. Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
3. Bushing stud connectors to: EEMAC 1Y-2 to consist of:
 - i. Connector body and stud clamp for stranded copper conductors.
 - i. Clamp for stranded copper conductors.
 - ii. Stud clamp bolts.
 - iii. Bolts for copper conductors.
 - iv. Sized for conductor as indicated.
4. Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2 No. 18.

26 01 03 WIRES AND CABLES

General Requirements

1. In general, wiring to be used at the University of Victoria shall be:
 - i. Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.
 - i. Aluminum conductors are not desirable. Upon special permission from FMEL they may only be permitted for feeder conductors larger than 3/0 AWG.
 - ii. Obtain approval of FMEL for the usage of any TECK wiring. Where permitted, TECK wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.
 - iii. Flexible armoured AC90 cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations. Drops to receptacle outlets are not permitted. AC90 is permitted in tight spaces such as millwork and lab benches.
 - iv. All control wiring except HVAC controls as specified in Mechanical Division is to be provided by the Electrical Contractor. This includes low voltage control wiring for motorized blinds and shades, to owner supplied equipment, to door access and security, to assistive hearing system, to audio-visual (AV) equipment.

Wire and Cable General

1. Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG, copper.
2. Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.

3. Use RWU90XLPE for underground installations.
4. Site service sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.
5. Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits below slabs. Increase conduit size as required.
6. Armoured AC90 cable may only be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors. Cable from luminaire to luminaire is not permitted. Allow nominally 900mm (3') extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.
7. TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes.
8. Conductors are to be colour-coded. Conductors No. 10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No. 8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50mm at terminations, junctions, and pull-boxes and conduit fittings. Conductors are not to be painted.

TECK Cable

1. TECK cable may be used in special situations such as feeds to motors and equipment. For all other uses, obtain permission from the University. Cables shall be chemically cross-linked thermosetting polyethylene rated type RW90, 600V with inner jacket of polyvinyl chloride material. The armour shall be interlocking aluminum. The outer jacket shall be low-acid gas-emitting, fire-retardant PVC rated for low temperature, black. Connectors shall be watertight approved for TECK cable.

Armoured Cables

1. The use of insulated copper AC90 cable with interlocking aluminum sheathing is permitted for drops to luminaires, not exceeding 3m in length and in difficult confined spaces and millwork.

Armoured Fire Alarm Cable

1. The use of flexible armoured fire alarm cable from junction box to ceiling mounted fire alarm device is permitted. Use SECUREX® II cable, fire rated to CSA FT4 requirements. Cable shall be armoured with interlocked aluminum tape armour. Cable armour shall be colour coded "red". This type of cable may also be used for renovations projects where conduit installation is difficult.

Wire Installation

1. Install wiring as follows:
 - i. All wires are to be pulled in together in a common raceway, using liberal amounts of approved lubricant.
 - i. All power circuits connected to isolated ground type receptacles are to have individual separate neutral c/w insulated bonding conductor.

- ii. No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.
- iii. All dimmer circuits are to have individual neutral conductors for each circuit.
- iv. Group all circuit conductors with their respective neutral conductor and provide identification of circuit number on conductors at all junction boxes.
- v. Group all cables wherever possible on channels.
- vi. For all control cabling, ground control cable shield.
- vii. Installation of conduit in concrete slabs is NOT permitted unless specifically approved in writing by addendum during tender stage. All conduits shall be surface mounted under floor slabs.

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

26 05 01 GENERAL CONSIDERATIONS

Mounting Heights

1. Mounting heights for electrical devices shall be as follows where possible. Where these heights cannot be achieved, obtain written instructions from the University for alternate mounting heights.
2. In offices and laboratories, mounting heights for receptacles and communications outlets are generally 150mm above counter height, unless not physically possible.
3. Install electric equipment at following heights unless indicated otherwise:
 - i. Local switches: 1400mm.
 - i. Wall receptacles:
 - ii. General: 300mm.
 - iii. Above top of continuous baseboard heater: 200mm.
 - iv. Above top of counters or counter splash backs: 150mm.
 - v. In mechanical rooms: 1400mm.
 - vi. Panel boards: as required by Code or as indicated.
 - vii. Communications outlets: 300mm.
 - viii. Wall mounted telephone and intercom outlets: 1500mm.
 - ix. Fire alarm stations: 1200mm.
 - x. Fire alarm bells: 2100mm (or if in conflict with ceiling, 300mm below ceiling).
 - xi. Television outlets: 300mm.
 - xii. Wall mounted speakers: 2100mm.
 - xiii. Clocks: 2100mm.
 - xiv. Thermostats: 1525mm
 - xv. Doorbell pushbuttons: 1500mm.
 - xvi. Where possible, wall mounted devices such as lighting switches and thermostats shall be aligned vertically.

Operating and Maintenance Manuals

1. Submit a copy of operating and maintenance manuals for review, two weeks prior to substantial completion. This will be reviewed and returned within one week.
2. Submit two hard copy sets and one digital copy set on CD of final operating and maintenance manuals for equipment or as requested by the general section of the contract 2 weeks prior to substantial completion of the project. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certification of verification, electrical inspection authority certificate and contract guarantee.
3. Hard copy manuals shall be inserted in "RED" coloured heavy duty three ring binders, with lettering on the spine identified as "OPERATING AND MAINTENANCE MANUAL", project title and system names.
4. Obtain and include a copy of all variable frequency drive shop drawings provided by the mechanical contractor on the project in manuals.
5. Include in maintenance data:

- i. Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
- i. Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts list. Advertising, sales or generic literature is not acceptable. All operations and maintenance data must pertain to the specific products used.
- ii. Wiring and schematic diagrams and performance curves.
- iii. Names and addresses of local suppliers for items included in maintenance manuals.
- iv. Copy of reviewed shop drawings.
- v. Guarantees and warranties information.
- vi. Test reports and systems demonstration: Include copies of all applicable test reports and manufacturer's letters verifying test completion.
- vii. Certificates: Include a copy of final certificates from electrical inspection authority, fire chief, and other authorities having jurisdiction over the work.
- viii. Schedules: All schedules included in the technical specification (motor schedules, lighting fixture schedules, panel schedules, security zone schedules, fire alarm schedules, low voltage relay schedules, dimmer schedules, etc.), shall be updated to reflect all changes made during tender and construction period.

26 05 02 UNDERGROUND CIVIL WORK (ELECTRICAL) – GENERAL

1. Site services to buildings require underground services installed in trenches, manholes, reinforced concrete encasement of ducts, etc.
2. This section covers the supply and installation of underground civil work required for electrical installations. The civil work shall include but not be limited to:
 - i. Trenching and excavation.
 - i. Concrete encasement re-barring, etc. of underground raceways.
 - ii. Manholes and pull boxes.
 - iii. Concrete luminaire bases.
 - iv. Sand bedding and back filling.
 - v. Repairing existing grade finish.
 - vi. Pull pits beneath main switchgear, secondary distribution of centres, and in communications rooms.

Protection of Existing Features

1. Contractors are to be made aware of existing features, trees, sidewalks, walkways, roadways, and other items which must be protected from damage.

Backfill

1. Sand shall mean screened pit material, free of all organic material. Screen shall eliminate all stones over 5mm in diameter and any sharp debris.
2. Selective granular material shall mean material found in excavation or obtained from a gravel pit, that excludes rubble, hard packed clays, sharp objects or rock that could cut duct or cable, and be free of all stones over 50mm in diameter.
3. Native material, shall mean material found on site, excluding material that would deteriorate over time, for example wood scraps or rubble, and stones over 300mm in diameter.
4. Crushed rock and drain rock shall be as obtained from reputable gravel pit, clean of rubble and fines.

Concrete Mix

1. Type 10 Portland cement, min. compressive strength 20 Mpa at 28 days, slump 50-75mm at point of discharge, nominal coarse aggregate.

Drainage

1. Floor drain in each manhole to consist of floor drain, backwater valve trap and pipe connection to provide positive drainage to storm drain system.
2. Sump pit 300 x 300 x 125mm with rock drainage only allowed if specifically noted for each location.
3. Provide power connections to sump pumps indicated on mechanical or civil drawings.

Manhole

1. Concrete manhole neck to bring cover flush with finished grade or 40mm above grade in unpaved areas.
2. Build up neck with brick and mortar to achieve above.
3. Precast concrete manholes, for primary power and communications services where indicated on plans.
4. Concrete manhole neck to bring cover flush with finished grade or 40mm above grade in unpaved areas.
5. Build up neck with brick and mortar to achieve above.
6. Size 4.3 metres long x 2.5 metres wide x 1.8 metres inside depth. AE Precast Products Ltd. #4212-“C” Series Manhole Type.
7. Manhole to be complete with knockout windows, steel reinforcement, unistrut channel supports (all sides), pulling irons, circular sump complete with metal cover, grounding sleeve, and #C-23/23A cast iron frame and traffic rated cover marked “Electrical” for power services, and “Communications” for communications service manholes.
8. Manholes to be complete with minimum 610mm deep concrete sump complete with concrete base, cast iron grate, and suitable for 100mm mechanical drainage service entry.
9. Seal all penetrations.

Manhole Frames

1. Cast iron manhole frames and covers road rated.
2. Hinged checker plate standard covers for pre-cast manholes or pull boxes.

Ground Rods

1. Ground rods – 3 metre copperweld. Provide ground rod to each manhole.

Cable Racks

1. Cantruss pre-set inserts for rack mounting, hot dip galvanized cable racks and supports on all faces of manholes and pull boxes – two if side exceeds 1.2 metres long.

Luminaire Bases

1. Supply and install luminaire bases consisting of round concrete reinforced bases. In landscape areas, bases are to be 100mm above finish grade and flush with grade at concrete surfaces.

Cable Pulling Equipment

1. Pulling irons of galvanized steel rods, size, shape and location as indicated. Standard polypropylene pull rope with tensile strength 5kN continuous in each duct run.

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

Grounding – Primary – General

1. This section covers work required for grounding of primary switchgear and for connections to the campus grounding system.

Materials

1. Use only ground rod electrodes, copper clad steel 19mm dia by 3m long. A minimum of four ground rods shall be provided and connected to the main grounding bus in the main electrical room.
2. Conductors for installation of campus ground in duct system and manholes shall be PVC-insulated, coloured green, stranded, untinned, soft annealed copper wire size # 4/0 AWG, unless noted otherwise.
3. Conductors: bare, stranded, untinned, soft annealed copper wire, size # 3/0 AWG, for ground bus, electrode interconnections, metal structures, transformers, switchgear, ground connections.
4. Bonding Conductor: # 2/0 AWG stranded soft annealed copper.
5. Conductors for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers: PVC-insulated, coloured green, stranded, untinned, soft annealed copper wire, size # 4 AWG.
6. Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, and vault doors.
7. Cable Sheath Isolating Sleeves: Elastimold or equal, to match 15 kV cable connector kits on campus.
8. Wall-mounted ground bus shall be copper ground bus mounted on insulated supports on wall of electrical room. Bus to be 75mm wide and 6mm thick. Length of bus to suit connection requirements.

Grounding Installation

1. Install continuous grounding system including electrodes, conductors, connectors, accessories, as indicated and to requirements of local authority having jurisdiction.
2. Install connectors to manufacturer's instructions.
3. Protect exposed grounding conductors from mechanical injury.

4. Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermit process or approved crimp-on type compressive connectors.

Neutral Grounding

1. Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
2. Interconnect electrodes and neutrals at each ground installation.
3. Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
4. Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

Grounding in Manholes

1. Install conveniently located grounding stud, electrode, size 2/0 AWG stranded copper conductor in each manhole.
2. Install ground rod with lug for grounding connection in each manhole so that top projects through bottom of manhole.

Cable Sheath Grounding

1. Bond single conductor, metallic sheathed cables together at one end only. Break sheath continuity by inserting insulating sleeves in cables.
2. Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.
3. Connect bonded cables to ground with No. 2/0 AWG copper conductor.
4. Use mechanical connectors for grounding connections to equipment provided with lugs.
5. Use # 4/0 AWG bare copper cable for main ground bus of substation.
6. Use tinned copper conductors for aluminum structures.

Campus Ground

1. Extend from existing manhole infrastructure a # 4/0 insulated ground to substation wall-mounted ground bus in main electrical room. Run through 50mm duct.
2. Ground Fault Circuit Interrupters – Class A

General Information

1. This section is for equipment and installation for ground fault circuit interrupters (GFCI).

2. The use of GFCI receptacles is also required for use within 1.5m of sinks in laboratories and washrooms.

Materials

1. Equipment and components for GFCI: to CAN/CSA-C22.2 No. 144.
2. Components comprising ground fault protective system to be of same manufacturer.

Breaker Type Ground Fault Interrupter

1. Single or two pole ground fault circuit interrupter for 15-20 A, 120 V, 1 phase circuit c/w test and reset facilities

Ground Fault Life Protector

1. 100 A, 2 pole circuit breaker to supply power to mains of 100 A, 208 V, 3 phase panel and complete with, automatic shunt trip breaker, zero sequence current sensor, facilities for testing and reset, CSA Enclosure 1, surface mounted, and ground fault trip indicator light.

Ground Fault Protector Unit

1. Self-contained with 15 A, 120 V circuit interrupter and duplex or single receptacle complete with solid state ground sensing device, facility for testing and reset, and CSA Enclosure 1, flush mounted with stainless steel face plate.

System Ground Fault Protection Panel

1. Self-contained panel suitable for 120/208 V, 3 phase, 4 wire, grounded supply with automatic 100 or 225 A breaker with shunt trip, ground fault relay factory set at 10 mA with inverse time delay characteristics from pick-up 1 s to 0.025 s, zero sequence current sensor, provision for testing and reset, and CSA Enclosure 1, surface mounted.

Pump Protection Panel

1. Ground fault personnel protection shall be provided for pump control panel circuits rated for 20 hp at 208 V 50 hp at 600 V, 3 phase grounded supply with test button, ground indicator light, reset button, line and load terminal blocks and control terminal block for wiring to starter control, unit sensitivity: 10 mA, and CSA Enclosure 1, surface mounted, contact rating: 5 A, 120 V, 60 Hz.

26 05 33 CLEARANCES AND DEPTH OF RACEWAYS

1. Unless specifically stated on plans, the following clearances are to be maintained for all underground raceways, to be used for power cables and communications.
 - i. Between communication and power raceways:
 - a. In concrete encasement – 75mm.
 - b. Direct buried raceway – 300mm.
 - ii. From all gas, water (except landscape sprinkler lines) and sewer utilities:
 - a. 1000mm running parallel.
 - b. 500mm at crossings.
 - c. 150mm at crossings is allowed if electrical raceway is concrete encased for length of crossing, plus 1000mm to either side of crossing.
 - iii. From landscape sprinkler lines:

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- a. 1000mm running parallel.
 - b. 150mm at crossings if sprinkler lines are run over electrical lines.
2. Unless specifically stated on plans, the following clearances are to be maintained for all underground direct buried cables for power and communications:
 - i. Between communications and power – 600mm.
 - ii. From all gas, water (except landscape sprinkler lines) and sewer utilities:
 - c. 1500mm running parallel.
 - d. 1000mm at crossings.
 - e. 150mm at crossings is allowed if cable is sleeved with duct and concrete encased for 1000mm to either side of crossing.
 3. Unless specifically stated on the plans, the following depth of raceways shall be a minimum from top of duct:
 - i. Roadways and private property except rock excavation:
 - f. Communications – 600mm.
 - g. Secondary power to 750 volts – 600mm.
 - h. Power above 750 volts – 900mm.
 - ii. Rock excavation:
 - i. All systems – 150mm from the top of concrete encasement. All raceways to be concrete encased with a minimum of 50mm concrete all round.
 4. Unless specifically stated on the plans all cables shall be buried to a minimum of 1000mm.

26 05 33 CONDUIT FOR ELECTRICAL SYSTEMS

Conduit, Conduit Fastenings and Fittings – General

1. The use of AC90 (BX) cabling inside buildings is generally permitted only for luminaire drops and in tight spaces such as millwork and lab benches. Special permission must be obtained in writing from the Consultant and FMEL for uses elsewhere.
2. This section describes the accepted types of conduit and underground ducts for the campus.
3. The use of electric non-metallic tubing (ENT) is NOT permitted on campus.
4. To provide flexibility, conduit home run fill should be limited to 20% in order to accommodate pulling of future conductors.
5. Conduit is not permitted inside concrete slabs for educational buildings. All conduits shall be surface mounted under suspended slabs. Underground conduit shall be “under” the slab.

Basic Wiring Method

1. Underground or in concrete exterior to building:
 - i. All wiring shall be in PVC DB2 conduit, complete with bonding conductor sized to suit.
2. Concrete walls and slabs interior to building:
 - i. All wiring shall be in rigid PVC conduit, complete with bonding conductor sized to suit (minimum 3/4").
 - i. Conduit shall run under slabs-on-grade and NOT in concrete, sized to suit.
 - ii. All wiring in areas of suspended slabs shall be EMT surface mounted to the underside of slab.

3. Partition walls and ceilings:
 - i. All wiring to be run in EMT conduit for branch circuits. EMT for fire alarm and low voltage raceways, and EMT and wire for all feeders and surface wiring in electrical and mechanical rooms.
4. T-bar ceilings:
 - i. EMT and wire to junction box with flexible armoured cable drops for individual luminaires (no feed through wiring to luminaires allowed, except for luminaires butted together). Allow adequate cable to relocate luminaire one T-bar space in any direction.
5. Motors and transformer connections (and all equipment that vibrates):
 - i. Short (600 to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Wire shall be stranded for all sizes. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.
6. Surface raceways – interior:
 - i. All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.
7. Surface raceways – exterior:
 - i. All surface raceways shall be rigid PVC conduit, protected from damage and excessive heating to the Consultant's satisfaction.
8. Gutters/wire-ways:
 - i. Gutters/wire-ways for branch circuits above and below electrical panels shall be a minimum of 250mm high. Depth and width shall be as required by Electrical Code.

Location

1. Locate electrical devices on walls with main regard for convenience of operation and conserving wall space, in conjunction with the electrical drawings. Switches, receptacles, fire alarm pull stations, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
2. Do not install outlets back-to-back in party wall; allow minimum one stud space horizontal clearance between boxes. Install behind all outlets in party walls a Lowry Acoustic backing pad.
3. Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.
4. All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.
5. All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.
6. All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted.
7. All junction boxes and other raceway access devices shall be mounted avoid being visible from public areas. Obtain approval for any and all junction boxes that (due to the building design) cannot be concealed.

8. All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated system.

Installation

1. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
2. Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
3. Use electrical metallic tubing (EMT) except above 2.4m not subject to mechanical injury.
4. Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.
5. Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
6. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
7. Use explosion proof flexible connections for connection to explosion proof motors. Install conduit sealing fittings in hazardous areas. Fill with compound.
8. Minimum conduit sizes for lighting and power circuits: 21mm.
9. Minimum sizes for conduit home runs shall be 21mm.
10. Provide minimum 50% spare capacity in conduit for all branch circuits.
11. Install fish cord in empty conduits.
12. Run 2-27mm spare conduits up to ceiling space and 2-27mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
13. All conduits shall be fastened to structure with steep straps (no cast type straps allowed).
14. All EMT fittings to be steel (no cast type fittings).

Rigid PVC Ducts and Raceway

1. Install PVC conduit and fittings using new PVC cement, approved by the conduit manufacturer. PVC cement to be low VOC type.
2. Clean terminations with solvent and bevel inside edge of field cut conduit.
3. Protect conduit and fittings from water and keep dry while making connections.
4. Secure PVC raceway using PVC clamp on surface runs, and use tie wire in concrete slab when connecting to rebar.

EMT Raceway

1. Insure that fittings are installed on raceway to provide effective continuity of raceway ground.
2. Fire Stopping
3. Apply ULC approved fire stopping assembly to all conduit penetrations passing through fire rated walls and floors.
4. Provide shop drawings showing details for each type of application on the project. Shop drawings shall include catalogue data and installation details.
5. For all communication sleeves accessible via ceilings or in stacked closets/rooms passing through floors, provide 2 hour rated STI EZ-PATH assembly. Provide minimum 4 – 100m square sleeves between each floor and each communication closet/room.

26 05 36 CABLE TRAYS FOR ELECTRICAL SYSTEMS

General Information

1. In general, the use of cable tray along corridors is preferred for communications cable installation and management. Where space permits, cable tray shall be minimum 300mm wide and 150mm deep. Ladder type tray with rungs at minimum every 150mm is required. Where there is insufficient space, use basket tray as specified.
2. Cable trays shall also be provided inside communications rooms running along the perimeter of the room.
3. Where cable tray is installed in server rooms, tray will be exposed and will require multiple receptacle outlets of various CSA configurations. This will require confirmation with the FMGT Project Officer prior to design.

Cable Tray – Centre Hung Type

1. Centre hung supported tubular member steel tray system, complete with minimum C-1 load rating and triangular 100mm deep rungs spaced at 150mm centres.
2. Tray sections joined by two bolt splice connector complete with 12mm diameter threaded steel rod support assembly.
3. Cable trays to be bottom rung supported nominal 305mm wide.
4. Rungs to be complete with protective end caps.

Cable Tray – Basket Type

1. Ceiling steel rod Cantruss rack supported 150mm wide wire basket type tray system, 50mm high, and 50mm x 100mm mesh pattern.
2. Heavy gauge zinc plated carbon steel wire.
3. Provide radiused drop outs at each cable tray termination (5 positions) and 8 positions above optical table.
4. Provide 10mm threaded rods for support of cable tray.

5. Provide plastic protector caps for protection from irregular cuts.
6. Provide 90 degree horizontal elbows (radiused corners) at all turns.

Installation

1. Support cable-trough on one or both side(s) depending on if the cable-trough is centre hung or basket tray style.
2. Cable tray system is not to pass through walls. Penetration at all wall locations to consist of minimum 4 – 50mm conduit sleeves, complete with bushings at each end, and sealed around conduits to maintain integrity of wall separation system. Where penetrations pass through fire rated assemblies, use 4 – 100mm square STI EZ-Path fire stopping sleeves.
3. Provide bonding of cable tray system using #6 copper bonding conductors connected to building ground system in accordance with Canadian Electrical Code.

Cables in Cable-Trough

1. Lay cables into cable-trough individually using rollers when necessary to pull cables.
2. Secure cables in cable-trough at 6m centres, with nylon ties.
3. Identify cables every 30m width size 2 nameplates.

26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

Installation of Cables in Trenches and Ducts

1. The University's power distribution and communications campus backbone consists of underground ducts and manholes which provide durability and flexibility during maintenance operations and when new facilities are being constructed.
2. Consideration shall be given to design new duct-banks that have spare capacity and that provide flexibility for providing services to potential future campus development sites.
3. Typical duct-banks for the campus will include concrete encased ducts that carry power, telephone cabling, copper data communications cabling, fibre optic cabling, security cabling and fire alarm cabling.

Cable Protection

1. Provide plastic marker tape with metallic backing strip above all duct-banks in order to facilitate future locating of ducts.

Direct Burial of Cables

1. Direct buried cables are to be avoided as much as possible. When needed, they shall be enveloped in sand bedding and separated as required by code.
2. Underground cable splices are not acceptable.

3. Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
4. Cable separation shall be as prescribed by the Canadian Electrical Code.

Cable Installation in Ducts

1. Installation of cables in ducts is the preferred underground installation. Cabling shall be installed without splices inside ducts.
2. Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
3. To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.
4. Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
5. After installation of cables, seal duct ends with duct sealing compound.

Markers

1. Mark cable every 150m along duct runs and changes in direction.
2. Mark underground splices.
3. Where markers are removed to permit installation of additional cables, reinstall existing markers.
4. Install cedar post type markers.
5. Lay concrete markers flat and centred over cable with top flush with finish grade.

Field Quality Control

1. All cables and wires shall be checked for phase rotation, for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
2. After installing cable but before splicing and terminating, contractors are to perform insulation resistance test with 1000 V megger on each phase conductor.
3. Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
4. Remove and replace entire length of cable if cable fails to meet any of test criteria.

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

Wiring Identification

1. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
2. Maintain phase sequence and colour coding throughout.

3. Colour code: to CSA C22.1.
4. Use colour coded wires in communication cables, matched throughout system.
5. Group neutral with associated conductors in junction boxes.

Conduit, Junction Box and Cable Identification

1. Junction box covers are to be colour coded as follows:
 - i. Fire Alarm – Red
 - i. Communications – Green
 - ii. Mechanical Controls – Blue
 - iii. Emergency Power – Yellow
 - iv. Audio-Visual and Intercom – Orange
 - v. Security system – White
2. Colour coding for cables/wire shall be as follows: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Communications Category 5E	Yellow	
Communications Category 6 or 6A	White	
Other Communication Systems	Green	Blue
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

26 09 00 INSTRUMENTATION AND CONTROL FOR ELECTRICAL SYSTEMS

26 09 19 ENCLOSED CONTACTORS

General

1. Materials and installation for contactors for system voltages up to 600 V.
2. Contactors: to CSA C22.2 No. 14.
3. Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
4. Fused switch combination contactor as indicated.
5. Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
6. Mount in CSA Enclosure 1 unless otherwise indicated.
7. Include following options in cover:
 - i. Red indicating lamp.
 - i. Stop-Start pushbutton.
 - ii. Hand-Off-Auto or On-Off selector switch, as indicated.
8. Control transformer as required.

26 09 23 LIGHTING CONTROL DEVICES

Low Voltage – System Description

1. The use of central low voltage lighting controls provides the University with energy management capabilities, which enhance its sustainability and reduce greenhouse gas emissions. The central control systems are programmable and tied to the overall campus energy management system.
1. Central low-voltage controls systems are to be provided with low-voltage relays, switches, photoelectric daylighting sensors, programmable scanners, time clocks, occupancy sensors, and vacancy sensors. The preferred vendor for this system is Douglas Controls.
2. In video conferencing spaces and spaces which are provided with dimming fluorescent and/or incandescent lighting, central relay controls with low-voltage switching shall be provided in addition to local incandescent or fluorescent dimmer controls.
3. In classrooms, provide sufficient relays and control switches to accommodate full lighting level, 50% lighting levels, whiteboard illumination, front and back of classroom illumination. The use of luminaires with T5HO fluorescent lamps and stepped ballasts may be appropriate in these spaces.
4. For LEED® projects, special attention to controllability of lighting must be considered in the control system design.

Occupancy Sensor Lighting Control

1. Wall mounted wall switch style PIR occupancy sensors shall have adjustable delayed-off time setting 30 seconds to 30 minutes, and a 180° field of view. Product shall be Wattstopper or Sensor Switch equal.
1. Ceiling mounted PIR occupancy sensors with 120V controls shall have adjustable delayed-off time setting 20 seconds to 15 minutes, 360° field of view, and built-in isolated relay. Product shall be Leviton #ODC0S-I1W or Sensor Switch equal.
2. Ceiling mounted PIR occupancy sensors with 24V controls shall have adjustable delayed-off time setting 15 seconds to 30 minutes, 360° field of view, 24VDC supply, and built-in isolated relay. Product shall be Wattstopper "CI" Series with range suitable for coverage area and complete with Wattstopper power pack or Sensor Switch equal.

Photosensitive Daylighting Control

1. Light Level Switch shall be accomplished with indoor ceiling or wall mounted photo conductive cell that switches a circuit for stepped ballasts off when sufficient daylight is sensed, resulting in a 50% lighting output for the luminaires being controlled. Acceptable product: Wattstopper #LS-100 with range suitable for sensing area and complete with Wattstopper power pack.

Exterior Lighting Electronic Time Clock/Photocell Control

1. Electronic controls for exterior lighting shall consist of a microprocessor controlled low voltage lighting control panel with adjustments and indications built into face of controller. Douglas #WPC-5577 photometric controller. The system shall comprise of two output groups, each with three Douglas Relay outputs (max two 20A relays per output) and 2 on/off momentary outputs, a master override button built into the control panel, memory backup (7 days), an astronomical clock and a remote photo sensor complete with weatherproofing mounting package. Douglas #WPS-5527. Manufacturer: Douglas or Leviton equivalent.

Exterior Lighting Combination Time Clock and Photocell Control

1. Combination time clock and photocell controls shall comprise of:
 - i. Recessed mounted adjustable photocell capable of switching 1500 watt load.
 - i. A 365 day electronic timing control centre complete with photo control feature.
 - ii. Time clock controls 3 circuits independently, complete with manual bypass switch for each circuit.
 - iii. Shall be complete with 24 hour reserve power timing mechanisms. Manufacturer: Intermatic #ET70415CR or equivalent.
2. Contactor to switch exterior lights to 40 Amp rated poles as required, electrically held controlled by 120 volts from photocell / time clock. Acceptable manufacturers: Square D, Cutler-Hammer.

Network Lighting Controls – General Information

1. Lecture theatres and teaching spaces that require dimming controls or controls using Creston audio-visual interface shall be provided with a networked lighting control system with DMX communication interface.

Acceptable Manufacturers

1. Lutron Electronics Co. Inc. or approved equal.

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1. All lighting control equipment – dimming panels, switching panels, dimming ballasts, control panel and controls – shall be manufactured by a single manufacturer.

Panels

1. The networked lighting control system shall be installed in a panel which is completely pre-wired by the manufacturer. These panels and components are to be U.L.C. or CSA marked as appropriate.
1. Panels are dedicated feed through type and are not required to contain branch circuit protection. Branch circuit power is obtained from the associated power panel. Refer to the Dimmer/Switch System details.
2. Panels shall be cooled via free-convection, unaided by fans, and capable of continuous operation to all of these section specifications within an ambient temperature range of 0°C (32°F) to 40°C (104°F).
3. Control panels shall be able to control a “scene” or “pre-set” as a specified look or mood created by different lighting zones set at different intensities.
4. In the event that any of the communication lines to any of the dimmer and/or relay panels is interrupted for any reason, the lights controlled by those panels shall remain at their current levels until the interruption is cleared. In the event of a control station failure or interruption of a communication line to any of the controls, the lights controlled by those stations shall remain at their current levels. The control system shall have non-volatile memory backup that can store all system data for one year minimum. It shall not be necessary to reboot the system manually nor use any tape or floppy disk/hard drive to restore the system once power has been restored – system shall automatically return to its previous state. The main processor shall be protected by an integral isolation transformer and shall meet the ANSI/IEEE specification for transient protection.
5. Control Panel: Lutron Cat. #GRAFIK EYE 3000 System.
6. Dimmer panels shall be constructed of dimmer modules with four circuit dimmer modules rated 20A (16A continuous) at 120V per circuit. Module shall be capable of controlling incandescent, tungsten, magnetic low voltage and neon/cold cathode sources directly. Module shall be capable of controlling fluorescent (using dimming ballasts) and electronic low voltage sources (using electronic transformers) directly. All dimmers shall be voltage regulated so that a $\pm 10\%$ variation in line voltage shall cause no more than a $\pm 5\%$ variation in load voltage when dimmer is operating at 40V (5% light output). Filtering shall be provided in each dimmer so that the current rise time shall be at least 350 μ sec at 50% rated dimmer capacity as measured from 10-90% of the load current waveform at a 90% conduction angle, and at no point rise faster than 30 μ A/msec. Manufacturers shall note that additional filters may be required to meet this specification. These filters need not be integral to the dimming module, but must be integral to the dimming cabinet.

Controls

1. The control panel shall have a built-in dry contact A/V interface for monitoring emergency stand-by power status and activating full brightness scene. Lutron Cat. #GRXAV.
1. Wallstation Controls shall be 2-button remote wall station: For activation of pre-programmed scenes at control panel. Lutron Cat. #SJ2BSL C-Touch remote activator. White finish complete with lockable cover. Wall stations are to be provided on the wall at the front of all lecture theatres and teaching spaces as well as in the lecture booth. Stations shall also be provided at the entrance of lecture and teaching space to provide a pre-set scene for entering and accessing the space safely.

2. In large lecture theatres, lighting shall be controlled in banks running front to back and side-to-side. Control of lamps individually in each luminaire is preferred over dimming.
3. All digital control stations shall be provided with a lockable front hinged cover.
4. Provide 5-50mm conduits from instructor's console to control booth.
5. Provide 25mm conduit from instructor's console to motorised shade operators for low-voltage control wiring.

Programming

1. Pre-programming is to be completed by Lutron prior to delivery.
1. Final programming of dimmer system is to be done by Lutron once system is substantially complete.

Field Quality Control

1. Testing and Inspection: Complete system is to be tested and inspected in accordance with manufacturer's recommendations.
1. On completion of installation, manufacturer representative shall be notified to carry out site inspection and report any inconsistencies to the Department Representative and Consultant.
2. One copy of the test results is to be provided to Electrical Design Consultant and one copy is to be included in each Maintenance Manual.

Spare Parts

1. 2 dimmer modules.

26 09 36 MODULAR DIMMING CONTROLS

Dimming Switches

1. Incandescent dimmers shall be full range dimmer designed to produce 0% to 100% brightness control by means of single slider. Dimmers shall be advanced solid-state circuitry with silicon symmetrical switch, LED push button switch separate from slide to turn dimmer on/off, rated 1000 watts at 120V.
1. Electronic low voltage dimmers shall be full range dimmers designed to produce 0% to 100% brightness control by means of single slider. They shall be provided with advanced solid-state circuitry with silicon symmetrical switches, LED push button switch separate from slide to turn dimmer on/off. Rated at 425 watts.
2. Fluorescent line voltage dimmers shall be full range dimmer designed to produce 0% to 100% brightness control by means of single slider. These shall be provided with advanced solid-state circuitry with silicon symmetrical switch and line voltage control interfaces to work with Advance Mark X or Lutron Hi-Lume/Eco-10 T5 and T8 electronic ballasts. Units are to have LED push button switch separate from slide to turn dimmer on/off, rated at 1000 watts at 120V.
3. Fluorescent low voltage dimmers shall be full range dimmer designed to produce 0% to 100% brightness control by means of single slider. These dimmers shall be advanced solid-state circuitry with silicon symmetrical switch with low voltage (0-10VDC) control signal to interface to Advance Mark VII or Motorola Helios T5 and T8 dimming ballasts.

4. All dimmers shall have LED push button switch separate from slide to turn dimmer on/off and be complete with 120V power supply where required, have multi-location capability, be equipped with radio/TV interference filter. Accepted manufacturers: Lightolier Sunrise ZP425QE or Lutron equivalent.

26 10 00 MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION

26 11 01 SUBSTATIONS

Unit Substation to 15kV – General

1. New buildings are to be provided with an indoor unit substation designed to accept 15kV and 25kV primary voltages, however the primary voltage connected will be 15kV.
2. Indoor unit substations are to be provided with:
 - i. Primary switchgear including two incoming 25kV and one 25kV outgoing SF6 gas filled switches.
 - i. Dual bumpless transfer primary switching controls including uninterrupted power supply, programmable logic controller, HMI control interface and outlet jack.
 - ii. Primary switch contact lights with manual momentary switch located on the primary switch enclosure.
 - iii. Power transformer.
 - iv. Secondary switchgear.
 - v. Digital information metering.
3. The unit substation is suitable for use on a 12.47kV/25kV, 3-phase, 3-wire, 60 Hz grounded system with a 3-phase fault level of 5,000 A.
4. The high voltage unit substation consists of an assembly of high voltage switchgear transformer, bus bar, and all equipment and connections necessary to make a complete installation.
5. Provide DANGER – HIGH VOLTAGE signs for all high voltage switchgear cubicle doors and transformer enclosures.
6. Provide adequate lifting lugs for transformer as well as all cubicle sections.
7. Install all unit substation components and auxiliary equipment in sheet steel cubicles.
8. Cubicles shall be of formed code-gauge sheet steel construction with all panel edges turned into the framework. All panels (including side panels) not installed against walls or adjacent cubicles shall be hinged with “hold-down” bolts. All other panels shall be welded in place. Enclosure panels shall be well braced and reinforced to prevent vibration.
9. Provide keyless porcelain lamps in HV fused disconnect switch and transformer cubicles complete with a labelled flush-mounted switch on the cubicle door of the main switch.
10. All panels on which relays, meters, meter switches, metering test blocks, controls, and other similar apparatus are mounted shall be hinged to give ready access to equipment wiring when the door is opened. These panels shall be completely barricaded from high voltage cubicles.
11. The unit substation shall be assembled by a single manufacturer regularly engaged in the fabrication of such equipment and shall be completely shop assembled and tested prior to delivery to the site.
12. Interlocks shall be provided as shown on the drawings.

13. Provide continuous lamicooid or neatly painted mimic single line diagram fastened to the front of switchgear and extending from cubicle to cubicle.
14. A, B, and C phase designation shall be made obvious in the back of each cell.

Quality Assurance

1. Submit 10 copies of production test results to FMGT Representative/Consultant. Do not ship equipment until test results have been accepted by FMGT Representative/Consultant.

Extra Materials

1. Include 3 fuse refills for primary switched.

Indoor Unit Substation

1. Primary switchgear: Indoor, 25kV, 600 A, 3-phase, 4-wire, interrupting capacity 250 MVA, symmetrical, BIL 95kV.
2. Interior mounted metal-enclosed unit substation.
3. Provide a 15kV class interior mounted metal-enclosed unit substation, c/w provision for dual radial feeders.
4. All sections, high voltage and low voltage, when bolted together shall present a unified aesthetic appearance.
5. The unit substation shall be adequately and naturally ventilated (louvers on the substation roof are not permitted). Louver sizes for the core and coil assembly shall be as recommended by the transformer manufacturer.

High Voltage Switchgear Cubicles

1. The high voltage switchgear cubicles shall include a fixed disconnect switch and accessory components, all completely factory assembled and type tested.
2. The cubicles shall be complete with appropriately sized, CSA-approved, split support for high voltage cables and shall be suitable for the installation of stress cone cable terminations specified elsewhere. Details of the terminations shall be provided on submission of shop drawings. Terminals shall be pre-drilled holes to accept one-hole crimp-on type compression lugs.
3. Service entrance cubicles shall have provision for padlocking by Owner.
4. The minimum rating of the integrated assembly shall be as follows:
 - i. Voltage class: 12.47/25kV.
 - i. BIL: 95kV.
 - ii. Minimum short circuit capacity: 250 MVA at 25kV (symmetrical for all current carrying components).
 - iii. 60 Hz withstand 55kV for circuit breakers.
 - iv. Main bus, continuous current: 600 A.
5. Bus bar supports shall be NEMA BIL rated epoxy or porcelain insulators. All bus bars shall be designed to withstand thermal and electromagnetic stresses at the specified ratings and shall be tin-plated copper construction.

6. Nameplates shall be permanently fixed to the exterior of each enclosure indicating:

i. Manufacturer's name.

Switchgear kV.

Switchgear BIL.

Switchgear maximum short circuit MVA.

Switchgear momentary amperes.

Switchgear fault closing amperes.

Switchgear continuous bus amperes.

Switchgear year of manufacture.

Switchgear drawing numbers.

Circuit breaker catalogue number.

7. The high voltage switchgear shall be designed, manufactured and tested in accordance with CSA 22.2 No. 31 and shall bear CSA approval label and meet the requirements of the local inspection authority.

Bus Bars

1. Three phase and full capacity neutral bare bus bars, continuous current rating 600 A extending full width of multi-cubicle switchboard suitably supported on insulators.
2. Main connections between bus bars, major switching components of continuous current rating to match major switching components.
3. High conductivity copper for bus bars and main connections.
4. Brace bus bar system to withstand stresses resulting from short circuit currents specified.
5. Tin surfaced joints, secured with non-corrosive bolts and washers, tightened with torque wrench in accordance with manufacturer's recommendations.
6. Identify phases of bus bars by suitable markings.
7. Bus bar connectors when switchgear shipped in more than one section.

Grounding

1. Copper ground bus not smaller than 60mm x 6mm extending full width of multi-cubicle switchboard and situated at bottom.
2. Lugs at each end for size 4/0 AWG grounding cable.
3. Bond non-current carrying parts, including switchgear framework, enclosure and bases to ground bus.

Dual Primary Load Interrupter Switches

1. 15k/25V, 600A continuous, 3-pole, gang-operated, SF6 gas filled, non-automatic type. All arcing accompanying interruption shall be contained within completely enclosed interrupting units. The units shall be mechanically operated by and interlocked with the interrupter blades so as not to open until the blades have cleared the main contacts by a distance greater than the external flash over distance across the interrupting unit. Manual remote operating HMI interface permitting operation of switches from a safe distance is required.
2. Interrupting rating to match that of switchgear.

3. Inspection windows shall be of wired safety glass or laminated heat-tempered safety-plate glass, gasket mounted at the front. Windows shall be so located that the open and closed position of the switches can be readily seen from the exterior of the enclosure.
4. Live-line neon-type indicating lights shall be connected on each phase of the incoming cubicles. Indicating lights shall be connected to the line side of the disconnect switch and shall be visible through the inspection window.
5. Operating handles shall be externally mounted and non-removable and shall provide for latching and padlocking in open positions. They shall swing in a vertical plane normal to the front face of the switchgear.
6. Provide two Form C contacts on each load break switch. Wire from one contact on each switch to 2 status inputs on the digital metering system (2 separate status points for each contact). The contacts will be wired to indicate which feeder is currently energized and in conjunction with primary parallel transfer system.
7. Provide Kirk key type interlocking as shown on the drawings with 2 keys and 3 locks as shown. Provide full operating instructions as indicated on drawings inscribed on lamicoid labels and installed at the operating handle location of each load break switch.
8. Provide inspection luminaires to observe the open/closed status of load break switch contacts. Luminaires shall have keyless porcelain lamp holders, complete with 100W rough service lamp and a labelled flush-mounted switch on the cubicle door of the load break switch.

Dual Primary Parallel Transfer System

1. Provide a complete dual primary parallel transfer switch system as indicated on drawings and specified herein.
2. Key Interlock Synchronization Control Station.
3. Provide control station as shown on the drawings and completely manufactured, pre-wired, and tested at the factory. Submit factory test reports to the Consultant.
4. The synchronizing check relay shall be verified by the independent testing agency for phase angle allowance, and voltage difference. This testing will be required to meet IEEE/ANSI/NETA standards. The standard of acceptance shall be the power system simulator microprocessor based relay test set known as the Doble System. Sync-check relays shall be Basler BE1-25 M1E-A6P-N4S3F.
5. The programmable relay shall be proven for all required functions and tested, commissioned, and witness verified, to the satisfaction of the Consultant and electrical maintenance staff. Programmable relay shall be Moeller "Easy" 618-AC-RC.
6. Provide solenoid operated key release designated as "K1" on the drawings, complete with 1 N.O. and 1 N.C. auxiliary contacts.
7. Provide test switches as shown on the drawings. Test switches shall be ABB/Westinghouse Flexi-test type FT-1 or equivalent.
8. Provide adjustable volume, selectable tone alarm horn, Edwards 5540B or equal.
9. Provide a locking handle for the control station front door. Key for the front door handle shall be identical to substation.

-
10. The manufacturing and pre-wiring of control station to be of matching quality and appearance to unit substation equipment.
 11. Potential Transformers:
 - i. Potential Transformers (PTs) shall comply with the latest edition of CAN3-C13 and IEEE C57.13.
 - i. Provide PTs of the number shown on drawings complete with heavy gauge steel draw-out assembly, disconnecting and grounding means, and primary and secondary fuses. The PTs shall have the following characteristics:
 - a. Insulation: 15kV, 95kV BIL.
 - b. Ratio: as shown on drawings.
 - c. Continuous thermal rating (30°C rise above 55°C ambient): minimum 500VA.
 - d. CSA accuracy class: 0.3 WXYZ, 0.6 ZZ.
 - ii. The steel draw-out assembly shall typically include all the standard features of the switchboard manufacturer's 15kV class PT drawer, complete with pre-drilled mounting provision for a second PT core. The drawer shall be a compact assembly designed to fit into the switchboard cubicle.
 - iii. PT drawers shall be completely manufactured, pre-wired, and tested at the factory. Submit factory test reports to the Consultant.
 - iv. Provide warning signs on PT drawer-out assemblies.
 - v. Provide solid bus bar taps complete with bus bracing and support insulators from the switchgear main bus to the PT-1 and PT-2 high voltage stab connectors. Cable taps are not acceptable unless factory test results are submitted for Consultant's approval, showing compliance with BIL rating of 95kV crest.
 12. Switchboard and Control Station Wiring:
 - i. Provide the monitoring and control devices complete with all necessary wiring, fuses, fuse blocks, and terminal blocks for external and internal connections. Identify all terminals clearly with the appropriate control circuit wire numbers.
 - vi. All control wiring to shall be Type TBS or SIS and shall conform to CSA C22.2 No. 31. Provide wire numbering sleeves for all conductors.
 13. Relay Programming:
 - vii. Provide two non-volatile memory cards EASY-M-16K, for use with the Moeller programmable relay. One card will be used to load a standardized control program. The second card shall be a spare. Program the relay as follows:
 - a. Relay starts in RUN mode when the power is switched on (to ride through momentary power interruption when switching CS-1).
 - b. If control power to the relay is on, and I1 is not turned on with 1 minute of I2 being turned on, initiate alarm; otherwise, turn to Q1 to proceed with paralleling.
 - c. If control power to the relay is on, and I2 is on, and I4 and I5 are both off continuously for more than 5 minutes, initiate alarm.
 - d. If I1 is on and I2 is on, initiate alarm.
 - e. If I2 remains on for more than 5 minutes, initiate alarm.
 - f. Alarm: Flash Q2, turn on Q3, and turn on Q4 to sound the horn.
 - g. Horn silence: If I3 is turned on momentarily, turn off Q4 and check all "initiate alarm" conditions listed above. If any alarm condition remains, continue flashing Q2, even though the horn is turned off. If alarm conditions have all cleared, turn off Q2.
 - viii. Submit full program printout and ladder-type logic circuit diagram for Consultant's approval.
 - ix. Upon receiving the Consultant's approval, store the circuit diagram, as well as all the parameter settings for the circuit diagram, and all the system settings in both memory cards.

- x. Provide a 4 hour training session for UVic personnel in the use and programming of the relays.
 - xi. Demonstrate, during the training session, how to program the circuit diagram and how to transfer the program to relays.
 - xii. Hand over both memory cards to UVic upon completion of working session.
14. Field Tests:
- ii. Perform tests in accordance with University requirements.
 - iii. Inspect and test load break switches as follows:
 - a. Inspect and check quick-make, quick-break operation.
 - b. Check contact resistance ("millivolt drop" test)
 - c. Check operation of all auxiliary contacts.
 - d. Test all interlocking procedures.
 - e. Fully test the correct and safe operation of the parallel transfer system.
15. The entire system and its operation shall be demonstrated with operational training of the procedures, calibrations, and safety interlocks to the electrical maintenance staff. Allow for minimum 2 training sessions for the staff.

26 12 16 DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

General

1. Dry type medium voltage transformers shall be designed and included in the primary unit substation. The transformer shall be rated for 115,000kV and 25,000kV primary but connected to and fused for 15,000kV.
2. The unit shall be kept heated and dry to prevent moisture and dampness from penetrating transformer.

Shop Drawings

1. Shop drawings shall include:
 - i. Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
 - i. Technical data shall include kVA rating, primary and secondary voltages, frequency, 3-phase, polarity or angular displacement, full load efficiency, regulation at unity of pf, BIL, insulation type, and sound rating.

Control Submittals

1. Submit to FMGT Representative/Consultant 6 copies of standard factory test certificates of each transformer and type test of each transformer in accordance with CSA C9.

Transformer Characteristics

1. Transformers shall be as follows:
 - i. Type: 3-phase, dry type natural air ventilated, ANN (T type or Scott connection type not acceptable).
 - i. Ratings: 300kVA.
 - ii. Voltages: Primary: 25000 V delta.
 - iii. Secondary: 120/208 V wye, solidly grounded.
 - iv. Frequency: 60 Hz.
 - v. Coil Winding Material: Copper.

- vi. Insulation Class: Class H (Class 220 system) non-hygroscopic, VIP type.
 - vii. Impedance: Approximately 6.0% at 135°.
 - viii. Voltage Taps: 4 full capacity taps, 2 1/2% each, 2 above and 2 below rated voltage.
 - ix. Sound Level: Maximum 68 dB when installed on vibration isolators within enclosure at ANN rating.
 - x. Voltage Class: 15kV.
 - xi. BIL: 95kV.
 - xii. Max. Full Load Temperature Rise: 115°C average temperature rise for the windings measured by resistance when operating continuously at full load in 40°C maximum ambient.
 - xiii. Max. Magnetizing Inrush Current: 12 times rated full load current.
2. Provide a ventilated formed sheet-steel enclosure with bolted removable sides compatible with enclosures of adjacent cubicles. Enclosure panels shall be well braced and reinforced to prevent vibration. Provide transformer with “coil-face taps” behind a hinged locked door key-interlocked with the transformer primary disconnecting device such that it is impossible to open the door with the switch closed. Identify the door as to function and affix thereto a nameplate with detailed connection diagram, key-interlocks, and instructions for tap-changing.
 3. Provide for transformer an enclosure-mounted thermometer and a thermostat having its temperature-sensing element affixed to the core and coil assembly in such a way as to best sense the winding temperature. Remote current actuated sensing devices are not acceptable. Set the thermostat to operate main fusible load interrupter shunt trip mechanism and a remote bell when the temperature reaches 100% of this rating. Wire via identified terminals in the control cubicle section of the low voltage switchboard for extension by others to remote Building Alarm Panel/Building Automation System.
 4. Insulation panels on the interior of transformer enclosures shall be provided if necessary to maintain electrical clearances.
 5. Provide flexible connections between transformer and high voltage and low voltage bus bars.
 6. Each transformer shall have vibration dampers, placed between core/coil and structural members.
 7. Provide terminal board, tap changing links, and suitable solderless connections.
 8. Mount transformer core and coil assemblies on vibration isolators and restrain with Mason Industries Type “Z41011” snubbers.
 9. Special additional features shall be as follows:
 - i. All terminations shall use a minimum of 2 bolts.
 - xiv. All connections shall be made from flat bus bar for solid bolting (clamped round rod not allowed).
 - xv. Solid material shall be used for coil end blocks.
 - xvi. All bus bars shall be fully insulated.
 - xvii. All bus bar mounting hardware shall include Belleville washers.
 - xviii. All non-conductor mounting shall have 2 lock nuts.
 10. Transformers shall be supplied with a copper grounding pad at the base.
 11. Nameplate shall be installed on transformer clearly showing the following information.
 - i. Manufacturer’s name.
 - xix. Transformer serial number and year of manufacture.
 - xx. Rated kVA.

- xxi. Rated high and low voltage levels.
 - xxii. Rated frequency.
 - xxiii. Connection diagram and physical terminal markings.
 - xxiv. Percentage impedance at rated voltage.
 - xxv. Temperature rise (or total temperature).
 - xxvi. Insulation class.
 - xxvii. HV BIL.
 - xxviii. Voltage Tap data.
 - xxix. Total weight of transformer.
12. Transformer shall be manufactured and tested (production tests) in accordance with CSA C9-M1981 incorporating modifications as specified herein. Submit production test reports.
13. Transformer shall be manufactured by Square D, Hammond Manufacturing Co. Ltd., Canadian General Electric Co. Ltd., ABB Inc., Skyway, Magnetek-Polygon, Tracon Engineering, or approved equal subject to compliance with these specifications.
14. Transformer manufacturers listed above as well as all manufacturers requesting approval during the tender period must submit the following information pertaining to total losses (iron, copper, and other miscellaneous losses) no later than 10 days prior to tender closing. The figures shall include transformer enclosure losses:
- i. No load.
 - xxx. 25% load.
 - xxxi. 50% load.
 - xxxii. 75% load.
 - xxxiii. 100% load.

Enclosure

1. Fabricated from sheet steel.
2. Bolted removable panels for access to tap connections, enclosed terminals (fan brackets, fans, other accessories).
3. Conductor entry:
 - i. Knockouts.
 - i. Potheads.
 - ii. Junction boxes.
 - iii. Bushings.
 - iv. Clamping rings.
 - v. Entry for (bus bars, cable).

Accessories

1. Winding temperature detector relay and sensing elements 2 sets of SPDT contacts.
2. Wiring and terminal box for protective devices.
3. Digital type winding temperature indicator with alarm contacts.
4. Fans for forced air cooling, (____) V, (____) phase, 60Hz, with thermostat control.
5. Grounding terminal: inside of enclosure.

Field Quality Control

1. Energize transformers and apply incremental loads:
 - i. 0% for 4 hours.
 - i. 10% for next 1 hour.
 - ii. 25% for next 2 hours.
 - iii. 50% for next 3 hours.
 - iv. Full load.
 - v. At each load change, check temperatures ambient, enclosure and winding.
 - vi. Adjust cooling fan controls if required.

26 13 16 MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHGEAR

Disconnected Switches – Fused and Non-Fused – General

1. Fusible or non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No. 4 size as indicated.
2. Provision for padlocking in on-off switch position by three locks.
3. Mechanically interlocked door to prevent opening when handle in ON position.
4. Fuses: size as indicated, in accordance with standards.
5. Fuse Holders: to CSA C22.2 No. 39 relocatable and without adaptors, for type and size of fuse indicated.
6. Quick-make, quick-break action.
7. ON-OFF switch position indication on switch enclosure cover.

Fusible Load Interrupter Switch

1. 3-pole, gang-operated, 24kV, 600 A continual, non-automatic load interrupter switch. Operating handle externally mounted and non-removable, and provides for latching and padlocking in open position. It shall swing in a vertical plan normal to the front face of the switchgear. Provide Kirk key type interlocking as shown on the drawings. Include full operating instructions on a nameplate mounted above the opening handle of each unit.
2. Continuous full load rating: 600 A, interrupting rating: 20 kA symmetrical.
3. Voltage rating: 25kV.
4. Interphase barriers:
 - i. Inspection window mounted at the front. Window located so that the open and closed position of the switch can be readily seen from the exterior of the enclosure.
5. Interrupting rating that of switchgear.
6. Fixed operating handle.
7. Provide non-renewable current-limiting type fuses. Provide 3 spare fuses of the same type and rating, and install a separate metal cabinet in the electrical room.

Load Break Switch

1. Indoor load break switch with integral fuse holders.
2. Ratings:
 - i. Voltage: 7.2/12.5kV
 - i. BIL: 95kV
 - ii. Continuous current rating: 600 Amps
 - iii. Interrupting capacity: 250 MVA
 - iv. Fault closing (RMS): 20,000 Amps
 - v. Momentary rating (RMS): 40,000 Amps
3. Switches:
 - i. Gang operated with manual actuator that can be locked in the "OFF" position and position indicator. Phase to phase and phase to ground insulating barriers. Energized components to be supported from the mounting frame on porcelain insulators. Provide current-limiting fuses equipped with striker pins to give blown fuse protection (failure of one fuse to open other phases). Provide 3 spare fuses mounted at the cubicle.
4. Trip Power: Provide adequate capacitor power supply for automatic tripping of the load break switch.
5. Trip Relays: Ground fault on secondary side of transformer. Thermal relay to trip on high transformer temperature.

Main Dry Type Transformer

1. Refer to Section regarding Dry Type, Medium Voltage Transformers.
2. Secondary Switchgear
3. Secondary switchgear: indoor, 120/208V, (___) A, 3-phase, wye connected, maximum short circuit current (42) kA, manufactured to CSA C22.2 No. 31.
4. Matches primary switchgear enclosure construction and outline exactly.
5. Cubicles contain:
 - i. Digital metering system complete with current transformers.
 - i. Distribution circuit breakers.
 - ii. Copper bus including double capacity neutral from transformer to distribution cubicles including vertical buses. Bus ratings as per drawings.
6. The switchboard has provision for all outgoing feeder cables as well as allowance for future cables.
7. Distribution circuit breakers:
 - i. Moulded-case, fixed-mount with bus extensions for rear connection. 942) kA 1.C. min. Adjustable thermal-magnetic trip elements or adjustable electronic trip units per drawings. Tripping characteristics shall be set per the coordination study requirements.
8. Digital metering system: refer to Section Metering and Switchboard Instruments.

Equipment Identification

1. Provide equipment identification in accordance with Section – Electrical General Requirements.

2. Nameplates: Switchgear designation: label – white plate, black letters, 30mm high lettering, engraved Main 12.5kV Switchgear, L.R.C.

Coordination Study

1. Provide a Computer Programmed System Coordination Study using ETAP software, prepared on time characteristic curves plotted on KE form #485258 log graph paper, showing the system selectively from the main substation down to the largest low voltage breaker on the main secondary switchboard for this project. The study will be completed and stamped by a Professional Engineer registered in B.C. The study shall include the following:
 - i. Supply authority's relays or fuses protecting the incoming service.
 - i. Main and feeder protective devices necessary to insure coordination.
 - ii. Main feeder cable damage curve.
 - iii. Transformer single and 3-phase thermal damage curve.
 - iv. Symmetrical and asymmetrical fault current calculations will be completed and recorded, verifying protection of various elements of the system.
 - v. A summation chart showing all ratings and settings with reference to the appropriate curve.
 - vi. Recommendations and conclusions of the effectiveness of the coordination study.
 - vii. Protective devices associated with the largest motor.
 - viii. Protective devices associated with the standby emergency power plant.
 - ix. The drawings will not be hand drawn but shall be of computer graphics quality.

Acceptable Manufacturers

1. Subject to full compliance with the requirements of these specifications, equipment supplied by the following distributors/manufacturers is acceptable:
 - i. Siemens Electric.
 - i. Schneider Group.
 - ii. Cutler Hammer.

26 20 00 LOW-VOLTAGE ELECTRICAL TRANSMISSION

26 21 00 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

Service Equipment – General Information

1. This section applies to service entrance rated service equipment and buildings not equipped with a unit substation.

Service Entrance Board

1. Service entrance board shall have cubicles, free standing, dead front, size as required. Frame and structure of enclosure and all components to be secured to earthquake standards.
2. These boards shall have a barrier metering section from adjoining sections and be compliant with B.C. Hydro metering standards.
3. Bus bars and main connections shall be copper.

Moulded Case Circuit Breakers

1. Fully rated for available fault.
2. Common-trip breakers with single handle and trip mechanism for multipole applications.
3. Magnetic instantaneous trip elements in circuit breakers, 400A and above, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

Moulded Case Circuit Breakers – Current Limiting

1. Fully rated for available fault.
2. Common-trip breakers with single handle and trip mechanism for multipole applications.
3. Breakers up to 225 Amp to limit fault (RMS Symmetrical Amps) to 10,000A at 51,600 Amp input.

Fusible Disconnects

1. Disconnect switches shall be heavy duty, lockable position, complete with HRC fuses, quick make/quick break mechanism, adapted for HRC fuses.

Fuses

1. All fuses shall be designed for special fault limiting.
2. Fuse sizes 30A – 350 Amp shall be bus low peak LPN-RK1 (or equivalent fuse providing equal or better fault limiting characteristics).
3. Fuse sizes 400 – 600 Amp shall be bus T-tron type JJN (or equivalent fuse providing equal or better fault limiting characteristics).

Grounding

1. Copper ground bus extending full width of cubicles and located at bottom.
2. Copper lugs at each end for size #4/0 grounding cable, connect to main ground bus.

Equipment Identification

1. Provide equipment identification nameplates with:
 - i. White plate, black letters, size 30mm lettering.
 - i. Complete board labelled: "120/208 600V".
 - ii. Branch disconnects labelled: "Feeder Panel _____".

Manufacturers

1. Manufacturer: Square D, Cutler-Hammer, Seimens.

26 23 00 LOW-VOLTAGE SWITCHGEAR

General

1. Materials and installation for low voltage switchgear for controlling relatively large loads – 2000 A or larger.
2. Provide and install a complete distribution centre as indicated on the plans.
3. The available space is restrictive, and the electrical equipment has been designed to accommodate this. All proposed manufacturers shall take particular note of this when pricing equipment, and include for any variations to their standard equipment in the tender sum.
4. This section of specification includes main distribution centres, and fused disconnects in main distribution centres.

Shop Drawings & Product Data

1. Submit shop drawings and product data that indicates:
 - i. Floor anchoring method and foundation template.
 - i. Dimensioned cable entry and exit locations.
 - ii. Dimensioned position and size of bus.
 - iii. Overall length, height and depth of complete switchgear.
 - iv. Dimensioned layout of internal and front panel mounted components.
2. Include time-current characteristic curves for circuit breakers and fuses rated 250A and higher.

Storage and Protection

1. Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.
2. Provide energized strip heater in each cell to maintain dry condition during storage.

Extra Materials

1. Provide maintenance materials including:
 - i. 3 fuses for each type above 600 A.
 - i. 6 fuses for each type up to and including 600 A.

Rating

1. Secondary switchgear: indoor, (347/600) (120/208) V, 3 phase, 4 wire, 60 Hz, minimum short circuit capacity (65) kA (RMS symmetrical), in amperage capacity sized to Canadian Electrical Code plus a 25% spare capacity.

Enclosure

1. Main incoming section to contain:
 - i. Moulded case circuit breaker sized as indicated.
 - i. Digital metering.
2. Distribution sections to contain:
 - i. Moulded case circuit breakers sized as indicated.
 - ii. Copper bus, from main section to distribution sections including vertical bussing.
3. Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 1 (2) cubicle unit.
4. Access from front (and rear).
5. Steel channel sills for base mounting in single length common to multi-cubicle switchboard.
6. Interior lighting: 100 W lamp in porcelain lamp-holder in each cubicle with externally mounted switch and pilot light.
7. Receptacle: 120 V, single phase, 60 Hz, duplex, U-ground, in each cubicle.

Bus Bars

1. Three phase and full capacity neutral bare bus bars, continuous current rating, self-cooled, extending full width of cubicles in the switchboard, suitably supported on insulators.
2. Main connections between bus and major switching components to have continuous current rating to match major switching components.
3. Bus bars and main connections: 99.3% conductivity copper.
4. Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.
5. Tin plated joints, secured with non-corrosive bolts and Belleville washers.
6. Identify phases of bus bars by suitable marking.
7. Bus bar connectors, when switchboard shipped in more than one section.

Grounding

1. Copper ground bus not smaller than 50mm x 6mm extending full width of cubicles inside the switchboard and situated at bottom.
2. Copper lugs at each end for size #4/0 grounding cable, connect to main ground bus.

Ground Fault Unit

1. For main breakers rated at 1000 amps, 347/600 volt or higher or 2000 amps at 120/208 volt or higher, provide ground fault breaker unit.

Moulded Case Circuit Breakers

1. Rated for fault as indicated on one line.
2. Common-trip breakers with single handle and trip mechanism for multipole applications.
3. Magnetic instantaneous trip elements in circuit breakers, 400A and above, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.
4. Manufacturer: Square D, Cutler-Hammer.

Moulded Case Circuit Breakers – Current Limiting

1. Rated for fault as indicated on one line.
2. Common-trip breakers with single handle and trip mechanism for multipole applications.
3. Breakers up to 225 Amp to limit fault (RMS Symmetrical Amps) to 10,000A at 51,600 Amp input.
4. Manufacturer: Square D, Cutler-Hammer.

Fusible Disconnects and Fuses

1. Disconnect switches shall be heavy duty, lockable position, complete with HRC fuses.
2. Disconnects shall have quick make/quick break mechanism.
3. Disconnects shall be adapted for HRC fuses.
4. Manufacturer: Square D, Cutler-Hammer.

Fuses

1. All fuses shall be designed for special fault limiting.
2. Fuse sizes 30A – 350 Amp shall be bus low peak LPN-RK1 9or equivalent fuse providing equal or better fault limiting characteristics).
3. Fuse sizes 400 – 600 Amp shall be bus T-tron type JJN (or equivalent fuse providing equal or better fault limiting characteristics).

Equipment Identification

1. Nameplates:
 - i. White plate, black letters, size 7.
 - i. Complete switchgear labelled: "(120) (208) (600) V".
 - ii. Main cubicle labelled: "Main Breaker" or "Main Switch".
 - iii. Branch disconnects labelled: "Feeder Panel _____".

Low Voltage Lighting Switching System

1. Low voltage relays shall be mounted in lighting relay cabinet sized to hold relay groups complete with barriers for relays from different sources, sequencers/scanners/scheduler, nodes, modules, controls, and transformer. Each relay cabinet shall be provided with 4 spare relays minimum. Control relays for new cabinets to be 2 wire, latching, 20A, 1-pole HID type. Douglas #WR-6161 and control relays for KO type cabinets to be 2 wire, latching, 20A, 1-pole KO mount type. Douglas #WR-6221. Provide additional enclosures as required to house new relays.
2. Transformer shall be 120V primary/24V secondary, 40VA steady draw. Douglas #WR-4075-120. Source of power to transformer shall be from emergency power distribution.
3. Sequencers/scanners shall provide programmable Douglas sequencers/scanners #WRS-2224.
4. Systems shall have network nodes at each lighting control panel for communications between panels using LON Works protocol. Douglas #WNX-2624.
5. Low voltage switches shall be Douglas low voltage switches complete with mounting brackets and brushed stainless steel cove plates. Provide filler plates in unused button sections. Switches shall be:
 - i. 2 wire LED switches Élan Series capable of switching up to minimum 8 low voltage relays. Douglas #WR-8600 Series.
 - i. 2 wire mullion type #WN-3851/WN-38012 capable of switching up to minimum 4 low voltage relays.
 - ii. 2 wire non-LED switches #WR-8001 capable of switching up to minimum 8 low voltage relays.
 - iii. Programmable data line switches to control groups of relays from anywhere in the W-2000 network (i.e. useful for master switching stations). Douglas #WNS-2300 Series.
 - iv. Key switches to be Douglas #WRK-8611.
6. Provide LAN/web-based interface for remote monitoring by UVic Electrical Shop. Douglas Network Manager #WNP-2150. Provide data outlet at lighting controls location in electrical room and connect to network manager.
7. Provide 120V relay connected to local lighting circuit. Connect this relay to a delay timer (Douglas #WTS-4181) and connect the delay timer output to the programmable scanner input to indicate power failure. In the event of a power failure, all lighting relays for circuits from emergency power panel to be enabled.

26 24 13 SWITCHBOARDS

Metering and Switchboard Instruments – General

1. The University requires that all main service power distribution to be provided with Owner's digital information metering. The metering equipment must also be provided with Ethernet port for connection to the campus central monitoring system.
2. The use of meters can be a valuable tool for monitoring energy consumption as well and monitoring abnormalities such as low/high power factor, harmonic distortion and phase imbalance.
3. The type of digital metering in this section is typically not suitable for achieving the LEED® measurement and verification credit due to cost. For LEED® measurement and verification, the use of DDC system CT's is acceptable.
4. Digital metering products shall be Power Measurements 7550 ION Digital Metering System for educational buildings and Power Measurements 7330 ION Digital Metering System for residential buildings. These meters shall measure the following as a minimum:
 - i. Meter to display true RMS value of: A – 3-phase current, V – L to L or L to N, 3-phase voltage, kW – kilowatts, kVA – kilovolt amperes, KVAR – kilovolt amperes reactive, Pf – power factor, F – frequency, kWd – kilowatt demand, Ad – amperes demand, kWh – kilowatt hours, programmable LED for energy (kWh) pulsing, Vuax - auxiliary input to 120 V AC/DC.
 - i. Record and store the following information in meter memory: V – max/min at 1 second interval, A – max/min at 1 second interval, F – max/min at 1 second interval, kW – max/min at 1 second interval, Pf – max/min (or kVA max/min) at 1 second interval, kWd – at field programmable intervals of 1 minute to 30 minutes; set at 1 minute, Ad – per kWd.
5. Connection of Ethernet to campus monitoring system will be provided by University forces.

26 24 16 PANELBOARDS

Panelboards Breaker Type – General Information

1. Panels may be recessed in walls in corridors of buildings, however, it is preferable to have such equipment located in electrical rooms and closets.
2. All panels shall have hinged lockable front doors.

References

1. Canadian Standards Association (CSA International)
 - i. CSA C22.2 No. 29 latest edition, panelboards and enclosed panelboards.

Panelboards

1. Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
 - i. Install circuit breakers into panelboards before shipment.
 - ii. In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
2. (250) (600) V panelboards: bus and breakers rated for A (symmetrical) interrupting capacity as required.

3. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
4. Panelboards shall be provided with minimum 50% spare capacity for future breaker additions.
5. Two keys for each panelboard and key panelboard alike.
6. Copper bus with neutral of same ampere rating as mains.
7. Mains: suitable for bolt-on breakers.
8. Trim with concealed front bolts and hinges.
9. Trim and door finish: baked gray enamel.

Breakers

1. Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
2. Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
3. Lock-on devices for fire alarm, clock outlet, emergency lighting, door supervisory controls, intercom systems, stairway lighting, exit and night light circuits.

Equipment Identification

1. Provide equipment identification nameplate for each panelboard size 4 engraved.
2. Nameplate for each circuit in distribution panelboards size 2 engraved.
3. Complete circuit directory with typewritten legend showing location and load of each circuit.

Installation

1. Locate panelboards as indicated and mount securely, plumb, and true and square, to adjoining surfaces.
2. Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
3. Mount panelboards to height to meet CSA-22.1 breaker mounting height requirements.
4. Connect loads to circuits.
5. Connect neutral conductors to common neutral bus with respective neutral identified.
6. Provide written directory cards indicating devices and equipment being fed, including the room number.

26 24 19 MOTOR-CONTROL CENTRES

General Information

1. Group motor starters in mechanical or electrical rooms in a motor control centre. Obtain permission from FMGT if loose starters have been used.
2. Motor control centres are to be installed on a concrete housekeeping pad.

Shop Drawings

1. Submit shop drawings that indicate:
 - i. Outline dimensions.
 - i. Configuration of identified compartments.
 - ii. Floor anchoring method and dimensioned foundation template.
 - iii. Cable entry and exit locations.
 - iv. Dimensioned position and size of bus bars and details of provision for future extension.
 - v. Schematic and wiring diagrams.

Supply Characteristics

1. (347/600) (120-/208) V, 60Hz, wye connected, 3-phase, 4-wire, grounded neutral.

Vertical Section Construction

1. Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
2. Each vertical section divided into compartment units, minimum 305mm high, or as indicated.
3. Each unit to have complete top and bottom steel plate for isolation between units.
4. Horizontal wire-ways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from bus bars by steel barriers.
5. Vertical wire-ways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
6. Openings, with removable cover-plates, in side of vertical sections for horizontal wiring between sections.
7. Incoming cables to enter at (top) (bottom) with terminals.
8. Provision for outgoing cables to exit via top or bottom with terminals.
9. Removable lifting means.
10. Provision for future extension of both ends of motor control centre including bus bars without need for further drilling, cutting or preparation in field.
11. Divide assembly for shipment to site, complete with hardware and instructions for re-assembly, as recommended by the manufacturer.

Sills

1. Continuous 75mm channel iron floor sills for mounting bases with 19mm diameter holes for bolts.

Bus Bars

1. Main horizontal and branch vertical, 3-phase and neutral high conductivity tin plated copper bus bars in separate compartment (bare) self-cooled, extending entire width and height of motor control centre, supported on insulators and rated as required using standard products.
2. Branch vertical bus bars for distribution of power to units in vertical sections.
3. No other cables, wires, equipment in main and branch bus bar compartments.
4. Brace bus work to withstand effects of symmetrical short-circuit current as required.
5. Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creep age surface designed to discourage collection of dust.

Ground Bus

1. Copper ground bus extending entire width of motor control centre.
2. Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

Motor Starters and Devices

1. Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off-load, while buses energized.
2. Unit mounting:
 - i. Engaged position – unit stabbed into vertical bus.
 - i. Withdrawn position – unit isolated from vertical bus but supported by structure. (Terminal block accessible for electrical testing of starter).
 - ii. Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
 - iii. Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
3. External operating handle of circuit switch interlocked with door to prevent door opening with switch in “ON” position. Provision for 3 padlocks to lock operating handle in “OFF” position and lock door closed.
4. Hinge unit doors on same side.
5. Overload relays manually reset from front with door closed.
6. Pushbuttons and indicating lights mounted on door front.
7. Devices and components by one manufacturer to facilitate maintenance.

8. Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

Equipment Identification

1. Motor control centre main nameplate:
 - i. Size No. 7, engraved "MCC ##" on the first line.
 - i. "(347/600V) (120/208V) 3-phase, 4-wire" on the second line.
2. Individual compartment nameplates: Size No. (5), engraved as indicated.

26 26 00 POWER DISTRIBUTION UNITS

Motor Starters to 600V – General

3. This section includes the requirements for starters MCC mounted or loose mounted.

Shop Drawings and Product Data

1. Submit shop drawings that indicate, mounting method and dimensions, starter size and type, layout of identified internal and front panel components, enclosure types, wiring diagram for each type of starter, and interconnection diagrams.

Extra Materials

1. Provide listed spare parts for each different size and type of starter:
 - i. 3 contacts, stationary.
 - i. 3 contacts, movable.
 - ii. 1 contact, auxiliary.
 - iii. 1 control transformer(s).
 - iv. 1 operating coil.
 - v. 2 fuses.
 - vi. 10% indicating lamp bulbs used.

Starters

1. Starters: to IEC 947-4 with AC4 utilization category.

Manual Motor Starters

1. Single or 3-phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - i. Switching mechanism, quick make and break.
 - i. One or 3 overload heater(s), manual reset, Trip indicating handle.
2. Accessories:
 - i. Toggle switch, heavy duty labelled as indicated.
 - ii. Indicating light: heavy duty type and colour as indicated.
 - iii. Locking tab to permit padlocking in "ON" or "OFF" position.

Full Voltage Magnetic Starters

1. Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

- i. Contactor solenoid-operated, rapid action type.
 - i. Motor overload protective device in each phase, manually reset from outside enclosure.
 - ii. Wiring and schematic diagram inside starter enclosure in visible location.
 - iii. Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
2. Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:
 - i. Locking in "OFF" position with up to 3 padlocks.
 - iv. Independent locking of enclosure door.
 - v. Provision for preventing switching to "ON" position while enclosure door open.
3. Accessories:
 - i. Selector switches: heavy duty labelled as indicated.
 - vi. Indicating lights: heavy duty type and colour as indicated.
 - vii. 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

Magnetic Starter, Reduced Voltage, Auto-Transformer

1. Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with the following components:
 - i. Three – 3 pole contactors.
 - i. Auto-transformer with (50%, 65% and 80%) (65% and 85%) taps.
 - ii. One adjustable pneumatic timing relay.
 - iii. One – 3 pole manual reset overload device.
 - iv. Thermal overload protection of auto-transformers.
2. Accessories:
 - i. Selector switches heavy duty labelled as indicated.
 - v. Indicating lights: heavy duty type and colour as indicated.
 - vi. Auxiliary control devices as indicated.

Variable Frequency Drives

1. Variable frequency drives are specified by the Mechanical Consultant but require consultation with FMEL.
2. Obtain a copy of shop drawings from the Mechanical Contractor and insert a copy into each Operating and Maintenance Manual.

Control Transformer

1. Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
2. Size control transformer for control circuit load plus 20% spare capacity.

Equipment Identification

1. Provide equipment identification in accordance with Section 26 05 00 Common Work Results – Electrical.
2. Manual starter designation label, white plate, black letters, size 1, engraved.

3. Magnetic starter designation label, white plate, black letters, size 1, engraved.

26 27 23 INDOOR SERVICE POLES

General Information

1. Indoor aluminum service poles are to be used to provide power and communications outlets to work stations and equipment in open spaces where floor boxes are not acceptable.

Indoor Service Poles

1. Indoor service poles: extruded aluminum sections to ASTM B317, brushed finish.
2. Nominal length of poles: from floor to ceiling, with plus or minus 50mm adjustment. Total adjustment: 100mm. Refer to architectural drawings and elevations for ceiling heights.
3. Service poles approximately 100mm square with snap on covers to provide access to wiring without removing unit. Barrier to isolate power from communication systems.
4. Service poles with fastening accessories at top of pole to secure to an inverted T-Bar ceiling using set screws to permit relocation. Flange at ceiling to conceal wiring.
5. Metal sleeves at bottom of pole to conceal vertical adjustment. Removable and reversible grip-tight devices for carpet and tile floors to prevent movement of poles.
6. Service poles with prewired duplex receptacles as indicated, 4 knockout holes for communication. (Cord with moulded set extending 3 m from top of pole.) (3TW No. 12 AWG leads terminating in utility box with cover, mounted at top of pole.)

26 27 26 WIRING DEVICES

General Information

1. Switches, receptacles, wiring devices, cover plates and their installation is covered under this section.
2. In general, wiring devices are to be specification grade throughout with the exception of residential buildings where residential grade devices are acceptable.

Switches

1. 15 A, 120 V, single pole, double pole, 3-way, 4-way switches, as indicated, to: CSA-C22.2 No. 55 and CSA-C22.2 No. 111.
2. Manually-operated general purpose ac switches with terminal holes approved for No. 10 AWG wire, silver alloy contacts, urea or melamine moulding for parts subject to carbon tracking, suitable for back and side wiring and white toggle.
3. Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

Receptacles

1. Provide a minimum of one general purpose maintenance receptacle outlet at 15 metre intervals in corridors and common spaces. Outlets are to be CSA 5-20RA type fed from 20A-1P branch circuit breakers. Feed no more than 8 general maintenance outlets from a single branch circuit.
2. Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No. 42 with white urea moulded housing, suitable for No. 10 AWG for back and side wiring, break-off links for use as split receptacles, 8 back-wired entrances, 4 side-wiring screws, and triple wipe contacts and riveted grounding contacts.
3. Duplex receptacles in corridors and for general maintenance, CSA type 5-20 RA, 125 V, 15 A, U ground, t-slot, to: CSA-C22.2 No. 42 with white urea moulded housing, suitable for No. 10 AWG for back and side wiring, break-off links for use as split receptacles, 8 back-wired entrances, 4 side-wiring screws.
4. Triple wipe contacts and riveted ground contacts. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with white urea moulded housing, suitable for No. 10 AWG for back and side wiring, and 4 back-wired entrances, 2 side-wiring screws.
5. Other receptacles with ampacity and voltage different from those above shall be compatible with equipment being served.
6. Clock hanger outlets, 15 A, 125 V, 3-wire, grounding type, suitable for no. 10 AWG for installation in flush outlet box.

Cover Plates

1. Cover plates for wiring devices to: CSA-C22.2 No. 42.1.
2. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
3. Stainless steel, vertically brushed, 1mm thick cover plates, thickness 2.5mm for wiring devices mounted in flush-mounted outlet box.
4. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
5. Weatherproof double lift spring-loaded cast aluminum cover plates complete with gaskets for duplex receptacles as indicated.
6. Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

Moulded Case Circuit Breakers

1. Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters.

Submittals

1. Include time-current characteristic curves for breakers with ampacity of 225 A, and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

Breakers

1. Moulded-case circuit breakers, circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5.
2. Bolt-on moulded case circuit breaker: quick-make/quick-break type, for manual and automatic operation (with temperature compensation for 40°C ambient).
3. Common-trip breakers: with single handle for multi-pole applications.
4. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - i. Trip settings on breakers with adjustable Trips to range from 3-8 times current rating.
5. Circuit breakers with interchangeable Trips as indicated.
6. Circuit breakers to have minimum 10,000 symmetrical RMS interrupting capacity rating.
7. All circuit breakers used for emergency generator power distribution shall be fully rated. The use of series rated breakers is NOT acceptable.

Thermal Magnetic Breakers

1. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time; current tripping and instantaneous tripping for short circuit protection.

Magnetic Breakers

1. Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

Current Limiting and Series Rated Thermal Magnetic Breakers

1. Thermal magnetic breakers with current limiters.
 - i. Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
 - i. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
2. Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
 - i. Breakers applied following manufacturer's guidelines and accepted best practice.

Solid State Trip Breakers

1. Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and tripping time for phase and/or ground fault short circuit protection, as required.

Optional Features

1. Include:
 - i. Shunt trip.
 - i. Auxiliary switch.

- ii. Motor-operated mechanism c/w time delay unit.
- iii. Under-voltage release.
- iv. On-off locking device.
- v. Handle mechanism.

26 29 33 CONTROLLERS FOR FIRE PUMP DRIVERS

General

1. Connect emergency distribution to fire pump controller. Fire pump controller will be provided by the Mechanical Contractor.
2. Make all connections to the fire pump controller, as required by the Mechanical Contractor.
3. Provide fire pump alarm monitoring in accordance with NFPA20. This shall include the following:
 - i. Pump or motor running.
 - i. Loss of phase.
 - ii. Phase reversal.
 - iii. Controller connected to alternate source.

26 30 00 FACILITY ELECTRICAL POWER GENERATING AND STORAGE EQUIPMENT**26 32 13 ENGINE GENERATORS**

Diesel Electric Generating Units – Liquid – General

1. New buildings are to be provided with a new diesel fired emergency/standby power generator complete with sub-base fuel tank, sound attenuated weatherproof enclosure.
2. Generators shall generally be mounted outdoors on a reinforced concrete slab.
3. The fuel tank shall have a volume capable of 72 hours of run time at full load.
4. Where buildings require both emergency and standby power distribution, 2 auto-transfer switches will be required in order to separate the 2 distribution sets.
5. The generator enclosure is to be vandal and rodent proof.
6. All equipment shall be new and of current production by a national firm who manufactures the generator and control panel and who assembles the standby generator set as a matched unit having a service and parts organization within British Columbia.
7. Single supplier: The supplier shall be the manufacturer's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall have 24-hour service availability and factory-trained service technicians authorized to do warranty service on all warrantable products.

Operation and System

1. The standby power system is to be designed to energize the complete power service automatically on failure of normal power or when being tested.
2. The transfer switch shall include an automatic energizing mode that will cycle the emergency power system to run for an adjustable period on pre-selected days and time annually.
3. All signals shall be indicated remotely via annunciator in the electrical room. Annunciator shall be compliant with all requirements of CSA C282-(latest edition) and have all required indicators displayed on the annunciator.
4. The generator system shall be a liquid cooled diesel electric generating unit with control panel, with combined control, transfer and power isolating and by-pass panel.
5. All operating and maintenance data is to be provided in operating and maintenance manuals, at substantial completion stage of the project. The data must also include all testing and verification reports.

Warranty

1. Contractor shall hereby warrant the diesel generating unit, equipment and accessories against defects and malfunction for five years from the date of substantial completion commissioning stage.

Maintenance – Extra Materials

1. Provide spare materials for generator systems as noted in the following clauses.
2. For panels provide the following:
 - i. One spare control circuit breaker per rating.
 - i. Twenty four spare indicating light bulbs per rating.
 - ii. One spare control relay and socket per rating and contact arrangement.
 - iii. One spare contactor operating coil.
 - iv. One set of contacts (3) for transfer contactor.
3. Provide generator unit with standard set of engine manufacturer's spare parts for one year normal operation 1,000 operating hours. Spares to include:
 - i. Six fuel filter elements, for each type of fuel filter/water separator.
 - v. Six lubricating oil filter elements.
 - vi. Three air cleaner elements.
4. Where metric size nuts and bolts are used, provide one set of sockets complete with ratchet handle and set of combination wrenches, to fit sizes used.
5. Provide conclusive evidence that Canadian distributor has been established and will stock in Canada spare parts likely to be required during normal life of engine.

Maintenance – Tools

1. Supply suitable engine barring device and battery manufacturer's standard set of tools for battery service.
 - i. Battery service tools to include hydrometer, 1 plastic bottle for topping up purposes, and 1 insulated battery terminal wrench.
2. Provide complete set of specialized tools required for proper care, adjustment and maintenance of equipment supplied.

Generator Plant

1. The generation plant shall consist of a fully automatic #2 diesel engine driven electrical generation plant completely equipped with the following:
 - i. Fuel system and sub-base fuel tank.
 - i. Exhaust system.
 - ii. Cooling system.
 - iii. Battery starting system, including battery charger.
 - iv. All automatic controls.
 - v. Radio suppression to commercial standards.
 - vi. Block heater.
 - vii. Surge suppression.
 - viii. Fully rated breakers for emergency power, standby power, fire pump power and load bank power connection.
2. The unit shall be designed to provide a minimum of 25% spare capacity.

26 32 13 DIESEL-ENGINE-DRIVEN GENERATOR SETS

Diesel Engine – Generator Set

1. Diesel engine-generator set fueled with #2 diesels. Diesel engines requiring premium fuels shall not be considered.
2. Performance:
 - i. Voltage regulation shall be $\pm 1.5\%$ for any constant load between no load and rated load.
 - i. Maximum transient voltage dip shall not exceed 25% below rated voltage on application of the single largest surge load step at a 0.8 power factor.
 - ii. Maximum transient voltage rise shall not exceed 12% above rated voltage on removal of full load at 0.8 power factor.
 - iii. Transient recovery time is 1 second.
 - iv. Stability plus or minus 0.25%.
 - v. Frequency regulation shall be isochronous from steady state no load to steady state rated load.
 - vi. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, with the engine-generator set at operating temperature.
 - vii. Motor starting capability shall be a minimum of 2 – 5 horsepower motors. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
 - viii. The unit shall be capable of delivering 10% overload for 1 hour every 12 hours of continuous operation, without exceeding maximum permissible temperature rise.
 - ix. The unit shall be capable of providing stable voltage and pick up of essential loads within 10 seconds.
 - x. The generator shall be equipped with surge suppression and the excitation system shall include an instantaneous overcurrent shutdown capability after 10 seconds.
 - xi. A wide range of load power factors can be expected on campus. Generator design and performance shall accommodate extreme power factors applicable to specified install locations. Consult with FMEL for generator selection.
3. AC Generator:
 - i. The AC generator shall be: synchronous, 4 pole, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc(s).
 - xii. All insulation system components shall meet NEMA MG1 temperature limits for Class H, 125°C insulation systems. Actual temperature rise measured by resistance method at full load shall not exceed 80°C ambient.
 - xiii. A permanent magnet generator (PMG) shall provide excitation power for immunity from voltage distortion caused by non-linear loads. The PMG shall sustain excitation power for optimum motor starting and to sustain short circuit current at approximately 300% of rated current for not less than 10 seconds.
 - xiv. The automatic voltage regulator shall be temperature-compensated, solid-state design. The voltage regulator shall be equipped with 3-phase RMS sensing the regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot.
 - xv. Voltage control is to be in accordance with applicable CSA Bulletins.
4. Engine-Generator Set Control:
 - i. Provide cycle cranking of 15 SEC (ON) / 15 SEC (OFF) for 3 attempts (75 SEC). If engine fails to start, indicate over-crank on the alarm status panel, but continue attempts to start.

- xvi. The engine shall comply with all requirements of SCAQMD Rule 1470 and be Tier 3 approved in Canada. Provide all supporting documentation showing that these criteria are met.
 - xvii. The control shall shut down and lock out upon: over-speed, low lubricating oil pressure, high engine temperature, or operation of a remote manual stop station. A panel mounted switch shall reset the engine monitor and test all the lamps.
 - xviii. The CSA Type 3 weatherproof enclosed control panel shall be mounted on the generator set with vibration isolators. A front control panel illumination lamp with ON/OFF switch shall be provided.
 - xix. Engine generator set control shall be of solid state design. Relays will be acceptable only for high current circuits. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine.
5. Base:
- i. The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
 - xx. The generator set shall be equipped with factory installed vibration isolators mounted between the set and fabricated steel base to prevent distortion of alignment between generator and engine when installed. Base channel and all parts to withstand this force without damage.
 - xxi. The base is to have earthquake restraint as required by local codes.
 - xxii. The exhaust flex-connector and all exposed exhaust components, including muffler shall be fully insulated by means of a thermos-fibre blanket-type heat resistant wrapping, 25mm thick, with SS mesh inner liner and silicone/aluminized outside cover secured by stainless steel lacing hooks and wire.
 - xxiii. The engine shall be radiator cooled and equipped with a pusher fan. The cooling system shall be filled with a solution of 50% ethylene glycol. Provided shall be a translucent overflow coolant recovery reservoir.
 - xxiv. A 115 VAC engine jacket heater, sufficient to maintain coolant at 40°C, shall be provided complete with thermostat and electrical disconnect on engine start, if required to prevent element damage.
 - xxv. Motorized (spring open/power close) air inlet and (gravity close) exhaust shutters shall be sealed to minimize air leakage and shall automatically open whenever the engine is started.
 - xxvi. Circuit Breaker:
 - i. Shall be mounted on the generator and shall be a non-automatic trip free thermal magnetic moulded case circuit breaker in CSA Type 3 (weatherproof) enclosure complete with neutral bar isolated from ground.
 - ii. Circuit breakers shall be 3-pole fully rated 3Ø, 4 wire operation.

Remote Annunciator

1. Supply a remote annunciator suitable for surface mounting, with audible alarm and status indicator. (Locate in main electrical room.)
2. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by CSA 282 (latest edition) NFPA Standard 110 for Level 1 systems for the local generator control panel.

Generator Enclosure

1. The sound attenuated genset housing shall be a rigid, free-standing, vandal-resistant cabinet, fabricated to EEMAC 3 standards with sufficient bracing to form a structure capable of withstanding wind, snow and ice loading. The roof shall have a minimum 100mm overhang and provide rain gutters over all doors and openings. External hinges shall each feature a waterproof cap and lower grease fitting to permit pressure lubrication.
2. After fabrication the metal surfaces of the enclosure shall be prepared to SSPC-SP6 commercial blast. Immediately following surface preparation a 3 mil coating of zinc rich epoxy metal primer shall be applied. Primer coating material shall be Amercoat 68HS. After curing, two addition 2 mil coats of aliphatic polyurethane shall be applied, Amercoat 450HS approved, for a total 7 mil film thickness.
3. Alternately, galvanized metal surfaces shall be prepared with an etching primer, Metaprime 39103/39104 approved. Following this, 2 separate 2 mil coats of aliphatic polyurethane shall be applied, Amercoat 450HS coating material approved, for a total 4 mil film thickness.
4. Access to all regularly serviced items within the enclosure shall be provided by at least 2 hinged lockable doors on each side.
5. The enclosure must be vandal resistant. Externally accessible fasteners shall preferably be blind head (e.g. stove bolts) although Allen head will be permissible. Air inlet and outlet openings shall be designed such that objects of any size directed at the enclosure from vertically downward to horizontally flag cannot enter and shall be sized such that inlet air velocity is below the level at which water penetration will occur. No other enclosure openings will be allowed.

Generator Noise

1. The engine exhaust system shall incorporate a seamless, stainless steel flex-connector and critical silencing type muffler, all mounted within the genset enclosure. Discharge shall be into the air outlet hood, downstream of the radiator. Sound attenuated air inlet and discharge hoods with opening bird screens shall be rectangular in shape and match the profile of the enclosure.
2. Genset overall full load operating noise level shall be less than 65 dbA when measured at a distance of 7 meters from any side of the enclosure and 1 meter above ground. This shall be demonstrated during shop testing.
3. Ducting and sound attenuation components shall be designed and supplied by an approved manufacturer specializing in this type of work. Manufacturer shall be Excel Engineering, Alum-Tekko Industries or Sonic Engineering.

26 36 00 TRANSFER SWITCHES

Transfer Switch Equipment

1. New automatic switches shall be Thomson Technology. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure. Transfer switches shall also be continuously rated in ambient temperatures of -10°C to +30°C, relative humidity up to 95% (non-condensing), with altitudes up to 3,048 meters. Transfer switch equipment shall have withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings.
2. Transfer switches are to be complete factory assembled transfer equipment with electronic control designed for surge voltage isolation, voltage sensors on all phases of all sources, linear operator,

permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break / quick-make over-centre contact mechanisms suitable for safe manual operation under load.

3. Automatic Controls shall be solid-state and designed for a high level of immunity to power line surges and transients. Solid-state under-voltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. Voltage sensors shall be temperature compensated. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block. The maximum reaction time of 10 seconds permitted under CSA Standard C282 – (latest edition) shall include the adjustable 0 to 5 second delay. The switch shall retransfer the load to the normal source (after normal power restoration) after a time delay transfer, adjustable from 0 to 120 seconds. Retransfer time delay shall be immediately bypassed if the emergency power source fails. Factory set at 1 minute. The switch shall retransfer the load to the normal source if the generating set output interrupts after normal source restores voltage. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 30 minutes, beginning on return to the normal source. Power for transfer operation shall be from the source to which the load is being transferred.
4. Retransfer – Momentary position to override retransfer time delay and cause immediate return to normal source.

26 50 00 LIGHTING

26 51 13 INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

General

1. In general, lighting design shall consider sustainability and energy efficiency in order to meet the desired sustainability goals of the University.
2. Although this section makes reference to compact fluorescent lamps and fixtures, these are not preferred by the University. The preference is to use 4' long fluorescent lamps throughout the building, where possible. The use of LED down-lighting may be considered in some situations however, prior approvals must be obtained from the FMGT Department Representatives.
3. Lighting shall be designed to IES, B.C. Building Code and WCB requirements on all projects.

Lamps

1. Incandescent lamps:
 - i. Bulb shape A to 150W, medium base, inside frosted, 130V rated.
2. Halogen lamps:
 - i. PAR30S IR type lower wattage energy saving type lamps, 4,200 hours average life, minimum initial lumens:
 - a. 40W, Spot 10°, Flood 25°, Wide Flood 40° - 720 (equivalent to 60W non-IR)
 - b. 50W, Spot 10°, Flood 25°, Wide Flood 40° - 970 (equivalent to 75W non-IR)
 - c. 50W (130V long life), Spot 10°, Flood 25°, Wide Flood 40° - 650 (equivalent to 50W non-IR)
 - d. Manufacturer: GE Quartzline, Philips
 - ii. MR16 type to be 12V, solid nickel steel pins, and total infill ceramic base. Lamp life rated 4000 hours, enclosed reflector with clear glass cover, 3000K colour:
 - a. Narrow spot 10° to 13° beam angle
 - b. Spot 20° to 26° beam angle
 - c. Narrow flood 32° to 35° beam angle
 - d. Flood 38° to 45° beam angle
 - e. Wide Flood 55° to 65° beam angl
 - f. Manufacturer: EYE Iwasaki Electric Co. Ltd., Philips, Osram
3. Fluorescent Lamps
 - i. T8-Type:
 - a. Instant start 265 mA, bulb shape T8, medium bi-pin base, 20,000 hours life, 3500K, CRI 86 (min), Minimum initial lumens:
 1. 30W – 2950 lumens T8
 - b. Acceptable manufacturer: Philips Energy Advantage 835
 - ii. T5-Type:
 - a. Programmed start high output, bulb shape T5, miniature bi-pin base, 35,000 hours life, 3500K, CRI 98 (min), minimum initial lumens:
 1. 54W – 5000 lumens T5
 - b. Acceptable manufacturer: Philips F54T5
 - iii. PL Type:
 - a. Instant start, two pin base, double looped or quad, rated average life 10,000 hours, colour temperature 3500K, minimum initial lumens:
 1. 13W – 1250
 2. 26W – 1800
 - iv. Compact Fluorescent
 - a. Instant start, four pin base, twin tube, rated average life 20,000 hours, colour temperature 3500K, minimum initial lumens:
 1. 40W – 3150 lumens
4. Metal Halide:

- i. ED type bulb, mogul base for vertical mount and position oriented mogul base for horizontal use, 20,000 hours average life, colour temperature 3000 degrees K, minimum initial lumens:
 - a. 100W – 8000 250W – 21500
 - b. 175W – 14000 400W – 37000
 - c. Manufacturer: Philips M/3K/ALTO
5. High Pressure Sodium:
- i. Bulb shape E, mogul base, rated life 24,000 hours, colour corrected type, 2200K colour temperature, colour rendering index: 65, coated, minimum initial lumens:
 - a. 70W – 5985
 - b. 100W – 8800
 - c. 150W – 13500

Ballasts

1. Fluorescent electronic ballast:
 - i. All fluorescent ballasts are to be electronic, instant start or programmed start type, refer to luminaire schedule. Rating: 60Hz voltage as indicated. Suitable for lamp quantity as indicated in luminaire schedule.
 - ii. Totally encased and shall not exceed 25°C temperature rise over 40°C ambient.
 - iii. Ballast shall have a power factor of 90% or above.
 - iv. Ballast shall not contain PCBs.
 - v. Sequenced start progression which first heats cathode filaments and then ignites lamp.
 - vi. Sound rated: shall not exceed Class A.
 - vii. Mounting: integral with luminaire.
 - viii. Warranted for five years – date of installation to be marked on ballast.
 - ix. Input total harmonic distortion (THD) shall not exceed 10%.
 - x. Ballast shall have a frequency of operation of 20kHz or greater and operate without visible flickers.
 - xi. Electrical Contractor to provide 10 spare ballasts.
 - xii. Manufacturer: Advance Centium or Optanium or pre-approved equal.
2. Fluorescent Electronic 50/100 Step Dim Type Ballast
 - i. All fluorescent ballast's are to be electronic type. Rating: 60Hz voltage as indicated, for use with rapid start lamps, and shall have an average lamp current crest factor of 1.4.
 - ii. Ballast shall have a ballast factor of 95%.
 - iii. Sequenced start progression which first heats cathode filaments and then ignites lamp.
 - iv. Mounting: integral with luminaire.
 - v. Warranted for 5 years – date of installation to be marked on ballast.
 - vi. Input total harmonic distortion (THD) shall not exceed 10%.
 - vii. Ballast shall have a frequency of operation of 20 KHz or greater and operate without visible flickers.
 - viii. Step dim function to switch ballast between 50% and 100% output.
 - ix. Electrical Contractor to provide 10 spare ballasts.
 - x. Manufacturer: Advance Optanium or pre-approved equal.
3. Fluorescent Dimmable Ballast
 - i. All fluorescent ballast's are to be electronic type. Rating: 60Hz voltage as indicated, for use with rapid start lamps, and shall have an average lamp current crest factor of 1.4.
 - ii. Ballast shall have a power factor of 90% or above.
 - iii. Ballast shall not contain PCBs.
 - iv. Sequenced start progression which first heats cathode filaments and then ignites lamp.
 - v. Mounting: integral with luminaire.
 - vi. Warranted for 5 years – date of installation to be marked on ballasts.
 - vii. Input current Third Harmonic content shall not exceed 10%, and total harmonic distortion (THD) of less than 10%.
 - viii. Ballast shall have a frequency of operation of 20 KHz or greater and operate without visible flickers.
 - ix. Dimmable to 5% output.

- x. Electrical Contractor to provide 10 spare ballasts.
- xi. Manufacturer: Lutron or Advance Mark Series.
- 4. Metal Halide Ballast – Design Linear Type:
 - i. Rating: 60Hz voltage as indicated, for use with metal halide lamp.
 - ii. Totally encased and designed for 40°C ambient temperatures.
 - iii. Power factor: minimum 95% with 95% of rated lamp lumens.
 - iv. Type: constant wattage auto-transformer.
 - v. Capacitor: non PCB.
 - vi. Input voltage range: plus or minus 10% of nominal.
 - vii. Minimum starting temperature: minus 29°C at 90% line voltage.
 - viii. Mounting: indoor and outdoor integral with luminaire, or as noted.
 - ix. Crest factor: 1.8 minimum.
- 5. High Pressure Sodium Ballast: to ANSI C82.4-1978, Design Linear Type:
 - i. Rating: voltage as indicated, for use with high pressure sodium lamp.
 - ii. Totally encased and designed for 40°C ambient temperatures.
 - iii. Power factor: minimum 95% with 95% of rated lamp lumens.
 - iv. Type: constant wattage, isolated secondary magnetic regulated with matching igniter as recommended by manufacturer.
 - v. Capacitor: non-PCB.
 - vi. Input voltage range: plus 5% to minus 5%.
 - vii. Minimum starting temperature: minus 34°C at 90% line voltage.
 - viii. Mounting: indoor integral with luminaire, unless noted otherwise.

Finishes

- 1. Baked enamel finish:
 - i. Conditioning of metal before painting:
 - a. For corrosion resistance: conversion coating to ASTM F1137.
 - b. For paint base: conversion coating to ASTM F1137.
 - ii. Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel or alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.
 - iii. Reflector and other inside surfaces finished as follows:
 - a. White, minimum reflection factor 85%.
 - b. Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.
 - c. Film thickness is not less than 0.03mm average and in no areas less than 0.025mm.
 - d. Gloss not less than 80 units as measured with Gardner 60E gloss meter.
 - e. Flexibility: withstand bending over 12mm mandrel without showing signs of cracking or flaking under 10 times magnification.
 - f. Adhesion: 24mm square lattice made of 3mm square cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.
- 2. Alzak finish:
 - i. Aluminum sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:
 - g. Finish for mild commercial service, minimum density of coating 7.8 g/m², minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
 - h. Finish for regular industrial service, minimum density of coating 14.8 g/m², minimum reflectivity 82% for specular and 73% for diffuse.
 - i. Finish for heavy duty service, minimum density of coating [21.8] g/m², minimum reflectivity 85% for specular, 65% for diffuse.

Accessories

1. Pendant Mounting
 - i. Pendant mounting shall be with white enamelled luminaire tubing provided as an accessory with luminaire unless otherwise specified.
 - i. Slope ceiling mounted adapters shall be white enamelled supports provided as an accessory with luminaire unless otherwise specified.
2. Wire Guards
 - i. Wire guards shall be spot welded at crossing of members and be a minimum of 4.5mm thick galvanized steel. Guards shall be hinged from either side and be secured using wing nuts.

Lenses

1. Refer to luminaire schedule.

Luminaires

1. For luminaire specifications, refer to luminaire schedule except for luminaires at white boards in teaching spaces.
2. Luminaires for whiteboards in teaching spaces shall be Insite Compact-5 Interior Architectural Fluorescent or equivalent with T5HO lamp placed continuously along the entire length of whiteboards. The switching arrangement shall be such that each 8 foot section can be switched separately. Whiteboard luminaires shall be wall mounted above whiteboards.

26 52 00 EMERGENCY LIGHTING

Unit Equipment for Emergency Lighting

3. Emergency lighting equipment: to CSA C22.2 No. 141.
4. Supply voltage: (120) (347) V, ac.
5. Output voltage: 24 V dc.
6. Operating time: 30 minimum. Where a generator is placed indoor, provide emergency lighting battery pack a two lighting heads lasting a minimum of a 2 hour duration.
7. Battery: sealed, maintenance free.
8. Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
9. Solid state transfer circuit.
10. Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
11. Signal lights: solid state, for "AC Power ON".
12. Lamp heads: remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: quartz 18 W.

13. Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
14. Finish: standard factory white.
15. Auxiliary equipment:
 - i. Ammeter.
 - i. Voltmeter.
 - ii. Test switch.
 - iii. Time delay relay.
 - iv. Battery disconnect device.
 - v. AC input and DC output terminal blocks inside cabinet.
 - vi. Shelf or wall bracket.
 - vii. Cord and single twist-lock plug connection for AC.
 - viii. RFI suppressors.
16. Acceptable manufacturers: Ready-Lite, Emergi-Lite, Beghelli, Thomas & Betts.

26 53 00 EXIT SIGNS

Standard Units

1. Exit lights: to CSA C22.2 No. 141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging Guidelines.
2. Housing: extruded aluminum housing, brush aluminum finish.
3. Face and back plates: extruded aluminum.
4. Lamps: multiple, LED-12W, 120 or 347 V.
5. Operation: designed for 50,000 hours of continuous operation without re-lamping.
6. Letters: 150mm high x 19mm, with 13mm thick stroke, red on die-cast aluminum face, reading EXIT.
7. Down-light: translucent acrylic in bottom of unit.
8. Face plate to remain captive for re-lamping.
9. Acceptable product: Ready Lite #CX5000 Series or Emergi-Lite, Beghelli and Thomas & Betts equal.

26 56 00 EXTERIOR LIGHTING

Lighting Control Devices – Photoelectric – General

1. Each building exterior lighting system is to be controlled using a single photocell connected to contactors in appropriate quantity to control the lighting system designed by the consultant. Exterior lighting controls shall also include a time clock and a manual override switch.

Photoelectric Lighting Control

1. Photocells shall be cabinet wall mounted, capable of switching 1800 watts, 5000 operations at the rated voltage for the lighting system. The system shall also operate satisfactory between a plus or minus 10% voltage range and a temperature range: minus 40 °C to plus 40 °C.

Contactors

1. Contactors are to be waterproof cabinet mounted capable of switching multiple lamp circuits with total lighting load of 6000 watts.

Exterior Lighting Controls

1. All exterior luminaires, whether indicated on plans or not, must be provided with photocell and timer controls complete with manual override switch.

27 00 00 COMMUNICATIONS

The 'Communication Systems Guidelines' document outlines University requirements for telecommunication rooms and systems. The document may be obtained by emailing a request to the following address:

netadmin@uvic.ca

27 50 00 DISTRIBUTED COMMUNICATIONS AND MONITORING SYSTEMS

27 53 13 CLOCK SYSTEMS

Interior Lighting Time Clock Control

1. For University Residence Buildings, a central low-voltage control system may not be required and in such cases, time clock controlling 3 circuits independently, complete with manual bypass switch for each circuit shall be provided. Control of corridor lighting shall be such that emergency night lighting is left un-switched while the remaining lighting is controlled by timer to reduce energy consumption by turning parts of the corridor lighting off at late night hours. Manufacturer: TORK "W" Series.
2. Interface the corridor lights to turn on when the fire alarm system is activated.

Installation

1. Locate and install equipment such that it is acceptance to maintenance staff and to keep noise away from teaching spaces.
2. Provide complete system verification and commissioning including training to University Maintenance staff.

Clock Systems – System Description

1. Install a complete Global Positioning system (GPS) Master – GPS Satellite Synchronous Wireless Clock system to tie into existing campus system. The GPS clock system is to include GPS receivers and transmitters and clocks, as manufactured by Primex Wireless.
2. Clocks are typically required in all classrooms, laboratories, lecture theatres, study spaces and other locations as defined by the University of Victoria.
3. The system is to be modular in design to allow for future expansion.

Wireless Master Transmitter

1. Transmitter shall be 1 watt complete with 16 selectable channels on 72 MHz frequency, DST bypass switch, time zone adjustment switch, LCD display, durable metal housing, integral antenna mounted on top of transmitter housing, wall mounting rack, UPS battery back-up, and extended 4 year warranty. Primex #14143.

GPS Receiver

1. GPS receiver to be compatible with master transmitter and complete with #14014 interconnecting coaxial cable, mounting bracket and hardware.

Clocks

1. 12 hour analog type complete with second hand sweep and 12 1/2" diameter high impact polycarbonate lens, brushed aluminum metal frame, integral receiver for wireless communication to master transmitter to match existing campus clocks. Provide clock lock mounting option for tamper control. Finish shall be brushed aluminum. Connect at 120V to wall mounted recessed clock type receptacle. Primex #SNS4Z180-120V (single sided), SNS4Z227-120V (dual-sided).

Electronic Transmitting Unit

1. Electronic transmitting unit: solid state transmitter with 120 V, 60 Hz power supply, oscillator, 2-stage push pull power amplifier capable of generating (250) W of carrier signal power.
2. Signal output: coupled to building main secondary bus through capacitors mounted in transmitter unit.

Satellite Access

1. Include Industry Canada application fee for 1Watt Satellite Access. Primex #IC2365-1.
2. Clock Power
3. Clocks shall be powered via a 120 volt outlet. Battery operated units are NOT acceptable.

28 10 00 ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION

28 13 13 ACCESS CONTROL SOFTWARE INTERFACES

Access Control System Infrastructure – System Description

1. Provide complete conduit system, including junction boxes and pull string for the installation of a door access control system. The door access control system will be provided by University of Victoria Campus Security Forces.
2. Provide 120 volt power for door access control panels and components as required and as indicated.
3. Access control infrastructure shall include:
 - i. Junction boxes and conduit for card readers, as indicated.
 - i. Junction boxes and conduit for motion sensors, as indicated.
 - ii. Conduit to door frames for door contacts, as indicated.
 - iii. Conduit to operable windows on the main floor for window contacts.

28 30 00 ELECTRONIC DETECTION AND ALARM

28 31 00 FIRE DETECTION AND ALARM

Multiplex Fire Alarm System – General Description

1. The University requires that all new fire alarm system control panel, components, and devices, as required for the project, be Secutron 2900 Series and fully compatible with the existing fire alarm infrastructure on campus.

System Description

1. Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control, and multiplexing techniques for data transmission.
2. System to carry out fire alarm and protection functions, including receiving alarm signals; initiating single-stage alarm; supervising components and wiring; actuating graphic displays and auxiliary functions; initiating trouble signals and signaling to the University campus monitoring system.
3. Zoned, coded, single-stage.
4. Modular in design to allow for future expansion.
5. Operation of system shall not require personnel with special computer skills.
6. System is to include but not be limited to:
 - i. New Central Control Unit (CCU) in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signaling.
 - i. Power supply.
 - ii. Initiating/input circuits.
 - iii. Output circuits.
 - iv. Auxiliary circuits.
 - v. Class A wiring configuration.
 - vi. Addressable manual and automatic initiating devices.
 - vii. Audible and visual signaling devices.
 - viii. End-of-line resistors.
 - ix. Remote annunciation and general alarm activation.
 - x. Field control modules.

System Operation

1. Activation of any manually actuated or automatic detection, or sprinkler system addressable alarm device is to:
 - i. Cause audible and visual alarm indication at CCU and visual indication at remote annunciator.
 - i. Cause controlled operation of the audible and visual signal devices, throughout the building (capability for both continuous and temporal sound patterns).
 - ii. Indicate device that initiated the alarm at CCU.
 - iii. Transmit signal to University Campus monitoring station.

2. Provision to silence signals by “alarm silence” switch at control unit and remote annunciator.
3. Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
4. Actuation of any sprinkler system supervisory device to:
 - i. Indicate respective supervisory zone at CCU and remote annunciator.
 - iv. Cause audible signal to sound at CCU and visual indication at remote annunciator.
 - v. Display the activated device type and location.
5. Resetting alarm or supervisory device to return system indications/functions back to normal at control unit and remote annunciator.
6. Trouble on system to:
 - i. Give audible and visual indication of circuit in trouble at the CCU and visual indication at remote annunciator.
 - vi. Acknowledge trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal at control unit and remote annunciator.
7. Trouble on system: suppressed during course of alarm.
8. Trouble condition on any circuit in system is not to initiate alarm conditions.
9. In the event of a CCU microprocessor failure, alarm-initiating circuits are to report alarms in the conventional collective mode for each addressable line, and alert signals are to sound throughout.
10. Response time, from initiation of an alarm to registration at the CCU and activation of all signaling devices, is not to exceed 10 seconds.
11. Signaling devices are to be active for 1 minute before they can be de-activated.

Control Panel

1. CCU: Secutron 2900 Series.

Auxiliary Circuits

1. Auxiliary contacts for control functions.
2. Actual status indication (positive feedback) from controlled device.
3. Alarm and/or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
4. Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
5. Auxiliary circuits: rated at 2 A, 24 VDC or 120 VAC, fuse-protected.

Products-of-Combustion Detectors

1. Smoke Detector – Addressable Dual Chamber, photoelectric, twist-lock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector’s status, and field adjustable address setting.

2. Duct Smoke Detector – Addressable Dual Chamber, ionization, twist-lock, plug-in type with fixed wire-in base assembly with integral red alarm LED. Detector to be addressable type c/w electronics to communicate detector's status, and field adjustable address setting.

Heat Detectors

1. Thermal fire detectors, addressable, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise.
2. Thermal detectors, addressable, fixed temperature: 57°C.

Remote LED Alarm Indicator

1. Remote indicating LED #RA400ZA to indicate status of concealed devices.

Manual Alarm Stations

1. Addressable manual pull station compatible with fire alarm panel.

Audible Signal Appliances (Gongs/Bells)

1. Bells 250mm diameter, red.
2. Audible signal alarms in suites – Sonalerts complete with built-in silence switch supervised isolation module for each device. Group modules in electrical closets on respective floors.

Visual Signal Appliances (Strobe Lights)

1. Visual signal alarms in suites designated for hearing impaired – combination temporal horn/strobe complete with silence switch and supervised isolation module for each device. Group modules in electrical closets on respective floors.

Fault/Isolation Modules

1. Provide fault/isolation modules for all fire alarm zones and supervisory circuits.

Smoke Alarms

1. In suites: dual ionization type, 120VAC.
2. In suites: designated for hearing impaired: dual ionization type complete with horn/strobe, 120VAC.

Door Holders

1. Provide electromagnetic hold-open devices for smoke control doors.
2. Door holders to be complete with all necessary mounting hardware and accessories. Provide flush mounting boxes in finished areas and matching surface boxes in unfinished areas or as required suiting the application. Provide solid backing for all mounting boxes.
3. Provide the following features:
 - i. Rated for 120V AC continuous service.

- i. Power source for hold-open devices in nearest electrical panelboard or as indicated. Install breakers as required and label clearly. Group hold-open devices on dedicated circuits on a floor by floor basis or to suit layout.
 - ii. De-energize hold-open devices during an alarm condition, using appropriate addressable output modules. Do not use relays energized by a bell circuit. Provide dual voltage relays as required.
4. Provide manual switch override of magnetic door holders and locate in main electrical room.

Mechanical System Control

1. Provide control of mechanical system air handling equipment during an alarm condition, as indicated on the drawings and specified under the Mechanical Division.
2. Provide addressable output modules to enable smoke removal fans as described in the mechanical specifications. Provide separate override control switches in both the control panel and the remote annunciator panel(s).
3. Provide relay contact to DDC system to signal the status of the fire alarm system.
4. Provide relay contacts to DDC system to signal the status of the smoke removal switches.

Kitchen Equipment Fire Suppression System

1. Provide relay interlocks to kitchen cooking equipment fire suppression system panel for fire alarm activation and cooking equipment shut-down as indicated on plans.

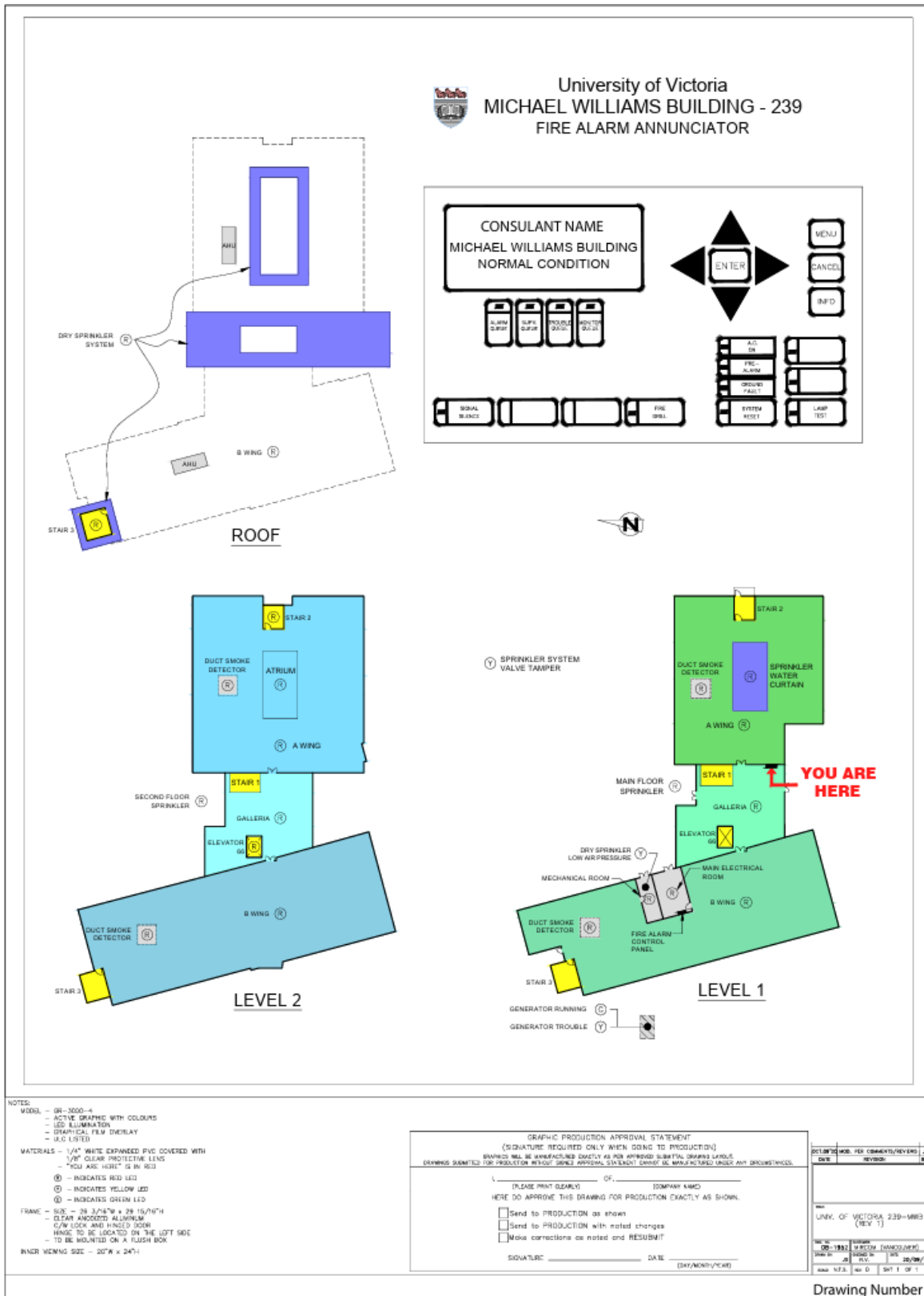
Sprinkler System

1. Provide water flow/tamper modules for connection to sprinkler system for monitoring of flow switches and valves.
2. Provide input modules for connection of pressure switches for monitoring.
3. Provide alarm/trouble indication of heat tracing system at the control panel and remote annunciator panel.
4. Where the building is equipped with a fire pump, provide 4 trouble LED annunciation zones on the fire alarm system indicating the following:
 - i. Pump or motor running.
 - i. Loss of phase.
 - ii. Phase reversal.
 - iii. Controller connected to alternate source.

Annunciator

1. Provide and install flush mounted LED back-lit remote graphic annunciator c/w driver, LCD display, scroll, acknowledge button, system re-set system trouble, power on, and signal silence, where indicated on plans.
2. Annunciator to be complete with brushed aluminum trim and hinged lockable cover.

3. Where the building is equipped with a fire pump, provide 4 trouble LED annunciation zones on the fire alarm system indicating the following:
 - i. Pump or motor running.
 - i. Loss of phase.
 - ii. Phase reversal.
 - iii. Controller connected to alternate source.
4. Provide 100 watt, 120 volt ceramic strip heater inside annunciator enclosure for exterior weatherproof mounted annunciator panels. Monitor strip heater via the fire alarm system and provide trouble indicator. Provide 120 volt power to heater, whether shown or not on plans.
5. Panel Graphics, for Floor levels, use UVic floor levels. If a space doesn't have an official level number, it is sufficient to use a descriptor such as "Crawlspace" or "Attic". All levels should be shown. Repetitive levels can be shown on one graphic. Include official wing designations where applicable. Use official stair and elevator numbers. Buildings equipped with more than one annunciator panel should use the same graphics at each annunciator panel location. Floor plans for each unique floor layout should be provided as part of the information at the annunciator. Do not use "S" or "L" prefixes for these spaces. Do not use room numbers as they are subject to change. Identify "You Are Here" on the drawing. Orient the drawing so that the arrow on "You Are Here" is facing up. Include North Arrow on drawing. Indicate Fire Department connections. Graphics should be consistent between all panels. See example on following page.



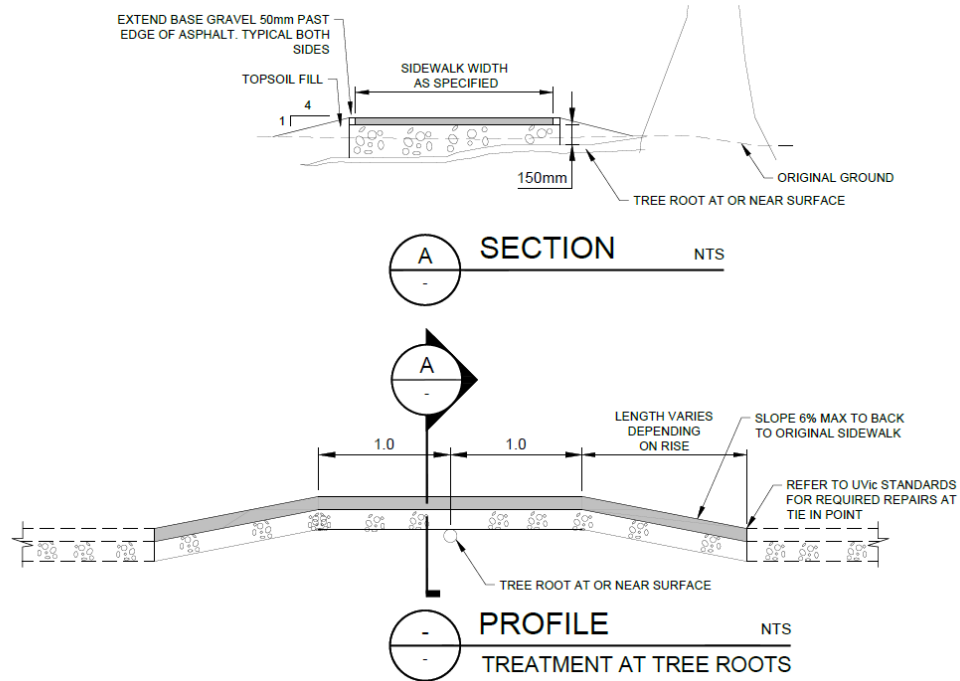
Wire and Cable

1. Conductor Insulation: minimum rating 300 volts. Single conductor RW90XLPE (X-link).
2. Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated.
3. Conductor sizes as follows:
 - i. To initiating circuits: #18 AWG minimum, and in accordance with manufacturer's requirements.
 - i. To signal circuits: #16 AWG minimum, and in accordance with manufacturer's requirements.
 - ii. To control circuits: #12 AWG minimum, and in accordance with manufacturer's requirements.
 - iii. Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.
4. Fire alarm bell circuits to be Red/Black stranded 2C#12 only.
5. Red fire alarm LV cable 3C#18 with "fire alarm" written on jacket is to only be used for fire alarm.
6. All wiring to be copper.
7. All wiring to be tag identified at the points of connection.
8. Provide a ground conductor with all system wiring and bond all metal parts including device boxes.
9. All fire alarm system wiring to be in conduit except short drops from ceiling junction box to detectors mounted in T-bar ceiling may be rated fire alarm system cable conduit and boxes.

32 10 00 BASES, BALLASTS, AND PAVING

Design of Rigid Paving

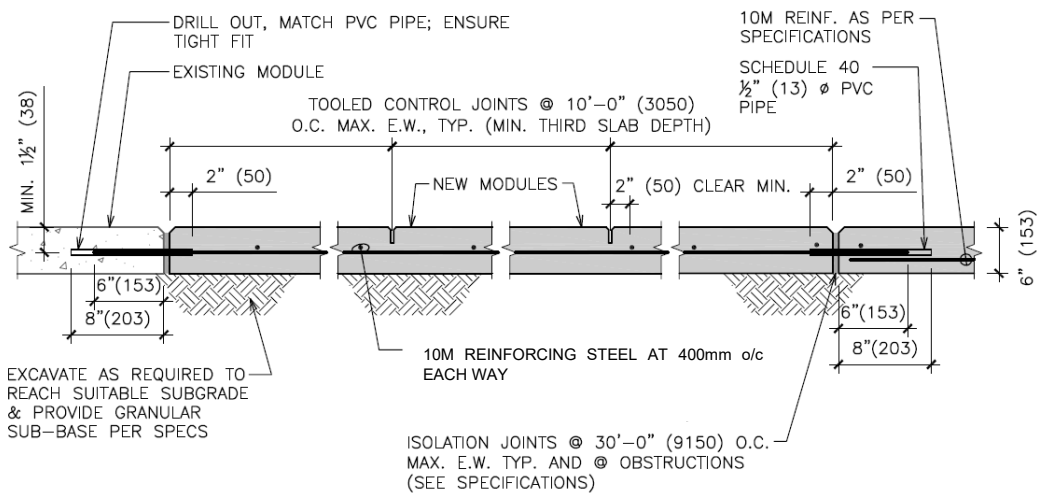
1. Typical paving materials for pedestrian and traffic surfaces (walkways, plazas, stairs, ramps, etc.):
 - i. Concrete:
 - a. Exposed aggregate (10mm nominal size).
 - b. Broom finish (preferable for wheelchair access areas).
 - c. Smooth troweled finish not acceptable.
 - ii. Concrete Pavers:
 - a. Nominal sizes, permeable installation.
 - iii. Asphalt:
 - a. Roadways.
 - b. Parking areas.
 - c. Pathways.
 - iv. Gravel:
 - a. Service roads.
 - b. Paths / trails.
 - c. Garden areas (crushed rock or limestone, consult FMGR).
2. All walkways shall be minimum 1200mm wide, and sized to suit the intensity of traffic, prominence of location, etc.
3. Minimize the surface area of paved and impermeable surfaces:
 - i. Use permeable paving wherever possible.
 - ii. EcoGrid and other similar systems shall only be used where directed by FMGT.
10. When slope regrading of a parking area is required, the landscape on the sides of the parking area will and also need to be built up so there is a gentle slope (4H:1V) down to existing grade
11. When the walkway is above grade, the landscape on the sides of the path will and also need to be built up so there is a gentle slope (4H:1V) down to existing grade
12. Grading to match or blend into existing landscape
13. Removal of 1 tree requires planting 3 trees. Species, size and location of new trees determined by Owner. UVic to be notified when roots are encountered before proceeding with work in that area. As a rule, roots larger than the diameter of your thumb should not be disturbed. If roots are present refer to figure 32 10 00.1 for details.



1.

2. Figure 32 10 00.1

14. For bidding purposes, contractors are to assume asphalt parking lots are 50mm thick, except for areas within Parking Lot 11, which vary between 50mm and 75mm and allow for the removal of existing soils below as required to provide the required thicknesses of granular sub-base and concrete or asphalt.
15. When butting to existing concrete paving refer to figure 32 10 00.2 for reinforcing, and design details. Slabs shall be reinforced with 10M at 400mm on centre each way at mid-depth of slab.



3.

4. Figure 32 10 00.2

Quality Assurance for Ridged Paving

-
1. The Contractor shall retain a Geotechnical engineer to review the subgrade throughout the project.
 2. The Contractor shall retain concrete materials testing agency to test plastic and hardened properties of the mix, including slump, air content, and compressive strength.
 - i. Allow for testing as per CSA A23.1.
 - ii. Keep a record of pour and test locations and submit test results to the owner / consultant upon request.
 3. The Contractor shall retain an asphalt materials testing agency to perform Marshall testing for flow and stability.
 - i. Allow for sampling and testing every day that asphalt is being placed.
 - ii. Keep a record of test locations and submit test results to the owner / consultant upon request

32 11 00 BASE COURSES

Granular Base Products

1. Granular base shall be crushed gravel "road base"; maximum size aggregate 19mm minus as per MMCD Sections 32 11 23 and 31 05 17 2.10.
1. Sub Grade Preparation
 1. Contractor to engage a geotechnical engineer to review subgrade throughout the project.
 2. Remaining subgrade to be free of organic or other deleterious materials, unless otherwise approved by geotechnical.
 2. Granular Base Placement
 1. For asphalt parking lots Granular base material to achieve 100mm minimum depth. Base gravel pad to be 50mm wider than parking lot width on either side.
 2. For concrete walkways granular base material to achieve 150mm minimum depth.
 3. The maximum layer depth that can be placed (at one time) is 150mm and compacted to at least 95% of modified proctor density to ASTM D698.

32 12 16 ASPHALT PAVING

1. Products
 1. All materials shall be new, of merchantable quality, and suitable for the intended purpose.
 2. Upper Course #2 asphalt as per MMCD Section 32 12 16
 3. Joint Sealer is to be as per MMCD Section 32 12 13.1.
2. Placing Asphalt
 1. All work to comply with applicable MMCD specifications.
 2. Contractor shall provide, maintain and pay for all materials, tools, machinery, equipment, temporary facilities, controls and conveniences necessary for execution of the Work.

-
3. All installation methods of materials must comply with the latest Manufacturer's printed instructions. Contractor to notify the Consultant in writing of any conflict between the Contract Documents and Manufacturer's instructions. All packaged materials must be delivered, stored and maintained with the Manufacturer's seals and labels intact.
 4. Clean surfaces of existing concrete or asphalt tie in and apply bituminous material prior to new asphalt placement.
 5. Supply, place and compact MMCD Upper Course #2 mix to the lengths and widths shown on the contract documents.
 6. Apply joint sealer at tie in points to existing asphalt sidewalks.
 7. The method of measurement and payment in the contract document overrides those in MMCD.
3. Cold Weather Requirements
 1. When "Forecasted Air Temperature" is at or below 7°C:
 2. Asphalt shall not be placed on or against any surface which is at a temperature of less than 7°C
 4. Drainage of Pedestrian Paved
 1. Large paved areas shall be sloped to drains, minimum 1% to maximum 2% fall. Where falls are 2%, provide sufficient number of drains to prevent "dishing."
 2. Provide positive slopes away from entrances and exits, not less than 4%, to adequate storm drains, gratings or landscape. Do not extent the 4% slope for more than 2m horizontally.

32 13 13 CONCRETE PAVING

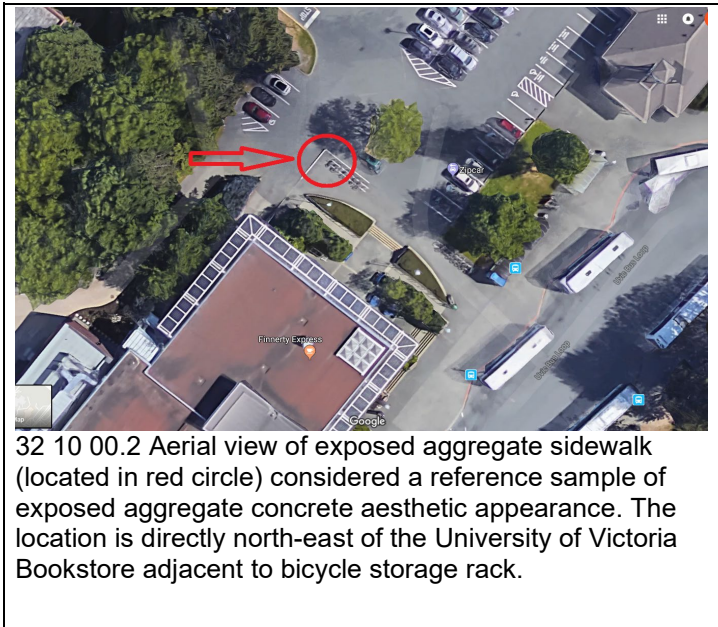
Concrete Products

1. All new concrete modules to be **150mm** thick, minimum. Thickness will be closely monitored and isolated areas less than 150mm thick will not be accepted.
2. Portland cement shall be type GU or GUL.
3. Concrete shall have a unit weight of $23 \pm 1 \text{ kN/m}^3$. Curing and protection for hot, cold or dry weather is to be as per clauses 7.4.1.8 and 7.4.2 of CAN/CSA A23.1 as a minimum. See also the "Cold Weather Requirements" section of these specifications. Maintain curing regime 3 per CSA A23.1 Table 19, extended wet curing.
4. Broom Finish Slab-on-Grade
 - i. The general contractor is responsible for working with the concrete supplier to ensure that the plastic and hardened mix properties meet site requirements for placing, finishing, and owner specified performance requirements. The general contractor shall meet the documentation and quality control requirements outlined under the "Performance" alternate of Table 5 of CSA A23.1.
 - ii. The concrete supplier shall meet all certification and documentation requirements as outlined under the "Performance" alternate of Table 5 of /CSA A23.1.
 - iii. Concrete to conform to CSA A23.1, exposure class C-2
 - a. Maximum water-cementing materials ratio: 0.45
 - b. 28-day Compressive Strength: 32 MPa, minimum

- a. Nominal maximum aggregate size: 20mm
- b. Air content: 5-8%
- c. Curing: Type 3 (wet 7 days minimum, Per Table 19 CSA A23.1)
- d. Slump: 80mm +/- 20 mm

5. Exposed Aggregate Finish Slab-on-Grade

- i. This section outlines the requirements to achieve a standardized aesthetic appearance of exposed aggregate concrete walkways and other flatwork on the University of Victoria Campus.
- ii. The standard of acceptance is the concrete sidewalk near the University of Victoria Bookstore as shown in figures 32 10 00.1.



32 10 00.2 Aerial view of exposed aggregate sidewalk (located in red circle) considered a reference sample of exposed aggregate concrete aesthetic appearance. The location is directly north-east of the University of Victoria Bookstore adjacent to bicycle storage rack.

- iii. The general contractor shall meet the documentation and quality control requirements outlined under Alternate 2, "Prescriptive" of Table 5 of CSA A23.1.
- iv. The supplier shall meet all certification and documentation requirements as outlined under Alternate 2, "Prescriptive" of Table 5 of CSA A23.1.
 - a. Prior to commencement of the work, the contractor/ concrete supplier shall provide an explicit mix design to confirm the proportions of the concrete mix and to confirm conformance with of this specification.
 - b. The concrete supplier shall provide batch records for all concrete loads.
 - c. The concrete supplier shall record and report water content for delivered concrete: including batch water, wash rack water and any other water additions.
- v. Prescriptive Mix Design Parameters
 - a. Cement content: 300 kg/m³
 - b. Supplementary Cementing Materials (SCM) content: 30 kg/m³
 - c. Air Content: 6 – 9 %
 - d. Maximum Water cementing materials ratio: 0.45:
 - e. Coarse aggregate to be sourced from quarries located on the southern half of Vancouver Island (Generally up to and including Nanaimo) and shall be non-staining and non-reactive to alkali conditions.
 - f. Pre-approved quarries for coarse aggregate include:
 - Butler Brothers - Keating Pit
 - Van-Isle Aggregates - Spruston Pit

- Hub City Paving – Nanaimo River Road Pit
- Alternates to be approved by the Owner via mock up sample.
- g. Coarse aggregate to be natural round stone, not subject to fresh mechanical fracture, except as described below:
 - Maximum 15% content of naturally angular and freshly fractured particles, as determined by particle count.
 - Maximum 10% content of thin, flat or elongated particles, as determined by particle count.
 - Aggregate samples shall be submitted to the Owner.
 - Acceptance of the proposed coarse aggregate stone material, with regard to the particle shape and texture considerations, is reserved by the owner or his designated representative.
- h. Gradation to be in conformance with CSA A 23.1 Table 11, Group II, 10-5, with the following exception:
 - The allowable grading for the 10-mm sieve opening shall be 65% to 90% (percent passing).
 - Alternate grading to be approved by the Owner.
- vi. Fine aggregate
 - a. To be natural sand.
 - b. Gradation to be in conformance with CSA Table 10, FA 1
- vii. Combined Aggregate Content:
 - a. Combined aggregate content shall be proportioned such that the concrete has a minimum coarse aggregate (>5-mm in diameter) content of 43%, by volume (of total concrete volume).
 - b. If concrete pumping is required, and only when accepted by the owner, the minimum coarse aggregate (>5-mm in diameter) content shall be 39%, by volume (of total concrete volume).

Note: Concrete mix MAY not be pumpable. Satisfactory pumping SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF WORK.
- viii. Water reducing admixture:
 - a. As required to achieve desired workability
 - b. In conformance with ASTM C494
- ix. Slump: 80 +/- 30 mm
- x. Air entrainment admixture:
 - a. As required to achieve specified air content
 - b. In conformance with ASTM C260
- xi. Curing: type 3 (wet 7 days minimum)
- xii. Admixtures containing calcium chloride are not permitted.

Aggregate Products

1. To be in conformance with CSA A23.1/ A23.2 for use in concrete.
 - i. Current aggregate test data, in accordance with CSA A23.1 Table 11 & 12, shall be submitted for review.

Surface Retarder (spray-applied water-soluble surface retarder) Products

1. Approved products
 - i. TOP-STOP by WR Meadows
 - ii. Unisol F Spray by Universal Concrete Accessories
 - iii. Masterfinish EA by BASF

Isolation Joint Products

-
1. Asphalt-impregnated fibreboard (by WR Meadows), Ceramar foam (By WR Meadows), or none (i.e. cold joint) - to match existing conditions.
 1. Placing Concrete
 1. Do concrete work in accordance CSA A23.1.
 2. Provide finish (broomed, exposed aggregated, or "smooth") to match surrounding concrete in colour, profile, and texture. Broomed finish to provide corrugations approximately 2mm deep.
 - i. For exposed aggregate finish, follow surface retardant manufacturer's recommendations for application. Do not apply surface retarder until all bleed water has evaporated.
 3. For exposed aggregate finish, internal vibration and/or vibrating screed are not permitted.
 4. Provide edging to match surrounding concrete.
 5. The final finish shall be done by experienced concrete workers thoroughly conversant with trowel and exposed aggregate work.
 6. Perform work in sufficiently small quantities such that one crew can perform all of the finishing work in a given area.
 7. Account for differences in environmental conditions throughout the day that may affect concrete finish. Varying environmental conditions (eg. hot/windy afternoon) shall not be acceptable cause for failure of the work to match the mock-up.
 2. Tolerances
 1. Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.
 2. Depth of aggregate exposure to be within 15% of mock-up (eg. if 33% of aggregate diameter exposed in mock-up, aggregate in completed work to be exposed 28-38% of diameter)
 3. Isolation Joints
 1. Install isolation joints around manholes, catch basins and along length adjacent to concrete curbs, buildings, or permanent structure.
 2. If module is in a location where isolation joints are provided between all modules, provide isolation joints to match existing.
 4. Curing
 1. Wet cure concrete continuously in accordance with CSA-A23.1 Table 19, regime 3, for at least 7 days after placing.
 2. Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.
 3. Protect fresh concrete from direct sunlight and excessive wind.
 4. Provide temperature control, if required.
 5. Cold Weather Requirements

1. Forecasted Air Temperature at or Below 5°C:
 - i. The aggregate or mixing water shall be heated to maintain a minimum concrete temperature of 10°C at time of pour.
 - ii. Concrete shall not be placed on or against any surface which is at a temperature of less than 5°C.
 - iii. Concrete temperature shall be maintained above 2°C for at least 7 days or until the concrete reaches 70% of specified strength. Cover concrete with polyethylene and insulation or construct hoarding and provide heat as required.
 - iv. Forms and steel shall be free from ice and snow.

6. Mock-Ups
 1. The owner will designate an existing module on site to which the mock-up is to be matched.
 2. Power wash existing modules near mock-up to allow for comparison with mock-up.
 3. The Contractor shall construct a mock-up replacement panel, minimum 1200mm by 1200mm by 100mm thick. The methods used to provide the sample finish shall be the same as those determined with the Consultant and subsequently used in the remainder of the work.
 4. It is recommended the mock-up is utilized to determine the appropriate application time for the surface retarder. This can be completed by separating the mock-up area into sections and washing off the retarder at varying intervals in order to achieve the desired depth of etch.
 - i. Note: the surface retarder application time is dependent on many factors including temperature, wind, exposure to sun, etc. The contractor shall satisfy oneself with the variability of these factors and make provisions to account for environmental changes throughout the progress of the project.
 5. Mock-up to cure 10 days minimum. Subsequently, the owner and the consultant will review the mock-up. If the mock-up is not deemed to be an acceptable match, the contractor shall provide additional mock-ups approved by the owner and the consultant.
 6. The cost of the mock-up process is to be included in the base price.
 7. Once approved, the mock-up is to be cut into 12"x12" squares and four such squares are to be kept on site to serve as portable samples. The mock-up may not remain as part of the finished work.
 8. The mock-up, once accepted, shall be the standard to be achieved with regards to appearance. A very close match between the mock-ups and subsequent work is required. New modules deemed not to comply with this standard will be rejected and are to be replaced at the contractor's expense.

32 30 00 SITE IMPROVEMENTS

32 33 13 SITE BICYCLE RACKS

1. Benches With Backs
 - ii. Shall have arms,
 - iii. Frame to be textured silver powder coated steel,
 - iv. Planks to be recycled plastic, grey in color,
 - v. Standard of acceptance: Wishbone Site Furnishings Aylesbury Park Bench – A-5 With Arms.
2. Benches Without Backs
 - i. Shall not have arms,
 - ii. Shall have skateboard guards,
 - iii. Frame to be textured silver powder coated steel,
 - iv. Planks to be recycled plastic, grey in color,
 - v. Standard of acceptance: Wishbone Site Furnishings Aylesbury Backless Park Bench – ASB-6 – With Skateboard Guards
3. Picnic Tables
 - i. Frame to be textured silver powder coated steel,
 - ii. Planks to be recycled plastic, grey in color,
 - iii. Standard of acceptance: Wishbone Site Furnishings Park Picnic Table – PKPT-6
4. Pedestal Picnic Tables
 - i. Frame to be textured silver powder coated steel,
 - ii. Planks to be recycled plastic, grey in color,
 - iii. Standard of acceptance: Wishbone Site Furnishings Single Ped Picnic Table – SPPTGP-40
5. Moveable Chairs
 - i. Shall be Stackable,
 - ii. Constructed of resin and fiberglass with UV protection, black, red or white in color
 - iii. Tubular legs, non-slip replaceable foot pads, 300 LB weight rating
 - iv. Standard of Acceptance: Bum Contract Side Chair – Bora Bistrot
6. Moveable Pedestal Tables
 - i. Shall be 28" square
 - ii. Constructed of resin and fiberglass with UV protection, black in color
 - iii. Adjustable/Replaceable feet,
 - iv. Standard of Acceptance: Bum Contract Patio Table –Nardi - CLIP 70
7. Moveable Tables With Legs
 - i. Shall be 28" square
 - ii. Constructed of resin and fiberglass with UV protection, black in color
 - iii. Adjustable/Replaceable feet,
 - iv. Standard of Acceptance: Bum Contract Patio Table –Nardi - Cube 70

32 33 23 SITE TRASH AND LITTER RECEPTACLES

1. Typical waste receptacles:
 - i. Waste receptacles: 610 x 610 x 710mm high, exposed aggregate concrete containers, from Mackays Precast.

- i. Waste receptacles for buildings: Schaefer GMT Cart, from Rollins Machinery – 2 sizes:
 - i. Gray 360L – 610 x 890 x 1010mm high.
 - ii. Blue or Brown 240L – 585 x 740 x 1070mm high.
1. Waste Receptacle Enclosures:
 - i. Provide screening such that waste bins are visible only from the direction of service vehicle approach.

32 80 00 IRRIGATION

32 84 23 UNDERGROUND SPRINKLERS

Irrigation

1. Irrigation is required in all contained planting areas.
2. All Irrigation work to be completed in accordance with IIABC and BCLNA standards.
2. Drip irrigation shall not be used except in special circumstances as determined by FMGR. Polyvinyl pipe sizes: Class 200 pipe is preferred as a minimum in all applications; Class 160 may be used in special circumstances, with FMGR approval.
3. Reinstatement following construction:
 - i. All irrigation systems impacted by construction to be reinstated by Contractor.
 - i. Systems to be tested and verified by FMGT Grounds.
 - ii. Equipment Standards:
 - a. Lawn sprinkler heads (Rotor type) Hunter I-40-04-SS, Hunter 1-20-04-SS or Hunter PGJ-04.
 - b. Lawn sprinkler heads (Pop up type): Irritrol I-Pro series with check valve and rainbird VAN nozzles
 - c. Shrub bed Rotors: Hunter PGJ-00 or Hunter I-20-00 on 3'-0" sched 80 grey risers supported by metal posts.
 - d. Shrub bed Spray Heads: Irritrol I-Pro Series 12" pop ups with check valve or sched 80 grey risers with shrub adaptors supported by metal posts
 - e. All sprinkler heads to have a minimum of 2' of flexible PVC. No swing joints

32 90 00 PLANTING

32 91 00 PLANTING PREPARATION

General Landscaping

1. All work shall conform to the latest edition of the B.C. Landscape Standard, issued by the British Columbia Society of Landscape Architects (BCLSA), unless approved by the Owner otherwise.
2. Preserve and enhance the overall character of the campus through the elements of landscape. Use continuity and consistency as design principles to create a coherent relationship between buildings and structures that may be quite different in their architectural expression.
 - i. Consider trees as the most important elements to define the functional and visual character of spaces. Douglas fir is the primary planting material, followed by other evergreens such as Cedar, Sequoia and Arbutus (broadleaf), as well as the deciduous Oak, Maple, and Dogwood.
 - i. Shrubs shall be of a wider variety.
3. The established policy of the University stipulates that existing trees shall be retained wherever possible. Where tree removals over 100mm diameter are necessary, the University strives to provide 3 new trees on campus to replace every 1 tree removed.
4. In areas of brush and small trees under 100mm in diameter, the area to be cleared will be marked out by the University. Where existing trees over 100mm in diameter interfere with construction, the University will clearly mark the individual trees which are to be removed if required as part of the work.

32 91 13 SOIL PREPARATION

Landscape Materials

1. Soil Additives:
 - i. Manure: Well-rotted mushroom manure, to requirements of B.C. Landscape Standard.
 - i. Sand: Hard, granular sharp sand to CSA A82 SO-M1976, well-washed and free of impurities.
 - ii. Peat Moss: Horticultural grade, to the B.C. Landscape Standard.
 - iii. Wood Residuals: Content of sawdust (such as fir or hemlock) shall not cause a C to N ratio higher than 40:1. Cedar or Redwood sawdust shall not be present in the soil mix.
 - iv. Dolomite Lime: Horticultural commercial grade, finely and uniformly ground, containing not less than 20% by weight.
 - v. Compost: Well-rotted vegetable matter, free of impurities and chemicals.
2. Fertilizers:
 - i. Standard commercial brands, meeting requirements of Canada Fertilizer Act, packed in waterproof containers with weight, analysis and manufacturer's name clearly marked. Granular, pelleted, or pill form, dry and free-flowing. Applied fertilizers must not contain a Phosphorus % in excess of 1% of total weight of overall applied fertilizer.
3. Planting Soil:
 - i. Shall be substantially free from roots, sticks, building materials, wood chips, pollutants, crab grass, noxious weeds or seeds/parts thereof.
 - a. Maximum requirements of dolomite lime to require pH: 220kg/100sq.m (100 lbs/1000sf).
 - b. Salinity: Maximum saturation extract conductivity 3.0 millihos/cm at 25°C.

- c. Total Nitrogen: 0.2-0.4% by weight.
- d. Available Phosphorus: 50-70 ppm.
- e. Available Potassium: 50-100ppm.
- f. Cation Exchange Capacity: 30-50meq.
- g. Carbon to Nitrogen Ratio: maximum 40:1.
- h. Allowable pH: lawns 6.0-6.5; planting areas 5.0-6.0.
- i. Texture:
 - 1. Dry weight organic content (compost) 30-50%.
 - 2. Particle size glasses: rock and gravel (2mm) 0-3%.
 - 3. Sand: (0.05 & 2mm) 30-35%.
 - 4. Silt & Clay: (0.05mm) 15-20%.
 - 5. Clay: (0.002mm) 0-10%.

4. Bark Mulch

- i. Dark brown in colour, 25mm and smaller, Douglas fir or Hemlock, free of chunks and all foreign and harmful material.

Landscape Reinstatement

1. Soil Preparation and Placement:

- i. Supply, prepare and place planting medium where indicated on drawings and as affected by the work.
- i. Prior to placement, do not move or work soil or additives when they are excessively wet, frozen, extremely dry or in any manner, which will adversely affect soil structure.
- ii. Protect soil, additives and fertilizers against extreme wetting and against contamination by weeds and insects.
- iii. Deliver and store fertilizers and chemical ingredients in the original manufacturer's containers.
- iv. Place a minimum 50mm layer of bark mulch in all planting beds.
- v. Thoroughly mix soil with additives to produce planting medium.
- vi. Scarify compacted sub-grades to a minimum depth of 100mm (4") prior to placing planting soil.
- vii. Place planting soil to depth of 225mm for groundcover areas, 450mm for shrubs and gardens.
- viii. Individual plants shall have shrub pit 300mm wider and 150mm deeper than root-ball.
- ix. Crown or slope for positive surface drainage.
- x. Do not compact, but finish the surface smooth, uniform and firm against deep footprints.
- xi. Protect planted areas with 1220mm high temporary fencing.

2. Grass:

- i. Reinstatement topsoil as per FMGT Standard mix see "typical soil preparation and placement notes above).
- xii. Roll out topsoil to compact prior to sodding.
- xiii. Replant using sod.
- xiv. Apply Quickstart fertilizer.

32 93 00 PLANTS

Plantings

- 1. The University quadrangle is strongly defined by formal planting, walkways and the surround architecture. Trees in this space are primarily Pin Oak, Garry Oak, and Douglas fir. All future formal planting within the quadrangle shall be consistent with the existing.

2. Maintain the informal planting and natural plant material growth outside the quadrangle.
3. Plant materials shall be selected with the acknowledgement that UVic practices Integrated Pest Management. Discuss plant combination to be applied in specific locations with FMGR.
4. Areas of site to be “reforested” – i.e. areas where planting will recover the quality of native growth – will primarily be Douglas fir, Western Red Cedar, Big Leaf Maple, and Dogwood.
5. Transition areas between forest and developed areas shall be provided with plant materials compatible to both areas.
6. Areas closer to buildings (domesticated areas) shall use trees such as Pacific Crabapples, Red Oaks, Pin Oak, Garry Oak and Maple.
7. In special circumstances, other specimen materials may be required by the botanical studies program for educational purposes, as directed by FMGT in co-ordination with FMGR and the Biology Department.
8. Shrubs shall be chosen to define space, complement buildings, control circulation and provide wind screening. In developed areas, ground cover shall be primarily lawn, supplemented by other materials with proven performance suitability on campus. Shrubs and ground cover are elements of space continuity; however, the extent of their use shall be evaluated in relation to the cost of maintenance required for the first two years of plant establishing.
9. Annuals provide desirable bright colour, but should be used only in contained areas where irrigation is available, and maintenance and replacement are not problematic (i.e. courtyards).
10. Mulching (fertile mulch) of planting beds is required. Hog fuel type of Bark mulch is prohibited. Consult FMGR.
11. UVic prefers the short-term use of irrigation to establish plants (maximum 2 growing seasons). Low water, drought tolerant planting is encouraged.

Planting Warranty

1. One full year labour and planting.
2. Materials warranty to be provided for all landscape work.

40 00 00 PROCESS INTERCONNECTIONS**40 05 09 WALL PIPES, FLOOR PIPES & PIPE SLEEVES**

Sleeves

1. Specify Schedule 40 steel pipe sleeves at points where pipes pass through masonry, concrete or fire rated assemblies and at mechanical room floor penetrations to stories below.
2. Sleeves shall have an annular fin continuously welded at midpoint where passing through foundation walls.
3. Specify fill for voids around pipes.
4. Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof, fire retardant, non-hardening mastic.
5. Where sleeves pass through walls or floors, provide space for fire stopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity. Ensure there is no contact between copper tube or pipe and ferrous sleeve.

Escutcheons

1. Specify escutcheons on pipes passing through walls, partitions, floors and ceilings in finished areas.
2. Chrome or nickel plated brass or Type 302 stainless steel, 1 piece type with set screws.

40 05 67 SPECIALIZED PRESSURE AND FLOW CONTROL VALVES

1. Gas services entering a building will have a seismic valve downstream of the gas metre before the main enters the building and any branch supply lines are taken off.

40 00 00 GAS AND VAPOUR PROCESS PIPING AND DUCTWORK

40 12 00 COMPRESSED AIR PROCESS PIPING

Compressed Air

1. Use copper for compressed air piping.

40 73 13 PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

Pressure Gauges

1. Minimum 85mm (3-1/2" diameter), with isolating cock, Imperial and S.I. units. Selected for normal working pressure is about mid-range.
2. Dwyer magnehelic gauge across each filter bank.