

**FIRE SAFETY PLAN**

**FOR**

**Quantum Matter Institute  
and Brimacombe Building**

**2355 East Mall**

**Vancouver, B.C. - UBC**

**Produced By:**

**National Fire & Safety Planners**  
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**Produced For:**

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# INSTRUCTIONS TO OCCUPANTS

## ***IF YOU DISCOVER A FIRE:***

- Leave the fire area.
- **IMMEDIATELY**, sound the fire alarm by activating the nearest red alarm pull station.
- Call the Fire Department. **Dial 911** Tell them you are reporting a fire at:  
**2355 East Mall, Vancouver, B.C. - UBC**
- At your discretion attempt to control the fire with available fire equipment.
- Close doors behind you, leave the building by the nearest safe exit.

## **DO NOT USE THE ELEVATOR**

## ***WHEN YOU HEAR THE ALARM:***

- Leave the building immediately by the nearest safe exit.
- Close doors behind you.
- **REMAIN CALM.**
- When you have reached the outside, move away from the building.
- Call the Fire Department. **Dial 911** Tell them you are reporting a fire at:  
**2355 East Mall, Vancouver, B.C. - UBC**
- Go to the designated assembly area.
- **DO NOT GO BACK INTO THE BUILDING FOR ANY REASON.** The Fire Department will advise when it is safe to do so.

## **THE DESIGNATED ASSEMBLY AREA FOR THIS BUILDING IS:**

- 1) East of the building on the along west side walk of Agronomy Road.***
- 2) Northeast of the building on south side of the of Engineering Student Centre.***

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## EMERGENCY AND CRITICAL PHONE NUMBERS

<b>Fire Department</b>	911
<b>Fire Department (Non-Emergency Number)</b>	E-COMM (604)215-4842
<b>Police Department</b>	911
<b>Ambulance</b>	911
<b>Poison Control</b>	(604)682-5050
<b>Elevator Service</b>	UBC Plant Operations (604)822-7342
<b>Fire Alarm Service</b>	UBC Plant Operations (604)822-7342
<b>Sprinkler Service</b>	UBC Plant Operations (604)822-7342
<b>Fire Extinguisher Service</b>	UBC Plant Operations (604)822-7342
<b>Emergency Lighting Service</b>	UBC Plant Operations (604)822-7342
<b>Emergency Generator Service</b>	UBC Plant Operations (604)822-7342
<b>Fire Hose Service</b>	UBC Plant Operations (604)822-7342
<b>Fire Pump Service</b>	UBC Plant Operations (604)822-7342
<b>Fire Alarm Monitoring</b>	tyco Integrated Security (604)289-2647
<b>Fire Safety Planning</b>	National Fire & Safety Planners (604)232-3488

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## DEFINITIONS

- ACCESS TO EXIT:** Means that part of a *means of egress* within a *floor area* that provides access to an *exit* serving the *floor area*.
- ALARM SIGNAL:** Means an audible signal transmitted throughout a zone or zones or throughout a *building* to advise occupants that a fire emergency exists.
- ALERT SIGNAL:** Means an audible signal to advise designated persons of a fire emergency.
- APPROVED:** Means approved by the *authority having jurisdiction*.
- AREA OF REFUGE:** Means a space that facilitates a safe delay in egress, is sufficiently protected from fire conditions developing in the *floor area*, and provides direct access to an *exit* or fire fighters' elevator.
- AUTHORITY HAVING JURISDICTION:** Fire Chief - Vancouver Fire & Rescue Services.
- BUILDING:** Means any structure used or intended for supporting, or sheltering any use or *occupancy*.
- BUILDING HEIGHT:** Means the overall height of a *building* from the first storey to the roof.
- CLASS "A" FIRE:** Means a fire involving combustible materials such as wood, cloth or paper.
- CLASS "B" FIRE:** Means a fire involving a *flammable liquid* or *combustible liquid*, fat or grease.
- CLASS "C" FIRE:** Means a fire involving energized electrical equipment.

**CLASS "D" FIRE:** Means a fire involving a combustible metal.

**CLOSURE:** Means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

**COMBUSTIBLE CONSTRUCTION:** Means that type of construction that does not meet the requirements for *noncombustible construction*.

**COMBUSTIBLE LIQUID:** Means a liquid having a *flash point* at or above 37.8 degrees Celsius and below 93.3 degrees Celsius.

**DEPUTY FIRE SAFETY DIRECTOR (DFSD):** The person designated to assist the *FSD* or fulfil his/her duties in his/her absence.

**ELECTRICAL SERVICE ROOM:** Means a room or space provided in a *building* to accommodate building electrical service equipment and constructed in accordance with the British Columbia Building Code.

**ELECTRICAL SERVICE VAULT:** Means an isolated enclosure either above or below ground, with fire resisting walls, ceilings and floors for the purpose of housing transformers and other electrical equipment.

**EXIT:** Means that part of a *means of egress*, including doorways, that leads from the *floor area* it serves, to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare.

**FIRE ALARM SYSTEM:** Means a device or combination of devices designed to warn *occupants* of a *building* of a fire or other emergency.

**FIRE CHIEF:** Means the person appointed as the officer in charge of the Fire Department and includes the *Deputy Fire Chiefs* and the manager, fire protection services.

**FIRE COMMISSIONER:** Means the person appointed as *Fire Commissioner* pursuant to the *Fire Services Act of British Columbia*.

**FIRE DAMPER:** Means a *closure* which consists of a damper installed in an air distribution system or a wall or floor assembly, which is normally held open but designed to close automatically in the event of a fire in order to maintain the integrity of a *fire separation*.

**FIRE DETECTOR:** Means a device which detects a fire condition and automatically initiates an electrical signal to actuate an *alert signal* or an *alarm signal* and includes *heat detectors* and *smoke detectors*.

**FIRE SAFETY DIRECTOR:** Means the person designated by the Building Management to implement and maintain the *Fire Safety Plan*.

**FIRE SEPARATION:** Means a construction assembly that acts as a barrier against the spread of fire.

**FIRE SUPPRESSION SYSTEM:** Means a device or combination of devices designed to extinguish or support extinguishment of fire.

**FIRE WATCH:** Means a procedure where a person is responsible to patrol a *building* or site and to sound an alarm in case of fire, or conduct such duties as required by the *Fire Chief*.

**FIREWALL:** Means a type of *fire separation* of *noncombustible construction* which subdivides a *building* or separates adjoining *buildings* to resist the spread of fire and which has a *fire resistance rating* as prescribed in the B.C. Building Code and has structural stability to remain intact under fire conditions for the required fire-rated time.

**FLAMMABLE LIQUID:** Means a liquid having a *flash point* below 37.8 degrees Celsius and having a vapour pressure not more than 275.8 kPa (absolute) at 37.8 degrees Celsius as determined by ASTM D 323, "Vapour Pressure of Petroleum Products (Reid Method)." See Subsection 4.1.2..



**FLASH POINT:** Means the minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. (See Subsection 4.1.3.)

**FLOOR AREA:** Means the space on any *storey* of a *building* between exterior walls and required *firewalls*, including the space occupied by interior walls and *partitions*, but not including *exits*, *vertical service spaces*, and their enclosing assemblies.

**FLUE:** Means an enclosed passageway for conveying *flue* gases.

**FLOOR OF ACTIVATION:** Means the floor from which the *fire alarm system* was activated.

**HAZARDOUS MATERIAL:** Means a product, substance or organism that are designated as dangerous in the Transportation of Dangerous Goods Act (Canada), but shall not include a quantity of such product, substance or organism that if accidentally spilled is insufficient to cause danger to lives or the environment.

**INSPECTOR:** Means an inspector with Vancouver Fire & Rescue Services, Fire Prevention Office. Means an inspector with the Office of the *Fire Commissioner*.

**LOCK (KEY) BOX:** Means a container in a form acceptable to the *Fire Chief* which is designed to hold *building* or premises *access* keys and is attached to a *building* (typically adjacent to main entrance).

**MEANS OF EGRESS:** Means a continuous path of travel provided for the escape of persons from any point in a *building* or contained open space to a separate *building*, an open public thoroughfare, or an exterior open space protected from fire exposure from the *building* and having access to an open public thoroughfare. *Means of egress* includes *exits* and *access to exits*.

**MONITORED:** Means a *fire alarm system* that is electronically *monitored* on a 24 hour basis by an outside monitoring agency.

**NONCOMBUSTIBLE  
CONSTRUCTION:**

Means that type of construction in which a degree of Fire Safety is attained by the use of noncombustible materials for structural members and other *building* assemblies.

**OPERATIONS BOX:**

Means a container in which diagrams showing the type, location, and operation of the *fire protection system* are kept (typically adjacent to main entrance).

**SPRINKLERED:**

(as applying to a *building* or part thereof) Means that the *building* or part thereof is equipped with a system of automatic sprinklers.

**SUITE:**

Means a single room or series of rooms of complementary use, operated under a single tenancy, and includes *dwelling units*, individual guest rooms in motels, hotels, boarding houses, rooming houses, and dormitories as well as individual stores and individual or complementary rooms for *business and personal service occupancies*.

**SUPERVISORY STAFF:**

Means those occupants of a *building* who have some delegated responsibility for the fire safety of other occupants under the fire safety plan (ie. *Fire Safety Director* and *Deputy Fire Safety Director*)

**ZONE:**

Means an area of a *building* designated as part of a *fire alarm system* or *sprinkler system*.

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**ABBREVIATIONS****CSA:**

Canadian Standards Association  
(55 Scarsdale Road, Don Mills, Ontario M3B 2R3)

**NFPA:**

National Fire Protection Association  
(Batterymarch Park, Quincy, Massachusetts 02269 U.S.A.)

**ULC:**

Underwriter's Laboratories of Canada  
(7 Underwriters Road, Scarborough, Ontario M1R 3A9)

1. BUILDING DESCRIPTION & SAFETY FEATURES

**BUILDING CONSTRUCTION & OCCUPANCY**

Building address: . . . . . 2355 East Mall, Vancouver, B.C. - UBC

Building name: . . . . . Quantum Matter Institute and Brimacombe Building

Building type: . . . . . educational laboratory research low-rise building

No. of storeys: . . . . . 4 + basement

Year of Construction: . . . . . added QMI addition 2017

Main construction materials: . . . . . poured reinforced concrete

Exterior finish: . . . . . concrete, brick, metal and glazing

Roof construction: . . . . . torch-on supported by a concrete slab

Interior construction and finish: . . . . . gypsum wall board on top of steel studs covered by various wall coverings and metal trim

**LIST OF BUILDING FIRE SAFETY FEATURES**

- Fire Alarm System
- Emergency Generator
- Emergency Lighting - Battery Power
- Fire Extinguishers
- Sprinkler System
- Standpipe System

**OCCUPANT LOAD & EXIT CAPACITY CALCULATIONS SEE NEXT PAGE (QMI only):**

2355 East Mall, Denver, CO 80202

**AREAS OF USAGE**

Basement .....	labs, work rooms, mechanical rooms, electrical rooms, elevator machine room, vaults, washrooms, storage rooms, meeting room, workspaces
Main Floor .....	labs, offices, washrooms, comm. room, meeting room, workspaces, QMI reception, QMI main entrance lobby, Brimacombe main entrance lobby, electrical closet
Level 2 .....	labs, offices, workspaces, washrooms, meeting room, electrical room, electrical closet
Level 3 .....	labs, offices, workspaces, washrooms, comm. room, electrical closet
Level 4 .....	labs, offices, workspaces, meeting room, washrooms, electrical room, electrical closet
Lower Roof .....	mechanical room, electrical room
Upper Roof .....	roof

## **ALTERNATIVE SOLUTIONS**

Summary of the Alternative Solutions (for QMI only):

- 1) Pressurization of Exit Stair Shafts
- 2) Exit Exposure Protection - Water Curtain Sprinkler System Design Criteria
- 3) Sprinkler Protected Glazing System

See Appendix C for the Alternative Solutions Report.

EXIT SYSTEMS

Stair Descriptions: .....	<div><div>■ <b>Stair #1 (Brimacombe Building):</b> located in the northwest section of the Brimacombe Building provides access from level 4 to a grade level (main floor) exit</div><div>■ <b>Stair #2 (Brimacombe Building):</b> located in the centre section of the Brimacombe Building provides access from the lower roof and basement to a grade level (main floor) exit</div><div>■ <b>Stair #3 (Brimacombe Building):</b> located in the east section of the Brimacombe Building provides access from the lower roof and basement to a grade level (main floor) exit</div><div>■ <b>Stair #1 (QMI):</b> located in the north section of the QMI Building provides access from level 4 and basement to a grade level (main floor) exit</div><div>■ <b>Stair #2 (QMI):</b> located in the south section of the QMI Building provides access from level 4 and basement to a grade level (main floor) exit</div></div> <div>Stair locations are clearly shown on attached floor drawings</div>
Exit Descriptions: .....	Exits are located on the north, east, south and west sides of the building. Exit locations are clearly shown on attached floor drawings
Exit Doors .....	marked with exit sign mounted above
Roof access: .....	- the top of Stair #2 (Brimacombe Building) and Stair #3 (Brimacombe Building) on the lower roof level

***Areas of refuges (Brimacombe Building only):***

- basement at the bottom of Brimacombe stair 2 and Brimacombe stair 3
- main floor within Brimacombe stair 1, Brimacombe stair 2 and Brimacombe stair 3
- level 2 within Brimacombe stair 1, Brimacombe stair 2 and Brimacombe 3
- level 3 within Brimacombe stair 1, Brimacombe stair 2 and Brimacombe 3
- level 4 within Brimacombe stair 1, Brimacombe stair 2 and Brimacombe 3

**FIRE ALARM SYSTEM**

Main Fire Alarm Control Panel Model: . . . . . Simplex 4100ES

No. of stages: . . . . . single

Location: . . . . . west section of Brimacombe building within the  
main electrical room

Supervised: . . . . . Yes

Monitoring company name: . . . . . tyco Integrated Security (604)289-2647

Special Annunciating Devices: . . . . . strobe lights

Systems Supervised by Fire Alarm System:

- main water service line
- standpipe
- low air - dry sprinkler system
- wet sprinkler system

Fire alarm system initiating devices:

- pull station
- heat detector
- smoke detector
- standpipe flow
- sprinkler flow

Heat detector locations: ■ bottom of elevator shaft

Smoke detector locations:

- make-up air system duct work
- common corridors
- in front of the elevator within Brimacombe Building on each level
- tops of stairwells
- top of elevator shaft
- all electrical closets (main floor, levels 2 - 4)
- comm rooms



Initiating devices cause: . . . . . full evacuation alarm

Extent of alarm sounding: . . . . . throughout building

Graphic annunciator locations: . . . . .

**QMI:**

northeast section of the building within the main entrance lobby on the main floor

Fan Sequence of Operation: . . . . .

1) AHU-4 and AHU-5/Fume Hood exhaust fans EF-1 to EF-10/Scavenger Exhaust Fans SEF-1 to SEF-4/Lab General Exhaust Fans HRU-1 & HRU-2.

a) In the event of a fire alarm signal, or upon detection of smoke by the duct smoke in the air handling units' supply ducts, the air handling units AHU-4 & AHU-5 fans shall shut-off. All dampers in the air handling units shall close.

b) All fume hood exhaust fans shall continue to operate.

c) All scavenger exhaust fans shall continue to operate.

d) All exhaust VAV boxes shall close to the fully closed position and the lab general exhaust fans HRU-1 & HRU-2 shut off.

2) Smoke exhaust fan EF-1, shall operate via a manual switch at the fire alarm annunciator panel for post-fire smoke clean-up. The fan wiring and controls shall be by Div 26. Shut-off damper shall be fail safe open on fire alarm signal.

3) Stair pressurization fan SF-1 shall operate in the event of a fire alarm signal. The off switch at the fire alarm annunciator panel shall allow manual turning off of stair pressurization fan.

4) Alarms shall be annunciated by the BMS to indicate the equipment failure/shut down and the building fire alarm condition. The BMS shall not annunciate nuisance alarms for monitored input points on systems shut down by the BMS or fire alarm system (eg. high supply air temperature, low duct static pressure, etc.).

Fire alarm panel silencing information: . . . . . found in Appendix B

## **HEATING, VENTILATING & AIR CONDITIONING**

Type of Heating: . . . . . MUA's: heat, air conditioning & ventilation system; perimeter heating in the offices

**CLOSURES**

***Fire Doors***

Locations: . . . . . exit stairwells, common corridors, and at all required fire separations

Hold-open devices: . . . . . there are no hold-open devices used in this building - fire doors limit the spread of smoke and fire and must not be wedged open at any time.

**FIRE DAMPERS & FIRE STOP FLAPS**

Locations: in all duct work that pass through fire separations

**EMERGENCY GENERATOR**

Make & Model: . . . . . Kohler Power Systems

Rated Output: . . . . . 360KW

Fuel: . . . . . diesel (1530 litres)

Location: . . . . . south section of the complex in the service courtyard

Supplies Emergency Power to: . . . . . life safety and non-life safety system loads in both  
Brimacombe and QMI

**EMERGENCY LIGHTING - BATTERY POWER**

Emergency lighting comprise of selected base building luminaires which are fed off the emergency generator.

Additionally, emergency lighting unit equipment (battery packs) are also provided in the QMI main electrical room and the QMI main mechanical room located on level -1

These units must operate for a minimum of 30 minutes.

**ELEVATORS**

Number of Elevators: ..... 1

Locations: ..... northwest section of the building adjacent to the  
main entrance of Brimacombe

Elevator Service Company: ..... West Coast Elevator Services Ltd.

Elevator Service Company Tel: ..... (604)980-0364

Weight Capacity: ..... 2727 kgs

Floor Access: ..... all

Recall Floor: ..... main floor

**FIRE EXTINGUISHERS**

General Locations: ..... throughout the buildings

Extinguisher Type: ..... ABC multi-purpose dry chemical

See page 3.8 for instructions on the proper use of fire extinguishers.

**STANDPIPE SYSTEMS**

Standpipe Type . . . . .	Automatic-Wet
Standpipe Classification . . . . .	Class I - 2½" Connections
Riser location: . . . . .	south section of the QMI within stair #6 (QMI)
Riser Size: . . . . .	6"
Stairwell Connection Size: . . . . .	2½"
Hose Cabinet	
Connection Size: . . . . .	1½" (in Brimacombe Building only)

***Standpipe Isolation Valve Locations***

- south centre section of the QMI within the mechanical room at the main sprinkler valves

***Fire Hose***

**(Only in Brimacombe Building)**

Fire Hose Mounting: . . . . .	Fire hose cabinets
Locations: . . . . .	common areas
Lined: . . . . .	Yes
Size & Length: . . . . .	1½" x 100'
Nozzle Type: . . . . .	combination fog
Quick Release Valve: . . . . .	No

See page 3.9 for instructions on the proper use of fire hose.

## **SPRINKLER SYSTEMS**

System Types: . . . . . wet & dry

Protected Areas: . . . . . **wet system:** both buildings

**dry system:** the canopy on the northeast exterior corner of building above the main entrance of the QMI

Control Valve Locations: . . . . . **wet valve #1:** southeast section of the Brimacombe building within the mechanical room on level 1

**wet valve #2 & dry valve:** south section of the QMI within the mechanical room on level 1

Supervised by Fire Alarm . . . . . yes

Sprinkler Floor

Isolation Valves: . . . . .

### **Main Floor:**

- 1 in the northwest section of the Brimacombe building within the corridor adjacent to Stair #1 (Brimacombe Building)
- 1 in the east section of the Brimacombe building adjacent to the double doors to the QMI and Stair #3 (Brimacombe Building)
- 1 in the south section of the QMI adjacent to Stair #6 (QMI)

### **Level 2:**

- 1 in the northwest section of the Brimacombe building within the corridor adjacent to Stair #1 (Brimacombe Building)
- 1 in the east section of the Brimacombe building adjacent to the double doors to the QMI and Stair #3 (Brimacombe Building)
- 1 in the south section of the QMI adjacent to Stair #6 (QMI)

### **Level 3:**

- 1 in the northwest section of the Brimacombe building within the corridor adjacent to Stair #1 (Brimacombe Building)
- 1 in the east section of the Brimacombe building adjacent to the double doors to the QMI and Stair #3 (Brimacombe Building)
- 1 in the south section of the QMI adjacent to Stair #6 (QMI)

**Level 4:**

- 1 in the northwest section of the Brimacombe building within the corridor adjacent to Stair #1 (Brimacombe)
- 1 in the east section of the Brimacombe building adjacent to the double doors to the QMI and Stair #3 (Brimacombe Building)
- 1 in the south section of the QMI adjacent to Stair #6 (QMI)

**NATURAL GAS SHUT-OFF**

Location: west exterior side of the building access via Engineering Road

**WATER SHUT-OFFS**

Interior Location: south section of QMI within the mechanical room in the basement

Exterior Location: southeast exterior corner of QMI

**ELECTRICAL DISCONNECT****Brimacombe Building:**

Main electrical  
disconnect location: ..... main electrical room (Brimacombe Building)

Main electrical room: ..... east section of Brimacombe building on the basement  
level within the main electrical room

**QMI Building:**

Main electrical  
disconnect location: ..... electrical room (QMI)

Electrical room (QMI): ..... centre section of the QMI building on the basement  
level within the electrical room (QMI)

**Main Electrical Shut-off for both buildings is on the basement level within the main electrical room of Brimacombe Building (west section of the Brimacombe building on level 1)**

**FIRE DEPARTMENT CONNECTIONS**

Location: northeast corner of the building adjacent to QMI building main entrance

No. & Type of Connection: (1) - 2½" F.D. Auto Sprinkler siamese connection



**FIRE HYDRANT LOCATION**

<b><u>Type</u></b>	<b><u>Location</u></b>
public	north of the Brimacombe building on the south side of Engineering Road
public	west side of the Brimacombe building on the west side of Engineering Road
public	east side of the QMI on the west side of East Mall
public	southeast of the QMI on the east side of East Mall

**FIRE DEPARTMENT ACCESS**

Primary Access: . . . . . northeast corner of the building (at the QMI main entrance)

Secondary Access: . . . . . south and west sides of the building

## 2. FIRE SAFETY PERSONNEL & DUTIES

### APPOINTMENT OF FIRE SAFETY DIRECTOR

**Fire Safety Director:** Gary Lockhart

**Days & Hours:** 24/7

**Tel:** cell: (604)809-9194 Home: (604)263-5370  
work: (604)822-2955

**Position:** Building Manager & Research Engineer

### GENERAL DUTIES OF FIRE SAFETY DIRECTOR

- Responsible for the administration and maintenance of the Fire Safety plan that meets all the measures contained in Section 2.8 of the current B.C. Fire Code, (copy enclosed).
- Responsible for training the deputy, Floor Wardens, and other key personnel to perform their duties in the areas of fire prevention and emergency evacuation.
- Responsible for obtaining and issuing equipment such as flashlights, ID bands, and megaphones for outside communications.
- Proper records must be kept by the Fire Safety Director of current Floor Wardens, number and quality of fire drills, names and locations of physically disabled people in the building, equipment issued, and fire incidents. He/she must also keep a record of all Fire Safety meetings.
- The Fire Safety Director should also consider other emergency situations that could affect the building such as bomb threats, earthquakes, and hazardous chemical spills.
- Alternative measures should be worked out in cooperation with the local fire department (such as hourly watches), during a temporary shutdown of the fire alarm system. These measures should be recorded as part of the building fire safety plan.
- In the Fire Safety Plan, the Fire Safety Director will specify the procedure for calling the fire department at the sound of the Alarm. Upon arrival of the fire department the Fire Safety Director will assist them as a liaison.
- Will temporarily assume the general duties of the Floor Wardens until Floor Wardens are appointed (if applicable).

*NOTE: Fire Safety Director may not be on site at all times.*

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## **FIRE SAFETY DIRECTOR DUTIES DURING AN EMERGENCY EVACUATION:**

### **IF YOU DISCOVER A FIRE:**

1. Activate the fire alarm.
2. Notify the fire department, call 911.
3. Assist people with physical disabilities (to refuge area if applicable).
4. Fight the fire only if it is small. Make sure you are between the fire and exit at all times.
5. Report details to fire department officer.

### **WHEN YOU HEAR THE FIRE ALARM:**

1. Notify the fire department, call 911.
2. Proceed to the fire alarm annunciator and determine the location of the fire.
3. Evacuate the fire area.
4. Assist people with physical disabilities (to refuge area if applicable).
5. Fight fire only if it is small. Make sure you are between the fire and exit at all times.
6. Report details to fire department officer.

*NOTE: Fire Safety Director may not be on site at all times.*

## **APPOINTMENT OF DEPUTY FIRE SAFETY DIRECTOR**

**Deputy Fire Safety Director:** Pinder Dosanjh

Days & Hours:

Tel: work: (604)822-1997

Position:

## **DUTIES OF THE DEPUTY FIRE SAFETY DIRECTOR**

To assist the Fire Safety Director and be prepared to take over the duties as Fire Safety Director in his/her absence.

*NOTE: Deputy Fire Safety Director may not be on site at all times.*

---

**FLOOR WARDENS**

If the possibility that floor wardens are, or may be required, the following described duties of floor wardens and deputy floor wardens will apply.

**APPOINTMENT OF FLOOR WARDENS:**

AREA OF RESPONSIBILITY	FLOOR WARDEN	ASSISTANT FLOOR WARDEN
Basement	_____	_____
Main Floor	_____	_____
Shops/High Head Lab		
Level 2	_____	_____
Level 3	_____	_____
Level 4	_____	_____

---

## GENERAL DUTIES OF FLOOR WARDENS

Daily Check of floor area for:

- Accumulation of combustible materials, rubbish or flammable liquids.
- Dangerous ignition sources, i.e. worn extension cords, oily rags, overheating equipment.
- Exit lights in good order and adequate lighting in public corridors and stairwells.
- Fire and exit doors and their self closing hardware to ensure that they are in good operating condition. Doors must not be wedged open for any reason.
- Unobstructed exit routes. (Definition of exit routes in previous sections).
- Condition of fire fighting equipment.

\*Note: The Fire Safety Director will temporarily assume the above duties until such time as Floor Wardens are appointed.

## FLOOR WARDEN DUTIES DURING AN EMERGENCY EVACUATION:

Supervise the evacuation of the occupants of their floor to the predetermined assembly area outside the building.

1. Check to see if the exits are clear of fire and smoke. Choose an alternate route if necessary. **DO NOT USE THE ELEVATOR UNDER ANY CIRCUMSTANCE.**
2. Direct Assistant Floor Warden to check the floor area, including all washrooms to ensure that all people have left the area.
3. Notify the Fire Safety Director of any people with physical disabilities, and their exact whereabouts.
4. Close all doors. **DO NOT LOCK.**
5. One Floor Warden will stay with the people with physical disabilities, the rest will proceed to the assembly area. Once the fire department relieves the remaining Floor Warden, he/she also proceeds to the assembly area.
6. Ensure that no one from his/her floor re-enters the building.
7. Once everyone from his/her floor is safely at the assembly area, notify the Fire Safety Director.

## **ASSISTANT FLOOR WARDENS**

### **DUTIES OF THE ASSISTANT FLOOR WARDEN:**

- Assist the Floor Warden in fire prevention and emergency evacuation.
- Assume the duties of the Floor Warden in his/her absence.

---

## **FIRE DRILL PROCEDURES**

### **CONDUCTED ANNUALLY:**

In general, fire drills must be conducted on an annual basis for buildings on the UBC campus. The exception is high-occupancy or special-occupancy buildings such as the child-care centre, which must run fire drills more frequently.

Fire drills should be scheduled by the Building Safety Committee and/or in cooperation with the Fire Safety Director. Prior to scheduling a fire drill, the Committee and/or Director should consult with building occupants to determine an optimal date and time for the drill. Exam periods and times of peak activities, (such as Registration time for Student Services), should be avoided.

This consultation process is important to ensure fire drills are not conducted during a time which may cause a serious inconvenience to occupants, as this will only lead to increased resentment and should not be advertised to building occupants: however, it is acceptable to notify occupants that a fire drill will be conducted "in the near future" or "next week," etc. Notifying occupants of an upcoming fire drill also presents the opportunity to remind fire wardens and occupants of what to do during a building evacuation, and where to assemble outdoors.

### **SCHEDULING:**

To schedule a fire drill, call Plant Operations at 822-2173 and request a fire drill for the building. Request a specific date and time, and provide your name, (i.e. the Fire Safety Director), as the contact.

Just prior to the fire drill, Plant Operations will confirm with you that the date/time are still acceptable for the drill.

### **DURING THE FIRE DRILL:**

Please note that the Fire Safety Director must meet the Fire Department representative at the annunciator panel upon evacuating the building. Both Plant Operations and the Fire Department must meet with the Fire Safety Director to confirm that all occupants have evacuated and are accounted for, (to the best of the Director's knowledge). At this time, Plant Operations will turn off the alarm and the Fire Department will declare it safe to re-enter the building.

The Fire Safety Director may then indicate to the Fire Wardens that it is o.k. to re-enter the building.

### **RECOMMENDATIONS:**

Upon completion of the fire drill, the Fire Department will fill out a Fire Drill Inspection Report, including recommendations and the time taken to complete the building evacuation. The final report will be mailed to the Fire Safety Director and copied to Judi Van Swieten, Disaster Planning Coordinator.

Any recommendations arising as a result of conducting the fire drill should be directed to the Building Safety Committee to be addressed.



- Notify occupants of the date and time of the drill.
- Notify the alarm supervisory service, (if applicable), and the fire department that you are planning to have a non-evacuation fire drill, and that you will call them back when the drill is complete.
- Discuss evacuation procedures with D.F.S.D. and those occupants *willing* to participate.
- Have the D.F.S.D. perform the *If You Discover A Fire* scenario in the *In Case of Fire* procedures for occupants. The F.S.D. should perform his or her duties as detailed in the plan.
- Restore the manual fire alarm pull station, and then reset the fire alarm system.
- Notify the alarm supervisory service, (if applicable), and the fire department that the fire drill is complete.
- Discuss drill with occupants in an attempt to identify problems.
- *Complete the Incident/Activity Report.*

---

**FIRE DRILL INCIDENT/ACTIVITY REPORT****(1) INCIDENT / ACTIVITY**

☐ FIRE ☐ FALSE ALARM  
☐ FIRE DRILL ☐ TRAINING  
☐ FIRE SAFETY MEETING ☐ FIRE EQUIP. OPERATED

**(2) DETAIL**

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ DEVICE/EQUIP.: \_\_\_\_\_

FLOOR: \_\_\_\_\_ ALARM ZONE: \_\_\_\_\_ # OF INJURIES: \_\_\_\_\_

CAUSE/REASON FOR INCIDENT: \_\_\_\_\_

EXPLAIN DAMAGE/LOSS: \_\_\_\_\_

**(3) ACTION**

WHO DISCOVERED THE FIRE?: \_\_\_\_\_

DID FIRE DEPT. ATTEND? \_\_\_\_\_ IF NOT WHY? \_\_\_\_\_

WHO OPERATED FIRE EQUIPMENT? \_\_\_\_\_

**(4) COMMENTS / RECOMMENDATIONS**

\_\_\_\_\_  
\_\_\_\_\_

SIGNED \_\_\_\_\_ DATE \_\_\_\_\_

**(5) DISTRIBUTION LIST**

☐ FIRE DEPARTMENT ☐ HEAD OFFICE  
☐ DEPUTY FIRE SAFETY DIR. ☐ TENANTS  
☐ INSURANCE COMPANY ☐ POLICE  
☐ MONITORING COMPANY

### **3. FIRE PREVENTION, PREPAREDNESS & CONTROL**

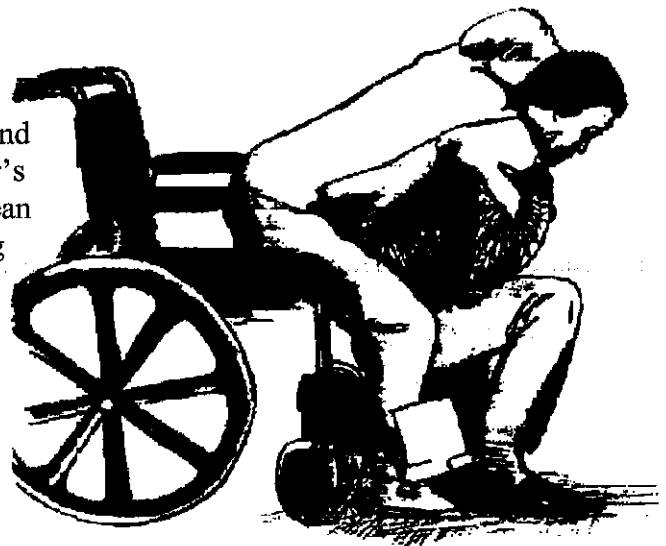
This section contains information for both Fire Safety personnel and building occupants including: general description and operation of fire prevention equipment, and emergency evacuation procedures. The Fire Safety Director should provide this information to building occupants.

## EVACUATION PROCEDURES FOR PEOPLE WITH PHYSICAL DISABILITIES

In most cases people with physical disabilities should be placed under the supervision of designated personnel until the Fire Department can rescue them. If it is life threatening for the people with physical disabilities and their supervisors to remain on that floor, it is recommended that the people with physical disabilities be transported via the stairwell to a grade level exit.

Below are some techniques which may be used to perform this transport:

- 1. THE BACK PACK LIFT:** The Rescuer would kneel at the front of the person being assisted and place the person's arms up and over the rescuer's shoulders and chest. The rescuer would then lean forward before raising slowly, to a full standing position. (Figure 1)



*Figure 1. The Back Pack Lift*



- 2. TWO RESCUER EXTREMITIES CARRY:** The person being assisted would be placed on the stairwell landing. One rescuer would lift at the legs, under the knees, while the other would lift under the shoulders with fingers locked across the individual's chest. Rescuers, with backs erect, would lift together, rising slowly to a standing position. (Figure 2)

*Figure 2. Two Rescuer Extremities Carry*

**3. TWO RESCUER SEAT CARRY:** Two rescuers position themselves next to the wheelchair (or beside the person being assisted) in order to grasp each other's upper arm or shoulder (Figs. 3 & 4). The person being assisted would place his/her arms firmly around both rescuer's necks as per Fig. 5. The two rescuers would then lean forward placing their free arm under the individual's legs, firmly grasping each other's wrists as per Fig. 6. Working together, both rescuers lift, using legs, and carefully step forward.

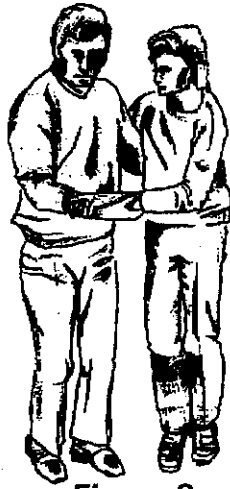


Figure 3.



Figure 4.



Figure 5.



Figure 6.

These are but a few examples of transporting a person down a stairwell.

**NOTE:** It is important to notify the Fire Department where people with physical disabilities are located and if you intend to transport the individual down a stairwell. The Fire Department will then be able to respond quicker in helping you and the people with physical disabilities to evacuate the building safely.

## PEOPLE WITH PHYSICAL DISABILITIES INFORMATION SHEET

Name	Disability	Location in Building
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## THE ABCD's OF PORTABLE FIRE EXTINGUISHERS

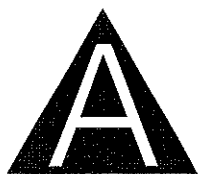
A fire extinguisher is a storage container for an agent like water, or chemicals. It is designed to put out a small fire, not a big one.

Extinguishers are labelled ABC or D according to whether the fire on which it is to be used occurs in wood or cloth, flammable liquids, electrical, or metal sources.

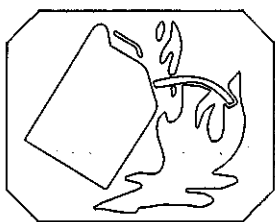
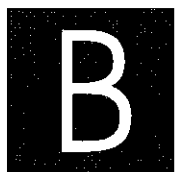
If you plan to buy one extinguisher, a multi-purpose dry chemical labelled ABC puts out most types of fires — wood, paper, cloth, flammable liquid, or electrical fires.

### BUYING AND MAINTAINING AN EXTINGUISHER

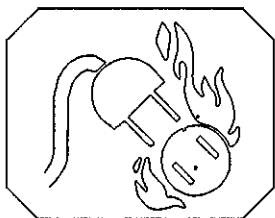
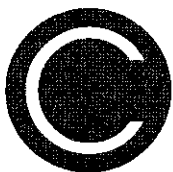
1. Extinguishers come in dry chemical, foam, carbon dioxide, and water types. Whatever type you buy, it should be labelled by a nationally recognized testing laboratory.
2. The higher the number rating on the extinguisher the more fire it puts out. High rated ones are often (not always) the heavier models. Make sure you can hold and operate the one you might buy for home use or be required to use at work.
3. Ask your dealer how to have your extinguisher serviced and inspected. Recharge it after ANY use. A partially used one might as well be empty.
4. Extinguishers should be installed away from potential fire hazards and near an escape route.

**THE ABCD's OF PORTABLE FIRE EXTINGUISHERS - cont'd*****Ordinary Combustibles***

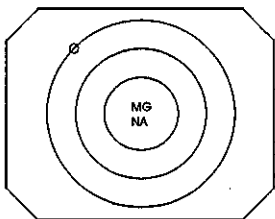
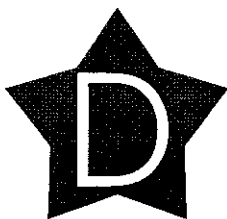
Fires in wood, paper, cloth, trash, drapes, upholstery and other ordinary materials require an extinguisher labelled A.

***Flammable Liquids & Gases***

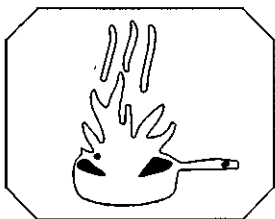
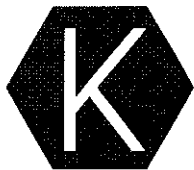
Fires in gasoline, oils, paints, lacquer, tar and other flammable liquids require an extinguisher labelled B.

***Live Electrical Equipment***

Fires started in wiring, overheated fuse boxes, conductors, and other live electrical sources require an extinguisher labelled C.

***Combustible Metals or Combustible Metal Alloys***

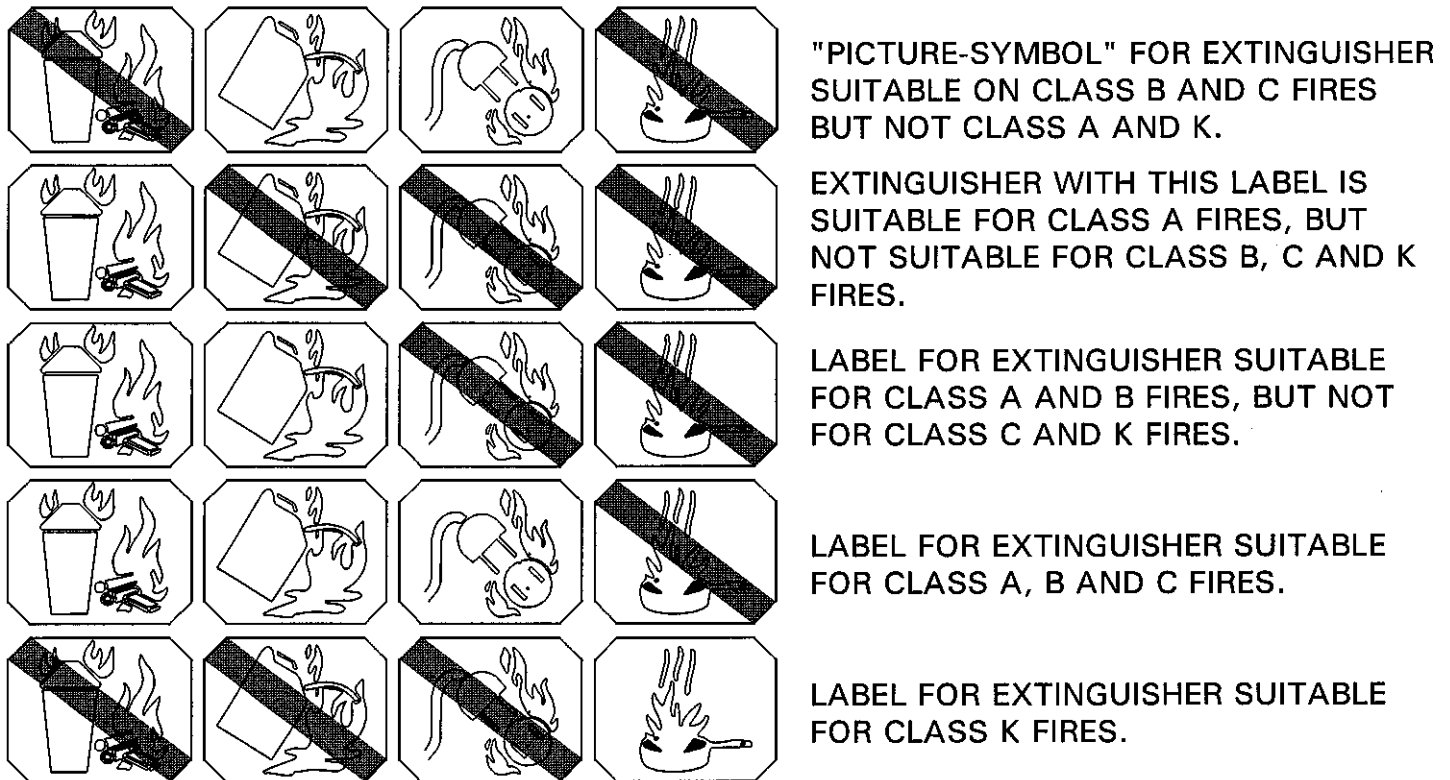
Certain metals such as magnesium and sodium require special dry powder extinguishants labelled D. The star is coloured yellow.

***Commercial Kitchen Use***

Fires & cooking appliances that involve combustible cooking media, vegetable or animal oils and fat require an extinguisher labelled K.



## THE ABCD's OF PORTABLE FIRE EXTINGUISHERS - cont'd



**Figure 7. ABCD's of Portable Extinguishers**

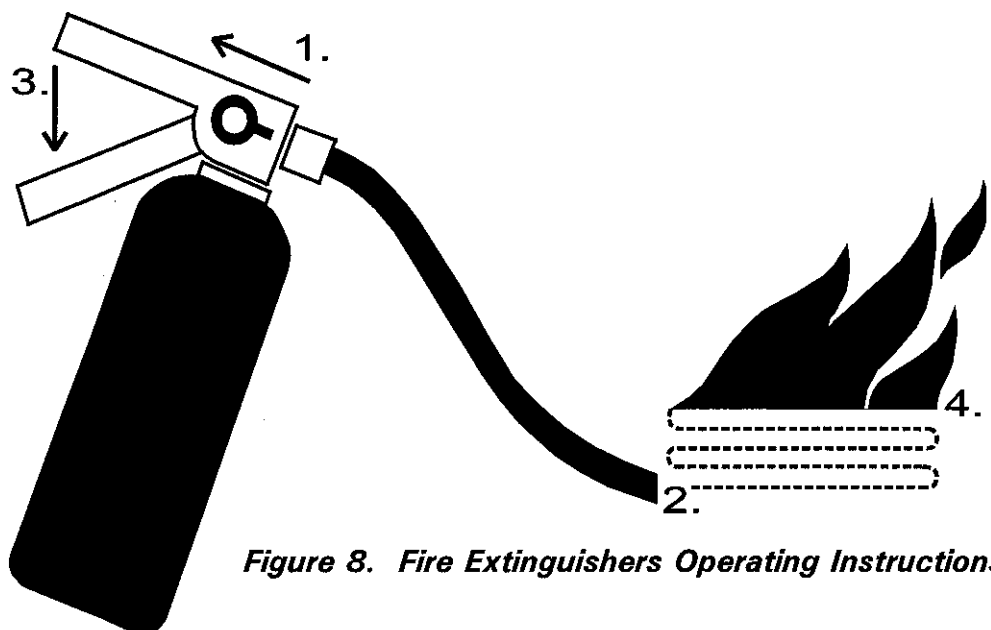
## OPERATION OF PORTABLE FIRE EXTINGUISHERS

1. Try to extinguish only a small fire.
2. Do not try to fight the fire if you have any doubt as to whether or not you should. Get out and call the Fire Department.
3. Make sure you can get to an exit.
4. A small fire can easily become a large fire if it is not extinguished properly. Make sure you know how to use your fire extinguisher.

### DIRECTIONS FOR USE:

READ THE DIRECTIONS ON YOUR FIRE EXTINGUISHER AS TYPES VARY.

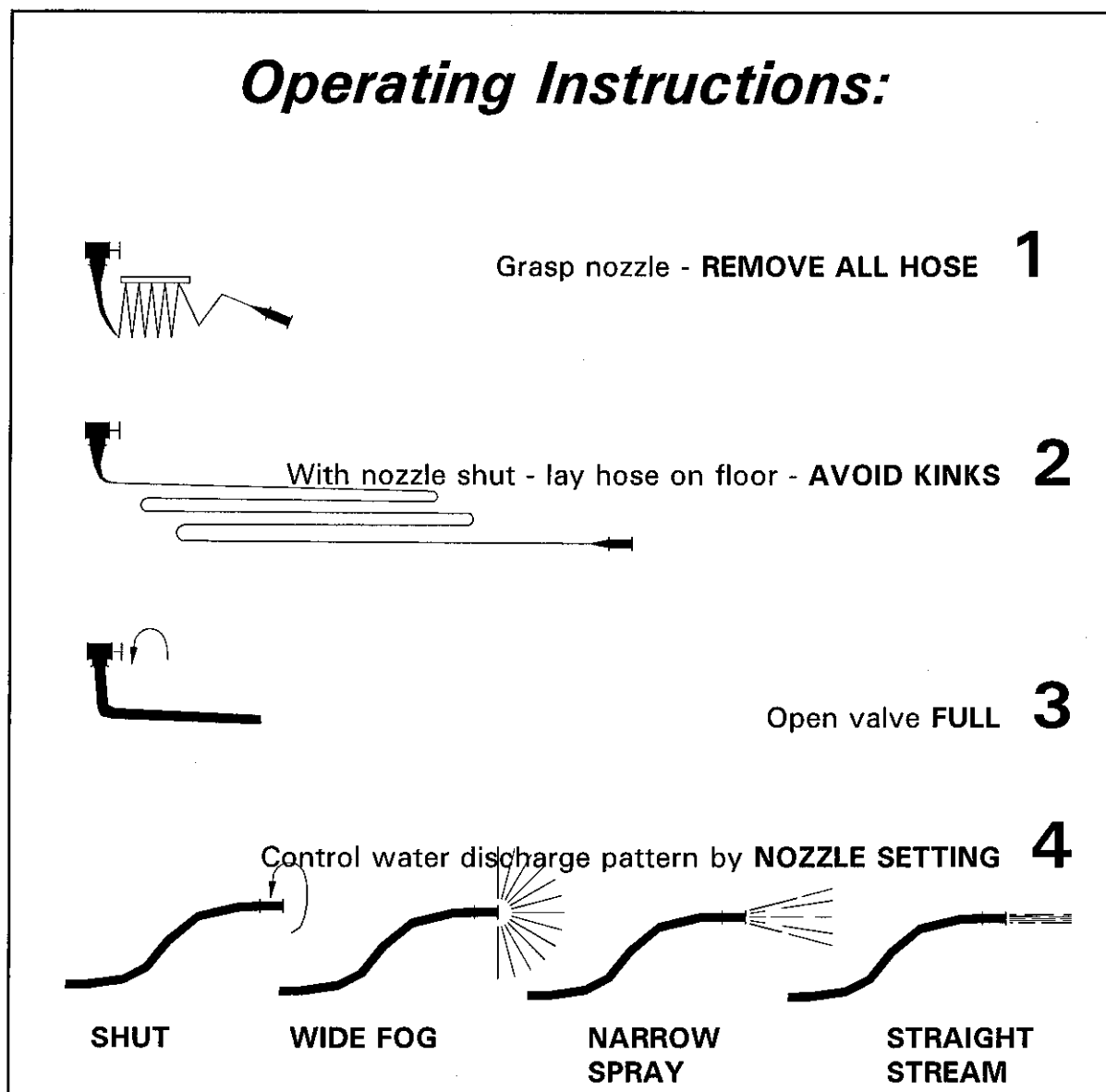
1. **P Pull:** Pull the pin.
2. **A Aim:** Always aim at the base of the fire using the nozzle provided.
3. **S Squeeze:** Activate the fire extinguisher by squeezing the handle.
4. **S Sweep:** Move from side to side in a sweeping motion, watching to make sure flames don't start up again. Breakup any clumps of burnt materials to ensure the fire is fully extinguished.



*Figure 8. Fire Extinguishers Operating Instructions*

## OPERATION OF HOSE-RACK

To be used by qualified personnel only.



**Figure 9. Hose-rack Operating Instructions**

## 4. FIRE PROTECTION EQUIPMENT SERVICING

All maintenance, repairs and annual service of life safety equipment is to be performed by an ASTT Certified Technician.

Fire protection servicing requirements for the following categories are obtained from the 2012 B.C. Fire Code, Standards referenced by the Fire Code, and by the authority having jurisdiction.

Note: Unless otherwise specified all code references are quoted from Division B of the 2012 B.C. Fire Code.

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#### 2.2.1.1. (Division C) Responsibility

- 1) Unless otherwise specified, the owner or the owner's authorized agent shall be responsible for carrying out the provisions of this Code.

Referenced from 2012 B.C. Fire Code.

**2.2.1.2. (Division C) Records**

- 1) Where this Code requires that tests, inspections, maintenance or operational procedures be performed on a fire safety system, records shall be made and the original or a copy shall be retained at the premises for examination by the *authority having jurisdiction*.
- 2) The initial verification or test reports for each system shall be retained throughout the life of the systems.
- 3) Records of tests, inspections, maintenance or operational procedures undertaken after the initial tests referred to in Sentence (2) shall be retained so that at least the current and the immediately preceding records are available.
- 4) Notwithstanding the conditions stated in Sentence (3), no record shall be destroyed within two years of being prepared.

**Referenced from 2012 B.C. Fire Code.**

**HOT WORKS****5.2.1.1. Application**

- 1) This Section shall apply to hot works involving open flames or producing heat or sparks, including, without being limited to, cutting, welding, soldering, brazing, grinding, adhesive bonding, thermal spraying and thawing pipes.
- 2) Except as provided in this section, hot works described in Sentence (1) shall conform to CAN/CSA W117.2, "Safety in Welding, Cutting, and Allied Processes."

**5.2.1.2. Training**

- 1) Hot works shall be performed only by personnel trained in the safe use of equipment in conformance with this Section.

**HOT WORK EQUIPMENT****5.2.2.1. Maintenance**

- 1) Hot work equipment shall be maintained in good operating condition.

**5.2.2.2. Inspection**

- 1) Hot work equipment shall be examined for leakage or defects prior to each use.
- 2) Leaks or defects found in hot work equipment shall be repaired prior to use.

**5.2.2.3. Equipment Not in Use**

- 1) All valves shall be closed and gas lines bled when Class 2 gas hot work equipment is not in use.
- 2) Electric hot work equipment shall be de-energized when not in use.

**5.2.2.4. Compressed Gas Equipment**

- 1) The design and installation of oxygen-fuel gas equipment shall conform to NFPA 51, "Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes."
- 2) Unalloyed copper piping shall not be used for acetylene gas.
- 3) Oil or grease shall not be used with equipment for oxygen.
- 4) Cylinders of Class 2 gases shall conform to Part 3.

**PREVENTION OF FIRES****5.2.3.1. Location of Operations**

- 1) Except as provided in Sentence (2), hot work shall be carried out in an area free of combustible and flammable contents, with walls, ceilings and floors of *non-combustible construction* or lined with noncombustible materials.
- 2) When it is not practicable to undertake hot work in an area described in Sentence (1),
  - a) combustible and flammable materials within a 15 m distance from the hot work shall be protected against ignition in conformance with Article 5.2.3.2.
  - b) a fire watch shall be provided during the hot work and for a period of not less than 60 min after its completion in conformance with Article 5.2.3.3, and
  - c) a final inspection of the hot work area shall be conducted 4 h after completion of work.
- 3) When there is a possibility of sparks leaking onto combustible materials in areas adjacent to the area where hot work is carried out,
  - a) openings in walls, floors or ceilings shall be covered or closed to prevent the passage of sparks to such adjacent areas, or
  - b) Sentence (2) shall apply to such adjacent areas.

**5.2.3.2. Protection of Combustible and Flammable Materials**

- 1) Any combustible and flammable material, dust or residue shall be
  - a) removed from the area where hot work is carried out, or
  - b) protected against ignition by the use of noncombustible materials.
- 2) Combustible materials or *building* surfaces that cannot be removed or protected against ignition as required in Sentence (1) shall be thoroughly wetted where hot work is carried out.
- 3) Any process or activity creating flammable gases or vapours, *combustible dusts* or *combustible fibres* in quantities sufficient to create a fire or explosion hazard shall be interrupted and the hazardous conditions shall be removed before hot work is carried out.

**5.2.3.3. Fire Watch**

- 1) The exposed areas described in Sentences 5.2.3.1.(2) and (3) shall be examined for ignition of combustible materials by personnel equipped with and trained in the use of fire extinguishing equipment.

**5.2.3.4. Work on Containers, Equipment or Piping**

- 1) Hot work shall not be performed on containers, equipment, or piping containing *flammable liquids*, *combustible liquids* or Class 2.1 flammable gases unless
  - a) they have been cleaned and tested with a gas detector to ascertain that they are free of explosive vapours, or
  - b) safety measures are taken in conformance with good engineering practice. (See Appendix A).
- 2) Hot work shall not be performed on a totally enclosed container.
- 3) Hot work shall not be performed on metal objects that are in contact with combustible materials unless safety precautions are taken to prevent their ignition by conduction.

**5.2.3.5. Work Adjacent to Piping**

- 1) When hot work is to be carried out near piping containing Class 2.1 flammable gas, the piping shall:
  - a) conform to Sentence 5.2.3.4.(1), or
  - b) be protected by a thermal barrier against the passage of heat.

**5.2.3.6. Fire Extinguishing Equipment**

- 1) At least one portable fire extinguisher shall be provided in the hot work area.

**5.2.3.7. Fire Safety Plan**

- 1) In *buildings* or areas described in Article 2.8.1.1., the required fire safety plan shall include the safety measures described in this Subsection for the safe conducting of hot works.

**2.1.5.1. Portable Fire Extinguishers - Selection**

- 2) Except as otherwise required by this Code, portable extinguishers shall be selected and installed in accordance with NFPA 10, "Portable Fire Extinguishers".

**Referenced from 2012 B.C. Fire Code.**

**ALTERNATE MEASURES FOR OCCUPANT FIRE SAFETY****CAN/ULC-S536-2004, B1**

In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.

**CAN/ULC-S536-2004, B2**

An attempt to minimize the impact of inoperative equipment should be made, (ie. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance with the accepted Fire Safety Plan.

**CAN/ULC-S536-2004, B3**

Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:

- A. Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be completed. The Fire Department should be notified in writing of shutdowns longer than 24 hr;
- B. Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;
- C. Have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and
- D. Notify the Fire Department, the monitoring station, and building occupants/owner when work has been completed and systems are operational.



## **AUTOMATIC SPRINKLER SYSTEMS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **SPRINKLER SYSTEM SHUTDOWN**

#### **6.1.1.4. Protection during Shutdown**

- 1) When any portion of a fire protection system is temporarily shut down, alternative measures shall be taken to ensure that protection is maintained. See Appendix A.

#### **A-6.1.1.4. Protection during Shutdown (Sprinkler System)**

- 1) Interruption of normal operation of a fire protection system for any purpose constitutes a "temporary shutdown." Types of interruptions include, but are not limited to, periodic inspection or testing, maintenance and repairs. During a shutdown, alternative measures are necessary to ensure that the level of safety intended by the Code is maintained.

In the shutdown of a fire alarm system, alternative measures should be worked out in cooperation with the fire department to ensure that all persons in the building can be promptly informed, and the fire department notified, should a fire occur while the alarm is out of service.

When a sprinkler system is shut down, measures that can be taken include the provision of: emergency hose lines and portable extinguishers, extra fire watch service and, where practicable, temporary water connections to the sprinkler system.

#### **6.4.1.1. Inspection, Testing and Maintenance**

- 1) Water-based fire protection systems shall be inspected, tested and maintained in conformance with NFPA 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems." (See Appendix A).

## **DAILY MAINTENANCE**

### **NFPA 25-2008 5.4.1.1**

Replacement sprinklers shall have the proper characteristics for the application intended. These include the following:

- (1) Style
- (2) Orifice size and *K*-factor
- (3) Temperature rating
- (4) Coating, if any
- (5) Deflector type (e.g., upright, pendant, sidewall)
- (6) Design requirements

## **WEEKLY INSPECTIONS**

### **NFPA 25-2008 13.3.2.1**

All valves shall be inspected weekly.

### **NFPA 25-2008 13.3.2.2**

The valve inspection shall verify that the valves are in the following condition:

- (1) In the normal open or closed position
- (2) Properly sealed, locked or supervised
- (3) Accessible
- (4) Provided with appropriate wrenches
- (5) Free from external leaks
- (6) Provided with appropriate identification

### **NFPA 25-2008 13.4.4.1.2**

Gauges shall be inspected weekly.

#### **NFPA 25-2008 13.4.4.1.2.1**

The gauge on the supply side of the dry pipe valve shall indicate the normal supply water pressure is being maintained.

#### **NFPA 25-2008 13.4.4.1.2.2**

The gauge on the system side of the dry pipe valve shall indicate that the proper ratio of air or nitrogen pressure to water supply pressure is being maintained in accordance with the manufacturer's instructions.

**NFPA 25-2008 5.2.4.4**

For dry pipe or preaction systems protecting freezers, in accordance with Figure A.5.2.4.4 the air pressure gauge near the compressor shall be compared weekly to the pressure gauge above the dry pipe or preaction valve. When the gauge near the compressor is reading higher than the gauge near the dry pipe valve, the air line in service shall be taken out of service, and the alternate air line opened to equalize the pressure. The air line taken out of service shall be internally inspected, have all ice blockage removed, and shall be reassembled for use as a future alternate air line.

**MONTHLY INSPECTIONS****NFPA 25-2008 13.3.2.1.1**

Valves secured with locks or supervised in accordance with applicable NFPA standards shall be permitted to be inspected monthly.

**NFPA 25-2008 13.4.4.1.4**

The dry pipe valve shall be externally inspected monthly to verify the following:

- (1) The valve is free of physical damage.
- (2) All trim valves are in the appropriate open or closed position.
- (3) The intermediate chamber is not leaking.

**NFPA 25-2008 5.2.4.1**

Gauges on wet pipe sprinkler systems shall be inspected monthly to ensure that they are in good condition and that normal water supply pressure is being maintained.

**QUARTERLY TESTS****NFPA 25-2008 13.2.5.1**

Systems where the sole water supply is through a backflow preventer and/or pressure reducing valves, the main drain test of at least one system downstream of the device shall be conducted on a quarterly basis.

**NFPA 25-2008 13.2.6.1**

Mechanical waterflow devices, including but not limited to water motor gongs, shall be tested quarterly.

**NFPA 25-2008 5.2.6 Alarm Devices**

Alarm devices shall be inspected quarterly to verify that they are free of physical damage.

**NFPA 25-2008 5.2.7 Hydraulic Nameplate**

The hydraulic nameplate for hydraulically designed systems shall be inspected quarterly to verify that it is attached securely to the sprinkler riser and is legible.

**NFPA 25-2008 5.3.3.1**

Mechanical waterflow devices including, but not limited to, water motor gongs, shall be tested quarterly.

**NFPA 25-2008 13.4.4.2.1 Dry Pipe Valves Testing**

The priming water level shall be tested quarterly.

**6 MONTH TEST****NFPA 25-2008 5.3.3.2**

Vane-type and pressure switch-type waterflow devices shall be tested semiannually.

**YEARLY TESTS****NFPA 25-2008 5.2.1.1**

Sprinklers shall be inspected from the floor level annually.

**NFPA 25-2008 5.2.1.1.1**

Sprinklers shall not show signs of leakage; shall be free of corrosion, foreign materials, paint, and physical damage and shall be installed in the proper orientation (e.g., upright, pendant, or sidewall).

**NFPA 25-2008 5.2.1.1.2**

Any sprinkler shall be replaced that has signs of leakage; is painted, other than by the sprinkler manufacturer, corroded, damaged, or loaded; or in the improper orientation.

**NFPA 25-2008 5.2.1.1.4**

Sprinklers installed in concealed spaces such as above suspended ceilings shall not require inspection.

**NFPA 25-2008 5.2.1.1.5**

Sprinklers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**NFPA 25-2008 5.2.1.3**

The supply of spare sprinklers shall be inspected annually for the following:

- (1) The proper number and type of sprinklers
- (2) A sprinkler wrench for each type of sprinkler

**NFPA 25-2008 5.2.2 Pipe and Fittings**

Sprinkler pipe and fittings shall be inspected annually from the floor level.

**NFPA 25-2008 5.2.2.1**

Pipe and fittings shall be in good condition and free of mechanical damage, leakage, and corrosion.

**NFPA 25-2008 5.2.2.2**

Sprinkler piping shall not be subjected to external loads by materials either resting on the pipe or hung from the pipe.

**NFPA 25-2008 5.2.2.3**

Pipe and fittings installed in concealed spaces such as above suspended ceilings shall not require inspection.

**NFPA 25-2008 5.2.2.4**

Pipe installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**NFPA 25-2008 5.2.3 Hangers and Seismic Braces**

Sprinkler pipe hangers and seismic braces shall be inspected annually from the floor level.

**NFPA 25-2008 5.2.3.1**

Hangers and seismic braces shall not be damaged or loose.

**NFPA 25-2008 5.2.3.2**

Hangers and seismic braces that are damaged or loose shall be replaced or refastened.

**NFPA 25-2008 5.2.3.3**

Hangers and seismic braces installed in concealed spaces such as above suspended ceilings shall not require inspection.

**NFPA 25-2008 5.2.3.4**

Hangers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**NFPA 25-2008 5.2.5 Buildings**

Annually, prior to the onset of freezing weather, buildings with wet pipe systems shall be inspected to verify that windows, skylights, doors, ventilators, other openings and closures, blind spaces, unused attics, stair towers, roof houses, and low spaces under buildings do not expose water-filled sprinkler piping to freezing and to verify that adequate heat [minimum 4.4 Degrees Celsius (40 Degrees Fahrenheit)] is available.

**NFPA 25-2008 13.4.4.1.5**

The interior of the dry pipe valve shall be inspected annually when the trip test is conducted.

**NFPA 25-2008 13.4.4.2.2**

Each dry pipe valve shall be trip tested annually during warm weather.

**NFPA 25-2008 13.2.5 Main Drain Test**

A main drain test shall be conducted annually at each water-based fire protection system riser to determine whether there has been a change in the condition of the water supply piping and control valves.

**NFPA 25-2008 13.3.3.4**

A main drain test shall be conducted any time the control valve is closed and reopened at system riser.

**3 YEAR TESTS****NFPA 25-2008 13.4.4.2.2.2**

Every 3 years and whenever the system is altered, the dry pipe valve shall be trip tested with the control valve fully open and the quick-opening device, if provided, in service.

**NFPA 25-2008 13.4.4.2.2.3**

During those years when full flow testing in accordance with 13.4.4.2.2.2 is not required , each dry pipe valve shall be trip tested with the control valve partially open.

## **5 YEAR TESTS**

### **NFPA 25-2008 5.3.1.1.2**

Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, sprinklers shall either be replaced or representative sprinkler samples shall be tested.

### **NFPA 25-2008 13.4.4.1.6**

Strainers, filters, and restricted orifices shall be inspected internally every 5 years unless tests indicate a greater frequency is necessary.

### **NFPA 25-2008 5.3.2 Gauges**

Gauges shall be replaced every 5 years or tested every 5 years by comparison with calibrated gauge. Gauges not accurate to within 3 percent of the full scale shall be recalibrated or replaced.

## **10 YEAR TEST**

### **NFPA 25-2008 5.3.1.1.1.5**

Dry sprinklers that have been in service for 10 years shall be tested or replaced. If maintained and serviced, they shall be retested at 10-year intervals.

## **50 YEAR TEST**

### **NFPA 25-2008 5.3.1.1.1**

Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10-year intervals.

#### **NFPA 25-2008 5.3.1.1.1.1**

Sprinklers manufactured prior to 1920 shall be replaced.

#### **NFPA 25-2008 5.3.1.1.1.2**

Sprinklers manufactured using fast response elements that have been in service for 20 years shall be replaced, or representative samples shall be tested. They shall be retested at 10-year intervals.

#### **NFPA 25-2008 5.3.1.1.1.3**

Representative samples of solder-type sprinklers with a temperature classification of extra high 163 Degrees Celsius (325 Degrees Fahrenheit) or greater that are exposed to semicontinuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.

**NFPA 25-2008 5.3.1.1.4**

Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing. Test procedures shall be repeated at 5-year intervals.

**CLOSURES**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

**2.2.2.4. Inspection and Maintenance**

- 1) Defects that interfere with the operation of *closures* in *fire separations* shall be corrected, and such closures shall be maintained to ensure that they are operable at all times by
  - a) keeping fusible links and other heat-actuated devices undamaged and free of paint and dirt,
  - b) keeping guides, bearings and stay rolls clean and lubricated,
  - c) making necessary adjustments and repairs to door hardware and accessories to ensure proper closing and latching, and
  - d) repairing or replacing inoperative parts of hold-open devices and automatic releasing devices.

**DAILY INSPECTION****2.2.2.4. Inspection and Maintenance**

- 2) Doors in *fire separations* shall be inspected at intervals not greater than 24 h to ensure that they remain closed unless the door is equipped with a hold-open device conforming to the British Columbia Building Code.

**MONTHLY INSPECTION & MAINTENANCE****2.2.2.4. Inspection and Maintenance**

- 3) Doors in *fire separations* shall be operated at intervals not greater than one month to ensure that they are properly maintained in accordance with Sentence (1), as specified in the fire safety plan prepared in conformance with Section 2.8.
- 4) Closures in *fire separations* shall not be obstructed, blocked, wedged open, or altered in any way that would prevent the intended operation of the *closure*.



**2.2.2.5. Fire Door Signs**

- 1) Every door used as a *closure* with a required *fire protection rating* shall have a permanent sign clearly displaying the words, "FIRE DOOR KEEP CLOSED" posted on the visible side of the door when it is in the open position, except where the door is
  - a) located between a corridor and an adjacent sleeping room in hospitals or nursing homes,
  - b) located between a corridor and an adjacent classroom,
  - c) located between a *public corridor* and a *suite* of Group C or D *occupancy*, or
  - d) fitted with an acceptable hold-open device designed to be released by a signal from a *fire detector*, fire alarm system or sprinkler system. (See Appendix A).

Referenced from 2012 B.C. Fire Code.

**EMERGENCY GENERATOR**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

**GENERAL****6.5.1.1. Inspection, Testing and Maintenance**

- 1) Except as provided in Articles 6.5.1.2. to 6.5.1.5. emergency power systems shall be inspected, tested and maintained in conformance with CAN/CSA- C282, "Emergency Electrical Power Supply for Buildings."

**CAN/CSA-C282-2005 11.5.1 General Maintenance**

The emergency electrical power system shall be maintained as specified in the manufacturer's manual of operating instructions, provided that the manual covers at least the items listed in Tables 2 to 6. The owner's representative shall ensure that qualified personnel with appropriate training, experience, and supervision perform the maintenance work.

### CAN/CSA-C282-2005 11.5.3 Records

A permanent log of the maintenance work (including inspections and tests) shall be maintained in accordance with the manufacturer's manual of operating and maintenance instructions (see Clause 11.5.1). The permanent log shall be kept on site and shall include at least the following:

- (a) the date on which the work was done;
- (b) a note of parts replaced;
- (c) a note of any unsatisfactory condition discovered and the steps taken to correct it;
- (d) the name of the person who performed the work; and
- (e) a note verifying that any switches or controls that were deactivated for safety purposes during maintenance have been restored to their intended operating condition.

### WEEKLY INSPECTIONS, TESTS & MAINTENANCE

**Table 2 - Weekly Inspection, Test, and Maintenance Requirements**

<p>1. Consumables:</p> <ul style="list-style-type: none"> <li>(a) Inspect day tank fuel level (gas pressure) and main tank level (gas pressure) (if applicable). Minimum 2 h supply required (see Clause 7.3.1).</li> <li>(b) Inspect lubricating oil level.</li> <li>(c) Inspect engine coolant level.</li> <li>(d) Inspect engine, generator, fuel tank(s), and cooling systems for leakage.</li> <li>(e) Inspect for proper operation of fuel transfer pump (if applicable).</li> <li>(f) Inspect fuel filter for contamination if filter is equipped with a transparent bowl.</li> </ul>
<p>2. Starter system:</p> <ul style="list-style-type: none"> <li>(a) Inspect electric starter for cleanliness, mounting, and terminal security.</li> <li>(b) Air starter: <ul style="list-style-type: none"> <li>(i) Inspect air tanks for pressure.</li> <li>(ii) Inspect valves for leakage.</li> <li>(iii) Test auxiliary engine and compressor for proper operation.</li> <li>(iv) Bleed off any condensation.</li> </ul> </li> </ul>
<p>3. Batteries and charging equipment:</p> <ul style="list-style-type: none"> <li>(a) Inspect all battery cells for correct electrolyte fill level.</li> <li>(b) Test all battery cells for correct electrolyte specific gravity.</li> <li>(c) Inspect electrical connections for tightness and evidence of corrosion.</li> <li>(d) Inspect battery for cleanliness and dryness between terminals.</li> <li>(e) Inspect charger electrical connections for cleanliness and tightness.</li> <li>(f) Test charger for proper operation of float and equalize modes.</li> </ul>

4. Engine: (a) Test lubricant and/or coolant heaters for proper operation. (b) Inspect governor control linkages and oil level (if applicable). (c) Inspect fuel pump oil sump (if applicable). (d) Inspect fan belts for correct tension and wear.
5. Control panel: (a) Inspect control panel covers for security. (b) Test annunciator lamps to confirm that they are operational. (c) Inspect control panel settings (ensure that the unit is ready for automatic start-up). (d) Test remote visual and audible trouble signals at the building fire alarm panel.
6. Inspect air control louvre settings to ensure proper operation.
7. Test emergency lighting unit(s).
8. Verify whether room temperature is above 10C.
9. Inspect generator and transfer switch room(s) for cleanliness and accessibility to all components of the emergency system.
10. Correct all defects found during inspections and tests.
11. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

**Note:** *The person performing the work described in this Table shall have received appropriate training and be qualified to perform the specified tasks.*

## **MONTHLY INSPECTIONS, TESTS & MAINTENANCE**

### **CAN/CSA-C282-2005 11.4 Periodic Operational Tests**

The emergency electrical power supply system shall be completely tested as specified in Table 3 at least once a month in all facilities.

**Table 3 - Monthly Inspection, Test, and Maintenance Requirements**

1. All items specified in Table 2.
2. Test and verify the entire system as follows: (a) Simulate a failure of the normal electrical supply to the building. (b) Operate the system under at least 30% of the rated load for 60 min. (c) Operate all automatic transfer switches under load. (d) Inspect brush operation for sparking. (e) Inspect for bearing seal leakage. (f) Inspect for correct operation of all auxiliary equipment, e.g., radiator shutter control, coolant pumps, fuel transfer pumps, oil coolers, and engine room ventilation system(s). (g) Record the readings for all instruments in the log (see Clause 11.5.3) and verify that they are normal. (h) Drain the exhaust system condensate trap.
3. Inspect block heater hoses and wires.
4. Correct all defects found during inspections and tests.
5. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

**Note:** The person performing the work described in this Table shall have received appropriate training and be qualified to perform the specified tasks.

## 6 MONTH INSPECTIONS, TESTS & MAINTENANCE

**Table 4 - Semi-Annual Inspection, Test, and Maintenance Requirements**

1. All items specified in Tables 2 and 3.
2. Inspect and clean engine crankcase breathers.
3. Inspect and clean all engine linkages.
4. Lubricate the engine governor and ventilation system.
5. Test protective devices for proper operation.
6. Before start-up, perform two full cranking cycles (as specified in Clauses 10.4.1 and 10.4.2). Near the end of each cycle (and while still cranking), measure and record the lowest indicated battery voltage. If the measured voltage is less than 80% of the battery's rated voltage, replace the battery. Alternatively, perform a battery load test using a suitable load tester.
7. Inspect ventilation system belt(s).
8. Correct all defects found during inspections and tests.

9. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).

**Note:** Items 2 to 9 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.

## YEARLY INSPECTIONS, TESTS & MAINTENANCE

### CAN/CSA-C282-2005 11.3 Annual Test

The emergency generator set shall be subjected annually to a 2 h full-load test (see Table 5).

**Table 5 - Annual Inspection, Test, and Maintenance Requirements**

1. All items specified in Tables 2 to 4.
2. Control panel: <ul style="list-style-type: none"> <li>(a) Open all inspection covers and inspect all electrical connections.</li> <li>(b) Test breakers for proper operation.</li> <li>(c) Clean insulators and bushings.</li> <li>(d) Test voltage regulator for proper operation.</li> <li>(e) Operate all moving parts to ensure that they move freely.</li> <li>(f) Clean and dress contacts as necessary.</li> <li>(g) Remove all dust.</li> <li>(h) Check gauge calibration.</li> <li>(i) With the generator set operating at full load (see Clause 11.3), conduct an infrared survey of all electrical connections to identify any high-resistance connections.</li> </ul>
3. Engine: <ul style="list-style-type: none"> <li>(a) Change engine lubrication oil and filters.</li> <li>(b) Test strength of coolant and chemical protection level of coolant inhibitors.</li> <li>(c) Change fuel filters, clean strainer(s), and verify that the fuel supply valve is open.</li> <li>(d) Inspect the exhaust system. Check and record the back pressure of the exhaust system to ensure that it complies with the engine manufacturer's requirements, and compare with previous readings.</li> <li>(e) Clean and lubricate linkages.</li> <li>(f) Inspect air filters.</li> <li>(g) Inspect all mechanical connections.</li> <li>(h) Inspect all electrical connections.</li> <li>(i) For spark ignition engines, inspect all components of ignition system(s) and service or replace as appropriate.</li> <li>(j) Inspect all external surfaces of heat exchanger(s) and clean as necessary.</li> <li>(k) Inspect all belts and hoses and replace if necessary.</li> <li>(l) Test and inspect ignition system(s). Replace any defective components.</li> <li>(m) Inspect coolant pump(s) for leaks and external wear (if belt driven, remove the belt(s) first).</li> </ul>

<p>4. Diesel fuel storage tank(s):</p> <p>The fuel oil in any storage tank (and day tank, if used) shall be tested in accordance with Clause 11.5.5, and if the fuel oil fails the test, it shall be.</p> <ul style="list-style-type: none"> <li>(a) drained and refilled with fresh fuel in accordance with Article 6.7.1.5 of the national Fire Code of Canada; or</li> <li>(b) full filtered to remove water, scale, bacteria, and oxidized gums/resins in order to minimize filter clogging and ensure diesel start-up (see Clause B.20 for commentary).</li> </ul> <p>When the fuel is filtered, it shall be treated with a suitable conditioner and stabilizer to minimize degradation while in storage.</p> <p>Note: The bottoms(s) of the tank(s) shall be also tested chemically for water.</p>
<p>5. Generator:</p> <ul style="list-style-type: none"> <li>(a) Test surge suppressor and rotating rectifier on brushless machines.</li> <li>(b) Grease bearings (replace old grease with new) (if applicable).</li> <li>(c) Clean commutator and slip rings (if applicable).</li> <li>(d) Clean rotor and stator windings using clean compressed air.</li> <li>(e) Inspect coupling bolts and alignment.</li> <li>(f) Inspect conduits for tightness.</li> <li>(g) Inspect windings at rotor and stator slots.</li> <li>(h) Inspect all electrical connections.</li> <li>(i) With the generator set operating at full load (see Clause 11.3), conduct an infrared survey of all electrical connections to identify any high-resistance connections.</li> </ul>
<p>6. Transfer switches:</p> <ul style="list-style-type: none"> <li>(a) Isolate transfer switch, open all inspection covers, and inspect all electrical connections.</li> <li>(b) Operate all moving parts to ensure that they move freely.</li> <li>(c) Clean and dress contacts as required.</li> <li>(d) Remove all dust.</li> <li>(e) Clean and lubricate linkages.</li> <li>(f) Conduct an infrared survey of all electrical connections, contacts, and energized components while under load on both the normal and the emergency side.</li> </ul>
<p>7. Lubricate door locks and hinges (if necessary), especially those of outdoor enclosures.</p>
<p>8. Conduct a 2 h full-load test (see Clause 11.3).</p>
<p>9. As needed, review and provide instruction on the technical requirements specified in Tables 2 to 4 with the person(s) responsible for carrying out the work.</p>
<p>10. Correct all defects found during inspections and tests.</p>
<p>11. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).</p>

**Note:** Items 2 to 11 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.

**5 YEAR INSPECTIONS, TESTS & MAINTENANCE****Table 6 - Quinquennial (Every Five Years) Inspection, Test, and Maintenance Requirements**

<p>1. Generator: Inspect insulation of generator windings. Use an insulation tester (megger). The resistance in megohms should be not less than</p> $\frac{\text{Rated voltage} + 1000}{1000}$ <p>If the resistance is less, dry out the insulation using the auxiliary heat process.</p>
<p>2. Engine:</p> <ul style="list-style-type: none"><li>(a) Drain and flush the cooling system. Refill the system with new coolant.</li><li>(b) Clean radiator tubes and cooling fins.</li><li>(c) Replace thermostats.</li><li>(d) Inspect valve clearances and adjust as appropriate.</li></ul>
<p>3. Correct all defects found during inspections and tests.</p>
<p>4. Record all inspections, tests, and corrective actions in the log (see Clause 11.5.3).</p>

**Note:** *Items 1 to 4 require special skill and shall be carried out by a qualified contractor, the system manufacturer, or individuals trained and certified by the system manufacturer.*

**6.5.1.5. Supply of Fresh Fuel**

- 1) Liquid fuel *storage tanks* shall be drained and refilled with fresh fuel at intervals not greater than 12 months.

**Referenced from 2012 B.C. Fire Code.**

## **EMERGENCY LIGHTING**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **MONTHLY INSPECTIONS**

#### **6.5.1.6. Inspection of Unit Equipment**

- 1) Self-contained emergency lighting unit equipment shall be inspected at intervals not greater than one month to ensure that
  - a) pilot lights are functioning and not obviously damaged or obstructed,
  - b) the terminal connections are clean, free of corrosion and lubricated when necessary,
  - c) the terminal clamps are clean and tight as per manufacturer's specifications, and
  - d) the battery surface is kept clean and dry.
- 2) Self-contained emergency lighting unit equipment shall be tested
  - a) at intervals not greater than one month to ensure that the emergency lights will function upon failure of the primary power supply

### **YEARLY TESTS**

#### **6.5.1.6. Inspection of Unit Equipment**

- 2) Self-contained emergency lighting unit equipment shall be tested
  - b) at intervals not greater than 12 months to ensure that the unit will provide emergency lighting for a duration equal to the design criterion under simulated power failure conditions
- 3) After completion of the test required in Clause (2)(b), the charging conditions for voltage and current and the recovery period shall be tested to ensure that the charging system is functioning in accordance with the manufacturer's specifications.

**Referenced from 2012 B.C. Fire Code.**



## **FIRE ALARM SYSTEM**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **6.1.1.4. Protection during Shutdown (Fire Alarm System)**

- 1) When any portion of a fire protection system is temporarily shut down, (including maintenance or periodic inspection) alternative measures shall be taken to ensure that protection is maintained (that is, all persons in the building can be informed promptly, and the fire department notified, if a fire should occur while the alarm system is out of service).

### **A-6.1.1.4. Protection during Shutdown (Fire Alarm System)**

- 1) Interruption of normal operation of a fire protection system for any purpose constitutes a "temporary shutdown." Types of interruptions include, but are not limited to, periodic inspection or testing, maintenance and repairs. During a shutdown, alternative measures are necessary to ensure that the level of safety intended by the Code is maintained.

**In the shutdown of a fire alarm system, alternative measures should be worked out in cooperation with the (local) fire department to ensure that all persons in the building can be informed promptly, and the fire department notified, if a fire should occur while the alarm system is out of service.**

### **6.3.1.2. Testing and Inspection**

- 1) Fire alarm systems shall be inspected and tested in conformance with CAN/ULC-S536, "Inspection and Testing of Fire Alarm Systems."
- 2) Fire alarm and detection systems components shall be accessible for purposes of inspection or maintenance.

The CAN/ULC-S536 standard requires that the initial inspection and periodic testing procedures shall be conducted by "qualified personnel acceptable to the authority having jurisdiction."

## **DAILY INSPECTIONS**

### **CAN/ULC-S536-2004 4.1.1**

The following daily inspections shall be conducted to confirm the operability of the fire alarm system:

- A. Status of the principal and remote trouble indicators; and
- B. Status of the "power-on" or equivalent indicator.

## MONTHLY INSPECTIONS & TESTS

NOTE: The inspection and test requirements in this Subsection may be omitted during the month when the yearly tests required by Section 5, Periodic Inspections and Tests - Yearly, are being performed.

### CAN/ULC-S536-2004 4.2.1

While on the emergency power supply, inspect and test the following to confirm the operability of the fire alarm system:

NOTE: It is recommended that tests be coordinated with emergency power generator tests.

- A. One initiating field or manual pull station device shall be operated on a rotational basis and the system checked for operation as follows:
  - (i) An alert or an alarm signal confirmed on a rotational basis to a minimum of one zone or as may be required by the Fire Safety Plan for the building;
  - (ii) The primary annunciator inspected to determine that the tested device annunciated correctly;
- B. Operation of the common audible and visual trouble signals;
- C. Batteries shall be inspected for the following:
  - (i) Terminals are clean and lubricated;
  - (ii) Terminal clamps are secure;
  - (iii) Electrolyte level and specific gravity, where applicable, are as specified by the manufacturer.

## YEARLY TESTS

### CAN/ULC-S536-2004 5.2.2

Each control unit and transponder shall be tested to confirm operability, including the following functions, as applicable.

- A. Power 'on' indicator;
- B. Common visual trouble signal;
- C. Common audible trouble signal;
- D. Trouble signal silence switch;
- E. Main power supply failure trouble signal;
- F. Ground fault tested on positive and negative initiates a trouble signal;
- G. Alert signal operation;
- H. Alarm signal operation;
- I. Automatic transfer from alert signal to alarm signal;
- J. Manual transfer from alert signal to alarm signal;
- K. Automatic transfer from alert signal to alarm signal cancel (acknowledge) feature operates on a two-stage system;
- L. Alarm signal silence inhibit function;
- M. Alarm signal manual silence operation;
- N. Alarm signal silence visual indication;
- O. Alarm signal, when silenced, automatically reinitiates upon subsequent alarm;
- P. Alarm signal silence automatic cut-out timer.
- Q. Audible and visual alert signals and alarm signals programmed and operate per design and specification;
- R. Input circuit, alarm and supervisory operation, including audible and visual indication;
- S. Input circuit supervision fault causes a trouble indication;
- T. Output circuit alarm indicators operate;
- U. Output circuit supervision fault causes a trouble indication;
- V. Visual indicator test (lamp test);
- W. Coded signal sequences operate not less than the required number of times and the correct alarm signal operates thereafter;
- X. Coded signal sequences are not interrupted by subsequent alarm;
- Y. Ancillary circuit by-pass will result in a trouble signal;
- Z. Input circuit to output circuit operation, including ancillary device circuits for correct program operation, as per design and specification;
- AA. Reset operation;
- BB. Main power supply to emergency power supply transfer;
- CC. Status change confirmation (smoke detectors only) verified.;
- DD. Receipt of the alarm transmission to the fire signal receiving centre;
- EE. Receipt of the supervisory transmission to the fire signal receiving centre;
- FF. Receipt of the trouble transmission to the fire signal receiving centre;
- GG. Record the name and telephone number of the fire signal receiving centre; and

- HH. Operation of the fire signal receiving centre disconnect means results in a specific trouble indication at the control unit or transponder and transmits a trouble signal to the fire signal receiving centre.

## **FIRE DEPARTMENT ACCESS TO BUILDINGS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **2.5.1.5. Maintenance of Fire Department Access**

- 1) Streets, yards and roadways provided for fire department access shall be maintained so as to be ready for use at all times by fire department vehicles.
- 2) Vehicles shall not be parked to obstruct access by Fire Department vehicles and signs shall be posted prohibiting such parking.

Referenced from 2012 B.C. Fire Code.

## **FIRE DAMPERS AND FIRE STOP FLAPS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

## **YEARLY INSPECTIONS & MAINTENANCE**

### **2.2.2.4. Inspection & Maintenance**

- 5) Fire dampers and fire stop flaps shall be inspected at intervals not greater than 12 months to ensure that they are in place and are not obviously damaged or obstructed.

Referenced from 2012 B.C. Fire Code.

## **FIRE DEPARTMENT CONNECTIONS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **DAILY INSPECTIONS**

#### **2.5.1.4. Access to Fire Department Connections**

- 1) Access to fire department connections for sprinkler or standpipe systems by firefighters and their equipment shall be maintained free of obstructions at all times.

### **QUARTERLY INSPECTIONS**

#### **NFPA 25-2008 13.7.1**

Fire Department connections shall be inspected quarterly. The inspection shall verify the following:

- (1) The fire department connections are visible and accessible.
- (2) Couplings or swivels are not damaged and rotate smoothly.
- (3) Plugs or caps are in place and undamaged.
- (4) Gaskets are in place and in good condition.
- (5) Identification signs are in place.
- (6) The check valve is not leaking.
- (7) The automatic drain valve is in place and operating properly.
- (8) The fire department connection clapper(s) is in place and operating properly

#### **NFPA 25-2008 13.7.2**

If fire department connection plugs or caps are not in place, the interior of the connection shall be inspected for obstructions, and it shall be verified that the valve clapper is operational over its full range.

#### **NFPA 25-2008 13.7.3**

Components shall be repaired or replaced as necessary in accordance with the manufacturer's instructions.

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## HEATING, VENTILATING & AIR CONDITIONING

### 2.6.1.6. Operation and Maintenance Procedures

- 1) Heating, ventilating and air conditioning systems, including *appliances, chimneys* and *flue pipes*, shall be operated and maintained so as not to create a hazardous condition.

### YEARLY TESTS

### 2.6.1.6. Operation and Maintenance Procedures

- 2) Except for self-contained systems within *dwelling units*, disconnect switches for mechanical air conditioning and ventilation systems shall be operated at intervals not greater than 12 months to establish that the system can be shut down in an emergency.

Referenced from 2012 B.C. Fire Code.

## MEANS OF EGRESS

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### DAILY MAINTENANCE

- 1) *Means of egress* shall be maintained in good repair and free of obstructions.

### 2.7.3.1. Exit Lighting, Exit Signs and Emergency Lighting Installation & Maintenance

- 2) *Exit* lighting and *exit* signs shall be illuminated during times when the *building* is occupied.

### MONTHLY TESTS

### 2.7.2.1. Exit Doors

- 1) Except as provided in Sentences (2), (3) and (4), all doors forming part of a *means of egress* shall be tested at intervals not greater than one month to ensure that they are operable.

Referenced from 2012 B.C. Fire Code.

## **PORTABLE FIRE EXTINGUISHERS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

### **6.2.1.1. Inspection, Testing and Maintenance**

- 1) Portable extinguishers shall be inspected, tested and maintained in conformance with NFPA 10, "Portable Fire Extinguishers."

**Referenced from 2012 B.C. Fire Code.**

### **NFPA 10-2007 7.1.2.2 Personnel**

Maintenance, servicing, and recharging shall be performed by trained persons having available the appropriate servicing manual(s), the proper types of tools, recharge materials, lubricants, and manufacturer's recommended replacement parts or parts specifically listed for use in the extinguisher.

## **MONTHLY INSPECTIONS**

### **NFPA 10-2007 7.2.1.1 Inspection Frequency**

Fire extinguishers shall be inspected when initially placed in service.

### **NFPA 10-2007 7.2.1.2**

Fire extinguishers shall be inspected either manually or by means of an electronic monitoring device/system at minimum of 30-day intervals.

### **NFPA 10-2007 7.2.2 Procedures**

Periodic inspection or electronic monitoring of fire extinguishers shall include a check of at least the following items: items:

- (1) Location in designated place.
- (2) No obstruction to access or visibility
- (3) Pressure gauge reading or indicator in the operable range or position
- (4) Fullness determined by weighing or "hefting" for self-expelling-type extinguishers, cartridge-operated extinguishers, and pump tanks
- (5) Condition of tires, wheels, carriage, hose, and nozzle for wheeled extinguishers
- (6) Indicator for nonrechargeable extinguishers using push-to-test pressure indicators

**NFPA 10-2007 7.2.2.1**

In addition to 7.2.2, fire extinguishers shall be visually inspected in accordance with 7.2.2.2 if they are located where any of the following conditions exists:

- (1) High frequency of fires in the past
- (2) Severe hazards
- (3) Locations that make fire extinguishers susceptible to mechanical injury or physical damage
- (4) Exposure to abnormal temperatures or corrosive atmospheres

**NFPA 10-2007 7.2.2.2**

Where required by 7.2.2.1, the following inspection procedures shall be in addition to those addressed in 7.2.2:

- (1) Operating instructions on nameplates are legible and face outward
- (2) Safety seals and tamper indicators are broken or missing
- (3) Examine for obvious physical damage, corrosion, leakage, or clogged nozzle

**NFPA 10-2007 7.2.4.4**

Where manual inspections are conducted, records for manual inspections shall be kept on a tag or label attached to the fire extinguisher, on an inspection checklist maintained on file, or by an electronic method.

**NFPA 10-2007 7.2.4.3**

At least monthly where manual inspections are conducted, the date the manual inspection was performed and the initials of the person performing the inspection shall be recorded.

**NFPA 10-2007 7.2.4.5**

Records for manual inspection shall be kept to demonstrate that at least the last 12 monthly inspections have been performed.

**YEARLY TESTS & MAINTENANCE****NFPA 10-2007 7.3.1.1.1**

Fire Extinguishers shall be subjected to maintenance at intervals of not more than one year, at the time of hydrostatic test, or when specifically indicated by an inspection or electronic notification.



**NFPA 10-2007 7.3.2 Procedures**

Maintenance procedures shall include a thorough examination of the basic elements of a fire extinguisher and components of the electronic monitoring system and following the procedures detailed in the manufacturer's service manual:

- (1) Mechanical parts of all fire extinguishers
- (2) Extinguishing agent of cartridge or cylinder operated dry chemical, stored-pressure loaded stream, and pump tank fire extinguishers
- (3) Expelling means of all fire extinguishers
- (4) Physical appearance
- (5) Components of electronically monitored system

**NFPA 10-2007 7.3.2.2 Seals or Tamper Indicators**

At the time of the maintenance, the tamper seal of rechargeable fire extinguishers shall be removed by operating the pull pin or locking device.

**NFPA 10-2007 7.3.2.2.1**

After the applicable maintenance procedures are completed, a new tamper seal shall be installed.

**NFPA 10-2007 7.4.2.3.1**

The premixed agent in liquid charge-type AFFF and FFFP fire extinguishers shall be replaced at least once every 3 years.

**NFPA 10-2007 7.4.2.3.2**

Only the foam agent specified on the extinguisher nameplate shall be used for recharge.

**NFPA 10-2007 7.4.2.3.3**

The agent in nonpressurized AFFF and FFFP fire extinguishers that is subjected to agent analysis in accordance with manufacturer's instructions shall not be required to comply with 7.4.2.3.1.

**SIX YEAR TEST****NFPA 10-2007 7.3.1.2.1 Six-Year Maintenance**

Every 6 years, stored-pressure fire extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to the applicable maintenance procedures as detailed in the manufacturer's service manual.

**NFPA 10-2007 7.3.1.2.1.1**

When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the 6-year requirement shall begin from that date.

**NFPA 10-2007 7.3.1.2.1.2**

The removal of agent from halon agent fire extinguishers shall only be done using a listed halon closed recovery system.

**NFPA 10-2007 7.3.3.1 Six-Year Service Label**

Fire extinguishers that pass the applicable 6-year requirement of 7.3.1.2.1 shall have the maintenance information recorded on a suitable metallic label or equally durable material that is a minimum size of 2 in. x 3 1/2 in. (51 mm x 89 mm).

**STANDPIPE AND HOSE SYSTEMS**

**The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.**

**DAILY TESTS****NFPA 25-2008 13.3.3.4**

A main drain test shall be conducted any time the control valve is closed at each system riser

**NFPA 1962-2003 4.1.7**

Hose shall be removed from the apparatus and reloaded so that the folds occur at different positions with sufficient frequency to prevent damage and the setting of permanent folds in the rubber lining.

**NFPA 1962-2003 4.3.5.1 Damage Prevention.**

Hose stored on racks or reels shall be protected from the weather and any local environmental condition potentially harmful to the hose.

**NFPA 1962-2003 4.3.6**

In areas where rodents can pose a problem, the hose shall be visually inspected more frequently for rodent damage.

**NFPA 1962-2003 4.3.7**

After each use and before being placed back in service, the hose shall be inspected as specified in Section 4.6, service-tested as specified in Chapter 7, and cleaned and dried as specified in Section 4.7.

**NFPA 1962-2003 4.6.1**

Physical inspection shall determine that the hose, couplings, and any nozzle have not been vandalized, are free of debris, and exhibit no evidence of mildew, rot, or damage by chemicals, burns, cuts, abrasion, and vermin.

**NFPA 1962-2003 4.6.4**

If the hose fails the physical inspection, it shall be removed from service and either repaired as necessary and service-tested as specified in Chapter 7 or condemned.

**NFPA 1962-2003 6.1.1**

Nozzle valves attached to in-service hose shall be kept in the closed position.

**NFPA 1962-2003 6.1.4**

If the nozzle fails the inspection for any reason, it shall be removed from service and repaired or replaced.

**NFPA 1962-2003 6.1.5**

If, during use, there is an obstruction that cannot be removed by flushing the nozzle, the nozzle shall be taken from the hose line and the obstruction removed through the connection end as soon as is practicable, since any further attempt to force the obstruction out through the tip can damage the nozzle.

**NFPA 1962-2003 6.1.6**

Care shall be taken to avoid dents or nicks in nozzle tips, as these can seriously affect the reach of the stream.

**NFPA 1962-2003 6.1.8**

Nozzle control valves shall be opened and closed slowly to eliminate unnecessary strain on the hose and couplings and reduce pressure surges.

**NFPA 1962-2003 6.2.3**

After each use, and during each hose service test, couplings shall be visually inspected for the following defects:

- (1) Damaged threads
- (2) Corrosion
- (3) Slippage on the hose
- (4) Out-of-round
- (5) Swivel not rotating freely
- (6) Missing lugs
- (7) Loose external collar
- (8) Internal gasket in accordance with Section 6.3
- (9) Other defects that impair operation

**NFPA 1962-2003 6.2.4**

Hose with defective couplings shall be removed from service and repaired or replaced.

**NFPA 1962-2003 6.2.5**

Care shall be taken not to drop the couplings on pavement or other hard surfaces that can cause damage to the swivel section or exposed threads.

**NFPA 1962-2003 6.2.6**

Care shall be taken to prevent vehicles from driving over couplings.

**NFPA 1962-2003 6.3.1**

The thread gasket in couplings and nozzles shall be inspected for presence, tight fit, and lack of deterioration.

**NFPA 1962-2003 6.3.2**

Gaskets shall not protrude into the waterway.

**QUARTERLY INSPECTIONS****NFPA 25-2008 6.2.1**

Components of standpipe and hose systems shall be visually inspected quarterly.

**NFPA 25-2008 13.2.6 Alarm Devices**

Mechanical waterflow devices, including but not limited to water motor gongs, shall be tested quarterly.

**NFPA 25-2008 6.2.2**

Table 6.2.2 shall be used for the inspection, testing, and maintenance of all classes of standpipe and hose systems.

**NFPA 25-2008 Table 6.2.2 Standpipe and Hose Systems**

<b>Component/Checkpoint</b>	<b>Corrective Action</b>
<b><i>Hose Connections</i></b>	
Cap missing	Replace
Fire hose connection damaged	Repair
Valve handles missing	Replace
Cap gaskets missing or deteriorated	Replace
Valve leaking	Close or repair
Visible obstructions	Remove
Restricting device missing	Replace
Manual, semiautomatic, or dry standpipe - valve does not operate smoothly	Lubricate or repair
<b><i>Piping</i></b>	
Damaged piping	Repair
Control valves damaged	Repair or replace
Missing or damaged pipe support device	Repair or replace
Damaged supervisory devices	Repair or replace
<b><i>Hose</i></b>	

Inspect	The hose including gaskets, shall be removed and inspected and the hose reracked or rereeled at intervals in accordance with NFPA 1962-2003, <i>Standard for the Care, Use, and Service Testing of Fire Hose Including Couplings and Nozzles</i> .
Mildew, cuts, abrasions, and deterioration evident	Replace with listed, lined, jacketed hose
Coupling damaged	Replace or repair
Gaskets missing or deteriorated	Replace
Incompatible threads on coupling	Replace or provide thread adapter
Hose not connected to hose rack nipple or valve	Connect
Hose test outdated	Retest or replace in accordance with NFPA 1962-2003, <i>Standard for the Care, Use, and Service Testing of Fire Hose Including Couplings and Nozzles</i> .
<b>Hose Nozzle</b>	
Hose nozzle missing	Replace with listed nozzle
Gasket missing or deteriorated	Replace
Obstructions	Remove
Nozzle does not operate smoothly	Repair or replace
<b>Hose Storage Device</b>	
Difficult to operate	Repair or replace
Damaged	Repair or replace
Obstruction	Remove
Hose improperly racked or rolled	Remove
Nozzle clip in place and nozzle correctly contained?	Replace if necessary
If enclosed in cabinet, will hose rack swing out at least 90 degrees	Repair or remove any obstructions
<b>Cabinet</b>	
Check overall condition for corroded or damaged parts	Repair or replace parts; replace entire cabinet if necessary

Difficult to open	Repair
Cabinet door will not open fully	Repair or move obstructions
Door glazing cracked or broken	Replace
If cabinet is break-glass type, is lock functioning properly?	Repair or replace
Glass break device missing or not attached	Replace or attach
Not properly identified as containing fire equipment	Provide identification
Visible obstructions	Remove
All valves, hose, nozzles, fire extinguisher, etc., easily accessible	Remove any material not related

**NFPA 25-2008 6.3.3.1**

Where freezing conditions necessitate a delay in testing, tests shall be performed as soon as weather allows.

**NFPA 25-2008 13.2.5.1**

Systems where the sole water supply is through a backflow preventer and/or pressure reducing valves, the main drain test of at least one system downstream of the device shall be conducted on a quarterly basis.

**NFPA 25-2008 13.5.1.1**

All valves shall be inspected quarterly to verify that the valves are in the following condition:

- (1) In the open position
- (2) Not leaking
- (3) Maintaining downstream pressures in accordance with the design criteria
- (4) In good condition, with handwheels installed and unbroken

**YEARLY INSPECTIONS****NFPA 25-2008 6.2.1**

Components of standpipe and hose systems shall be visually inspected annually.

**NFPA 1962-2003 4.1.2**

Hose that is in service shall be service-tested as specified in Chapter 7 at least annually.

**NFPA 1962-2003 6.1.2**

All nozzles shall be inspected after each use and at least annually.

**NFPA 1962-2003 6.1.3**

The nozzle inspection shall verify the following:

- (1) The waterway is clear of obstructions.
- (2) There is no damage to tip.
- (3) All controls and adjustments operate as designed.
- (4) The shutoff valve, if so equipped, operates as designed and closes off the flow completely.
- (5) There are no missing or broken parts.
- (6) The thread gasket is in good condition in accordance with Section 6.3.

**5 YEAR TESTS****NFPA 25-2008 6.3.1.1**

A flow test shall be conducted every 5 years at the hydraulically most remote hose connection of each zone of an automatic standpipe system to verify the water supply still provides the design pressure at the required flow.

**NFPA 25-2008 6.3.1.2**

Where a flow test of the hydraulically most remote outlet(s) is not practical, the authority having jurisdiction shall be consulted for the appropriate location for the test.

**NFPA 25-2008 6.3.2.1**

Hydrostatic tests at not less than 200 psi (13.8 bar) pressure for 2 hours, or at 50 psi (3.4 bar) in excess of the maximum pressure, where maximum pressure is in excess of 150 psi (10.3 bar), shall be conducted every 5 years on manual standpipe systems and automatic dry standpipe systems, including piping in the fire department connection.

**NFPA 25-2008 6.3.2.2**

Hydrostatic tests shall be conducted in manual standpipe systems in accordance with 6.3.2.1 on any system that has been modified or repaired.



**NFPA 1962-2003 4.3.2**

In-service hose designed for occupant use only shall be removed and service-tested as specified in Chapter 7 at intervals not exceeding 5 years after manufacturer and every 3 years thereafter.

**STROBE LIGHTS**

The Fire Safety Director is responsible to have all required testing of the safety equipment performed on time by qualified service personnel and keep appropriate records for viewing by the Fire Inspector. See 2.2.1.2., (Division C) of the 2012 B.C. Fire Code on page 4.1 of this Fire Safety Plan.

**YEARLY TESTS****CAN/ULC-S536-2004 (5.7.9.1.) Testing of Signal Devices**

Each visible signal device shall be inspected for operability, including the following:

- D. The visible signal device shall function as intended and shall be clearly visible from all points within the visual alarm area; and
- E. Devices using a combination of signalling principles shall be tested to the requirements appropriate to each principle of operation

**Standards referenced by the 2012 B.C. Fire Code**

Portable Fire Extinguishers: NFPA 10 "Standard for Portable Extinguishers"

Fire Alarm and Voice Communication Systems: CAN/ULC-S536 "Standard for Inspection and Testing of Fire Alarm Systems"

Standpipe and Hose Systems: NFPA 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems"

Emergency Power Systems: CAN/CSA-C282 "Emergency Electrical Power Supply for Buildings"

## 5. LEGAL BASIS FOR FIRE SAFETY PLANNING

### WHY PLAN?

In British Columbia the Fire Services Act stipulates the requirements for fire prevention within the province. The B.C. Fire Code Regulations 2012 are pursuant to the Fire Services Act and require that emergency planning and fire safety planning be done as follows:

### ***B.C. Fire Code - Section 2.8 Emergency Planning***

#### **2.8.1. General**

##### **2.8.1.1. Application**

- 1) Fire emergency procedures conforming to this Section shall be provided for:
  - a) every *building* containing an *assembly, care, treatment or detention occupancy*,
  - b) every *building* required by the B.C. Building Code to have a fire alarm system,
  - c) demolition and construction sites regulated under Sections 5.6.,
  - d) storage areas required to have a fire safety plan in conformance with Articles 3.2.2.5 and 3.3.2.9.
  - e) areas where *flammable liquids* or *combustible liquids* are stored or handled, in conformance with Article 4.1.5.5., and
  - f) areas where hazardous processes or operations occur, in conformance with Article 5.1.5.1.

##### **2.8.1.2. Training of Supervisory Staff**

- 1) *Supervisory staff* shall be trained in the fire emergency procedures described in the fire safety plan before they are given any responsibility for fire safety.

##### **2.8.1.3. Keys and Special Devices**

- 1) Any keys or special devices needed to operate the alarm system or provide access to any fire protection systems or equipment shall be readily available to on-duty *supervisory staff*.

## 2.8.2. Fire Safety Plan

### 2.8.2.1. Measures in a Fire Safety Plan

- 1) In *buildings* or areas described in Article 2.8.1.1., a fire safety plan conforming to this Section shall be prepared in cooperation with the fire department and other applicable regulatory authorities and shall include:
  - a) the emergency procedures to be used in case of fire, including:
    - i) sounding the fire alarm (See Appendix A),
    - ii) notifying the fire department,
    - iii) instructing occupants on procedures to be followed when the fire alarm sounds,
    - iv) evacuating occupants, including special provisions for persons requiring assistance (See Appendix A),
    - v) confining, controlling and extinguishing the fire,
  - b) the appointment and organization of designated *supervisory staff* to carry out fire safety duties,
  - c) the training of *supervisory staff* and other occupants in their responsibilities for fire safety,
  - d) documents, including diagrams showing the type, location and operation of the *building* fire emergency systems,
  - e) the holding of fire drills,
  - f) the control of fire hazards in the *building*,
  - g) the inspection and maintenance of *building* facilities provided for the safety of occupants, and
- 2) The fire safety plan shall be reviewed at intervals not greater than 12 months to ensure that it takes account of changes in the use and other characteristics of the *building*.

### **2.8.2.3. Assembly Occupancies**

- 1) In Group A, Division 1 *assembly occupancies* containing more than 60 occupants, there shall be at least 1 supervisory staff member on duty in the *building* to perform the tasks outlined in the fire safety plan in Clause 2.8.2.1.(1)(a) whenever the *building* is open to the public.

### **2.8.2.5. Retention of Fire Safety Plans**

- 1) The fire safety plan shall be kept in the building for reference by the fire department, *supervisory staff* and other personnel.

### **2.8.2.6. Distribution**

- 1) A copy of the fire emergency procedures and other duties for *supervisory staff*, as laid down in the fire safety plan, shall be given to all *supervisory staff*.

### **2.8.2.7. Posting of Fire Emergency Procedures**

- 1) At least one copy of the fire emergency procedures shall be prominently posted on each *floor area*.
- 2) In every hotel and motel bedroom the fire safety rules for occupants shall be posted showing the locations of *exits* and the paths of travel to *exits*.
- 4) All *buildings* served by one or more elevators shall have, at each elevator entrance on each floor level, a permanently mounted fire safety sign or symbol indicating that the elevator is not to be used in case of fire.
- 5) The sign or symbol required by Sentence (4) shall be at least 100 mm in height and width and shall be designed in accordance with NFPA 170 "Standard for Fire Safety Symbols."

## 6. HAZARDOUS MATERIALS

### 3.2.2.5. Fire Safety Plan

- 1) A fire safety plan conforming to Section 2.8 and Sentences (2), (3) and (5) shall be prepared.  
(See Section 5 of this Fire Safety Plan for Section 2.8 of the 2012 B.C. Fire Code or 2000 Vancouver Fire By-Law, Emergency Planning).
- 2) The fire safety plan shall identify
  - a) the product classifications, as described in Sentence 3.2.1.1.(1), for each part of the *building* where products of different classification are stored,
  - b) the method of storage, including aisle widths for *rack* storage,
  - c) the maximum permitted height of storage for the *building* or part of the *building*, if different,
  - d) the maximum permitted size of *individual storage areas*, and
  - e) in *sprinklered buildings*, the sprinkler system design criteria, inside and outside hose allowances, and results of the benchmark sprinkler system main drain and water flow tests.
- 3) The storage method and maximum height of storage as described in Clauses (2)(b) and (c) shall be posted in the storage area
- 4) Signs required in Sentence (3) shall have
  - a) a minimum dimension of 200 mm, and
  - b) letters not less than 25 mm high.
- 5) When the products stored include Group A plastics, rubber products, Level 2 or 3 aerosols, or *dangerous goods*, the fire safety plan shall identify the location and maximum quantity of product that is being stored.

**5.1.1.1. Application**

- 1) This Part applies to processes and operations that involve a risk from explosion, high flammability or related conditions which create a hazard to life safety.

**5.1.5.1. Fire Safety Plan**

- 1) Except as provided in Sentences (2) and (3), a fire safety plan conforming to Section 2.8. shall be prepared for areas where processes and operations described in Article 5.1.1.1. take place.
- 2) In addition to the information required in Section 2.8., the fire safety plan shall include
  - a) the location and identification of storage and use areas for specific products, in conformance with Article 3.2.2.5., and
  - b) the names, addresses and telephone numbers of persons to be contacted in case of fire during non-operating hours.
- 3) In addition to the information required in Sentence (2), where Class 7 radioactive materials are used or handled, the fire safety plan shall include the information specified in Subsection 3.1.2.

Location #1: south side of Brimacombe Building within the service courtyard  
Chemical Name: Compressed Nitrogen  
Quantity: 5680 litres  
Container Type: metal tank  
PIN#: UN1977

See Guide 121 for Hazardous Materials Information.

Location #2: south side of Brimacombe Building within the service courtyard under the emergency generator  
Chemical Name: Diesel Fuel  
Quantity: 1530 litres  
Container Type: Metal tank  
PIN#: UN1202

See Guide 128 for Hazardous Materials Information.

Location #3: Loading Dock Compressed Gas Cylinder Storage  
Chemical Name: Nitrogen, Helium, Argon, Compressed Air, Oxygen, Carbon Dioxide  
Quantity: Less than 20 cylinders  
Container Type: Metal cylinders  
PIN#: UN1066, UN1046, UN1006, UN1002, UN1072, UN1013

Location #4: within Room 127D Flammable Gas storage, Receiving  
Chemical Name: Propane, Hydrogen  
Quantity: Less than 10 cylinders  
Container Type: Metal cylinders  
PIN#: UN1075, UN1054

Location #5: within Room 127E Acid storage, Receiving  
Chemical Name: Nitric Acid, Phosphoric Acid, Hydrofluoric Acid, Hydrochloric Acid, Acetic Acid, Sulphuric Acid  
Quantity: Less than 150 litres  
Container Type: Glass bottles  
PIN#: UN2031, UN1805, UN1790, UN1789, UN1830

Location #6: within Room 127F Flammable Liquid Storage, Receiving  
Chemical Name: Acetone, Mineral Spirits, Vacuum pump oil  
Quantity: Less than 150 litres  
Container Type: Plastic and metal bottles  
PIN#: UN1090, N1268, unregulated

**GUIDE  
121****Gases - Inert****POTENTIAL HAZARDS****FIRE OR EXPLOSION**

- Containers may explode when heated.
- Ruptured cylinders may rocket.

**HEALTH**

- Vapours may cause dizziness or asphyxiation without warning.
- Vapours from liquefied gas are initially heavier than air and spread along ground.

**PUBLIC SAFETY**

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 metres (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

**PROTECTIVE CLOTHING**

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

**EVACUATION****Large Spill**

- Consider initial downwind evacuation for at least 500 metres (1/3 mile).

**Fire**



**Fire**

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 metres (1/2 mile) in all directions; also, consider initial evacuation for 800 metres (1/2 mile) in all directions.

**EMERGENCY RESPONSE****FIRE**

- Use extinguishing agent suitable for type of surrounding fire.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

**Fire Involving Tanks**

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank.
- ALWAYS stay away from tank engulfed in fire.

**SPILL OR LEAK**

- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible turn leaking containers so that gas escapes rather than liquid.
- Do not direct water at spill or source of leak.
- Use water spray to reduce vapours or divert vapour cloud drift. Avoid allowing water runoff to contact spilled material.
- Prevent entry into waterways, sewers, basements or confined areas.
- Allow substance to evaporate.

**FIRST AID**

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

**GUIDE  
128****Flammable Liquids  
(Non-Polar/Water-Immiscible)****POTENTIAL HAZARDS****FIRE OR EXPLOSION**

**HIGHLY FLAMMABLE:** Will be easily ignited by heat, sparks or flames.

- Vapours may form explosive mixtures with air.
- Vapours may travel to source of ignition and flash back.
- Most vapours are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapour explosion hazard indoors, outdoors or in sewers.
- Those substances designated with a "P" may polymerize explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.
- **If molten aluminum is involved, refer to GUIDE 169.**

**HEALTH**

- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapours may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

**PUBLIC SAFETY**

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

**PROTECTIVE CLOTHING**

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighter's protective clothing will only provide limited protection.

**EVACUATION****Large Spill**

- Consider initial downwind evacuation for at least 300 metres (1000 feet).

**Fire**

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 metres (1/2 mile) in all directions.

## **EMERGENCY RESPONSE**

### **FIRE**

**CAUTION:** All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

**CAUTION:** For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.

#### **Small Fire**

- Dry chemical, CO2, water spray or regular foam.

#### **Large Fire**

- Water spray, fog or regular foam.
- Use water spray or fog; do not use straight streams.
- Move containers from fire area if you can do it without risk.

#### **Fire Involving Tanks Or Car/Trailer Loads**

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### **SPILL OR LEAK**

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- A vapour suppressing foam may be used to reduce vapours.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

#### **Large Spill**

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapour; but may not prevent ignition in closed spaces.

**FIRST AID**

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Wash skin with soap and water.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

# **APPENDIX A - Service Requirements Table**

**Table 1. Fire Protection Systems Weekly Test Record**

FIRE PROTECTION SYSTEMS WEEKLY TEST RECORD FOR THE YEAR _____								
Month					(E) Dry Valve Gauges	(F) Emergency Generator	(G) Sprinkler Valves	Signature
Jan.								
Feb.								
Mar.								
Apr.								
May								
June								

Month					(E) Dry Valve Gauges	(F) Emergency Generator	(G) Sprinkler Valves	Signature
July								
Aug								
Sept.								
Oct.								
Nov.								
Dec.								



***Table 1. Fire Protection Systems Monthly Test Record***

FIRE PROTECTION SYSTEMS MONTHLY TEST RECORD FOR THE YEAR _____									
Month	(A) Manual Alarm Station by Rotation	(B) Annuncia- tion Signals	(C) Trouble Signal Device Normal	(D) Battery & Terminal Check O.K.	(E) Emergency Lighting	(F) Fire Extinguisher s	(G) Wet Sprinkler System	(H) Dry Sprinkler System	Signature
Jan.									
Feb.									
Mar.									
Apr.									
May									
June									
July									
Aug.									
Sept.									
Oct.									
Nov.									
Dec.									

***Fire Protection Systems Monthly Test - con't***

FIRE PROTECTION SYSTEMS MONTHLY TEST RECORD FOR THE YEAR _____									
Month 20__	(I) Means of Egress	(J) Closures	(K) Emergency Generator	(L) Exit Lighting					Signature
Jan.									
Feb.									
Mar.									
Apr.									
May									
June									
July									
Aug.									
Sept.									
Oct.									
Nov.									
Dec.									

***Table 2. Fire Protection Systems Quarterly Test Record***

FIRE PROTECTION SYSTEMS QUARTERLY TEST RECORD FOR THE YEAR _____									
Month 20__	(A) Water Flow Devices		(C) Fire Department Connections	(D) Standpipe & Hose Systems	(E) Dry Sprinkler System				Signature
Jan.									
Feb.									
Mar.									
Apr.									
May									
June									
July									
Aug.									
Sept.									
Oct.									
Nov.									
Dec.									

***Table 3. Fire Protection Systems Semiannual Test Record***

FIRE PROTECTION SYSTEMS SEMIANNUAL TEST RECORD FOR THE YEAR _____									
Month	(A) Vane-Type Water Flow Devices							(H) Emergenc y Generator	Signatur e
Jan.									
Feb.									
Mar.									
Apr.									
May									
June									
July									
Aug.									
Sept.									
Oct.									
Nov.									
Dec.									

**Table 4. Fire Protection Systems Yearly Test Record**

FIRE PROTECTION SYSTEMS YEARLY TEST RECORD FOR THE YEAR _____									
(1) Fire Alarm System	(2) Emergency Lighting	(3) Fire Extinguishers		(5) Sprinkler Inspection	(6) Strobe Lights		(8) Standpipe & Hose Systems Water Supply	(9) Fire Hose	Signature
(10) Fire Dampers & Fire Stop Flaps		(12) Emergency Generator		(14) Heating Ventilation & Air Conditioning					Signature
									Signature

## **APPENDIX B - Fire Alarm Panel Operation**

## Simplex 4100ES Fire Alarm Panel

### SEQUENCE OF OPERATION

***DO NOT SILENCE OR RESET THE PANEL IN ALARM UNTIL IT HAS BEEN DETERMINED BY THE FIRE DEPARTMENT THAT THERE IS NO FIRE!***

The fire alarm panel can be in one of three modes: **NORMAL, ALARM, TROUBLE.**

There are at least three lamps you must familiarize yourself with: **POWER ON LAMP** (usually green), **ALARM ZONE LAMPS** (usually red), **TROUBLE LAMP(S)** (yellow).

There are at least three switches you must familiarize yourself with: **RESET, ALARM SILENCE, TROUBLE SILENCE.**

### NORMAL MODE

The fire alarm system senses that all detectors, devices, wiring and all panel components are operating properly. The only visual indication on the panel is the illuminated power-on lamp.

### ALARM MODE

- (a) **Audible and Visual Indication:** bells/horns/speakers throughout the building are sounding. At the panel there is only visual indication of alarm. If the panel is zoned, locate the zone lamp (usually red) that is illuminated, note the description to locate the cause of the alarm.
- (b) **Cause Of An Alarm:** An alarm is caused by activation of a manual station or detectors in the building.
- (c) **How To Silence The Bells:** Located on the alarm panel is a switch labelled **ALARM/SIGNAL SILENCE**. Pressing this switch will silence the bells but retain the alarm status of the panel. This will aid investigation of the alarm cause. When the system is silenced the panel is now in Trouble Mode and pulses the trouble buzzer as a reminder that you have silenced the bells. To silence the trouble you must operate the **TROUBLE SILENCE** switch.
- (d) **To Reset The Panel:** Locate on the alarm panel a switch labelled **RESET** and depress this switch to clear the panel. If the panel fails to clear then the alarm cause is still present. Only **ALARM SILENCE** will stop the bells from ringing until the problem has been corrected.

### TROUBLE MODE

- (a) **Audible And Visual Indication:** At the panel is a buzzer which is sounding and in addition one or more lamps (usually yellow and labelled **TROUBLE**) are illuminated.
- (b) **Cause Of Trouble:** Trouble on the system could be from many sources and requires a qualified technician to troubleshoot and locate the actual cause.
- (c) **How To Silence The Trouble Buzzer:** Locate the switch labelled **TROUBLE SILENCE** and operate. Note that the trouble lamp remains on.
- (d) **To Reset:** The panel will self-restore once the trouble cause has been eliminated. If operating the **RESET** switch will not clear a trouble from the panel, refer above to Silence The Trouble Buzzer.

## **APPENDIX C - Alternative Solutions**





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## APPROACH TO BUILDING CODE COMPLIANCE

*for*

**UBC QMI  
(ADDITION TO BRIMACOMBE BUILDING)**

*at*

**2355 EAST MALL  
VANCOUVER, BC**

*Prepared for*

**UBC Properties Trust**  
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Vancouver, BC  
V5T 1E2

**July 30, 2014  
Revised November 25, 2014  
Revised January 14, 2016  
Revised April 19, 2016**

**GHL File UBC-1899.75**



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## 1. INTRODUCTION

This report outlines the general approach to compliance with key Division B, Part 3 requirements of the BC Building Code 2012 for the proposed Quantum Mechanics Institute (QMI) at 2355 East Mall, Vancouver (UBC), BC. The QMI will be an addition to the existing Brimacombe building which currently houses the Advanced Materials and Process Engineering Laboratory (AMPEL).

This report is intended to provide the design team with an overview of the approach to Code compliance on requirements relating to fire safety. The report is not intended as a contract document for bidding or construction purposes.

The report should be read in conjunction with architectural drawings prepared by Public: Architecture + Communication Inc. A reduced copy of the design drawings, which this report is based on, is included in *Appendix A*.

## 2. APPLICABLE BUILDING CODE

The applicable Building Code for this project will be the BC Building Code (BCBC) 2012. All references indicated in this report refer to Division B of the BCBC 2012 unless otherwise indicated.

## 3. PROJECT DESCRIPTION

This project is a horizontal expansion of the existing Brimacombe building. The existing Brimacombe building was constructed circa 1990. A preliminary Code report prepared by Gage-Babcock & Associates (GBA Report) dated August 31, 1992 outlines some key characteristics of the existing building: The existing building is 4 storeys plus basement, of Group F-2 major occupancy, sprinklered, and has a building area of approximately 2500m<sup>2</sup>. The building was constructed based on the 1990 National Building and Fire Codes.

The current project will be a horizontal expansion to the east, which will house the QMI. Approximately 5000m<sup>2</sup> of gross floor area will be added to the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> storeys, as well as a basement. The building area will be increased by approximately 1000m<sup>2</sup>.

## 4. BUILDING CHARACTERISTICS

The expanded building will have the following characteristic:

- Building Height            4 storeys plus basement
- Building Area             Approximately 3500m<sup>2</sup> (existing 2500m<sup>2</sup> + new 1000m<sup>2</sup>)
- Sprinklered                Yes

## 5. OCCUPANCY CLASSIFICATION

The existing building was classified as Group F, Division 2 “*Medium Hazard Industrial Occupancy*” based on the laboratory use as described in GBA’s report. The expanded facility, the Quantum Mechanics Institute (QMI), will also be of laboratory use. As the expansion will be considered as part of the existing building, the building will continue to be classified as Group F, Division 2 occupancy.



## 6. CONSTRUCTION REQUIREMENTS

Based on the building characteristics and proposed occupancy within the building, construction requirements will be based on application of Article 3.2.2.73 “*Group F, Division 2, up to 4 Storeys, Increased Area Sprinklered*”, which permits up to 4500m<sup>2</sup> in building area for a 4 storey building of Group F-2 occupancy. Based on this construction Article, the expansion will meet the following:

- Noncombustible construction;
- Floor assemblies are fire separations with a 1h fire-resistance rating;
- Mezzanines have a 1h fire-resistance rating;
- Loadbearing walls, columns and arches have a 1h fire-resistance rating.

### ***Minor Combustible Materials Permitted***

Combustible materials used in this project will need to meet the requirements of Subsection 3.1.5, which include but not limited to:

- a) Combustible and foamed plastic insulation will need to be protected by a thermal barrier in conformance with Article 3.1.5.12.
- b) Foamed plastic insulation in exterior walls will need to be protected from both the interior and exterior sides of the wall in conformance with Articles 3.1.5.5, 3.1.5.12 and 3.2.3.8.
- c) Combustible cladding in exterior walls will need to be protected in conformance with Article 3.1.5.5 and Sentence 3.2.3.7.(1) or 3.2.3.7.(4).
- d) Wood used as an interior ceiling finish must not exceed 25mm thick and when the quantity is more than 10% of the fire compartment ceiling the wood in excess of 10% needs to be treated to such that the flame spread rating does not exceed 25.
- e) Wood frame walls are permitted provided the walls are non-loadbearing, not installed as enclosures for exits or shafts, and not used as vertical fire separations to maintain floor-to-floor fire separations.

Unoccupied roof assemblies are permitted to have no fire-resistance rating based on the provision of sprinkler protection. All loadbearing members require the same fire-resistance rating as the floor assembly being supported.

### ***Basement Pump Room***

The pump room located below the basement is exempted being considered a storey per the provisions of Sentence 3.2.1.1.(8) and will be considered a service space designed to comply with the following referenced provisions:

- Fully sprinklered per Article 3.2.5.15 and equipped with waterflow detecting devices connected to the fire alarm system and indicated separately on the annunciator panel.
- Provided with illuminated exit and directional exit signs per Sentence 3.3.1.24(1).
- Provided with an audible devices connected to the fire alarm system per Sentence 3.2.4.19.(10).
- Provided with emergency lighting at an average of 10lx per Sentence 3.2.7.3.(2).
- 2 points of egress.
- Travel distance not exceeding 50m to an exit per Sentence 3.4.2.4.(3).



## 7. APPROACH TO EXISTING BUILDING

There is no requirement in the Building Code that mandates retroactively applying new requirements and standards to an existing building. Generally, provided the existing construction does not present an 'unsafe' condition, the existing construction is permitted to remain as is. Any new construction must not decrease the level of safety afforded by the existing construction.

As the project is a horizontal addition and will be structurally independent of the existing building, the new construction should have very limited impact on the existing building. Further, the existing building appears to have been constructed of noncombustible construction with 1h fire-resistance rating based on Gage-Babcock's 1992 report, which complies with the proposed construction classification based on Article 3.2.2.73.

### 2h Fire Separation

A 2h fire separation will be introduced at the boundary between the existing and the expansion portion of the building. The 2h fire separation is intended to limit the risks of existing building construction affecting occupants in the new portion, if any. Therefore, on this basis the QMI addition will comply with the BCBC 2012 while the existing building will be assumed, for the purpose of this project, to be in general conformity with the Code when it was originally constructed. It is desired to place the doors connecting the existing building and the addition on hold-open devices which will be released at the actuation of the fire alarm.

## 8. FIRE SEPARATIONS

Fire separations will be provided based on the following:

<u>Separation Around</u>	<u>FRR of Separation</u>
Exits	1h
Janitor's room (sprinklered)	0h
Electrical room (non-sprinklered)	2h
Electrical room (sprinklered)	0h
Service rooms with fuel fired appliance (sprinklered)	1h
Service rooms without fuel fired appliance (sprinklered)	0h
Refuse (garbage) storage room	1h
Loading bay	1.5h
Laboratories	1h

Openings in fire separations necessary for the functional movement of people, goods, and building services will be protected in accordance with Subsections 3.1.7, 3.1.8, 3.5.3 and 3.6.2, as summarized in the following table:

Grade of Fire Separation Penetrated (h)	FPR of Closures and Doors (h)	FPR of Firestop System Used in Service Penetration (h)	FRR of Vertical Service Shaft (h)	FRR of Elevator and Exit Stair Shafts (h)	FRR of Horizontal Service Space (h)
1	¾	¾ - F rated	¾	1	1
1.5	1	1 - F rated	n/a	n/a	1.5
2	1½	1½ - F rated	n/a	n/a	2

FPR = Fire Protection Rating. FRR = Fire Resistance Rating.



**Notes:**

- a) Installation of closures will comply with NFPA 80 2007 "Fire Doors and Other Opening Protectives".
- b) Fire rated doors require self-closers and positive latching mechanisms and signage visible when door is in open position indicating: FIRE DOOR KEEP CLOSED.
- c) 20min fire protection rated doors are permitted in a 1h fire rated separation between public corridors and suites per Article 3.1.8.10. These doors will have a maximum 6mm clearance at the bottom and a maximum 3mm clearance at the sides and top.
- d) The maximum temperature rise for exit doors will be 250C after 30min per Table 3.1.8.15.
- e) Penetrations in rated fire separations will be firestopped per Subsection 3.1.9.

## 9. INTERCONNECTED FLOOR SPACE

The addition portion of the building will include a convenience stairway that connects all floor levels from the basement to the 4<sup>th</sup> storey; there will also be a number of floor openings that connect the spaces between different floor levels. Accordingly, the addition will be designed as one interconnected floor space (IFS) based on Articles 3.2.8.3 to 3.2.8.9. Based on the 2h fire separation between the addition and the existing part of the building, the application of Articles 3.2.8.3 to 3.2.8.9 will be limited to the QMI addition only and as summarized below.

Division B	Division B Acceptable Solution	Compliance Approach
3.2.8.3	Noncombustible construction or heavy timber construction.	Comply with Division B.
3.2.8.4	Sprinkler to NFPA 13.	Comply with Division B.
3.2.8.5	Provide pressurized vestibules to protect exits from smoke infiltration.	An <b>alternative solution</b> will be provided to directly pressurize the exit stairwell to 37Pa, measured with all doors closed. Exit door opening forces at all storeys for the stair must not exceed 90N.
3.2.8.5	Provide one or a combination of cumulative exiting per Sentence 3.4.3.2.(6).	Comply with Division B.  This will be achieved as described under the cumulative exiting heading below.
3.2.8.6	Protected floor space.	Not applicable.
3.2.8.7	500mm deep draft stops along with closely spaced sprinklers and smoke detectors along edge of floor opening.	Comply with Division B.
3.2.8.8	Manual exhaust at 4 air changes/h for the interconnected floor space (effectively all levels of 1st – 4th storey).	Comply with Division B.
3.2.8.9	Combustible content limit of 16g/m <sup>3</sup> within the interconnected floor space where the ceiling height exceeds 8m (combustible content generally refers to furniture and excludes interior finishes).	Comply with Division B.  The combustible content limit requirement will be required to be noted in the building's Fire Safety Plan.
3.2.4.12.(1)(f)	Smoke detectors in the vicinity of draft stops required by 3.2.8.7.	Comply with Division B



### Cumulative Exiting

A review of the exit stair capacity (existing and expansion) and the occupant load based on field observation of the existing AMPEL facility and discussion with the user indicates that the occupant loads in the building will be limited such that cumulative exiting will be achieved in the IFS. This will be based on occupants in the expanded portion using one of the three existing exits, as well as revisiting the occupant load calculations as explained below.

- **Occupant Load Calculations:** Although the previous GBA report has indicated an occupant load factor of 4.6m<sup>2</sup>/person for laboratory use based on the prescriptive provision in the Building Code, the occupant load for the entire building (new and existing) has been recalculated based on an occupant load factor of 9.3m<sup>2</sup>/person (office load) to better reflect the actual occupant load of the facility. The 9.3m<sup>2</sup>/person has been determined by GHIL to be a more appropriate factor based on the fact that the existing building which houses the AMPEL and the new addition which will house the QMI are graduate research facilities. This type of space is more comparable to office (Group D) occupancy in terms of occupant load, where occupants are mostly research scientists working in laboratories. The facilities will not be open to undergraduate students and as such, they are not teaching laboratories in schools, for which the 4.6m<sup>2</sup>/person factor is based on. Field review carried out by GHIL and discussion with Dr. Jeff Young (director of AMPEL) also confirms that the occupant load of the facilities will be more appropriately represented by the 9.3m<sup>2</sup>/person factor. A copy of the email correspondence is attached in *Appendix B*. Based on this, the following occupant load for the building is derived (the occupant load calculation is attached in *Appendix B*).

	Occupant Load (persons)		
	New Addition (QMI)	Existing	Total
Basement	47	1	48
1 <sup>st</sup> storey	61	186	247
2 <sup>nd</sup> storey	68	89	157
3 <sup>rd</sup> storey	67	88	155
4 <sup>th</sup> storey	65	21	86
<b>Total</b>	<b>308</b>	<b>385</b>	<b>693</b>

- **Cumulative Exiting Calculation:** The 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> storeys will be served by four above-grade exit stairs, three located in the existing building and one in the expansion part. Based on the exit stair door width and stair rise and run dimensions, the four exit stair will each have an exit capacity of 150 persons or 600 persons for the four stairs combined. As the total occupant load in the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> storeys of the new and the existing do not exceed 600 persons (157 + 155 + 86 = 398persons); cumulative exiting in the above-grade storeys will be provided.

It is noted that the existing AMPEL will not be part of the IFS and is therefore not required to provide cumulative exiting. This calculation is simply to demonstrate that occupants in the expanded portion can rely on one of the three existing exits to meet cumulative exiting with a conservative margin of safety.



Exiting in the 1<sup>st</sup> storey will rely on the exterior exit doors and therefore will not affect the exit stair capacity. Exiting in the basement will rely on the stairway; as the basement is served by three stairs each with 150 person capacity, or a total of 450 persons, cumulative exiting will also be provided in the basement.

Accordingly, cumulative exiting will be provided.

## 10. EXIT / EGRESS SYSTEMS

Exit capacity will be designed based on the occupant load of the addition in compliance with the Building Code. The expansion portion will be provided with 1 exit stairway while relying on the excess exit capacity provided by the three existing exit stairs in the existing wing. The existing stairs meet the minimum exit width and rise-and-run dimensions of BCBC 2012 and as such can be relied upon for exiting, given that the existing and the expansion will be considered as one building.

Travel distance from anywhere in the floor area to an exit will be no more than 45m based on the building (new and addition) being sprinklered.

Generally, two means of egress will be provided for a room. One means of egress is permitted if:

- a) the floor space / room is not more than 200m<sup>2</sup> in area;
- b) the travel distance from anywhere within the space / room to the door of the room is not more than 25m;
- c) the occupant load in the floor space / room is not more than 60 persons.

### **Exit Signs**

Exit signs will be provided for the addition in conformance with Subsection 3.4.5 and would be the green and white pictogram ISO signs specified in Sentence 3.4.5.1.(2). As the existing building and the new addition will be regarded as one building, it has been agreed that the exit signs in the existing portion of the building will be updated to the new exit signs specified by BCBC 2012 (See *Appendix C*). The update would apply to all principal exit routes and at exits in the existing building; exit signs in individual rooms will be retained and updated if/when renovations are carried out in that room. Exit signage will be coordinated by the Project Architect and Electrical Engineer.

### **Direction of Door Swing**

Egress doors will swing in the egress direction per Sentence 3.3.1.10.(2). Doors in paths providing access to exit will provide a clear absolute width of 800mm in compliance with Sentence 3.3.1.12.(10). Exit stair enclosures shall be designed to provide a clear absolute headroom of 2100mm. In accordance with Sentence 3.3.1.12.(10), door assemblies providing access need to have a clearance of 600mm beside the latching jamb of the door when the door swings towards the direction of travel and 300mm beside the latching jamb of the door when the door swings in the direction of travel.





### **Door Hardware**

Panic hardware will be provided on the following:

- All doors providing access to exit from rooms having an assembly occupancy of more than 100 (Sentence 3.3.2.6.(1)).
- Every exit door from a floor area containing an assembly occupancy greater than 100 (Clause 3.4.6.15.(2)(a)).
- Any exterior door leading from an exit stair shaft in a building having an occupancy load greater than 100 (Clause 3.4.6.15.(2)(b)).

### **11. AUTOMATIC SPRINKLER SYSTEMS**

This QMI addition will be sprinklered and designed to the requirements of NFPA 13, 2007 edition “*Installation of Sprinkler Systems*” and the BC Building Code 2012. The automatic sprinkler system will be monitored to provide signals to the Fire Department and will be electrically supervised. The storey directly below the roof will have sprinklers in all rooms, including closets; any omissions permitted elsewhere in NFPA 13 will not apply to this storey. Floor areas open to the exterior or unheated will be provided with dry pipe sprinkler systems. The architect and sprinkler design engineer must coordinate detailing to address freeze protection of all exterior and interior sprinkler piping subject to freezing where applicable.

NFPA 13 permits the omission of sprinklers from electrical equipment rooms based on the following conditions:

- the room is dedicated to electrical equipment only,
- only dry type electrical equipment is used,
- the room is 2h fire rated, and
- storage is not permitted in the room.

Canopies exceeding 4ft (1.2m) are required to be sprinklered unless the canopy is of noncombustible construction and the floor area beneath is not used for storage.

### **12. STANDPIPE SYSTEM**

Per Article 3.2.5.8, the building will require a standpipe system and will be designed to comply with Articles 3.2.5.9 and 3.2.5.10, and NFPA 14 – 2007 Edition “*Installation of Standpipe and Hose Systems*”. Hose connections will be located in exits in accordance with NFPA 14.

### **13. SMOKE DETECTORS**

Per Articles 3.2.4.12 and 3.2.4.13 of the Building Code, smoke detectors will be required in the vicinity of draft stops required by Article 3.2.8.7; in ducts if the air-handling system serves more than one storey; and at the top of the new exit stair shaft.



#### 14. FIRE ALARM AND DETECTION SYSTEMS

This building will be provided with fire alarm and detection systems designed in accordance with the requirements of Subsection 3.2.4; key provisions of the Building Code are listed below:

- Fire alarm system required for sprinklered buildings.
- Fire alarm system electrically supervised and monitored to provide signals to the Fire Department.
- Annunciator to provide zone identification for each storey as proposed for the automatic sprinkler system. In addition, the existing and new portions of the building will be zoned separately.
- Air handling system connecting more than one storeys will shut down based on duct-type smoke detector actuation.
- Manual pull stations be installed near the principal entrance and every required exit.
- Smoke detectors are required within exit stairs, unsprinklered electrical rooms, and air handling systems serving more than 1 storey. Smoke detectors will also be provided on each side of held-open doors between the existing and new portions of the building.

The system will be designed to transmit a signal to the Fire Department using the method described in Sentence 3.2.4.8.(4) (i.e. central station monitoring).

##### ***New Annunciator Panel***

A new fire alarm annunciator panel will be provided at the main entrance of the QMI addition that faces East Mall, which will be the primary Fire Department response location for the building. The new annunciator panel will include both the existing and the QMI addition.

##### ***Description of Fire Alarm Operation***

The building will have a single stage fire alarm system which will activate upon activation of any automatic device (heat detector, sprinkler, or smoke detector) or manual pull station. Upon activation, the exit stairwell pressurization addressed by Alternative Solution A will actuate automatically. Per the Alternative Solution, a switch will be provided to turn off the pressurization if required (i.e., an on-auto-off switch). The exhaust system required by 3.2.8.8 will be turned on manually for smoke cleanup purposes by the Fire Department. A note will be placed next to the exhaust switch to remind the Fire Department to open the door prior to activating the exhaust. The building's normal air handling unit systems are permitted to continue to operate under fire alarm and will only be required to turn off when the duct-type smoke detector is activated per Sentence 3.2.4.13.(1) of the Building Code.

#### 15. LIGHTING AND EMERGENCY POWER

The minimum average lighting levels will conform to Article 3.2.7.1 at 50lx in exits, stairs and corridors. Emergency lighting is required in the following locations and will be designed to meet the requirements of Subsection 3.2.7:

- Exits
- Principal access to exit routes in open floor areas
- Exterior exit stairs and pathways
- Rooms with occupant loads greater than 60



### Requirements for Emergency Power

- Emergency lighting provided at an average level of 10lx and no less than 1lx at floor level.
- Emergency power is required for:
  - Emergency lighting
  - Fire alarm systems
  - Exit signs
  - Fire pump (if required)
- Emergency power duration:
  - Supervisory power for fire alarm system = 24h
  - Emergency power under full load = 30min

### 16. EXIT EXPOSURE PROTECTION

Exit facilities and exterior exit paths will be protected from openings based on Article 3.2.3.13. Window openings that are within 3m horizontally and 10m below or 5m above an exterior exit path will be protected using water curtain sprinklers, which will be addressed by *Alternative Solution B*.

### 17. LIMITING DISTANCE AND SPATIAL SEPARATION

Each storey of the QMI Addition will be regarded as a fire compartment for the purpose of Subsection 3.2.3 based on the 2h fire separation between the addition and the existing and Sentence 3.2.3.2.(3) which permits each storey of an IFS to be considered independently. A summary of spatial separation requirements is as follows. It is noted that the building although classified as Group F-2 occupancy; such occupancy is limited to the laboratories only, which are separated from the remainder of the building by 1h fire separation. As such, for the North and South exterior walls; their spatial separation requirements are determined based on the lower fire hazard classification of Table 3.2.3.1.D as permitted by Sentence 3.2.3.2.(2).

Exterior Wall	Occupancy	Limiting Distance	Table	% unprotected openings permitted	Exterior wall fire rating	Exterior wall construction	Cladding Type
North	Group D	9m	3.2.3.1.D	100%	n/a	Noncombustible or combustible permitted if meeting 3.2.3.8 or 3.1.5.5.	
East	Group F-2	9m	3.2.3.1.E	42%	1h	Noncombustible or combustible permitted if meeting 3.2.3.8 or 3.1.5.5.	Noncombustible required
East	Group D	9m	3.2.3.1.D	100%	n/a	Noncombustible or combustible permitted if meeting 3.2.3.8 or 3.1.5.5.	
South	Group D	7m <sup>1</sup>	3.2.3.1.D	100%	n/a	Noncombustible or combustible permitted if meeting 3.2.3.8 or 3.1.5.5.	
West	The west exterior wall faces the existing portion of the building; therefore, spatial separation requirements do not apply to this face of the expansion.						

<sup>1</sup> The LD for QMI's south face is determined by subtracting the 6m LD required for the existing Pulp & Paper Building from the 13m separation between QMI and Pulp and Paper. Based on our analysis, Pulp & Paper has a 22% UPO for the first 4 storeys that would expose QMI.



### ***Foam Plastic Insulation in Exterior Wall***

Foam plastic insulation in the exterior wall assembly will be required to be behind minimum 25mm thick concrete or masonry on the exterior side per Sentence 3.2.3.8.(1) and be protected by minimum 1 layer 12.7mm gypsum board per Sentence 3.1.5.12.(3).

## **18. FIRE DEPARTMENT ACCESS**

As part of the QMI addition, the Fire Department response point has been proposed to be relocated from the existing building's entrance at Engineering Lane to the entrance at the QMI addition at East Mall. The new fire alarm annunciator panel and the Fire Department connection will be located at the new response point, which will be within 45m to the nearest fire hydrant.

## **19. STORAGE OF HAZARDOUS SUBSTANCES AND LABORATORIES**

### **▪ *Laboratories***

Laboratories in each storey will be separated from the remainder of the floor area by 1h fire separations per BCFC 2012 Division B, Sentence 5.5.2.2.(1). Storage of hazardous substances in the building will conform to the Fire Code requirements summarized below. Code references made in this section of the report refer to the BC Fire Code 2012:

### **▪ *Flammable Gases and Oxygen (Class 2.1 and 2.2)***

In accordance with Division B Sentence 3.2.7.1.(1), special measures for storage of flammable gases and oxygen will not be required provided the storage quantity in each fire compartment is not more than 25kg of flammable gas and not more than 150kg of oxygen.

### **▪ *Flammable and Combustible Liquids (Class I, Class II and Class III Liquids)***

In accordance with Division B Articles 4.2.6.2 and 4.2.6.3 of the BCFC, flammable and combustible liquids are permitted in this building:

#### **a) Incidental Use**

Incidental storage, handling and use of flammable and combustible liquids are permitted provided the quantities do not exceed:

- 10L, including not more than 5L of Class I liquids in a room.
- 250L, including not more than 60L of Class II liquids and 10L of Class I liquids in a 45min rated fire compartment.

If the quantities exceed the foregoing amounts, the flammable and combustible liquids need to be stored in storage rooms or cabinets noted as follows.

#### **b) Storage Rooms**

Flammable and combustible liquids exceeding the incidental use amount can be stored in storage rooms provided the quantities do not exceed:



Minimum Fire Separation Around Storage Room (h)	Maximum Quantity* (L)	Maximum Density (L/m <sup>2</sup> )
1	10,000	200
2	1,500	100

\* The quantity is permitted to be doubled if the room is sprinklered to NFPA 30.

Storage rooms are required to be liquid-tight where the walls join the floor. A curb or a grate-covered trench may be required at the door to achieve the spill control objective.

Where Class IA or IB liquids are dispensed within a storage room, the room will need to be designed to prevent critical structural and mechanical damage from an internal explosion in conformance with good engineering practice, such as NFPA 68, "Venting of Deflagrations".

Dispensing of Class IA or IB liquids outside a storage room is permitted provided the quantities do not exceed that for incidental use noted in a) above.

c) **Storage Cabinets**

Up to 500L of flammable and combustible liquids, including not more than 250L of Class I liquids are permitted to be stored in cabinets in a fire compartment.

Dispensing of Class IA or IB liquids within the fire compartment is permitted provided the quantities do not exceed that for incidental use noted in a) above.

In addition to the above, Class I liquids are not permitted to be stored in the basement, except not more than 5L of Class I liquids are permitted to be stored in the basement provided they are stored in safety containers conforming to ULC/ORD-C30, "Safety Containers".

## 20. WATER CLOSET REQUIREMENTS

Based on the added occupant load of 308 persons, 5 male and 5 female water closets will be needed to serve the expansion of the building per Table 3.7.2.2.B of the Building Code. As noted earlier, even though the building is classified as Group F-2 major occupancy based on the proposed use, the occupant profile is more appropriately represented as Group D occupancy. Accordingly, the water closets will be provided in accordance with Table 3.27.2.2.B for Group D occupancy.

## 21. ALTERNATIVE SOLUTIONS

Division A - Clause 1.2.1.1.(1)(b) and Division C - Section 2.3 confirm that compliance with the Building Code may be achieved by one of two means; either through the acceptable solutions described in Division B or through an alternative solution. The following alternative solutions have been proposed:

Solution A	Pressurization of Exit Stairwell In Lieu of Pressurized Vestibules
Solution B	Exit Exposure Protection
Solution C	Sprinkler Protected Glazing System



## 21.1 Solution A

### Pressurization of Exit Stair Shafts

#### Code Reference

Sentence 3.2.8.5.(1)

#### Acceptable Solution

The acceptable solution requires exits that are open to an interconnected floor space (IFS) to be protected by a pressurized vestibule. The vestibule is required to be designed such that:

- the doors of the vestibule and the exit are not less than 1.8m apart;
- the vestibule is separated by a fire separation with no fire-resistance rating; and
- the vestibule limits infiltration of smoke to less than 1% of contaminated air within the stair.

#### Code Objectives

[F06-OS1.2], [F05-OS1.5], [F06, F03-OP1.2]

F06 To retard the effects of fire on facilities for notification, suppression and emergency response.

F05 To retard the effects of fire on emergency egress facilities.

F03 To retard the effects of fire on areas beyond its point of origin.

OS1.2 To limit the risk of injury due to fire or explosion impacting areas beyond its point of origin.

OP1.2 To limit the risk of building damage due to fire or explosion impacting areas beyond its point of origin.

OS1.5 Persons being delayed in or impeded from moving to a safe place during a fire emergency.

The foregoing can be summarized that the objective is to limit the effects of fire, specifically smoke, from infiltrating exits in an IFS, given exits are used for evacuation and also access for emergency responders.

#### Alternative Solution

It is proposed to pressurize the exit stair shafts with a 37Pa differential, measured with all doors closed to meet the performance criteria of Sentence 3.2.8.5.(1). The pressurization system will turn on automatically upon activation of the building's fire alarm system. Mechanical systems to maintain the 37Pa pressure differential will need to be served by emergency power for minimum 1h duration. The pressurization will include a pressure relief mechanism such that the pressure build-up in the stairwell will not result in door opening forces exceeding 90N.

#### Discussion

Division B offers a performance-based solution for smoke management of exit facilities. Sentence 3.2.8.5.(1) requires the construction of a vestibule that would limit the infiltration of smoke into exits to less than 1% of the contaminated air. The prescriptive part of the solution is in requiring this performance be met at the vestibule. It is proposed to provide mechanical pressurization directly in the exit shafts that are open to the 5



level IFS at QMI in lieu of vestibules, in order to achieve the objectives of the Code. There are three aspects of the vestibule requirement in Division B for which this alternative solution needs to demonstrate equivalent performance. These three vestibule requirements are as follows:

**1. Separation of Doorways by 1.8m**

Although not explicitly stated in the Building Code, the intent of the 1.8m separation between the vestibule door and the exit door is to create an “air lock”. The assumption is that the separation distance would result in the vestibule door being closed by the time an occupant opens the exit stair door; however, under real evacuation conditions, queuing at exit doors will result in occupants holding / blocking the vestibule door to gain access to the exit door. Therefore, in reality, the 1.8m separation of doors will not be effective in creating the air lock, and would provide no significant benefit during evacuation. The proposed alternative solution on the other hand, is a pressurization system which maintains a positive air flow even if the doors are opened.

**2. Fire Rating of Vestibule vs. Exit Stair Shaft**

Division B Sentence 3.2.8.5.(1) permits the vestibule to be separated from the IFS by a non-rated fire separation. The assumption is that in a sprinklered fire compartment, the thermal effect of fire is limited and the chief concern is the effects of smoke. Using Sentence 3.2.8.5.(1) as the established minimum level of performance acceptable by Code, the alternative solution would provide a superior level of performance, in that the pressurization system is provided to the exit stair shafts which are separated from the floor area by 2h fire separations. In the event of sprinkler failure, noting that this is not contemplated by the Division B solution, the alternative solution would offer a superior level of protection based on the 2h fire separation of the pressurized space, which can be expected to offer protection against both the thermal and smoke effects of fire from infiltrating the exits. In comparison, a Division B-compliant vestibule would fail in the event of a fully-developed fire, causing the loss of the pressurized space. This would result in a significant reduction in the ability to prevent smoke from entering the exits as the requirements of Clause 3.2.8.5.(1)(a) and (c) are both contingent on the presence of a vestibule.

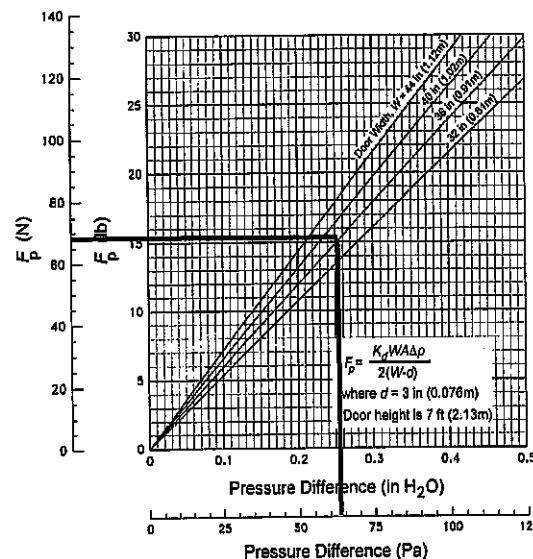
**3. Limit Infiltration of Smoke in Exits to Less Than 1% of Contaminated Air**

The third aspect of the acceptable solution is that the vestibule needs to be designed to limit the infiltration of smoke to not more than 1% of the contaminated air in the exit. It is important to note that the “1% contaminated air” is not precisely defined in the Building Code. Clause 3.2.8.5.(1)(c) states that the vestibule needs to be designed such that the smoke contamination in an exit stair shaft does not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal to the January design temperature on a 2.5% basis. Appendix A A-3.2.8.5.(1).(c), the commentary for Clause 3.2.8.5.(1)(c), further provides a prescribed solution, and suggests that if provided, it would meet the intent of Clause 3.2.8.5.(1)(c). The prescribed solution is a vestibule provided with equipment capable of maintaining a supply of air into the vestibule which is sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than the air pressure in the adjacent floor areas. However, if one were to follow the performance criterion based on a modelling approach, the “1% contaminated air” is not precisely defined, in that the Code does not specify what constitutes “contaminated”. In the absence of a quantitative measure of contamination (for example, a certain concentration of an indicator gas specified, such as carbon monoxide), there is a lack of starting point for ascertaining that a design would meet the “1% contaminated air” criterion.

In the absence of other guidelines in the BCBC 2012, in lieu of providing pressurized vestibules, pressurization of the exit stairs to 25Pa – 87Pa with all doors closed as referenced in the **International**



**Building Code (IBC) 2012 Ref. 909.20.5 ‘Stairwell Pressurization Alternative’** is considered to be an acceptable acceptance criterion for this alternative solution. The IBC provision allows for the omission of a pressurized vestibule for fully sprinklered buildings, provided the exit stairs are pressurized as specified (25Pa – 87Pa). It is noted that the maximum 87Pa specified by the IBC 2012 is intended to address excessive door opening forces. In this case, this alternative solution will use the Code-referenced value of 90N (see Figure below); therefore, the exit stairs will be pressurized to a minimum of 25Pa with no door opening forces exceeding 90N. The door closing force of door closers required at exit doors is taken into consideration in calculating the maximum pressure difference. It is noted that this force can range between 14N and 35N. Taking an average force of 22N exerted by the door closer, the maximum pressurization will be designed to not exceed 64Pa for a door with a width of 0.91m.



Door-opening forces due to pressure difference. Source: Klotz, *Principles of Smoke Management*. Chapter 6 - Figure 6.22. 2002.

### System Demonstration Requirements

The following will need to be implemented and demonstrated prior to occupancy as part of completion of this alternative solution:

1. Pressurization of the exit stair shafts to minimum 25Pa, designed with all doors closed. The 25Pa will be measured at the door furthest away from the injection point.
2. Mechanical units that are part of the pressurization system needs to be served by emergency power for a minimum 1h duration.
3. Pressurization of the stair shaft to actuate automatically upon activation of the fire alarm signal.
4. Pressurization of the exit stair shaft designed such that the opening forces for all doors in the stair shaft will not exceed 90N (measured at the door closest to the injection point).
5. The pressurization system will be designed such that the fan will begin operating in the order of 1min after the building's fire alarm has been actuated.

### Conclusion

In conclusion, the proposed alternative solution will perform “as well as” the acceptable Division B design requirements of Sentence 3.2.8.5.(1) with respect to [F06-OP3.1] and [F12-OP3.1].





## 21.2 Solution B

### Exit Exposure Protection

#### Code References

Sentences 3.2.3.13.(2) and 3.2.3.13.(3)

#### Acceptable Solutions

The Building Code requires openings in exterior walls within 3m horizontally of exit discharge locations, paths and exterior exit stairs to be protected with wired glass, glass blocks or fire rated closures. Similarly, exterior wall openings less than 5m above the exterior stairs or ramps should be protected with wired glass, glass blocks or other fire rated closures.

#### Code Objectives

The applicable objectives, functional statements and intents for the acceptable solution are summarized below:

- F05 To retard the effects of fire on emergency egress facilities.
- F06 To retard the effects of fire on facilities for notification, suppression and emergency response.
- OS1.2 Fire or explosion impacting areas beyond its point of origin.
- OS1.5 Persons being delayed in or impeded from moving to a safe place during a fire emergency.
- OP1.2 Fire or explosion impacting areas beyond its point of origin.

To limit the probability of fire spread from exterior walls or openings of a building to exit facilities, which could lead to delays in evacuating or moving to a safe place, and/or delays in firefighter access to the building by emergency responders, which could lead to fire emergency response operations being delayed or ineffective. To further elaborate, the intent of this provision is to reduce the degree of radiation that occupants would be exposed to while using the exit facility to evacuate floor areas.

#### Alternative Solution

For this project, the exit discharge location for the north-east exit stair (Stair #2) may be exposed to unprotected openings at the north-east exterior wall and the exit discharge and unenclosed exterior stair for the exit stair located between gridlines 4-6 and C-D may be exposed to the adjacent fire compartment in the existing building. It is proposed to address exit exposure protection for this exit/egress paths using water curtain sprinkler systems. Locations for which exit exposure protection will be provided using water curtain sprinkler systems are included in *Appendix D*.

#### Discussion

Direct compliance with the Building Code would require the use of fire protection rated closures to prevent the passage of heat and flame through these openings. Water curtains are frequently used in locations where the use of conventional closures is impractical and are recognized as being effective in preventing the passage of heat and flame by NFPA 13, 2007 Edition.

The report entitled "*The Design of Effective Water Spray Cooling in Stairwell Sprinkler Systems*" by Leonard Cooper of the US Centre for Fire Research, National Bureau of Standards indicates that water curtains which bring fire gases down to the fully saturated state will reduce the temperature of 425C fire gases to 52C, and that



the temperature of fully saturated fire gases will never exceed the boiling temperature of water. It further indicates that a water curtain flow of 3 usgpm/lin ft will be sufficient to fully saturate the fire gases. A copy of this report is available upon request.

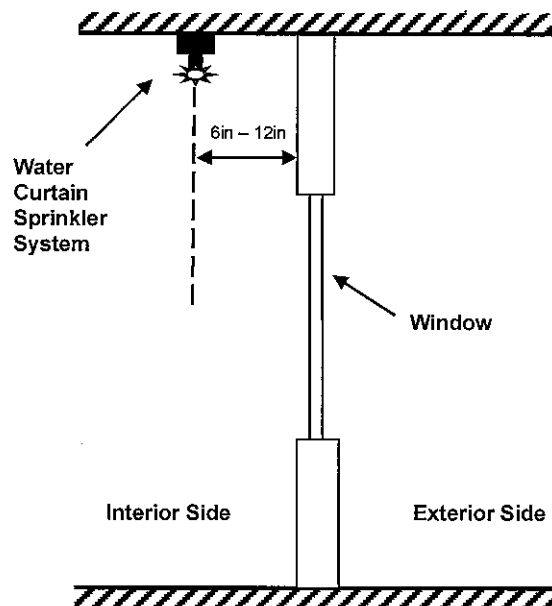
The reduction of the temperature of hot fire gases to below the boiling temperature of water will effectively prevent the spread of fire by convective effects. With respect to radiative heat, the paper entitled "*Measurement of the Transmission of Radiation through Water Sprays*" by A.J.M. Heselden and P.L. Hinkley, addresses the reduction of radiative heat transmission (copy available upon request).

This document states on Page 8 that "... a water curtain produced by a water flow of 3 gal/ft/min could absorb at least 50% to 55% of incident radiation from sources 800C to 1000C ...". A copy of this report is also available upon request.

The Building Code, under Sentence 3.2.3.13.(4), permits the use of wired glass and glass blocks to reduce radiation at exterior openings of a building. Glass is a generic material which absorbs approximately 50% of thermal radiation. Therefore, the Code assumes a 50% reduction in radiative heat transfer is acceptable for exit exposure protection.

Another consideration is reliability. Sprinklers are recognized as being highly reliable, with a reliability rate exceeding 95%. In comparison, a study by Factory Mutual indicates that more than 15% of all fire doors in the study failed to operate properly. Therefore, a water curtain will provide more reliable protection than a directly complying closure.

The following schematic diagram illustrates the approximate location of the proposed water curtain sprinkler relative to the windows:





## **Water Curtain Sprinkler System Design Criteria**

The proposed water curtain sprinkler systems will be based on the requirements of NFPA 13 (2007) and as summarized below:

<i>sprinkler heads</i>	quick response to match floor area sprinklers.
<i>sprinkler position</i>	6in (150mm) to 12in (300mm) from plane of opening being protected.
<i>sprinkler spacing</i>	openings under 6ft (1.8m) in width, one sprinkler head centred in opening; openings over 6ft (1.8m), space at 6ft (1.8m) o.c., with no more than 3ft (0.9m) to edge of opening.
<i>sprinkler obstruction</i>	sprinklers to be located to provide unobstructed spray pattern. Pipes, ducts, fixtures or other obstructions significantly changing spray pattern of the water curtain sprinklers are not permitted. The sprinklers should be located to meet all obstruction requirements of NFPA 13 and should be reviewed by GHL.
<i>sprinkler piping</i>	wet or dry system to match the floor area system.
<i>sprinkler supply</i>	water curtain sprinkler systems will be supplied from the floor area system.
<i>flow</i>	27usgpm/sprinkler.
<i>hydraulic calculation</i>	to be hydraulically calculated based on the water curtain sprinkler demand, adjacent floor area demand, and inside/outside hose allowances per NFPA 13.
<i>baffles</i>	noncombustible baffles to be provided between any sprinklers located closer than 6ft (1.8m) apart and in accordance with NFPA 13. Alternate baffle arrangements should be reviewed by GHL prior to installation.

Deviation or substitutions from the above design measures shall be approved in writing by GHL Consultants Ltd. It should be noted that the water curtain sprinkler system is intended to control the spread of fire at the location of the water curtains. They are not intended to maintain glazing in the wall opening intact. Therefore, coverings such as blinds if provided, will not adversely affect the performance of the water curtain systems.

### *Conclusion*

Based on the provision of water curtain sprinkler system, the proposed Alternative Solution will achieve the minimum level of performance required by the applicable acceptable solution in Division B of the BC Building Code 2012.



### 21.3 Solution C

### Sprinkler Protected Glazing System

#### Code References

Sentences 3.1.8.1.(1), 3.1.8.1.(2) and 3.1.8.4.(1)

#### Acceptable Solutions

Sentence 3.1.8.1.(1) prescribes that a wall, partition or floor assembly required to be a fire separation be constructed as a continuous element having the required fire-resistance rating except that openings are permitted provided they are protected with closures in as specified by Sentence 3.1.8.1.(2)

Sentence 3.1.8.4.(1) prescribes that the fire-protection rating of a closure be determined based on specified tests outlined in this Sentence.

#### Code Objectives

[F03-OS1.2], [F03-OP1.2]

F03 To retard the effects of fire on areas beyond its point of origin.

OS1.2 To limit the risk of injury due to fire or explosion impacting areas beyond its point of origin.

OP1.2 To limit the risk of building damage due to fire or explosion impacting areas beyond its point of origin.

The objective is to limit the probability that fire separations will have insufficient resistance to the spread of fire through the assemblies and to limit the probability that closures will have insufficient resistance to the spread of fire.

#### Alternative Solution

It is proposed to include tempered glazing/steel panels in the 1h fire rated separations between the labs and the remainder of the building on the 1<sup>st</sup> to 4<sup>th</sup> storeys of the QMI. Closures in the fire separation will require a fire protection rating of 45min. The required 1h fire resistance rating will be maintained through the use of a listed sprinkler protected glazing system. Doors not meeting the required 45min fire protection rating will be protected with water curtain sprinklers. The proposed locations of the sprinklers addressed by this alternative solution are shown on the drawings attached in *Appendix E*.

#### Discussion

For this project, it is proposed to include tempered glazing/steel panels in the fire separations between the labs and the remainder of the building on the 1<sup>st</sup> to 4<sup>th</sup> storeys of the QMI. Per Division B Sentence 5.5.2.2.(1) of the BCFC 2012, laboratories in each storey will be separated from the remainder of the floor area by 1h fire separations. Closures in the 1h fire separation will require a fire protection rating of 45min.

Direct compliance with the Building Code would require the use of fire rated assemblies and/or use of rated closures installed in conformance with Sentence 3.1.8.1.(2) for protection of openings in the fire rated separations. It is proposed to provide these openings with the necessary protection on an alternative solution basis.



Design criteria for the proposed glazing systems are based on Tyco Sprinkler Company product literature attached in *Appendix F*. The proposed Tyco WS™ model sprinkler heads have been tested by Underwriter's Laboratories Inc as indicated in the product literature. This test report confirms that glazing protected as described and tested will perform equivalent to a 2h fire separation when exposed to a fire representative of the standard time-temperature curve.

The glazing system to be protected will consist of tempered or heat strengthened glass, in steel or aluminum frames, or butt-jointed storefront glazing. The glazing will be protected by specially oriented Tyco WS™ model sprinklers. No intermediate horizontal mullions will be installed on the glazing. Careful coordination is required between the choice of sprinkler (*vertical pendant sidewall* or *horizontal sidewall*) and vertical mullions depth, spacing and/or configuration.

The proposed sprinkler protected glazing/steel system will include the following features:

- a. The installation of the sprinkler protected glazing will be in accordance with Tyco literature for WS™ model sprinklers (see *Appendix F*).
- b. The glazing system will be hydraulically calculated per NFPA 13 (2007) requirements, based on all glazing sprinklers demand, floor area demand and inside/outside hose allowances.
- c. Sprinkler protection will be provided for both sides of the glazing (see *Appendix E*).
- d. All glazing sprinklers will be served from a wet system. The Sprinkler Engineer will implement appropriate freeze protection measures (if necessary). The Sprinkler Engineer will also coordinate such measures with the project architect (CRP), general contractor, mechanical contractor, etc.
- e. The glazing sprinklers addressed by this alternative solution will be served independently from the water supply for the floor area coverage sprinklers.
- f. Noncombustible baffles will be required between any glazing sprinklers and/or floor area sprinklers that are less than 1.8m (6ft) apart. These will be identified by the sprinkler engineer and coordinated with the design team.
- g. Signage will be provided at the sprinkler control valve advising maintenance personnel that the sprinkler system forms an integral part of an active fire separation. This signage will reference the Fire Safety Plan for maintenance and/or shut down procedures. Both a summary of the Alternative Solution and shutdown / maintenance procedures will be documented in the building Fire Safety Plan.
- h. The glazing assembly will be in steel frames or aluminum frames or will be butt-jointed storefront glazing. The glazing assembly will have no intermediate horizontal mullions (refer to the Tyco literature in *Appendix F* for further details).
- i. Window coverings are not to be installed between the subject glazing sprinklers and the glazing assembly being protected.
- j. Refer to section below for sprinkler details at door locations.



- k. Refer to section below for close proximity fire and pony wall requirements.

The same Tyco WS™ model sprinklers as described above to will be used provide protection for locations in the fire separation where steel panels are proposed. It is our understanding that the proposed steel assembly will consist of 6mm steel panels inserted into a pressed metal frame. Similar to the glazing assembly no intermediate horizontal mullions will be installed on the steel panels. It is noted that steel is a more durable material than glass and is more resistant to breakage. Similar to glazing, the temperature of the steel panels will be kept low enough such as to minimize the transmission of heat to the adjacent floor area. Furthermore, the panels will prevent the projection of flames out of the labs in the event of a fire in the labs. It is therefore our opinion that steel assembly protected by Tyco WSTM sprinkler heads will provide an equivalent performance to the sprinkler protected glazing system.

### Doors

Doors and other openings are acknowledged as being a special case in the Building Code requiring a lesser degree of fire protection, such as less onerous temperature rise rating requirements and lower fire protection ratings. This is in part based on the practical difficulty of meeting the requirements for fire separations in a door and the reduced likelihood of storage of combustible materials immediately adjacent to the openings. In this case, as the doors are used for access and egress, as such the likelihood of storage materials in front of the doors is remote and therefore, the likelihood of a significant fire developing is minimal. For this project, the doors located in the 1h fire separation require a 45min fire protection rating per Sentence 3.1.8.10.(1).

It is proposed to provide protection for doors not meeting the 45min fire resistance rating in the form of quick response sprinklers. The sprinklers will be located above each opening on both sides of the door to provide an equivalent level of fire protection to that required for doors by the Building Code.

The proposed water curtain sprinkler systems will be based on the requirements of NFPA 13 (2007) and as summarized below:

<i>sprinkler heads</i>	quick response to match floor area sprinklers.
<i>sprinkler position</i>	6in (150mm) to 12in (300mm) from plane of opening being protected. To be located on both sides of door.
<i>sprinkler spacing</i>	openings under 6ft (1.8m) in width, one sprinkler centered in opening, openings over 6ft (1.8m), sprinklers spaced at 6ft (1.8m) o.c.; at no time more than 3ft (0.9m) to edge of opening from sprinkler.
<i>sprinkler obstruction</i>	sprinklers are to be located to provide unobstructed spray pattern; pipes, ducts, fixtures or other obstructions changing spray pattern of the subject sprinklers are not permitted. The sprinklers should be located to meet all obstruction requirements of NFPA 13 (2007).
<i>sprinkler piping</i>	wet system to match the floor area system.
<i>sprinkler supply</i>	sprinklers addressed by this alternative solution will be served independently from the water supply for the floor area system.



<i>pressure/flow</i>	26usgpm/sprinkler.
<i>hydraulic calculation</i>	to be hydraulically calculated based on the water curtain sprinkler demand, floor area demand, and inside/outside hose allowances as required by NFPA 13.
<i>baffles</i>	noncombustible baffles to be provided between any sprinklers located closer than 6ft (1.8m) apart and in accordance with NFPA 13.

Sprinklers used in a water curtain sprinkler system are recognized as being highly reliable, with a reliability rate exceeding 95%. In comparison, a study by Factory Mutual indicates that more than 15% of all fire doors in the study failed to operate properly. Therefore, a water curtain will provide more reliable protection than a directly complying closure equipped with a self-closer.

Additional technical support of this approach for protection of doors is found in the publication “*Fire Protection of Windows using Sprinklers*” by Kim and Lougheed, published in the IRC Construction Technology Update No. 12. A copy of this document is available upon request.

Therefore, the proposed protection for the door assemblies, using standard quick response sprinkler heads located on each side of the openings will provide a level of fire protection required for these door assemblies. With respect to temperature rise limit for these doors, in accordance with Table 3.1.8.15, the subject doors do not require a temperature rise rating.

As required by the Code, doors in required fire separations will have latches and self-closing devices.

### **Close Proximity Fire**

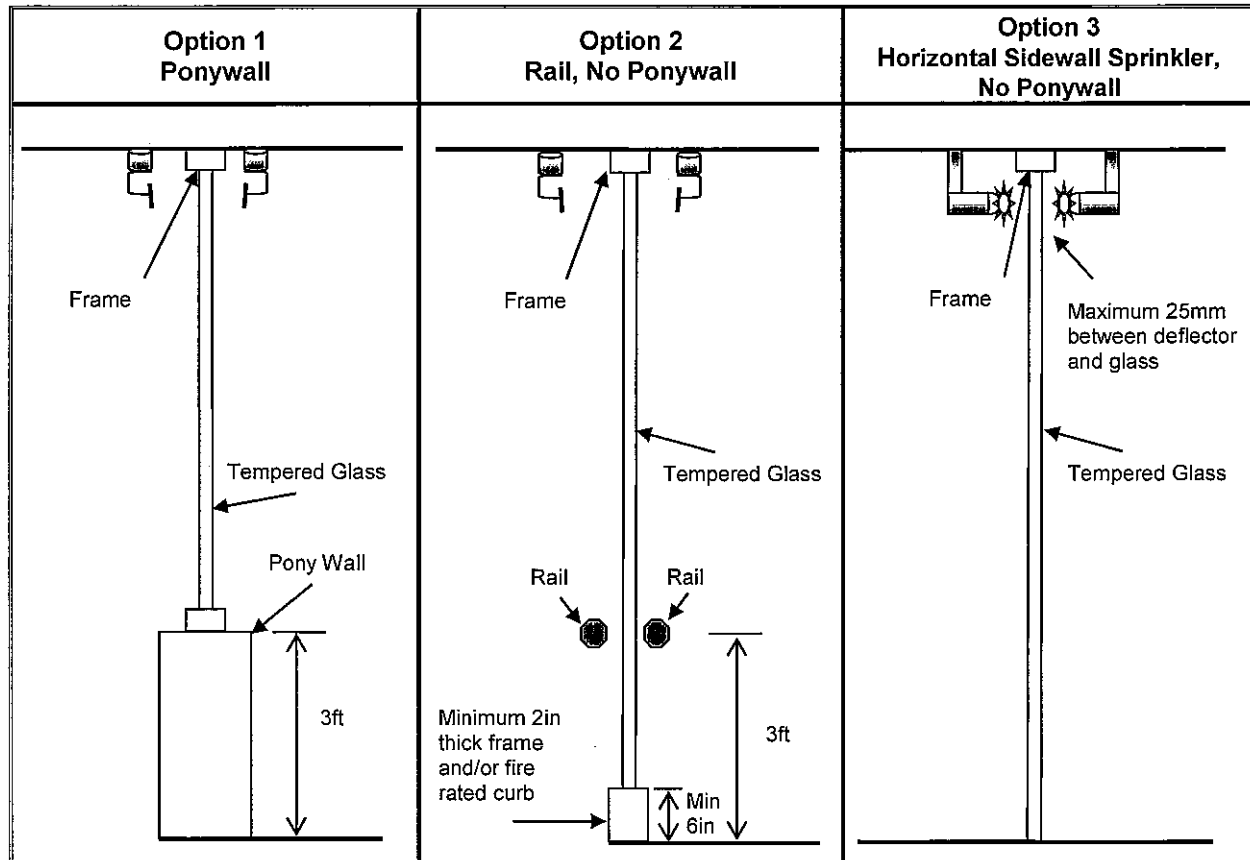
The listing and test protocol for the Tyco model WS™ sprinklers permit their installation at varying distances from the glass up to 12in. As a result, there is concern that a ‘close proximity fire’ located adjacent to the glazing could fracture the glazing prior to sprinkler activation, resulting in a requirement to keep combustibles a minimum 50.8mm (2in) from the glazing. The Tyco literature (copy in *Appendix F*) literature indicates that this can be accomplished by a 3ft high pony wall measured from the finished floor or any other method acceptable to the AHJ.

In order to keep combustibles away from the glass, the following three options are proposed:

- **3ft High Pony Wall:** Providing a 3ft high pony wall to keep combustibles at least 2in away from the glass. This option will be in conformance with Tyco literature (see diagram Option 1).
- **6in Curb and Guard/Handrail Combination:** Two features are proposed for this option; a 6in high curb located at the floor level that will extend out 2in from the glazing, and a handrail located at height of 3ft (36in) from the finished floor on the corridor side. These features are intended to keep combustibles not less than 2in away from the glazing (see diagram Option 2).
- **Horizontal Sidewall Sprinkler:** Studies lead by Dr. Andrew Kim of NRC, documented in reports entitled “Fire Exposure of Glazing” and “The Protection of Glazing Systems with Dedicated Sprinklers” (Journal of Fire Protection Engineering 2 (2), 1990, pages 45– 59) reported that fast-response window sprinklers located between 12.7mm to 25mm from the glass surface were able to



actuate and protect tempered glass from slow-growing fires located in close proximity to the glass. Based on this finding, Tyco WS™ horizontal sidewall window sprinklers positioned within 12.7mm to 25mm from the glazing can be installed to address the clearance of combustibles (see diagram Option 3).



We note that the glazing will be designed meet the lateral loading requirements for walls and guards as required by the Building Code. This will be coordinated and reviewed by the project architect (CRP).

#### Conclusion

In summary, based on the foregoing design criteria for the sprinkler protected glazing system, the proposed Alternative Solution will achieve the minimum level of performance required by the applicable acceptable solution under Division B of the BC Building Code 2012.





## 22. SUMMARY

This report has described the approach to Building Code compliance as well as the proposed Alternate Solutions for the horizontal expansion of the existing Brimacombe building to house the Quantum Mechanics Institute (QMI) at 2355 East Mall in Vancouver (UBC), BC.

Design consultants for this project will be required to incorporate all criteria for the proposed Alternative Solution systems into the construction documents to ensure correctness of the installation. Prior to installation of the Alternative Solution measures, appropriate design documentation for this project will be reviewed by GHIL for consistency with the Alternative Solutions as accepted by the Authority Having Jurisdiction. It is noted that GHIL will only review design documentation relating to the proposed Alternative Solutions that are beyond Building Code requirements. It is expected that components that are required by the Building Code, will be reviewed by appropriate design professionals.

GHIL will also conduct discretionary field reviews to observe compliance of the building and fire protection systems as installed, relative to the Alternative Solutions as discussed in this report. Upon satisfactory installation, confirmation will be submitted to the Authority Having Jurisdiction to be included in the application for final occupancy inspection.

Based on the protection measures outlined in this report, the proposed Alternative Solutions will achieve the minimum level of performance required by the applicable acceptable solutions under Division B of the BC Building Code 2012. Therefore, this report has demonstrated satisfactory compliance with the fire safety requirements of the BC Building Code 2012.

Prepared by,  
**GHIL CONSULTANTS LTD**

Reviewed by,

K. M. Gary Chen, MASC, P Eng

David W. Graham, P Eng, CP, FEC

### \* Limitation of Liability \*

This technical report addresses only specific Building Code issues under the GHIL/Client agreement for this project and shall in no way be construed as exhaustive or complete. This technical report is issued only to the Authority Having Jurisdiction, the Client, Prime Consultants and Fire Suppression Designer to this project and shall not be relied upon (without prior written authorization from GHIL) by any other party.

GC/DWG/NO/jm/clk/le

P:\PRJ\18\1899.75 - UBC Quantum Matter Institute\Report\Report (1899.75).doc

# **Appendix A**

Drawings



[illegible]

**CODE COMPLIANCE  
DRAWINGS BY**

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F: 604 689 4410

[illegible]

The applicable Building Code is the CBC 2012.

**General Notes:**

**Public**

UBC QMI & AMPEL  
2000 W. 10th Ave. #74312  
Vancouver, B.C. V6M 1Y8

7240 East Mall, Vancouver, BC  
 Tel: 604-681-1001  
 Fax: 604-681-1002  
 E-mail: [info@vancouver.ca](mailto:info@vancouver.ca)  
 Website: [www.vancouver.ca](http://www.vancouver.ca)

Level -1 and  
Level -2 Plans

CC 1.00

**CODE COMPLIANCE LEGEND**

10 HR. FRR		Enter		Travel Distance
34 HR. FRR				Exit Location
1 HR. FRR				Exit Location B
1 1/2 HR. FRR				Exit Location C
2 HR. FRR				

Alternative Solution C Notes (Refer to Appendix E)

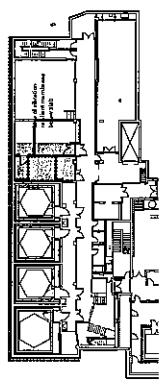
protected by Tyco WS™ sprinklers

Steel panels protected by Tyco WSTM sprinklers

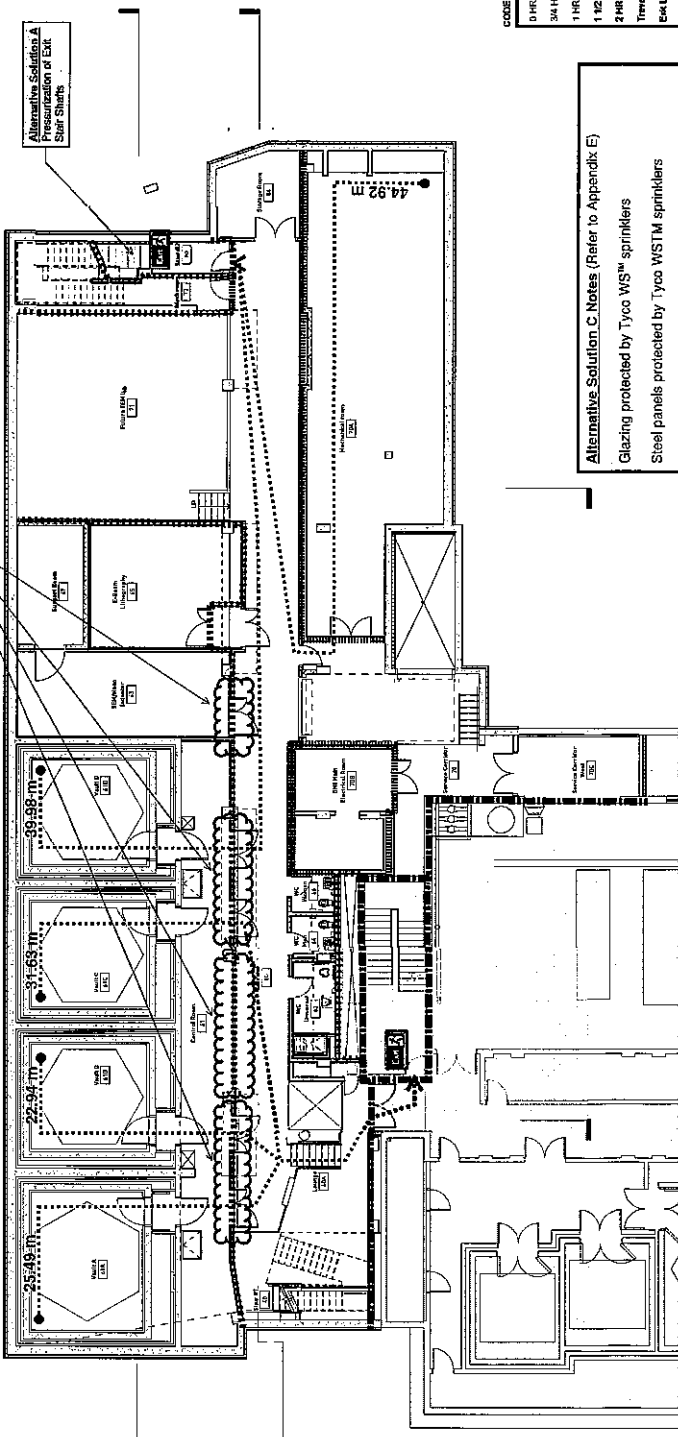
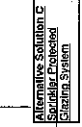
Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating



gyptian Low Vibration = Level +2



Propylan Low Vibration - Level-1



### Alternative Solution A Pressurization of Exit

Level -2 Plan

Level - 1 Plan

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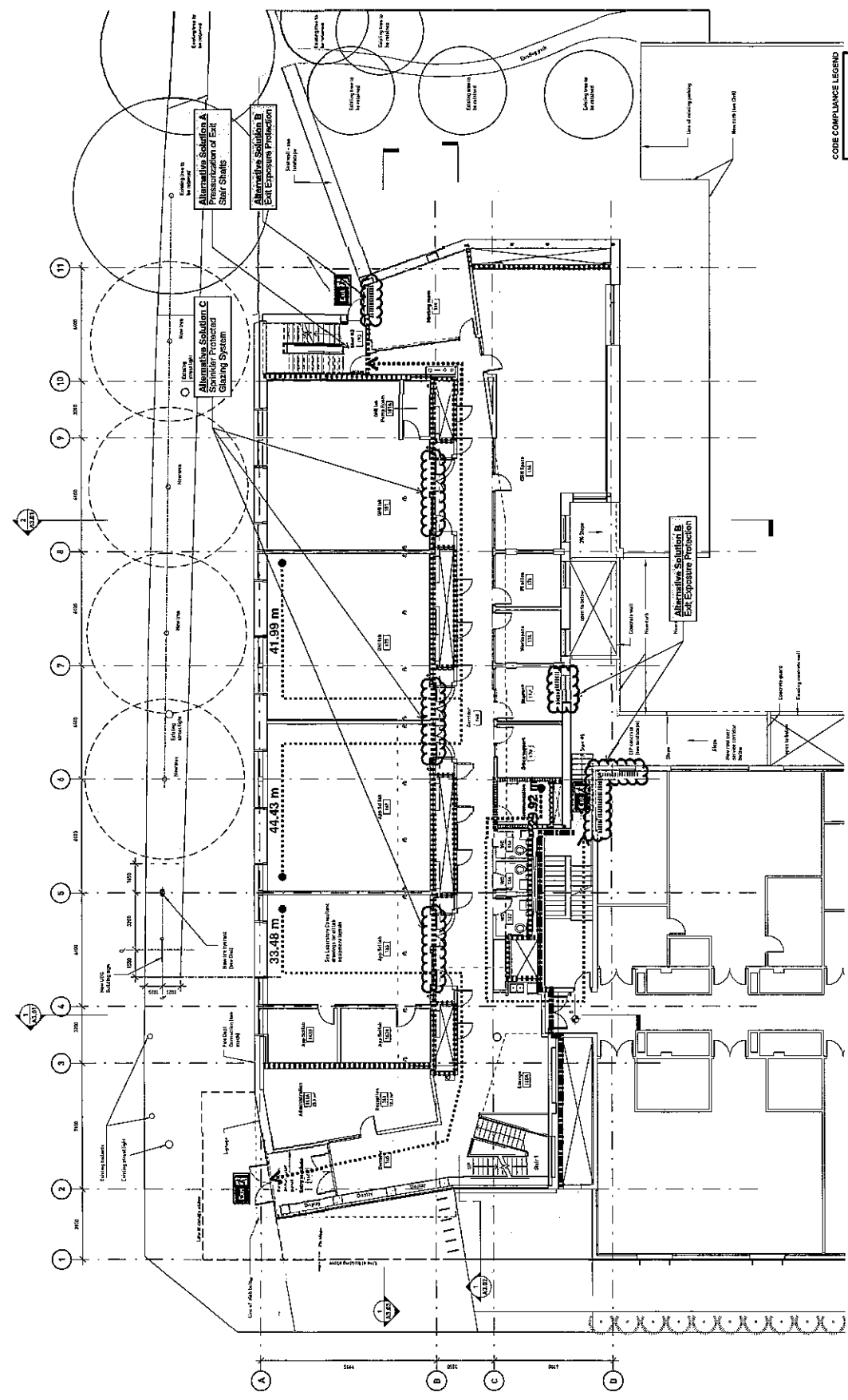
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The applicable Building Code is the BCBC 2012.

not for construction

**public**  
 UBC QMI Addition  
 2500 EAST AVE, VANCOUVER, BC  
 V6S 3K6  
 UBCO 188.75  
 1-30  
 2014-11-24  
 JAMES WONG  
 JAMES WONG

Main Level Plan  
 CC 1.01



**CODE COMPLIANCE LEGEND**

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**Alternative Solution C Notes (Refer to Appendix E)**  
 Glazing protected by Tyco WS<sup>TM</sup> sprinklers  
 Steel panels protected by Tyco WSTM sprinklers  
 Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating

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- | NO. | DATE     | DESCRIPTION       |
|-----|----------|-------------------|
| 1   | 01/12/14 | ISSUED FOR PERMIT |
| 2   | 01/12/14 | ISSUED FOR PERMIT |
| 3   | 01/12/14 | ISSUED FOR PERMIT |
| 4   | 01/12/14 | ISSUED FOR PERMIT |
| 5   | 01/12/14 | ISSUED FOR PERMIT |
| 6   | 01/12/14 | ISSUED FOR PERMIT |
| 7   | 01/12/14 | ISSUED FOR PERMIT |

**CODE COMPLIANCE**  
**ALTERNATIVE SOLUTIONS**  
**CONFORMANCE**  
**DRAWINGS BY**

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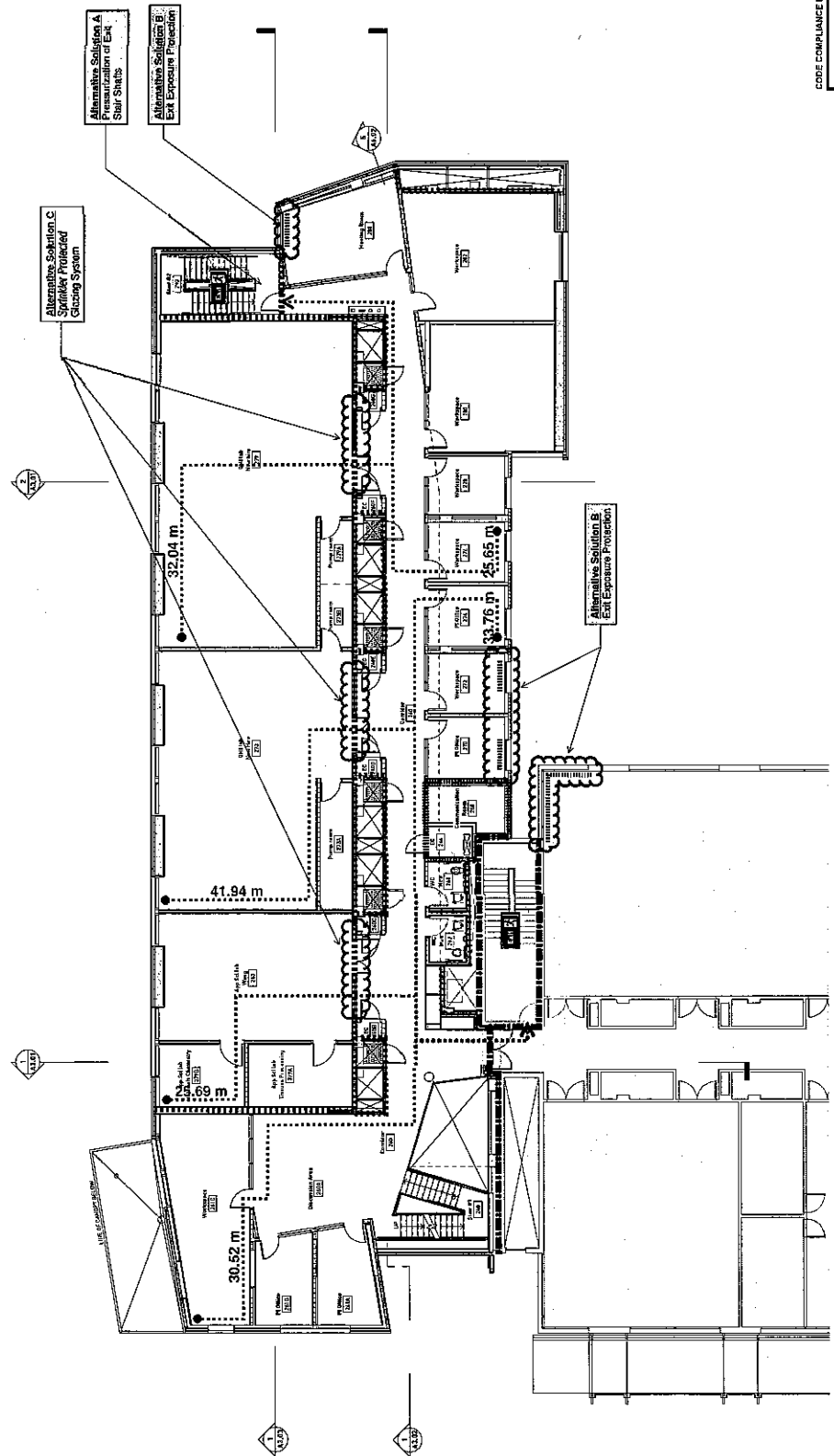
**public**  
 UBC QMI & AMPEL  
 2500 Main Street, Suite 100  
 Vancouver, BC V6C 1T2  
 F. 604 680 4410

**Level 2 Plan**  
 CC 1.02

**CODE COMPLIANCE LEGEND**

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**Alternative Solution C Notes (Refer to Appendix E)**  
 Glazing protected by Tyco WS<sup>TM</sup> sprinklers  
 Steel panels protected by Tyco WSTM sprinklers  
 Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating



1. Level 2 Plan  
 1/2000 1:100



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 F: 604 680 4410

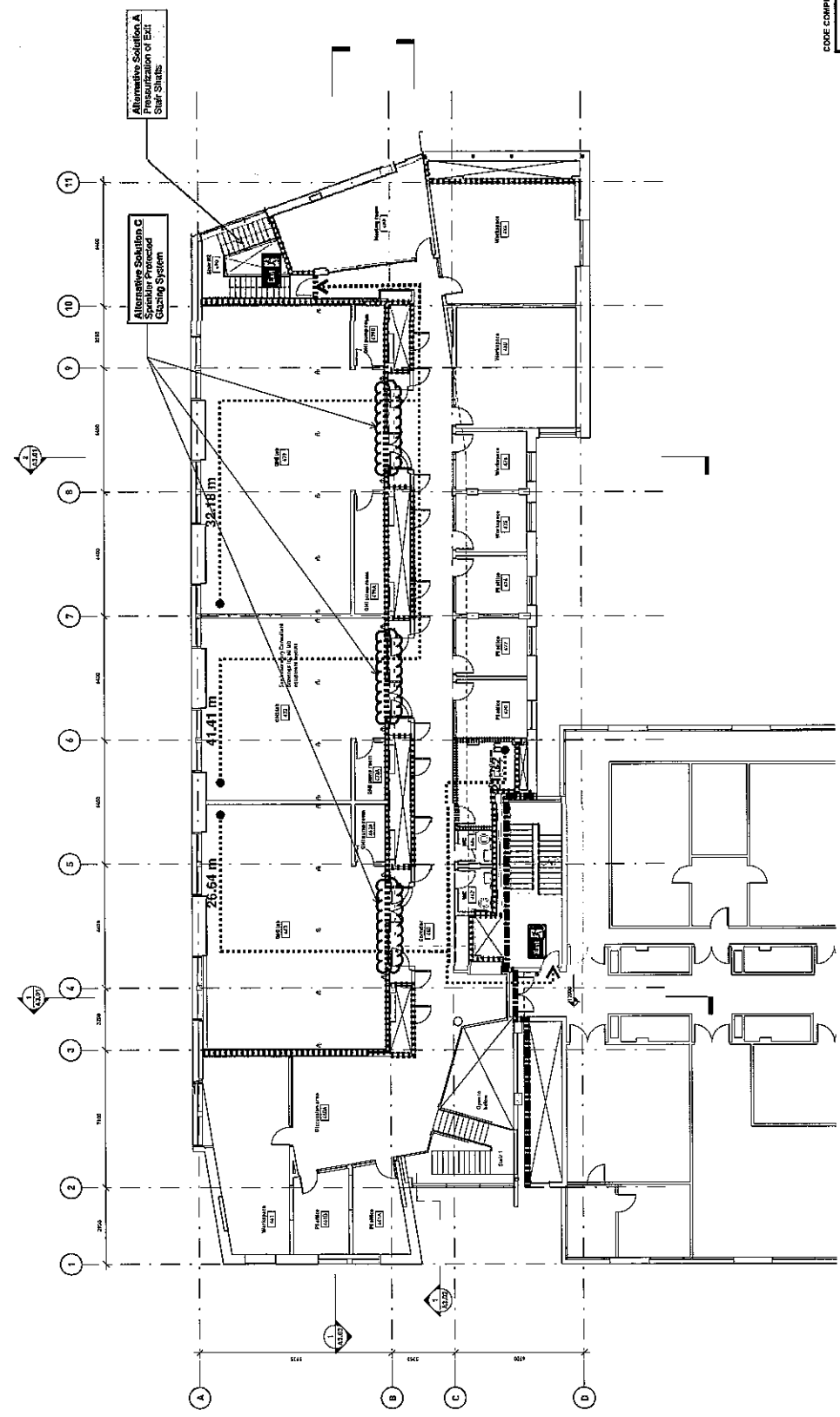
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not for construction

**public**  
 UBC QMI Addition

2550 East Main, Vancouver, BC  
 V6A 4K6  
 UBC QMI  
 2014-11-24

Level 4 Plan  
 CC 1.04



**CODE COMPLIANCE LEGEND**

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**Alternative Solution C Notes (Refer to Appendix E)**  
 Glazing protected by Tyco WS<sup>TM</sup> sprinklers  
 Steel panels protected by Tyco WSTM sprinklers  
 Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating

1. Level 4 Plan  
 3.000 1:100



Case	Date	Referral
1	2011.11.20	Referral for 2nd visit by phone
2	2012.02.01	Referral for 3rd visit by phone
3	2012.03.28	Referral for 4th visit by phone

**GHL**  
**CONSULTANTS LTD**

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\*\*\*\*\*

**Public**

8136 - 34939 CASH/REVENUE  
 34939/18 87 940 103  
 16 5 000 500 00/2  
 CASH 236 677 2733

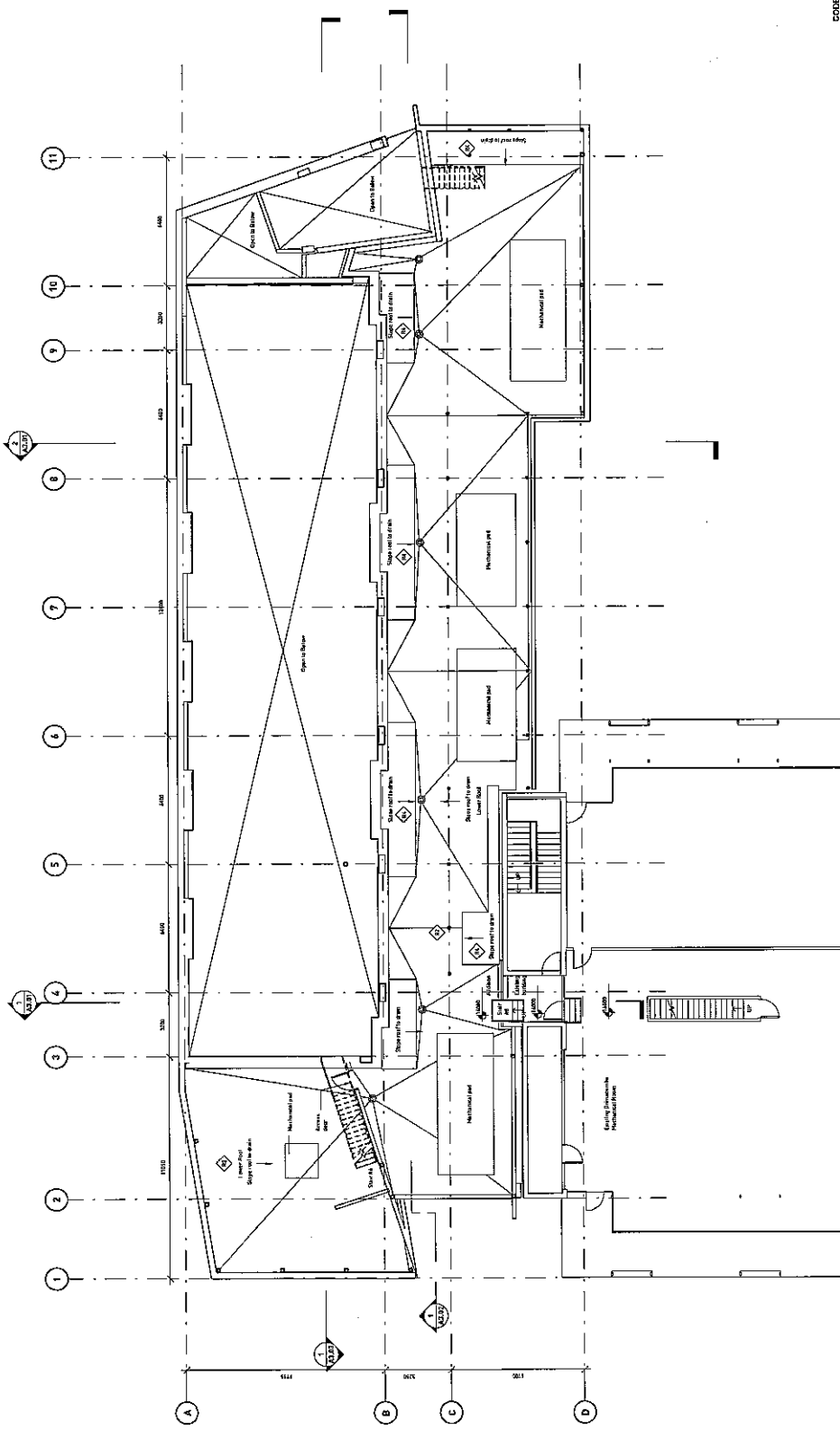
UVC QMI Addition

235-5 East Mall, Vancouver, BC  
 604-681-5555  
 UBC-1898.75  
 40000  
 100  
 2014-11-26  
 MARKED BY: SN  
 CHECKED BY: GC

Lower Roof Plan  
1"=10' 0"  
CC 1.05

**CODE COMPLIANCE LEGEND**

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1 HR. FRR	1111111111111111	↑	↑	↑
1 1/2 HR. FRR	1111111111111111	↑	↑	↑
2 HR. FRR	1111111111111111	↑	↑	↑
Travel Distance		↑	↑	↑
Exit Location		↑	↑	↑
All Solution 8		↑	↑	↑
All Solution 9		↑	↑	↑

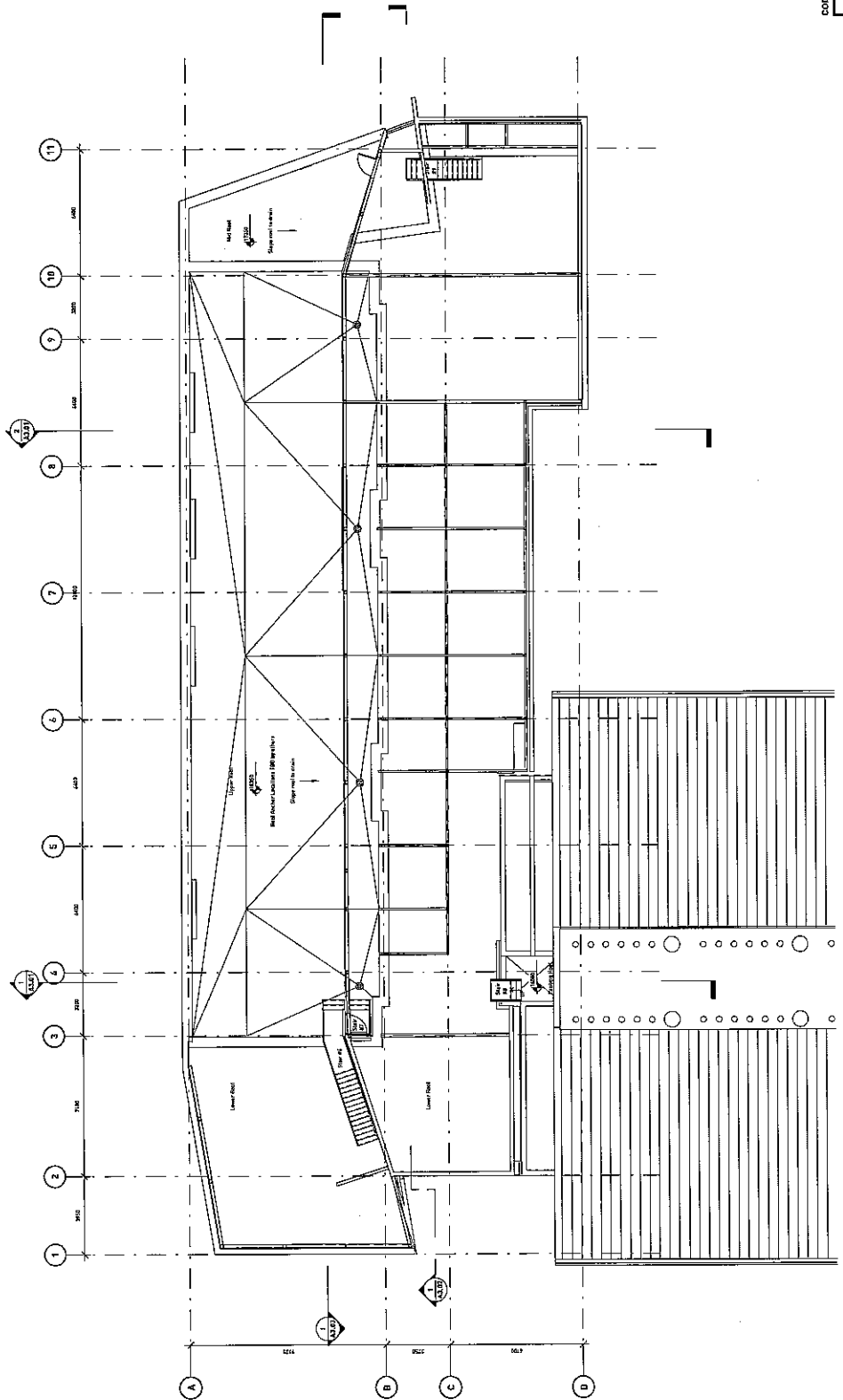


1 Lower Roof Plan  
7/23/01 1.100

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 1000 ...  
 Vancouver, BC V6C 1V2  
 P: 604 690 4460  
 F: 604 690 4410

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**CODE COMPLIANCE LEGEND**

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3/4 HR FR	3/4 HR FR
1 HR FR	1 HR FR
1 1/2 HR FR	1 1/2 HR FR
2 HR FR	2 HR FR
Truss Diagram	Truss Diagram
Eng. Location	Eng. Location
All Solution &	All Solution &
All Solution C	All Solution C

Upper Roof Plan  
 1/24/21 1:10

not for construction

public

UBC QMI Addition

2555 ...  
 1000 ...  
 Vancouver, BC V6C 1V2  
 P: 604 690 4460  
 F: 604 690 4410

Upper Roof Plan

CC 1.06

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- 1. 100% COMPLETE
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- 4. 100% COMPLETE
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- 6. 100% COMPLETE
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The applicable Building Code is the BCBC 2012.

UBC QMI & AMPEL

public

Sections  
 CC 3.01

2012 Building Code, Vancouver, BC  
 100-1000-15  
 1.100  
 December 20, 2015

CODE COMPLIANCE LEGEND

0 HR FR  
 30 HR FR  
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Time	Location	Activity
10:00-10:15	Room 101	Introduction to the course
10:15-10:30	Room 101	Review of the syllabus
10:30-10:45	Room 101	Discussion of the first assignment
10:45-11:00	Room 101	Break
11:00-11:15	Room 101	Introduction to the second assignment
11:15-11:30	Room 101	Discussion of the second assignment
11:30-11:45	Room 101	Break
11:45-12:00	Room 101	Introduction to the third assignment
12:00-12:15	Room 101	Discussion of the third assignment
12:15-12:30	Room 101	Break
12:30-12:45	Room 101	Introduction to the fourth assignment
12:45-13:00	Room 101	Discussion of the fourth assignment
13:00-13:15	Room 101	Break
13:15-13:30	Room 101	Introduction to the fifth assignment
13:30-13:45	Room 101	Discussion of the fifth assignment
13:45-14:00	Room 101	Break
14:00-14:15	Room 101	Introduction to the sixth assignment
14:15-14:30	Room 101	Discussion of the sixth assignment
14:30-14:45	Room 101	Break
14:45-15:00	Room 101	Introduction to the seventh assignment
15:00-15:15	Room 101	Discussion of the seventh assignment
15:15-15:30	Room 101	Break
15:30-15:45	Room 101	Introduction to the eighth assignment
15:45-16:00	Room 101	Discussion of the eighth assignment
16:00-16:15	Room 101	Break
16:15-16:30	Room 101	Introduction to the ninth assignment
16:30-16:45	Room 101	Discussion of the ninth assignment
16:45-17:00	Room 101	Break
17:00-17:15	Room 101	Introduction to the tenth assignment
17:15-17:30	Room 101	Discussion of the tenth assignment
17:30-17:45	Room 101	Break
17:45-18:00	Room 101	Introduction to the eleventh assignment
18:00-18:15	Room 101	Discussion of the eleventh assignment
18:15-18:30	Room 101	Break
18:30-18:45	Room 101	Introduction to the twelfth assignment
18:45-19:00	Room 101	Discussion of the twelfth assignment
19:00-19:15	Room 101	Break
19:15-19:30	Room 101	Introduction to the thirteenth assignment
19:30-19:45	Room 101	Discussion of the thirteenth assignment
19:45-20:00	Room 101	Break
20:00-20:15	Room 101	Introduction to the fourteenth assignment
20:15-20:30	Room 101	Discussion of the fourteenth assignment
20:30-20:45	Room 101	Break
20:45-21:00	Room 101	Introduction to the fifteenth assignment
21:00-21:15	Room 101	Discussion of the fifteenth assignment
21:15-21:30	Room 101	Break
21:30-21:45	Room 101	Introduction to the sixteenth assignment
21:45-22:00	Room 101	Discussion of the sixteenth assignment
22:00-22:15	Room 101	Break
22:15-22:30	Room 101	Introduction to the seventeenth assignment
22:30-22:45	Room 101	Discussion of the seventeenth assignment
22:45-23:00	Room 101	Break
23:00-23:15	Room 101	Introduction to the eighteenth assignment
23:15-23:30	Room 101	Discussion of the eighteenth assignment
23:30-23:45	Room 101	Break
23:45-24:00	Room 101	Introduction to the nineteenth assignment
24:00-24:15	Room 101	Discussion of the nineteenth assignment
24:15-24:30	Room 101	Break
24:30-24:45	Room 101	Introduction to the twentieth assignment
24:45-25:00	Room 101	Discussion of the twentieth assignment
25:00-25:15	Room 101	Break
25:15-25:30	Room 101	Introduction to the twenty-first assignment
25:30-25:45	Room 101	Discussion of the twenty-first assignment
25:45-26:00	Room 101	Break
26:00-26:15	Room 101	Introduction to the twenty-second assignment
26:15-26:30	Room 101	Discussion of the twenty-second assignment
26:30-26:45	Room 101	Break
26:45-27:00	Room 101	Introduction to the twenty-third assignment
27:00-27:15	Room 101	Discussion of the twenty-third assignment
27:15-27:30	Room 101	Break
27:30-27:45	Room 101	Introduction to the twenty-fourth assignment
27:45-28:00	Room 101	Discussion of the twenty-fourth assignment
28:00-28:15	Room 101	Break
28:15-28:30	Room 101	Introduction to the twenty-fifth assignment
28:30-28:45	Room 101	Discussion of the twenty-fifth assignment
28:45-29:00	Room 101	Break
29:00-29:15	Room 101	Introduction to the twenty-sixth assignment
29:15-29:30	Room 101	Discussion of the twenty-sixth assignment
29:30-29:45	Room 101	Break
29:45-30:00	Room 101	Introduction to the twenty-seventh assignment
30:00-30:15	Room 101	Discussion of the twenty-seventh assignment
30:15-30:30	Room 101	Break
30:30-30:45	Room 101	Introduction to the twenty-eighth assignment
30:45-31:00	Room 101	Discussion of the twenty-eighth assignment
31:00-31:15	Room 101	Break
31:15-31:30	Room 101	Introduction to the twenty-ninth assignment
31:30-31:45	Room 101	Discussion of the twenty-ninth assignment
31:45-32:00	Room 101	Break
32:00-32:15	Room 101	Introduction to the thirtieth assignment
32:15-32:30	Room 1	

**CODE COMPLIANCE  
DRAWINGS BY**

**GHL**  
**CONSULTANTS LTD**  
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The City Centre, Toronto, Ontario

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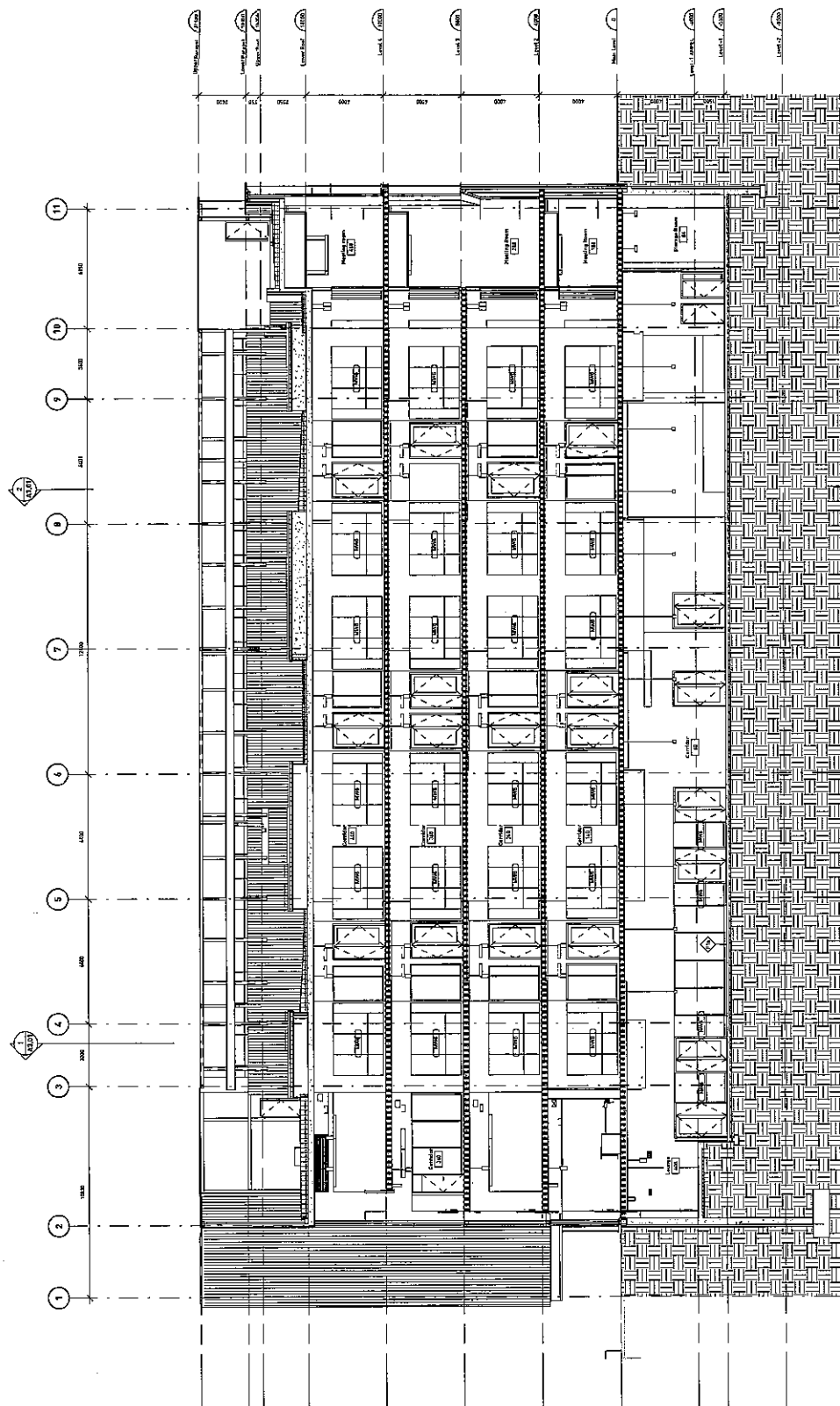
**General Medicine**

**Public**

JBC QMI &amp; AMPÉL

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Canada  
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Sections

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**CODE COMPLIANCE LEGEND**

0 HR FRR	
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**CODE COMPLIANCE**  
**BRANIFF BY**  
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 409 Denison Street, Suite 550  
 Toronto, Ontario M5T 1T2  
 P: 604 690 4440  
 F: 604 690 4419

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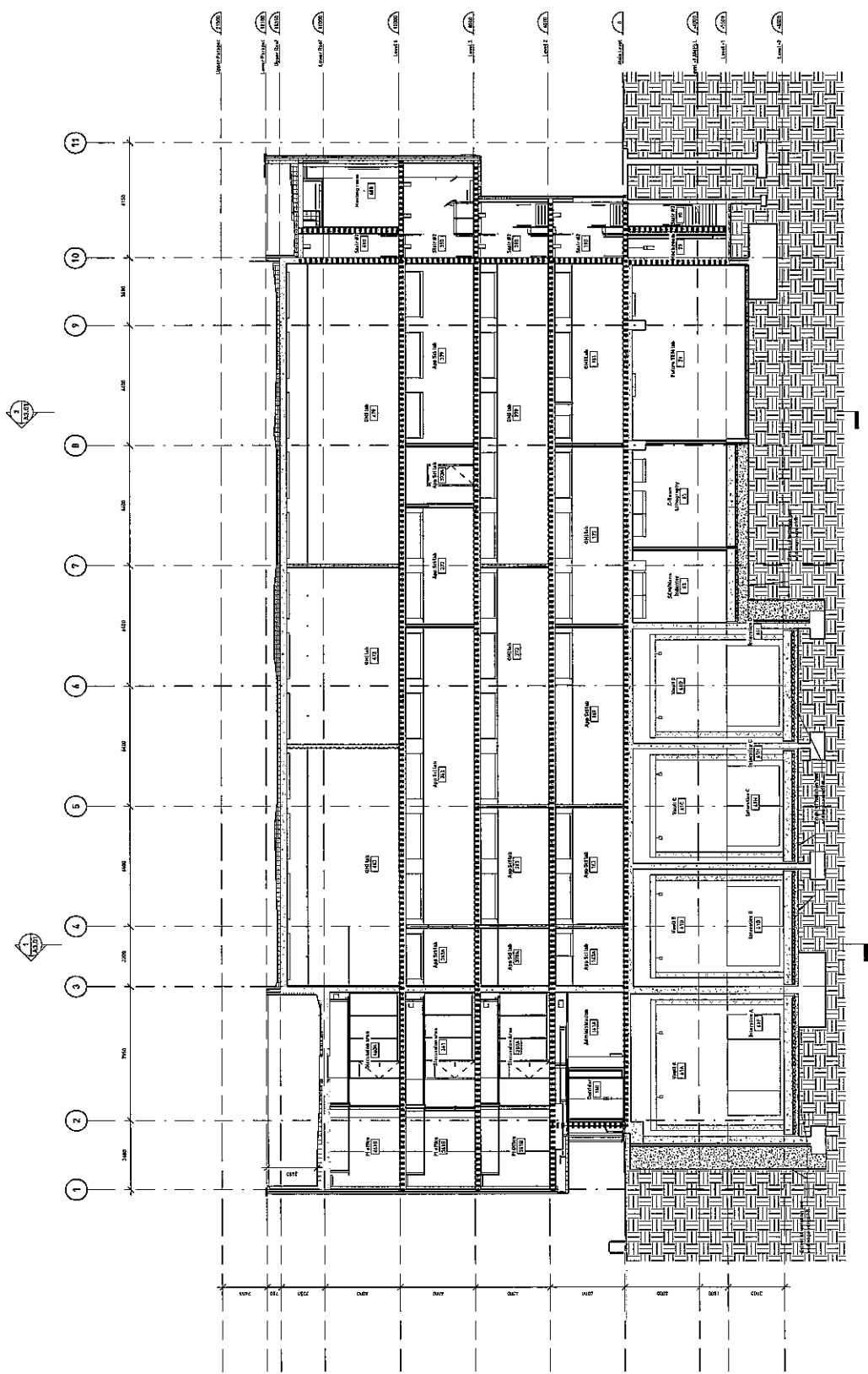
The applicable Building Code is the B.C.B.C. 2012.

**public**  
 UBC QM1 & AMPEL

**public**  
 UBC QM1 & AMPEL

2012 BC Building Code  
 2012 BC Building Code  
 2012 BC Building Code  
 2012 BC Building Code

**Sections**  
 CC 3.03



**CODE COMPLIANCE LEGEND**

0 HR FR	11111111
304 HR FR	11111111
1 HR FR	11111111
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2 HR FR	11111111

1 Section of Car-House Building Street  
 1/10/20 1:100

# **Appendix B**

Occupant Load Calculations

## Occupant Load & Exit Capacity Calculations

**Project:** UBC Quantum Matter Institute (AMPEL Addition)  
**Address:** University of British Columbia, Vancouver, BC  
**GHL File:** UBC-1899.75

**Date:** November 26, 2013  
**Code:** BCBC 2012  
**Prepared By:** GC

Level / Compartment	Area m <sup>2</sup>	OLF m <sup>2</sup> /per	Occupant Load Calculated Persons	Level / Compartment	Area m <sup>2</sup>	OLF m <sup>2</sup> /per	Occupant Load Calculated Persons
<b>NEW ADDITION</b>				<b>EXISTING</b>			
<b>Basement Level</b>				<b>Basement Level</b>			
- Labs	238.70	9.3	26	- General Storage	52.10	46	1
- Lounge	20.90	9.3	2	- Acid Neutralizer	35.30		
- Unfinished Space 12	243.30	9.3	26	- Building Maintenance	23.00		
- Unfinished Space 13	103.60	9.3	11	- Crwl Space	236.50		
				- Transformer	139.70		
				- Mechanical	211.20		
			<b>65</b>				<b>1</b>
<b>Main Level</b>				<b>Main Level</b>			
- Office Support Room	22.30	9.3	2	- Dirty Labs	877.20	9.3	94
- Workspace	206.30	9.3	22	- Offices	95.50	9.3	10
				- Thin Films	140.20	9.3	15
				- Polymers	104.50	9.3	11
				- Magnetism	139.70	9.3	15
				- SAML	104.50	9.3	11
				- Composites	211.20	9.3	23
			<b>25</b>				<b>186</b>
<b>Level 2</b>				<b>Level 2</b>			
- Workspace	189.50	9.3	20	- Offices	30.30	9.3	3
- Lab	428.30	9.3	46	- Lounge	93.10	9.3	10
- Meeting Room	36.70	9.3	4	- Supercond.	244.20	9.3	26
				- Magnetism	104.50	9.3	11
				- Powder	69.30	9.3	7
				- Microstructural	69.30	9.3	7
				- SAML	69.30	9.3	7
				- Superconductivity	139.70	9.3	15
			<b>71</b>				<b>89</b>
<b>Level 3</b>				<b>Level 3</b>			
- Workspace	185.00	9.3	20	- Offices	30.30	9.3	3
- Meeting Room	58.70	9.3	6	- Seminar	93.10	9.3	10
- Labs	367.30	9.3	39	- Opto-elect. I	69.30	9.3	7
- Lounge	20.90	9.3	2	- Opto-elect. II	69.30	9.3	7
				- Thin Films I	163.90	9.3	18
				- Thin Films II	45.10	9.3	5
				- Electronics	34.10	9.3	4
				- Surface Anal.	209.00	9.3	22
				- Semiconductor	104.50	9.3	11
			<b>68</b>				<b>88</b>
<b>Level 4</b>				<b>Level 4</b>			
- Workspace	174.10	9.3	19	- Offices	30.30	9.3	3
- Labs	428.30	9.3	46	- Grand offices	93.10	9.3	10
- Meeting Room	36.70	9.3	4	- Thin Films	173.80		
				- Opto-elect.	139.70		
				- Ion Implanter	34.10		
				- Clean Labs	252.10		
				- Mol. Beam	69.30	9.3	7
			<b>69</b>				<b>21</b>
<b>Total</b>			<b>298</b>	<b>Total</b>			<b>385</b>

### NOTES:

- Occupant Load Factors are from Table 3.1.17.1 of the BC Building Code 2012, unless otherwise indicated
- Area of calculation excludes circulation areas (i.e., stairs, ramps, elevators, lobbies, corridors, public washrooms, etc).

## **Appendix C**

Email Correspondence (regarding exit signs)



## Gary Chen (GHL)

---

**From:** Jeff Young <young@phas.ubc.ca>  
**Sent:** June-04-14 2:36 PM  
**To:** Gary Chen (GHL)  
**Cc:** Gordon, Barbara; Loewen, Ron; 'Craig Simms'  
**Subject:** RE: QMI - floor plans

I recall flagging this issue a few months ago.

My best guess at a realistic load for the existing AMPEL (interpreting load to mean roughly how many people, on average, are actually on the floor during regular working hours):

Basement:	10
1 <sup>st</sup>	60
2 <sup>nd</sup>	50
3 <sup>rd</sup>	50
4 <sup>th</sup>	60

If you are looking for a "will not be exceeded" load, maybe you add 15% to each of these?

The new building would logically be a bit lower, with a slightly higher (relatively) in the basement than the existing.

I'm presuming we ignore the fact that the 2<sup>nd</sup> floor is shelled at the moment, so for the new addition maybe the numbers, including the 15% are:

Basement:	20
1 <sup>st</sup>	60
2 <sup>nd</sup>	65
3 <sup>rd</sup>	65
4 <sup>th</sup>	65

Hope this helps.

Jeff F. Young PhD, PEng  
Professor, Department of Physics and Astronomy  
Director, Advanced Materials and Process Engineering Laboratory (AMPEL)  
University of British Columbia  
6224 Agricultural Rd  
Vancouver, BC, V6T 1Z1  
young@phas.ubc.ca  
(604) 822-8779

---

**From:** Gary Chen (GHL) [mailto:gc@ghl.ca]  
**Sent:** June-04-14 2:18 PM  
**To:** 'Jeff Young'  
**Cc:** Gordon, Barbara; Loewen, Ron; 'Craig Simms'  
**Subject:** RE: QMI - floor plans

Hi Jeff

We had our initial meeting with Campus & Community Planning yesterday regarding the QMI - code issues. One of the items that they would like us to confirm is the occupant loads. As noted in my earlier email, we feel the occupant load in the existing facility and the future expansion are more appropriately represented by the "office" load factor, instead of the "laboratory" load factor, which the Building Code assumes to be a teaching lab.

Can you confirm if the occupant loads below is consistent with your understanding of the occupant load in the building (existing and new). Is it reasonable to assume that this number of people will not be exceeded?

	Occupant Load (persons)		
	New Addition (QMI)	Existing Brimacombe	Total (New + Existing)
Basement	47	1	48
1 <sup>st</sup> storey	61	186	247
2 <sup>nd</sup> storey	68	89	157
3 <sup>rd</sup> storey	67	88	155
4 <sup>th</sup> storey	65	21	86
<b>Total</b>	<b>308</b>	<b>385</b>	<b>693</b>

Thanks

**K M Gary Chen** MASc, P Eng

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Building Codes & Fire Science

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---

**From:** Jeff Young [mailto:young@phas.ubc.ca]  
**Sent:** November-26-13 10:14 AM  
**To:** Gary Chen (GHL); Loewen, Ron; 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

Gary,

AMPEL and the extension are exclusively research buildings. There are no classrooms or undergraduate style teaching laboratories.

Jeff F. Young PhD, PEng  
Professor, Department of Physics and Astronomy  
Director, Advanced Materials and Process Engineering Laboratory (AMPEL)  
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[young@phas.ubc.ca](mailto:young@phas.ubc.ca)  
(604) 822-8779

---

**From:** Gary Chen (GHL) [<mailto:gc@ghl.ca>]  
**Sent:** November-26-13 10:06 AM  
**To:** 'Jeff Young'; Loewen, Ron; 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

Hi Jeff

Can you confirm that the AMPEL facility (existing and new) is intended for research, and not as a teaching lab.

If it's for research, we can rationalize that the occupant load is more comparable to an office load of 9.3 m<sup>2</sup> / person – that the occupants in the building are there to work.

A teaching lab would be like a high school chemistry lab or a first / 2<sup>nd</sup> year chemistry lab where we have significantly more people in the lab and is for the purpose of learning... The code assigns this type of space a load of 4.6m<sup>2</sup> /person.

With the 9.3 load I get 385 persons total for the existing AMPEL building and 298 for the expansion, which may still seem conservative to you, but is a significant relaxation from the occupant load assigned by the previous consultant (in 1992) for the existing space.

Thanks

**K M Gary Chen** MASc, P Eng

**GHL CONSULTANTS LTD**

Building Codes & Fire Science

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---

**From:** Jeff Young [<mailto:young@phas.ubc.ca>]  
**Sent:** November-25-13 4:30 PM  
**To:** Loewen, Ron; Gary Chen (GHL); 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

Thanks Ron.

My “off the top of my head” estimate was something just shy of 200, and that didn’t include visitors, technicians, staff etc. I probably also underestimated the grad student number. I think 250 is probably not a bad number, and much better than the occupancy number.

Jeff F. Young PhD, PEng  
Professor, Department of Physics and Astronomy  
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[young@phas.ubc.ca](mailto:young@phas.ubc.ca)  
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---

**From:** Loewen, Ron [<mailto:Ron.Loewen@ubc.ca>]  
**Sent:** November-25-13 4:25 PM  
**To:** 'Jeff Young'; 'Gary Chen (GHL)'; 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

All:

Jeff is correct, the headcount numbers are pretty much useless.

I propose firstly an overall estimate of Brimacombe occupancy as follows. From the Functional Program for QMI addition new construction, there are 128 heads and 2410 nsm, giving 19 nsm/head. If we apply 19 nsm/head to the 4593 existing Brimacombe nsm, we get 242 heads. Clearly the headcounts on the previous spreadsheet are not in the ballpark.

I've attempted to redo the spreadsheet headcount numbers (attached), based on some assumptions on area per head in the various space types. On the first tab of the attached spreadsheet, I've calculated the area per head in the Functional Program, for the labs, in order to estimate an appropriate lab area per head. I suggest 15 nsm/head for dry labs and 25 nsm/head for wet labs. In addition, I've used 11 nsm/head in faculty and staff offices, and 7.5 nsm/head in grad student offices. The total heads comes to 274.

Please review, I hope this is more useful to Gary.

Regards,

Ron

---

**From:** Jeff Young [<mailto:young@phas.ubc.ca>]  
**Sent:** 2013 November 25 04:08 pm  
**To:** 'Gary Chen (GHL)'; Loewen, Ron; 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

Yes, excessive indeed, hence my reality check comments.

Obviously I don't understand this process, but I have registered my observation!

Thanks for resending.

Jeff F. Young PhD, PEng  
Professor, Department of Physics and Astronomy  
Director, Advanced Materials and Process Engineering Laboratory (AMPEL)  
University of British Columbia  
6224 Agricultural Rd

Vancouver, BC, V6T 1Z1  
[young@phas.ubc.ca](mailto:young@phas.ubc.ca)  
(604) 822-8779

---

**From:** Gary Chen (GHL) [<mailto:gc@ghl.ca>]  
**Sent:** November-25-13 3:26 PM  
**To:** 'Jeff Young'; Loewen, Ron; 'Craig Simms'  
**Cc:** Gordon, Barbara  
**Subject:** RE: QMI - floor plans

Hi Jeff

There's the code-prescribed load factor and then there's reality –

We have to go with the code prescribed one ... similar to structural design....

But if we can get a sense of what reality is like then we can make a strong case for using a less onerous factor in the code.

The existing AMPEL building has a total occupant load of 973 persons which I find to be quite excessive based on my last two visits to the building recently.

**K M Gary Chen** MASc, P Eng

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---

**From:** Jeff Young [<mailto:young@phas.ubc.ca>]  
**Sent:** November-25-13 3:04 PM  
**To:** Loewen, Ron; 'Craig Simms'  
**Cc:** Gary Chen (GHL); Gordon, Barbara  
**Subject:** RE: QMI - floor plans

This is an interesting document, but I don't see how the room capacity numbers are relevant to anything. 164 capacity for the high head space presumably assumes it is used as an auditorium? Several other similar issues. Bottom line is I don't see how these numbers could be meaningfully used to assess realistic "occupancy".

Jeff F. Young PhD, PEng  
Professor, Department of Physics and Astronomy  
Director, Advanced Materials and Process Engineering Laboratory (AMPEL)  
University of British Columbia  
6224 Agricultural Rd  
Vancouver, BC, V6T 1Z1  
[young@phas.ubc.ca](mailto:young@phas.ubc.ca)  
(604) 822-8779

---

**From:** Loewen, Ron [<mailto:Ron.Loewen@ubc.ca>]  
**Sent:** November-25-13 2:28 PM  
**To:** 'Craig Simms'

**Cc:** Gary Chen (GHL); Gordon, Barbara; Jeff Young

**Subject:** RE: QMI - floor plans

Craig:

I understand this request to be for the current headcounts in the existing Brimacombe Building spaces.

Attached please find an inventory listing from 2011 with the room capacity (headcount) listed in the right-most column. Please note that many rooms will have multiple entries, since they may be shared between different administrative units. For example, room 122 is assigned 90% to Materials Engineering and 10% to Chemical and Biological Engineering. The total area of the room is  $466.31 + 51.81 = 518.21$  net square metres. The room capacity figure of 82 applies to the total area of 518.21 nsm.

I believe the room capacity figures were developed by Campus & Community Planning based on room function and area and were not verified by AMPEL.

Please let me know if you need anything further.

Regards,

Ron.

---

**From:** Craig Simms [<mailto:craig@publicdesign.ca>]

**Sent:** 2013 November 25 10:23 am

**To:** Jeff Young; Loewen, Ron

**Cc:** Gary Chen (GHL)

**Subject:** RE: QMI - floor plans

Hi Jeff, Ron,

Our code consultant is looking for the current total staff / student / faculty count for AMPEL. Can you provide this information or is there someone else that could assemble it?

Best,

Craig Simms  
Architect AIBC, LEED AP

.....  
PUBLIC: ARCHITECTURE + COMMUNICATION INC  
[www.publicdesign.ca](http://www.publicdesign.ca)

[craig@publicdesign.ca](mailto:craig@publicdesign.ca)  
T. 604 738 4323  
F. 604 873 4313

## Gary Chen (GHL)

---

**From:** Lin, Edmond <edlin96@mail.ubc.ca>  
**Sent:** June-06-14 2:39 PM  
**To:** Gary Chen (GHL); Craig Simms (craig@publicdesign.ca) (craig@publicdesign.ca)  
**Cc:** Allan, Arcangel (aarcangel@lmdg.com)  
**Subject:** FW: UBC - QMI - Exit Signs

FYI

---

**From:** Thayer, Michael  
**Sent:** Friday, June 06, 2014 2:22 PM  
**To:** Lin, Edmond; Hugli, Richard  
**Cc:** marcus.vonminden@vancouver.ca; Allan, Arcangel (aarcangel@lmdg.com); Plumridge, Andrew  
**Subject:** RE: UBC - QMI - Exit Signs

Hi Ed,  
The proposal for exit signage below is acceptable to Building Ops.  
Regards,  
Mike

Michael D. Thayer Architect AIBC  
Architect - Operations and Maintenance  
Technical Services, Building Operations  
Rm. 1007 University Services Building  
2329 West Mall  
Tel. 604-822-9510  
Cel. 604-817-7829  
[michael.thayer@ubc.ca](mailto:michael.thayer@ubc.ca)

---

**From:** Lin, Edmond  
**Sent:** Thursday, June 05, 2014 10:55 AM  
**To:** Thayer, Michael; Hugli, Richard  
**Cc:** [marcus.vonminden@vancouver.ca](mailto:marcus.vonminden@vancouver.ca); Allan, Arcangel ([aarcangel@lmdg.com](mailto:aarcangel@lmdg.com))  
**Subject:** FW: UBC - QMI - Exit Signs

Hi Michael & Richard,

Please review the proposal for the exit signage below. I do not have an issue with what is proposed.

Regards,

Edmond Lin, M. Eng., P. Eng., C.P.  
Chief Building Official, Campus and Community Planning  
The University of British Columbia  
2210 West Mall, Vancouver BC  
Canada V6T 1Z4  
Tel: (604) 822-8051  
Cell: (604) 868-5521  
Fax: (604) 822-6119  
E-mail: [edmond.lin@ubc.ca](mailto:edmond.lin@ubc.ca)  
<<http://www.planning.ubc.ca/>>

---

**From:** Gary Chen (GHL) [<mailto:gc@ghl.ca>]  
**Sent:** Thursday, June 05, 2014 10:50 AM  
**To:** Lin, Edmond  
**Cc:** Craig Simms ([craig@publicdesign.ca](mailto:craig@publicdesign.ca)); 'Allan Arcangel'; Dave Graham (GHL)  
**Subject:** UBC - QMI - Exit Signs

Hi Ed

Further to our meeting Tuesday, you asked me to send you an email about exit signs for the existing Brimacombe Building.

As you are aware, the QMI addition will be based on the BCBC 2012 which uses the new ISO "running person" sign. As the addition and the existing portions will be regarded as one building, it is our opinion that the existing exit signs in the Brimacombe building be updated such that there is consistent signage throughout the building. As the QMI is a significant addition and that the Code will not likely revert back to the old exit signage; given the life of the building – we recommend converting exit signs to match the new provision of the BCBC 2012.

As this could be a significant expenditure, our recommendation is to provide the new running person signs in all principal access to exit routes (i.e., corridors) and at the exits. Signs within the individual rooms / labs in the existing building would get updated later if/when the space gets renovated / updated.

The two-types of exit sign situation will be unavoidable for many existing buildings as we go through this transition period. For example, this is no different than an existing Shopping Mall built under the older code but are faced with the new signage when it comes to new TIs applied under the new permit. As the Code will unlikely to revert back to the old signage, the logical way would be to progressively change the old ones to the new ones.

We trust this proposal is acceptable to your office.

Gary

**K M Gary Chen** MASc, P Eng

**GHL CONSULTANTS LTD**

Building Codes & Fire Science

950 – 409 Granville Street, Vancouver, BC V6C 1T2

**P** 604 689 4449 Ext 114 \ **F** 604 689 4419 \ **E** [gc@ghl.ca](mailto:gc@ghl.ca) \ **W** [www.ghl.ca](http://www.ghl.ca)

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## **Appendix D**

Exit Exposure Locations

GHILL CONSULTANTS LTD  
 408 Glenview Street, Suite 950  
 Vancouver, BC V6H 1T2  
 Tel: 604-683-4449  
 Fax: 604-683-4410

GHILL CONSULTANTS LTD  
 408 Glenview Street, Suite 950  
 Vancouver, BC V6H 1T2  
 Tel: 604-683-4449  
 Fax: 604-683-4410

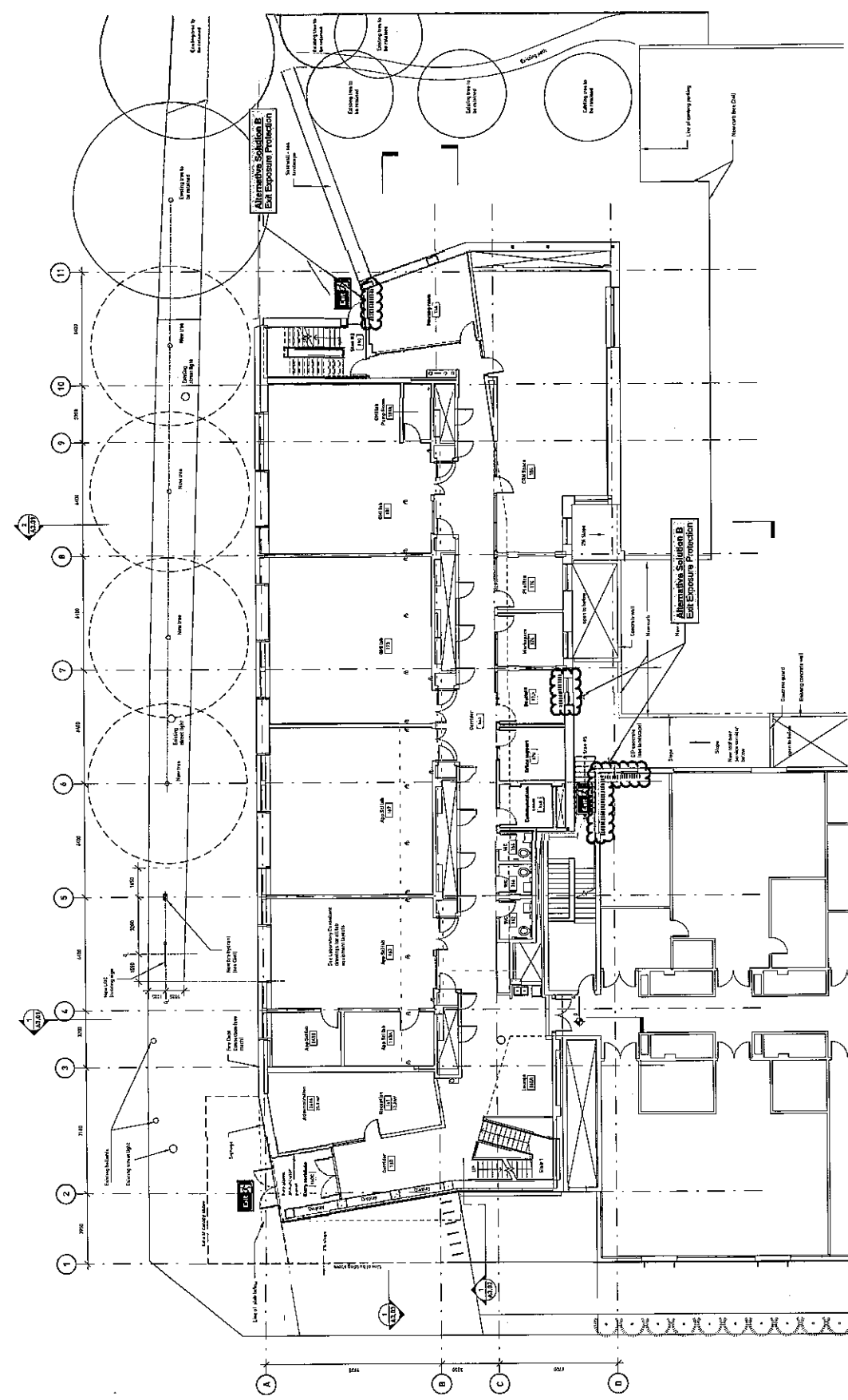
not for  
 construction

public

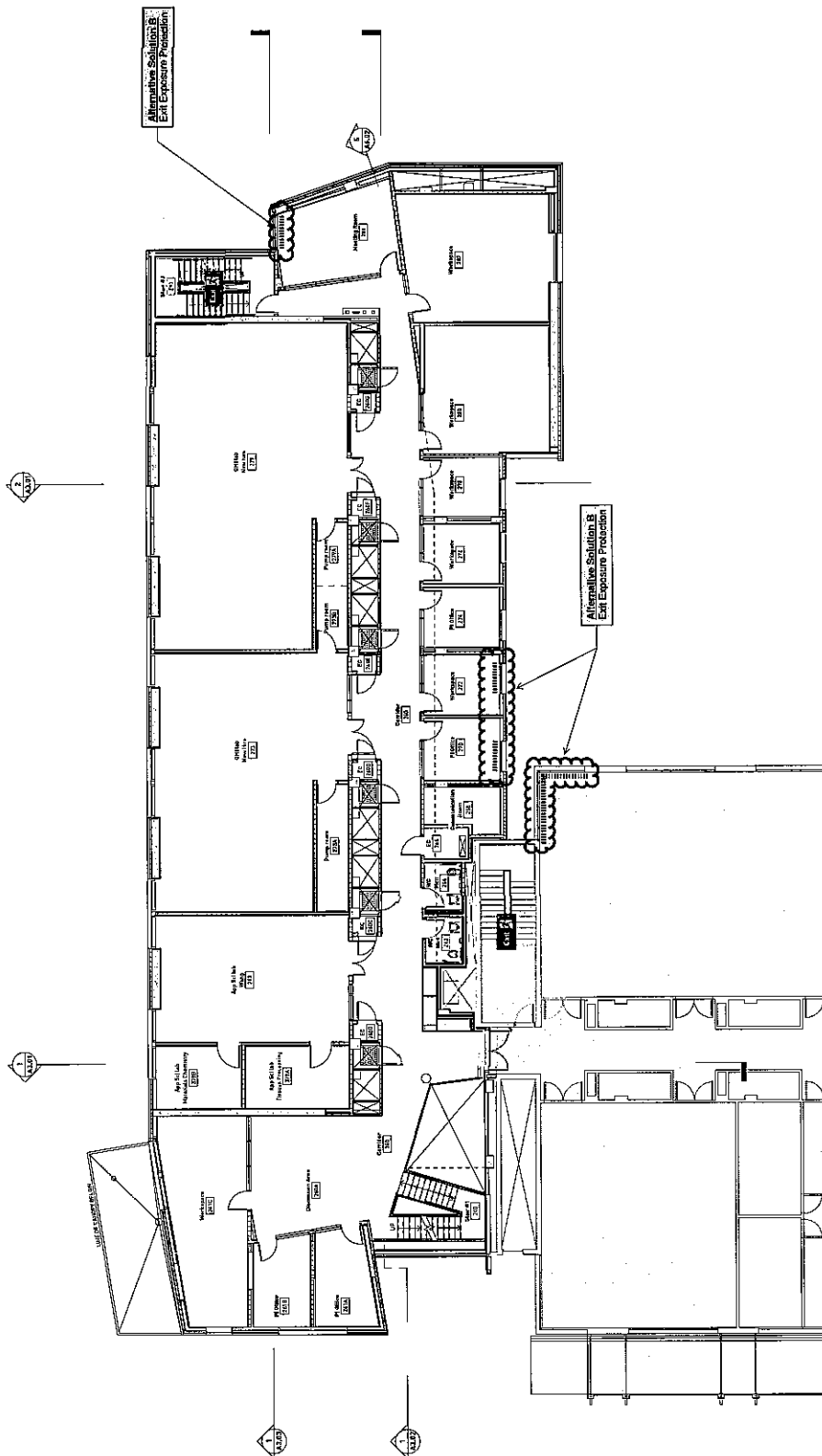
UBC QMI Addition

2017 Civil Mill, Mechanical, &  
 Electrical Plans  
 Project: UBC QMI Addition  
 Date: 11/20/2017  
 Drawn: J. Smith  
 Checked: J. Smith  
 Project No: 2017-04-18

Main Level Plan  
 A1.01



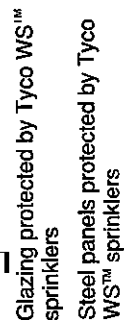
1 Main Level Plan  
 1/1600 = 1/1600



Level 2 plan

## **Appendix E**

Locations of Sprinklers addressed by Alternative Solution C

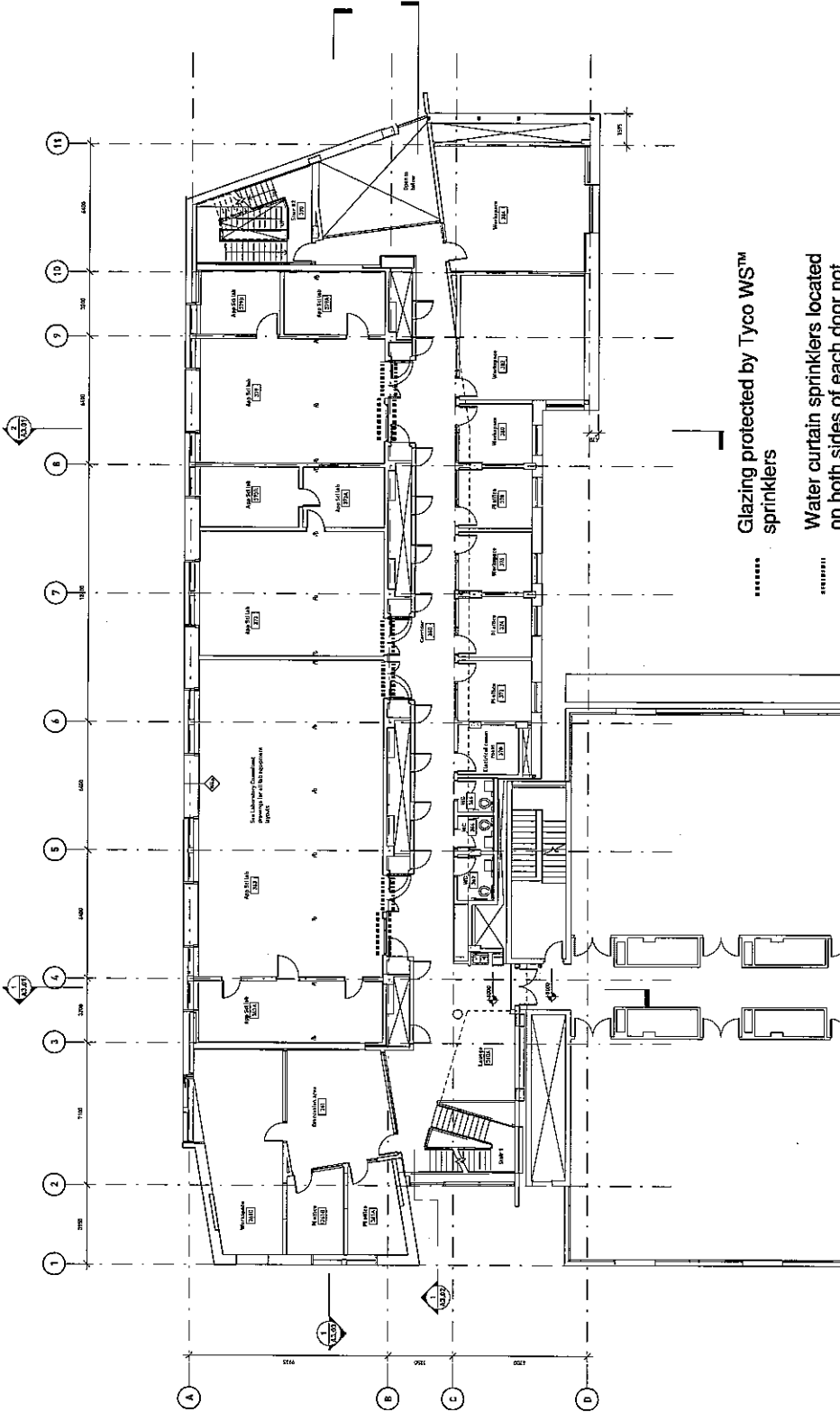


Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating

GHILL CONSULTANTS LTD  
 400 GUNNABLE STREET, SUITE 650  
 VANCOUVER, BC V6C 1T2  
 TEL: 604 683 4400  
 FAX: 604 683 4418

PROJECT NO. 1000000000  
 DRAWING NO. 1000000000  
 DATE: 10/01/2011  
 DRAWN BY: J. [Name]  
 CHECKED BY: J. [Name]  
 APPROVED BY: J. [Name]

GHILL CONSULTANTS LTD  
 400 GUNNABLE STREET, SUITE 650  
 VANCOUVER, BC V6C 1T2  
 TEL: 604 683 4400  
 FAX: 604 683 4418



Glazing protected by Tyco WS<sup>TM</sup> sprinklers  
 Water curtain sprinklers located on both sides of each door not meeting the prescribed 45min fire rating

not for construction

public

UBC QMI Addition

2550 GASTOWN, VANCOUVER, BC  
 PROJECT NO. 1000000000  
 DRAWING NO. 1000000000  
 DATE: 10/01/2011  
 DRAWN BY: J. [Name]  
 CHECKED BY: J. [Name]  
 APPROVED BY: J. [Name]

Level 3 Plan  
 A1.03

Level 3 Plan  
 1/10/11 1:100

General Notes: This floor plan was prepared in accordance with the requirements of the National Building Code of Canada (NBCC) and the Ontario Building Code (OBC). It is intended for use as a guide only and does not constitute a contract. The owner is responsible for ensuring that the building is constructed in accordance with the applicable codes and standards.

1. ALL DIMENSIONS ARE IN METERS.  
2. ALL WALLS ARE 200mm THICK UNLESS NOTED OTHERWISE.  
3. ALL FLOORS ARE 100mm CONCRETE ON 150mm RIGID INSULATION OVER 100mm POLYSTYRENE INSULATION.  
4. ALL ROOFS ARE 150mm CONCRETE ON 150mm RIGID INSULATION OVER 100mm POLYSTYRENE INSULATION.

**GHL CONSULTANTS LTD.**  
4000 DUNDAS STREET WEST, SUITE 200  
MISSISSAUGA, ONTARIO L4W 1T2  
P: 905.880.8449  
F: 905.880.8448

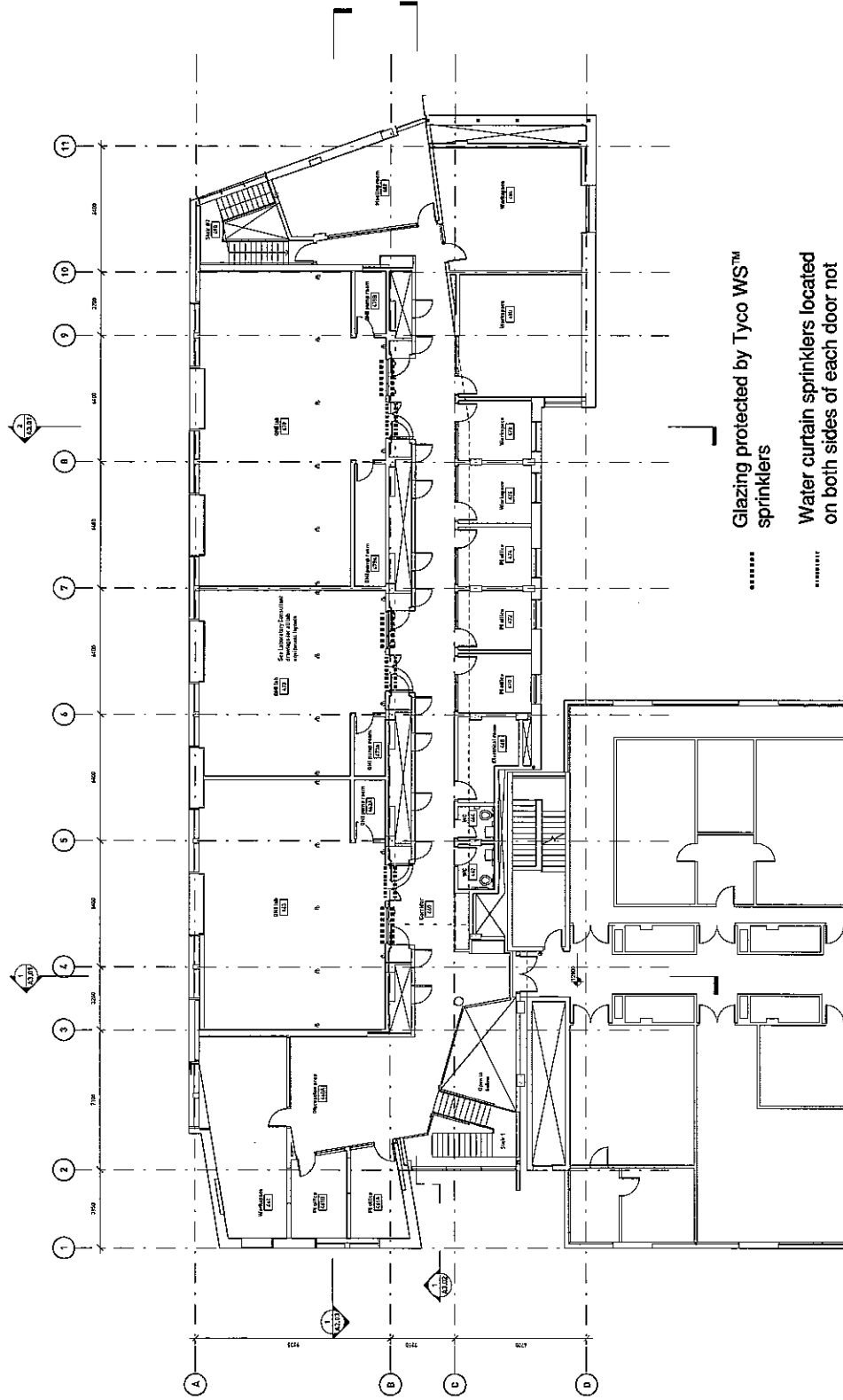
not for  
construction

public

UBC QMI Addition

2015 East Hill, Vancouver, BC  
Project Name: UBC QMI Addition  
Project Number: 1000  
Date: 10/10/2014

Level 4 Plan  
A1.04



1. Level 4 Plan  
2/10/2014 1:10

## **Appendix F**

Tyco Literature



## Model WS Specific Application Window Sprinklers Horizontal and Pendent Vertical Sidewall 5.6 K-factor

### General Description

The TYCO Model WS Specific Application Window Sprinklers are fast response, glass bulb-type spray sprinklers available in Horizontal Sidewall and Pendent Vertical Sidewall models.

These sprinklers are the first to be specifically Listed to provide complete wetting and coverage for heat strengthened, tempered, or ceramic glass windows using closed sprinklers. As part of the testing, the gas flow required to achieve the time/temperature relationship specified in ASTM E119 was established in a test furnace without sprinkler protection. A window assembly protected with the TYCO Model WS Window Sprinklers was then installed in the test furnace, and the same gas flow conditions were maintained for a two-hour test period. No cracking or visible damage to the window was permitted during the test period, even when a hose stream was directed at the window.

The success of the Model WS Window Sprinklers is based on their fast response thermal sensitivity and on their specially designed deflectors that ensure that the spray pattern wets the entire surface of the window.

Based on successful testing, the Model WS Window Sprinklers can be used as interior protection of windows or glazing in a sprinklered building or non-sprinklered building in accordance with Section 104 of the IBC ("Alternate Materials, Design and Methods of Construction and Equipment"). Also,

#### IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

the Model WS Window Sprinklers can be used as an open sprinkler for "Outside Sprinkler Protection against Exposure Fire", using the design requirements of NFPA.

As with any specific application sprinkler, the installation instructions included in this data sheet must be precisely followed. If there are additional local or jurisdictional installation standards/codes for window sprinklers on glazed window systems, this document does not relieve the designer/installer from these requirements. Consult your local jurisdiction to verify if or when these additional guidelines must be followed.

#### NOTICE

*TYCO Model WS Specific Application Window Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards recognized by the approval agency, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.*

*The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted with any questions.*

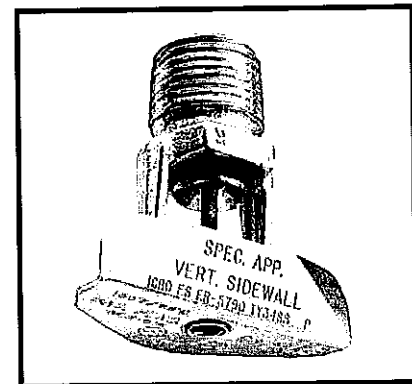
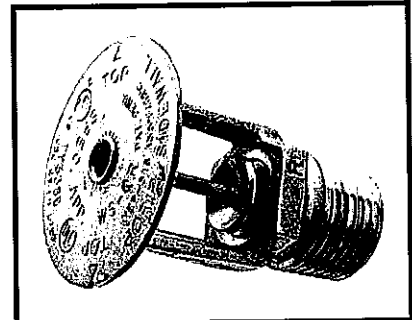
### Sprinkler Identification Number (SIN)

TY3388 - Horizontal Sidewall

TY3488 - Pendent Vertical Sidewall

TY3388 is a re-designation for C3388

TY3488 is a re-designation for C3488



## Technical Data

### Approvals

UL and C-UL Listed

NYC under MEA 289-04-E

Approvals only apply to the service conditions indicated in the Design Criteria section.

### Additional Recognition

ICC Evaluation Service (ESR-2397)

Ontario Building Code

### Pipe Thread Connection

1/2 inch NPT

### Discharge Coefficient

$K=5.6 \text{ GPM/psi}^{1/2}$  (80,6 LPM/bar<sup>1/2</sup>)

### Temperature Ratings

155°F (68°C)

200°F (93°C)

### Finish

Natural Brass, Signal White (RAL9003)  
Polyester, and Chrome Plated

### Physical Characteristics

Frame..... Brass  
Button..... Bronze/Copper  
Sealing Assembly..... Beryllium Nickel  
w/TEFLON

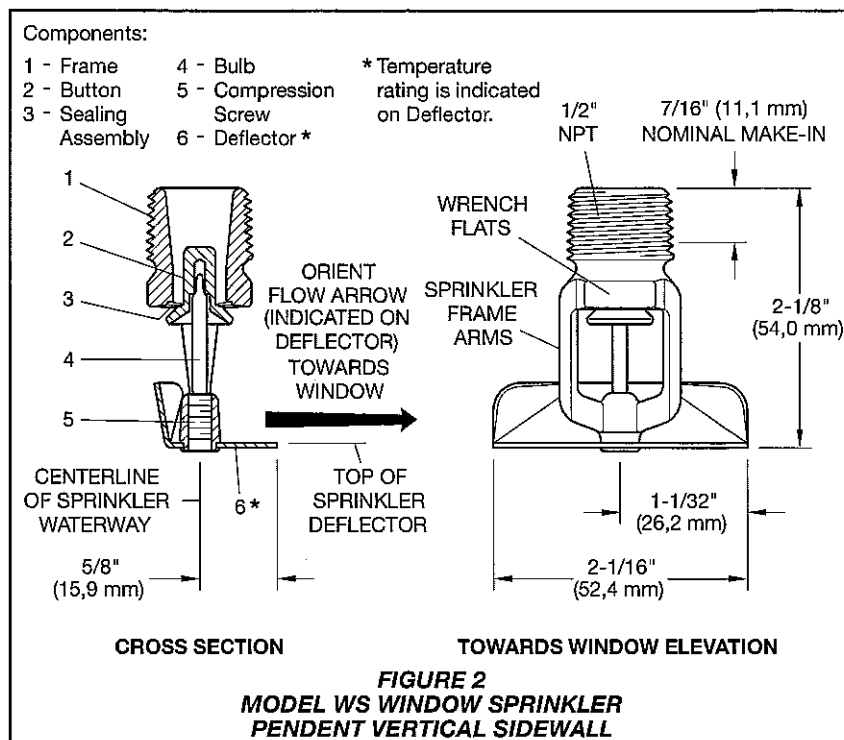
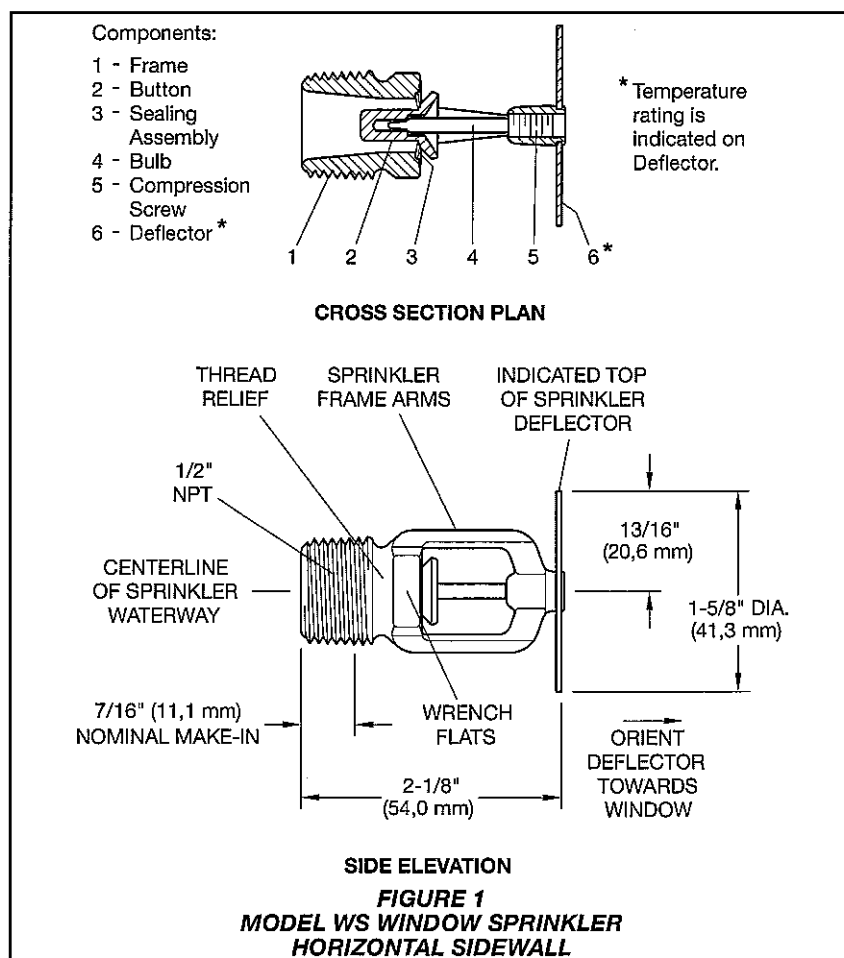
Bulb..... Glass  
(3 mm dia.)

Compression Screw..... Brass

Deflector..... Brass/Bronze

## Operation

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.



## Design Criteria

The TYCO Model WS Specific Application Window Sprinklers are UL and C-UL Listed and NYC Approved (MEA 335-01-E) for use as "Specific Application Window Sprinkler" and as open sprinklers for "Outside" use.

These sprinklers are also recognized by Underwriters Laboratories of Canada (ULC), and the Ontario Building Code for use in the Province of Ontario, Canada as providing a two-hour equivalency for a fire separation assembly when installed in accordance with this code.

### Area of Use

When acceptable to the Authority Having Jurisdiction and unless modified by a local jurisdictional standard or code mentioned previously, the TYCO Model WS Window Sprinklers may be used in either a sprinklered or unsprinklered building to protect non-operable window openings that are part of a fire separation provided:

- in an interior fire separation, the window sprinklers are installed on both sides of the window in the fire separation (Figure 3A-1),
- in jurisdictions where exterior spatial separation (that is, separation from adjacent space) is defined as protecting an adjacent building from a fire in your building, window sprinklers are installed on the interior side of the building (Figure 3A-2), or
- in jurisdictions where exterior spatial separation is defined as protecting your building from a fire in an adjacent building (that is, exposure protection), open window sprinklers are installed on the exterior side of the building (Figure 3A-3).

### System Protection Type

- Interior: Wet Systems
- Outside Exposure: Deluge

### Glass Type

The following types and thicknesses of glass are recognized for use with TYCO Model WS Window Sprinklers:

- Non-operable, heat-strengthened, tempered, single-glazed (single pane), not less than 1/4 in. (6 mm) thick;
- Non-operable, heat-strengthened, tempered, double-glazed (double pane or insulated), not less than 1/4 in. (6 mm) thick;
- Non-operable, UL Classified and labeled FireLite Plus WS ceramic glass by Technical Glass Products (TGP), not less than 5/16 in. (8 mm) thick; or,

**NOTE:** Refer to FireLite Plus WS ceramic glass technical data sheet for other classification limitations at [www.fireglass.com](http://www.fireglass.com).

- Non-operable, stronger glass window assemblies, not less than 1/4 in. (6 mm) thick.

### Type of Window Frame/Mullion

Non-combustible Frame with a standard EPDM rubber gasket seal

Vertical joints of glass panes must be connected by butt-joints using a silicone sealant between the individual panes or by Noncombustible Mullions.

(Refer to Figures 3B-1 and 3B-2)

### Maximum Length of Window Assembly

Unlimited

### Maximum Height of Window Assembly

13 ft. (3,96 m)

(Refer to Figures 3C and 3D)

### Maximum Distance Between Window Sprinklers

8 ft. (2,44 m)

(Refer to Figures 3B-1 and 3B-2)

### Minimum Distance Between Window Sprinklers

6 ft. (1,83 m) unless separated by a baffle or mullion of sufficient depth to act as a baffle.

A mullion will act as a baffle, when in the case of the Pendent Vertical Sidewall, the mullion extends to the back of the sprinkler deflector, and in the case of the Horizontal Sidewall, the mullion extends to the sprinkler wrench flat.

(Refer to Figures 3B-1 and 3B-2)

### Minimum Distance from Standard Sprinklers

6 ft. (1,83 m) unless separated by a baffle

### Sprinkler Location

- Mullioned Glazing Assemblies: Locate window sprinklers within each mullioned glazing segment. Refer to Figure 3B-1.
- Butt-Jointed Glazing Assemblies: Locate window sprinklers on maximum 8 ft. (2,44 m) centers. Refer to Figure 3B-2.

### Maximum Distance from Vertical Mullion

4 ft. (1,22 m)

(Refer to Figure 3B-1)

### Minimum Distance from Vertical Mullions

4 in. (101,6 mm)

(Refer to Figure 3B-1)

### Intermediate Horizontal Mullions

Intermediate Horizontal Mullions were not tested with the Model WS Window Sprinklers. Their use is outside the scope of the "Specific Application" Listing for the window sprinklers. Refer to Figure 3B-3.

### Deflector Location

Sprinkler Deflectors must be located as described below in order to ensure that the entire surface of the glass window is covered. Sprinkler Deflectors are positioned with respect to the window frame, not the ceiling.

- Horizontal Sidewall: Locate within the outside edge of the window frame from 1/2 to 4 in. (12,7 mm to 101,6 mm) away from the glass and  $2 \pm 1$  in. (50,8 mm  $\pm$  25,4 mm) down from the top of the exposed glass. Refer to Figure 3C.
- Pendent Vertical Sidewall: Locate 4 to 12 in. (101,6 mm to 304,8 mm) from the face of the glass and  $3 \pm 1$  in. (76,2 mm  $\pm$  25,4 mm) down from the top of exposed glass. Refer to Figure 3D.

### Minimum Clearance from Face of Glass to Combustible Materials

For glass types other than FireLite Plus WS ceramic glass by TGP, all combustible materials shall be kept 2 in. (50,8 mm) from the front face of the glass. This can be accomplished by a minimum 36 in. (914,4 mm) pony wall or other method acceptable to the authority having jurisdiction.

### Escutcheon Assemblies

The Model WS Window Sprinklers can be used with any metallic flush or extended escutcheons, provided the dimensions from the sprinkler deflector to the window frame and glass surface as specified in this data sheet are maintained. These sprinklers are not listed for recessed applications.

### Recommended Hydraulic Requirements

The authority having jurisdiction should be consulted to determine the hydraulic requirements for each installation.

### Interior Protection Sprinklered Building

Identify which compartmented area has the most hydraulically demanding window sprinklers. Calculate up to the most demanding 46.5 linear feet of Model WS Window Sprinklers on one side of the glazing. The 46.5 linear feet (14,2 linear meters) is based upon 1.2 x the square root of the system area of operation, when the system area of operation is 1500 sq.-ft. in accordance with NFPA 13 Light/Ordinary Hazard density curves.

Where the area of Glazing is less than 14.2 linear meters, all window sprinklers on one side shall be calculated.

If an area reduction for quick response sprinklers is utilized, the linear length of the calculated window sprinklers may be reduced, but in no case shall be less than 36 linear feet ( $1.2 \times \sqrt{900}$ ).

If a single fire can be expected to operate Model WS Window Sprinklers and sprinklers within the design area of a hydraulically calculated system, the water demand of the window sprinklers shall be added to the water demand of the hydraulic calculations and shall be balanced to the calculated area demand.

If the window sprinklers are located in an area other than the hydraulic design area, the demand of the window sprinklers is not required to be added to the demand of the remote hydraulic design area. However, it is necessary to prove hydraulically the simultaneous operation of the Model WS Window Sprinklers and the ceiling sprinklers adjacent to the window sprinklers.

#### **Interior Protection Non-Sprinklered Building**

Calculate all sprinklers on the most demanding side of the glazing assembly within the enclosure.

#### **Exterior Exposure Protection**

Calculate all sprinklers controlled by the deluge valve using the design requirements of NFPA.

#### **Duration of Water Supply**

Duration of water supply must comply with requirements of NFPA. If window sprinklers are used to provide the equivalency of a fire rating, the water supply must be capable of supplying water for the required rating period.

#### **Minimum Flow per Sprinkler**

20 GPM (75,7 LPM) for sprinkler spacing of 6 to 8 ft. (1,83 to 2,44 m) or 15 GPM (56,8 LPM) for sprinkler spacing less than 6 ft. (1,83 m).

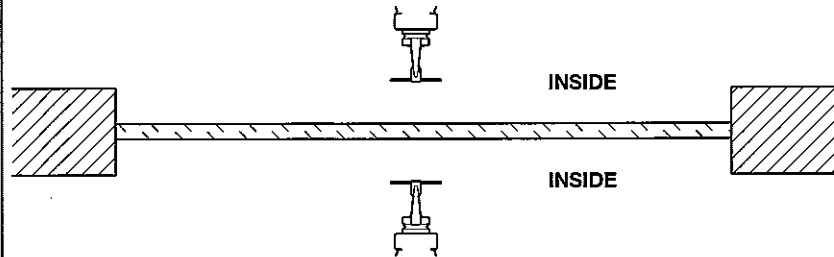
#### **Maximum Pressure per Sprinkler**

- Horizontal Sidewall: 70 psi (4,83 bar)\*

\* The 70 psi is only for cold solder purposes. If there is a baffle or a mullion of sufficient depth to act as a baffle, separating the sprinklers, the maximum pressure is 175 psi (12,07 bar).

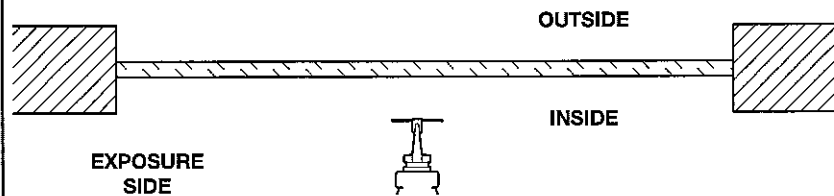
- Vertical Sidewall: 175 psi (12,07 bar)

When acceptable to the Authority Having Jurisdiction the Model WS Specific Application Window Sprinklers may be used in either a sprinklered or unsprinklered building to protect nonoperable window openings that are in an interior fire separation, the window sprinklers are installed on both sides of the window in the fire separation.



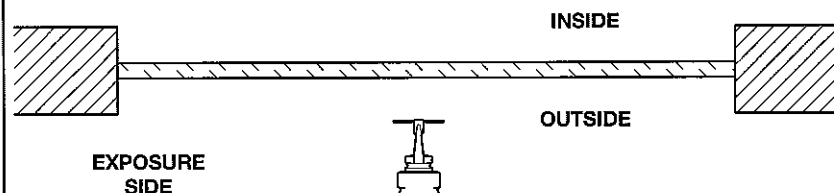
**FIGURE 3A-1 - INTERIOR FIRE SEPARATION**

When acceptable to the Authority Having Jurisdiction the Model WS Specific Application Window Sprinklers may be used in either a sprinklered or unsprinklered building to protect nonoperable window openings that are part of a fire separation provided in jurisdictions where exterior spatial separation is defined as protecting an adjacent building from a fire in your building, window sprinklers are installed on the interior side of the glass.



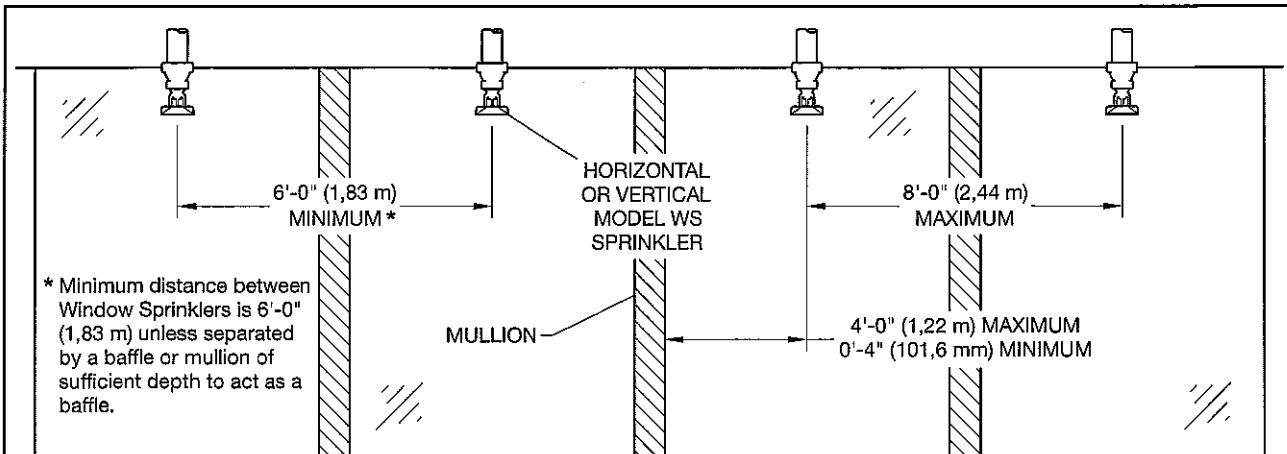
**FIGURE 3A-2 - EXTERIOR FIRE SEPARATION - SPRINKLERS INSIDE**

When acceptable to the Authority Having Jurisdiction the Model WS Specific Application Window Sprinklers may be used in either a sprinklered or unsprinklered building to protect nonoperable window openings that are part of a fire separation provided in jurisdictions where exterior spatial separation is defined as protecting your building from a fire in an adjacent building, open window sprinklers are installed on the exterior side of the glass.

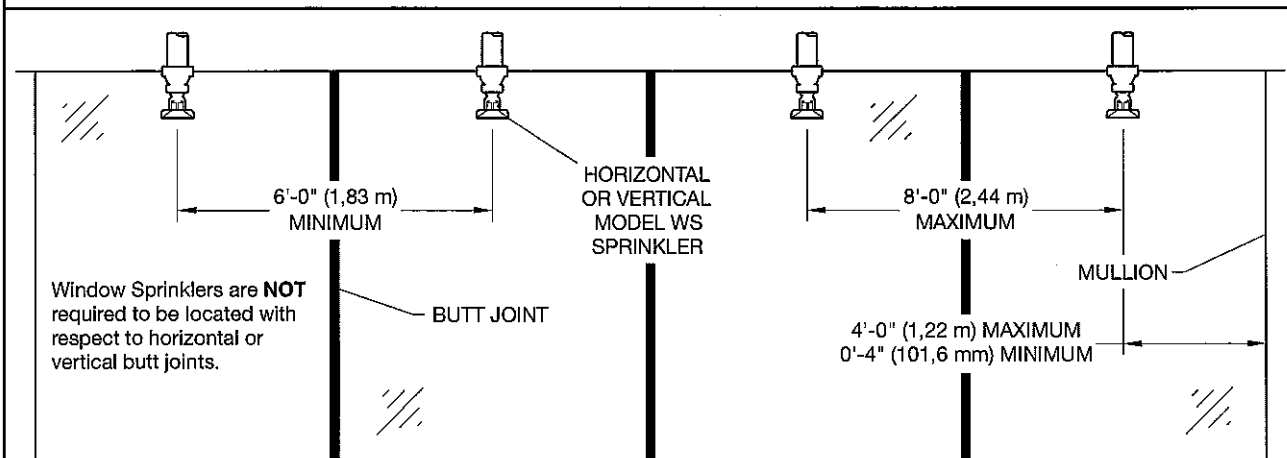


**FIGURE 3A-3 - EXTERIOR FIRE SEPARATION - SPRINKLERS OUTSIDE**

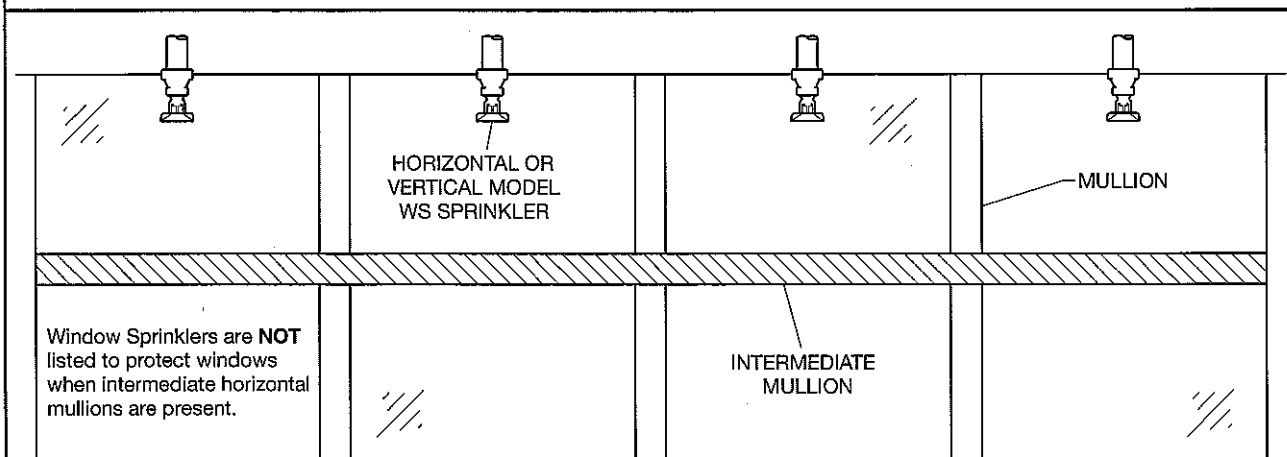
**FIGURE 3A (A-1 TO A-3)**  
**TYPICAL NON-OPERABLE WINDOW OPENINGS**



**FIGURE 3B-1 - MULTIPLE WINDOWS SEPARATED BY MULLIONS**

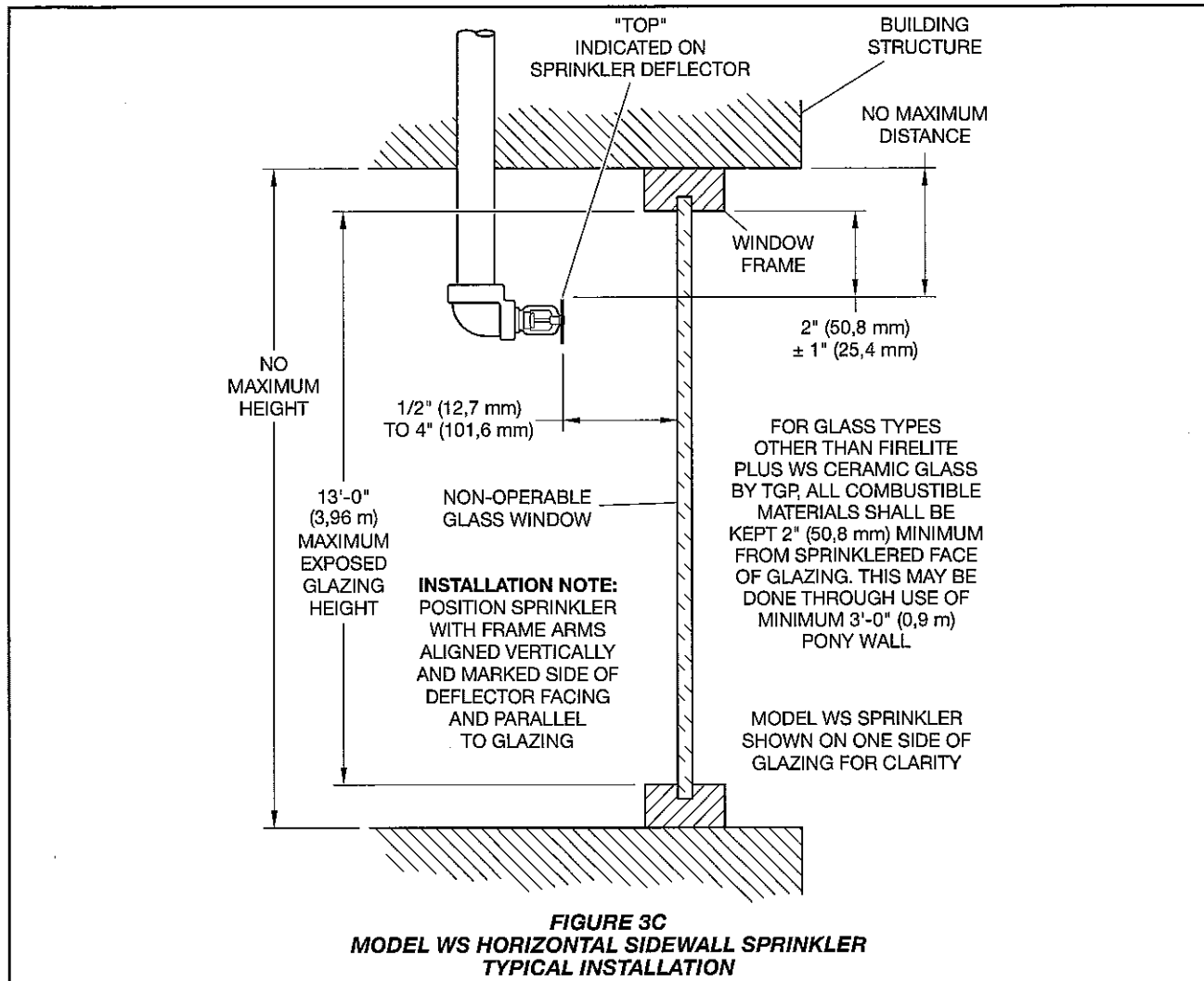


**FIGURE 3B-2 - MULTIPLE WINDOWS SEPARATED BY BUTT JOINTS**



**FIGURE 3B-3 - WINDOWS WITH HORIZONTAL MULLIONS**

**FIGURE 3B (B-1 TO B-3)  
WINDOW MULLIONS AND BUTT JOINTS**



## Installation

The TYCO Model WS Specific Application Window Sprinklers must be installed in accordance with this section.

### General Instructions

Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm).

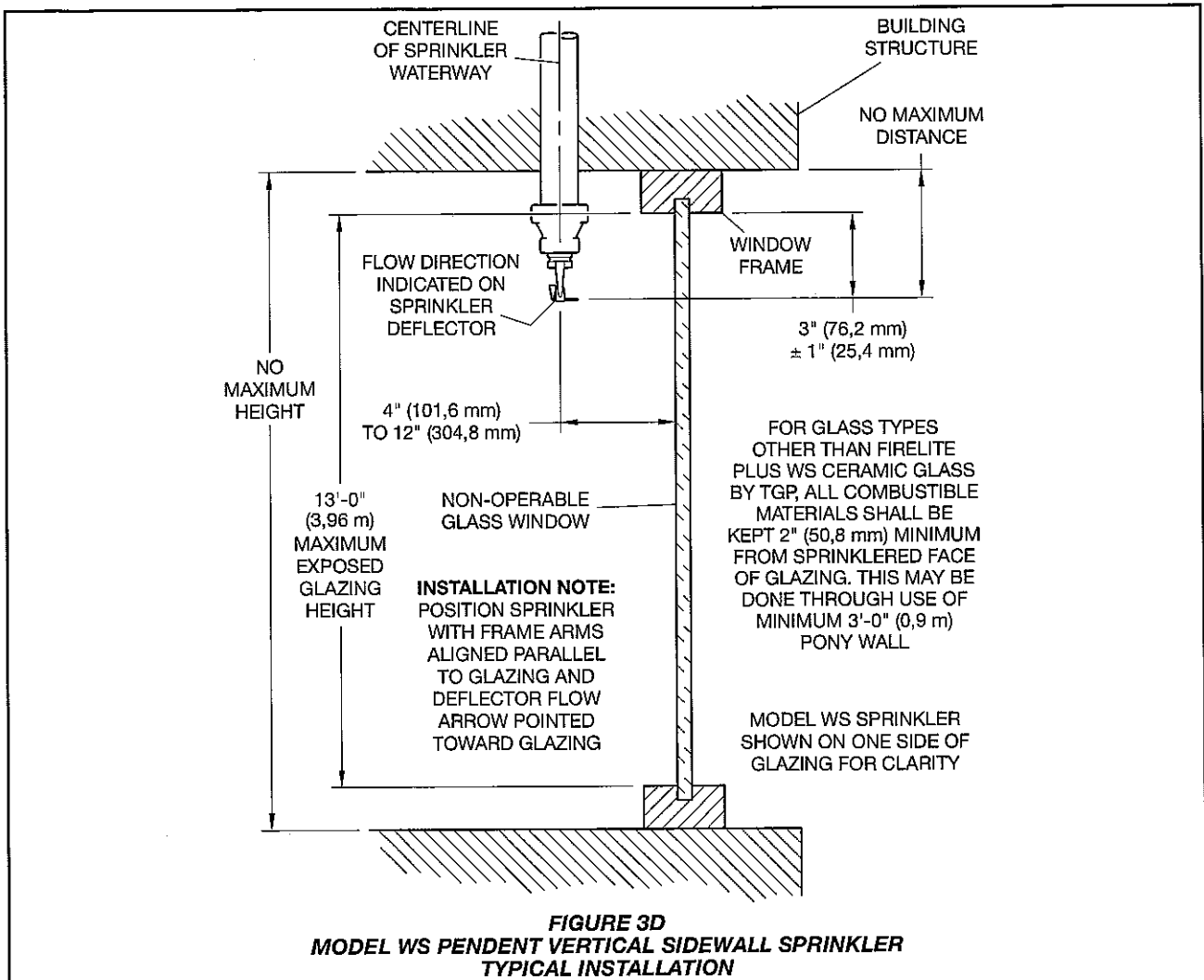
A leak-tight 1/2 inch NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 7 to 14 ft.-lbs. (9,5 to 19,0 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

**Step 1.** Install the pendent vertical sidewall sprinkler only in the pendent position with the center-line of the sprinkler parallel to the glass surface. Orient the sprinkler so that the direction of flow indicated on the sprinkler deflector is facing the window.

**Step 2.** Install the horizontal sidewall sprinkler only in the horizontal position with the center-line of the sprinkler perpendicular to the glass surface. Orient the sprinkler so that the word "Top" indicated on the sprinkler deflector is facing the top of window frame.

**Step 3.** With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

**Step 4.** With reference to Figures 1 or 2, apply End A of W-Type 20 Sprinkler Wrench only (Figure 4) to the sprinkler wrench flats and tighten the sprinkler into the sprinkler fitting.



## Care and Maintenance

The TYCO Model WS Specific Application Window Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

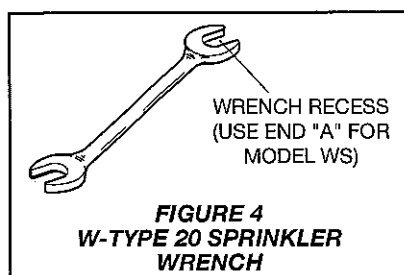
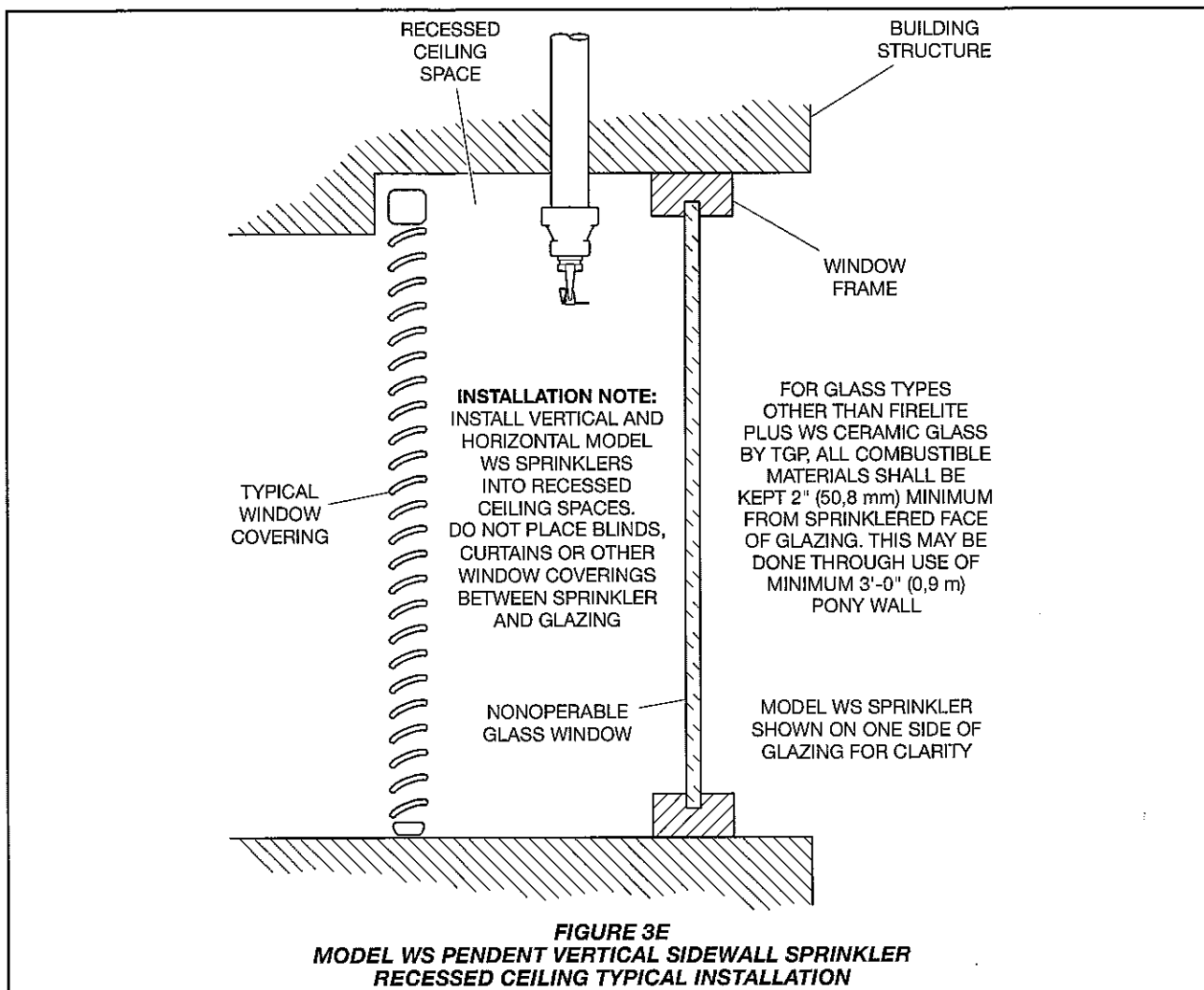
Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but

have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section.)

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards recognized by the Approval agency (e.g., NFPA 25), in addition to the standards of any authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.



## Limited Warranty

For warranty terms and conditions, visit [www.tyco-fire.com](http://www.tyco-fire.com).

## Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

### Model WS HSW Window Sprinkler with NPT Thread

Specify: Model WS Specific Application Window Sprinkler TY3388, Horizontal Sidewall, with (specify) temperature rating, (specify) finish, and P/N (specify)

#### 155°F (68°C)

Natural Brass . . . . . P/N 50-305-1-155  
Signal White (RAL9003)  
Polyester . . . . . P/N 50-305-4-155  
Chrome Plated . . . . . P/N 50-305-9-155

#### 200°F (93°C)

Natural Brass . . . . . P/N 50-305-1-200  
Signal White (RAL9003)  
Polyester . . . . . P/N 50-305-4-200  
Chrome Plated . . . . . P/N 50-305-9-200

### Model WS Pendent Vertical Sidewall Window Sprinkler with NPT Thread

Specify: Model WS Specific Application Window Sprinkler TY3488, Pendent Vertical Sidewall, with (specify) temperature rating, (specify) finish, and P/N (specify)

#### 155°F (68°C)

Natural Brass . . . . . P/N 50-304-1-155  
Signal White (RAL9003)  
Polyester . . . . . P/N 50-304-4-155  
Chrome Plated . . . . . P/N 50-304-9-155

#### 200°F (93°C)

Natural Brass . . . . . P/N 50-304-1-200  
Signal White (RAL9003)  
Polyester . . . . . P/N 50-304-4-200  
Chrome Plated . . . . . P/N 50-304-9-200

### Sprinkler Wrench

Specify: W-Type 20 Sprinkler Wrench, P/N 56-000-1-106

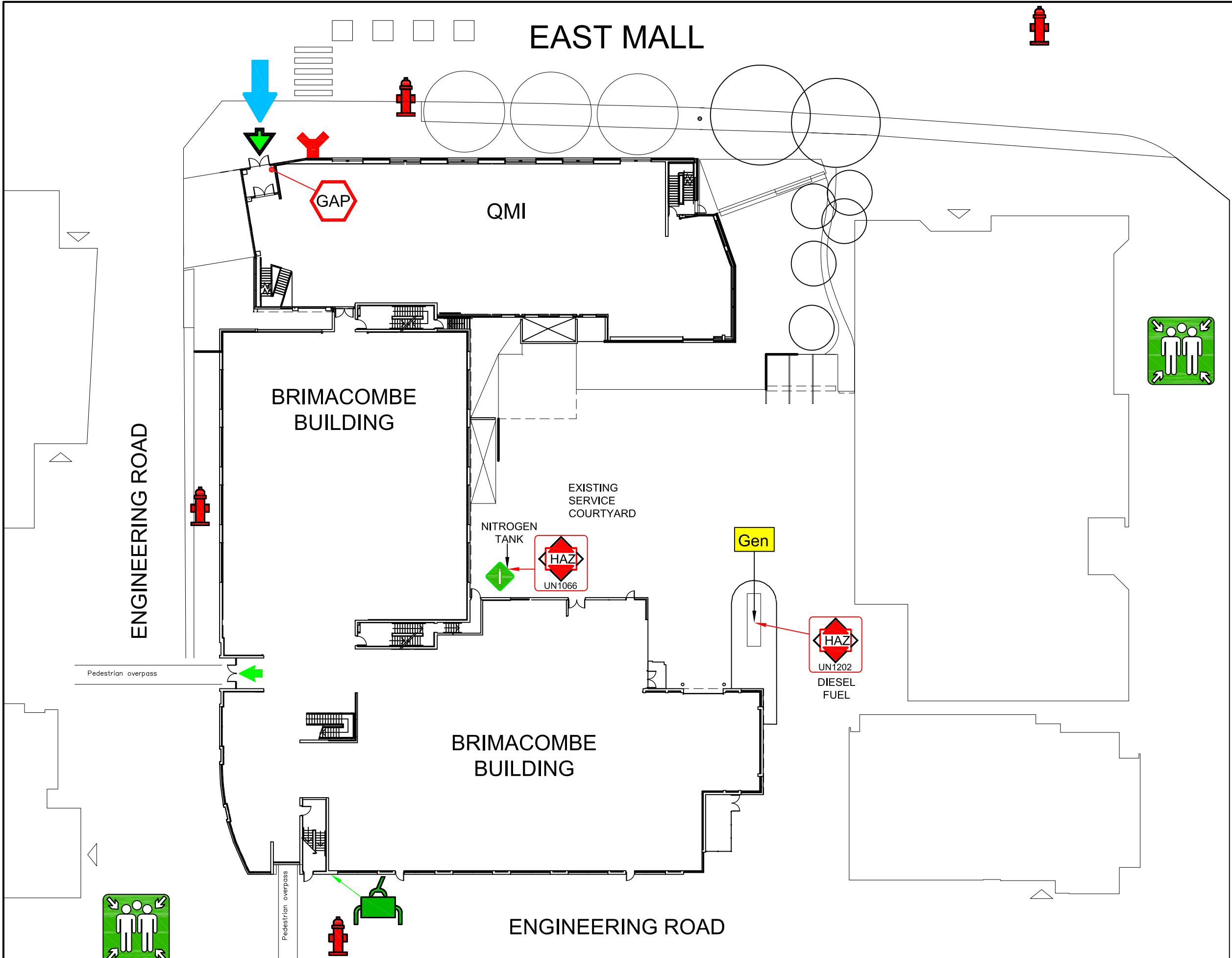
GLOBAL HEADQUARTERS | 1400 Pennbrook Parkway, Lansdale, PA 19446 | Telephone +1-215-362-0700



EAST MALL

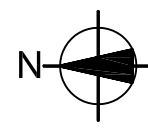
ENGINEERING ROAD

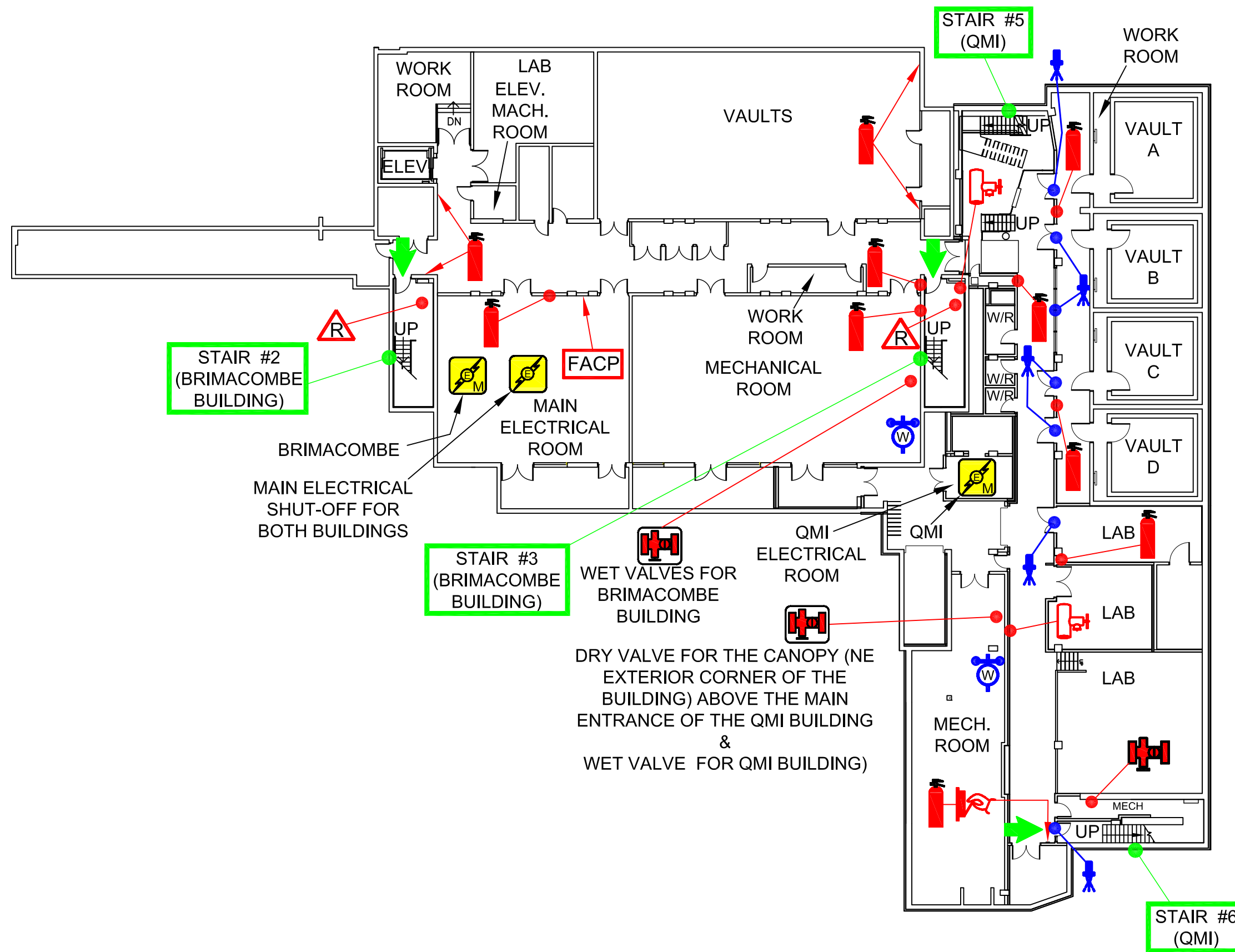
AGRONOMY ROAD



LEGEND

- ASSEMBLY AREA
- PRESSURIZED GAS CYLINDER
- GAS METER SHUT-OFF
- GENERATOR
- FIRE DEPT. ENTRY
- MAIN ENTRY
- GRAPHIC ANNUNCIATOR PANEL
- FIRE HYDRANT - PUBLIC
- FIRE DEPARTMENT CONNECTION
- HAZARD
- FIRE SAFETY PLAN

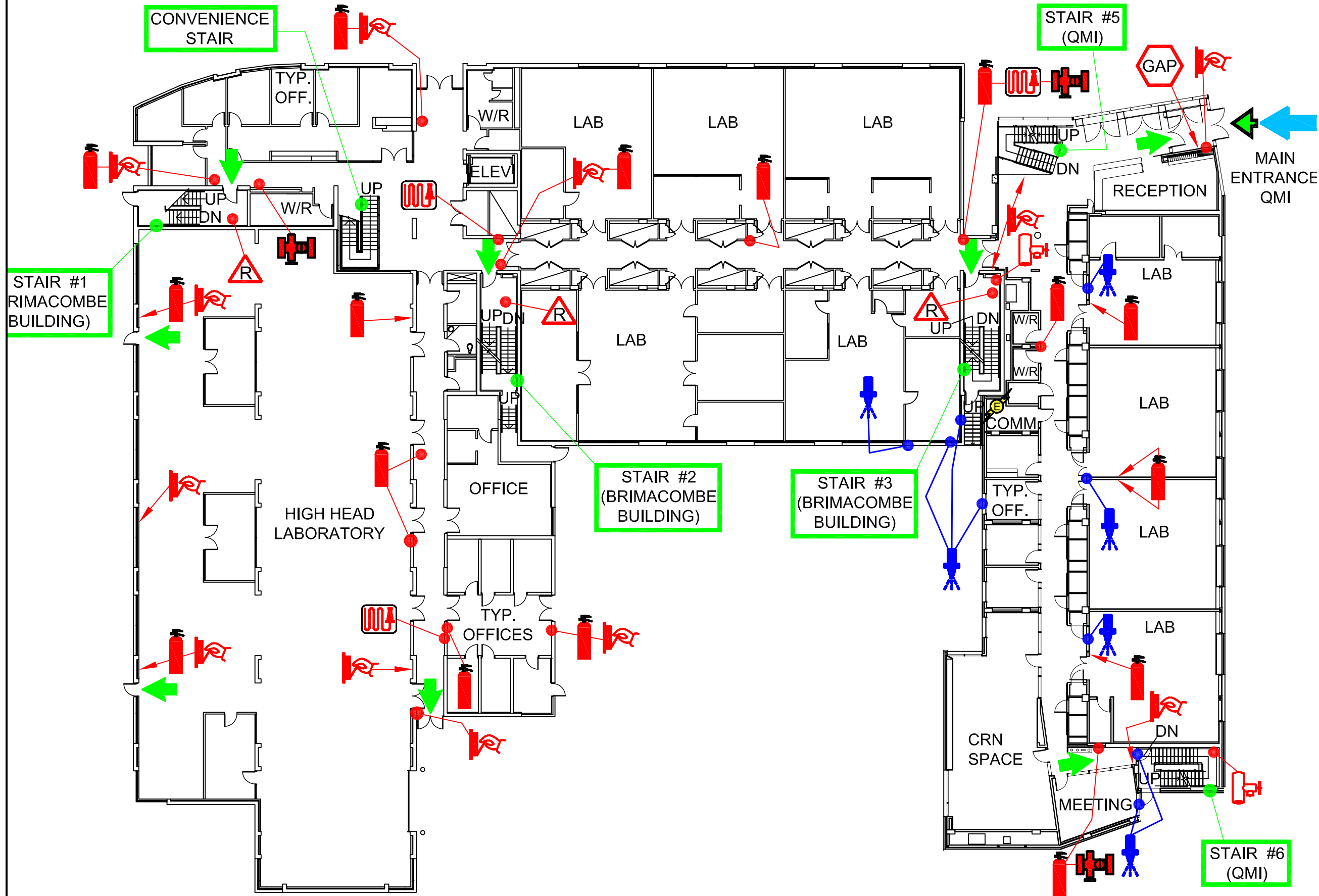




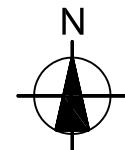
# LEGEND

- FIRE EXIT
- 1 1/2" - CLASS 2 FIRE HOSE IN CABINET
- SPRINKLER CONTROL VALVE
- AREA OF REFUGE
- FIRE DEPT. ENTRY
- MAIN ELECTRICAL SHUT-OFF
- WATER CURTAIN
- STANDPIPE CONNECTION
- FIRE ALARM CONTROL PANEL
- FIRE EXTINGUISHER
- FIRE PULL STATION

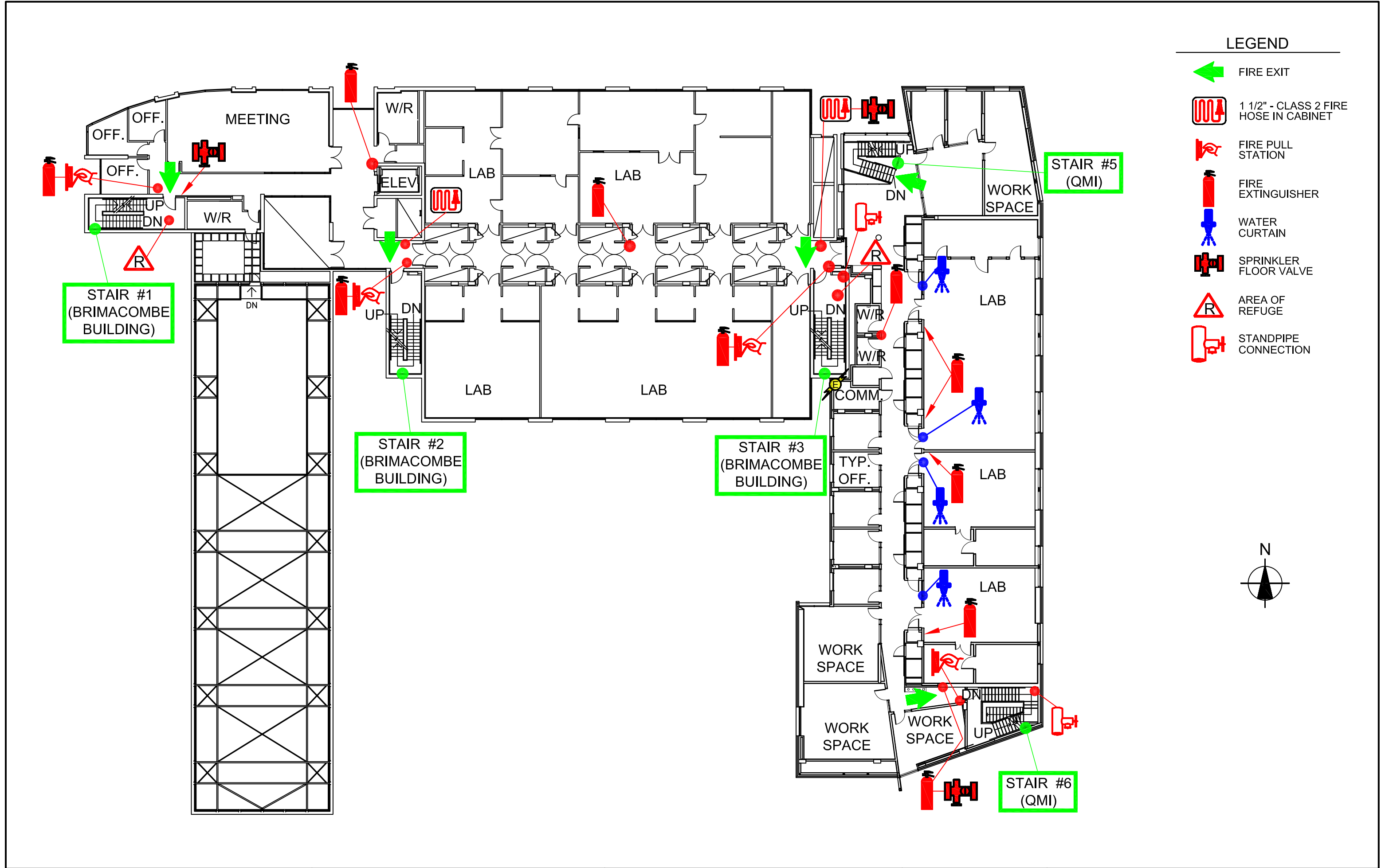


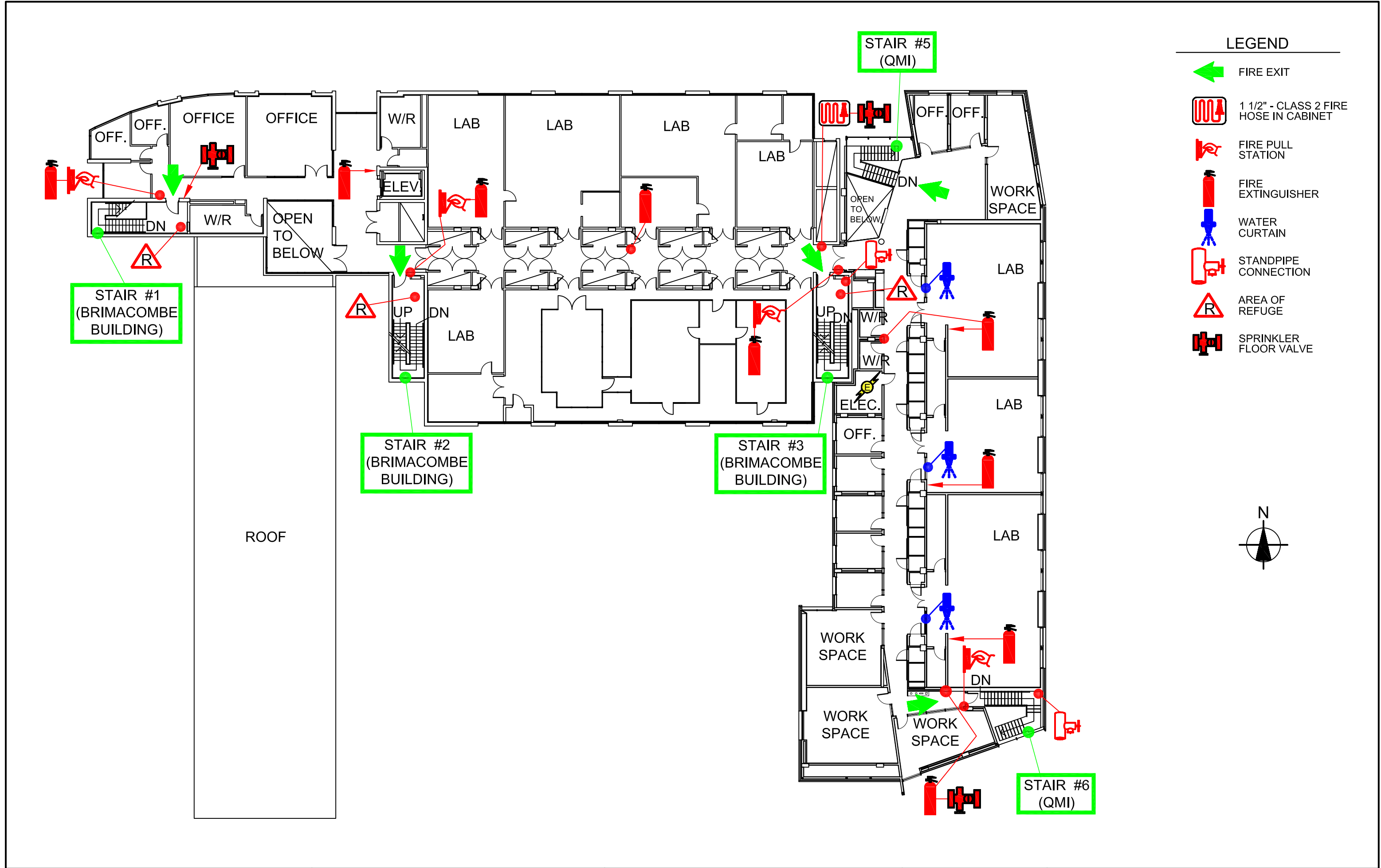


- LEGEND**
- FIRE EXIT
  - 1 1/2" - CLASS 2 FIRE HOSE IN CABINET
  - GRAPHIC ANNUNCIATOR PANEL
  - AREA OF REFUGE
  - FIRE DEPT. ENTRY
  - MAIN ENTRY
  - WATER CURTAIN
  - SPRINKLER FLOOR VALVE
  - FIRE EXTINGUISHER
  - FIRE PULL STATION

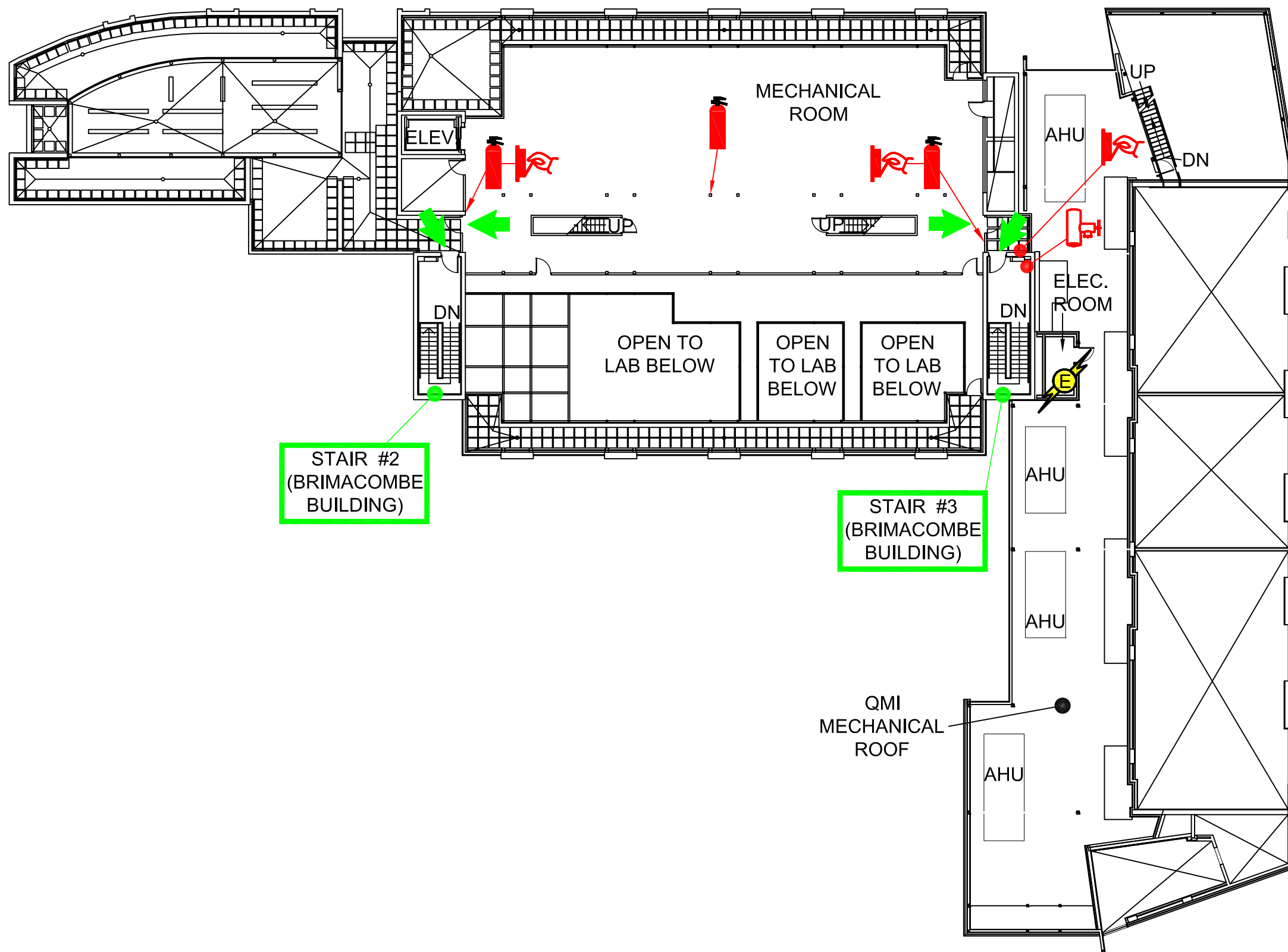
















# LEGEND

-  FIRE EXIT
-  FIRE EXTINGUISHER
-  FIRE PULL STATION
-  ELECTRICAL HAZARD



