Fire and Life Safety Analysis of a Regional Office Building

Submitted by: Peter Dwan

California Polytechnic State University, San Luis Obispo

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Keywords: Building Fire Protection, Prescriptive Analysis, Performance Based Design, Evacuation Time, Fire Dynamic Simulator

Executive Summary

This report has two objectives:

1. To confirm that the Fire and Life Safety Systems of a project building satisfy applicable prescriptive code requirements, and

2. To evaluate how the Fire and Life Safety Systems perform when challenged by a credible fire scenario.

The three-story, 31,430 sq. ft. project building is the regional office for an oil and gas company operating in Western Canada. The building includes an atrium which extends from the ground level, main floor to the third floor.

The Fire and Life Safety Systems within the scope of this study, include:

- Fire Detection and Alarms Systems (FDAS)
- Egress Components
- Water-Based Fire Protection Systems
- Structural Fire Protections Systems

Prescriptive Analysis

Analysis of the FDAS confirmed that the building is equipped with modern Fire Alarm System (FAS), code compliant, UL listed detection devices and notification appliances. The single stage FAS is augmented by a Remote Supervising Station. Notification appliances include audible and visual alarms which have proven effective in building response exercises.

The building egress elements were found to be designed and installed in compliance with the Life Safety Code. However, it was found that the building occupants have installed items which have eroded the building life safety features. Corridor width has been reduced to less than that required by the LSC by the installation of shelving and other items. In addition, combustible materials are being stored in the east exit stairway enclosure which may present a hazard to building occupants.

The building water supply was found to meet the design demand. The building owner has implemented effective programs for ongoing inspection, testing and maintenance the water-based fire protection system. Furthermore, processes are in place to track fire protection system impairment and ensure the system is returned to a fully operational status in a timely manner.

The occupancy classification of the project building was found to be Group B (Business) which requires Type II-A construction. It was confirmed that the building meets the International Building Code requirements for Type II-A construction.

Performance Based Analysis

The performance of the building Fire and Life Safety Systems when challenged by a design fire was assessed. The objective was to confirm that occupants could exit the building before they are exposed to untenable environmental conditions.

Two credible fire scenarios are evaluated; a trash bag fire in the east exit stairway enclosure and a chair fire located in the third floor, open-office area. The design fires are believed to be realistic with respect to their initial location, fire growth rate and smoke generation.

For the trash bag fire, it was concluded that the building water-based fire protection and fire detection and alarm systems work effectively when challenged. The Available Safe Egress Time (ASET) was found to be greater than the Required Safe Egress Time (RSET) and occupants could be expected to safely evacuate from the building.

In contrast, it was found that the heat release rate from the chair fire may be insufficient to activate detection systems before untenable smoke conditions develop. The ASET was found to be less than the RSET and occupants may not be able to safely evacuate from the building. The chair fire was proposed to be ignited by the unauthorized use of an electric space heater.

Recommendations

The following recommendations are made to ensure the building life safety systems are maintained and occupants can safety exit the building in the event of a fire.

1. Continue to support the fire detection and water-based fire protection system through an ongoing ITM program executed by certified technicians.

2. Implement a third-party audit program to provide assurance that the fire detection and water-based fire protection system ITM program continues to meet NFPA requirements.

3. Remove items such as shelving from the second and third floor corridors. These items were not in the building initial design and have reduced the corridor width to less than that required by the LSC.

4. Remove combustible janitorial supplies from the east exit stairway enclosure. These items present a hazard to building occupants should a fire occur.

5. Review the building policy which prohibits the use of portable, electric space heaters at the next company safety meeting.

Table of Contents

1.0 Introduction

This report has two objectives:

1. To confirm that the Fire and Life Safety Systems of a project building satisfy applicable prescriptive code requirements, and

2. To evaluate how the Fire and Life Safety Systems perform when challenged by a credible fire scenario.

The project building is the regional office for an oil and gas company operating in Western Canada. The three-story, 31,430 sq. ft. building features a training centre, emergency response centre, meeting rooms, dining areas, casual meeting space, coffee stations on each floor and a fitness area. Large perimeter windows combined with open-plan work spaces maximizes natural lighting in all areas. The building includes an atrium which extends from the ground level main floor to the third floor.

2.0 Scope

The Fire and Life Safety Systems within the scope of this study, include:

- Fire Detection and Alarms Systems
- Egress Components
- Water-Based Fire Protection Systems
- Structural Fire Protections Systems

The codes used to assess the prescriptive features of the project building include:

- NFPA 13 Standard for the Installation of Sprinkler Systems (2013)
- NFPA 25 Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems (2014)
- NFPA 72 National Fire Alarm and Signaling Code (2010)
- NFPA 101 Life Safety Code (2012)
- International Building Code (2014)

The Fire and Life Safety Systems were evaluated under fire conditions using fire growth data obtained from test burns conducted in controlled settings.

3.0 Fire Detection and Alarms Systems

The following Fire Detection and Alarms Systems (FDAS) components were examined:

- Fire Alarm System (FAS)
- Fire Detection Devices (including types, location, and placement)
    - Review of response characteristics during selected scenarios
- FAS Types and Management
    - Disposition of alarm, supervisory and trouble signals
    - Types, locations of alarm notification appliances and communications systems
    - Power requirements for the fire alarm and communication systems

- Commissioning, Inspection, Test, and Maintenance

All engineering drawings associated with the analysis of the FDAS are included in Appendix 1.

3.1 Fire Alarm System

The project building is equipped with an addressable, single stage Fire Alarm System (FAS) augmented by a Remote Supervising Station Alarm. FAS operating characteristics and associated Fire Alarm Control Panel (FACP) are outlined in the following sections.

3.1.1 *Operating Characteristics*

The FAS has the following operating characteristics:

- Operation of any initiating device results in the transmission of an alarm signal which sounds all building audible and visual notification appliances
- The location and unique identifier number of the devices is displayed on the FACP
- Alarm, supervisory and trouble signals are automatically transmitted to a Supervising Station operated by an external, third party
- The project building FAS includes a remote annunciator located in the Building Manager's main floor office. The remote annunciator provides the Building Manager with signal status and common controls with the main FACP
- All functions, including alarms, supervisory notices, trouble signals, are supervised and operational under both normal AC power and battery DC power modes
- All smoke detection devices have an indicating lamp which illuminates to indicate that the device has initiated an alarm. Concealed devices such as duct smoke detectors have remote indicating lamps.
- Elevators proceed to the ground floor when the fire alarm is activated. If the fire alarm is activated on the main floor the elevator will go to an alternate floor.

3.1.2 *Fire Alarm Control Panel*

The FACP is located at the building main entrance. The FACP is flush-mounted with all switches and controls secured behind a locked door with viewing glass.

The FACP is a GE Intelligent/Conventional Life Safety Control Panel Model QS4. The GE QS4 includes solid state, microprocessor based electronics with a high contrast LCD visual indicators. This model features:

- All supervisory and control equipment
- Standby battery power supply and charger
- Illuminated annunciator indication
- Bell silence switch
- System reset switch
- Trouble bell or buzzer and trouble silence switch

Details of the GE QS4 FACP are provided in Appendix 2

3.2 Fire Detection Devices

The project building is fully protected by automatic sprinklers and is fitted with smoke and heat detectors. The following section provides a detailed analysis of the sprinklers, winder sprinklers, smoke detectors and heat detectors.

3.2.1 *Sprinklers*

Sprinklers are fixed temperature, heat detectors. A variety of sprinkler-heads are used in the building as summarized in Table 1. The open-office areas on all floors are fitted with Victaulic model 2708 (155 °F) sprinklers. The sprinkler system is equipped with a Potter VSR-EU 6 Water Flow Detection Device located in the basement. A summary of the number and type of sprinklers found on each floor is shown in Appendix 3.

The sprinklers are typically installed on an east/west spacing of 4.5 m (14.7 ft). The north/south spacing varied up to a maximum of 4.5 m. The manufacturer's recommended installation criteria for window sprinklers are a maximum of 8 ft and a minimum of 6 ft between sprinkler heads. These spacing requirements were confirmed through a review of the as-built drawings and visual inspection from the main floor. It was not possible to measure the separation distance directly for safety reasons.

Temp (F)	Manufacturer	Model	Number	Description	Location
135	Victaulic	2708	700	Quick Response, Chrome Pendant	Open office areas, meeting rooms on all floors
135	Victaulic	2703	52	Standard Response, Brass Upright	Fitness room, janitors closet
286	Victaulic	2703	67	Standard Response, Brass Upright	Basement and penthouse mechanical and electrical rooms
135	Victaulic	3401	13	Large Orifice, Brass Upright	Shipping & receiving
135	Victaulic	2709	3	Standard Response, Chrome Sidewall	Above rollup door in shipping & receiving and in supply room
230	Victaulic	2709	3	Standard Response, Chrome Sidewall	Elevator shaft
286	Victaulic	2709	8	Standard Response, Chrome Sidewall	Electrical and data shafts on 1st, 2nd, and 3rd floor levels
135	Tyco	WS	42	Window Sprinkler	Atrium windows (3rd floor only)

Table 1: Sprinkler-head types are used in the building

3.2.2 *Window Sprinklers*

There are 42 Tyco window sprinklers installed on both sides of glass which provide fire separation between the open office space and the Atrium. The purpose of these sprinklers is to provide complete wetting and coverage for the tempered glass windows. The technical specification for the Tyco window sprinklers is included in Appendix 4.

3.2.3 *Smoke Detectors*

Photoelectric, light scattering smoke detectors are installed throughout the building, including:

- Top of stairwells
- Ceiling mounted in all office areas and meeting rooms
- Wall mounted in atrium
- Elevator lobbies
- Elevator mechanical rooms
- Electrical rooms
- Lunch rooms
- Data Rooms
- Server
- Stairwells

Four duct smoke detectors can be found in the west and east Penthouse Mechanical Rooms, specifically located in the inlet and return air ducts. Details regarding each device are provided in Table 2. The technical specifications for the smoke detectors are included in Appendix 5.

Device	Type	Manufacturer	Model
Smoke Detector	Photoelectric – Light Scattering	Edwards	SIGA-PS Photo
Duct Smoke Detector	Photoelectric – Light Scattering	Edwards	SIGA-SD

Table 2: Photoelectric, light scattering smoke detectors

3.2.4 *Heat Detectors*

Fixed temperature, heat detectors are installed in the building electrical and mechanical rooms. A list of heat detectors is provided in Appendix 6. The type of heat detectors installed is listed in Table 3.

Device	Type	Manufacturer	Model
Heat Detector	Fixed Temperature (57 °C)	GE – Edwards	SIGA-HFS

Table 3: Fixed temperature heat detectors

Fixed temperature (57 °C) heat detectors are ceiling mounted in all electrical rooms, mechanical rooms and in the East and West Penthouses. Technical specification for the heat detectors is included in Appendix 7.

3.3 Fire Alarm System Types and Management

The project building is equipped with a single stage, FAS consisting of ULC listed equipment. The FAS is electrically supervised and meets all Code requirements.

The FAS includes a supervisory control panel, visual and audible alarms, manual pull stations, automatic heat detectors, automatic smoke detectors and computer room pre-action panel. Detection devices can be interchanged without requiring any changes to the wiring or control equipment.

3.3.1 *Alarm Management*

Operation of any initiating device will sound alarm. The location of the initiating device will be indicated on the FACP. All functions (alarms, supervisory notice, trouble indicating, etc.) are supervised and operational under both normal AC power and battery DC power modes.

All smoke detection devices have an indicating lamp on the device which illuminates and indicating which device has initiated alarm.

When a fire alarm is initiated, the system will perform the following functions:

- Sound alarms
- Indicate location and device on main FACP
- Send alarm to signal to monitoring company
- Unlock security doors
- Close doors held by hold open devices
- Turn on lights
- Shut down mechanical fans (upon activation of duct detectors only)
- Return all elevator to the main (ground) floor

Alarm, supervisory and trouble signals are automatically transmitted to a Supervising Station operated by an external third party (ADT). ADT is under contract with the building owner to monitor signals originating from the project building. ADT notifies the municipal Fire Department and building management personnel on receipt of an emergency signal. A copy of the Protective Signaling Service Agreement is included in Appendix 8.

3.3.2 *Trouble Signals*

All wiring and components for the FAS are fully supervised. Trouble on any circuit or component of the FAS is indicated by audible and visual alarms at FACP and the Remote Annunciator. Normal power and battery power supply are also supervised so that if either, or both, fail, trouble will be indicated. Indicating lamps are also provided for power supply batteries and battery chargers.

3.3.3 *Disposition of Alarms*

When the alarm initiating devices have been restored to a normal position, the system control can be reset by depressing a single reset pushbutton.

3.3.4 *Alarm Notification Appliances*

The building is fitted with Edwards Horn/Strobe combination notification appliances that are UL-1971 listed for indoor use as wall-mounted public-mode notification appliances for the hearing impaired. The type of notification appliances installed is listed in Table 4.

Device	Manufacturer	Model	Operating Parameters
Horn/Strobe combination	Edwards	G1-HDVM	101.4 dB*, 75 cd
Horn/Strobe combination	Edwards	GE 757 WP	98 dBA at 10 ft

Table 4: Types of alarm notification devices installed

Both devices use the following three pulse temporal pattern: ½ second ON, ½ second OFF, ½ second ON, ½ second OFF, 1 ½ second OFF, then repeat. Strobe flash rate is synchronized with all devices on the same circuit.

The location of alarm notification devices is summarized in Table 5. Weather proof horn/strobe combination appliances are mounted on the exterior walls of the East and West Penthouse. The GE 757 series are UL listed and intended for outdoor use.

Location	Manufacturer	Model	Number
Penthouse (exterior)	Edwards	757	2
Penthouse	Edwards	G1-HDVM	4
Third Floor	Edwards	G1-HDVM	22
Second Floor	Edwards	G1-HDVM	23
Main Floor	Edwards	G1-HDVM	22
Basement	Edwards	G1-HDVM	8

Table 5: Location of alarm notification devices

3.3.5 *Audible Alarm Signals*

The appliance must be able to meet the requirements NFPA 72 part 18.4.3.1 which require a sound level at least 15 dB above the average ambient sound level measured 5 ft (1.5 m) above the floor area. The

average ambient sound levels were analyzed in the West Penthouse Mechanical Room with results listed in Table 6.

Location	Average ambient Sound Level (dBA)	Target Sound Level (dBA)
Business occupancies	55	70
Mechanical rooms	85	100
Storage occupancies	30	45

Table 6: Average Ambient Sound Level According to Location. Analysis - West Penthouse Mechanical Room

The horn/strobe appliances are field set at 101.4 dBA.

The greatest distance a building occupant could be from the audible appliance is about 47.2 ft. based on the drawing shown in Appendix 9. The sound level 47 ft from the appliance is calculated using Equation 1 (SFPE Handbook).

$$dB_1 = dB_\circ + 20\ log\ (d_\circ/d_1) \qquad \textit{Equation 1}$$

$$dB_\circ = \textit{101.4 dB at 10 ft from source}$$

$$d_\circ = 10\ ft$$

$$d_1 = 47\ ft$$

$$dB_1 = 101.4\ dB = 20\ log(\frac{10}{47})$$

$$dB_1 = 89\ dBA$$

The sound level is further degraded by the angle between the worker and a line perpendicular to the appliance. The manufacture's specification provides additional information on the impact of direction on the sound level as shown in Table 7, in which angles are measured from a perpendicular axis, positive angles to the right. The angle is approximately -35° which suggested an additional 3 dB should be deducted from the 89 dB calculated above resulting in an estimated 86 dB.

Angle	dB
0	0

+18	-3
+42	-6
-50	-3
-75	-6

Table 7: Audible signal attenuation directional characteristics
Source: GE Security Genesis Temporal Horn-Strobe Installation Sheet No. 31000560 (2009)

The audible signal is attenuated below the target value of 100 dBA, which does not meet NFPA 72 requirements. After further investigation, it was discovered that this non-compliance is of no concern due to the mandatory use of hearing protection. Noise measurements taken by the company's Industrial Hygienist indicate that hearing protection is required in all building mechanical rooms. The use of hearing protection results in workers becoming reliant on visual signals from the horn/strobe appliance in event of an alarm.

3.3.6 *Analysis – Third Floor Open-Office Area*

The greatest distance from any given horn/strobe appliance in open-office area was found to be approximately 26 ft as shown in Appendix 9. The sound level at that point was calculated using Equation 1 (SFPE Handbook, 2009).

$$d_\circ = 10\ ft$$

$$d_1 = 26\ ft$$

$$dB_1 = 101.4\ dB = 20\ log(\frac{10}{26})$$

$$dB_1 = 93\ dBA$$

The angle between the appliance and the worker was measured to be about 35°. Based on Table 7, 3 dB should be deducted. The sound level at the greatest distance was found to be approximately 87 dB which is greater than the target value of 70 dB. It can be concluded that the audible notification appliance meets the requirements of the NFPA 72.

3.3.7 *Visual Alarm Signals*

The building was fitted with visual alarms to ensure persons with hearing impairment are adequately alerted to the fire alarm condition.

NFPA 72, Table 18.5.4.3.1(a) provides guidance on spacing for wall mounted, visible appliances. As shown in Table 4, the installed strobes are field-set to 75 cd. Table 18.5.4.3.1(a) indicates that a single 75 cd appliance is adequate for a 13.7 m x 13.7 m area. Based on the building drawings each 75 cd appliance covers an area of 4.5 m x 4.5 m in the open-office space of the first, second and third floors. The visual alarms also meet the following NFPA 72 requirements.

- Wall mounted appliances shall be 80 to 96 inches above finished floor
- Visible notification appliances shall be located not more than 15 ft from the end of the corridor with a separation not greater than 100 ft between appliances (NFPA 72 - 18.5.5.5.5)
- In corridors where more than two visible notification appliances are in any field of view, they shall flash in synchronization (NFPA 72 - 18.5.5.5.7)

3.3.8 *Mass Notification Systems*

The project building is not equipped with a mass notification system.

3.3.9 *Power Requirements for Fire Alarm*

Primary electrical power is provided by the local utility company. Backup power is supplied by a local, standby diesel generator which can supply 30kW, 347/600V, three-phase power at 500 Hz. Sufficient fuel is stored onsite to operate the generator at an 80% load for 8 hours.

The standby generator is designed to automatically start and accelerate to rated speed and voltage on a normal power failure within 15 seconds. During the generator start-up phase, the building FAS relies on an Uninterrupted Power Supply (UPS). The battery specifications are summarized in Table 8. The secondary power supply requirements for the building FAS are shown in Table 9, 10 and 11.

Model	Description	Number	Total Amp-hours Available
12V6A5	7.2 Ah Sealed Lead Acid Battery – 12 DC	2	14.4 Ah

Table 8: Uninterrupted Power Supply Batteries

Item	Description	Standby Current per Unit (mA)		Qty		Total Standby Current per Unit (mA)		Alarm Current per Unit (mA)		Qty		Total System Alarm Current per Unit (A)
A	Main FACP (Model QS4)	199	x	1	=	199.00		235	x	1	=	235
B	Auxiliary Panel	154	x	1	=	154.00		166	x	1	=	166
C	Isolator Module (SIGA-MM1)	0.05	x	17	=	0.77		0.05	x	17	=	0.8
D	Heat Detector	0.05	x	17	=	0.77		18	x	17	=	306
E	Smoke Detector	0.05	x	88	=	3.96		18	x	88	=	1584
F	Smoke Detector (Duct)	0.05	x	4	=	0.18		18	x	4	=	72
G	Horn/Strobe G1-HDVM	0.00	x	79	=	0.00		40	x	79	=	3160
H	Horn/Strobe 757 (Exterior)	0.00	x	2	=	0.00		337	x	2	=	674
I	Manual Pull Stations (SIGA 270)	0.25	x	14	=	3.50		0.4	x	14	=	6
J	Tamper Switches (SIGA WTM/CT2)	0.25	x	4	=	1.00		0.4	x	4	=	2
K	Control Relay Module (SIGA-CR)	0.10	x	4	=	0.40		0.1	x	4	=	0.4
		Total System Standby Current (A)				0.36		**Total System Alarm Current (A)**				6.21

Table 9: Current requirements during standby and alarm conditions

Standby:	24	h				**Alarm:**	5	min OR	0.08	h
Required Standby Time (h)		Total System Standby Current (A)		Required Standby Capacity (A-h)	Required Alarm Time (h)			Total system Alarm Current (A)		Required Alarm Current (A-h)
24	x	0.36	=	8.7	0.083		x	6.21	=	0.52
Required Standby Capacity (A-h)		Required Alarm Current (A-h)		Total required Capacity (A-h)		Factor of Safety (20%)		Required Battery Capacity (A-h)		
8.7	+	0.52	=	9.24	x	1.2	=	11.09		

Table 10: Required secondary power supply requirements

Circuit	Panel	Horn/Strobe - HDVMI (A)	Horn/Strobe - 757 (A)	Wire Size (AWG)	Resistance (Ohm/1000 ft)	Length (ft)	Total Current	Voltage Drop	% Voltage Drop	24 - V
		0	0							
Penthouse West and 3rd Floor West	FACP	10	1	12	1.98	286.0	0.7	0.8	3.5%	23.2
Penthouse East and 3rd Floor East	FACP	10	1	12	1.98	741.5	0.7	2.2	9.0%	21.8
2nd Floor West	FACP	10	0	12	1.98	299.0	0.4	0.5	2.0%	23.5
2nd Floor East	FACP	15	0	12	1.98	641.0	0.6	1.5	6.3%	22.5
Ground East	FACP	14	0	12	1.98	661.4	0.6	1.5	6.1%	22.5
Ground West and Basement	FACP	19	0	12	1.98	568.9	0.8	1.7	7.1%	22.3

Table 11: Required secondary power supply requirements

3.4 Commissioning, Inspection, Testing and Maintenance

The building FAS was tested to ensure operation is in conformance with the applicable standard required by the Authority Having Jurisdiction (CAN/ULC S537-04). The scope of the inspection included confirmation of the following requirements.

- The type of equipment installed was as specified
- The installer adhered to ULC and CSA requirements for wiring connections to all equipment
- The equipment was installed in accordance with the manufacturer's recommendations
- All devices were operated or tested to verify their operation
- The supervisory wiring of equipment connected to supervised circuits was operating

Testing was completed by Chubb Edwards on March 12, 2012. A copy of the test report is included in Appendix 10.

The FAS was also checked and tested to ensure proper operation. Testing included the satisfactory operation of all initiating devices, equipment functions and supervisory functions.

Subsequent to checking and testing, certification was performed on completed system. Certification was done by the installing contractor and the manufacturer's representative in accordance with CAN/ULC S537-04 and was completed in the presence of a registered Professional Engineer as required by National Building Code of Canada. A copy of the Certificate of Verification is included in Appendix 11. Additional FAS inspection, testing and maintenance programs are carried on weekly, monthly and annually.

3.4.1 *Ongoing Testing and Maintenance*

The building owner has entered into a contract with Siemens Canada Limited to conducts ongoing testing and inspection of the FAS. The service includes an annual test of all covered fire systems by certified specialists according to the protocol set in CAN/ULC S537-04. Seimens also performs sensitivity testing of all smoke detectors to ensure that the equipment is operating within the proper UL specified sensitivity range.

3.5 Fire Detection and Alarm System Findings

The preceding analysis confirms that the project building is equipped with modern FAS, code compliant, UL listed detection devices and notification appliances. Detection devices are suitably located to provide the rapid detection of a fire. The single stage FAS is augmented by a Remote Supervising Station. Alarm, supervisory and trouble signals are automatically transmitted to a Supervising Station operated by ADT. Notification appliances include audible and visual alarms which have proven effective in building response exercises. The building owners continue to support the FAS through an ongoing maintenance and testing program executed by certified technicians.

4.0 Egress Components

The purpose of this section is to determine if the project building met the prescriptive requirements of NFPA 101 – Life Safety Code (LSC). The occupancy classification of the various spaces within project building was determined. The means of egress was assessed and the building evacuation time was estimated.

4.1 Occupancy Classification

The occupancy types found in the project building are summarized in Table 12. Additional details of the occupancy are shown in Figures 1 through 4.

Floor	Use	Occupancy Description	Area (m2)	Occupant Load
Basement	Assembly	Fitness centre, training rooms and incidental storage (LSC 42.1.2.2)	355	164
	Storage	Storage of Ordinary Hazard Goods (LSC 6.2.2.3)	191	4
Main	Assembly	Meeting rooms some of which are fixed seating; eating area (no kitchen), waiting	355	138
	Business	Open plan office space with fixed seating; meeting rooms, incidental spaces such as storage, server room, coffee/copy/printing stations	1700	81
Second	Business		2175	176
Third	Business		2175	140

Table 12: Occupancy types found in the building

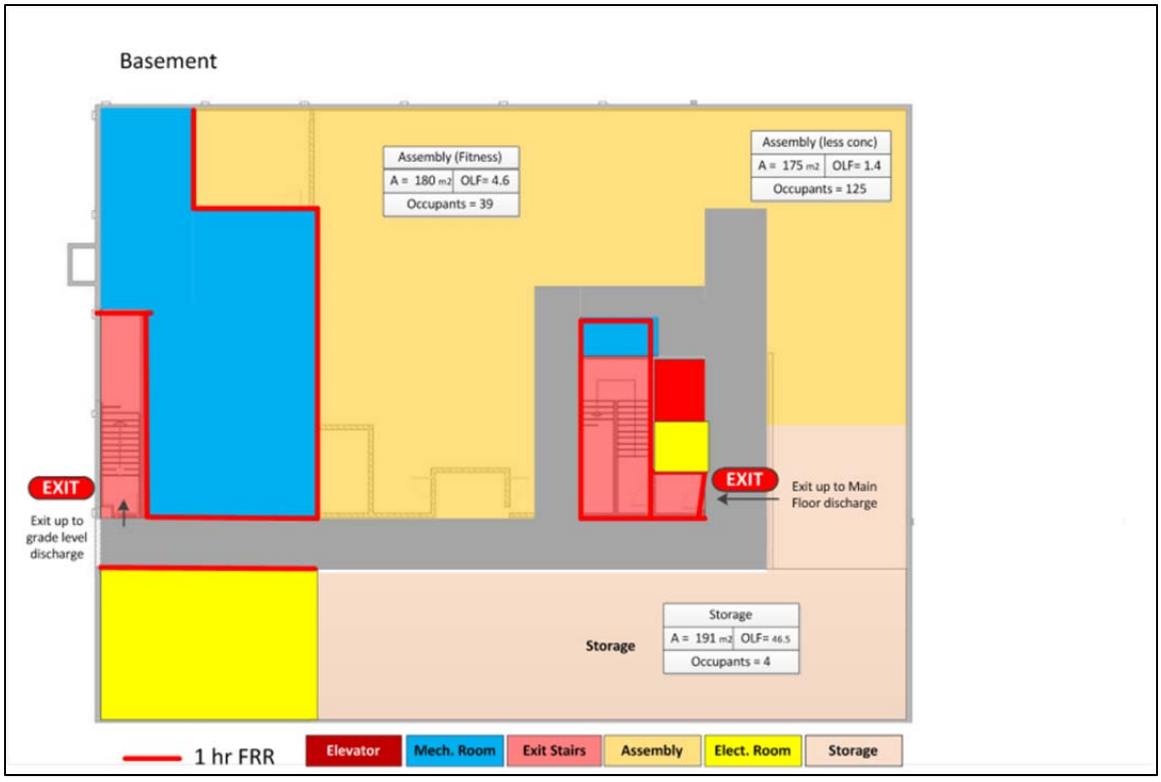

Figure 1: Basement occupancy classification

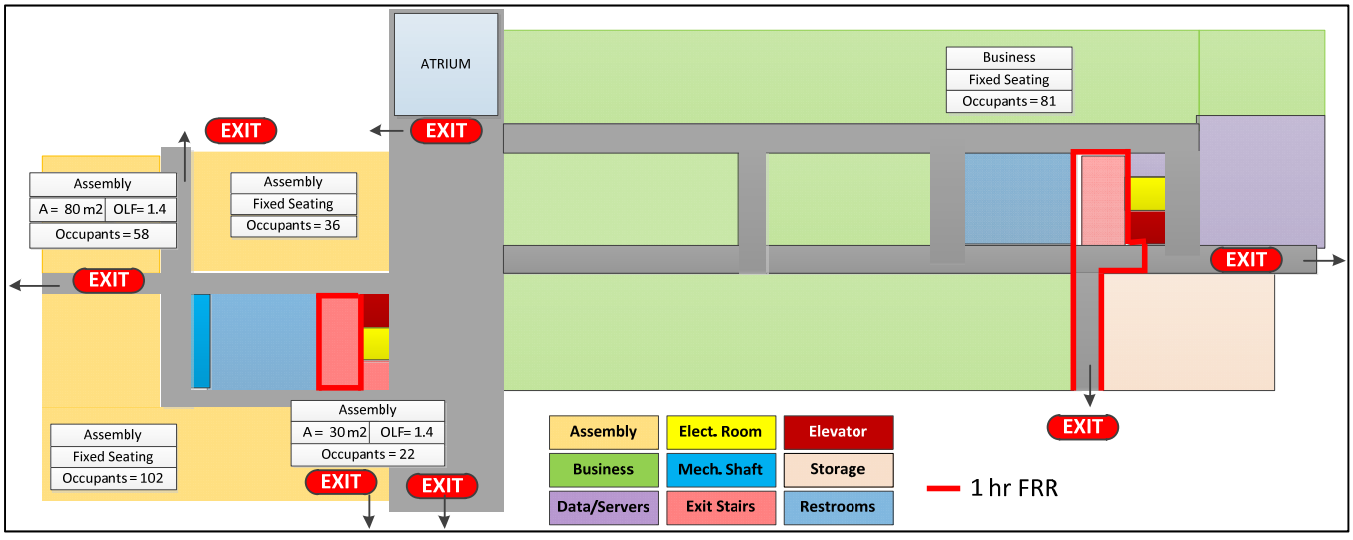

Figure 2: Main floor occupancy classification

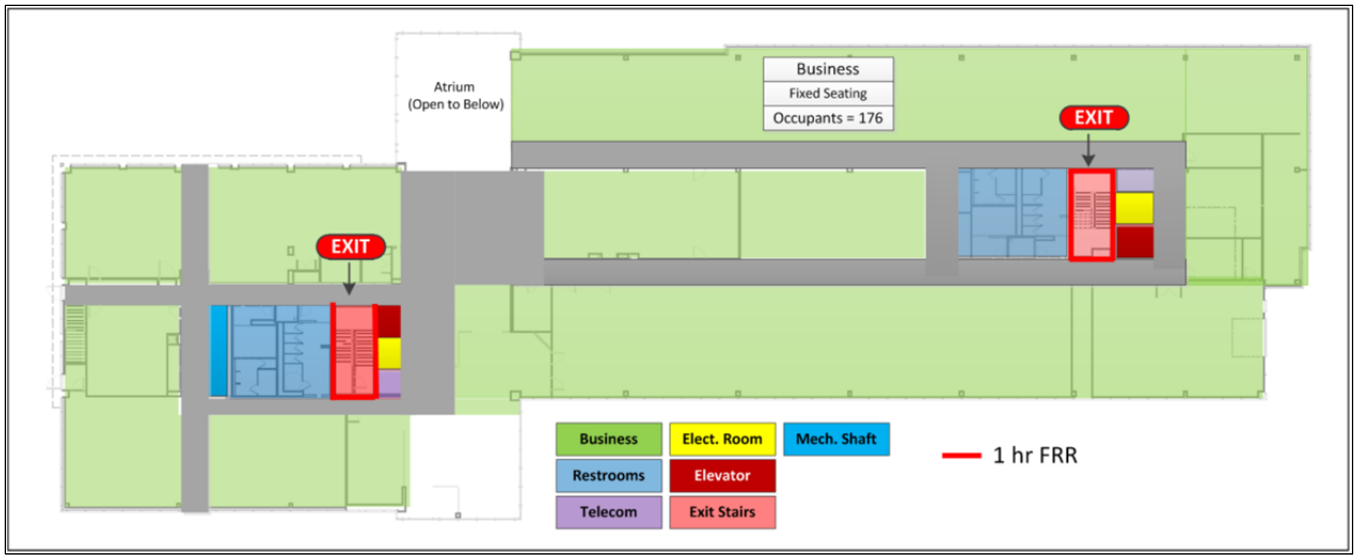

Figure 3: Second floor occupancy classification

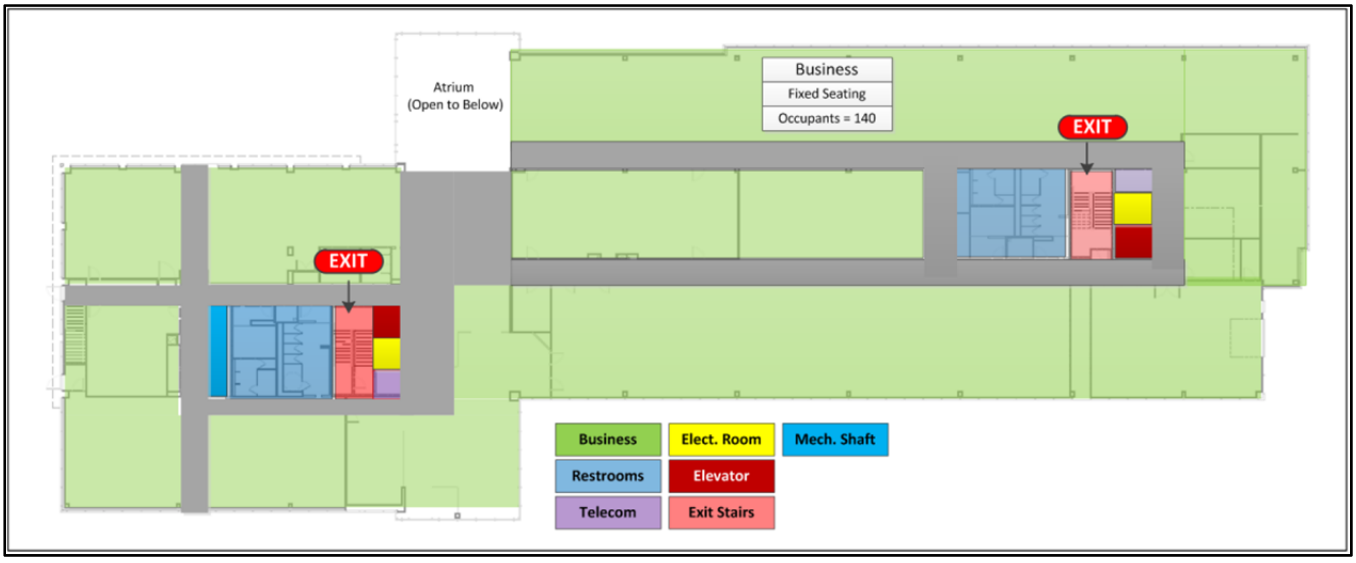

Figure 4: Third floor occupancy classification

4.2 Means of Egress

A means of egress consists of the exit access, the exit and the exit discharge components. The components of the various means of egress are evaluated in the following sections.

4.2.1 *Exit Access*

Distance between Exits (LSC 7.5.1.3.2)

When more than one exit is required, doors must be spaced at a distance no less than one half the maximum overall diagonal dimension of the space, unless the building is sprinklered. The half diagonal distance is presented in Figure 5. Note that the building is fully protected by automatic water sprinklers.

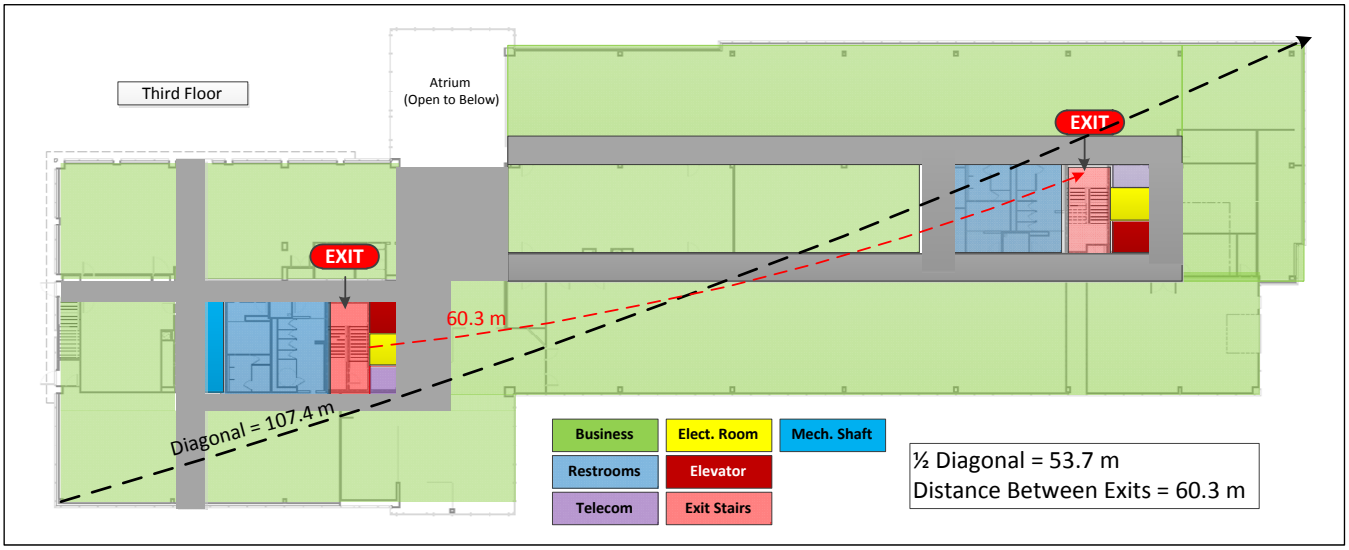

Figure 5: Exit separation distance

Maximum Length of Common Path of Travel (LSC 3.3.42 and Table A 7.6)

A common path of travel is that portion of the exit access that must be traversed before two separate and distinct paths of travel to two exits are available. The common path of travel is limited to 75 ft. (22.9 m) in most occupancies or 100 ft. (30.5 m) in sprinklered spaces.

Common travel paths in the Business Occupancy spaces are short due to the open-plan design. The longest common path of travel was found is the Assembly areas on the main and basement floors as shown in Figure 6 and 7 respectively.

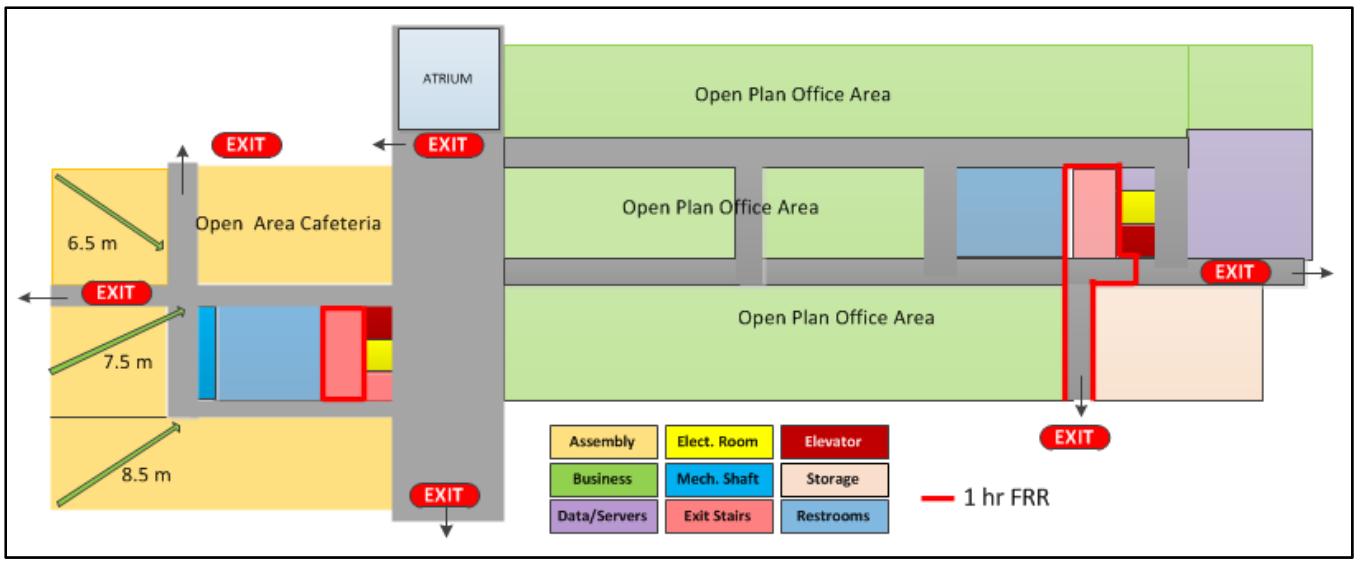

Figure 6: Common path of travel on the main floor. Most of the main floor is open plan space with multiple paths to the exits.

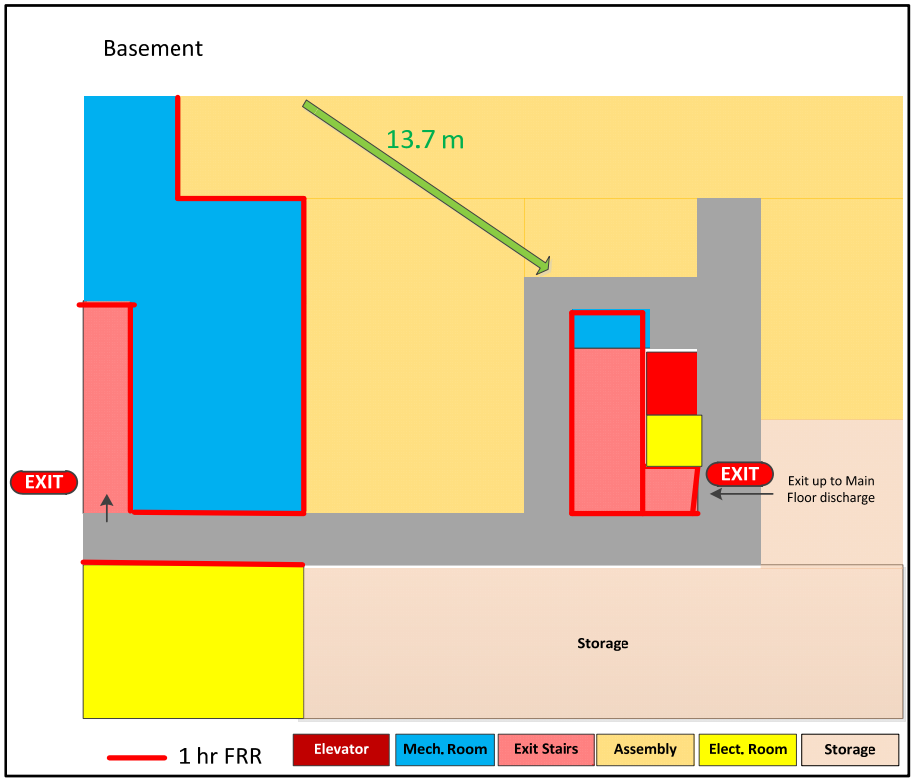

Figure 7: Common path of travel in basement

Exit Access Travel Distance (LSC 7.6; Table A.7.6; 38.2.6.3)

The maximum length of exit access travel, measured from the most remote point along the path of travel, cannot exceed 300 ft (91 m) in sprinklered spaces. The maximum travel distance found in the building was about 25 m.

Corridors (LSC 38.3.6)

Corridors are intended to provide a greater level of safety than the rooms that they serve. Corridors providing access to exits are required to be separated from use areas by fire barriers having a minimum 1 hour fire resistance rating unless the building is protected throughout by automatic sprinklers. The project building is fully protected by automatic sprinklers. One hour fire resistant construction is provided in the corridor leading from the East Exit Stairway to the exit discharge as shown in Figure 7.

Corridor Width (LSC 12.2.3.8 and 38.2.3.2)

For both Business and Assembly Occupancies, the minimum clear width of corridors serving 50 or more persons shall not be less than 44 in (1120 mm). The project building is designed and constructed with wide corridors which exceed the LSC requirements as shown in Figure 8. However, the building occupants have installed items such as stand-alone shelving and paper recycling bins which reduce the corridor width to less than the prescribed 44 inches in some locations as shown in Figure 9.

Figure 8: Third floor, 72" wide corridor along the north side of the building.

Figure 9: Second floor corridor obstructed by the shelving and paper recycling bins

Corridor Dead Ends (LSC 7.6 Table A.7.6)

Dead Ends are portions of corridors that, due to their configuration, required occupants to retrace portions of their path to reach an exit. The dead end limit for both Business and Assembly occupancies in a sprinklered building is 15 m. No dead ends greater than 8.5 m were found in the project building.

4.2.2 *Exit*

Number and Location of Exits (LSC 7.4.1.2)

Where the occupant load is greater than or equal to 50, the LSC requires more than one exit. This requirement is met throughout the project building. The building provides two exits from each above-grade floor which pass through a protected space (FRR = 1 hr) of the East and West Exit Enclosures; see Figure 10. The Basement is also served by two exits; one which utilizes the West Exit Enclosure and a second leading to a grade level exit which discharges on the west side of the building; see Figure 11.

Figure 10: East and west exit enclosures during the project building construction.

Figure 11: Egress from the basement is via the West Exit Stairway Enclosure or the exit stairs that can be seen passing though the basement roof slab in the foreground.

Exit Stair Enclosures (LSC 7.1.4.1; LSC 10.2; LSC 7.1.3.2.3 and IFC 315.2.2)

The Exit Stair Enclosures are constructed of concrete as shown in Figure 10. The interior walls and ceiling finish of the Exit Stair Enclosures are finished with paint only and meets the LSC requirements.

The LSC prohibits the use of exit enclosures for any purpose that has the potential to interfere with its use as an exit. The building owner has allowed considerable quantities of combustible janitorial supplies to be stored in the East Exit Enclosures as shown in Figure 12.

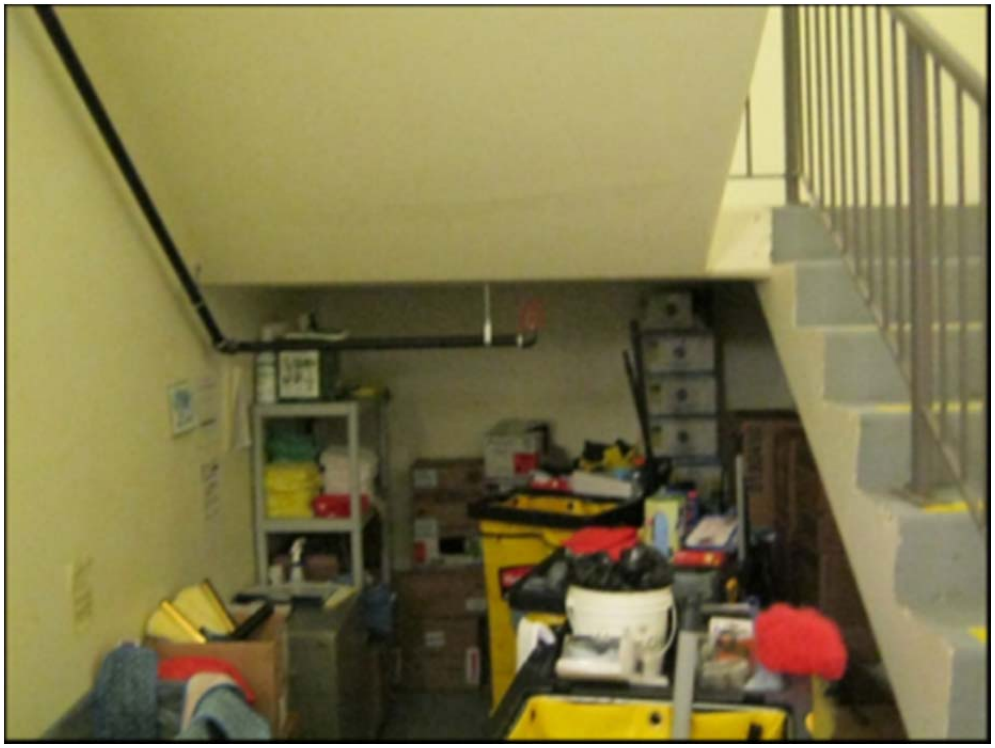

Figure 12: Janitor supplies stored at the main floor level within the east exit stair enclosure.

The capacity of exit doors and stairways was determined using capacity factors as shown in Table 13. In all cases it was found that the egress elements provided more capacity than required.

Floor	Egress Element	Nominal Width (mm)	Clear Width (mm)	Capacity Factor (mm/person)	Egress Element Capacity (persons)	Total Available/Required (persons)
Basement	Exit Stairway Door (West)	900	855	5	171	300/168
	Exit Stair (West)	1500	1140	7.6	150	
	Exit Stairway Door (East)	900	855	5	171	
	Exit Stair (East)	1500	1140	7.6	150	
Main	Double Doors off Atrium	1865	1775	5	355	1825/220
	Double Doors off Cafeteria	1865	1775	5	355	
	East	1100	1055	5	211	
	Main Entrance	1100	1055	5	211	
	South Adjacent to Main	1800	1755	5	351	
	South East	900	855	5	171	
	Shipping and Receiving	900	855	5	171	
Second	Exit Stairway Door (West)	900	855	5	171	300/176
	Exit Stair (West)	1500	1140	7.6	150	
	Exit Stairway Door (East)	900	855	5	171	
	Exit Stair (East)	1500	1140	7.6	150	
Third	Exit Stairway Door (West)	900	855	5	171	300/140
	Exit Stair (West)	1500	1140	7.6	150	
	Exit Stairway Door (East)	900	855	5	171	
	Exit Stair (East)	1500	1140	7.6	150	

Table 13: Egress element capacity base on LSC capacity factors

4.2.3 *Exit Discharge*

The exit discharge serves to connect the exit to a public way. Exit discharge must be kept clear and free of obstructions. The project building has a contractor who is responsible for snow removal and ensuring all exits are clear and free of ice.

Emergency Lighting (LSC 7.9.1.1)

Emergency lighting is provided for all egress paths. The emergency lights are integrated to the rest of the building lighting system. On loss of main power, the end lamps which illuminate egress paths remain on drawing power from an Uninterrupted Power Supply (UPS) located in the Basement; see Figure 13. The UPS specifications and test report are in attached in Appendix 12. The building lighting system is also connected to a backup, diesel generator which starts automatically on loss of main power.

Figure 13: Emergency lighting and exit signs. The devices identified by the arrows remain illuminated following a main power loss by drawing on the building UPS. Only the end lamps above the corridor are on the UPS.

Exit Signs (LSC 7.10.1.2 .1 and 7.10.1.2.2)

All exits are clearly identifiable as exits, and marked by an approved sign that is readily visible from any direction of exit access as shown in Figure 13. The emergency lighting UPS provides backup power to the exit signs. Horizontal components of the egress path within an exit enclosure are marked by approved exit signs.

4.3 Interior Finish

The required burning characteristics of interior finish materials are summarized in Table 14. As shown in Table 15 the floor, wall and ceiling finish materials met the requirements the flame spread and smoke development indices.

Occupancy Type	Walls and Ceilings		Floors
	Exits and Exit Access Corridors	Other Areas	
Existing Business (LSC 39.3.3.2)	A or B	A or B or C	No Requirements
Occupancy Type	Corridors and Lobbies	Enclosed Stairways	Assembly Areas (OL < 300)
Existing Assembly (LSC 13.3.3.2)	A or B	A	A or B or C

Table 14: Requirements for interior wall and ceiling finish

- *Class A interior wall and ceiling finishes shall be those finishes with a flame spread index of 0–25 and a smoke developed index of 0 – 450 and shall include any material classified at 25 or less on the flame spread index test scale and 450 or less on the smoke developed index test scale* (LSC 10.2.3.4.1).
- *Class B interior wall and ceiling finishes shall be those finishes with a flame spread index of 26–75 and a smoke developed index of 0 – 450 and shall include any material classified at more than 25 but not more than 75 on the flame spread index test scale and 450 or less on the smoke developed index test scale* (LSC 10.2.3.4.2).

Material	Manufacturer/Product	Flame Spread Index	Smoke Development Index	Reference
Acoustic Ceiling Tile	Armstrong/ Ultima	Class A	<50	http://www.armstrong.com/pdbupimages/1916183692.pdf
Carpet	Milliken/ Consequence	Class A	<450	Test Number 122839-8 Independent Textiles Testing Service Dalton GA
Linoleum Flooring	Johnsonite/ Veneto	Class A	<450	http://johnsonite.com/Portals/8/files/pdfs/Product%20Spec/Veneto%20Acoustiflor.pdf?ver=2013-06-09-231200-000
Rubber Flooring (Fitness Centre)	Mondo/ G712	Class A	<450	http://www.kieferusa.com/by-brand/mondo/mondo-advance/
Vinyl Wall Covering	Maharam/ Tek-Wall Parable 398650	20	20	Tek-Wall Parable was tested and met the following flammability requirements: Upholstered Walls: ASTM E 84 Unadhered flame 20, smoke 200 Walls: ASTM E 84 Adhered flame 20, smoke 20 clientservices@maharam.com
Vinyl Wall Covering	Maharam/ Tek-Wall View 399432	20	15	Tek-Wall View was tested and met the following flammability requirements: Upholstered Walls: ASTM E 84 Unadhered flame 25, smoke 70 Walls: ASTM E 84 Adhered flame 20, smoke 15 clientservices@maharam.com
Vinyl Wall Covering	Maharam/ Chord 398880	25	45	Test Number: 3922-9493 Material Tested: 20 oz. Fabric Backed Vinyl Wallcovering Date: August 22, 2007 Test Results: Time to Ignition = 00.07 minutes Maximum Flamespread Distance = 04.90 feet Time to Maximum Spread = 01.40 minutes Flame Spread Index = 25 Smoke Developed Index = 45

Table 15: Flame spread and smoke development indices for floor, wall and ceiling finish materials
Products were tested in accordance with ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials

4.4 Building Evacuation Time

The total time required to evacuate a building has several components as shown in Equation 2 (SFPE Handbook):

$$T_{evacuation} = T_{notification} + T_{reaction} + T_{pre-evacuation} + T_{movement} \qquad Equation\ 2$$

4.4.1 *Notification Time*

Notification time begins when ignition occurs, and ends when occupants are notified through some means, such as a visual or audible communication. Fire detection may occur via the installed fire protection system (e.g. smoke alarms) or when evidence of a fire is recognized by an occupant.

There are two variables which impact notification time; the lag time between ignition and the fire signature (e.g. smoke) to reach the detector at a prescribed level, and fire alarm system activation. The lag time from ignition to detection is a function of the designed fire scenario. The NFPA 72 specifies a maximum of 10 seconds for fire alarm system to actuate alarm notification appliance or voice communications after a detection device activates (NFPA 72 – 10.9.2). For the purpose of this analysis, the notification time is assumed to be 10 seconds.

4.4.2 *Reaction Time*

Reaction time is the time it takes an occupant to perceive the alarm, or fire cue, and decide to take action. Various factors effect reaction time including hearing ability, mental capacity, use of alcohol or drugs, age, and/or whether the occupant is awake or asleep (NFPA Handbook 4-51).

Occupant characteristics have been shown to influence how people respond to fire and their ability to self-rescue. The following characteristics of the building occupants were examined and taken into consideration when estimating the delay time and travel speeds.

Population and Density

The number of workers found on each floor was calculated using the area and Occupancy Load Factor (OLF) or from a simple count in cases where there was fixed seating. The population per floor is summarized in Table 16. The use of the building is restricted to company employees. The number of occupants in the basement set at zero to avoid double counting. At any particular time, the number of persons in the basement would be subtracted from the total for their respective “home” floor.

Floor	Population (persons)
Basement	*
Main	219
Second	176
Third	140

Table 16: Population distribution by floor

Familiarity with the Building

Occupants have a high degree of familiarity with the building. All visitors are required to sign in and must be met by their contact person prior passing beyond the reception area. Visitors are to take direction from their assigned contact person if the need for building evacuation arises. A high degree of building familiarity has been shown to reduce delay time. (SFPE Handbook pp 2102)

Activities

Building occupants are routinely engaged in business tasks while working at their desks or in small groups in the various meeting rooms. A small number may be using the basement fitness centre or main floor cafeteria. The building occupants would not be expected to be engaged in activities which would prolong their reaction or pre-evacuation time.

Physical and Cognitive Abilities

Physical and cognitive abilities can strongly influence egress travel and reaction times (NFPA Handbook Table 4.2.6). The building occupants are of average physical fitness and better than average cognitive abilities. The majority of the occupants have post-secondary training in subjects such as engineering, geology, computer science and accounting. The building meets all Code requirements for accommodation of persons with disabilities such as assessable washroom facilities. At the time of this analysis there were no occupants with special needs. However, the presence of persons with reduced mobility was taken into account in the egress modeling.

Social Affiliations

The building occupants are not transient therefore a high degree of social affiliation can be expected. Social affiliation can increase pre-evacuation time as people seek out friends prior to beginning to move toward an exit. (Proulx 1995)

Roles and Responsibilities

Each floor has several assigned Fire Wardens who have defined roles and responsibilities during a building emergency. The presence of a fire warden is expected to reduce the delay time. (SFPE Handbook pp 2100)

Location

The building is located in a northern climate where outside temperatures are routinely sub-zero during winter months. Under cool weather, delay times increase as shown in Table 15. (NFPA Handbook Table 4.2.1)

Culture

Occupants are frequently exposed to information and participate in activities meant to strengthen the safety culture. Groups with a strong safety culture would be expected to demonstrate the behavior expected of them and exit the building in an orderly fashion. (SFPE Handbook pp 2100)

Age

All building occupants are mature adults who would be expected to understand directions and make rational decisions. Age distribution has been shown to impact travel speed thus lengthening movement time. (NFPA Handbook Table 4.2.2 pp. 4-55) The age distribution among occupants is shown in Figure 14.

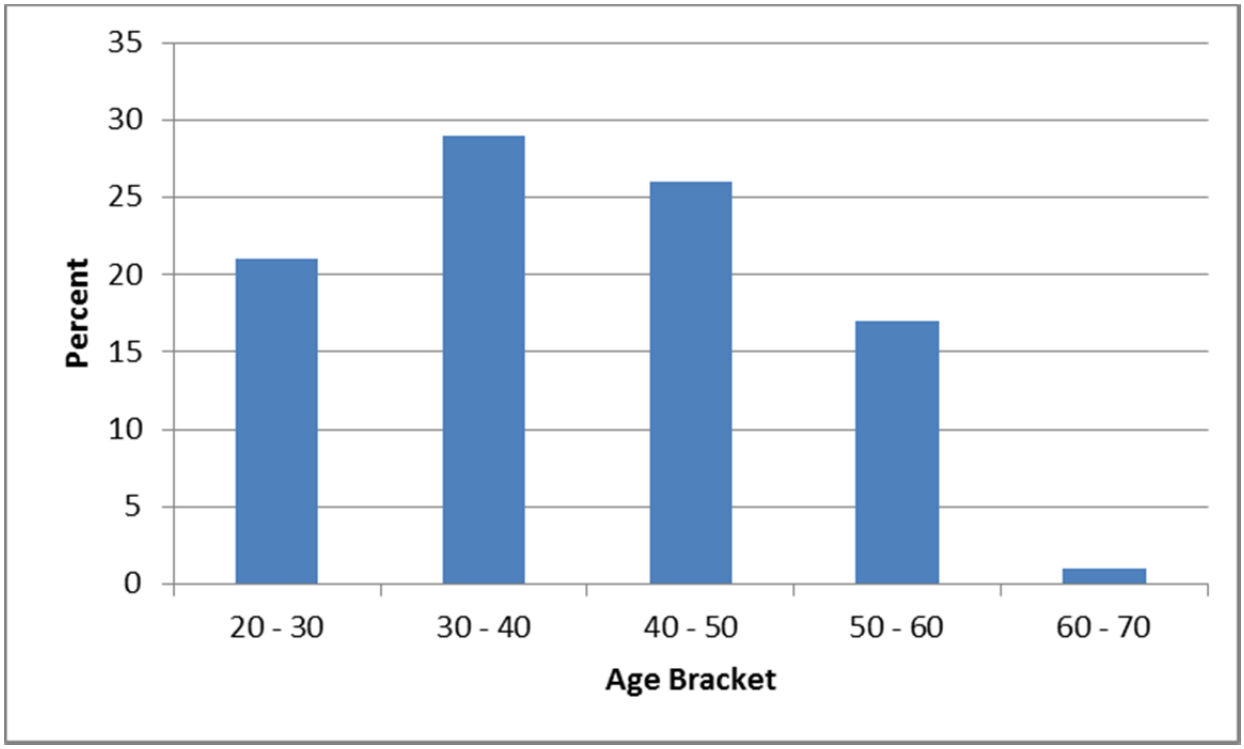

Figure 14: Age distribution of building occupants at the time of the analysis

4.4.3 *Pre-evacuation Time*

Pre-evacuation time starts when occupants receive an emergency cue or notification and ends when they initiate the exiting process. Pre-movement time includes the time it takes for occupants to understand the notice. Various human factors influence the duration of pre-movement time.

There are published studies which provide a measure of pre-evacuation time, however, as one author states that "the times [pre-evacuation] determined from the case studies should not be taken at face value as the 'correct' times to use in evacuation models for residential and office occupancies" (Proulx 1997).

4.4.4 *Delay Time*

There is considerable uncertainty in estimating the notification, reaction and pre-evacuation times. Therefore, Equation 2 is often simplified by combining notification, reaction and pre-evacuation times into one term; delay time (T_{delay}) as shown below:

$$T_{evacuation} = T_{delay} + T_{movement} \qquad \textbf{Equation 3} \text{ (SFPE Handbook, 2009)}$$

Evacuation studies in mid-rise office buildings have found that the delay time can range from for 0.6 to 1.1 minutes as shown in Table 17.

	N	Minimum (min)	1st Quartile (min)	Median (min)	3rd Quartile (min)	Maximum (min)	Mean (min)
Normal Day	92	0	0.4	0.6	0.8	< 4.0	0.6
Cool Day	161	0	0.5	0.9	1.4	< 5.0	1.1

Table 17: Mean delay time in mid-rise office buildings (NFPA Handbook – Table 4.2.1)

Both studies conducted were unannounced drills, supervised by fire wardens and in buildings fitted with good alarm performance. The two sets of data differ due to outside weather conditions, under which the drills occurred. Based on the analysis of the building population presented in the preceding sections and the study presented in Table 16, a delay time of about one minute was used for the project building.

4.4.5 *Movement Time*

There are three paths by which occupants can leave the building from the third floor, including two fire rated stairway enclosures and atrium stairs. For smoke control purposes, the atrium is separated from the third floor by glass panels and doors as shown in Figure 15. The glass panels and doors are not fire rated however they are protected on both sides by automatic fire sprinklers. Only the east and west fire rated, Exit Stairway Enclosures are included in estimating movement time. The atrium stairs and the east and west elevators were excluded as exit paths.

Figure 15: Atrium stair showing separation between the atrium and third floor office space

Movement time was calculated based on the following building features and the occupant population.

- Floor-to-floor height is 5600 mm (18.4 ft)
- There are two exit paths – the East and West Exit Stairway Enclosures
- Each stair is 1500 mm (59”)wide (tread width) with hand rails protruding 63.5 mm (2.5”)
- The stair risers are 178 mm (7”) wide and 279 mm (11”) high
- There are three landings between floors with dimensions of 1730 mm (68”) by 3200 mm (126”)
- There is a 900 mm (35.4”) clear width door at each stairway entrance and exit
- The main floor does not exit through stairways
- The population above the main floor is 316 persons

Assumptions

- The prime controlling factor will be either the stairway or the door discharging from them.
- Queuing will occur; therefore the specific flow (F_s) will be the maximum specific flow (F_{sm})
- All occupants start egress at the same time
- The population will use all facilities in optimum balance

Estimate Flow Capability of the Exit Stairway Door and Stair

The effective widths (W_e) of the exit stairs and exit door are shown in Table 17. The calculated flow rate (F_c) was determined using Equation 4 (NFPA Handbook pp. 4-60).

$$F_c = F_{s_{max}} W_e \quad Equation\ 4$$

$$F_c = 1.30\ (person/s/m) x\ 0.555\ m$$

$$F_c = 0.72\ person/s$$

As shown in Table 18, the flow capacity of the exit doors is less than the flow capacity of the exit stairway served. Therefore the flow is controlled by the stairway exits doors. Queuing will occur at the stairway door therefore the specific flow (F_{s0}) will be the maximum specific flow (F_{smax}).

Component	Nominal Width (mm)	Effective Width (W_e) (mm)	Maximum Specific Flow (F_{smax}) (person/s-m)	Calculated Flow Rate (F_c) (person/s)	Calculated Flow Rate (F_c) (person/minute)
Stairway Door	900	555	1.30	0.72	42
Stairs	1500	1140	1.01	1.15	69

Table 18: Calculated flow rate for the door entering the stairway exit enclosure and the stairs. The maximum specific flow rate (Fs max) values are from the NFPA Handbook (Table 4.2.8. The stairs have a 7 inch riser and 11 inch treads therefore Fs max = 1.01 per

Estimated Speed of Movement for the Estimated Stairway Flow

The travel speed (S) is estimated using Equation 5 (NFPA Handbook pp. 4-60).

$$S = k(1 - aD) \quad Equation\ 5$$

Where *k* and *a* are constants and *D* is density (persons/m^2) which is found in the NFPA Handbook - Figure 4.2.7.

For a 7”/11” stair the metric value of the constants are:

$$k = 1.08$$

$$a = 0.266$$

$$D = 1.88\ persons/m2$$

$$S = 1.08\ (1 - 0.266\ x\ 1.88) = 0.54\ m/s$$

The travel distance between floors was determined using the vertical floor-to-floor distance and a conversion factor of 1.85 for 7”/11” stair dimensions. The vertical floor-to-floor distance of 5.6 m (18.4 ft) converts to a 10.4 m (34.0 ft) travel distance. An additional 10.8 m is added to account for the landing giving a total travel distance between floors of 21.2 m.

The travel time between floors is then determined using Equation 6.

$$Time = \frac{Distance}{Speed} \quad Equation\ 6$$

$$Time = \frac{21.8\ m}{0.54\ m/s} \approx 40\ seconds\ or\ 0.67\ minutes$$

Estimate the Building Evacuation Time

If all the occupants in the building start evacuation at the same time, each stairway can discharge 42 persons/minute, as shown in Table 18. The building evacuation time is estimated as follows.

$$Evacuation\ Time = \frac{\frac{316\ persons}{42\ persons/min}}{2\ exits} + 0.67\ minutes$$

$$Evacuation\ Time \approx 4.4\ minutes$$

As discussed above, the behaviour of the building population may have significant impact on the total evacuation time. Based on studies of delay times in mid-rise office buildings, presented in Table 16, it is appropriate to add addition minutes of delay time to the calculated value for a total evacuation time of approximately 5.4 minutes as shown below.

$$T_{evacuation} = T_{delay} + T_{movement}$$

$$T_{evacuation} = 1 + 4.4$$

$$T_{evacuation} = 5.4\ minutes$$

4.4.6 *Egress Simulation*

Evacuation of the project building was modeled using the Pathfinder simulation application. The maximum numbers of occupants were placed in each space based on the OLF or fixed seating arrangements. Default settings were used such that all occupants travelled at the same speed and began to evacuate the building at the same time. The results are summarized in Table 19. The total evacuation time was approximately 7 minutes, longer than the evacuation time estimated using the hand calculated result of 5.4 minutes.

Simulation:	Egress April 9 v1
Version:	2016.1.0229
Mode:	Steering (Flow-limited)
Total Occupants:	491
Exit Times (s):	
Min:	1.6
Max:	431.4
Average:	153.6
StdDev:	136.0

Table 19: Summary of the Pathfinder simulation results

It has been shown that human behavior introduces considerable uncertainty into evacuation modeling. The higher, more conservative value of 7 minutes is taken as an estimate of the building total evacuation time.

4.5 Egress Components Findings

This analysis determined that the building egress elements were designed and installed to meet the requirements of the Life Safety Code. However, it was found that the building occupants have installed items which have eroded the building life safety features. Corridor width has been reduced to less than that required by the LSC by the installation of shelving and other items. In addition, combustible materials are being stored in the East Exit Stairway Enclosure which may present a hazard to building occupants.

5.0 Water-Based Fire Protection Systems

The purpose of this section is to describe and analyze the water-based fire suppression systems in the project building. The scope of this section includes:

- Identification and characterization of the water supplies serving the fire suppression systems including the static pressure, residual pressure and flow at the point of connection to the water supply system
- Identification of the occupancy classification and associated sprinkler system design criteria for the fire suppression systems
- Identification of the locations and sizes of system risers, cross-mains, branch lines and sprinklers
- Identification of the types of sprinklers
- Performing hydraulic calculations for the fire suppression systems
- Identification of the inspection, testing and maintenance requirements for the fire suppression system

5.1 Water-Based Fire Suppression System

The building is protected by a water-based, automatic sprinkler system. The building layout and architectural features required special solutions for some areas such as the server room, shipping and receiving areas and the atrium.

5.1.1 *Pre-action System*

The Server Room is protected by a pre-action, double interlocked, integrated sprinkler system. The local pre-action fire panel is installed in the adjacent Point of Presence (POP) Room. Smoke detectors are located in the floor plenum and at the ceiling.

The pre-action system deluge valve, as shown in Figure 16, is controlled by a pneumatic actuator which is normally held in the closed position by system air pressure and a normally closed, electric solenoid. Both the supervisory pressure and the smoke detection system must be relieved before the deluge valve will allow water to fill the sprinkler system.

Figure 16: Preaction deluge vale located in the POP room

On receipt of an alarm signal from a single smoke detector, the local alarm panel enters a first stage alarm. The first stage alarm will result in a slow pulse strobe and tone at the Main Fire Panel located in the Main Lobby. On receipt of alarm states from either two smoke detectors or a single pull station, a second stage alarm is initiated by the POP Room alarm panel. This will results in a quick pulse strobe and tone appearing on the Main Fire Panel. A second stage alarm does not activate the pre-action deluge valve.

Once a sprinkler head is opened the pressure loss in the dry pipe system is detected which triggers the opening of the deluge valve allowing water to flow into the system. Both one smoke detector and the opening of a sprinkler head will activate the solenoid valve, open the deluge valve and cause water to discharge.

5.1.2 *Glazing Protection*

The building includes an Atrium which extends the entire height of the building as shown in Figure 17. The area is protected by special application window sprinklers installed on both sides of the glass panes as shown in Figure 18. The window sprinklers provide fire separation between the Atrium and the offices.

Figure 17: Atrium which extends from the main floor to the full height of the building

Figure 18: Gazing protection in the atrium space

5.1.3 *Glycol System*

The shipping and receiving area located on the south east corner of the main floor is protected by a wet sprinkler system fitted with V-3104 large orifice brass upright sprinklers (K = 8.0). The likelihood of exposing the sprinkler system to freezing temperatures in this area is high. As a precautionary measure, the sprinkler system is filled with a 60% mixture of propylene glycol with a freezing point of -51 °C. The shipping and receiving sprinkler system is isolated from the main system by double check valve assembly as shown in Figure 19.

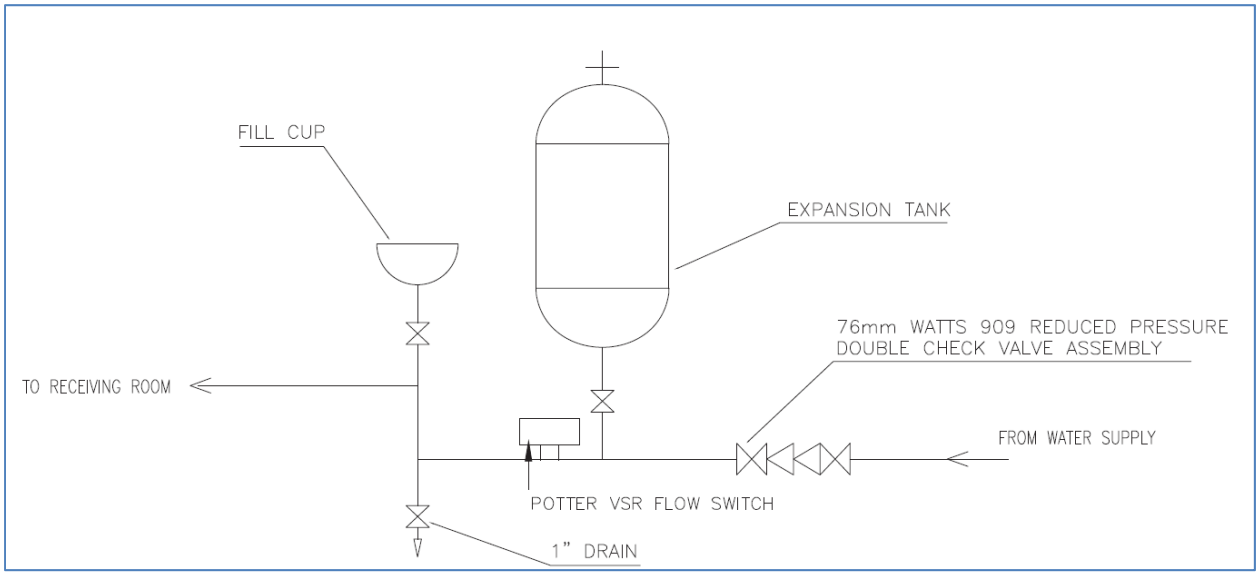

Figure 19: Double check valve assembly which isolates from the glycol filled shipping and receiving sprinkler system from the main system

5.2 Water Supply

The building sprinkler system is supplied with water from the municipal water supply as shown in Figure 20. The results of a flow test at the nearest hydrant are summarized in Table 20.

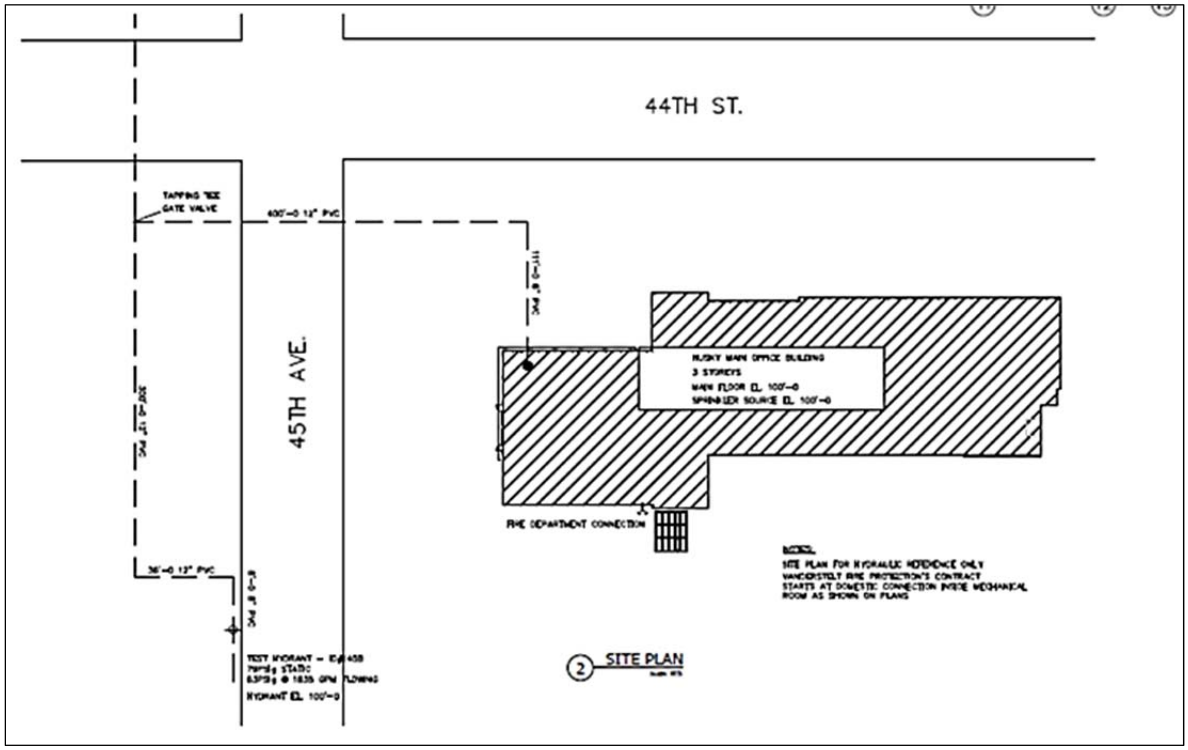

Figure 20: Plan view of the municipal water supply that services the building

Static Pressure	79 psig
Residual Pressure	63 psig at 1835 gpm

Table 20: Hydrant flow test results (Hydrant No. 145B)

As shown in Figure 20, the test hydrant is remote from the Point of Connection (POC). The head loss from the test hydrant back to the POC and the Base of Riser (BOR) was calculated using the Hazen-William Equations. It was estimated that the pressure at the BOR was approximately 55 psig, which is demonstrated in Appendix 13.

5.2.1 *Occupancy Classification*

The building's main purpose is to provide office space for company personnel. Based on this use, the first (main), second and third floors of the building were classified as Light Hazard (LH). LH occupancies are defined as occupancies or portions of the occupancies where the quantity and/or combustibility of

contents is low and fires with relatively low rates of heat release are expected (NFPA 13 (2013) Section 5.2).

The basement includes water meter room, exercise facilities, mechanical and electrical rooms, and limited storage. Goods stored in the basement are limited to Class III commodities such as paper products. Small quantities of Group A plastics may also be present e.g. computers and monitors. The basement of the building was assigned Ordinary Hazard – Group 1 (OH-1). OH-1 occupancies are defined as occupancies or portions of the occupancies where the combustibility is low, the quantity of combustibles is moderate, stock piles of combustibles do not exceed 8 feet, and fires with moderate rates of heat release are expected (NFPA 13 (2013) Section 5.3.1.1).

The building includes an east and west mechanical penthouse. These areas were also assigned the classification of Ordinary Hazard – Group 1 (OH-1). The quantity of combustibles is low however the presence of electrical motors and mechanical equipment justifies the increase from LH to OH-1.

5.2.2 *Sprinkler System Design Basis*

The sprinkler system was designed and constructed in compliance with the requirements of NFPA 13 (2010 Edition).

Piping

All sprinkler piping used in the building was found to be UL listed and FM approved. The internal surface of all pipe up to 4 ½ inches (NPS) was coated with Allied Tube & Conduit antibacterial formula as described in Appendix 14.

Risers and Feed Mains

Risers and feed mains pipes are located in stairwells as shown in Figure 21. All pipes are constructed from 4 ½ inch Schedule 40 Pipe - ASTM A135, Type E Grade A black iron.

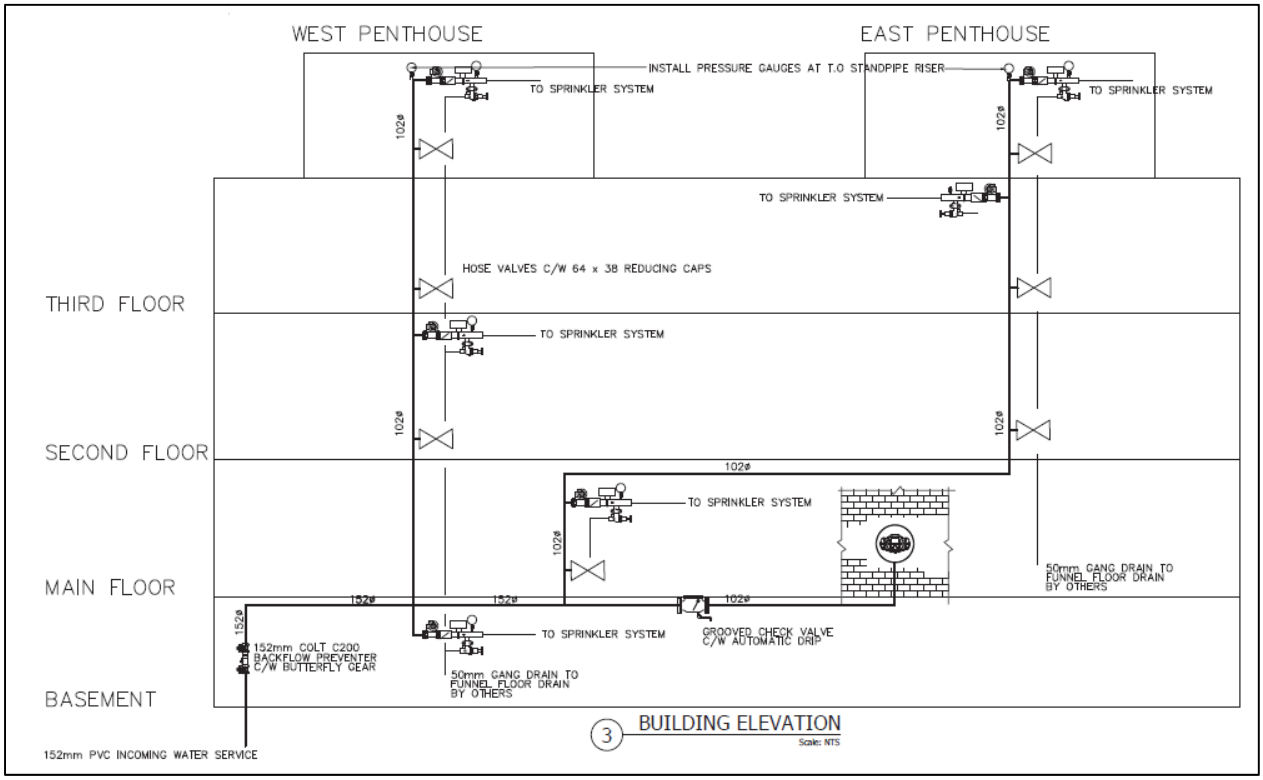

Figure 21: Riser and feed main arrangement

Cross Mains and Branch Lines

Cross mains and branch lines are constructed from Schedule 40, black iron pipe. Cross mains pipe sizes increase from 2 ½" in the basement to 4" in the mechanical penthouse to accommodate hydraulic requirements as summarized in Table 21. Similarly, branch lines increase in size from 1 ¼" at the basement to 2" at the penthouse.

Floor	Cross Mains (inch)	Branch Line (inch)
Basement	2 ½	1 ¼
First	2 ½	1 ½
Second	2 ½	1 ½
Third	3	1 ½
Penthouse	4	2

Table 21: Cross mains pipe sizes

Atrium Glazing Protection

The glazing sprinklers are installed on a 1 ½" branch lines supplied by a 3" Schedule 40 riser originating from the basement.

Pipe Hangers

Typical single rod and trapeze hanger arrangement are shown in Figures 22 and 23 respectively.

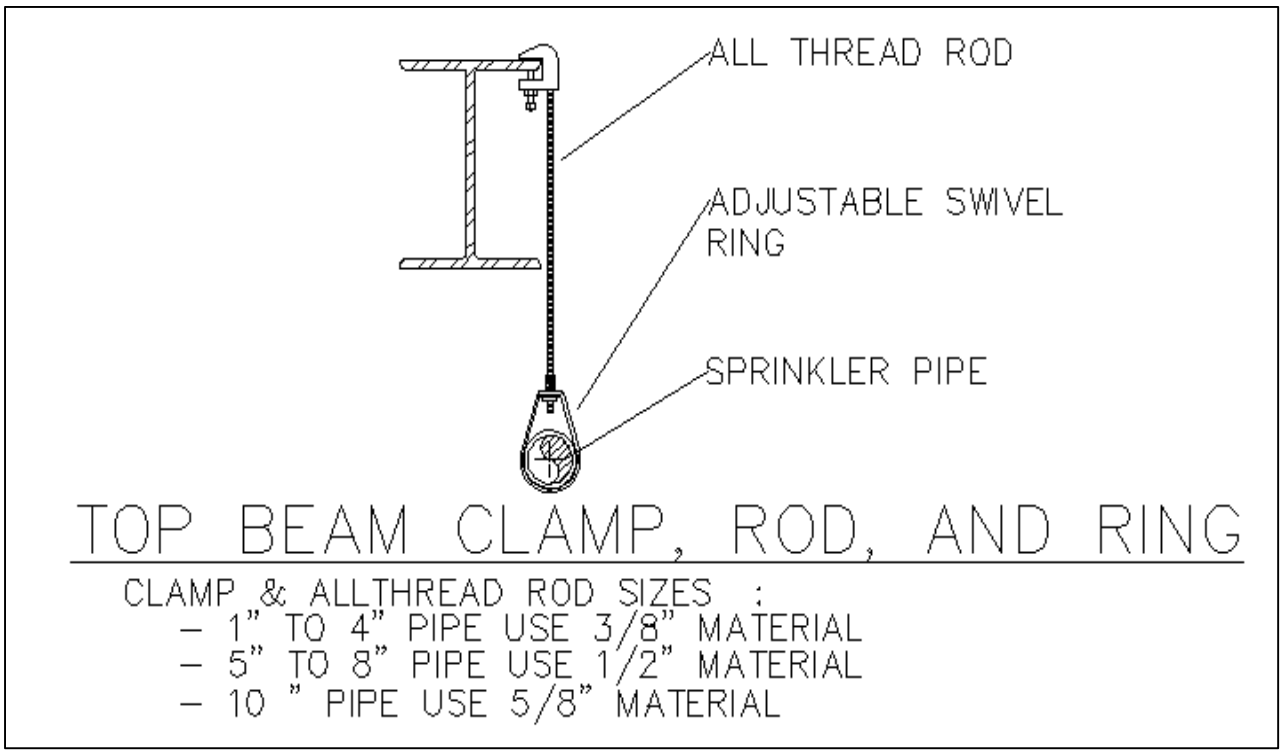

Figure 22: Typical single rod hanger arrangement (24.5 mm = 1 inch

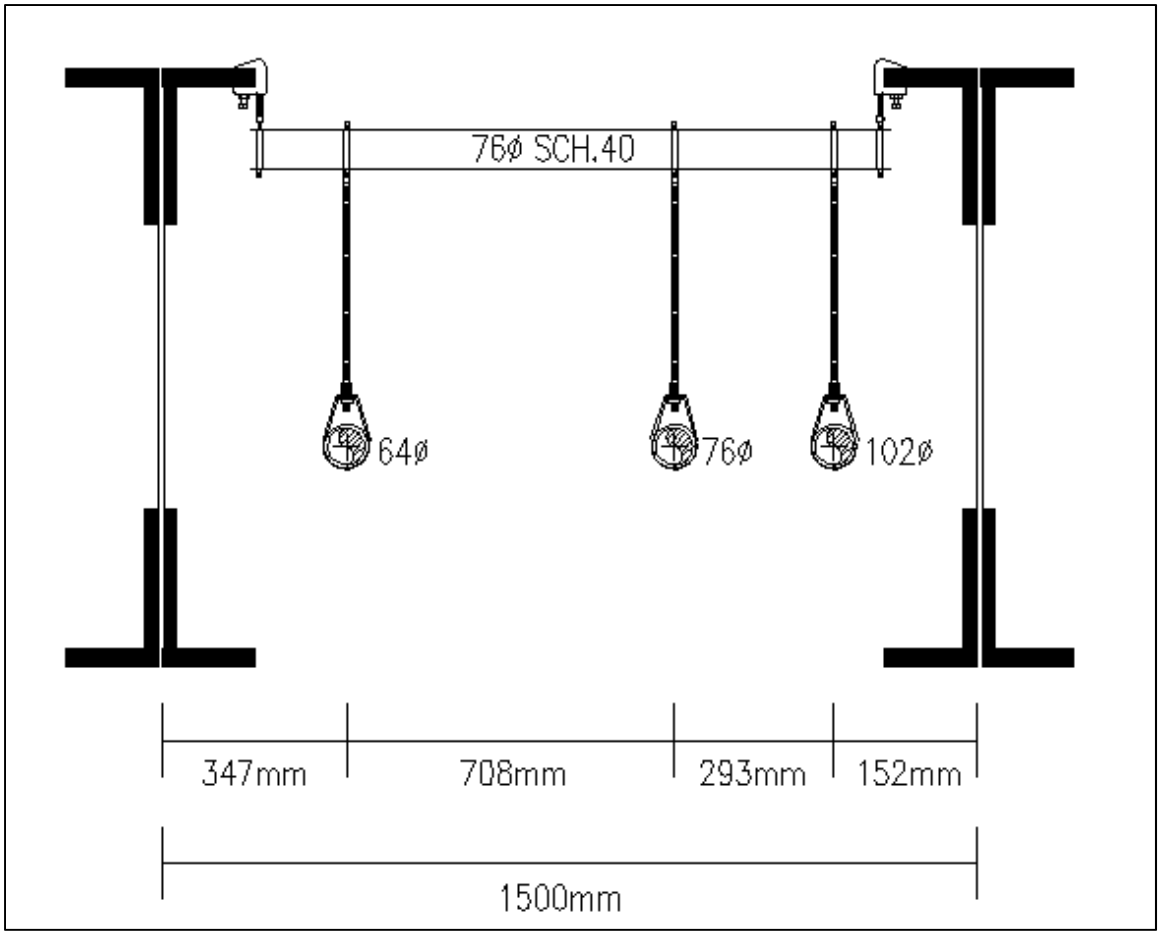

Figure 23: Seismic Bracing

The building was constructed according to the requirements of the National Building Code of Canada (2005). No special provisions for seismic activity were required based on the low probability of earthquake in the area.

Sprinkler Valves and Supervisory Devices

The types of valves and supervisory devices used throughout the building are summarized in Table 22. A complete list of valves associated with the fire sprinklers system is included in Appendix 15.

Valves/Devices	Manufacturer	Model	Listing/Approvals	Appendix
FireLock Butterfly Valve	Victaulic	705	UL, FM	16
FireLock Check Valve	Victaulic	717	UL, FM	17
FireLock Zone Control Riser Module	Victaulic	747M	UL, FM	18
Double Check Valve	Colt	C200 OSY	UL, FM	19
OSY Valves	Wilkins (Zurn)	350A	UL,FM, AWWA	20
Butterfly Valve	FireLock	Series 705	UL,FM	21
Vane Type Waterflow Alarm Switch	Potter VSR	VSR – EUX* *X = NPS	UL,FM	22
Pre-action Double Interlocked Cabinet	FireFlex Systems	TotalPac2		23

Table 22: Sprinkler valve and supervisory devices used throughout the building

Main Riser

The arrangement of valves and fittings on the main riser is shown in Figure 24. The actual arrangement is shown in Figure 25.

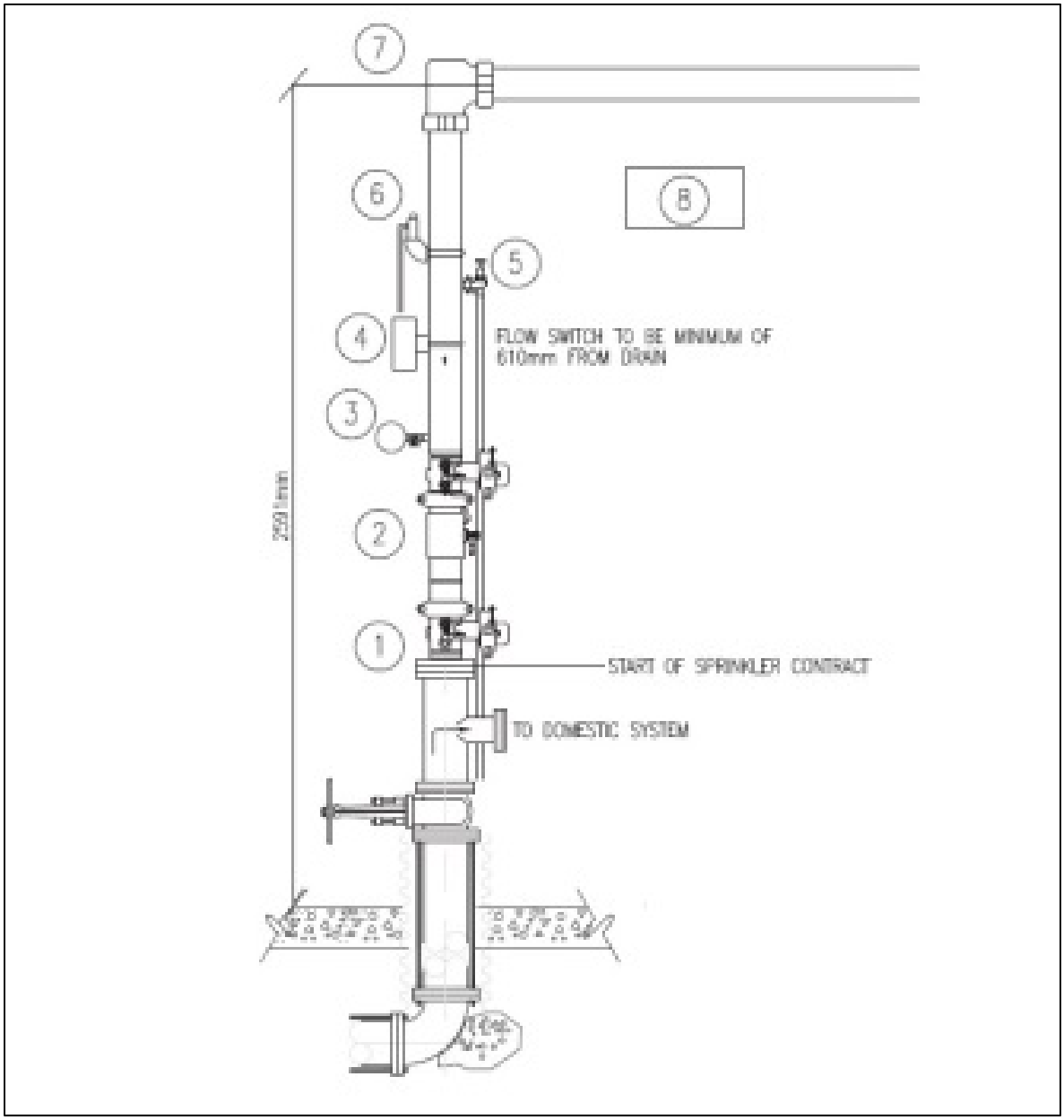

Figure 24: Main riser arrangement where (1) 6" Victaulic flange, (2) 6" backflow preventer, (3) pressure gauge, (4) 6" flow switch (5) 2"drain (6) ½ " relief valve (7) 90□ Victaulic elbow (8) spare sprinkler cabinet

Figure 25: Main water supply arrangement

Floor Control Valves

A typical floor control valve arrangement is shown in Figure 26. The actual arrangement is shown in Figure 27.

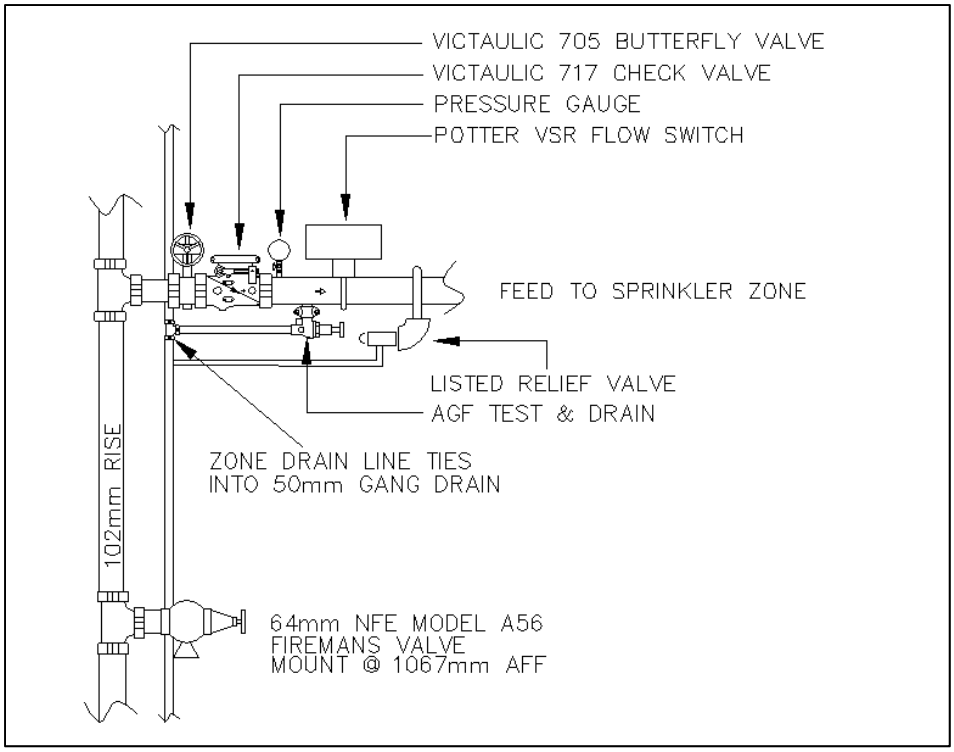

Figure 26: Floor control valve arrangement

Figure 27: A typical floor control valve arrangement

5.2.3 *Sprinklers*

The sprinkler layout drawings are included in Appendix 24. The types of sprinklers installed in the building are summarized in Table 1. A detailed list of the number and type of sprinklers on each floor is included in Appendix 3. The technical specifications for each type of sprinkler are included in Appendix 4 and Appendices 25, 26 and 27.

5.2.4 *Hydraulic Calculations*

The East Penthouse was selected as the most hydraulically remote location in the project building. This decision was based on:

- The East Penthouse was determined to contain hazards which justified its classification as OH-1. Accordingly, the penthouse would have a high water demand than the remainder of the building (with the exception of the basement) which was classified as LH.
- The Penthouse was at a higher elevation than any other areas of the building which added to the demand requirements.
- A density of 0.15 gpm/ft^2 applied to 1500 ft^2 was used to determine the system demand.

5.2.5 *Protection Area*

The protection area coverage (A_s) of the sprinkler is determined by Equation 7.

$$A_s = S \; x \; L \qquad Equation\ 7$$

Where:

S = the upstream or downstream distance between sprinklers (11.8 ft.)

L = the perpendicular distance to the sprinkler on adjacent branch line (9.8 ft)

$$A_s = 11.8 \; x \; 9.8 = 115.6 \; ft^2$$

$$Number\ of\ Sprinklers\ Expected\ to\ Operate\ (N_s) = \frac{System\ Area\ of\ Operation}{Coverage\ Area\ per\ Sprinkler}$$

$$N_s = \frac{1500 \; ft^2}{115.6 \;\; ft^2/sprinkler}$$

$$N_s = 13 \; sprinklers$$

Coverage Area per Sprinkler

The area selected for analysis included Sprinklers 1 through 13 as shown in Figure 28. The demand was calculated starting with Sprinkler 1 on Branch Line 1. The flow and pressure was calculated back to the zone control valve. The frictional losses associated with pipe and fitting, along with elevation changes, were taken into account and are summarized in Appendix 28. The analysis revealed that the municipal water supply can meet the system demand as shown in Figure 29.

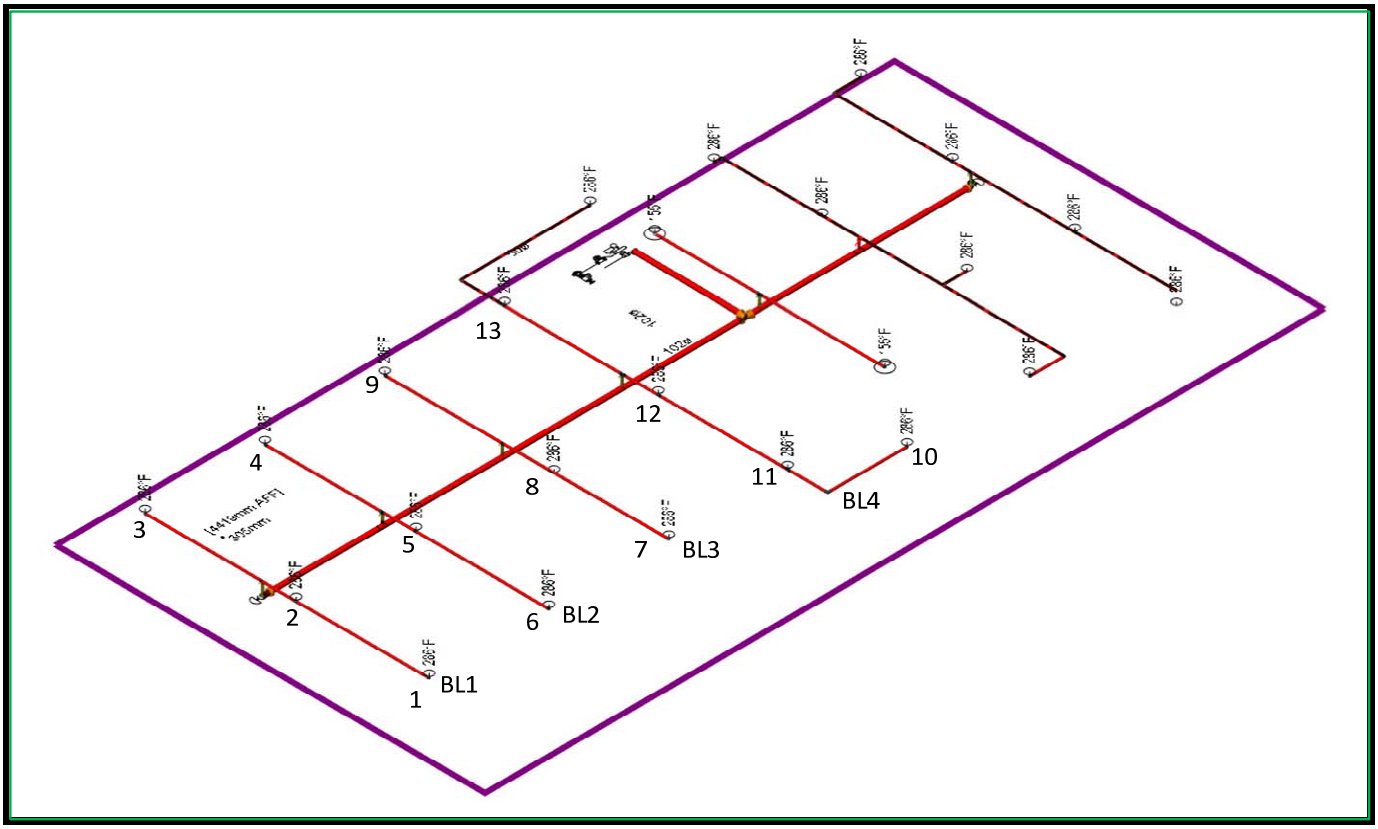

Figure 28: East Penthouse showing the 13 sprinklers selected for analysis.

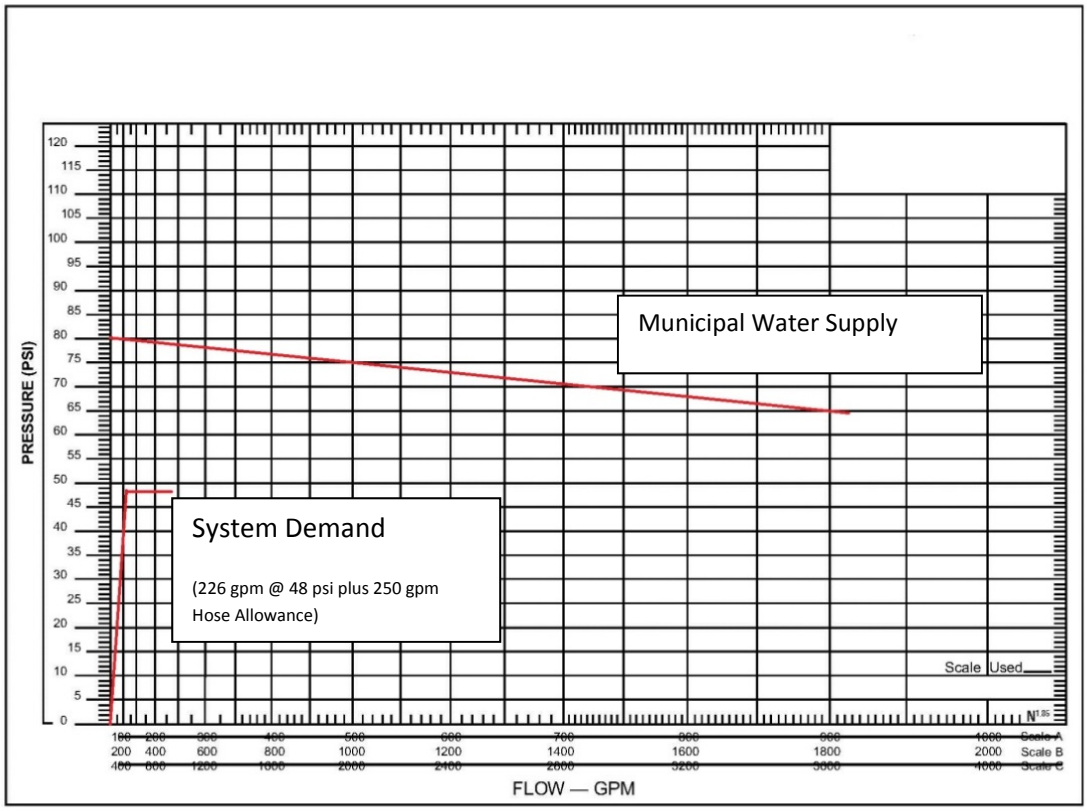

Figure 29: The system demand compared to the available municipal water supply

5.2.6 *Inspection Testing and Maintenance*

The building owner contracted a third party engineering firm to inspect the automatic fire sprinkler system prior to occupancy. The Inspector concluded that the system was constructed in compliance with applicable codes and will operate if required; see Appendix 29.

Ongoing Inspection Testing and Maintenance

The building owner has hired a third party contractor to manage all aspects of the day-to-day building operation. The scope of duties for the full time, onsite contractor include responsibility for the fire protection system, which has to meet the Inspection, Testing and Maintenance (ITM) requirements specified in NFPA 25.

The NFPA 25 ITM requirements for the sprinkler system, standpipes and associated equipment are summarized in Appendix 30.

The building maintenance contractor utilizes Asset Planner, a computer-based preventive maintenance application, to track NFPA 25, ITM tasks. The contractor conducts routine inspections such as confirming

valve positions and water pressure. Tasks requiring a certified technician are flagged in Asset Planner. Sample tasks are included in Appendix 31.

5.2.7 *Fire Protection System Impairment*

The building owner has established a process for the local, responsible person to communicate Fire Protection System Impairment (FPIN) conditions. The purpose of the FPIN procedure is to provide the building owner with a mechanism to track local impairments and ensure that all aspects of the system are returned to their normal state of readiness once the problem has been corrected. In some instances the building owner is required to notify Insurance Underwriters of impairment conditions.

The FPIN reporting system is automated. Email impairment notices will continue to be sent to the local, responsible person and the Corporate Loss Control Engineer until the impairment condition has been rectified. The FPIN procedure is attached in Appendix 32.

The building maintenance contractor is responsible for establishing a local impairment management process as defined in NFPA 25 (Chapter 15). Based on interviews the contactor was found to be knowledgeable about the building fire protection system and the ITM requirements in NFPA 25.

5.3 Water-Based Fire Protection System Findings

The preceding analysis confirms that the project building has an adequate municipal water supply that can meet the design demand. The building owner has implemented effective programs for ongoing inspection, testing and maintenance for the system. Processes are in place to track fire protection system impairment and ensure the system is returned to a fully operational status in a timely manner.

6.0 Structural Fire Protections Systems

The purpose of this section is to describe and analyze the structural fire protection features of the project building. The scope of this section includes:

- Determining the required construction classification in accordance with the International Building Code (IBC)
- Identifying the material used to construct columns, beams, floor assemblies, roof assemblies, exterior walls and interior walls and partitions
- Summarizing the fire resistance requirement for different elements of the building
- Determining the fire resistance rating of columns, beams, floor assemblies, roof assemblies, exterior walls and interior walls and partitions, door openings, joints and penetrations

6.1 Construction Classification

Elevation views of the building structure are shown in Figures 30 and 31.

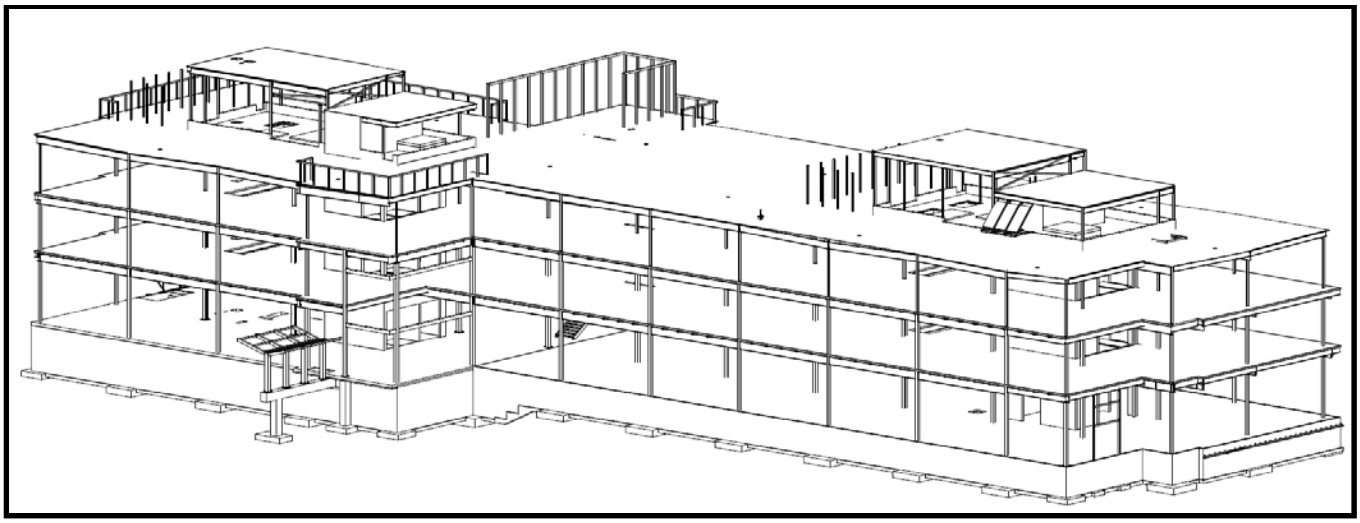

Figure 30: South East elevation view of the Project Building

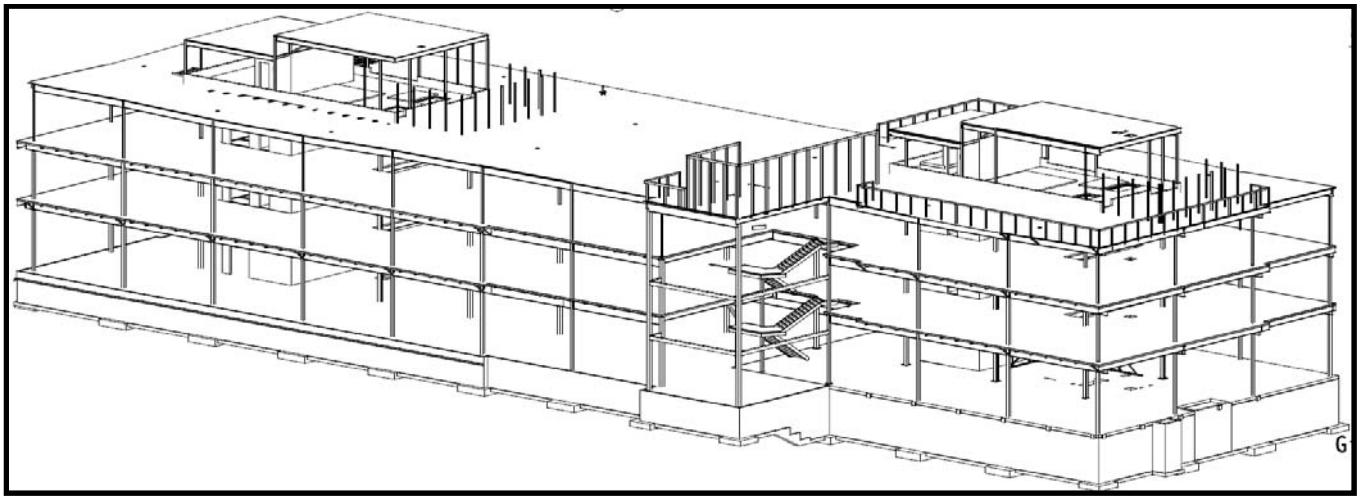

Figure 31: North West elevation view of the Project Building

The building occupancy classification and dimensions are summarized in Table 23. The IBC defines the building height as the vertical distance from grade plane to the average height of the highest roof surface. The highest roof surface was taken to be the mechanical penthouse roof as shown in Figure 32.

Building Occupancy Classification	Group B – Business (IBC Section 304)
Area	31,430 sq. ft. per floor
Stories	3
Height	64 ft

Table 23: Building occupancy classifications and dimension

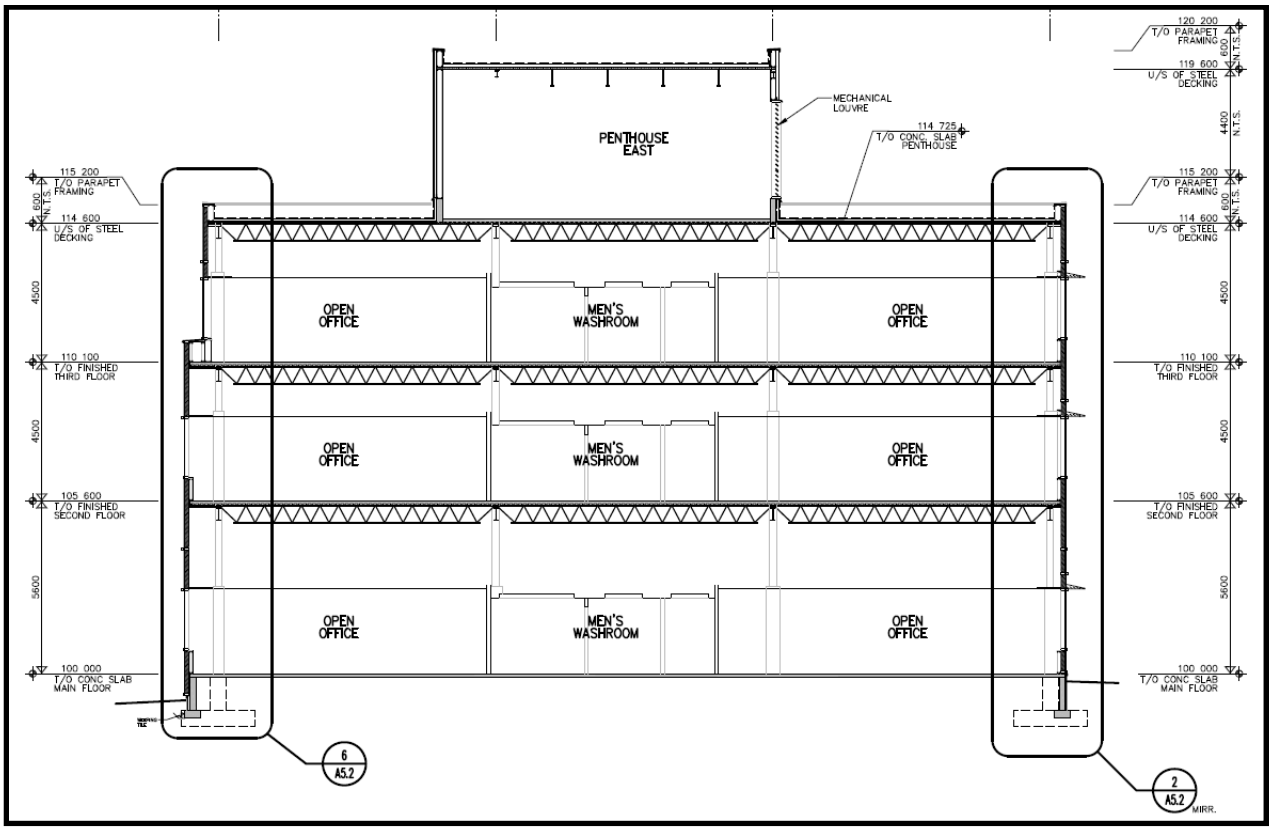

Figure 32: View of the building showing East Mechanical Penthouse

Without consideration of the IBC provisions for area or height increases, construction Type II-A would be required for this building as shown in Table 24. The IBC permits the modification of tabular values based on frontage and sprinklers. The following sections demonstrate that consideration of frontage and sprinklers had no effect on the construction type, which remained as Type II A.

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT (feet)	UL	160	65	55	65	55	65	50	40
		STORIES(S) AREA (A)								
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	3	5	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500

Table 24: Type of building construction; adapted from the IBC (2012) - Table 503

The IBC allows for area modifications based on building frontage and the presence of automatic sprinklers throughout the structure. The area modification is determined using Equation 8 as shown below.

$$A_a = A_t + (A_t \times I_f) + (A_t \times I_s) \quad Equation\ 8$$

Where:

A_a = Allowable area per floor (ft^2)

A_t = Tabular area per floor in accordance with IBC Table 503 (ft^2)

I_f = Area increase due to frontage as calculated in accordance with IBC Section 506.2

I_s = Area increase due to sprinkler protection in accordance with IBC Section 506.3

6.1.1 *Frontage Increase*

The building was constructed on an 8.5 acre, company-owned site as shown in Figure 33. The layout makes maximum use of the frontage provisions in the IBC as determined using Equation 9.

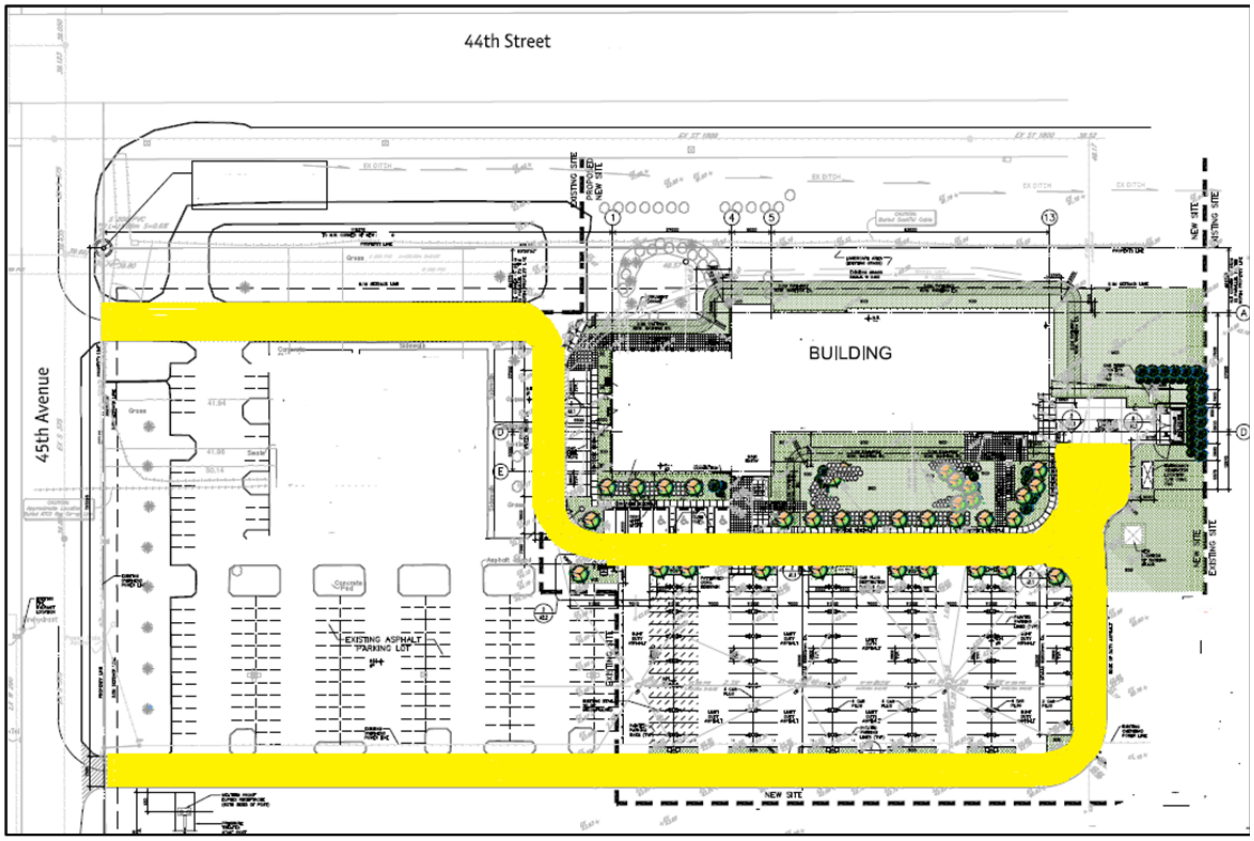

Figure 33: Plan view of the building site.

$$I_f = \left(\frac{F}{P} - 0.25\right) \times \frac{W}{30} \qquad Equation\ 9$$

Where:

F = Building perimeter which fronts on a public way or open space having a 20 ft. minimum width

P = Perimeter of building

W = Minimum with of public way or open space

From Figure 33:

$$F = 891\ ft.$$

$$P = 891\ ft.$$

$$W = 60\ ft.$$

$$I_f = \left(\frac{891}{891} - 0.25\right) \times \frac{60}{30}$$

$$I_f = (1 - 0.25) \times 1^*$$

W/30 cannot exceed 1 (IBC 506.2.1)

$$\boldsymbol{I_f = 0.75}$$

6.1.2 *Automatic Sprinkler System Allowance*

Section 506.3 of the IBC allows buildings protected with an approved automatic sprinkler to increase the area by 200% (Is = 0.2) for multi-storied buildings. Type II B tabular values were adjusted to see if they would satisfy the building requirements. As shown in Table 24, a Type II B building has a tabular area per floor of 23,000 ft^2. Applying the frontage and sprinkler increase factors allows the area to be increased to 86,250 ft^2 as shown below and as summarized in Table 25. However, the area increase is of no value because a Type II B building fails to meet the height requirements. The analysis confirms that the required construction classification is Type II A.

$$A_a = A_t + (A_t \times I_f) + (A_t \times I_s)$$

$$A_a = 23{,}000 + (23{,}000 \times 0.75) + (23{,}000 \times 2)$$

$$A_a = 86{,}250\ ft^2$$

Base Area	100%
Frontage Increase	25%
Sprinkler Increase	200%
Area After Increase	325%

Construction Type	Tabular Floor Area (ft2)	Allowable Floor Area (ft2)	Maximum Building Area (ft2)
I A	UL	UL	UL
I B	UL	UL	UL
II A	37,500	121,875	365,625
II B	23,000	86,250	258,750

Table 25: Area increase after application of the frontage and sprinkler factors

6.2 Materials of Construction

Type II buildings are constructed of noncombustible materials such as masonry, concrete and steel. The following sections provide details of these noncombustible materials.

6.2.1 *Steel Columns*

The building was design to support the expected environmental (wind, snow and seismic), dead and lives loads. The distribution of the superimposed dead and live loads are shown in Appendix 33. The steel columns designed to support these loads are summarized in Table 26.

Type	Metric (mm and kg/m)	Imperial Size (inches and lb/ft)
C1	HSS 203x203x9.5	8 x 8
C2	HSS 254x254x13	12 x 12
C3	W250X149	W 10 x 100
C4	HSS 127x127x6.4	5 x 5
C5	HSS 152x152x6.4	6 x 6
C6	HSS 178x178x6.4	7 x 7
C7	HSS 203x203x6.4	8 x 8
C8	HSS102x102x6.4	4 x 4

Table 26: Steel columns used in the building

6.2.2 *Beams and Joists*

The steel beams used in the building are summarized in Table 27. Open web, 650 mm deep, steel joists were used throughout the building and were installed on a 1500 mm OC as shown in Figure 34.

SI	Imperial
W 610 X 101	W 24 X 68
W 610 X 92	W 24 X 62
W 530 X 66	W 21 X 44
W 460 X 60	W 18 X 40
W 410 X 46	W 16 X 31
W 410 X 39	W 16 X 26
W 150 X 14	W 6 X 9

Table 27: Steel beams used in the building

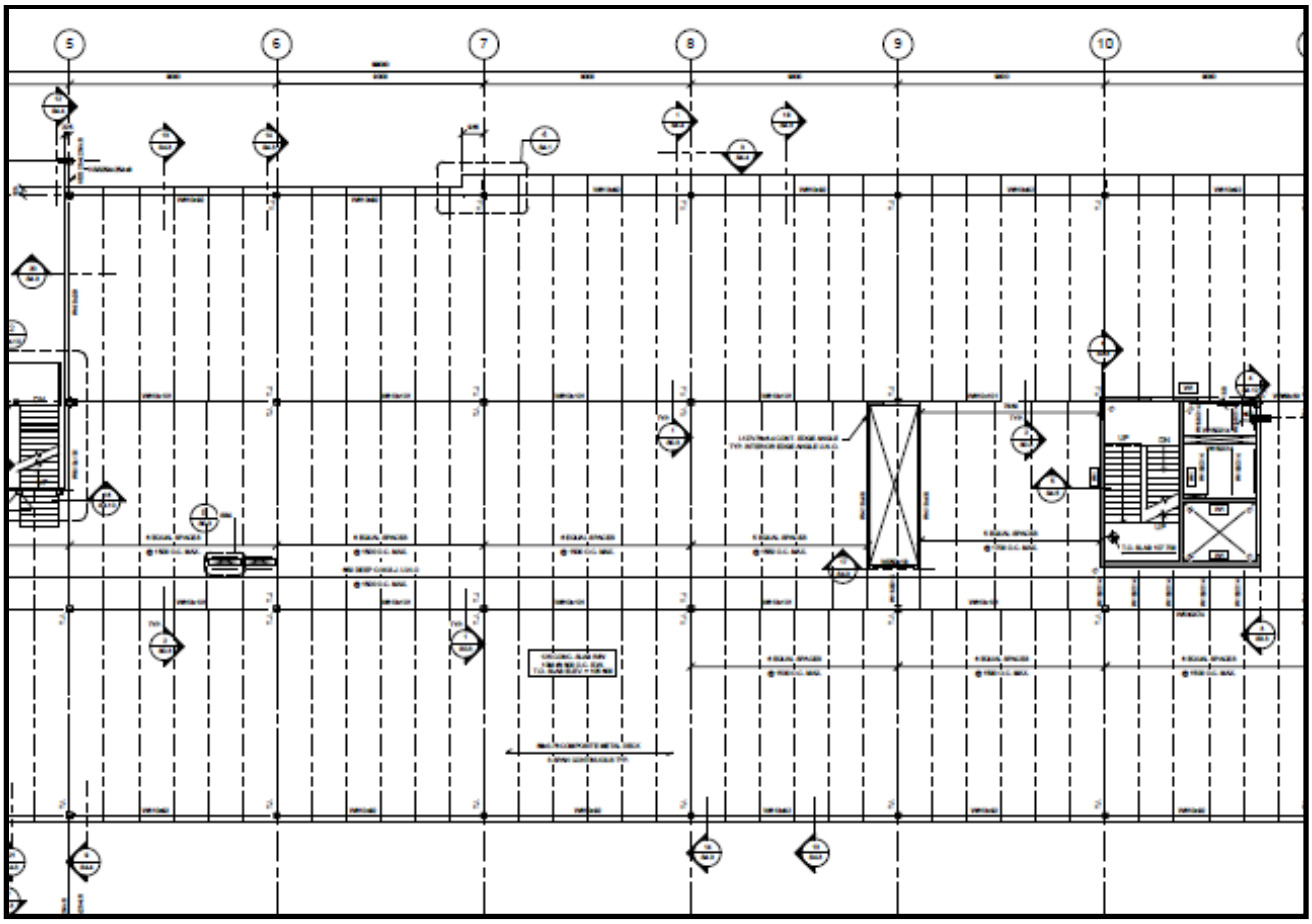

Figure 34: Plan view of structural elements showing typical floor joist (vertical dashed lines) spacing at 1500 mm

6.2.3 *Floor Assemblies*

Various floor assembly types were used throughout the building as summarized in Table 28. A typical arrangement of the floor assemblies is shown in Figure 35. Type F3 floors assemblies can be seen in Figure 35 between the main/second and second/third floors.

Type	Description
F1	Concrete slab, sheet vapour retarder, compact gravel sub-base (Note – Type F1 floor assemblies are used on-grade applications i.e. on the East Main Floor where the floor is installed on grade and the Basement floor)
F2	Structural concrete slab, 1 hour fire separation with a 1 hour fire resistance rating(Note – Type F2 floor assemblies are used only on the west main floor where the floor is installed over the basement)
F3	100 mm concrete topping steel deck, steel structure,1 hour spray fireproofing ULC Design F818 (Note – Type F3 floor assemblies are installed on the second and third floors)
F4	Structural concrete slab, 1 hour fire separation with a 1 hour fire resistance rating, 64 mm steel studs @400 mm OC, 12.7 mm gypsum board
F5	100 mm concrete topping steel deck, steel structure

Table 28: Floor assemblies used in the building

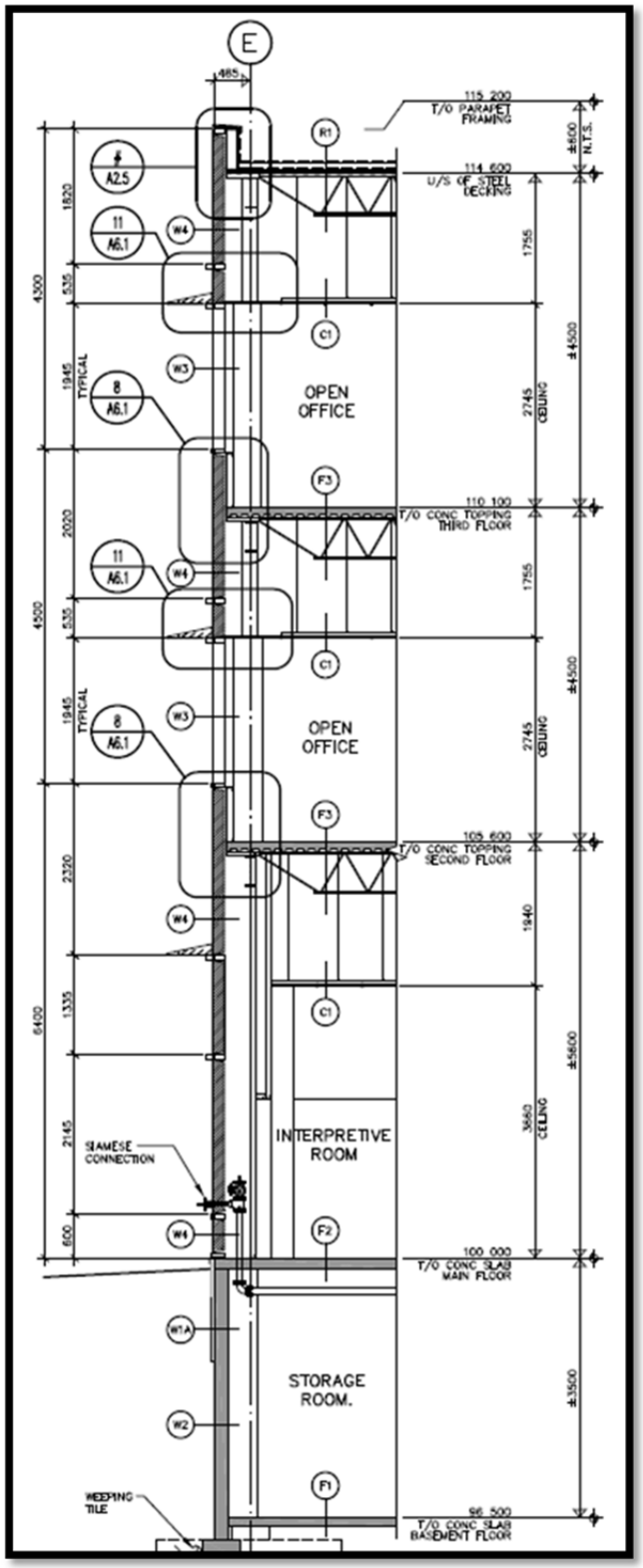

Figure 35: Typical location of the various floor assemblies used in the building

6.2.4 *Roof Assemblies*

Two types of roof assemblies were used as described in Table 29. Type R2 was used on the east and west mechanical penthouses while Type R1 was used in all other locations.

Type	Description
R1	SBS Roof Membrane, fibre board, 150 mm rigid insulation (R30), peel-and-stick membrane, 12.7 mm exterior roof deck sheathing, metal deck, steel structure (sloped to drain)
R2	50 mm rigid insulation, water proof membrane, concrete slab, sheet vapour retarder, compacted gravel sub-base

Table 29: Roof assemblies used in the building

6.2.5 *Wall Assemblies*

The wide variety of wall assemblies types are found within the building as shown in Table 30. The building exterior is covered in a metal and glass, non-load bearing, curtain wall designated as W4.

Type	Description
W1	Parging to depth of 300 mm below grade, 50 mm rigid insulation as per detail or to a depth or 1200 mm below grade - entire depth of grade beam
W1A	Parging to depth of 300 mm below grade, 50 mm rigid insulation, water proof membrane as per detail or to depth of 1200 mm below grade - entire depth of grade beam
W2	Water proof membrane, concrete wall
W2A	Water proof membrane, concrete wall, 92 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
W2B	50 mm rigid insulation, water proof membrane, concrete wall, 64 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
W3	Double glazed sealed units in anodized aluminum unitized curtain wall system
W4	Spandrel glass panel, 100 mm rigid insulation, galvanized back panel in anodized aluminum curtain wall system
W4A	Spandrel glass panel, 100 mm rigid insulation, galvanized back panel in anodized aluminum curtain wall system, air space, 92 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
W4B	Spandrel glass panel, 100 mm rigid insulation, galvanized back panel in anodized aluminum curtain wall system, air space, 50 mm rigid insulation to a depth of 1200 mm below - entire depth of grade beam

W5	Composite metal panel, 100 mm Z-Girts, 75 mm rigid insulations, Air/Vapor barrier, 12.7 mm exterior gypsum board, 92 mm steel studs @ 400 mm OC, void space
W6	SBS roof membrane, 12.7 mm insulation overlay board, R30 rigid insulation (125 mm @ R5 per 25 mm) vapor retarder, 12.7 mm exterior roof deck sheathing, concrete wall, interior side painted
W7	Galvanized corrugated metal panel, 100 mm Z-Girts, 75 mm rigid insulations, Air/Vapor barrier, 12.7 mm exterior gypsum board, 202 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
W7A	Galvanized corrugated metal panel, 100 mm Z-Girts, 75 mm rigid insulations, Air/Vapor barrier, concrete wall, 64 mm steel studs @ 400 mm OC, 12.7 mm gypsum board (fire separation with a 2 hr. fire resistance rating in accordance with ULC Design No. W404, caulk perimeter of gypsum board to all building substrates for a smoke seal from floor to U/S Conc.)
W8	Composite metal panel, 75 mm rigid insulations, Z-Girts, Air/Vapor barrier, 12.7 mm gypsum board, 152 mm steel studs @ 400 mm OC, batt insulation, 12.7 mm exterior ply sheathing, roof membrane, flexible membrane flashing, prefinished metal flashing

Table 30: Wall assemblies used in the building

6.2.6 *Partitions*

A large number of partition types were installed in the building to meet the Life Safety and esthetic goals of the designer as summarized in Table 31. Exits such as the east and west stair wells have Type P1A partitions to provide a fire resistant space and allow increased egress time.

Type	Description
P1	Concrete wall
P1A	Concrete wall (fire separation with 1 hour fire resistance rating)
P2	190 mm concrete block
P2A	190 mm concrete block (fire separation with 1 hour fire resistance rating ULC – U905)
P3	Typical Shaft Wall – 2 layers 15.9 mm fire-rated gypsum board, 64 mm C-H steel studs @ 400 mm OC, 25 mm fire-rated gypsum board (fire separation with a 1 hour fire resistance rating ULC Design NO. W507, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P5	12.7 mm gypsum board, 64 mm C-H steel studs @ 400 mm OC, concrete wall
P5A	12.7 mm gypsum board, 64 mm C-H steel studs @ 400 mm OC, 190 mm concrete block
P5B	12.7 mm gypsum board, 64 mm C-H steel studs @ 400 mm OC, acoustic batt insulation, 12.7 mm exterior gypsum board, (fire separation without hour fire resistance rating , caulk perimeter of gypsum board to all building substrates for a smoke seal)

P5E	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, void space
P6	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
P6A	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, acoustic batt insulation, 12.7 mm gypsum board
P6B	15.9 mm fire rated gypsum board, 92 mm steel studs @ 400 mm OC, 15.9 mm fire rated gypsum board (fire separation with a 1 hour fire resistance rating ULC Design NO. W407, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P6C	15.9 mm fire rated gypsum board, 92 mm steel studs @ 400 mm OC, 15.9 fire rated gypsum board, acoustic batt insulation (fire separation with a 1 hour fire resistance rating ULC Design NO. W407, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P6E	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, void space
P6G	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, acoustic batt insulation, 12.7 mm gypsum board, (fire separation without a fire resistance rating (caulk perimeter of gypsum board to all building substrates for a smoke seal)
P7	12.7 mm gypsum board, 152 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
P7A	12.7 mm gypsum board, 152 mm steel studs @ 400 mm OC, acoustic batt insulation, 12.7 mm gypsum board
P7B	12.7 mm gypsum board, 152 mm steel studs @ 400 mm OC
P7C	12.7 mm gypsum board, 152 mm steel studs @ 400 mm OC, acoustic batt insulation, 12.7 mm gypsum board , (fire separation without a fire resistance rating (caulk perimeter of gypsum board to all building substrates for a smoke seal)
P8	15.9 fire rated gypsum board, 152 mm steel studs @ 400 mm OC, acoustic batt insulation, 15.9 fire rated gypsum board (fire separation with a 1 hour fire resistance rating ULC Design NO. W407, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P9	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 190 mm concrete block (fire separation without a fire resistance rating, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P9A	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 190 mm concrete block (fire separation with a 1 hour fire resistance rating ULC Design NO. W905)
P9C	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 190 mm concrete block (fire separation with a 1 hour fire resistance rating ULC Design NO. W905) 64 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
P10/P10A	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 190 mm, concrete wall (1 hour fire

	resistance rating)
P10B	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 190 mm, concrete wall (1 hour fire resistance rating) 64 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
P11	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, concrete wall
P11A	12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, concrete wall (1 hour fire resistance rating)
P12	15.9 mm fire-rated gypsum board, 12.7 mm gypsum board, 92 mm steel studs @ 400 mm OC, 12.7 mm gypsum board, 15.9 mm fire-rated gypsum board, (fire separation with a 2 hour fire resistance rating ULC Design NO. W404, caulk perimeter of gypsum board to all building substrates for a smoke seal)
P13	12.7 mm gypsum board, 64 mm steel studs @ 400 mm OC, 12.7 mm gypsum board
P14	12.7 mm plywood, 92 mm steel studs @ 400 mm OC, 12.7 mm plywood
P15	Interior chain link fencing

Table 31: Partitions used in the building

6.3 Fire Resistance Rating of Building Elements

The above sections demonstrated the occupancy classification and dimensions required from a building of Type II-A construction. The fire resistance requirements for a Type II-A building as summarized in Table 32.

BUILDING ELEMENTS	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame	3	2	1	0	1	0	HT	1	0
Bearing walls									
Exterior	3	2	1	0	2	2	2	1	0
Interior	3	2	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions									
Exterior									
Nonbearing walls and partitions									
Interior	0	0	0	0	0	0	0	0	0
Floor construction and associated secondary members	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members	1.5	1	1	0	1	0	HT	1	0

Table 32: Fire resistance requirements (hours) for a Type II-A building

6.4 Primary Structural Frame

A Type II-A building is required to have a minimum 1 hour fire resistance rating on the primary structural as shown in Table 31. This was achieved by the application of a spray-applied fire resistant material. The spray-applied fire resistant material selected for the building was A/D Type FP manufactured by AD Fire Protection Systems. The product specification sheet is included in Appendix 34. The material was applied to all primary structural elements including columns, beams and joists. A typical application on a column is shown in Figure 36.

In most cases the fire proofing was not visible due to the installation of drop ceilings and other finishing materials. However the fire proofing was visible in the loading dock area as shown in Figures 37 and 38.

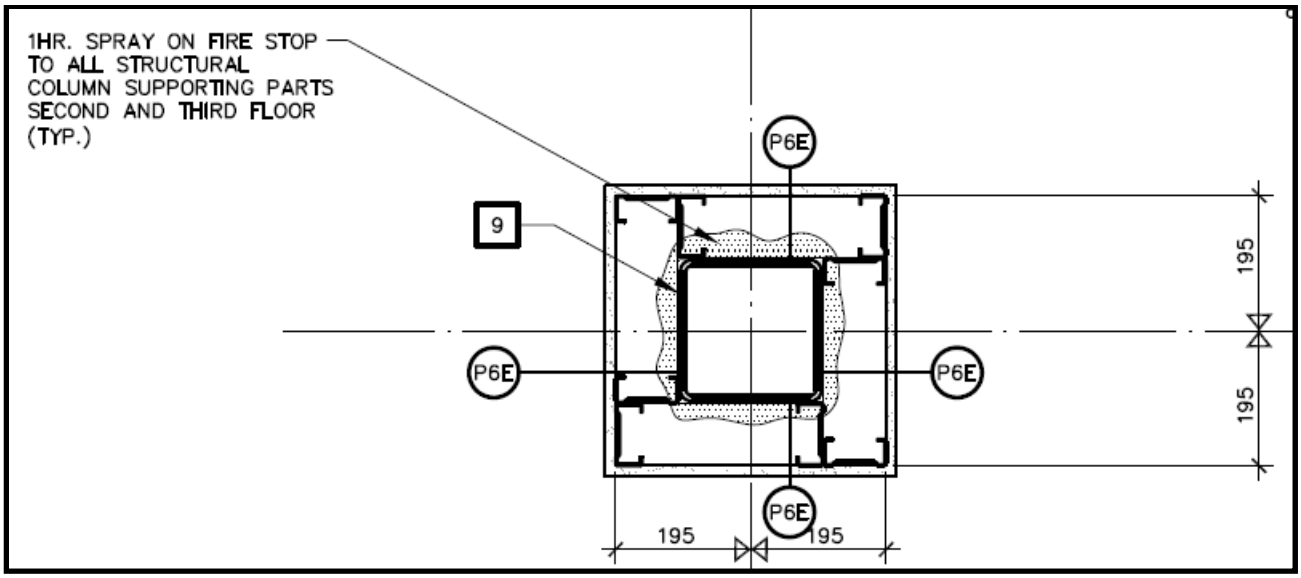

Figure 36: Typical application of fire resistant material to a steel column

Figure 37: Fire proofing visible above the gypsum wall board applied for esthetic purposes.

Figure 38: Fire proofing on joists and the underside of the floor assemblies

6.4.1 *Bearing Walls*

The walls surrounding the stair wells have a 2 hour fire resistance rating in accordance with ULC Design No. W404 as referenced in Appendix 35.

6.4.2 *Non Bearing Walls and Partitions*

A Type II-A building is not required to have a fire resistance rating on the non-bearing walls and partitions. However, as shown in Figure 39, the vertical exit enclosures (stairwells) have concrete partition types P1 and P10A which offer 1 hour fire resistance rating as described in Table 31.

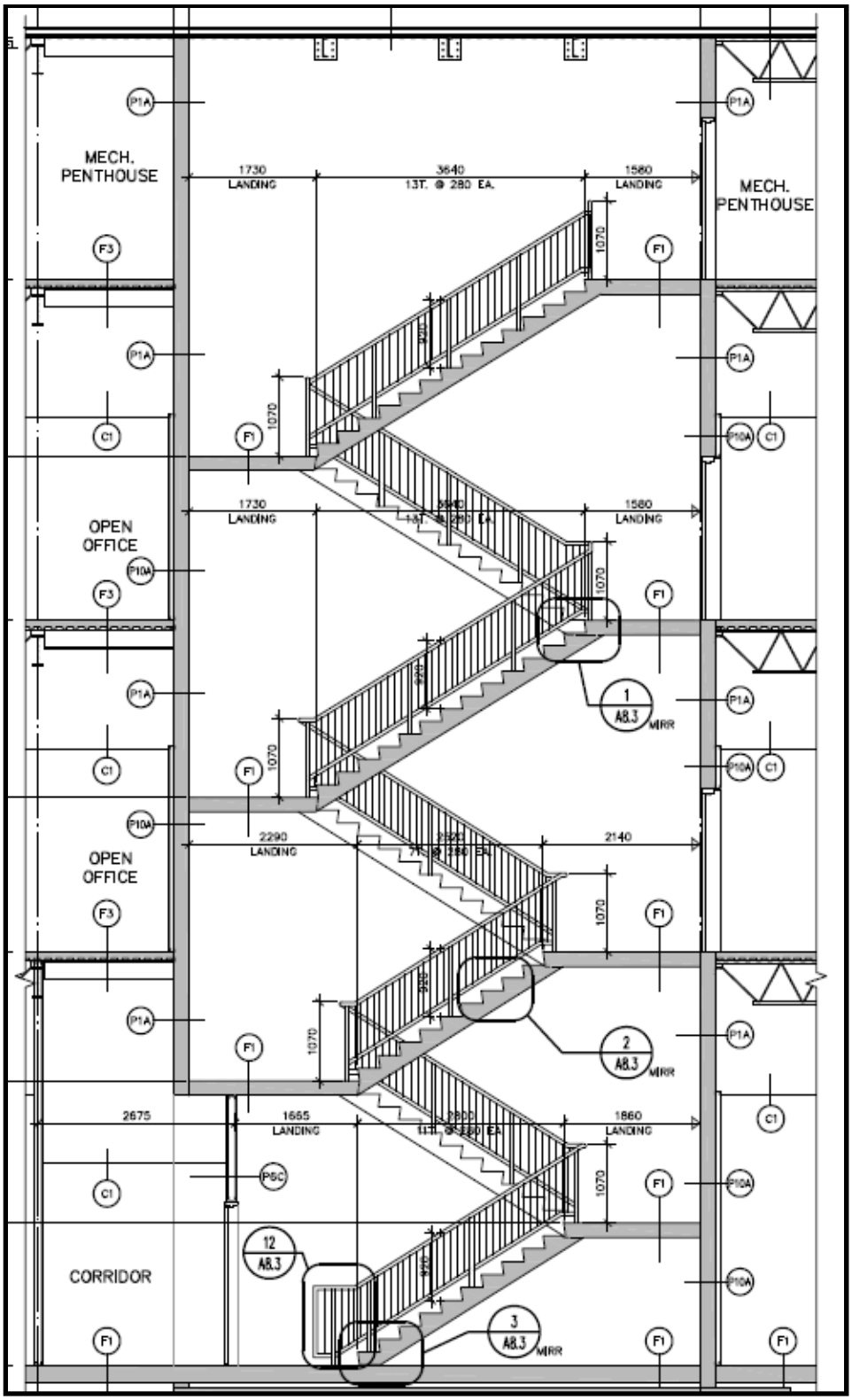

Figure 39: Fire resistant partitions enclosing stairwells

6.4.3 *Floor Assemblies*

A Type II-A building is required to have a minimum 1 hour fire resistance rated floor assemblies. As shown in Figure 39, Type F3 floors are installed in the second and third floors of the building. Type F3 floor assemblies have a 1 hours spray fireproofing and meet the ULC Design Specification F818 which is included in Appendix 36.

6.4.4 *Roof Assemblies*

A Type II-A building is require to have a minimum 1 hour fire resistance rating on the roof assemblies as shown in Table 31 . This one hour fire rating was achieved by the application of a spray-applied fire resistant material.

6.4.5 *Door Openings*

The building is equipped with fire rated, interior doors as required by Code. (LSC- 08-11.00); see Figures 40 and 41.

Figure 40: Fire rated door certification

Figure 41: Fire rated door certification

6.5 Joints and Penetrations

The building design specification required that fire stop and smoke seal material was installed in the flowing locations.

- Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls, including structural penetrations
- Edges of floor slabs at curtain wall and precast concrete panels; see Figure 42
- Top of smoke and fire-resistance rated masonry and gypsum board partitions
- Intersection of fire-resistance rated masonry and gypsum board partitions
- Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls
- Penetrations through fire-resistance rated floor slabs, ceilings and roofs
- Openings and sleeves installed for future use through fire separations
- Around mechanical and electrical assemblies penetrating fire separations
- Rigid ducts having a cross sectional area greater than 129 cm^2 (fire stopping to consist of bead of fire stopping material between retaining angle and fire separation)

Various products were used to limit fire spread through penetrations as shown in Figures 43, 44 and 45. The fire stop used on the cable tray and piping penetrations was 3M Fire Barrier Sealant CP 25WB which is a latex based, intumescent sealant; see product specifications in Appendix 37. A self-leveling silicone sealant manufactured by Hilti was used on the floor penetrations as shown in Figure 45. The product specifications are included in Appendix 38.

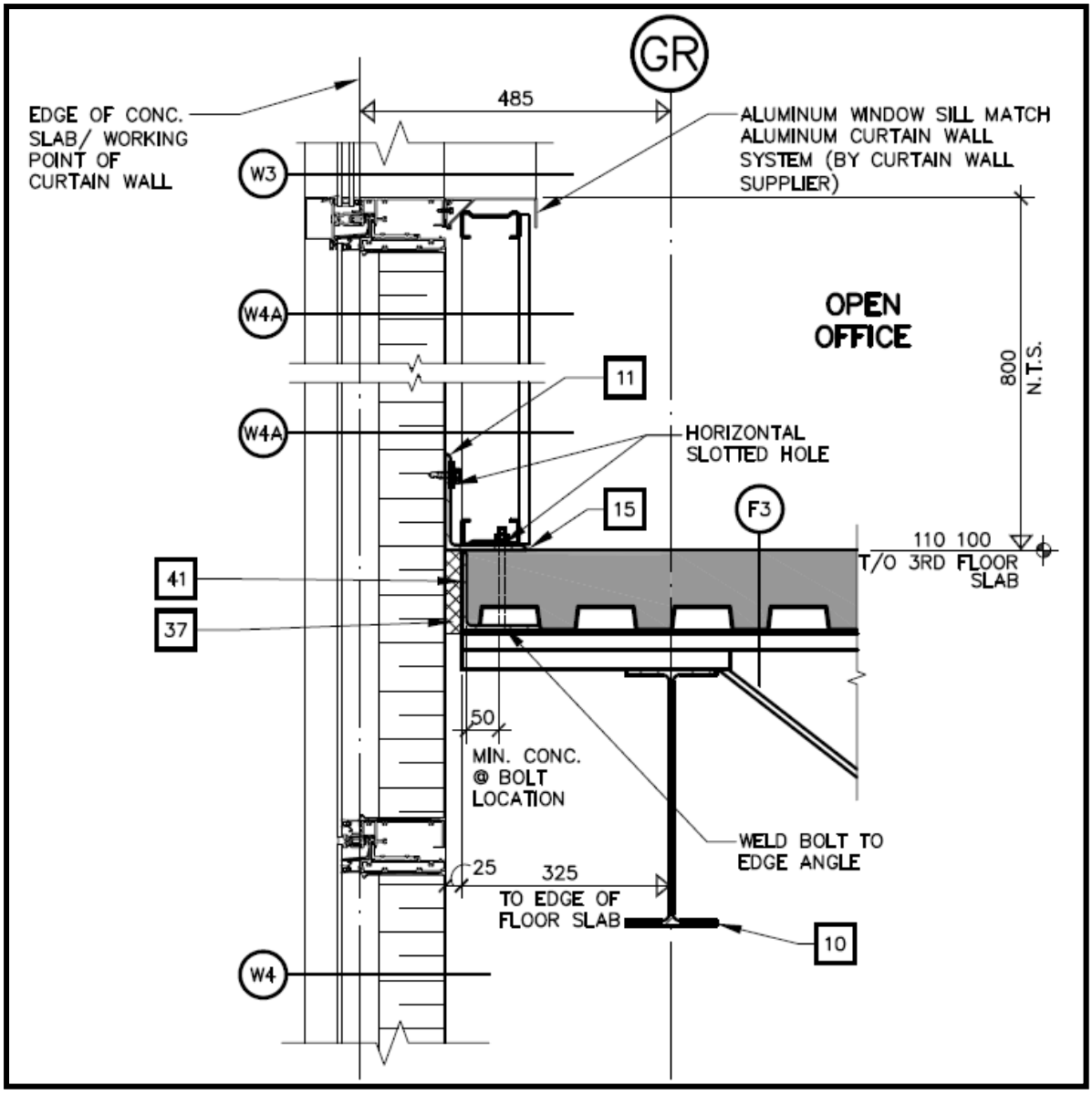

Figure 42: Section view showing the requirement for fire stop installation between the curtain wall and the floor slab (identified as 37)

Figure 43: Typical cable tray wall penetration showing typical application of fire-stop material.

Figure 44: Typical wall penetration by pipe

Figure 45: Typical floor penetration

6.6 Structural Fire Protection System Findings

The occupancy classification of the project building was found to be Group B (Business) which requires Type II-A construction. It was confirmed that the materials used to construct columns, beams, floor assemblies, roof assemblies, exterior walls and interior walls and partitions met the International Building Code requirements for Type II-A construction.

7.0 Performance Based Analysis

This section evaluates how the project building life safety and fire protection systems perform when challenged by a design fire. The objective is to confirm that occupants can exit the building before they are exposed to untenable environmental conditions. This approach is consistent with the requirements for design fire scenarios specified in the Life Safety Code (LSC – 5.5 and A.5.2.2 Method 2).

Two credible fire scenarios are evaluated; a trash bag fire in the East Exit Stairway Enclosure and a chair fire located in the third floor, open-office area. The design fires are believed to be realistic with respect to their initial location, fire growth rate and smoke generation.

The smoke yield and products of combustion are highly dependent on the fuels involved in the fire and the available oxygen. For this analysis the carbon monoxide and soot yield values used in Fire Dynamic

Simulator (FDS) were those recommended by the New Zealand Building Code for design fires (CO yield 0.04 and soot yield = 0.07).

7.1 Tenability Limits

Tenability limits are defined as the exposure thresholds that can cause incapacitation, serious injuries or ineffective evacuation movement. Tenability limits for temperature, carbon monoxide and smoke obscuration are used in this analysis as defined below.

7.1.1 *Temperature*

The effects of thermal radiation on humans depend strongly on the thermal radiation flux, the duration of exposure, the type of clothing worn, the ease of sheltering and the individual exposed (NFPA 130).

- Tenability limit: T > 60 ^{o}C

7.1.2 *Carbon Monoxide*

Over half of fire related deaths are reported to have been caused by inhalation of smoke and toxic gases (Bryan 2002). Animal models have demonstrated that exposure to carbon monoxide concentrations between 1000 and 8000 ppm with a fractional effective dose of 27,000 ppm-min may lead to unconsciousness (Purser 2002).

- Tenability limit: [CO] > 1000 ppm

7.1.3 *Smoke Obscuration*

Studies have shown that obscuration due to smoke can greatly reduce successful building egress. Occupants tend to turn back when the visibility is reduced below 10 m (Bryan 2002). Tadahisa found that occupants with a high building-familiarity needed visibility levels at 4 m before they were deterred compared to 13 m for occupants unfamiliar with the building (Tadahisa 1997).

- Tenability limit: Visibility < 10 m at a height above floor level of 1.8 m

7.2 Trash Bag Fire Scenario

The rational for evaluating a trash bag fire in the East Exit Stairway Enclosure was based on observations made during a building tour. It was found that cleaning staff were using East Exit Stairway Enclosure to store janitorial supplies. A previously noted in Section 4.2.2, the LSC prohibits the use of exit enclosures for any purpose that has the potential to interfere with its use as an exit. The building owner has allowed considerable quantities of combustible materials to be stored in the East Exit Enclosures as shown in Figure 46 and as summarized in Table 33.

Item	Commodity	Estimated Quantity (kg)	
Paper towels	Paper	22 boxes @ 8.5 kg/case	187
Paper hand towels (folded)	Paper	13 boxes @ 8 kg/case	104
Toilet paper	Paper	31 cases @ 3.6 kg/case	112
Trash bag fitted to Janitorial Carts	Paper	3 bags @ 4.1kg/bag*	12
		Subtotal (paper)	415
Plastic bags (22” x 24”)	HDPE	8 cases@ 3 kg/case	24
Plastic bags (42” x 48”)	HDPE	9 cases@ 6 kg/case	54
Janitorial Carts	HDPE	3 @ 22.5 kg/cart	67
		Subtotal (PE plastic)	145

Table 33: Inventory of janitorial supplies located in the east exit stair enclosure at the main floor level

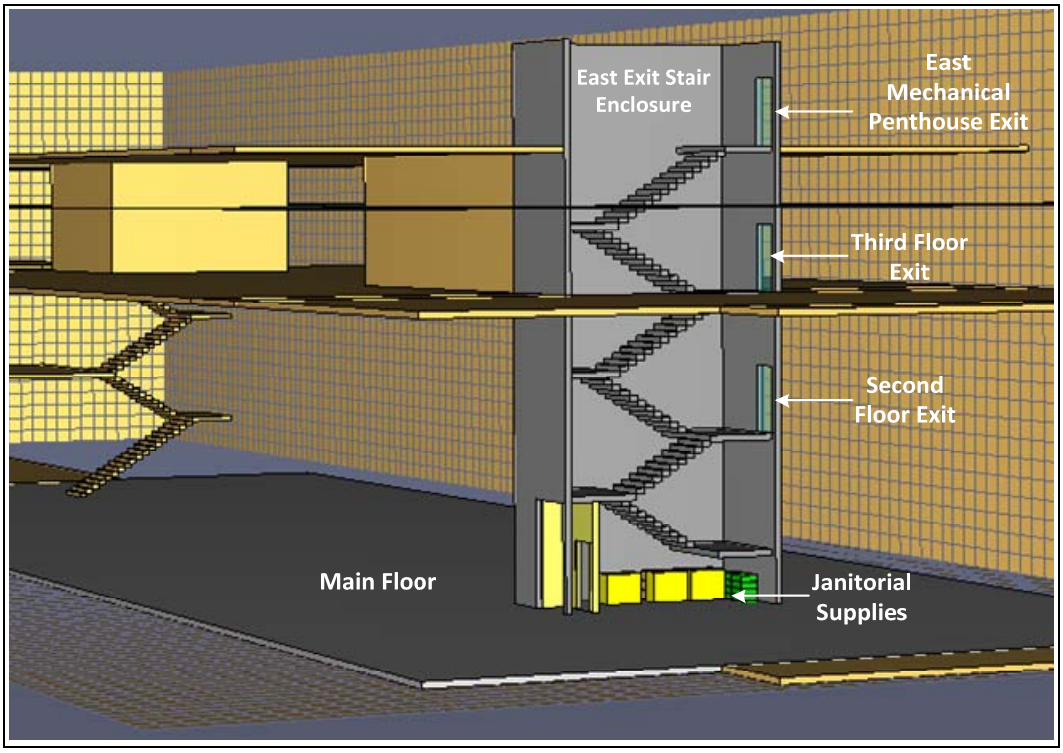

Figure 46: East Exit Stairway Enclosure. The stairs from the main floor to the first landing were hidden to display the janitorial supplies

7.2.1 *Design Fire*

It is proposed that the fire starts in a trash bags attached to one of the janitor’s carts. The design fire was based on published test-burn data (Kim 2000).

The East Exit Stairway Enclosure is an 18 m high rectangular shaft rising from the main floor to the East Mechanical Penthouse as shown in Figure 39. The outside dimensions of the shaft are 3.6 x 7.35 m with 200 mm thick concrete walls. All floor landings and stairs are of pre-cast concrete construction. The

main floor door is recessed into the enclosure by a wall constructed of metal studs and gypsum wall board.

The fire growth rate following a t^2 model (α = 0.1 kW/s) with a maximum Heat Release Rate (HRR) of 336 kW. The HRR from a trash bag fire is shown in Figure 47.

The FDS model was run with all doors to the Exit Stair Enclosure closed. The decision to keep the doors closed was based on observations during several visits to the building during and outside of normal business hours. The exit access doors were fitted with automatic closures and at no time were the doors ever seen to be propped open.

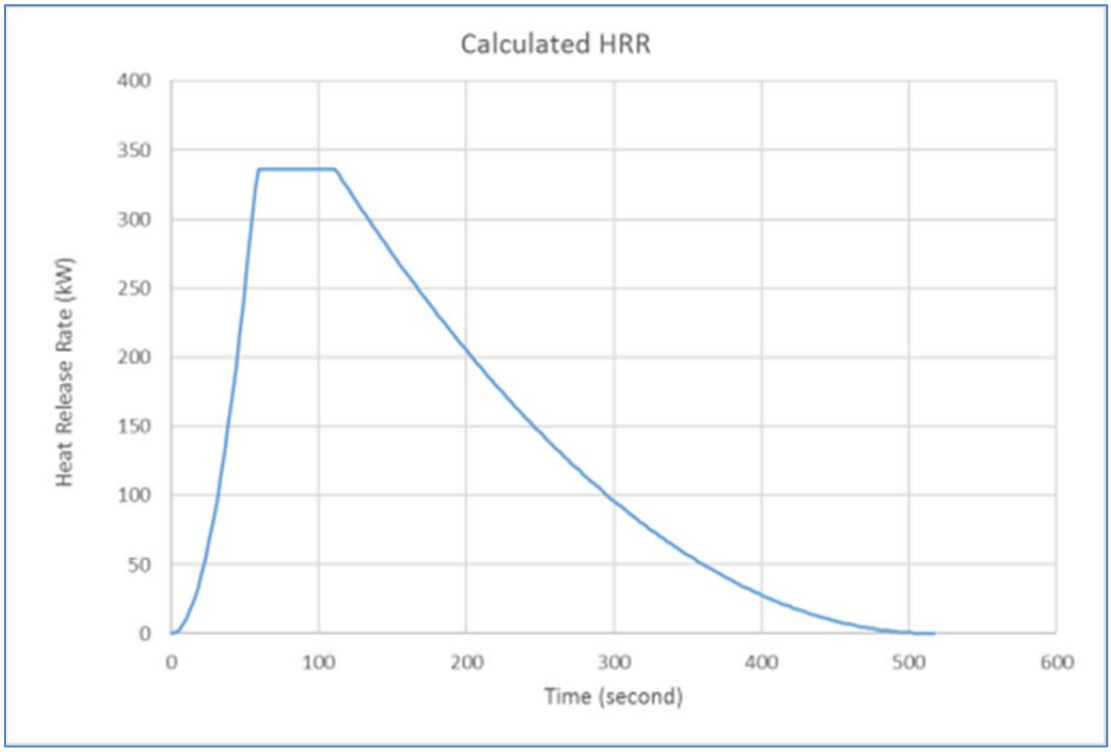

Figure 47: Heat release rate from trash bag fire.

7.2.2 *Trash Bag Fire - FDS Model*

The FDS model was run with two objectives.

1. To determine when the building systems detect the fire and,
2. To determine when the conditions in the building became untenable due to the effects of the temperature, carbon monoxide or smoke.

It was confirmed that the growth stage HRR of the FDS model was a good approximation of the design fire curve as shown in Figure 48.

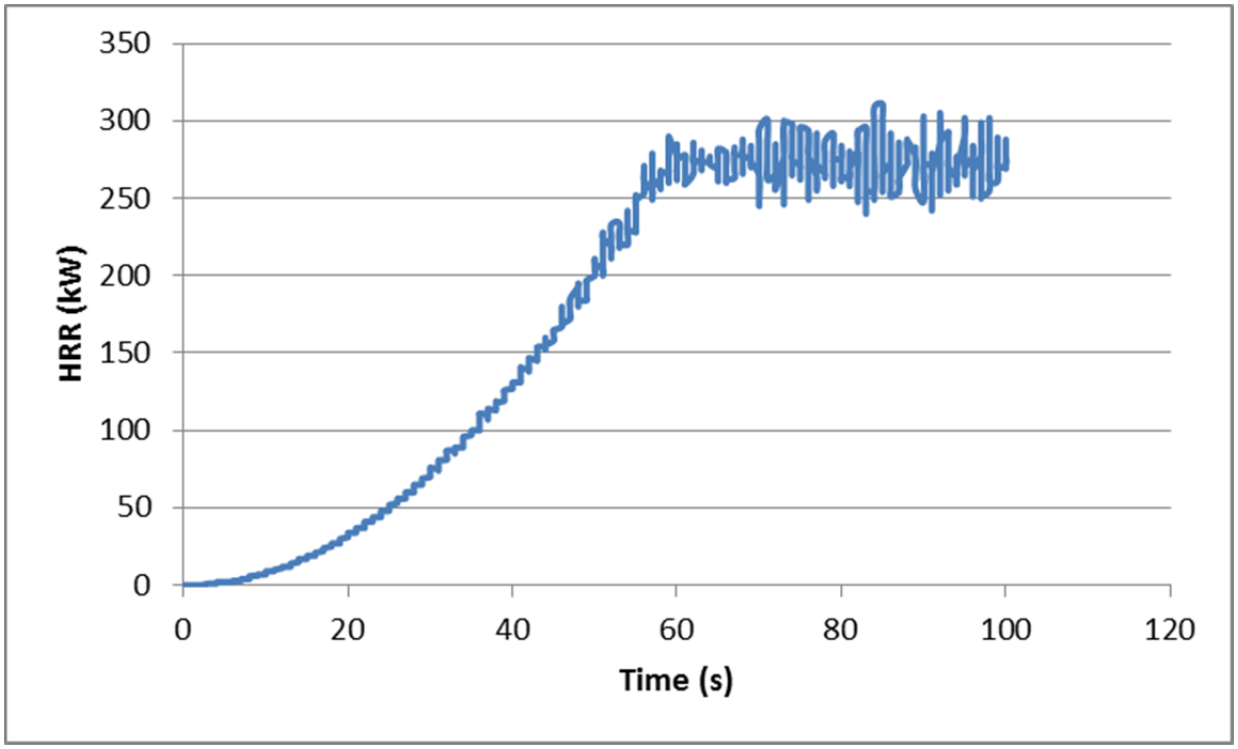

Figure 48: Heat release rate for Trash Bag fire as modeled in FDS

7.2.3 *Sprinkler Response*

As can be seen in Figure 12, a sprinkler head is located close to the janitors carts where the design fire is proposed to occur. A thermocouple was placed at the location of the sprinkler head (z = 1.6 m) to determine if the temperature increased enough to activate the sprinkler (57 °C). The thermocouple reached 57 °C after about 45 seconds as shown in Figure 49.

The FDS model was run twice to compare the effect of the sprinkler on the enclosure temperature. As shown in Figure 50, the sprinkler activated at about t = 40 s and had the effect of reducing the local temperature by about 40 °C at the peak HRR.

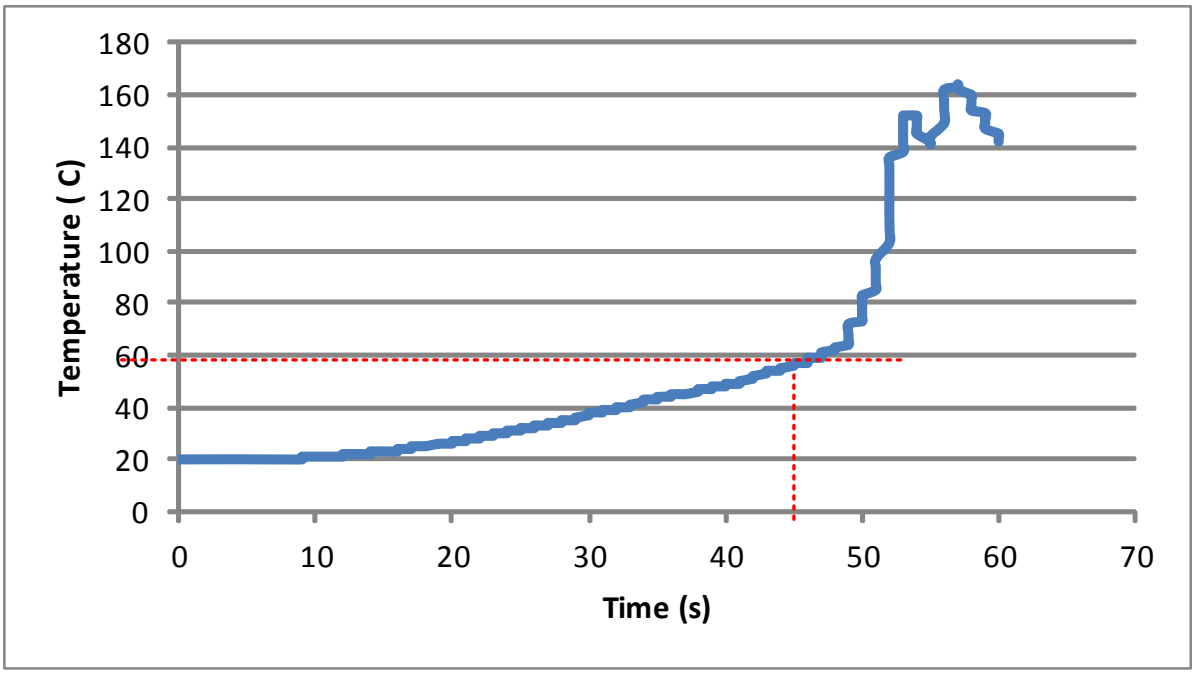

Figure 49: Temperature of thermocouple located at a height of 1.6 m above floor level. The sprinkler activation temperature was 57 °C

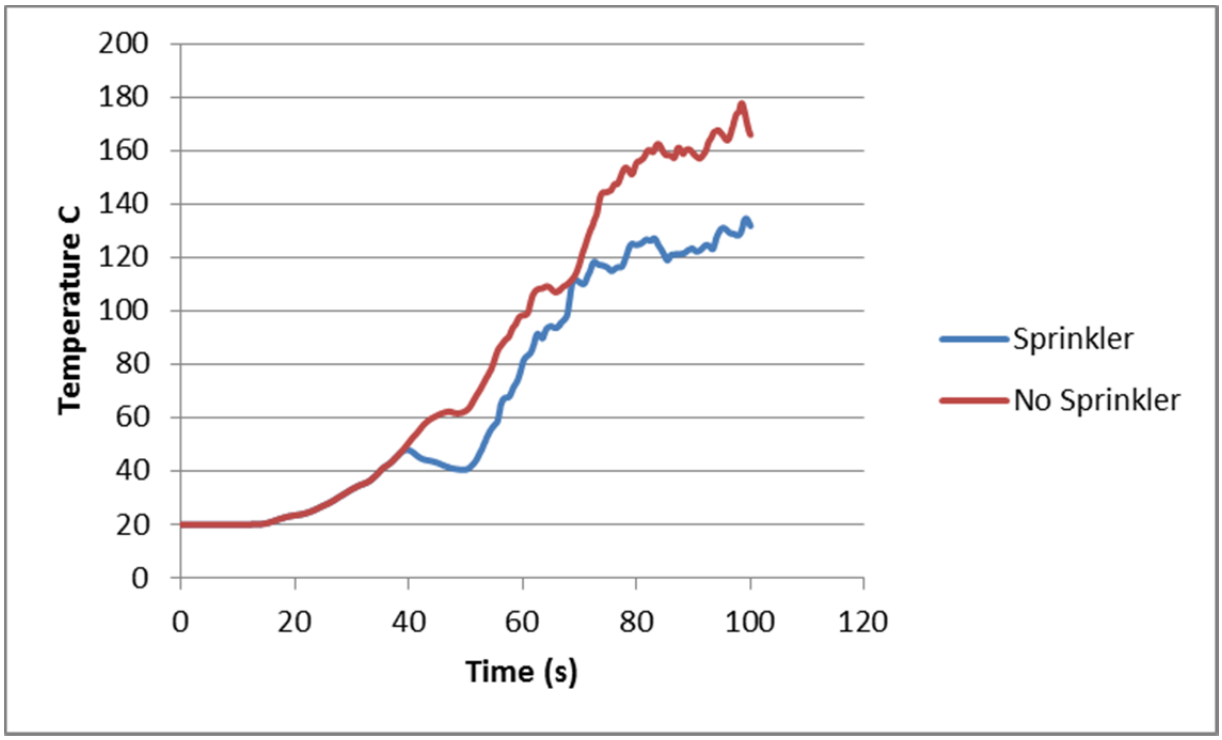

Figure 50: Effect of sprinkler activation on temperature at the elevation of sprinkler head (z = 1.6 m)

7.2.4 *Discussion of the Trash Bag Fire Scenario*

The results of the FDS model indicate that a sprinkler would be activated at about 40 seconds. As previously shown in Section 3.2.1, the sprinkler system is fitted with a Potter VSR-EU 6 Water Flow Detection Device. The water flow switch would signal the FACP which would activate all building notification appliances and send a signal to the remote Supervising Station. Personnel at the Supervising Station would in turn contact the City Fire Department and the on-call Building Manager.

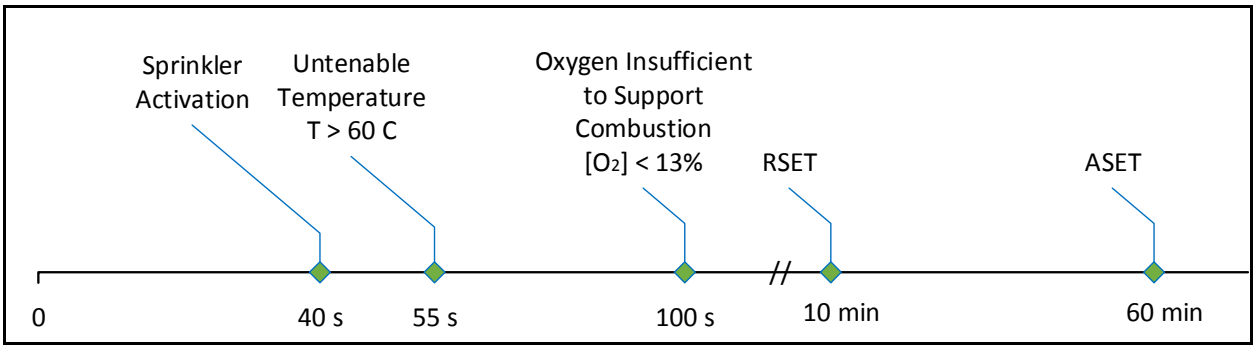

Figure 51: Timeline for activation of the fire detection system and development of untenable conditions

The results of the FDS model indicate that untenable temperature conditions developed after about 55 seconds at the main floor elevation. These untenable conditions extended to the second floor landing by about 100 seconds as shown in Figures 52, 53 and 54. The model also revealed that the enclosure became oxygen-limited ($[O_2] < 13\%$) after approximately 100 seconds as shown in Figure 55.

In Section 4.4.5, the building evacuation time was estimated to be approximately 5 minutes based on availability of both the east and west exit stairways. The proposed trash bag fire would reduce the number of exit stairways to one thus extending the building evacuation time to about 10 minutes (i.e. Required Safe Egress Time (RSET) ≈ 10 minutes).

In Section 6.1, the building was found to meet the fire resistance rating requirement of a Type II building and affords adequate passive fire protection for building occupants. The concrete walls and access door of the stairway have a 1 hour resistance rating which would contain the fire in the Exit Stairway Enclosure (Available Safe Egress Time (ASET) ≈ 60 minutes).

It can be concluded that:

1. The building water-based fire protection and fire detection and alarm systems have been shown to work effectively when challenged by the trash bag fire,

2. The ASET is greater than the RSET and occupants should be able to safely evacuate from the building, and

3. Oxygen-limited condition would prevent the fire growth provided the doors to the exit enclosure remain closed. However, pyrolysis would continue and the unburned fuels would present a significant hazard to occupants or firefighters should they open the Exit Stairway Enclosure door.

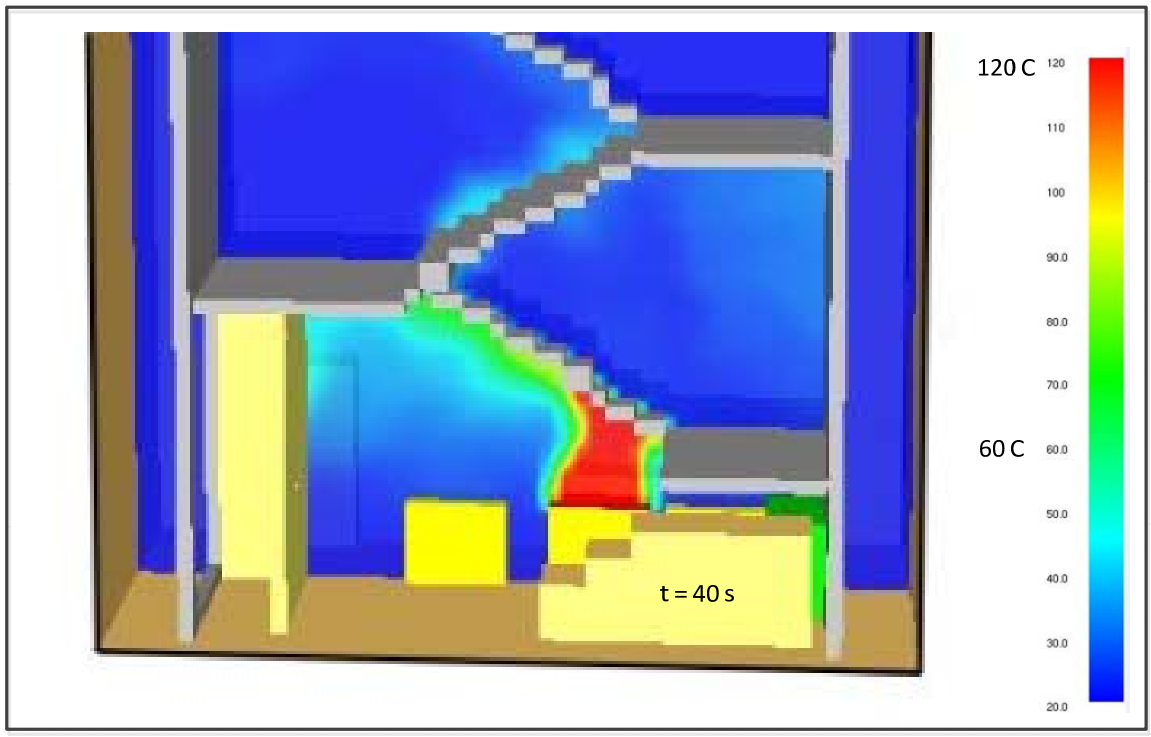

Figure 52: FDS slice views showing the Stairway Exit Enclosure temperature 40 seconds after ignition.

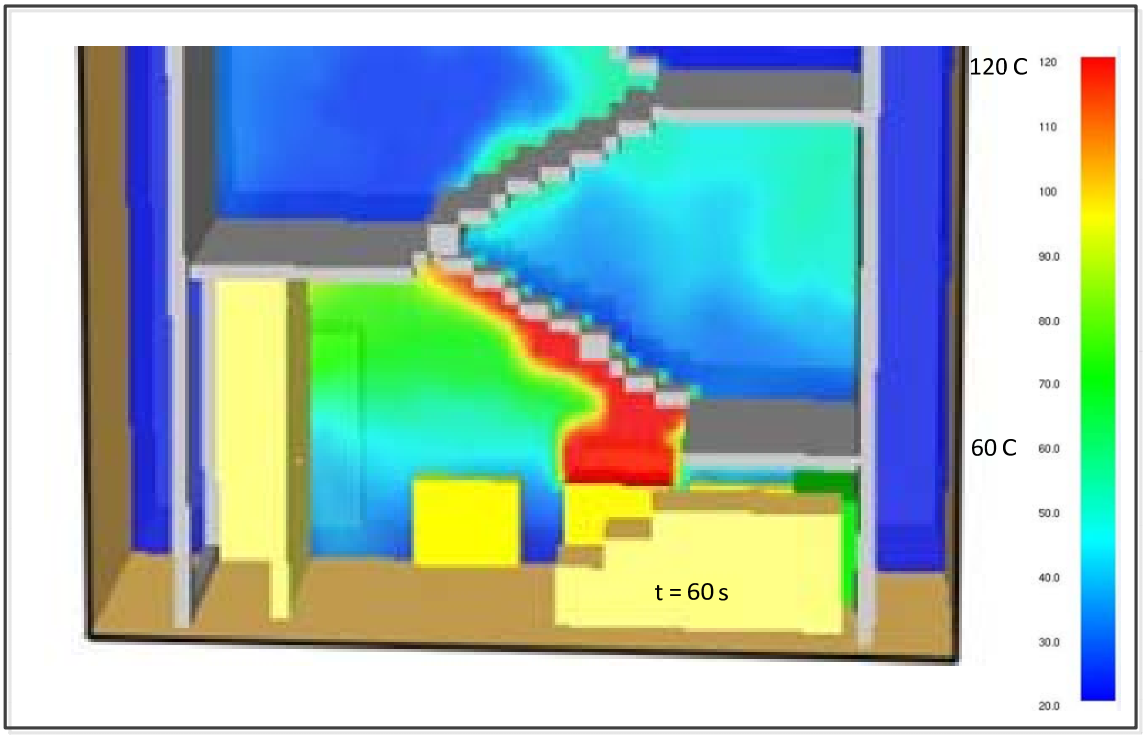

Figure 53: FDS slice views showing the Stairway Exit Enclosure temperature 60 seconds after ignition.

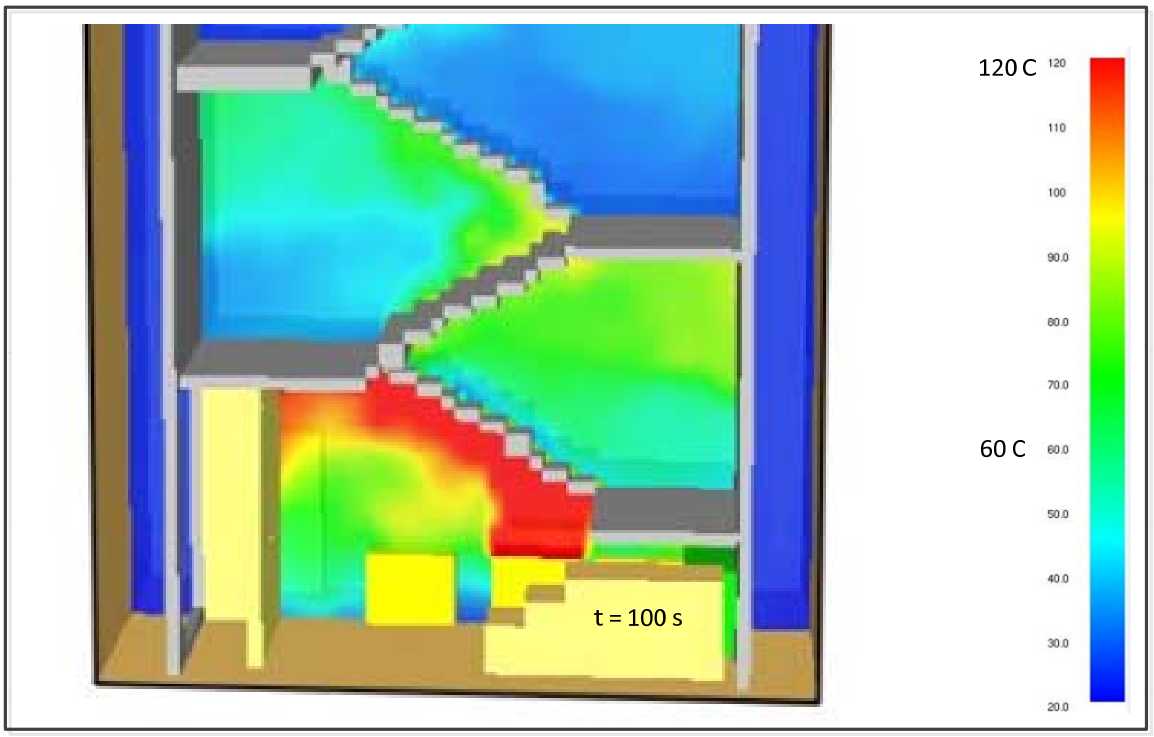

Figure 54: FDS slice views showing the Stairway Exit Enclosure temperature 100 seconds after ignition

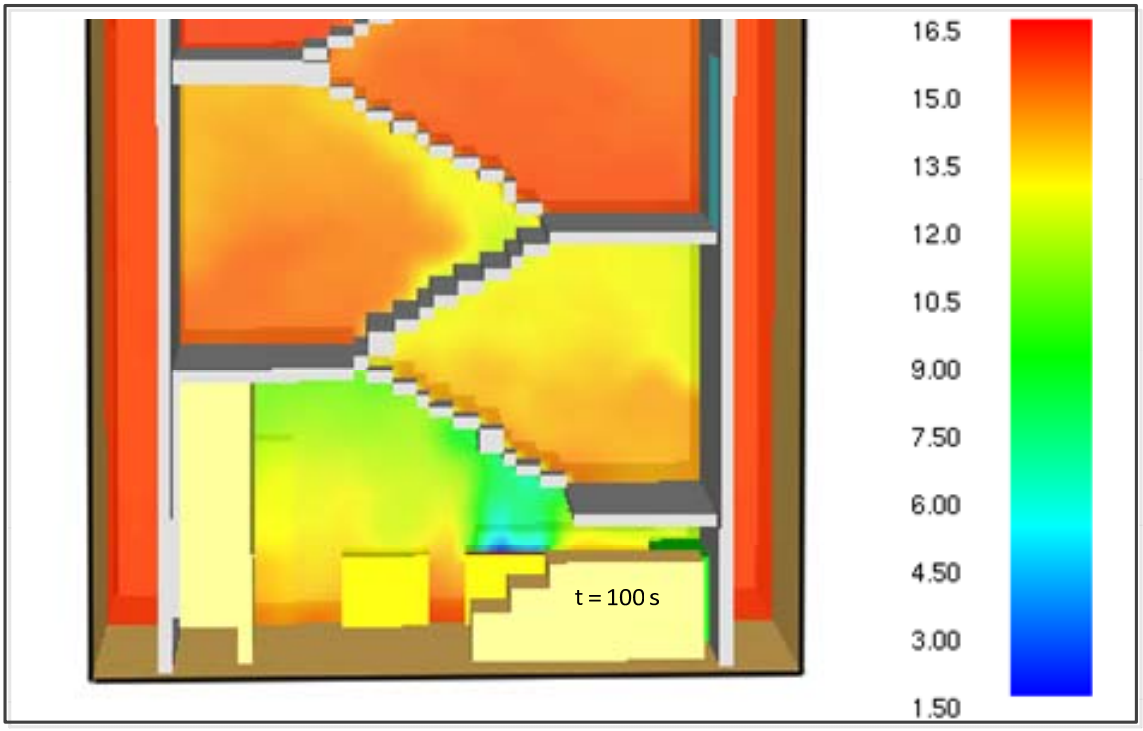

Figure 55: FDS slice views showing the Stairway Exit Enclosure. Oxygen limited conditions developed at 100 seconds after ignition

7.3 Chair Fire Scenario

The second fire scenario evaluated involves the ignition of a chair by a faulty electric space heater in an arrangement similar to that shown in Figure 56. The rational for selecting this fire scenario was based on two factors.

1. The high frequency of fires caused by electric space heaters. Heating equipment ranks second in reported home fires, home fire deaths and home fire injuries. Portable and fixed space heaters are involved in more fires than central heat (Hall 2013).

2. An office safety policy which prohibits the use of electric space heaters which has been generally disregarded by building occupants.

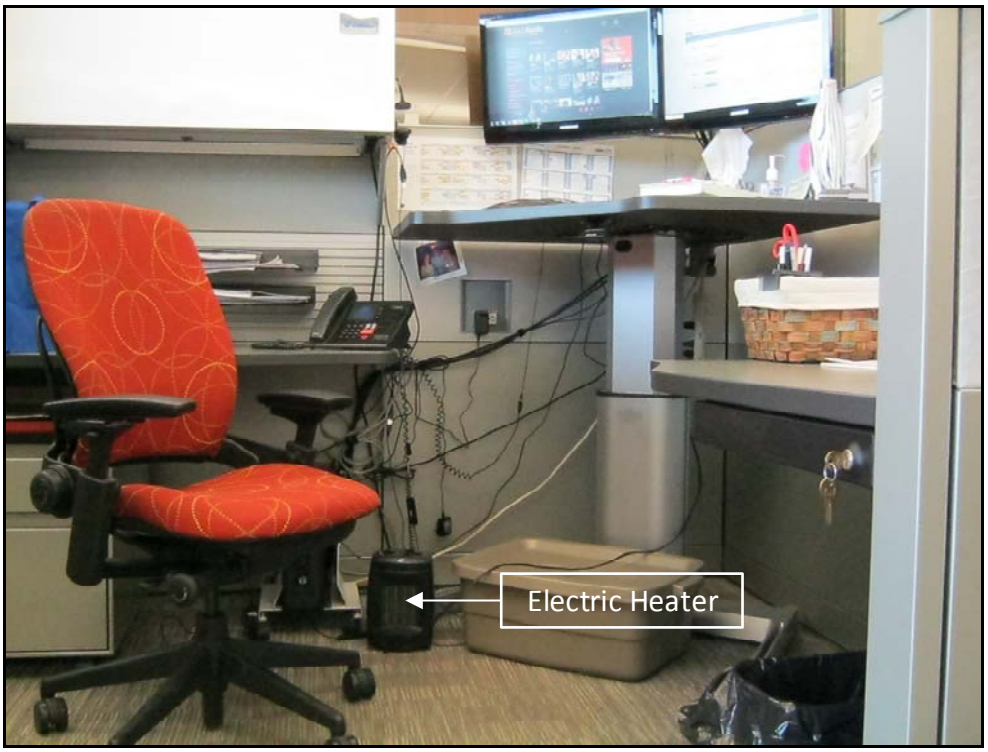

Figure 56: Electric space heater adjacent to office chair

7.3.1 *Design Fire*

The design fire was based on published test burn data published (Kim 2000). The fire growth rate following a t^2 model (α = 0.1 kW/s) with a maximum HRR of 1960 kW as shown in Figure 57.

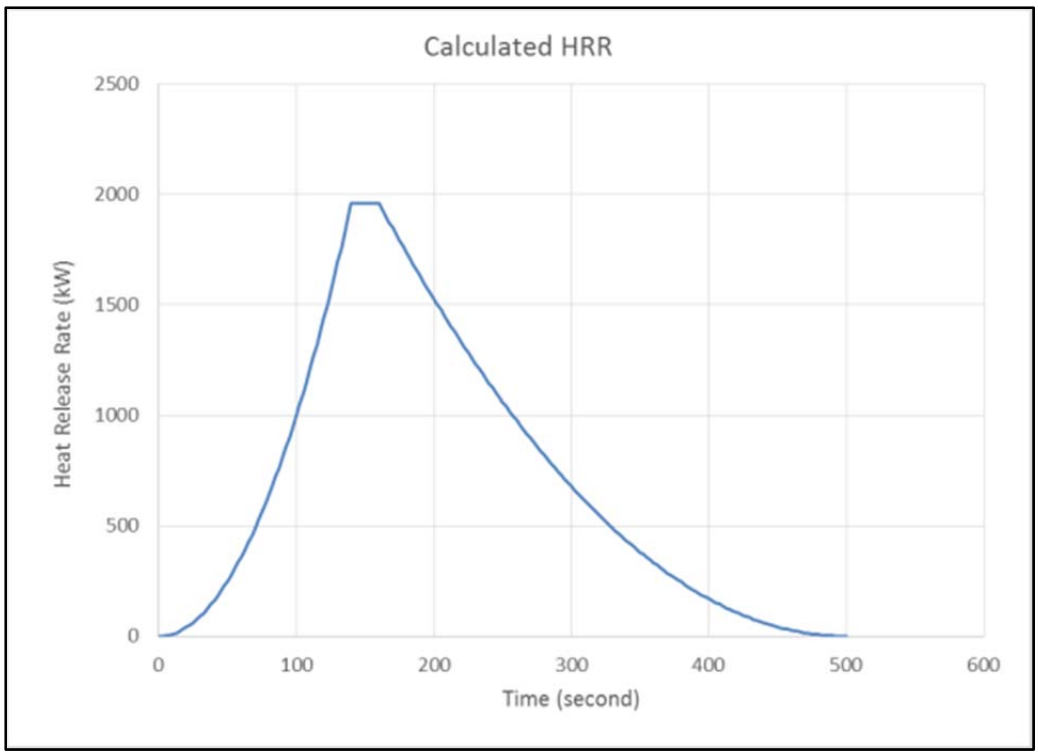

Figure 57: Heat release rate from a chair

The fire is proposed to occur on the third floor as shown in Figures 58 and 59. The following assumptions are made with respect to the physical space and the location of detection devices.

- Ceiling height = 2.44 m
- The fire occurs at the center of four sprinkler heads arranged in a rectangle with dimension 4.5 m x 4.0 m therefore the horizontal distance from the center of the fire to the nearest sprinkler head is 3.0 m.
- Sprinkler activation temperature = 57.2 °C
- Sprinkler RTI = 117 $(m\text{-}s)^{1/2}$
- Maximum horizontal distance from the center of the fire to the nearest smoke detector is 6.1 m
- Smoke Detector was an Edwards model SIGA-PS photoelectric – light scattering device
- Ambient temperature (Ta) = 20 °C

Figure 58: Location of the chair fire adjacent to the entrance to the West Exit Stairway on the third floor.

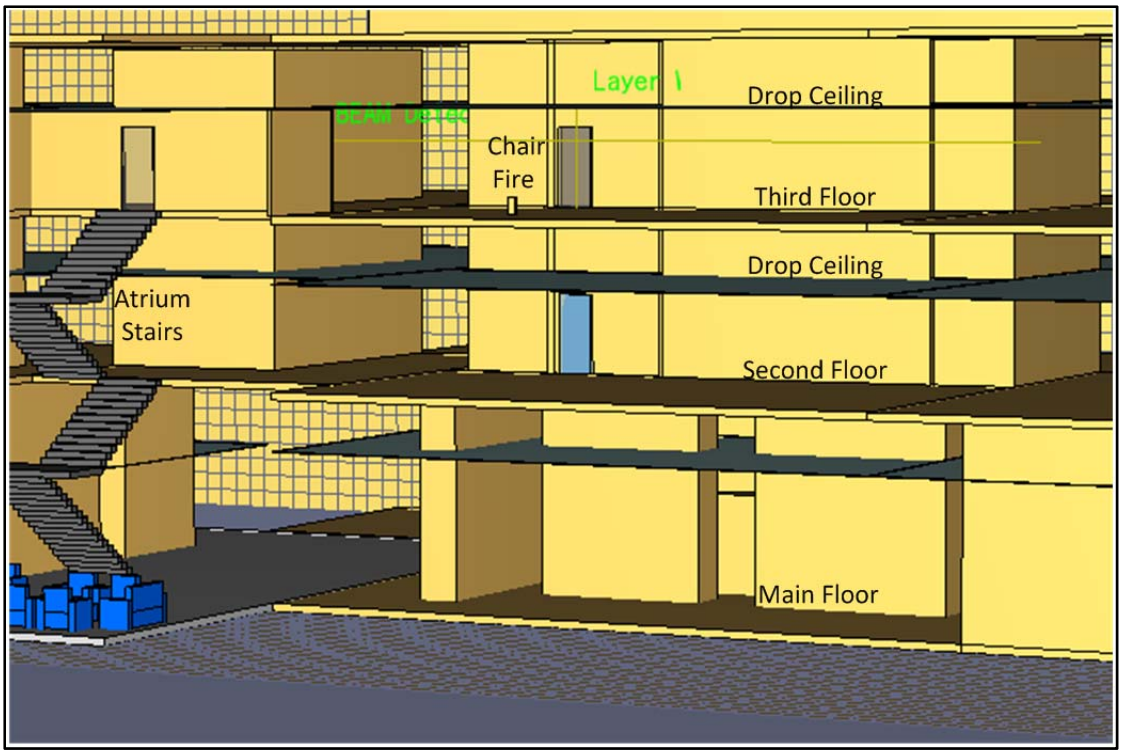

Figure 59: Location of the chair fire in the FDS simulation.

7.3.2 *Chair Fire Model*

A model of the chair fire was constructed using FDS. The FDS model was run with two objectives.

1. Determine when the building fire protection systems detect the fire and,
2. Determine when the conditions in the building became untenable due to the effects of the temperature, carbon monoxide or smoke.

Devices were included in the FDS model to estimate the temperature, CO concentration and visibility. The location of the interface between the hot, smoke-laden upper layer and the cooler lower layer was estimated using a Layer Zoning Device. The layer interface height was measured along a vertical axis adjacent to the third floor exit door as shown in Figure 60.

A Beam Detector was also included in the FDS model. The Beam Detector measures the percent obscuration between points. The end points of the Beam Detector were located at an elevation of 1.8 m above floor level along the travel path an occupant would traverse to evacuate the west half of the third floor as shown in Figure 60.

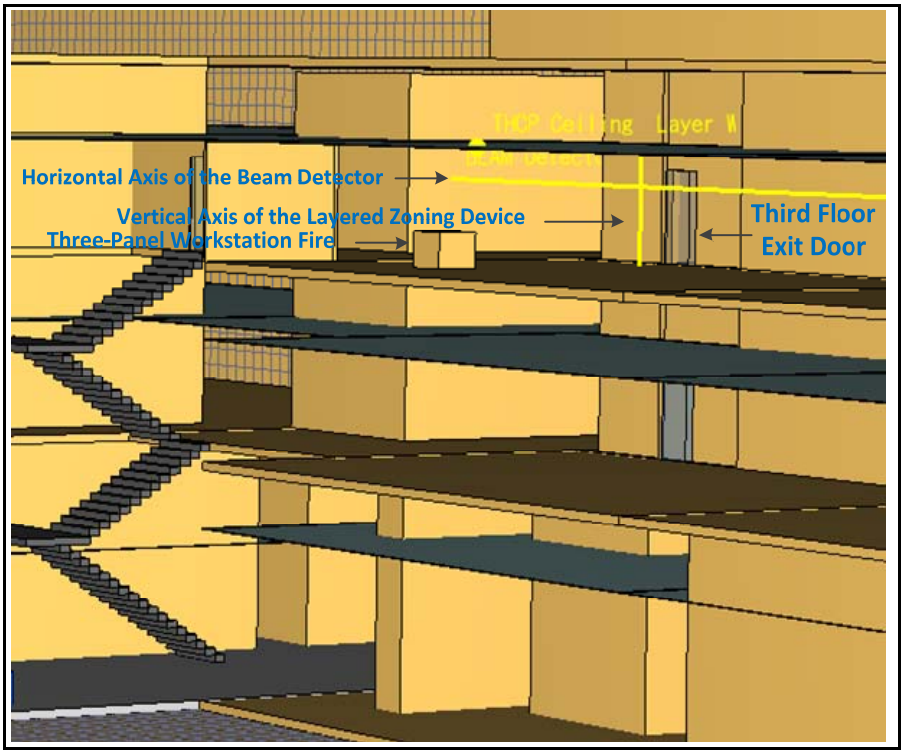

Figure 60: Model showing the location of the Layer Zoning Device, Beam Detector and Thermocouple (THCP)

The HRR from the chair fire during the growth stage was reasonably well duplicated in the FDS model as shown in Figure 61.

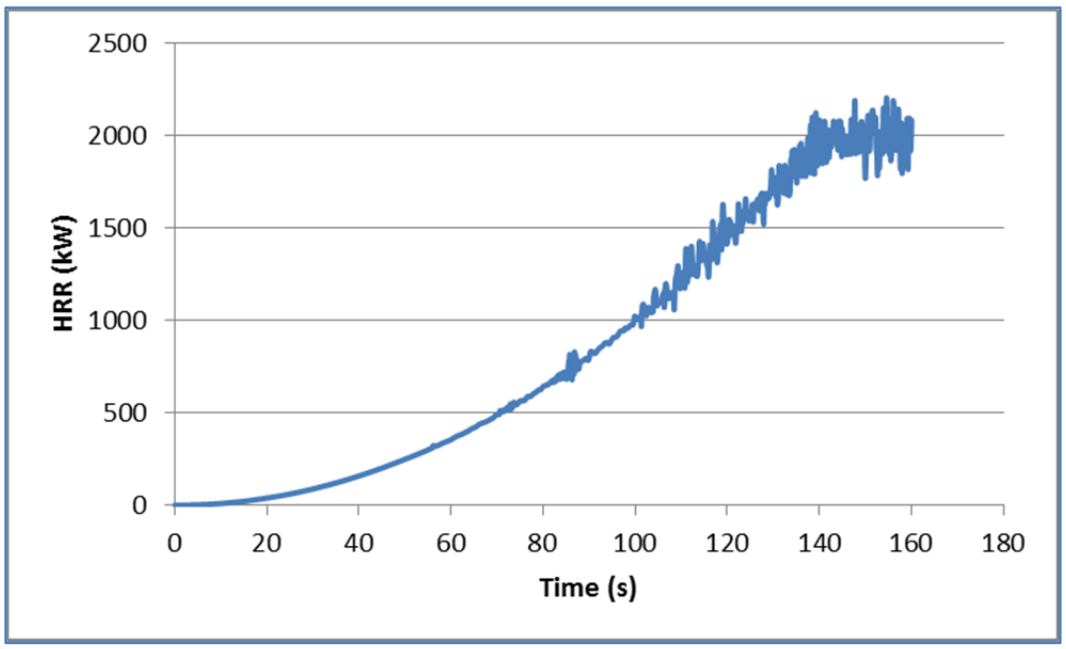

Figure 61: Heat release rate for chair fire as modeled in FDS

7.3.3 *Fire Effects on Tenability*

Temperature

The FDS model was run for 160 seconds corresponding to the fire growth phase. During the growth phase the temperature of the space around the chair fire did not reach the thermal tenability limit (T > 60 ^{o}C). As shown in Figure 62 the maximum temperature reached in the corridor adjacent to the fire was approximately 40 ^{o}C.

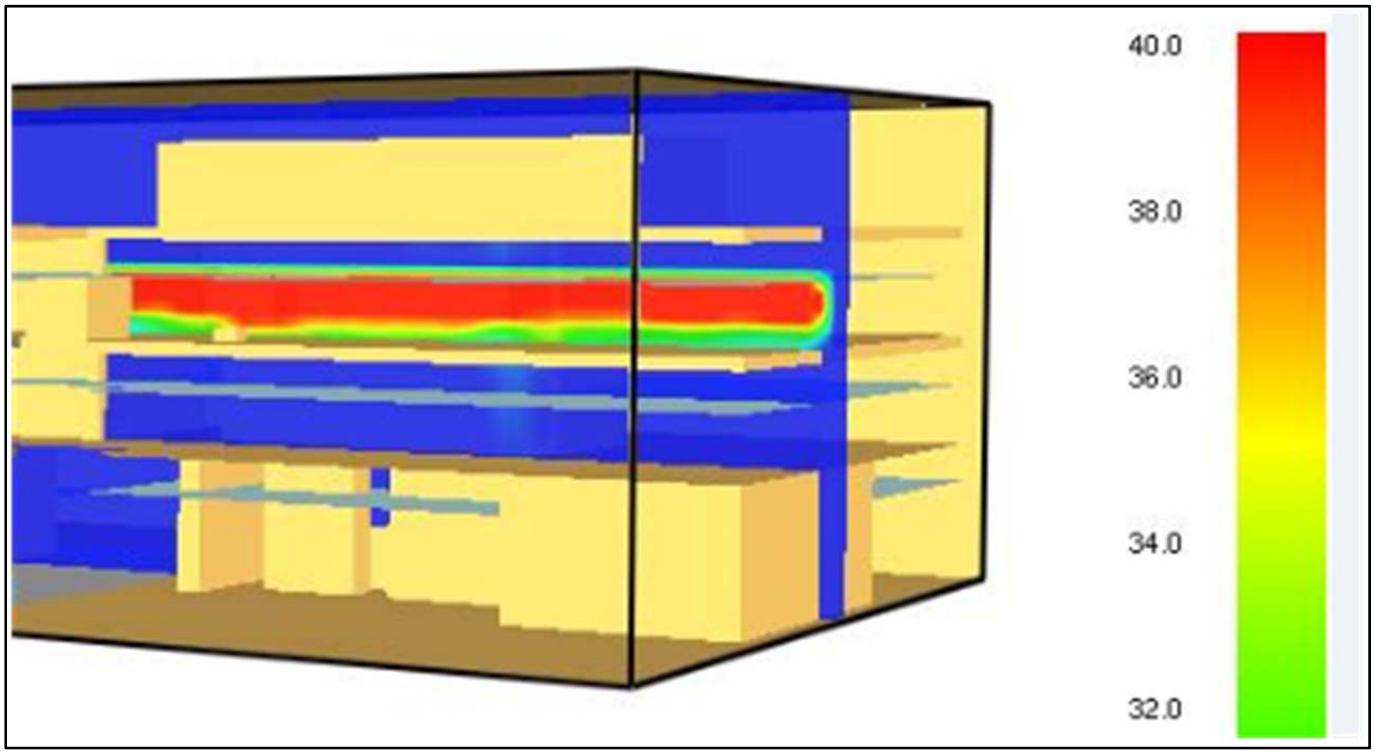

Figure 62: Temperature slice view at t = 156 s (x plane) Note the temperature did not rise to the tenability limit (T > 60 C)

Carbon Monoxide

The carbon monoxide level also remained below the tenability limit ([CO] > 1000 ppm) as shown in Figure 63. It is proposed that the combustion products where quickly diluted by fresh air drawn in from the surrounding, large open office space.

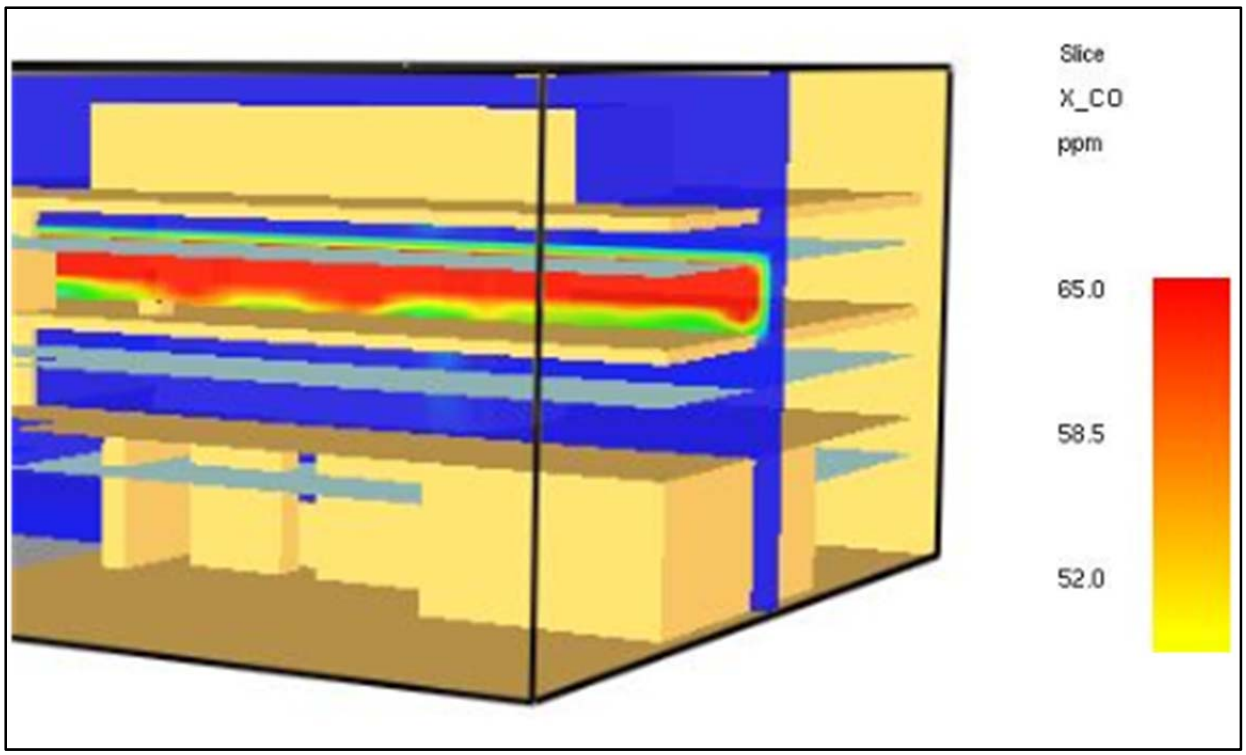

Figure 63: Carbon monoxide concentration in the vicinity of the chair fire at t = 160 s

Smoke

Smoke production from the chair quick exceeded the tenability limit. The smoke layer descended to 1.8 m above floor level after approximately 40 seconds; See Figure 64. Visibility declined rapidly reaching 100% obscuration in about 50 seconds; see Figure 65.

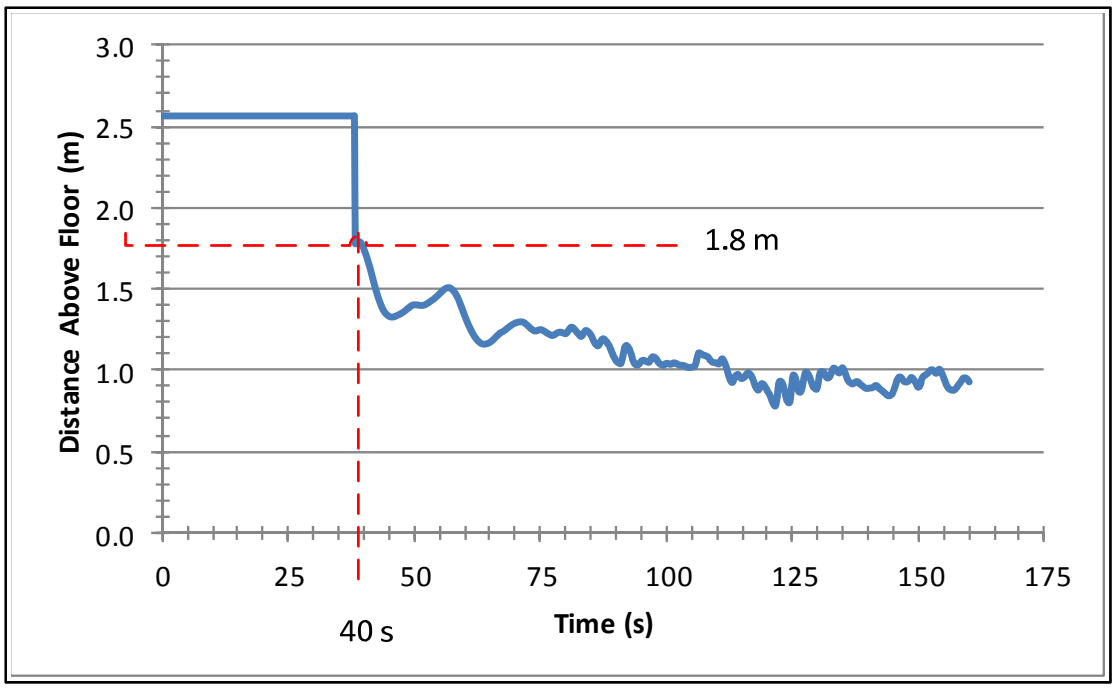

Figure 64: Smoke layer height as determined using the FDS Layer Zoning Device

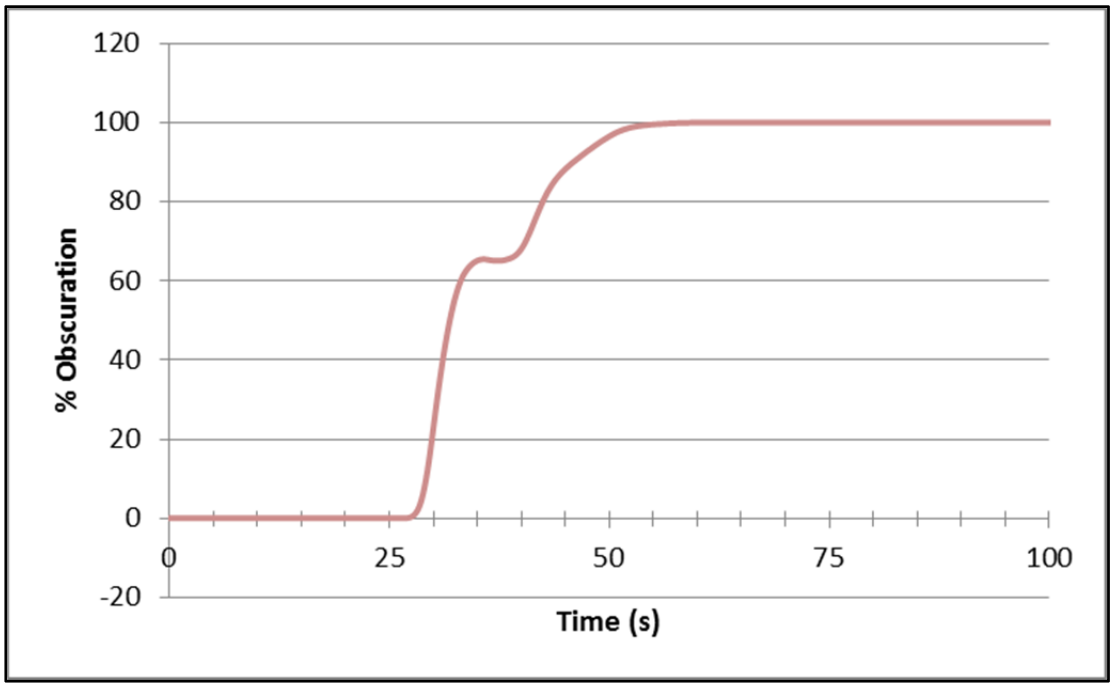

Figure 65: Percent Obscuration Smoke Obscuration as determined using a Beam Detector in the Chair Fire Model

7.3.4 *Sprinkler Response*

Sprinkler response was studied using the FDS and DETACT models.

DETACT Model – Sprinkler Response

The DETACT Model was run is estimate the sprinkler activation time during the chair fire. The DETACT Model inputs are summarized in Table 34. Based on the output of the DETACT Model, the sprinkler element would activate at about 112 seconds after the start of the fire as shown in Figure 66.

DETACT.XLS: Estimate of the response time of ceiling mounted fire detectors

INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	2.44	m	R/H	1.230
Radial distance (R)	3.0	m	dT(cj)/dT(pl)	0.261
Ambient temperature (To)	20	C	u(cj)/u(pl)	0.168
Actuation temperature (Td)	57.2	C	Rep. t2 coeff.	k
Response time index (RTI)	117	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.1	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

Table 34: DETACT model for the Sprinkler head

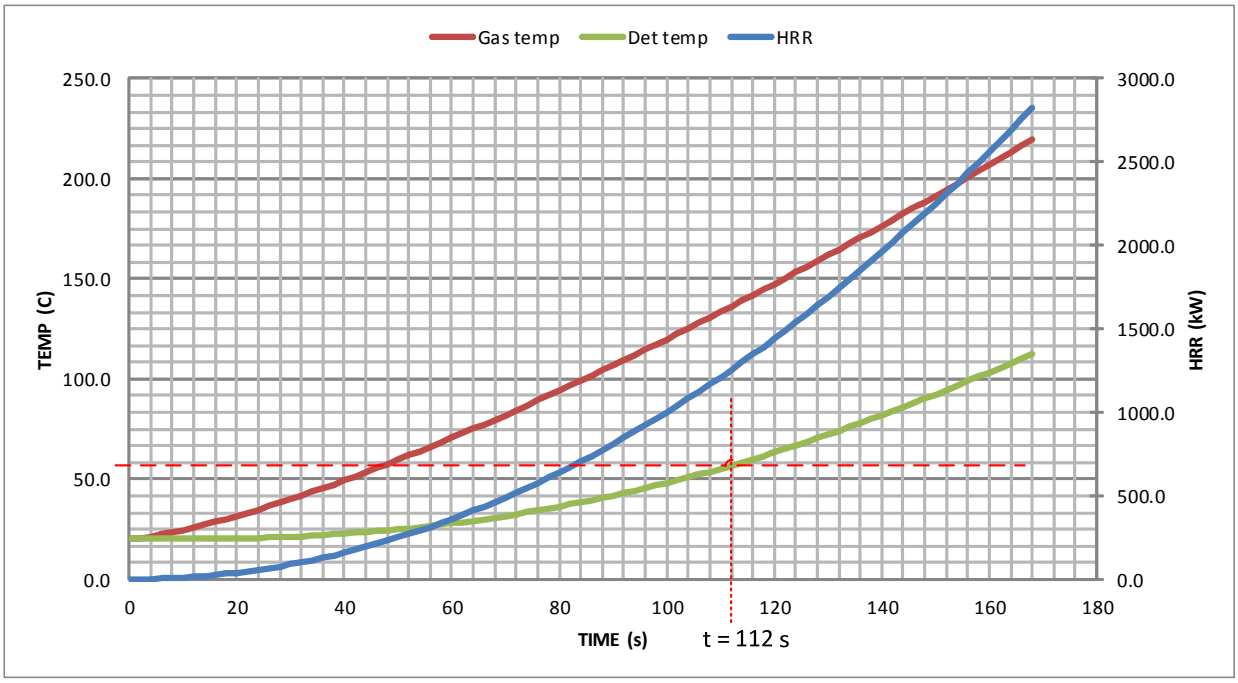

Figure 66: Output from the DETACT model indicating sprinkler head activation at approximately 112 s.

FDS Model – Sprinkler Response

Two sprinkler devices were added to the FDS Model to estimate the activation time. When modeling a fire there is always some uncertainty as to the location of the fire relative to detection devices. With this in mind, one sprinkler was placed directly above the fire. A second sprinkler was positioned a radial distance of 3 m from the center of the hot gas plume.

The results shown in Figure 67 show that a sprinkler would be activate between 80 and 150 seconds post ignition.

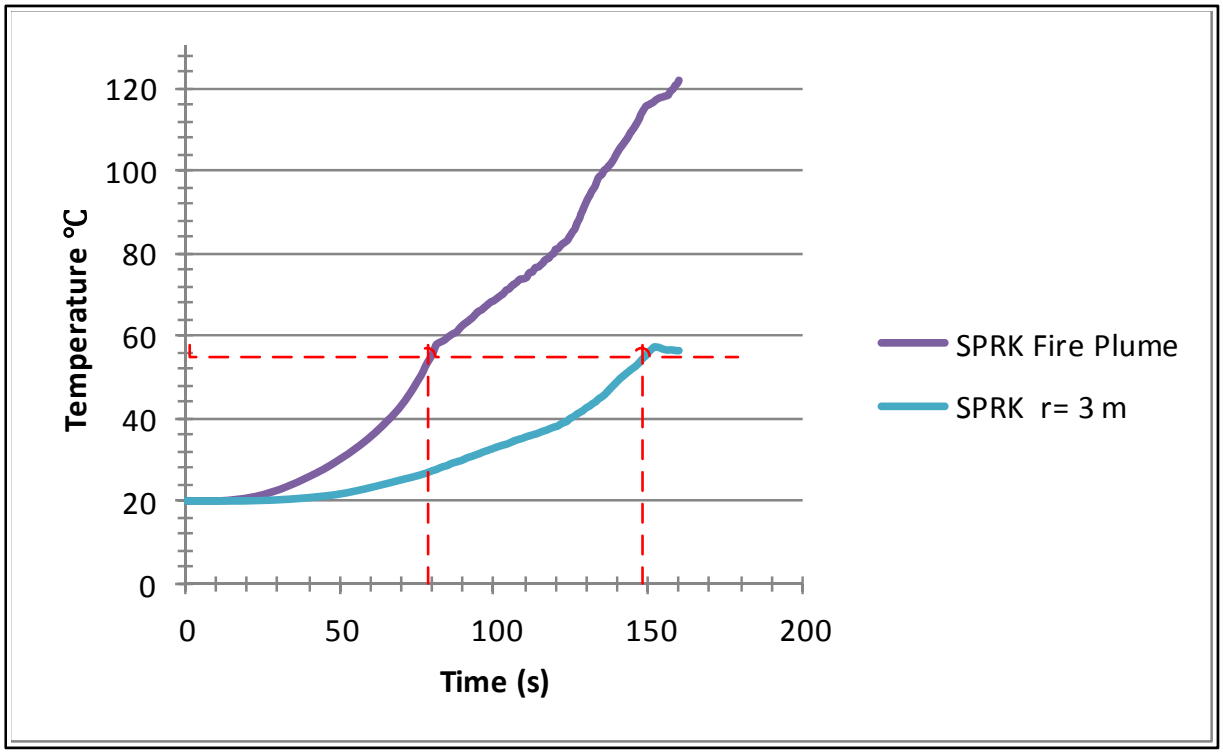

Figure 67: Sprinkler element temperature during the fire growth phase (Tact = 57 °C)

7.3.5 *Smoke Detector Response*

The smoke detector response is evaluated using the Optical Density vs. Temperature Model presented in NFPA 72. Equations 10 and 11 are used to confirm that the gas temperature and velocity were sufficient to activate the smoke detector (Alpert).

The temperature above ambient needed to activate the smoke detector for a light scattering smoke detector was estimated to be 21.1 °C (NFPA 72 - Table B.4.7.5.3).

Ceiling Jet Temperature

For r/H > 0.18

The temperature of the ceiling jet is Ta + ΔT and can be estimated from:

$$\Delta T = \frac{5.38\left(\frac{Q}{r}\right)^{2/3}}{H} \qquad \text{Equation 10}$$

$$\Delta T = \frac{5.38\left(\frac{1960\ kW}{6.1\ m}\right)^{2/3}}{2.44\ m}$$

$$\Delta T = 103.4\ ℃$$

$$T = 103.4 + 20 = 123.4\ ℃$$

Ceiling Jet Velocity

For r/H > 0.15

The ceiling jet velocity (U) is calculated from:

$$U = \frac{0.195\ Q^{\frac{1}{3}}\ H^{\frac{1}{2}}}{\left(\frac{r}{H}\right)^{5/6}} \qquad Equation\ 11$$

$$U = \frac{0.195(1960\ kW\ )^{\frac{1}{3}}\ 2.44^{\frac{1}{2}}}{\left(\frac{6.1}{2.44}\right)^{5/6}}$$

$$U = 1.77\ m/s$$

The ceiling jet velocity at r = 6.1 m exceeds the critical value (0.15 m/s) therefore activation of the device may occur. A temperature rise of 103 °C at r = 6.1 m is sufficient to activate the Smoke Detector.

DETACT Model – Smoke Detector Response

The DETACT Model was run is estimate the smoke detector activation time. The DETACT Model inputs are summarized in Table 35. Based on the output of the DETACT Model, the smoke detector would activate at about 120 seconds after the start of the fire as shown in Figure 68.

INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	2.44	m	R/H	2.500
Radial distance (R)	6.1	m	dT(cj)/dT(pl)	0.163
Ambient temperature (To)	20	C	u(cj)/u(pl)	0.093
Actuation temperature (Td)	41.1	C	Rep. t2 coeff.	k
Response time index (RTI)	2	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.094	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

Table 35: DETACT model input parameters for smoke detector response evaluation

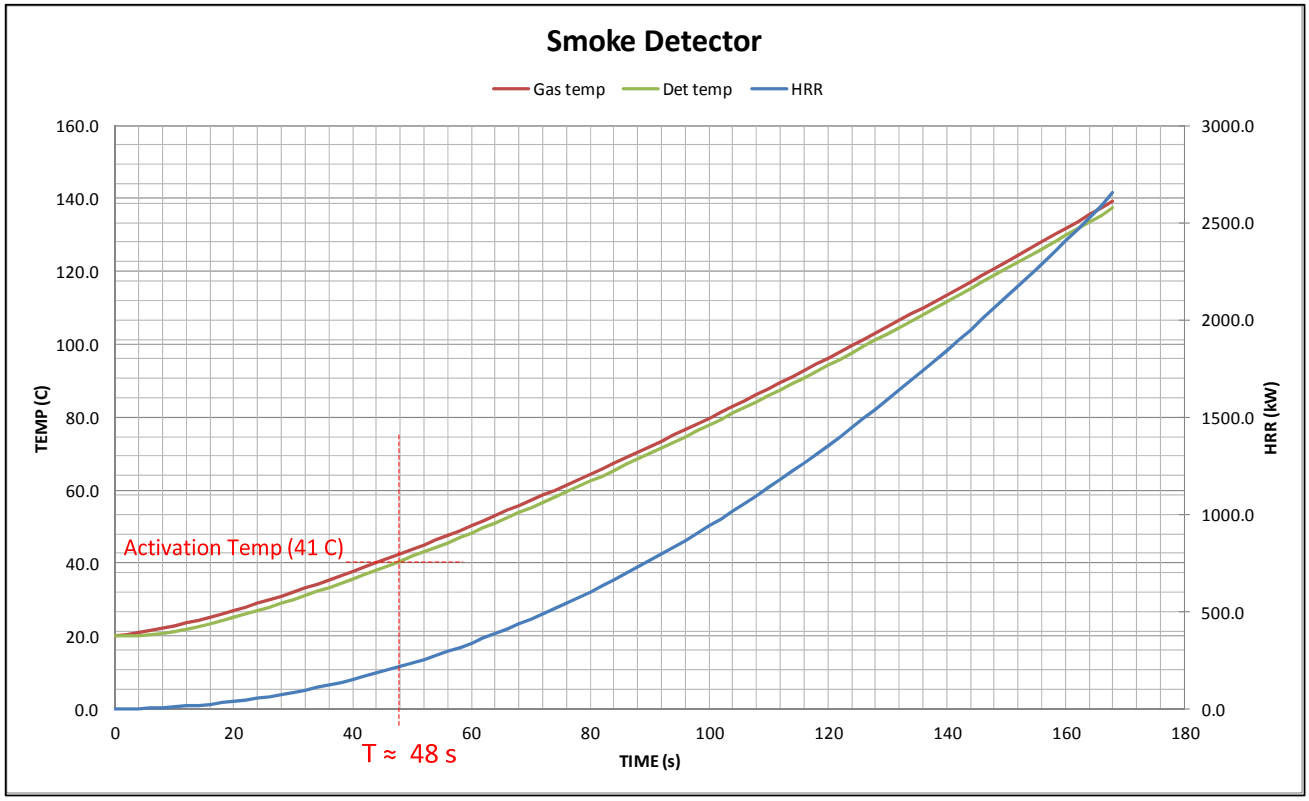

Figure 68: DETACT model output for the smoke detector response evaluation

7.3.6 *Discussion of the Chair Fire Scenario*

Untenable smoke conditions were found to develop before alarm activation via a smoke detector or sprinkler head as shown in Figure 69. The chair fire was found to produce untenable smoke conditions in the vicinity of the west exit door after approximately 40 seconds. A smoke detector located a radial distance of 6 m from the center of the hot gas plume would activate after about 48 seconds while a sprinkler at r = 3 m would activate between 110 (DETACT) and 150 (FDS) seconds.

It has been previously shown that that the delay component of the total evacuation time would be approximately one minute; see Section 4.4.5. A one minute delay could result in some building occupants being trapped in the extreme west end of the third floor.

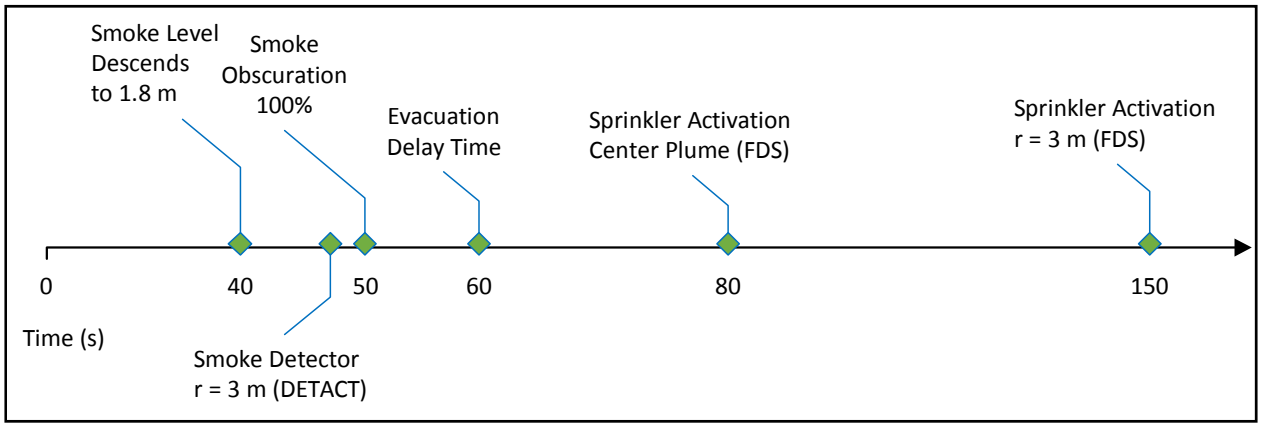

Figure 69: Time line for the chair fire to development of untenable conditions and activation of the fire detection system

It can be concluded that:

1. The HRR of the chair fire may be insufficient to activate detection systems before untenable smoke conditions develop in the egress path to the west, third floor stairway exit door.

2. The ASET is less than the RSET and occupants may not be able to safely evacuate from the building

It is recommended that the hazards associated with the use of electric space heaters are reinforced with the building occupants.

8.0 Conclusion and Recommendations

8.1 Prescriptive Analysis

It was confirmed that the building is equipped with a modern FAS, code compliant, UL listed detection devices and notification appliances. The single stage FAS is augmented by a Remote Supervising Station. Notification appliances include audible and visual alarms which have proven effective in building response exercises.

The building egress elements were found to be designed and installed in compliance with the Life Safety Code. However, it was found that the building occupants have installed items which have eroded the building life safety features. Corridor width has been reduced to less than that required by the LSC by the installation of shelving and other items. In addition, combustible materials are being stored in the east exit stairway enclosure which may present a hazard to building occupants.

The building water supply was found to meet the design demand. The building owner has implemented effective programs for ongoing inspection, testing and maintenance the water-based fire protection system. Furthermore, processes are in place to track fire protection system impairment and ensure the system is returned to a fully operational status in a timely manner.

The occupancy classification of the project building was found to be Group B (Business) which requires Type II-A construction. It was confirmed that the building meets the International Building Code requirements for Type II-A construction.

8.2 Performance Based Analysis

The performance of the building Fire and Life Safety Systems when challenged by a design fire was assessed. The objective was to confirm that occupants could exit the building before they are exposed to untenable environmental conditions.

Two credible fire scenarios are evaluated; a trash bag fire in the east exit stairway enclosure and a chair fire located in the third floor, open-office area. The design fires are believed to be realistic with respect to their initial location, fire growth rate and smoke generation.

For the trash bag fire, it was concluded that the building water-based fire protection and fire detection and alarm systems work effectively when challenged. The Available Safe Egress Time (ASET) was found to be greater than the Required Safe Egress Time (RSET) and occupants could be expected to safely evacuate from the building.

In contrast, it was found that the heat release rate from the chair fire may be insufficient to activate detection systems before untenable smoke conditions develop. The ASET was found to be less than the RSET and occupants may not be able to safely evacuate from the building. The chair fire was proposed to be ignited by the unauthorized use of an electric space heater.

8.3 Recommendations

The following recommendations are made to ensure the building life safety systems are maintained and occupants can safety exit the building in the event of a fire.

1. Continue to support the fire detection and water-based fire protection system through an ongoing ITM program executed by certified technicians.

2. Implement a third-party audit program to provide assurance that the fire detection and water-based fire protection system ITM program continues to meet NFPA requirements.

3. Remove items such as shelving from the second and third floor corridors. These items were not in the building initial design and have reduced the corridor width to less than that required by the LSC.

4. Remove combustible janitorial supplies from the east exit stairway enclosure. These items present a hazard to building occupants should a fire occur.

5. Review the building policy which prohibits the use of portable, electric space heaters at the next company safety meeting. A discussion to the NFPA statistics on the high number of fires linked to the use of space heaters may help to improve compliance.

9.0 References

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Tadahisa, J Studies on Human Behavior and Tenability in Fire Smoke; Presented at the Fire Safety Science – Proceedings of the 5th International Symposium (1997)

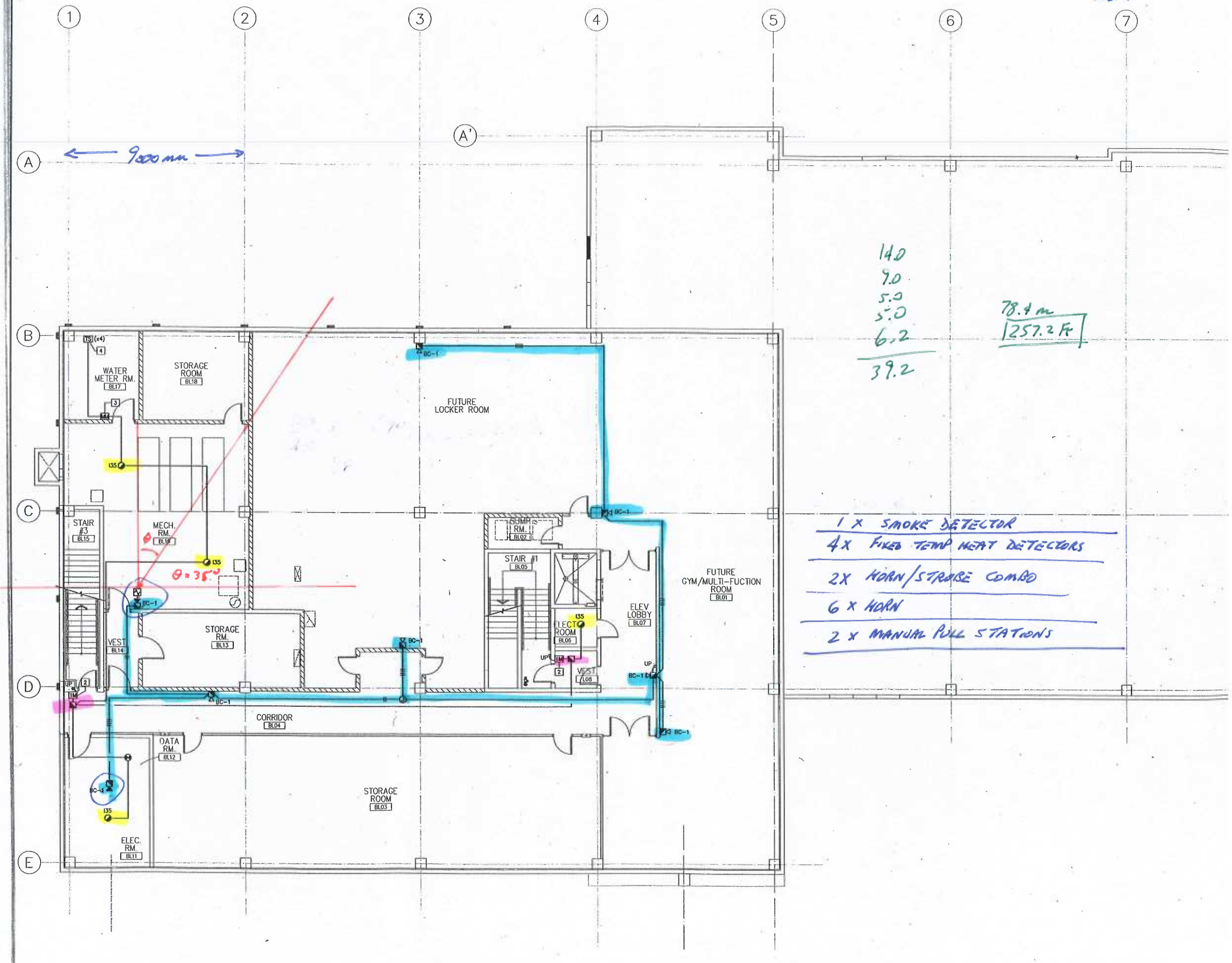
Appendix 1

Engineering Drawings

FDAS Analysis

BASEMENT.

WEST



14.0
9.0
5.0
5.0
6.2
39.2

78.4 m
257.2 Ft

1 x SMOKE DETECTOR
4x FIXED TEMP HEAT DETECTORS
2X HORN/STROBE COMBO
6 X HORN
2 x MANUAL PULL STATIONS

A/S = B

1 2 3 4 5 6 7 8 9 A'

9000 mm

9144 mm = 30ft

SMOKE DETECTOR

SPACING
SMOKE DETECTOR
11400 mm
37.4ft

ATRIUM 104

OPEN TO ABOVE

HC CR HC

HC CR

HC

CAFETERIA/ LUNCH ROOM 117

SERVERY

STORAGE ROOM 116

CORRIDOR 118

JAN ROOM 111

STAIR 105

ELEV. CAB

ELEVATOR LOBBY 107

ELEC ROOM 106

SECURITY POINT 103

SECURITY BUILDING CONTROL 134

RECEPTION DESK 102

STAIRS 115

VEST 114

CONFERENCE ROOM 113

MEN'S WASHROOM 110

WOMEN'S WASHROOM 109

CONFERENCE ROOM 119

TRAINING ROOM 120

MEN'S WASHROOM 121

WOMEN'S WASHROOM 123

JAN ROOM 122

PREFUNCTION ROOM 112

INTERPRETIVE ROOM 108

ENTRY LOBBY 101

OPEN TO ABOVE

VEST 100

FA LOOP A RETURN RUN TO MFAP

MAIN FIRE ALARM PANEL (MFAP) C/W 53mm CONDUIT TO MAIN TELPHONE BOARD CIRCUIT

BC-2 BC-3 CR UP DN IM

GRAND FLOOR WEST

1.8
2.4
7.3
7.8
3.2
5.0
2.0
10.3
5.4
2.3
47.6

H/S = 11

95.0 m
311.7 ft

GRAND FLOOR EAST

18.4
24.3
25.0
9.0
8.6
9.7
5.8
100.8

201.6 m = 661.4 ft

H/S = 14

1 E4-1 MAIN FLOOR PLAN – FIRE ALARM
SCALE: 1:100

GROUND FLOOR EAST

Notes:
Verify all dimensions, elevations, and datum; report any errors and/ or discrepancies to the architect prior to construction.

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Do not scale Drawings.

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9000 mm

9144 mm = 30Ft

SMOKE DETECTOR

SPACING
SMOKE DETECTOR
11400 mm
37.4ft

ATRIUM 104
OPEN TO ABOVE
CONFERENCE ROOM 119
TRAINING ROOM 120
MEN'S WASHROOM 121
WOMEN'S WASHROOM 123
JANI ROOM 122
DATA ROOM 125
ELEC ROOM 126
SITAR #2 124
ELEV CAB
ELEV LOBBY 127
FUTURE WELL FILING ROOM 128
FUTURE SCADA SERVER 129
FUTURE IT EPARTMENT 130
SECURITY BUILDING CONTROL 134
SECURITY POINT 103
ELEVATOR LOBBY 107
ELEC ROOM 106
RECEPTION DESK 102
CORR 133
FURNITURE STORAGE 132
RECEIVING ROOM 131
ENTRY LOBBY 101
OPEN TO ABOVE
VEST. 100
MAIN FIRE ALARM PANEL (MFAP) C/W 10mm CONDUIT TO MAIN TELPHONE BOARD CIRCUIT
BC-3
BC-2
CR
HC
HC CR
UP

GRND FLOOR WEST

1.8
2.4
7.3
7,8
3,2
5.0
2.0
10.3
5.4
2.3
47.6

H/S = 11

95.0 M
311.7 Ft

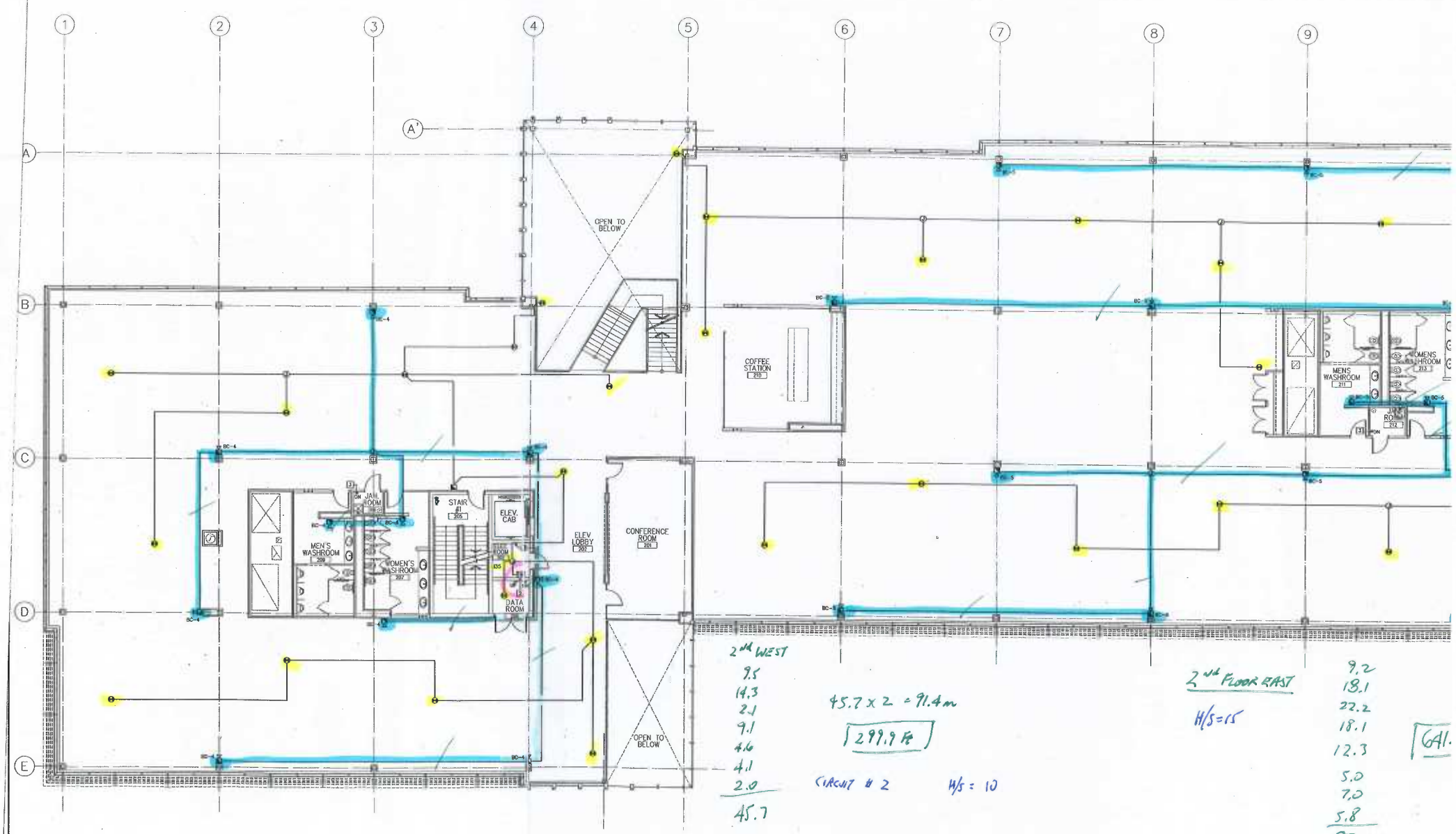
GRND FLOOR EAST

18.4
24.3
25,0
9.0
8.6
9.7
5.8
100.8

201.6m = 661.4 Ft

H/S = 14

11 12 13



1 2ND FLOOR PLAN – FIRE ALARM

2nd WEST

9.5
14.3
2.1
9.1
4.6
4.1
2.0

45.7

45.7 x 2 = 91.4 m

299.9 ft

CIRCUIT # 2

H/S = 10

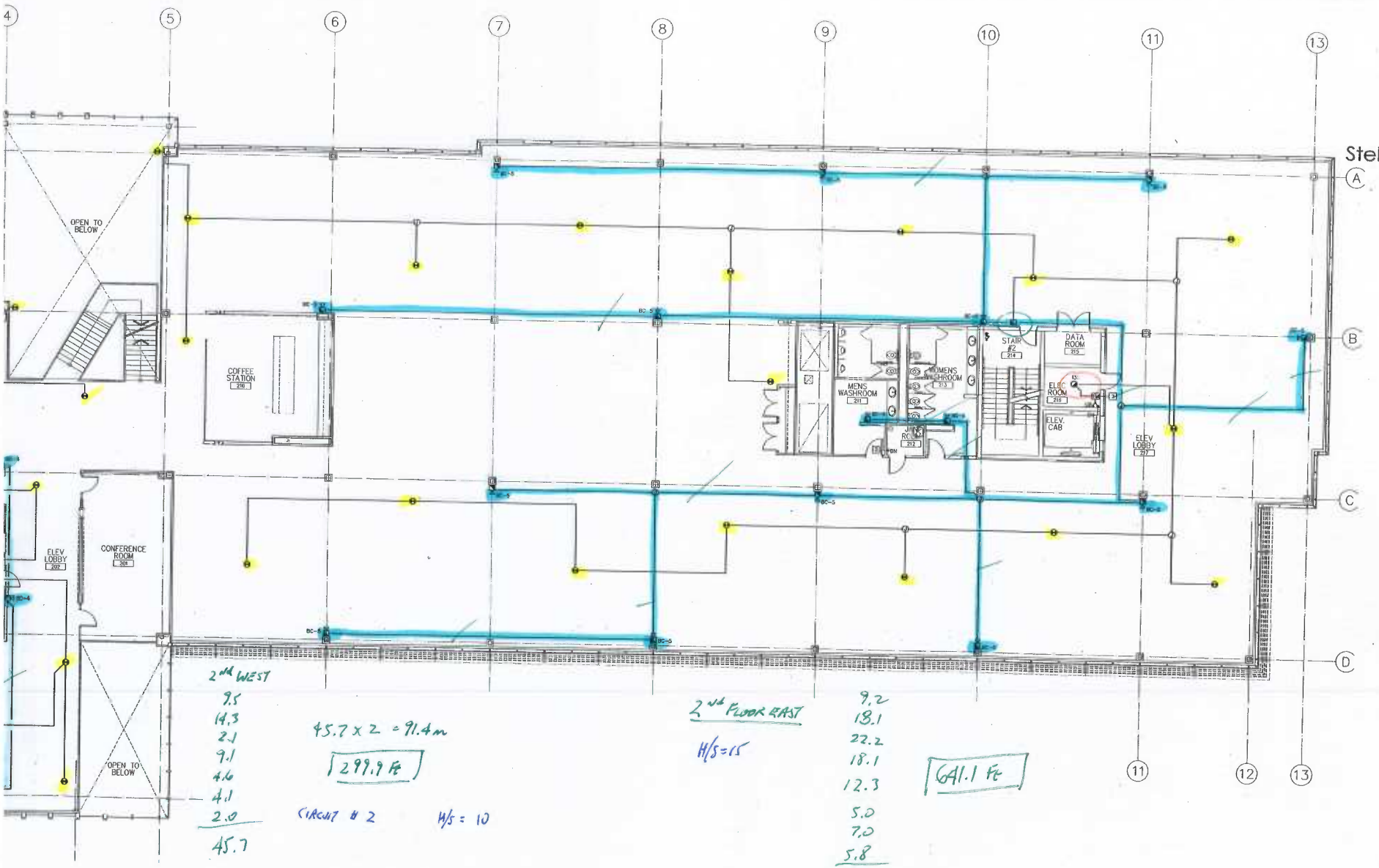
2nd FLOOR EAST

H/S = 15

9.2
18.1
22.2
18.1
12.3
5.0
7.0
5.8

97.7

GAL.



2nd WEST

9.5
14.3
2.1
9.1
4.6
4.1
2.0

45.7

45.7 x 2 = 91.4m

299.9 Ft

CIRCUIT # 2

H/S = 10

2nd FLOOR EAST

H/S = 15

9.2
18.1
22.2
18.1
12.3
5.0
7.0
5.8

97.7

641.1 Ft

2nd FLOOR EAST

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OPEN TO BELOW

ATRIUM 304

COFFEE STATION 310

MEN'S WASHROOM 309

WOMEN'S WASHROOM 307

JAN ROOM 308

STAIR #1 305

ELEV CAB

ELEC ROOM 303

DATA ROOM 306

ELEV LOBBY 302

CONFERENCE ROOM 301

MENS WASHROOM 311

JANITOR ROOM 312

BC-6

BC-7

9.6

4.5

θ=35°

Boom

$d_0 = 10$ ft

$d_1 = 8$ m = (26.2 ft) "OPEN OFFICE"

$dB_1 = dB_0 + 20 \log\left(\frac{d_0}{d_1}\right)$

$dB_1 = 101 + 20 \log\left(\frac{10}{26}\right) = 92.7$

WEST H/S ONLY

4.5
9.6
4.3
9.0
9.0

36.4 x 2 = 72.8 m

238.8 Ft

VISUAL APPLIANCE

4500 mm

1 3RD FLOOR PLAN – FIRE ALARM

3RD FLOOR

Notes:
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OPEN TO BELOW

ATRIUM 304

COFFEE STATION 310

MENS WASHROOM 311

WOMENS WASHROOM 313

AUX ROOM 312

STAIR #2

DATA ROOM 315

ELEC ROOM 316

ELEV. CAB

ELEV LOBBY 317

ELEV LOBBY 302

CONFERENCE ROOM 301

BC-7 BC-6 BC-5 DN IM

$\theta = 35°$

Boom

$d_0 = 10$ ft

$d_1 = 8$ m $= (26.2$ ft$)$ "OPEN OFFICE"

$dB_1 = dB_0 + 20 \log\left(\frac{d_2}{d_1}\right)$

$dB_1 = 101 + 20 \log\left(\frac{10}{26}\right) = 92.7$

WEST H/S ONLY

4.5
9.6
4.3
9.0
9.0

36.4 x 2 = 72.8 m

238.8 Ft

VISUAL APPLIANCE

4500 mm

4500 mm

N/S EAST

18.2
22.2
2.8
4.9
18.0
9
6.5
5.0
2.0

88.6

88.6 x 2 = 177.2 m

581.4 Ft

PENTHOUSE

Notes:
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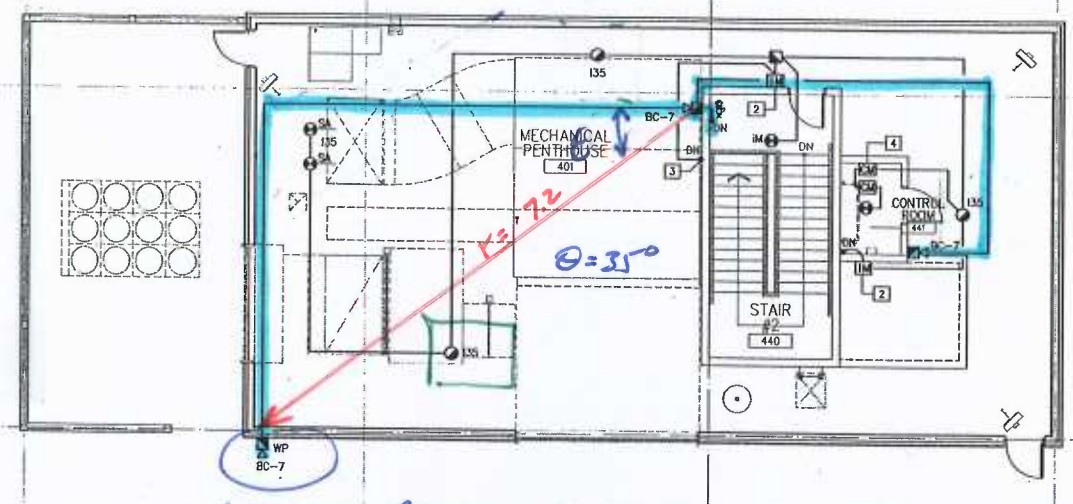
2 3 4 5 8 9 10 11 13

A' A B C D

9000 mm

EAST

SEE NOTES ON PENTHOUSE WEST



WEATHER PROOF

9.5
4.5
2.5
16.5
108.3 Ft

EAST 24.4 x 2 = 48.8 m
160.1 Ft

FIXED TEMP
57°C 135°F

PENTHOUSE MECHANICAL

85 AMBIENT SOUND FOR MECH

9000 mm
4.55

7.2 x 9000/4.55 = 14400 mm
47.2 Ft

$dB_1 = dB_0 + 20 \log\left(\frac{d_0}{d_1}\right)$

Device Rating =
θ = 35°
From Device Spec Table 5
-6 dB at 42°
d_0 = 10 Ft
dB_0 = 101.4

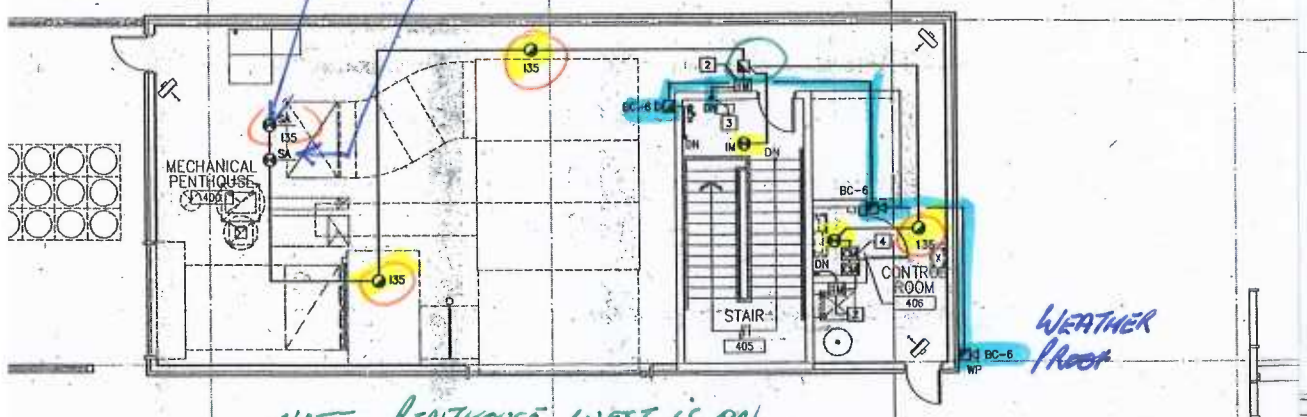
$dB_1 = 101.4dB + 20 \log\left(\frac{10}{47.2}\right)$
dB_1 = 87.9
adjusted For θ = 42°
$dB_1' = 88 - 6 = 82$

CIRCUIT #3	Ft	H/S	H/S WP
PENTHOUSE EAST	160.1	2	1
3RD FLOOR EAST	581.4	15	0
TOTAL	741.5	17	1

WEST

FIXED TEMP HEAT DETECTOR ON SUPPLY AIR

DUCT SMOKE DETECTOR ON SUPPLY AIR (SA)



WEATHER PROOF

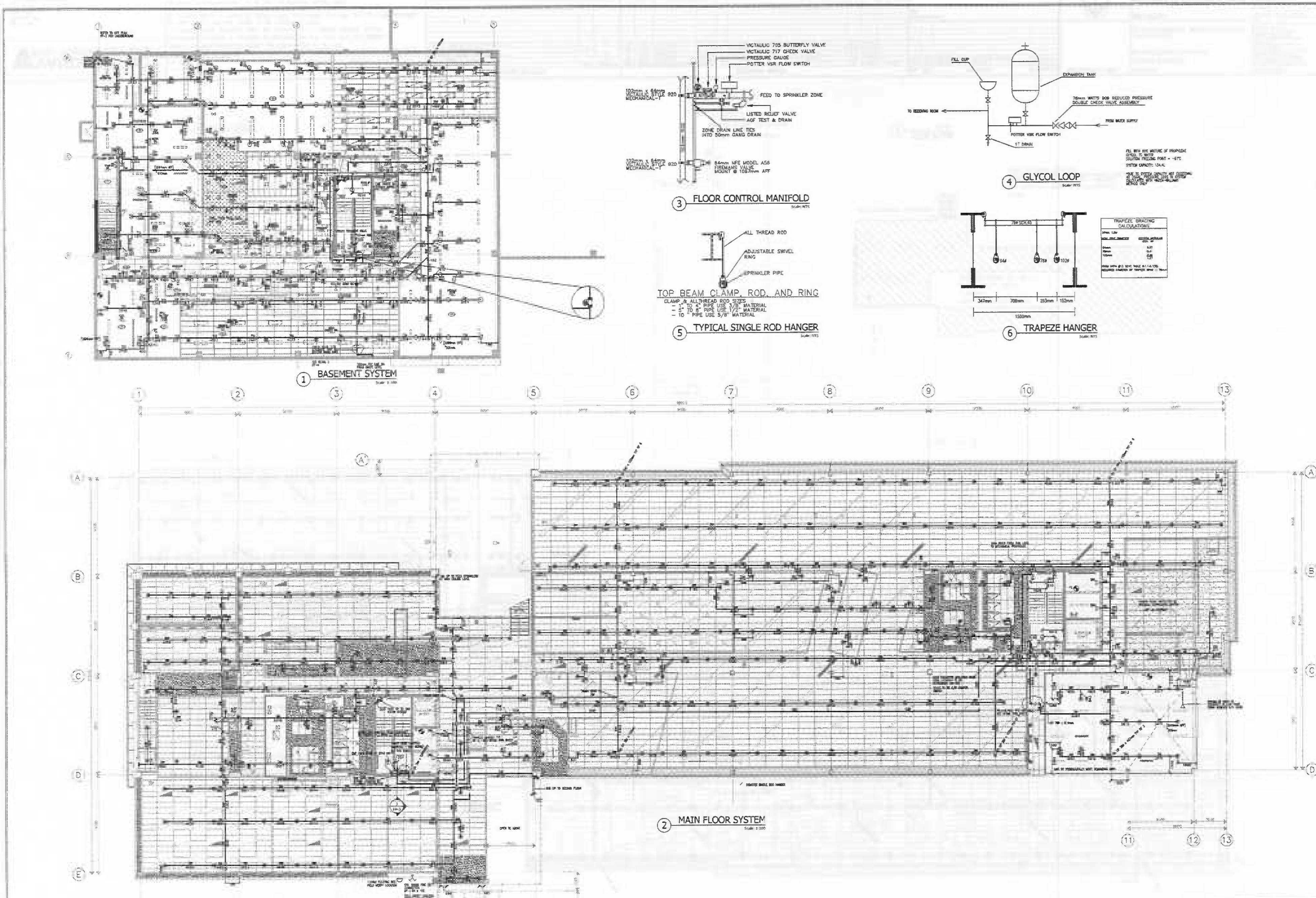
NOTE PENTHOUSE WEST IS ON SAME H/S CIRCUIT AS 3RD FLOOR WEST. (SAME ON EAST)

47.2 Ft

CIRCUIT #4

		H/S	H/S WP	
PENTHOUSE WEST	47.2 Ft	2	1	2.7
3RD FLOOR WEST	238.8 Ft	8	0	4.5
	286.0 Ft.	10	1	7.2

R PLAN – FIRE ALARM



VANDERSTELT FIRE PROTECTION LTD.

BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME.
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH.40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 DOMESTIC BLACK STEEL

REQUIRED SERVICES

	[illegible]	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE EXTINGUISHERS	X	
[illegible]		X

SPRINKLER LEGEND

SYM.	TEMP.	MANUFACTURER	MODEL	#	DESCRIPTION	K	ORIF.	S.I.N.
	155°	VICTAULIC	V-2703	45	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	286°	VICTAULIC	V-2703	23	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	155°	VICTAULIC	V-3401	13	LARGE ORIFICE BRASS UPRIGHT	8.0	19mm	
	155°	[illegible]	V-2706	278	[illegible]	5.6	12mm	
	155°	VICTAULIC	V-2706	3	STANDARD [illegible] SIDEWALL	5.6	12mm	
	200°	VIC[illegible]	V-27[illegible]	1	[illegible]	5.6	12mm	
	286°	VIC[illegible]	V-27[illegible]	4	STANDARD [illegible] CHROME SIDEWALL	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: [illegible]
TOTAL SPRINKLERS THIS PROJECT: [illegible]

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	22 SEPT 10
01	SF	[illegible]	21 APR 11

CONTRACTED BY: BOTTING ASSOCIATES, LTD.

PROFESSIONAL SEAL

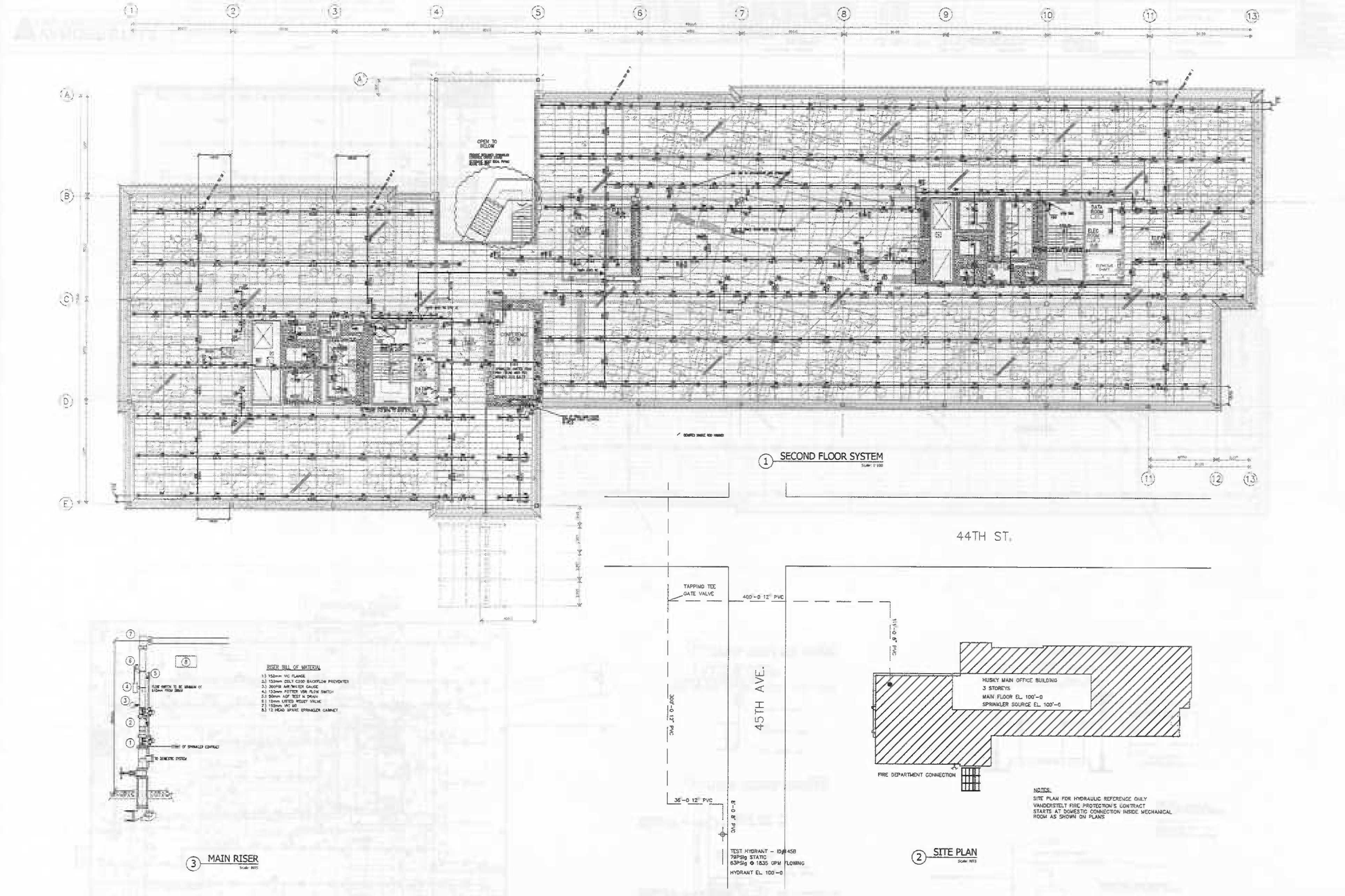
PROJECT NORTH

PROJECT: HUSKY ENERGY
MAIN OFFICE BUILDING
4429-44th ST
LLOYDMINSTER, SASKATCHEWAN

DESCRIPTION: BASEMENT SPRINKLER PLAN
MAIN FLOOR SPRINKLER PLAN

DISCLAIMER

DRAWN BY: SF
DATE: 05 AUG 2010
JOB #: 1116
DWG #: FP-1
SCALE: AS NOTED
SHEET No: 1 OF 4



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3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH. 40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 BLACK STEEL

REQUIRED SERVICES

	VFP	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE EXTINGUISHERS	X	
PIPING ENCLOSURES/BULKHEADS		X

SPRINKLER LEGEND

SYM.	TEMP.	MANUFACTURER	MODEL	#	DESCRIPTION	K	ORIF.	S.I.N
	155°	VICTAULIC	V-2708	205	QUICK RESPONSE CHROME PENDANT	5.6	12mm	
	155°	VICTAULIC	V-2703	1	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	286°	VICTAULIC	V-2703	2	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	[illegible]	VICTAULIC	V-2708	2	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 210
TOTAL SPRINKLERS THIS PROJECT: [illegible]

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	22.SEPT.10
01	SF	REVISED FOR INTERIOR FIT-UP	[illegible]

CONTRACTED BY: BOTTING & ASSOCIATES, LTD.

PROFESSIONAL SEAL: [redacted]

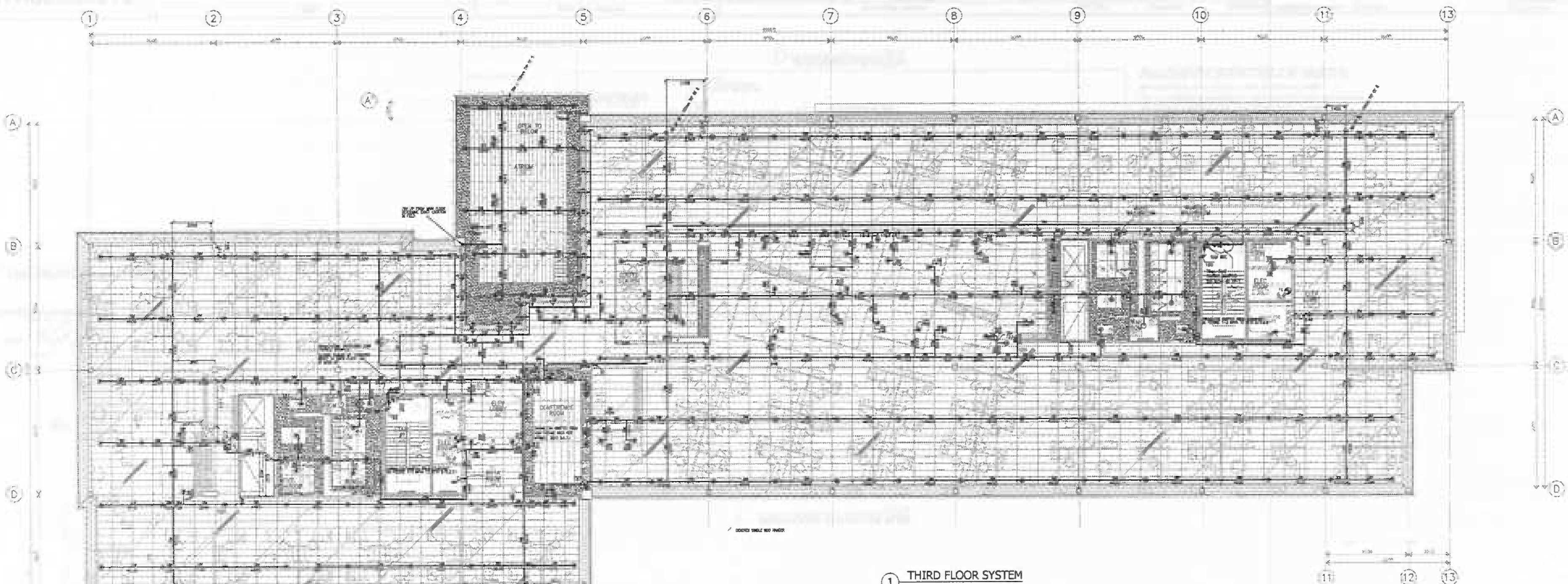
PROJECT: [redacted]
MAIN OFFICE BUILDING
4429-44th ST
LLOYDMINSTER, SASKATCHEWAN

PROJECT NORTH

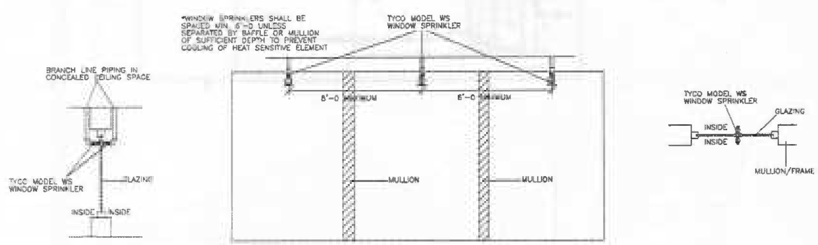
DESCRIPTION: SECOND FLOOR SPRINKLER PLAN

DISCLAIMER [illegible]

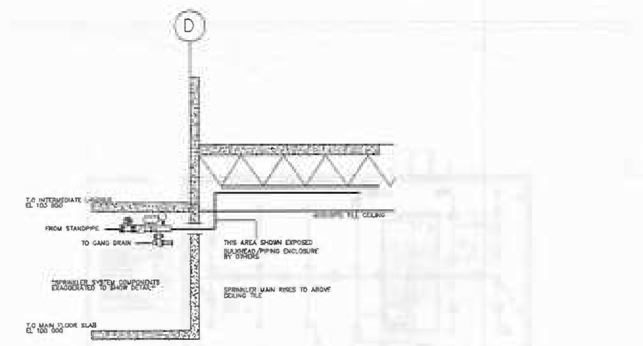
DRAWN BY: SF
DATE: 25 AUG 2010
JOB #: 1116
DWG #: FP-2
SCALE: AS NOTED
SHEET No: 2 OF 4



1 THIRD FLOOR SYSTEM



2 GLAZING PROTECTION



3 SECTION AT MAIN FLOOR WEST STAIR CORE

VANDERSTELT FIRE PROTECTION LTD.

BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH. 40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 BLACK STEEL

REQUIRED SERVICES

SPRINKLER LEGEND

SYM.	TEMP.	MANUFACTURER	MODEL	#	DESCRIPTION	K	ORIF.	S.I.N.
[illegible]	[illegible]	VICTAULIC	V-27[illegible]	214	[illegible] PENDANT	5.6	[illegible]	
[illegible]	[illegible]	VICTAULIC	V-2703	2	STANDARD RESPONSE BRASS UPRIGHT	5.6	[illegible]	
[illegible]	[illegible]	VICTAULIC	V-2703	2	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
[illegible]	[illegible]	[illegible]	V-2709	2	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	
[illegible]	[illegible]	[illegible]	V-2709	2	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	
[illegible]	[illegible]	[illegible]	WS	42	WINDOW SPRINKLER	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 266
TOTAL SPRINKLERS THIS PROJECT: 266

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	22.SEPT.10

CONTRACTED BY: BOTTING ASSOCIATES, LTD.

PROFESSIONAL SEAL

PROJECT NORTH

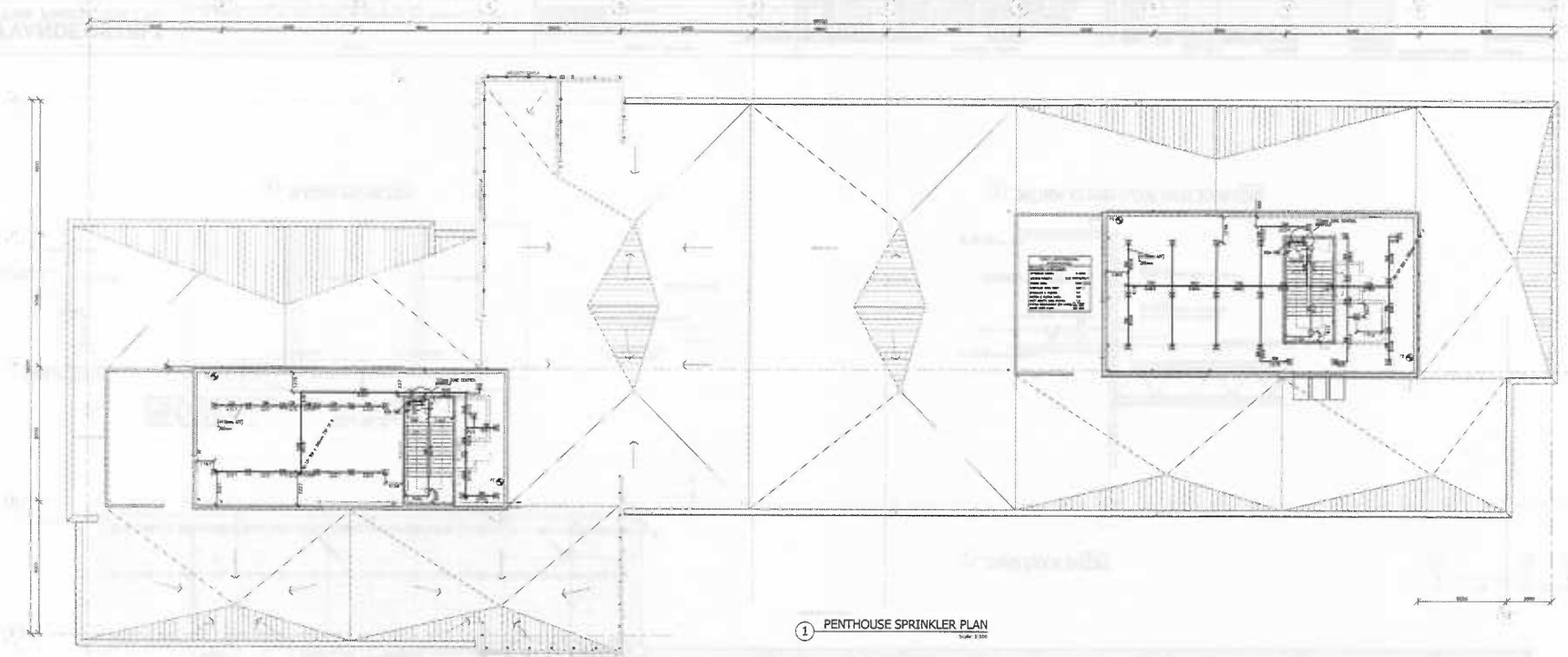
PROJECT: HUSKY ENERGY
MAIN OFFICE BUILDING

4429-44th ST
LLOYDMINSTER, SASKATCHEWAN

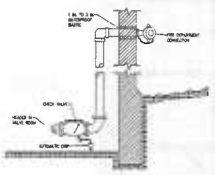
DESCRIPTION: THIRD FLOOR SPRINKLER PLAN

DISCLAIMER

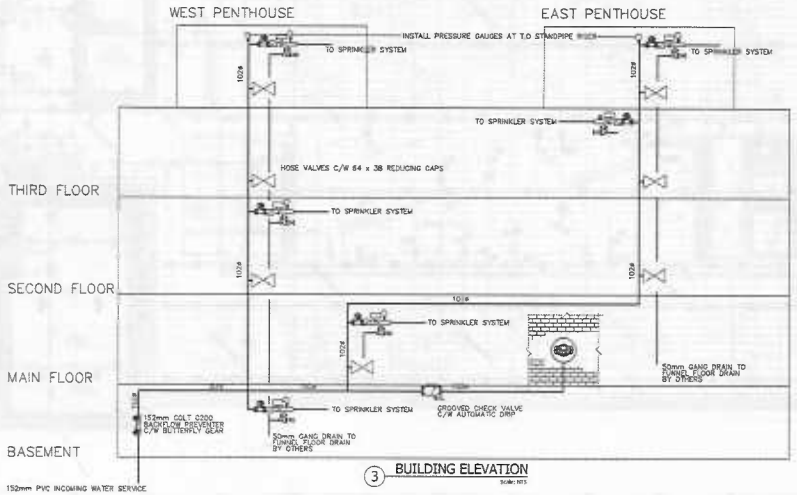
DRAWN BY: SF
25 AUG 2010
1116
AS NOTED



1 PENTHOUSE SPRINKLER PLAN



2 FIRE DEPARTMENT CONNECTION



3 BUILDING ELEVATION

STANDPIPE GENERAL NOTES:

STANDPIPES TO BE LOCATED IN STAIRWELLS AS SHOWN ON PLANS

HOSE VALVES TO BE 2 1/2" CLASS 1 THREADS OF TYPE TO SUIT LOCAL FIRE DEPARTMENT REQUIREMENTS

TEST LOCATION TO BE 2 1/2" HOSE VALVE LOCATED IN MECHANICAL PENTHOUSES

ALL STANDPIPE MAINS AND LINES TO BE DOMESTIC BLACK SCHEDULE 40

MAIN FIRE DEPARTMENT CONNECTION TO SERVE SPRINKLER SYSTEM AND STANDPIPE

ISOLATION VALVES TO BE LOCATED AT BASE OF STANDPIPE RISERS

STANDPIPE CLASSIFIED AS "MANUAL WET" THEREFORE NOT REQUIRED TO MEET NFPA 14 2007 500 GPM @ 100 PSIg STIPULATION, AS PER 2005 EDITION NBC

VANDERSTELT FIRE PROTECTION LTD.

BOX 130
VONDA, SK
S0K 4N0
PH. (306) 258-2290
FAX. (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUATE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH.40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH 40 DOMESTIC BLACK STEEL

REQUIRED SERVICES

	FYP	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE ALARM SYSTEM	X	
[illegible]		

SPRINKLER LEGEND

#	TEMP.	MANUFACTURER	MODEL #	DESCRIPTION	K	ORIF.	SIZE
30	155	VIKING	VK-2283	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
30	286	VIKING	VK-2293	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	

TOTAL SPRINKLERS FOR THIS SHEET: 60
TOTAL SPRINKLERS FOR PROJECT: 888

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	12 SEPT 10
01	SF	REVISED FOR INTERIOR FINISH	29 APR 11

PROFESSIONAL SEAL:

CONTRACTED BY:
ROTTING ASSOCIATES, LTD.

PROJECT NORTH

PROJECT:
HUSKY ENERGY
MAIN OFFICE BUILDING

4429-44th ST
LLOYDMINSTER, SASKATCHEWAN

DESCRIPTION:
PENTHOUSE SPRINKLER PLAN

DISCLAIMER
[boilerplate]

DRAWN BY: SF
CHECKED BY:
DATE: 25 AUG 2010
SCALE:
DWG # FP-4
REVISED: 31 JAN 11

Appendix 2

Fire Alarm Control Panel and Remote Enunciator

Technical Specifications

http://www.cietexas.com/wp-content/uploads/2013/11/Quickstart.pdf

Appendix 3

Number and Type of Sprinklers

Location	Temperature (F)	Manufacturer	Model	Number	Description
Main Floor and Basement	155	Victaulic	2703	45	Standard Response, Brass Upright
Main Floor and Basement	286	Victaulic	2703	23	Standard Response, Brass Upright
Main Floor and Basement	155	Victaulic	3401	13	Large Orifice, Brass Upright
Main Floor and Basement	155	Victaulic	2708	279	Quick Response, Chrome Pendant
Main Floor and Basement	155	Victaulic	2709	3	Standard Response, Chrome Sidewall
Main Floor and Basement	200	Victaulic	2709	1	Standard Response, Chrome Sidewall
Main Floor and Basement	286	Victaulic	2709	4	Standard Response, Chrome Sidewall
Second Floor	155	Victaulic	2708	205	Quick Response, Chrome Pendant
Second Floor	155	Victaulic	2703	1	Standard Response, Brass Upright
Second Floor	286	Victaulic	2703	2	Standard Response, Brass Upright
Second Floor	286	Victaulic	2709	2	Standard Response, Chrome Sidewall
Third Floor	155	Victaulic	2708	216	Quick Response, Chrome Pendant
Third Floor	155	Victaulic	2703	2	Standard Response, Brass Upright
Third Floor	286	Victaulic	2703	2	Standard Response, Brass Upright
Third Floor	200	Victaulic	2709	2	Standard Response, Chrome Sidewall
Third Floor	286	Victaulic	2709	2	Standard Response, Chrome Sidewall
Third Floor	155	Tyco	WS	42	Window Sprinkler
Penthouse	155	Victaulic	2703	4	Standard Response, Brass Upright
Penthouse	286	Victaulic	2703	40	Standard Response, Brass Upright
			Total	**888**	

Appendix 4

Sprinkler - Tyco Model TY 3388/3488

Technical Specifications

https://www.tyco-fire.com/TD_TFP/TFP/TFP620_05_2014.pdf

Appendix 5

Photo Electric and Duct Smoke Detectors

Technical Specifications

http://haseenhabib.com/firealarm/images/Photoelectric%20Smoke%20Detector.pdf

http://www.edwardsutcfs.com/product/duct-housing-smoke-detectors

Appendix 6

Location of Smoke and Heat Detectors

Smoke Detectors n = 88

Zone	Location	Device	Address
Zone 1 – Ground Floor West	Lunch room	S	2004
Zone 1 – Ground Floor West	Pre Funcition Room	S	2017
Zone 1 – Ground Floor West	Entry Lobby	S	2018
Zone 1 – Ground Floor West	Lunch room East	S	2031
Zone 1 – Ground Floor West	Atrium	S	2045
Zone 1 – Ground Floor West	Pre Funcition Room West	S	2051
Zone 1 – Ground Floor West	Attrium on Wall	S	2055
Zone 1 – Ground Floor West	Elevator Lobby	S	2056
Zone 2 – Ground Floor East	POP Server Room	S	1006
Zone 2 – Ground Floor East	Data Room	S	1007
Zone 2 – Ground Floor East	N/E Office	S	1014
Zone 2 – Ground Floor East	S/E Office	S	1015
Zone 2 – Ground Floor East	S/E Office	S	1021
Zone 2 – Ground Floor East	N/E Office	S	1022
Zone 2 – Ground Floor East	N/E Office	S	1023
Zone 2 – Ground Floor East	S/E Office	S	1024
Zone 2 – Ground Floor East	N/E Office	S	1044
Zone 2 – Ground Floor East	Server Room	S	1046
Zone 2 – Ground Floor East	N/E Office	S	1054
Zone 2 – Ground Floor East	East Office	S	1056
Zone 2 – Ground Floor East	Electrical Room	S	1057
Zone 2 – Ground Floor East	N/E Office	S	1060
Zone 2 – Ground Floor East	S/E Office	S	1062
Zone 2 – Ground Floor East	Elevator Lobby	S	1064
Zone 3 – Second Floor West	N/W Office	S	2005
Zone 3 – Second Floor West	S/W Office	S	2006
Zone 3 – Second Floor West	N/W Office	S	2012
Zone 3 – Second Floor West	S/W Office	S	2013
Zone 3 – Second Floor West	S/W Office	S	2019
Zone 3 – Second Floor West	Atrium Stairs	S	2026
Zone 3 – Second Floor West	N/W Office	S	2032
Zone 3 – Second Floor West	N/W Office	S	2033
Zone 3 – Second Floor West	Data Room	S	2039
Zone 3 – Second Floor West	S/W Office	S	2040
Zone 3 – Second Floor West	S/W Office	S	2047
Zone 3 – Second Floor West	Elevator Lobby	S	2052
Zone 3 – Second Floor West	S/W Office	S	2053
Zone 4 – Second Floor East	S/E Office	S	1005
Zone 4 – Second Floor East	N/E Office	S	1011
Zone 4 – Second Floor East	Elevator Lobby	S	1019
Zone 4 – Second Floor East	N/E Office	S	1020
Zone 4 – Second Floor East	N/E Office	S	1029
Zone 4 – Second Floor East	N/E Office	S	1030
Zone 4 – Second Floor East	S/E Office	S	1031
Zone 4 – Second Floor East	S/E Office	S	1032
Zone 4 – Second Floor East	N/E Office	S	1038
Zone 4 – Second Floor East	N/E Office	S	1040
Zone 4 – Second Floor East	N/E Office	S	1042
Zone 4 – Second Floor East	N/E Office	S	1045
Zone 4 – Second Floor East	N/E Office	S	1048
Zone 4 – Second Floor East	S/E Office	S	1052
Zone 4 – Second Floor East	S/E Office	S	1053
Zone 4 – Second Floor East	S/E Office	S	1058
Zone 4 – Second Floor East	S/E Office	S	1063

Smoke Detectors n = 88

Zone	Location	Device	Address
Zone 5 – Third Floor West	N/W Office	S	2007
Zone 5 – Third Floor West	S/W Office	S	2014
Zone 5 – Third Floor West	N/W Office	S	2020
Zone 5 – Third Floor West	Elevator Lobby	S	2021
Zone 5 – Third Floor West	Data Room	S	2025
Zone 5 – Third Floor West	N/W Office	S	2027
Zone 5 – Third Floor West	S/W Office	S	2028
Zone 5 – Third Floor West	S/W Office	S	2034
Zone 5 – Third Floor West	S/W Office	S	2035
Zone 5 – Third Floor West	S/W Office	S	2042
Zone 5 – Third Floor West	Atrium Stairs	S	2048
Zone 6 – Third Floor East	N/E Office	S	1003
Zone 6 – Third Floor East	N/E Office	S	1004
Zone 6 – Third Floor East	S/E Office	S	1012
Zone 6 – Third Floor East	S/E Office	S	1013
Zone 6 – Third Floor East	N/E Office	S	1016
Zone 6 – Third Floor East	N/E Office	S	1027
Zone 6 – Third Floor East	S/E Office	S	1028
Zone 6 – Third Floor East	S/E Office	S	1034
Zone 6 – Third Floor East	N/E Office	S	1035
Zone 6 – Third Floor East	S/E Office	S	1036
Zone 6 – Third Floor East	N/E Office	S	1043
Zone 6 – Third Floor East	N/E Office	S	1047
Zone 6 – Third Floor East	S/E Office	S	1050
Zone 6 – Third Floor East	N/E Office	S	1051
Zone 6 – Third Floor East	S/E Office	S	1055
Zone 6 – Third Floor East	Elevator Lobby	S	1059
Zone 7 – Penthouse West	Elevator Mechanical Room	S	2046
Zone 8 – Penthouse East	Elevator Mechanical Room	S	1061
Zone 9 – West Basement Stairs	Tops of Stairwell	S	2011
Zone 10 – West Stairwell	Tops of Stairwell	S	2041
Zone 11 – East Stairwell	Tops of Stairwell	S	1037
Zone 12 – West Elevator	Elevator Shaft	S	2049
Zone 13 – East Elevator	Elevator Shaft	S	1025

Heat Detectors n = 15

Zone	Location	Device	Address
Zone 1 – Ground Floor West	Electrical Room	HT	2022
Zone 2 – Ground Floor East	Electrical Room	HT	1009
Zone 3 – Second Floor West	Electrical Room	HT	2010
Zone 4 – Second Floor East	Electrical Room	HT	1001
Zone 5 – Third Floor West	Electrical Room	HT	2003
Zone 6 – Third Floor East	Electrical Room	HT	1017
Zone 7 – Penthouse West	North	HT	2029
Zone 7 – Penthouse West	South East	HT	2001
Zone 7 – Penthouse West	South West	HT	2043
Zone 8 – Penthouse East	Center	HT	1026
Zone 8 – Penthouse East	South	HT	1033
Zone 8 – Penthouse East	South West	HT	1018
Zone 32 – West Basement	Electrical Room	HT	2002
Zone 32 – West Basement	Main Electrical Room	HT	2008
Zone 32 – West Basement	Mechanical Room North	HT	2036
Zone 32 – West Basement	Mechanical Room South	HT	2015

Appendix 7

Heat Detectors

Technical Specifications

http://www.pyramidtech.net/Intelligent%20Initiating%20Devices/85001-0243%20--%20Intelligent%20Heat%20Detectors.pdf

Appendix 8

Protective Services Agreement

Underwriters Laboratories

Corporate Headquarters
7 Underwriters Road
Toronto, ON M1R 3B4

Certificate Number
1131488 C

PROTECTIVE SIGNALLING SERVICE

This Certifies that the Alarm Company whose name appears below is Listed by Underwriters' Laboratories of Canada (ULC) and is authorized to install and monitor Protective Signalling Fire Alarm Systems in compliance with the requirements in CAN/ULC-S561 for Protective Signalling Systems.

The Alarm Company named on this certificate bears the responsibility for the correctness of the system installation, periodic testing, maintenance and repair as well as the keeping of records respecting these activities.

It is also the responsibility of the Alarm Company to confirm that the equipment used in this installation is ULC Labelled and is suitable for the application. All required service is provided for in the care contract between the Alarm Company and the Occupant.

Underwriters' Laboratories of Canada makes no representations or warranties, expressed or implied, that the alarm system will prevent any loss by fire, smoke, water damage or otherwise, or that the system will in all cases provide the protection for which it is installed or intended. This certificate is evidence that the signalling devices are monitored and maintained by a ULC Listed Monitoring Station and that the service is subject to countercheck field inspections by ULC Representatives. This certificate is to be posted at the Subscriber's site and is valid only with a current maintenance contract.

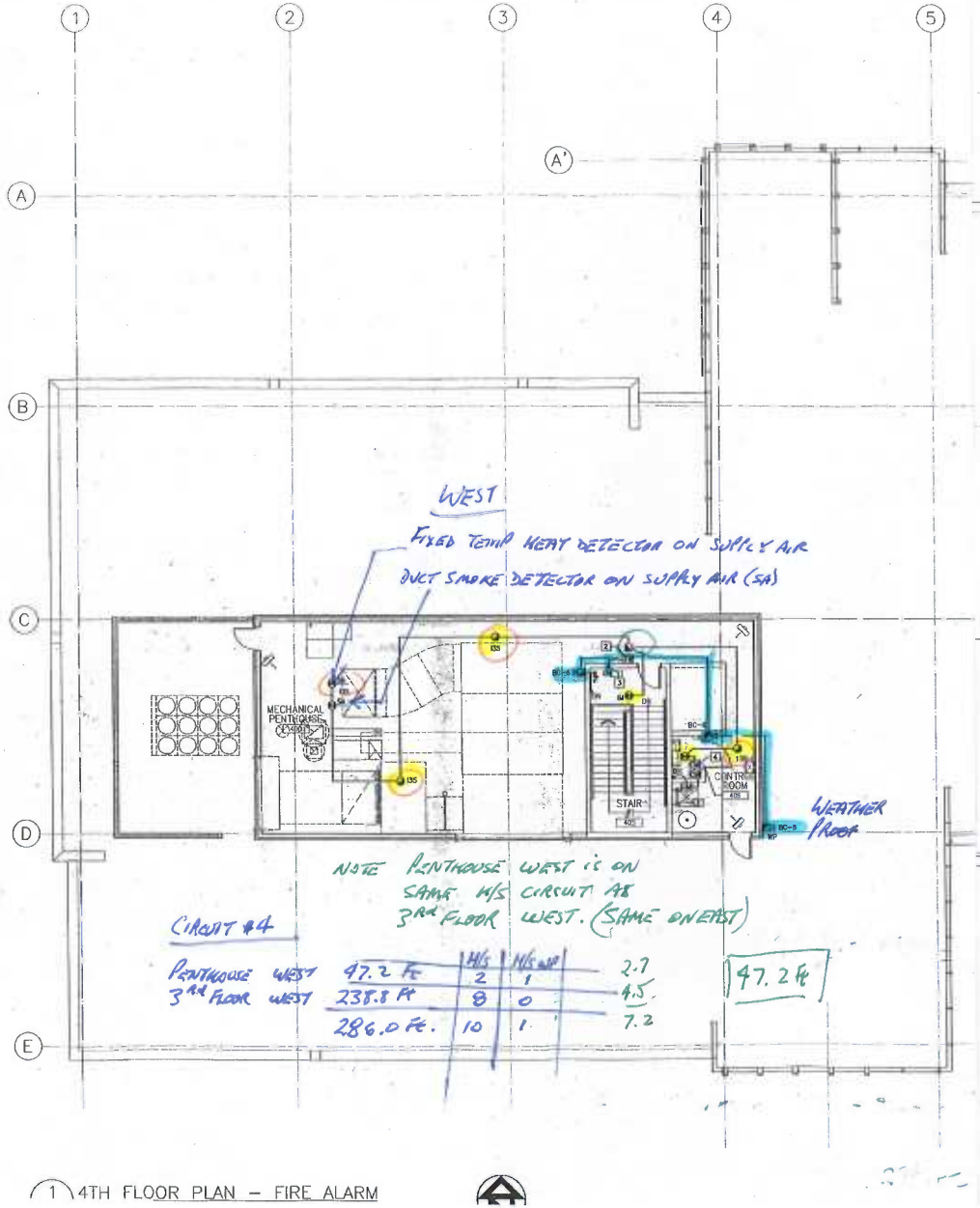
ULC is not an insurer and does not assume or undertake to discharge any liability of the Alarm Company or any other party for any loss, which may result from failure of the equipment, incorrect installation, non-conformity with requirements, cancellation of this certificate or withdrawal of the Alarm Company from Listing by ULC prior to the expiration date appearing on this certificate.

LISTED ALARM COMPANY								LOCATION
ADT SECURITY SERVICES CANADA, INC 16447 - 117 AVE								EDMONTON AB T5M 3V3
TYPE OF SYSTEM: Fire Panel	NUMBER OF SIGNAL SWITCHES							LOCAL F/A INTERCONNECTION
	ROOM TEMP	WATER FLOW	WATER LEVEL	PRESSURE	WATER TEMP.	CUT OFF VALVES	PUMP SUP.	
NUMBER OF RISERS: 0	0	0	0	0	0	0	0	YES
TRANSMISSION MODE: Active	ISSUED: D M Y 10/02/2012			EXPIRES: D M Y 10/02/2017			MAXIMUM TERM: 5 Years	

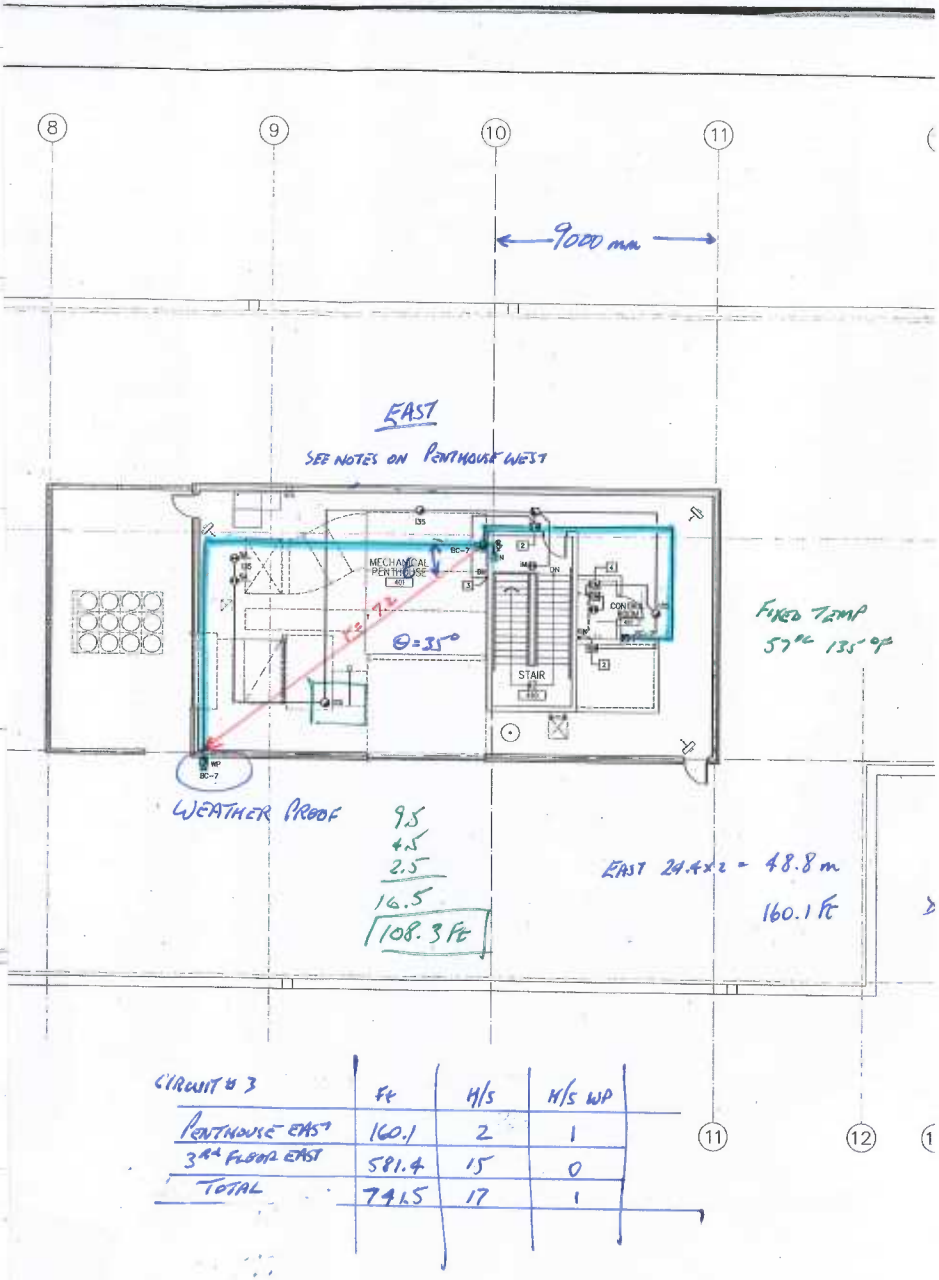
SUBSCRIBER	MAINTENANCE SYSTEM SHALL BE EXAMINED AND TESTED AT LEAST ONCE EACH YEAR			
XXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX #N080110804 XXXXXXXXXXXXXXXXXXXXXXXXXXXX	REPRESENTATIVE	DATE D	M	Y

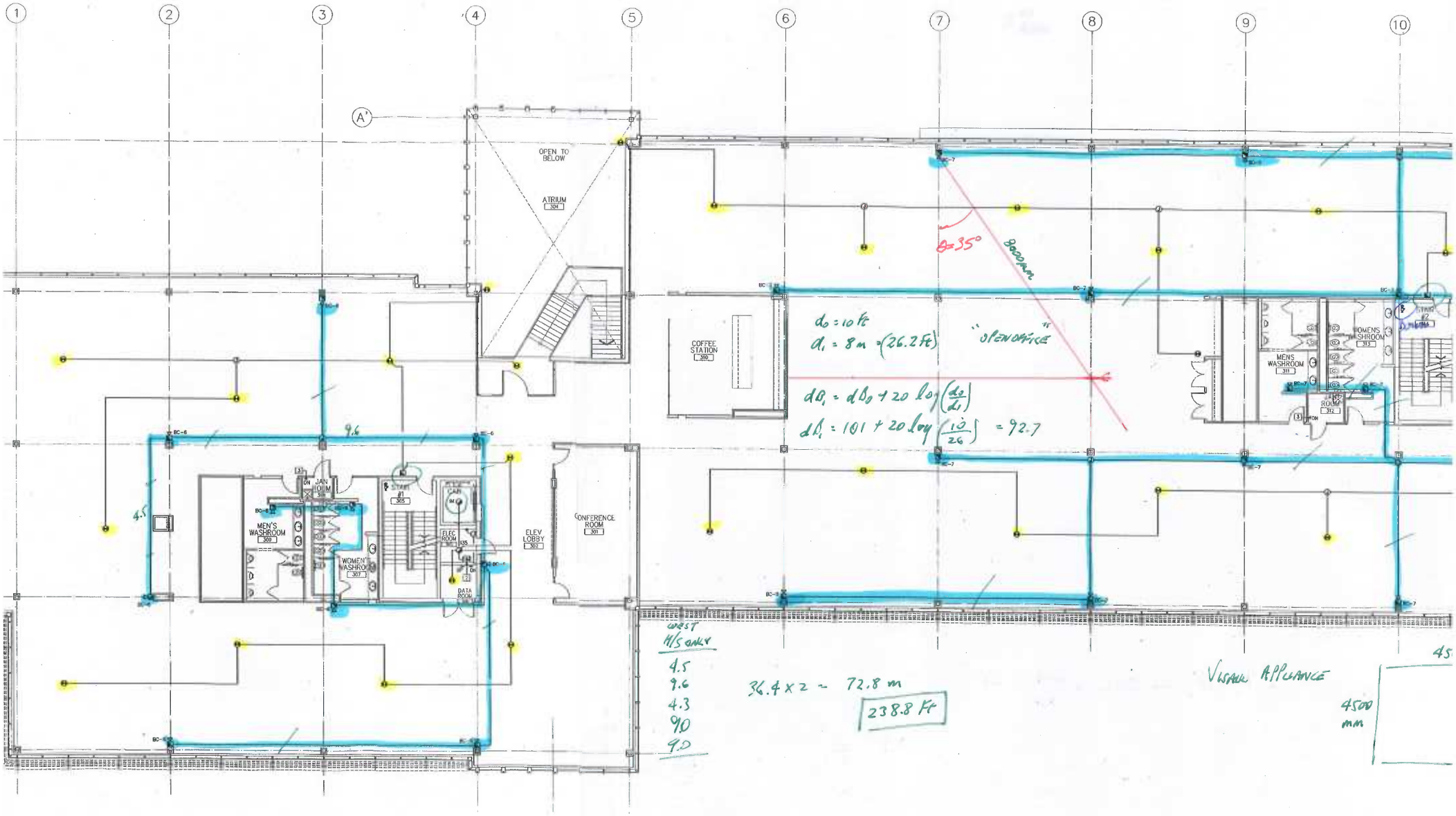
Appendix 9

Assessment of Audible Notification Appliances



1 4TH FLOOR PLAN – FIRE ALARM





1 3RD FLOOR PLAN – FIRE ALARM

Appendix 10

Fire Alarm System

Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

Chubb Edwards
10118 - 175 Street
Edmonton, AB
T5S 1L1
Tel 780-452-6411
Fax 780-453-8097

March 9, 2012

Saskalta Electric Ltd.
6206 - 50 Avenue
Lloydminster, AB
T9V 2C9

Project: [redacted]
4429 – 44 Street,
Lloydminster, AB
Reference: 50-210-4093-000

To Whom It May Concern:

In accordance with the project specifications, and in compliance with CAN/ULC-S537-04, we have completed the verification of the installed Fire Alarm System at the above named site as installed by Saskalta Electric Ltd. under the direction of the Engineering firm Stebnicki & Partners. At the conclusion of the verification February 3, 2012, we confirm the Fire Alarm System & devices verified functioned as intended and the system was left in satisfactory operation.

Please find enclosed all the necessary documents pertaining to this verification.

Should you require additional information regarding this verification inspection, we welcome the opportunity to assist you.

Yours Truly,
Chubb EDWARDS

Pat McDonnell
Fire Service Supervisor
Fire Systems

Chubb Edwards
10118 - 175 Street
Edmonton, AB
1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

BUILDING NAME:	HUSKY OFFICE BUILDING		
BUILDING ADDRESS	4429 - 44 STREET, LLOYDMINSTER, ALBERTA		
DATE:	FEB 3/2012	SINGLE STAGE: X	TWO STAGE:
MANUFACTURER:	EDWARDS	MODEL NUMBER:	QS4
BUILDING NUM.		PROP. NUM.:	50-210-4093

	YES	NO
1. THIS IS TO CERTIFY THAT THE ENTIRE FIRE ALARM SYSTEM HAS BEEN VERIFIED IN ACCORDANCE WITH THE STANDARD FOR THE VERIFICATION OF FIRE ALARM SYSTEMS, CAN/ULC-S537M04.	X	
2. THIS IS A PARTIAL VERIFICATION FOR PARTIAL OCCUPANCY.		X
3. THIS IS A PARTIAL VERIFICATION FOR A FIRE ALARM SYSTEM THAT HAS BEEN REPLACED IN STAGES.		X
4. THIS IS A VERIFICATION OF A PORTION OF AN EXISTING FIRE ALARM SYSTEM VERIFIED IN ACCORDANCE WITH SECTION 6, SYSTEM MODIFICATIONS.		X
5. INSTALLED IN ACCORDANCE WITH THE DESIGN AND CAN/ULC-S524, STANDARD FOR INSTALLATION OF FIRE ALARM SYSTEMS.	X	
6. THE FIRE ALARM SYSTEM IS FULLY FUNCTIONAL WITH NO DEFICIENCIES.	X	
THE FIRE ALARM SYSTEM IS FUNCTIONAL WITH DEFICIENCIES.		X
8. A COPY OF THIS REPORT HAS BEEN GIVEN TO : SASKALTA ELECTRIC	X	
9. A LABEL WITH THE DATE OF THE VERIFICATION AND TECHNICIAN'S NAME HAS BEEN INSTALLED ON THE DOOR OF THE CONTROL PANEL	X	

This is to certify that the information contained in this Fire Alarm System Verification Report is correct and complete.
This record is to be maintained by the building owner.

Derek Cole
Printed name of primary or supervising technician conducting the verification

Chubb Edwards
Company

780-452-6411
Telephone

[signature]
Signature of primary or supervising technician conducting the verification

Identification # of primary or supervising technician conducting the verification

Printed name of assisting technician conducting the verification

Company

Telephone

Signature of assisting technician conducting the verification

Identification # of assisting technician conducting the verification

Form based on CAN/ULC-S537-04 Appendix C

Chubb Edwards
10118 - 175 Street
Edmonton, AB
5S 1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

DOCUMENTATION

Every Line must have the appropriate marking in the space provided	YES	NO	N/A
A. Documentation for the fire alarm system is on site and is located:			
SASKALTA ELECTRIC	X		

Fire Alarm System Documentation Includes:

B. Instruction for resetting the system and silencing the alarm signals.	X		
C. Instruction for silencing the trouble signal, and action to be taken when the trouble signal sounds.	X		
D. Description of the function of each operating control and indicator on the fire alarm control unit.	X		
E Description of the area or fire zone protected by each alarm detection circuit. (this may be in the form of a list or plan drawings for the building)	X		
F Description of alarm signal operation.	X		
G Description of ancillary equipment controlled by fire alarm system.	X		

Chubb Edwards
10118 - 175 Street
Edmonton, AB
T5S 1L1
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Fire Alarm System Verification Report

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FIELD DEVICE AND RELATED CIRCUITS - TEST AND INSPECTION

	YES	NO	N/A
A. Correct field termination and wiring size.	X		
B. Correct circuit polarities.	X		
C. An open circuit fault on a conventional device circuit causes a trouble signal.	X		
D. Removal of any device or supporting field device circuit causes a trouble signal	X		
E. One contact device and one non-contact device test for operation and annunciation at the control unit or transponder, when using a field verifying device.	X		
F. Class A circuits serving conventional field devices tested for the capability of providing an alarm signal on each side of an open circuit fault connection at an electrically remote point in the circuit.	X		
G. Ground fault indications occur when tested at the electrically furthest field device, and do not result in normal to off-normal status change condition.	X		
H. Field device at the electrically furthest point from the power source (in every circuit) receives rated power in accordance with manufacturer's specs.	X		
Replaceable over-current devices are of correct rating	X		
J. Wire type and gauge in accordance with equipment manufacturer's installation wiring at all system termination points.	X		

REQUIRED SYSTEM RESPONSE TIMES

A. Audible signal devices and visible signal devices operated within 10 seconds	X		
& Subsequent input operated within 10 seconds.	X		
B. Remote connection operated within 10 seconds.	X		
C. Releasing device start of sequence operated within 10 seconds.	X		
D. Required annunciation operated within 10 seconds	X		
& subsequent input operation within 10 seconds.	X		
E. Required central alarm and control facility operated within 10 seconds	X		
& subsequent input operation within 10 seconds.	X		
F. Ancillary circuits operated within 10 seconds	X		
& subsequent input operation within 10 seconds.	X		

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CONTROL UNIT or TRANSPONDER INSPECTION

Control Unit or Transponder Location: MAIN ENTRY (SOUTH)

Control Unit or Transponder Identification: _____

	YES	NO	N/A
A. Input circuit designations correctly identified in relation to connected field devices.	X		
B. Output circuit designations correctly identified in relation to connected field devices.	X		
C. Correct designations for common control functions and indicators.	X		
D. Plug-in components, modules and cables securely in place.	X		
E. Record the date, revision, and version of firmware/software program. Date: _____ Rev.: _____ Ver.: _____			
F. Clean and free of dust and dirt.	X		
G. Fuses in accordance with manufacturer's specifications.	X		
H. Control unit/transponder lock functional.	X		
I. Termination points for wiring to field devices secure.	X		
J. Control unit power disconnects in accordance with the Canadian Electrical Code.	X		
K. Main power supply feed wiring in accordance with manufacturer's specifications.	X		
L. Verify control units or transponders with stand alone capability serves the same area for both input circuits and output circuits.	X		
M. Control units or transponders which operate with stand alone capability have signal silence, reset, and trouble silence switches with visual indicators, degraded mode capability and stand alone capability indicators.	X		
N. Control unit or transponder visual indicators comply with table 3, visual indicators - colour code.	X		

Form based on CAN/ULC-S537-04 Appendix C

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CONTROL UNIT or TRANSPONDER TEST

Control Unit or Transponder Location: **MAIN ENTRY (SOUTH)**

Control Unit or Transponder Identification: **0**

	YES	NO	N/A
A. Power On visual indicator operates.	X		
B. Common visual trouble signal operates.	X		
C. Common audible trouble signal operates.	X		
D. Trouble signal silence switch operates.	X		
E. Main power supply failure initiates trouble signal.	X		
F. Ground fault tested on both positive & negative initiates troubles signal.	X		
G. Alert signal operates.			X
H. Alarm signal operates.	X		
I. Automatic transfer from alert signal to alarm signal operates. (Auto EVAC)			X
J. Manual transfer from alert signal to alarm signal operates. - (Total EVAC)			X
K. Automatic transfer from alert signal to alarm signal cancel switch operates. (AEC)			X
L. Alarm signal silence inhibit function operates. Time 0 sec.			X
M. Alarm signal manual silence operates.	X		
N. Alarm signal silence visual indication operates.	X		
O. Alarm signals, when silenced, automatically reinitiates upon subsequent alarm.	X		
P. Alarm signal silence automatic cut-out timer. Time: 0 min.			X
Q. Audible & visual alert signals & alarm signals programmed and operate per design and specifications.	X		
R. Input circuit, alarm & supervisory operation, including audible & visual indication operate	X		
S. Input circuit supervision fault causes a trouble indication.	X		
T. Output circuit alarm indicators operate.	X		

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CONTROL UNIT or TRANSPONDER TEST - Continued...

	YES	NO	N/A
U. Output circuit supervision fault causes a trouble condition.	X		
V. Visual indicator test operates. (lamp test)	X		
W. Coded signal sequences operate not less than the required number of times and the correct alarm signal operates thereafter.	X		
X. Coded signal sequences are not interrupted by subsequent alarms.	X		
Y. Ancillary device control circuit is rated for the intended purpose.	X		
Z. Ancillary device bypass will result in a trouble indication.	X		
AA. Input circuit to output circuit operation, including ancillary device circuits, for correct program operation, as per design & specification. (refer to appendix C5.12, Ancillary Device Circuit Test)	X		
BB. Fire alarm system reset operates.	X		
CC. Main power supply to emergency power supply transfer operates.	X		
DD. Control unit or transponder bonded to ground.	X		
EE. Status change confirmation (smoke detectors only) verified. [alarm verification feature]			X
FF. Receipt of the system alarm transmission to the fire signal receiving centre.	X		
GG. Receipt of the system supervisory transmission to the fire signal receiving centre.	X		
HH. Receipt of the system trouble transmission to the fire signal receiving centre.	X		
II. If connected, record the name and telephone number of the fire signal receiving centre.	Name: ADT Telephone:		
JJ. Operation of the fire signal receiving centre disconnect (FDR) results in a specific trouble indication at the control unit/transponder, and transmits a trouble signal to the alarm receiving centre.			X

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POWER SUPPLY INSPECTION

Control Unit or Transponder Location: MAIN ENTRY (SOUTH)

Control Unit or Transponder Identification: 0

	YES	NO	N/A
A. Conforms with the requirements of CAN/ULC-S524, and the Canadian Electrical Code part 1, sec. 32.	X		
B. Fused in accordance with the manufacturer's marked rating for the system.	X		
C. Equipped with identified disconnect means.	X		
D. Adequate to meet requirements of the system.	X		
E. Power for ancillary devices is taken from a source separate from the fire alarm power supply	X		
F. Power for ancillary devices is taken from the control unit and is designed to supply such power.	X		
G. Ancillary devices powered from the control unit or transponder are recorded.	X		

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POWER SUPPLY TEST AND INSPECTION

Control Unit or Transponder Location: **MAIN ENTRY (SOUTH)**

Control Unit or Transponder Identification: **0**

A. Duration of Full Load Test as determined by occupancy per Canadian Building Code (0.08, 0.5, 1, 2 hr **0.5** **Hours**

B. Record battery type as recommended by the manufacturer. Type: **LEOCH** Volt: **12x2** Capacity: **26AH**

C. Battery Voltage with Main Power On **27** Vdc _____ Amps

D. Battery Voltage & Current - Power Off - Supervisory Condition **25.3** Vdc _____ Amps

E. Battery Voltage & Current - Power Off - Full Load Alarm Condition **25** Vdc _____ Amps

F. Battery Voltage - Power Off - After Full Load Alarm Test **25.3** Vdc

G. Battery Voltage & Current - Power On - After Full Load Alarm Test **25.8** Vdc _____ Amps

H. Recorded calculated Amphour capacity (Per ULC-S536 Appendix F4.1-C) **0** Amphr

I. Correct battery rating as determined by battery calculations based on full system load. **YES**

J. Battery rating is greater than 85% of its rated specifications after the test and has passed. **YES**

	YES	NO	N/A
K. Terminals clamped tightly, cleaned, and lubricated.	X		
L. Inspected for physical damage/electrolyte leakage.	X		
M. Correct electrolyte levels.	X		
N. Specific gravity of electrolyte is within manufacturer's specification.	X		
O. Battery has adequate ventilation.	X		
P. Battery In-service date recorded or manufacturer's date code	Date: _____		
Q. Disconnection causes a trouble indication	X		

R. Indicate type of battery test performed.

i) Required supervisory load for 24 hr - followed by the required full load operation	X
ii) A silent test by using the load resistor method (Per ULC-S536 Appendix F1)	
iii) Silent accelerated test (Per ULC-S536 Appendix F2)	

S. Generator provides power to the AC circuit serving the fire alarm system.	X		
T. Trouble condition at the emergency generator shall result in an audible trouble signal.	X		

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VOICE COMMUNICATION TEST

Indicate with an 'X' if there is no voice communication system included with this report: [X]

	YES	NO	N/A
A. Power on indicator operates.			
B. Common visual trouble indicator operates.			
C. Common audible trouble signal operates.			
D. Trouble signal silence switch operates.			
E. All-Call voice paging, including visual indicator, operates.			
F. Output circuits for selective voice paging, including visual indicator, operates.			
G. Output circuits for selective voice paging trouble operation, including visual indicator, operates.			
H. Microphone, including push to talk switch, operates.			
I. Operation of the voice paging system does not interfere with initial inhibit time of the fire alarm signal.			
All-Call voice paging operates on emergency power supply. (batteries)			
K. Upon failure of one amplifier, system automatically transfers to back-up amplifier.			
L. Circuits for emergency telephone call-in including audible and visual indicators, operate.			
M. Circuits for emergency telephone - two way voice communication operates.			
N. Circuits for emergency telephone trouble operation, including visual indication, operates.			
O. Emergency telephone operable (dial tone) or in use (busy tone) operate.			
P. Emergency telephone verbal communication operates.			

REMOTE TROUBLE SIGNAL UNIT TEST & INSPECTION

Remote Trouble Unit Location: _____

A. Input wiring from the control unit or transponder is supervised.			
B. Visual trouble signal operates.			
C. Audible trouble signal operates.			
D. Audible trouble signal silence operates.			

Form based on CAN/ULC-S537-04 Appendix C

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Edmonton, AB
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Fire Alarm System Verification Report

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ANNUNCIATORS OR SEQUENTIAL DISPLAYS - TEST & INSPECTION

Annunciator or Sequential Display Location: SECURITY ROOM

Annunciator or Sequential Display Identification: _____

	YES	NO	N/A
A. Power on indicator operates.	X		
B. Individual alarm & supervisory zones are clearly indicated & separately designated.	X		
C. Individual alarm & supervisory zone indication operates - *(If N/A See Exception)*	X		
Exception: Operation of each individual alarm & supervisory zone indication gives the identical indication, or lights the identical indicators at the other annunciator(s), and sequential display(s).			
Specific method of confirmation: _____			
A minimum of 1 alarm zone & 1 supervisory zone tested at each annunciator & sequential display to confirm operation.	X		
D. Individual alarm & supervisory zone designation labels are properly identified.	X		
E. Common trouble signal operates.	X		
F. Visual indicator test (lamp test) operates.	X		
G. Input wiring from control unit or transponder is supervised.	X		
H. Alarm signal silence visual indicator operates.	X		
I. Switches for ancillary functions operate as per design and specifications, or documented as detailed in appendix C, Description of Fire Alarm System for Inspection & Test Procedures.	X		
J. Other ancillary functions visual indicators operate.	X		
K. Manual activation of alarm signal & indication operates. (Total EVAC switch)			X
L. Displays are visible in installed location.	X		
M. Operates on emergency power.	X		

Form based on CAN/ULC-S537-04 Appendix C

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Fire Alarm System Verification Report

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PRINTER TEST

Printer Location: N/A

A. Operates per design and specification, or documentation as detailed in appendix C, Description of Fire Alarm System for Inspection and Test Procedures.			
B. Zone of each alarm initiating device is correctly printed.			
C. Rated voltage is present at printer (printer power is on).			

DATA COMMUNICATION LINK TEST

Control Unit or Transponder Location: MAIN ENTRY (SOUTH)

Control Unit or Transponder Identification: 0

Data Communication Link Identification: DCLA ☐ DCLB ☐ DCLR ☐

	YES	NO	N/A
A. Where Applicable, each system abnormal condition specified in Table 1, reported as tested for each data communication link at the control unit or transponder.	X		
). Tests for alarm and trouble received under a single ground fault condition conducted on each conductor of that data communication link independently.	X		
C. Each conductor in a data communication link, class A (DCLA) tested for the capability of providing an alarm signal on each side of a single open circuit fault condition.	X		
D. Where a data communication link serves devices on more than one floor area, impose a wire to wire short circuit fault within each floor area and confirm receipt and trouble and alarm condition from another floor area.	X		
E. Where fault isolation modules are installed in data communication links serving field devices, wiring shorted on the isolated side, annunciation of the fault confirmed, and then a device on the source side operated, and activation confirmed at the control unit or transponder.	X		
F. Where fault isolation in data communication links are provided between control units or transponders, the field wiring shorted between each pair of control units or transponders, in turn, annunciation of the fault confirmed and operation outside the shorted section confirmed.	X		

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ANCILLARY DEVICE LISTINGS

Type of Ancillary Equipment Installed on this System: ☐ CHECK 'X' HERE IF NONE INSTALLED

ELEVATOR HOMING x2

ELEVATOR HAT x2

ELEVATOR ALT HOMING x2

MUA SHUTDOWN x4

***NOTE: The equipment reported on this form does not include the actual operational test of the ancillary device**

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Fire Alarm System Verification Report

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FIELD DEVICE TESTING - LEGEND & NOTES

DEVICE	DESCRIPTION	TYPE	MODEL NO.
M	Manual Station	EDWARDS	SIGA 270
RHT	Rate of Rise Heat Detector	EDWARDS	SIGA HRS
HT	Fixed Temperature Heat Detector	EDWARDS	SIGA HFS
S	For Smoke Detector sensitivity test see chart on next page	EDWARDS	SIGA PS
S1	For Smoke Detector sensitivity test tool see chart on next page		
S2			
S3	For Manufacturer's Sensitivity Range see chart on next page		
RI	Remote Indicator		
DS	Duct Smoke Detector	EDWARDS	SIGA PS
SFD	Supporting Field Device - Monitor		
FD	Sprinkler Flow Switch	EDWARDS	SIGA WTM/CT2
SS	Sprinkler Supervisory Device	EDWARDS	SIGA WTM/CT2
PS	Sprinkler Pressure Device		
EM	Isolation Module		
B	Bell		
H	Horn or Horn/Strobe combination	EDWARDS	G1-HDVM
V	Visual Signal Device		
SP	Cone Type Speaker		
HSP	Horn Type Speaker		
AD	Ancillary Device	EDWARDS	SIGA CR
ET	Emergency Telephone		
EOL	End of Line Resistor/Capacitor		

The following notes apply to the device location records, based on CAN/ULC-S537-04 Appendix E

Note 1: Smoke detector sensitivity confirmation or sensitivity should be recorded with the individual device
Note 2: Status change - including time delays should be recorded with the individual device.
Note 3: Duct smoke detector pressure differential or positive air flow readings should be recorded with the device.
Note 4: Time delay settings of the sprinkler flow switch should be recorded with the device.
Note 5: Sprinkler supervisory devices cause supervisory condition to be annunciated -not an alarm condition.
Note 6: Upper & lower pressure settings of sprinkler pressure switches should be recorded with the device
Note 7: Low temperature settings of temperature devices should be recorded with the device.
Note 8: Identify the specific ancillary system controlled by the Ancillary device, in the Remarks column.
Note 9: Identify the correct field device operation (eg. Alarm, trouble, supervision, annunciation) as required.
Note 10: Identify zone number, circuit number and/or address as required.
Note 11: Identify conventional field device locations monitored by a Supporting Field Device.
Note 12: Identify active field device and supporting field device locations.
Note 13: Test and confirm conventional field circuit wiring supervision.
Note 14: Confirm field device free of damage.
Note 15: Confirm field device free of foreign substance - ie. Paint, Drywall compound or other debris.
Note 16: Confirm field device mechanically supported - independent of the wiring.
Note 17: Confirm the field device protective dust shields or covers are removed.

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Smoke Detector Sensitivity Ranges

Conventional Devices

Model	Type	Sensitivity Range	Tool	Low	High
EC10U-3	Ionization	0.69-1.18%	C-PST	140-180mV	500-560mV
EC30U-3	Optical	1.38-3.08%	C-PST	570-630mV	1450-1550mV
EC30DU-3	Optical	1.38-3.08%	N/A		
C2M-PD1	Photoelect	1.90-3.8%	Magnet	7 Flashes	4 flashes
C2M-PDC1	Photoelect	1.90-3.8%	Magent	7 Flashes	4 flashes
EDW1151A	Ionization	0.8%	MOD400R	Measure & compare to label	
EWD2151A	Photoelect	1.8%	MOD400R	Measure & compare to label	
EDW1400A	Ionization	1.5%	MOD400R	Measure & compare to label	
EDW1451A	Ionization	1.5%	MOD400R	Measure & compare to label	
EDW2400A	Photoelect	1.4%	MOD400R	Measure & compare to label	
EDW2451A	Photoelect	1.4%	MOD400R	Measure & compare to label	
SD-2W	Photoelect	0.79-2.46%	N/A		
ESD-4WSJ	Photoelect	0.67-2.46%	N/A	Test meter not required	
ESD-SJ	Photoelect	0.67-2.46%	N/A		

Intelligent Devices

Model	Type	Range	Tool
SIGA-IS	Ionization	0.7-1.6%	On-screen
SIGA-IPHS	Multisensor	1.0-3.5%	On-screen
SIGA-PS	Photoelect	1.0-3.5%	On-screen
SIGA-PHS	Multisensor	1.0-3.4%	On-screen
SIGA-SD	Photoelect	0.79-2.46%	On-screen
EDW2151A	Ionization		On-screen
EDW2251A	Photoelectric		On-screen
EDW2400A	Ionization		On-screen
EDW2451A	Photoelectric		On-screen
EDW7251A	Photoelectric		On-screen

For devices not listed consult the device Manufacturer or CFAA's NEWS and TIPS at www.cfaa.ca

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Ph: 780 452-6411

DEVICE LOCATION & TESTING

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Building Verified: HUSKY OFFICE BUILDING
Building Address: 4429 44 STREET, LLOYDMINSTER, ALBERTA

Date: FEB 3/2012
Verified By: Derek Cole

Location	Device	Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
ZONE 1 *1ST FL WEST*															
LUNCH ROOM	S		02004				X			X	X					
PRE-FUNTION ROOM	S		02017				X			X	X					
ENTRY LOBBY	S		02018				X			X	X					
ELECTRICAL ROOM	HT		02022				X			X	X					
LUNCH ROOM EAST	S		02031				X			X	X					
ATRIUM	S		02045				X			X	X					
PRE-FUNTION ROOM WEST	S		02051				X			X	X					
ATRIUM ON WALL	S		02055				X			X	X					
ELEVATOR LOBBY	S		02056				X			X	X					
LUNCH ROOM NORTH EXIT	M		02126				X			X	X					
PRE-FUNTION ROOM WEST	M		02135				X			X	X					
ENTRY LOBBY SOUTH	M		02137				X			X	X					
ATRIUM NORTH EXIT	M		02145				X			X	X					
ZONE 2 *1ST FL EAST*															
POP SERVER ROOM	S		01006				X			X	X					
DATA ROOM	S		01007				X			X	X					
ELECTRICAL ROOM	HT		01009				X			X	X					
N/E OFFICE	S		01014				X			X	X					
SOUTH EAST OFFICE	S		01015				X			X	X					
SOUTH EAST OFFICE	S		01021				X			X	X					

Form based on CAN/ULC-S537-04 Appendix E

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
N/E OFFICE	S		01022				X			X	X					
N/E OFFICE	S		01023				X			X	X					
SOUTH EAST OFFICE	S		01024				X			X	X					
N/E OFFICE	S		01044				X			X	X					
SERVER ROOM	S		01046				X			X	X					
N/E OFFICE	S		01054				X			X	X					
EAST OFFICE	S		01056				X			X	X					
ELECTRICAL ROOM	S		01057				X			X	X					
N/E OFFICE	S		01060				X			X	X					
SOUTH EAST OFFICE	S		01062				X			X	X					
ELEVATOR LOBBY	S		01064				X			X	X					
SHIP/REC EXIT	M		01133				X			X	X					
S/E EXIT	M		01139				X			X	X					
ZONE 3 *2ND FL WEST*																
N/W OFFICE	S		02005				X			X	X					
S/W OFFICE	S		02006				X			X	X					
ELECTRICAL ROOM	HT		02010				X			X	X					
N/W OFFICE	S		02012				X			X	X					
S/W OFFICE	S		02013				X			X	X					
S/W OFFICE	S		02019				X			X	X					
ATRIUM STAIRS	S		02026				X			X	X					
N/W OFFICE	S		02032				X			X	X					
N/W OFFICE	S		02033				X			X	X					
DATA ROOM	S		02039				X			X	X					
S/W OFFICE	S		02040				X			X	X					
S/W OFFICE	S		02047				X			X	X					
ELEVATOR LOBBY	S		02052				X			X	X					
S/W OFFICE	S		02053				X			X	X					

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
STAIR EXIT	M		02143				X			X	X					
ZONE 4 *2ND FL EAST*																
ELECTRICAL ROOM	HT		01001				X			X	X					
S/E OFFICE	S		01005				X			X	X					
N/E OFFICE	S		01011				X			X	X					
ELEVATOR LOBBY	S		01019				X			X	X					
N/E OFFICE	S		01020				X			X	X					
N/E OFFICE	S		01029				X			X	X					
N/E OFFICE	S		01030				X			X	X					
S/E OFFICE	S		01031				X			X	X					
S/E OFFICE	S		01032				X			X	X					
N/E OFFICE	S		01038				X			X	X					
N/E OFFICE	S		01040				X			X	X					
N/E OFFICE	S		01042				X			X	X					
N/E OFFICE	S		01045				X			X	X					
N/E OFFICE	S		01048				X			X	X					
S/E OFFICE	S		01052				X			X	X					
S/E OFFICE	S		01053				X			X	X					
S/E OFFICE	S		01058				X			X	X					
S/E OFFICE	S		01063				X			X	X					
STAIR EXIT	M		01132				X			X	X					
ZONE 5 *3RD FL WEST*																
ELECTRICAL ROOM	HT		02003				X			X	X					
N/W OFFICE	S		02007				X			X	X					
S/W OFFICE	S		02014				X			X	X					
N/W OFFICE	S		02020				X			X	X					
ELEVATOR LOBBY	S		02021				X			X	X					

Form based on CAN/ULC-S537-04 Appendix E

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
DATA ROOM	S		02025				X			X	X					
N/W OFFICE	S		02027				X			X	X					
S/W OFFICE	S		02028				X			X	X					
S/W OFFICE	S		02034				X			X	X					
S/W OFFICE	S		02035				X			X	X					
S/W OFFICE	S		02042				X			X	X					
ATRIUM STAIR	S		02048				X			X	X					
STAIR EXIT	M		02127				X			X	X					

ZONE 6 *3RD FL EAST*

N/E OFFICE	S		01003				X			X	X					
N/E OFFICE	S		01004				X			X	X					
S/E OFFICE	S		01012				X			X	X					
S/E OFFICE	S		01013				X			X	X					
N/E OFFICE	S		01016				X			X	X					
ELECTRICAL ROOM	HT		01017				X			X	X					
N/E OFFICE	S		01027				X			X	X					
S/E OFFICE	S		01028				X			X	X					
S/E OFFICE	S		01034				X			X	X					
N/E OFFICE	S		01035				X			X	X					
S/E OFFICE	S		01036				X			X	X					
N/E OFFICE	S		01043				X			X	X					
N/E OFFICE	S		01047				X			X	X					
S/E OFFICE	S		01050				X			X	X					
N/E OFFICE	S		01051				X			X	X					
S/E OFFICE	S		01055				X			X	X					
ELEVATOR LOBBY	S		01059				X			X	X					
STAIR EXIT	M		01143				X			X	X					

Location	Device	Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
ZONE 7 *PENTHOUSE WEST*															
SOUTH EAST	HT		02001				X			X	X				
NORTH	HT		02029				X			X	X				
SOUTH WEST	HT		02043				X			X	X				
ELEVATOR MECH ROOM	S		02046				X			X	X				
STAIR EXIT	M		02129				X			X	X				
ZONE 8 * PENTHOUSE EAST*															
SOUTH WEST	HT		01018				X			X	X				
CENTER	HT		01026				X			X	X				
SOUTH	HT		01033				X			X	X				
ELEVATOR MECH ROOM	S		01061				X			X	X				
STAIR EXIT	M		01137				X			X	X				
ZONE 9 * WEST BASEMENT STAIRS*															
TOPS OF STAIRWELL	S		02011				X			X	X				
ZONE 10 *WEST STAIRWELL*															
TOP OF STAIRWELL	S		02041				X			X	X				
BASEMENT STAIR EXIT	M		02153				X			X	X				
ZONE 11 * EAST STAIRWELL															
TOP OF STAIRWELL	S		01037				X			X	X				
ZONE 12*WEST ELEVATOR*															
ELEVATOR SHAFT	S		02049				X			X	X				
ZONE 13 *EAST ELEVATOR*															
ELEVATOR SHAFT	S		01025				X			X	X				

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
ZONE 14 *MAIN FLOW*																
MAIN FLOW	FS		02138				X			X	X					
ZONE 15 *MAIN TAMPER*																
MAIN TAMPER	TS		02139				X			X	X					
ZONE 16 *BASEMENT FLOW*																
BASEMENT FLOW	FS		02140				X			X	X					
ZONE 17 *BASEMENT TAMPER																
BASEMENT TAMPER	TS		02141				X			X	X					
ZONE 18 *1ST FL FLOW*																
1ST FL FLOW	FS		02 146				X			X	X					
ZONE 19 *1ST FL TAMPER																
1ST FL TAMPER	TS		02147				X			X	X					
ZONE 20 *2ND FL FLOW*																
2ND FL FLOW	FS		02132				X			X	X					
ZONE 21 *2ND FL TAMPER*																
2ND FL TAMPER	TS		02133				X			X	X					
ZONE 22 * 3RD FL FLOW*																
3RD FL FLOW	FS		01128				X			X	X					

Location	Device	Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
ZONE 23 *3RD FL TAMPER*															
3RD FL TAMPER	TS		01129				X			X	X				
ZONE 24 *WEST PENTHOUSE FLOW*															
FLOW	FS		02130				X			X	X				
ZONE 25 * WEST PENTHOUSE TAMPER*															
TAMPER	TS		02131				X			X	X				
ZONE 26 *EAST PENTHOUSED FLOW*															
FLOW	FS		01146				X			X	X				
ZONE 27 *EAST PENTHOUSE TAMPER*															
TAMPER	TS		01147				X			X	X				
ZONE 28 *SHIPPING AND REC*															
SHIP/REC FLOW	FS		01140				X			X	X				
ZONE 29 *SHIPPING AND REC															
SHIP/REC TAMPER #2	TS		01131				X			X	X				
TAMPER #1	TS		01135												
ZONE 30 *SERVER ROOM EST3*															
TROUBLE			C:01D:126				X			X	X				
1ST ALARM			C:01D:127				X			X	X				
ZONE 31 *SERVER ROOM EST 3 ALARM*															
2ND ALARM			C:01D:145				X			X	X				

Location	Device	Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
ZONE 32 *WEST BASEMENT															
ELECTRICAL ROOM	HT		02002			X			X	X					
MAIN ELECTRICAL ROOM	HT		02008			X			X	X					
MECH ROOM SOUTH	HT		02015			X			X	X					
MECH ROOM NORTH	HT		02036			X			X	X					
WEST STAIR EXIT	M		02151			X			X	X					
ZONE 33 DUCT SMOKE															
WEST PENTHOUSE UPPER	DS		02038			X			X	X					
ZONE 34 DUCT SMOKE															
WEST PENTHOUSE LOWER	DS		02024			X			X	X					
ZONE 35 DUCT SMOKE															
EAST PENTHOUSE UPPER	DS		01008			X			X	X					
ZONE 36 DUCT SMOKE															
EAST PENTHOUSE LOWER	DS		01039			X			X	X					
ZONE 37 MAIN DOM WATER SHUT OFF															
WATER MAIN SHUTOFF			C:02D:159			X			X	X					
ZONE 38 GENERATOR															
RUN		SIGA CT2	C:01D:151			X			X	X					
FAIL		SIGA CT2	C:01D:152			X			X	X					
BOOSTER 1 IN MAIN PANEL															
3RD FL ELEVATOR LOBBY WEST				3		X			X						
3RD FL NORTH CENTRAL				3		X			X						

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
3RD FL NORTH CENTRAL WEST				3			X			X						
3RD FL WOMENS WASHROOM				3			X			X						
3RD FL MENS WASHROOM				3			X			X						
3RD FL N/W				3			X			X						
3RD FL WEST CENTRAL				3			X			X						
3RD FL SOUTH WEST				3			X			X						
3RD FL SOUTH WEST CENTRAL				3			X			X						
3RD FL SOUTH CENTRAL				3			X			X						
WEST PENTHOUSE CENTRAL				3			X			X						
WEST PENTHOUSE CENTRAL		EOL		3			X			X						
WEST PENTHOUSE EAST SIDE				3			X			X						
WEST PENTHOUSE EXTERIOR EAST				3			X			X						
2ND FL ELEVATOR LOBBY WEST				2			X			X						
2ND FL NORTH CENTRAL				2			X			X						
2ND FL NORTH CENTRAL WEST				2			X			X						
2ND FL WEST WOMENS WASHROOM				2			X			X						
2ND FL WEST MENS WASHROOM				2			X			X						
2ND FL NOURTH WEST				2			X			X						
2ND FL WEST CENTRAL				2			X			X						
2ND FL SOUTH WEST				2			X			X						
2ND FL SOUTH WEST		EOL		2			X			X						
2ND FL S/W CENTRAL				2			X			X						
2ND FL SOUTH CENTRAL				2			X			X						
1ST FL N ATRIUM				1			X			X						
1ST FL CAFETERIA EAST				1			X			X						
1ST FL CAFETERIA WEST				1			X			X						
1ST FL CAFETERIA SOUTH CENTRAL				1			X			X						
1ST FL N/W CORRIDOR				1			X			X						
1ST FL WEST MENS WASHROOM				1			X			X						

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
1ST FL WEST WOMENS WASHROOM				1			X			X						
1ST FL WEST TRAINING ROOM				1			X			X						
1ST FL PREFUNTION RM				1			X			X						
1ST FL RM OFF ATRIUM				1			X			X						
BASEMENT S/E STORAGE ROOM				1			X			X						
BASEMENT S/E CORRIDOR				1			X			X						
BASEMENT EAST CORRIDOR				1			X			X						
SHIP/REC				4			X			X						
WOMENS WASHROOM EAST				4			X			X						
1ST FL SOUTH EAST CORRIDOR				4			X			X						
1ST FL MENS WASHROOM EAST				4			X			X						
1ST FL SOUTH EAST EXTERIOR WALL				4			X			X						
1ST FL SOUTH EAST EXTERIOR WALL				4			X			X						
1ST FL SOUTH VEST RECPTION				4			X			X						
BASEMENT SOUTH CORRIDOR WEST				1			X			X						
BASEMENT MECH ROOM				1			X			X						
BASEMENT ELECTRICAL ROOM				1			X			X						
BASEMENT FITNESS ROOM				1			X			X						
BASEMENT FITNESS ROOM		EOL		1			X			X						
BASEMENT SHOWER ROOM MENS				1			X			X						
BASEMENT SHOWER ROOM WOMENS				1			X			X						
BOOSTER 2																
PENTHOUSE EAST NORTH				2			X			X						
PENTHOUSE EAST- NORTH EAST				2			X			X						
EAST PENTHOUSE EAST				2			X			X						
EAST PENTHOUSE EXTERIOR				2			X			X						
3RD FL EAST				2			X			X						
3RD FL N/E OUTSIDE STAIRWELL				2			X			X						

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
3RD FL N/E CENTRAL EAST				2			X			X						
3RD FL N/E CENTRAL				2			X			X						
3RD FL N/E CENTRAL WEST				2			X			X						
3RD FL S/E WEST				2			X			X						
3RD FL S/E WEST CENTRAL				2			X			X						
3RD FL S/E CENTRAL				2			X			X						
3RD FL CENTRAL EAST				2			X			X						
3RD FL MENS WASHROOM EAST				2			X			X						
3RD FL WOMENS WASHROOM EAST				2			X			X						
3RD FL S/E SOUTH WALL EAST				2			X			X						
3RD FL S/E				2			X			X						
2ND FL EAST				1			X			X						
2ND FL EAST NORTH EXIT WALL				1			X			X						
2ND FL EAST NORTH EXIT WALL		EOL		1			X			X						
2ND FL N/E OUTSIDE STAIRWELL				1			X			X						
2ND FL N/E CENTRAL NORTH EXTIRIOR				1			X			X						
2ND FL N/E CENTRAL CORRIDOR				1			X			X						
2ND FL N/E NORTH WALL				1			X			X						
2ND FL N/E CORRIDOR WALL WEST				1			X			X						
2ND FL S/E EXT WALL WEST				1			X			X						
2ND FL S/E CORRIDOR WALL				1			X			X						
2ND FL S/E EXT WALL CENTRAL				1			X			X						
2ND FL S/E CORRIDOR WALL CENTRAL				1			X			X						
2ND FL EXT WALL EAST				1			X			X						
2ND FL MENS WASHROOM EAST				1			X			X						
2ND FL WOMENS WASHROOM EAST				1			X			X						
2ND FL S/E				1			X			X						
1ST FL N/E EXT WALL				3			X			X						
1ST FL N/E CORRIDOR				3			X			X						

Form based on CAN/ULC-S537-04 Appendix E

Location	Device		Address	Circuit Number	Sprinkler Flow Delay	Smoke Detector Sensitivity	Correctly Installed	Missing	Requires Service or Repairs	Active Operation Confirmed	Annunciation Indication Confirmed	Ground Circuit Confirmed	Supervision Circuit Confirmed	Decible Level	Duct Smk Pressure Differential	NOTES (REFER TO REPORT)
1ST FL N/E EXT WALL				3			X			X						
1ST FL N/E CORRIDOR CENTRAL				3			X			X						
1ST FL N/E EXT WALL				3			X			X						
1ST FL N/E CORRIDOR WEST				3			X			X						

Form based on CAN/ULC-S537-04 Appendix E

Chubb Edwards
)118 - 175 Street
Edmonton, AB
T5S 1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

ADDITIONAL POWER SUPPLY TEST AND INSPECTION

Control Unit, Transponder or Power Supply Loc: IN MAIN PANEL

Control Unit or Transponder Identification: _____

A. Duration of Full Load Test as determined by occupancy per Canadian Building Code (0.08, 0.5, 1, 2 hrs): 0.5 Hours

B. Record battery type as recommended by the manufacturer. Type: LEOCH Volt: 2 X 12 Capacity: 7.5

C. Battery Voltage with Main Power On: 27 Vdc — 0.098 Amps

D. Battery Voltage & Current - Power Off - Supervisory Condition: 25.3 Vdc — 0.1 Amps

E. Battery Voltage & Current - Power Off - Full Load Alarm Condition: 23.2 Vdc — 7.1 Amps

F. Battery Voltage - Power Off - After Full Load Alarm Test: 24 Vdc

G. Battery Voltage & Current - Power On - After Full Load Alarm Test: 25.9 Vdc — 1.99 Amps

H. Recorded calculated Amphour capacity (Per ULC-S536 Appendix F4.1-C): 5.95 Amphr

I. Correct battery rating as determined by battery calculations based on full system load: YES

. Battery rating is greater than 85% of its rated specifications after the test and has passed: YES

	YES	NO	N/A
K. Terminals clamped tightly, cleaned, and lubricated.	X		
L. Inspected for physical damage/electrolyte leakage.	X		
M. Correct electrolyte levels.	X		
N. Specific gravity of electrolyte is within manufacturer's specification.	X		
O. Battey has adequate ventilation.	X		
P. Battery in-service date recorded or manufacturer's date code	Date: _____		
Q. Disconnection causes a trouble indication	X		

R. Indicate type of battery test performed.

i) Required supervisory load for 24 hr - followed by the required full load operation	X
ii) A silent test by using the load resistor method (Per ULC-S536 Appendix F1)	
iii) Silent accelerated test (Per ULC-S536 Appendix F2)	

Chubb Edwards
10118 - 175 Street
Edmonton, AB
T5S 1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

ADDITIONAL POWER SUPPLY TEST AND INSPECTION

Control Unit, Transponder or Power Supply Loc: 1ST FL EAST ELECTRICAL

Control Unit or Transponder Identification:

A. Duration of Full Load Test as determined by occupancy per Canadian Building Code (0.08, 0.5, 1, 2 hrs)				0.5	Hours
B. Record battery type as recommended by the manufacturer.	Type: LEOCH	Volt: 12x2	Capacity: 7.5		
C. Battery Voltage with Main Power On	26.9	Vdc		0.098	Amps
D. Battery Voltage & Current - Power Off - Supervisory Condition	25.5	Vdc		0.103	Amps
E. Battery Voltage & Current - Power Off - Full Load Alarm Condition	24.1	Vdc		5.1	Amps
F. Battery Voltage - Power Off - After Full Load Alarm Test	24.8	Vdc			
G. Battery Voltage & Current - Power On - After Full Load Alarm Test	26.1	Vdc		1.95	Amps
H. Recorded calculated Amphour capacity (Per ULC-S536 Appendix F4.1-C)				5.022	Amphr
I. Correct battery rating as determined by battery calculations based on full system load.				YES	
J. Battery rating is greater than 85% of its rated specifications after the test and has passed.				YES	

	YES	NO	N/A
K. Terminals clamped tightly, cleaned, and lubricated.	X		
L. Inspected for physical damage/electrolyte leakage.	X		
M. Correct electrolyte levels.	X		
N. Specific gravity of electrolyte is within manufacturer's specification.	X		
O. Battery has adequate ventilation.	X		
P. Battery in-service date recorded or manufacturer's date code	Date:		
Q. Disconnection causes a trouble indication	X		

R. Indicate type of battery test performed.

i) Required supervisory load for 24 hr - followed by the required full load operation	X
ii) A silent test by using the load resistor method (Per ULC-S536 Appendix F1)	
iii) Silent accelerated test (Per ULC-S536 Appendix F2)	

Chubb Edwards
118 - 175 Street
Edmonton, AB
T5S 1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

SCHEDULE 'A' - MONITORING

Address of Monitored Property: [redacted]

Name of Monitored Property: [redacted]

Name of the Central Monitoring Station: ADT

Phone # of the Central Monitoring Station: 0

Name of responding CMS Operator: _____

Date of Test Call: _____ Time of Test Call: _____

Work Order Reference # _____

Type of monitored equipment:

Fire Alarm ☐ Fire Alarm & Sprinkler ☐ Sprinkler Only ☐

Events monitored:

Fire ☐ Supervisory ☐ Trouble ☐

Reason of Monitoring:

National Building Code ☐

Other (specify) ☐

Verification Agency: Chubb Edwards

Agency Address: _____

Date: _____

Technician: _____

Form based on requirements of Manitoba Building Code

Chubb Edwards
10118 - 175 Street
Edmonton, AB
T5S 1L1
Ph: 780 452-6411

Fire Alarm System Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

FIRE ALARM VERIFICATION REMARKS

DEFICIENCIES:

RECOMMENDATIONS:

NOTES:

Chubb Edwards
10118 - 175 Street
dmonton, AB
/5S 1L1
Ph: 780 452-6411

Fire Alarm System
Verification Report

Chubb EDWARDS
A UTC Fire & Security Company

We hope that you find this to your satisfaction and should you have any questions on this matter please contact our office at (780) 452-6411.

Appendix 11

Fire Alarm System

Certificate of Verification

Chubb EDWARDS

A UTC Fire & Security Company

22574

Certificate of Verification

THIS CERTIFIES that the Fire Alarm equipment

installed by Saskalta Electric

in accordance with the specifications prepared by Stebnicki & Partners

for [redacted]

located at [redacted]

was checked and inspected by a trained technician

Issued: February 3, 2012

in accordance with the conditions on the reverse.

All fire alarm systems must be properly maintained and subjected to periodic test and inspections under the applicable Fire Codes within your jurisdiction.

Branch Service Manager/Supervisor

UTC Fire & Security Canada

Vice President & General Manager
Chubb Edwards

Underwriters Laboratories

Corporate Headquarters
7 Underwriters Road
Toronto, ON M1R 3B4

Certificate Number
1131488 C

PROTECTIVE SIGNALLING SERVICE

This Certifies that the Alarm Company whose name appears below is Listed by Underwriters' Laboratories of Canada (ULC) and is authorized to install and monitor Protective Signalling Fire Alarm Systems in compliance with the requirements in CAN/ULC-S561 for Protective Signalling Systems.

The Alarm Company named on this certificate bears the responsibility for the correctness of the system installation, periodic testing, maintenance and repair as well as the keeping of records respecting these activities.

It is also the responsibility of the Alarm Company to confirm that the equipment used in this installation is ULC Labelled and is suitable for the application. All required service is provided for in the care contract between the Alarm Company and the Occupant.

Underwriters' Laboratories of Canada makes no representations or warranties, expressed or implied, that the alarm system will prevent any loss by fire, smoke, water damage or otherwise, or that the system will in all cases provide the protection for which it is installed or intended. This certificate is evidence that the signalling devices are monitored and maintained by a ULC Listed Monitoring Station and that the service is subject to countercheck field inspections by ULC Representatives. This certificate is to be posted at the Subscriber's site and is valid only with a current maintenance contract.

ULC is not an insurer and does not assume or undertake to discharge any liability of the Alarm Company or any other party for any loss, which may result from failure of the equipment, incorrect installation, non-conformity with requirements, cancellation of this certificate or withdrawal of the Alarm Company from Listing by ULC prior to the expiration date appearing on this certificate.

LISTED ALARM COMPANY	LOCATION
ADT SECURITY SERVICES CANADA, INC 16447 - 117 AVE	EDMONTON AB T5M 3V3

TYPE OF SYSTEM: Fire Panel	NUMBER OF SIGNAL SWITCHES							LOCAL F/A INTERCONNECTION
	ROOM TEMP	WATER FLOW	WATER LEVEL	PRESSURE	WATER TEMP.	CUT OFF VALVES	PUMP SUP.	
NUMBER OF RISERS: 0	0	0	0	0	0	0	0	YES

TRANSMISSION MODE	ISSUED (D M Y)	EXPIRES (D M Y)	MAXIMUM TERM
Active	10/02/2012	10/02/2017	5 Years

SUBSCRIBER

[redacted]
#N080110804
LLOYDMINSTER AB S9V 0Z8
[redacted]

MAINTENANCE
SYSTEM SHALL BE EXAMINED AND TESTED AT LEAST ONCE EACH YEAR

REPRESENTATIVE	DATE D	DATE M	DATE Y

Appendix 12

Uninterrupted Power Supply

Specifications and Test Report

PREVENTATIVE MAINTENANCE TEST REPORT

SO # 14953

prepared by: Bob Naletilich

verified by:

Computer Environment Solutions

9355 -45 Avenue

Edmonton, Alberta, Canada

T6E 5Z7

Ph. 780-436-6059

Fax. 780-436-4332

Web. www.ces.ca

for

UPS System & Serial Number:

Mitsubishi UPS 9900A 100kVA (10-7M73284-04)

Contact:

Phone #: -3754

Fax:

Email address: __

Mailing address.

Load Summary:

Phase A		Phase C	
Actual Current (Amps)--	15.0A	Actual Current (Amps)--	15.0A
Maximum Current (Amps)--	120.0A	Maximum Current (Amps)--	120.0A
Percent Current (%)--	12.5%	Percent Current (%)--	12.5%
Phase B		**System Load**	
Actual Current (Amps)--	16.0A	**Actual Load (kW)--**	**12.0kW**
Maximum Current (Amps)--	120.0A	**Maximum Load (kW)--**	**90kW**
Percent Current (%)--	13.3%	**Percent Load (%)--**	**13.3%**

Battery Summary:

*Actual Load Runtime (min)--	193	*Full Load Runtime (min)--	15
No. of battery operation:--	58	System on battery (min)	9

*Estimated

Summary of Notes:

Battery Notes: The Batteries are starting to get weak
UPS Notes: Load is 13.3%

Tuesday, February 09, 2016

PREVENTATIVE MAINTENANCE TEST REPORT

Site Checklist

All points marked:	Good	No-Good	N/A

Cleaning	Result	Comments
Air Filter	Good	
Electric Components	Good	
Covers	Good	

Parts Replacement	Result	Comments
Cooling Fan	Good	
Electrolytic Capacitors	Good	
AC Filter Capacitors	Good	
Control Power Supply Unit	Good	

Visual Inspection	Result	Comments
Capacitor Leakage	Good	
Component Damage	Good	
Unusual Sounds	Good	
Unusual Smell	Good	
Corrosion or Rust	Good	

Electrical Check	Result	Comments
Input Voltage Check	Good	
Control Power Supply Unit	Good	
Test Mode Operation	N/A	
Control Firmware	Good	
Converter and Inverter Op.	Good	
Transfer Test	N/A	
AC Failure / Batt. Op.	N/A	
Remote Alarm	N/A	

Thermal Check	Result	Comments
Infrared Scan	N/A	

Battery Check	Result	Comments
Midtronics Test	Good	

Power Quality	Result	Comments
Harmonic Analysis	N/A	

Firmware versions	C:RK6MR0		L:RK6NJ0

PREVENTATIVE MAINTENANCE TEST REPORT

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Serial Number:

Mitsubishi UPS 9900A 100kVA (10-7M73284-04)

Battery Information:

String ID:	**A**
Manufacturer:	C&D
Model:	UPS12-210MR
Type:	VRLA
Amps / Hour:	53.8
Date Code:	2011/12
Reference Value:	1250
Temp. (Celsius):	22
Date:	2/9/2016
Time:	10:30

Performance and Capacity

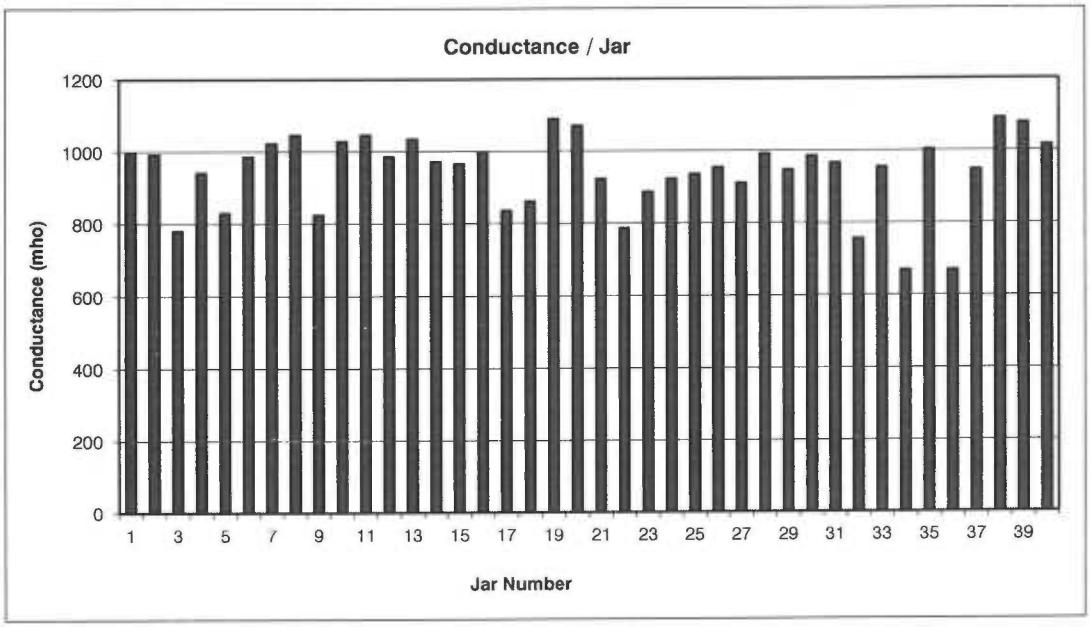
% of Ref. Value	
>=60%	Passed
<60%	Failed
Volts/Jar	
>=13 volts	Passed
<13 volts	Failed*
Floating voltage (Volts)	
Test performed ON\OFF line	

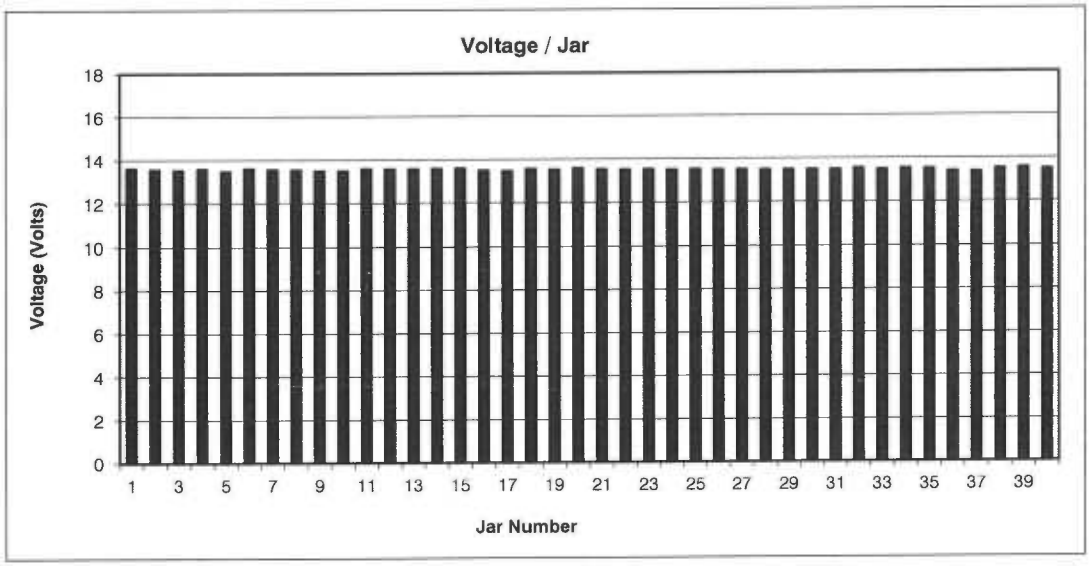
Jar No.	Volts/Jar	Conductance	% of Ref. Value	
1	13.615	997	81%	*Pass*
2	13.555	991	81%	*Pass*
3	13.522	780	64%	*Pass*
4	13.584	941	77%	*Pass*
5	13.465	830	68%	*Pass*
6	13.593	985	80%	*Pass*
7	13.556	1022	83%	*Pass*
8	13.539	1046	85%	*Pass*
9	13.495	824	67%	*Pass*
10	13.495	1028	84%	*Pass*
11	13.572	1046	85%	*Pass*
12	13.562	985	80%	*Pass*
13	13.558	1034	84%	*Pass*
14	13.573	972	79%	*Pass*
15	13.586	966	79%	*Pass*
16	13.496	997	81%	*Pass*
17	13.47	836	68%	*Pass*
18	13.556	861	70%	*Pass*
19	13.52	1090	89%	*Pass*
20	13.575	1071	87%	*Pass*
21	13.528	923	75%	*Pass*
22	13.501	787	64%	*Pass*
23	13.516	886	72%	*Pass*
24	13.489	923	75%	*Pass*
25	13.503	935	76%	*Pass*
26	13.488	954	78%	*Pass*
27	13.489	910	74%	*Pass*
28	13.474	991	81%	*Pass*
29	13.481	947	77%	*Pass*
30	13.482	985	80%	*Pass*

PREVENTATIVE MAINTENANCE TEST REPORT

Jar No.	Volts/Jar	Conductance	% of Ref. Value	
31	13.477	966	79%	*Pass*
32	13.533	756	62%	*Pass*
33	13.475	954	78%	*Pass*
34	13.52	669	55%	*Pass*
35	13.513	1003	82%	*Pass*
36	13.392	669	55%	*Pass*
37	13.367	947	77%	*Pass*
38	13.505	1090	89%	*Pass*
39	13.545	1077	88%	*Pass*
40	13.483	1015	83%	*Pass*

Graphed Results:





PREVENTATIVE MAINTENANCE TEST REPORT

Battery Information:

String ID:	**B**
Manufacturer:	C&D
Model:	UPS12-210MR
Type:	VRLA
Amps / Hour:	53.8
Date Code:	2011/12
Reference Value:	1250
Temp. (Celsius):	22
Date:	2/9/2016
Time:	11:15

Performance and Capacity

% of Ref. Value	
>=60%	Passed
<60%	Failed

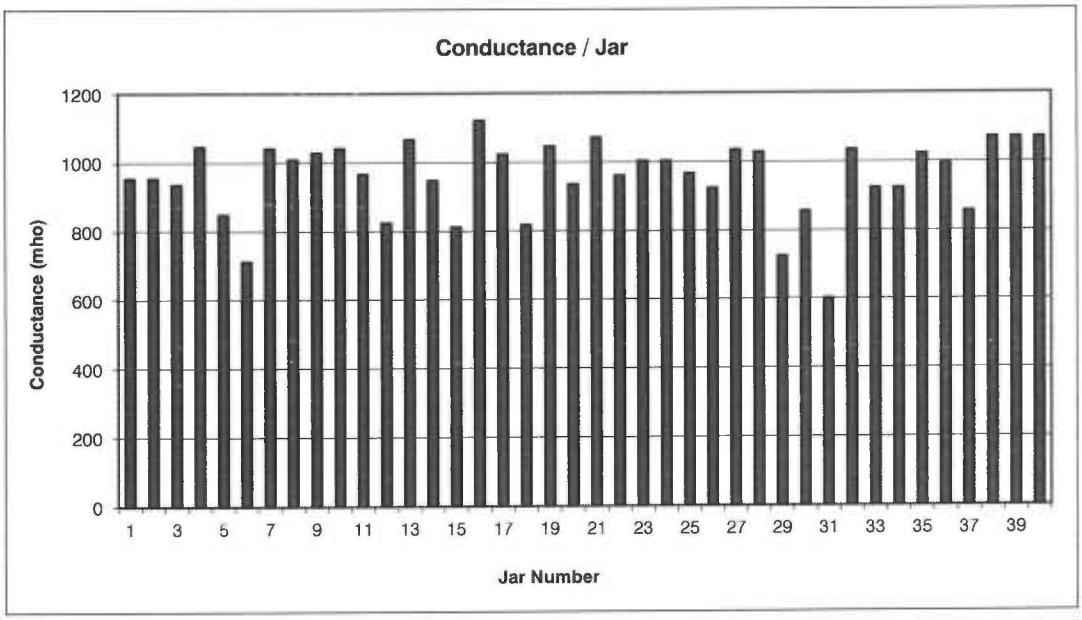
Volts/Jar	
>=13 volts	Passed
<13 volts	Failed*
Floating voltage (Volts)	
Test performed ON\OFF line	

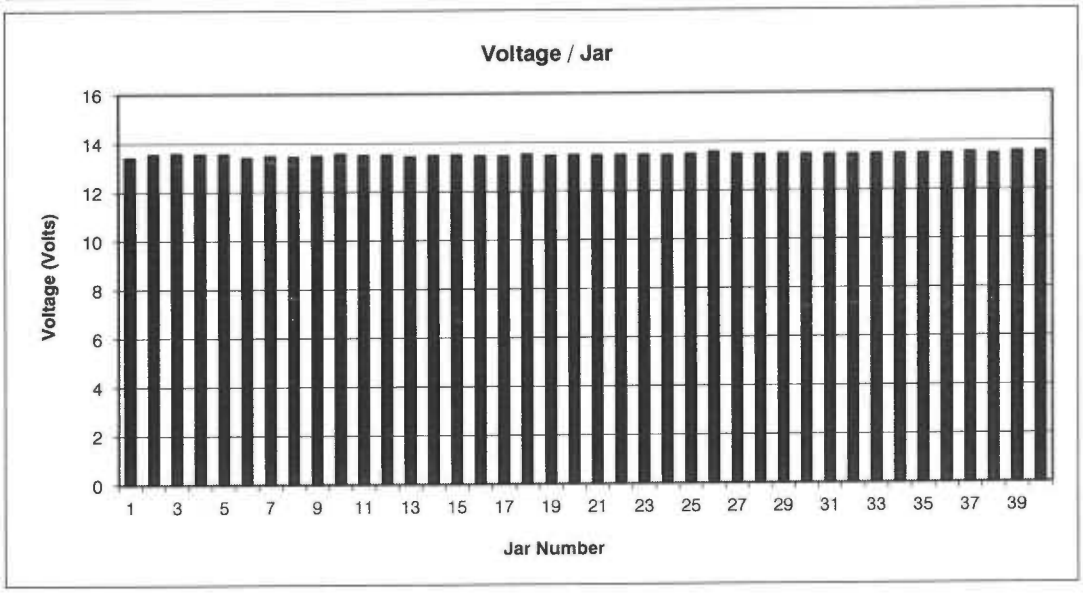
Jar No.	Volts/Jar	Conductance	% of Ref. Value	
1	13.404	954	78%	*Pass*
2	13.531	954	78%	*Pass*
3	13.571	935	76%	*Pass*
4	13.537	1046	85%	*Pass*
5	13.538	848	69%	*Pass*
6	13.406	712	58%	*Pass*
7	13.463	1040	85%	*Pass*
8	13.428	1009	82%	*Pass*
9	13.459	1028	84%	*Pass*
10	13.539	1040	85%	*Pass*
11	13.485	966	79%	*Pass*
12	13.497	824	67%	*Pass*
13	13.431	1065	87%	*Pass*
14	13.483	947	77%	*Pass*
15	13.491	811	66%	*Pass*
16	13.452	1121	92%	*Pass*
17	13.44	1022	83%	*Pass*
18	13.508	818	67%	*Pass*
19	13.448	1046	85%	*Pass*
20	13.471	935	76%	*Pass*
21	13.465	1071	87%	*Pass*
22	13.465	960	78%	*Pass*
23	13.464	1003	82%	*Pass*
24	13.457	1003	82%	*Pass*
25	13.493	966	79%	*Pass*
26	13.573	923	75%	*Pass*
27	13.478	1034	84%	*Pass*
28	13.465	1028	84%	*Pass*
29	13.484	725	59%	*Pass*
30	13.472	855	70%	*Pass*

PREVENTATIVE MAINTENANCE TEST REPORT

Jar No.	Volts/Jar	Conductance	% of Ref. Value	
31	13.464	601	49%	*Pass*
32	13.464	1034	84%	*Pass*
33	13.48	923	75%	*Pass*
34	13.477	923	75%	*Pass*
35	13.471	1022	83%	*Pass*
36	13.482	997	81%	*Pass*
37	13.534	855	70%	*Pass*
38	13.465	1071	87%	*Pass*
39	13.548	1071	87%	*Pass*
40	13.538	1071	87%	*Pass*

Graphed Results:





Appendix 13

Water Supply at Base of Riser

Pressure at the Point of Connection (POC) working back from the test hydrant

Pressure at POC = 63 + 0.97 + 0.14 = 64.1 psi

Pressure Loss (psi) = 0.97			
Pipe Schedule	40		
Pipe Material	PVC		
Nominal Size	12 inch		
Inside Diameter	11.938 inch		
Flow Rate	1835 gpm		
Length	336 ft		
Fittings	Number		
Long Radius Elbow (90°)	2		
Reducer	1	Outlet Size	8 inch

Pressure Loss (psi) = 0.14	
Pipe Schedule	40
Pipe Material	PVC
Nominal Size	8 inch
Inside Diameter	7.981 inch
Flow Rate	1835 gpm
Length	8 ft

Pressure at the Base of Riser (BOC) working forward from the Point of Connection

Pressure at BOC = 64.1 – 1.3 – 7.6 = 55.2 psi

Pressure Loss (psi) = 1.3			
Pipe Schedule	40		
Pipe Material	PVC		
Nominal Size	12 inch		
Inside Diameter	11.938 inch		
Flow Rate	1835 gpm		
Length	400 ft		
Fittings	Number		
Long Radius Elbow (90°)	1		
Reducer	1	Outlet Size	6 inch

Pressure Loss (psi) = 7.6	
Pipe Schedule	40
Pipe Material	PVC
Nominal Size	6 inch
Inside Diameter	6.065 inch
Flow Rate	1835 gpm
Length	111 ft

Appendix 14

Schedule 40 Black Iron Piping Specifications

http://www.nationalfire.com/media/product_files/SCH10-40.pdf

Appendix 15

Sprinkler Valve Summary

	Valve	Tag	Size (in)	Status	Type	Model
Basement	Backflow Contorl Valve - Supply	1001	6	Normally Open	Grooved Butterfly	Victaulic 705
	Backflow Contorl Valve - Discharge	1002	6	Normally Open	Grooved Butterfly	Victaulic 705
	Backflow Preventer	1003	6	n/a	DCVA	Watts 757
	Main Riser Module	1004	6	n/a	Riser Module	Victaulic 747M
	North Standpipe Shuotoff	1005	6	Normally Open	Grooved Butterfly	Victaulic 705
	South Standpipe Shutoff	1006	6	Normally Open	Grooved Butterfly	Victaulic 705
Basement	Basement Zone Control Valve	1007	4	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Check Valve	1008	4	n/a	Grooved Swing Check	Victaulic 717
	Basement Riser Module	1009	4	n/a	Riser Module	Victaulic 747M
Main Floor	Main Floor Zone Control Valve	1010	3	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Cehck Valve	1011	3	n/a	Grooved Swing Check	Victaulic 717
	Main Floor Riser Module	1012	3	n/a	Riser Module	Victaulic 747M
	Main Floor Standpipe Shutoff	1013	4	Normally Open	Grooved Butterfly	Victaulic 705
	RPZ Gate Valve Supply	1014	3	Normally Open	Flanged OS&Y	
	RPZ Gate Valve Discharge	1015	3	Normally Open	Flanged OS&Y	
	Reduced Pressure Zone Assembly	1016	3	n/a	Reduced Pressure Backflow Preventer	Watts 009
Second Floor	Second Floor Zone Control Valve	1017	3	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Check Valve	1018	3	n/a	Grooved Swing Check	Victaulic 717
	Second Floor Riser Module	1019	3	n/a	Riser Module	Victaulic 747M
Third Floor	Third Floor Zone Control Valve	1020	3	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Check Valve	1021	3	n/a	Grooved Swing Check	Victaulic 717
	Third Floor Riser Module	1022	3	n/a	Riser Module	Victaulic 747M
	Glazing Zone Control Valve	1023	2	Normally Open	Grooved Butterfly	Victaulic 705W
	Glazing Check Valve	1024	2	n/a	Grooved Swing Check	Victaulic 717
	Glazing Riser Module	1025	2	n/a	Riser Module	Victaulic 747M
Penthouse	East Zone Control Valve	1026	4	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Check Valve	1027	4	n/a	Grooved Swing Check	Victaulic 717
	East Floor Riser Module	1028	4	n/a	Riser Module	Victaulic 747M
	West Zone Control Valve	1029	4	Normally Open	Grooved Butterfly	Victaulic 705
	Zone Check Valve	1030	4	n/a	Grooved Swing Check	Victaulic 717
	West Floor Riser Module	1031	4	n/a	Riser Module	Victaulic 747M

Appendix 16

FireLock Butterfly Valve

Technical Specifications

http://static.victaulic.com/assets/uploads/literature/10.81.pdf

Appendix 17

FireLock Check Valve

Technical Specifications

http://static.victaulic.com/assets/uploads/literature/10.08.pdf

Appendix 18

FireLock Zone Control Riser Module

Technical Specifications

http://static.victaulic.com/assets/uploads/literature/10.96.pdf

Appendix 19

Double Check Valve

Technical Specifications

http://www.amesfirewater.com/Products/C200_C200N

Appendix 20

OSY Valve

Technical Specifications

http://content.zurn.com/web_documents/pdfs/specsheets/BF-350A.pdf

Appendix 21

Butterfly Valve

Technical Specifications

http://static.victaulic.com/assets/uploads/literature/10.81.pdf

Appendix 22

Vane Type Waterflow Alarm Switch

Technical Specifications

http://www.pottersignal.com/product/data sheet/5401146_VSR.pdf

Appendix 23

Pre-action Double Interlocked Cabinet

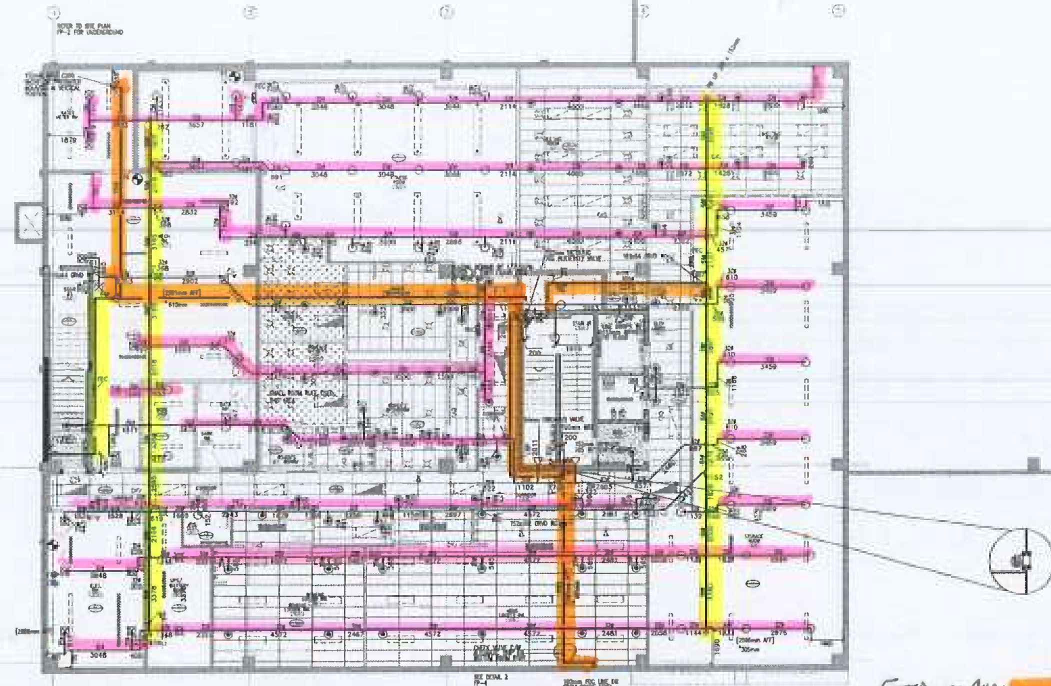
Technical Specifications

http://www.fireflex.com/datas/pdf/Anglais/TP2/Datasheet/T2%20SUREFIRE.pdf

Appendix 24

Building Sprinkler Drawings

Plan and Elevation Views



1 BASEMENT SYSTEM
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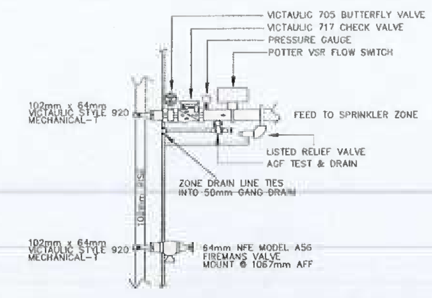
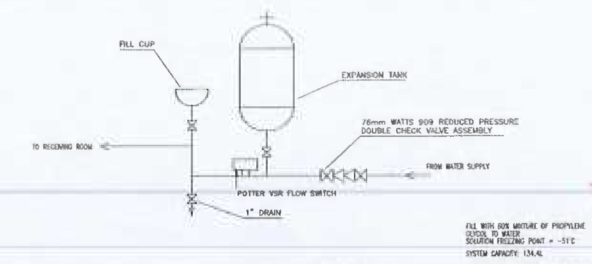
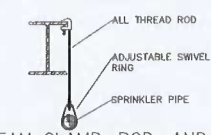


3 FLOOR CONTROL MANIFOLD
Scale: NTS

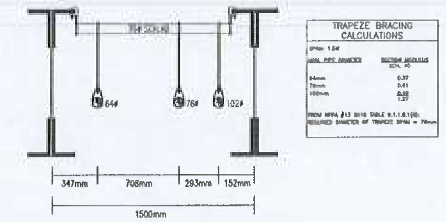


4 GLYCOL LOOP
Scale: NTS

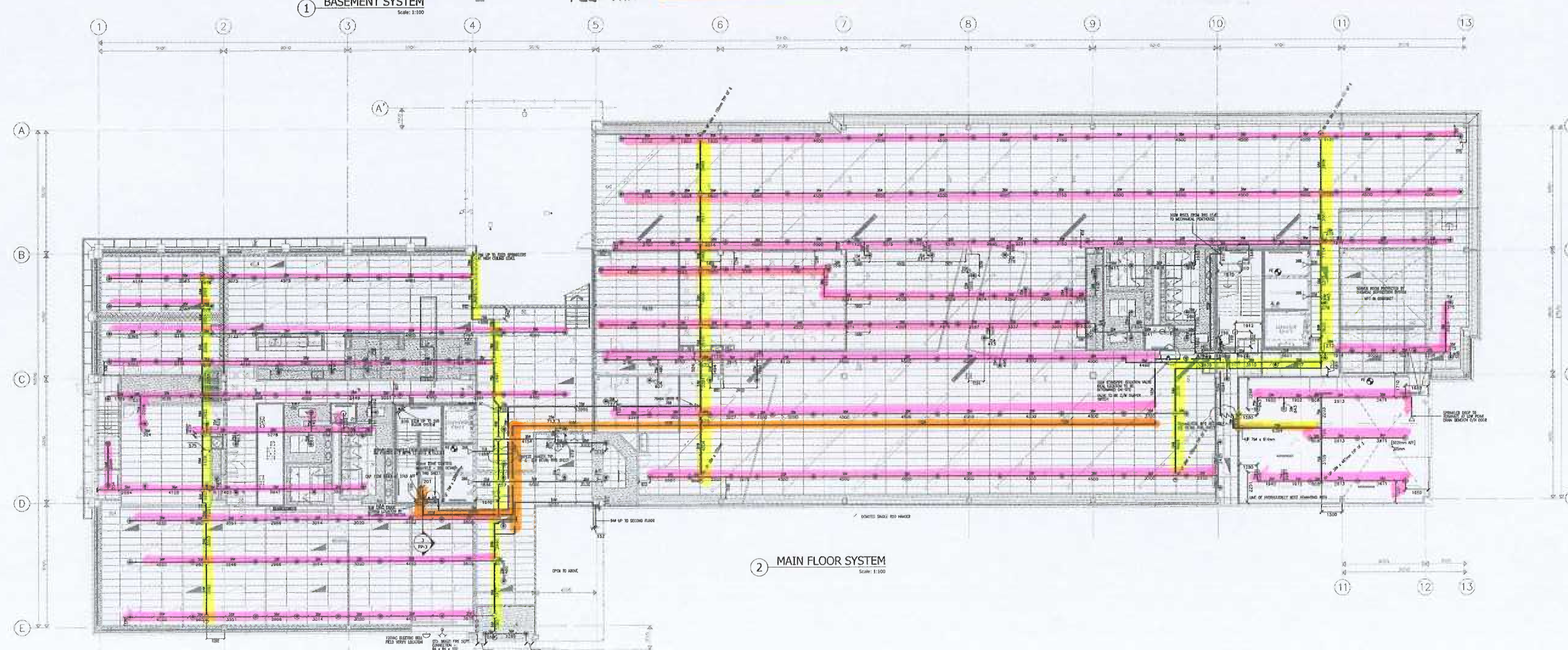


TOP BEAM CLAMP, ROD, AND RING
CLAMP & ALLTHREAD ROD SIZES
- 1" TO 4" PIPE USE 3/8" MATERIAL
- 5" TO 8" PIPE USE 1/2" MATERIAL
- 10 " PIPE USE 5/8" MATERIAL

5 TYPICAL SINGLE ROD HANGER
Scale: NTS



6 TRAPEZE HANGER
Scale: NTS



2 MAIN FLOOR SYSTEM
Scale: 1:100

VANDERSTELT FIRE PROTECTION LTD.

BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH.40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 DOMESTIC BLACK STEEL

REQUIRED SERVICES

	VFP	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE EXTINGUISHERS	X	
PIPING ENCLOSURES/BULKHEADS		X

SPRINKLER LEGEND

SYM.	TEMP.	MANUFACTURER	MODEL	#	DESCRIPTION	K	ORIF.	S.I.N
○	155°	VICTAULIC	V-2703	45	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	286°	VICTAULIC	V-2703	23	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
	155°	VICTAULIC	V-3401	13	LARGE ORIFICE BRASS UPRIGHT	8.0	19mm	
◉	155°	VICTAULIC	V-2708	279	QUICK RESPONSE CHROME PENDANT	5.6	12mm	
△	155°	VICTAULIC	V-2709	3	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	
△	200°	VICTAULIC	V-2709	1	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	
△	286°	VICTAULIC	V-2709	4	STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 368
TOTAL SPRINKLERS THIS PROJECT: 885

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	22.SEPT.10
01	SF	REVISED FOR INTERIOR FIT-UP	29.APR.11

CONTRACTED BY: BOTHING ASSOCIATES, LTD.

PROFESSIONAL SEAL:

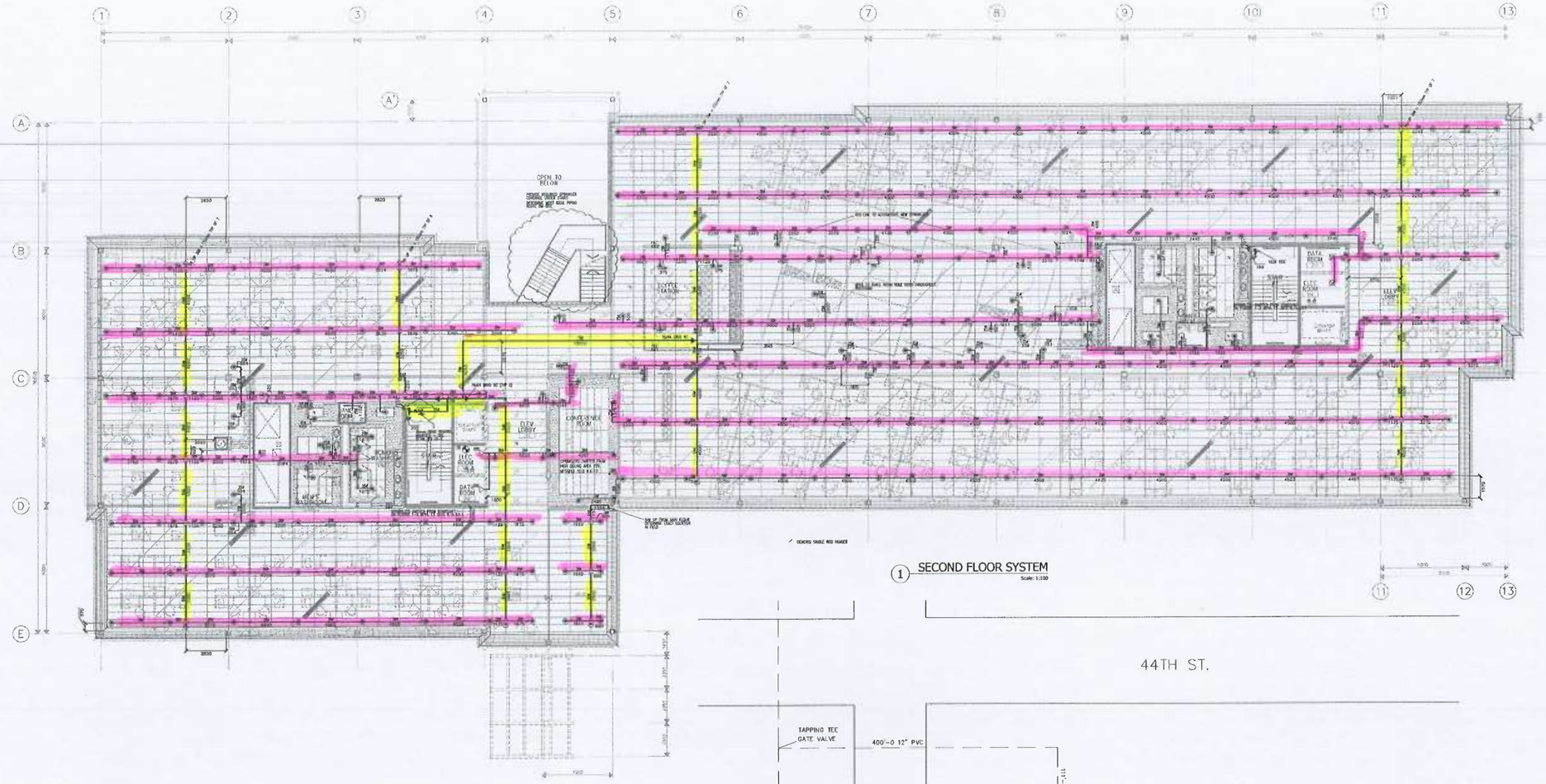
PROJECT NORTH

PROJECT:
XXXXX
XXXXXXX

DESCRIPTION:
BASEMENT SPRINKLER PLAN
MAIN FLOOR SPRINKLER PLAN

DISCLAIMER

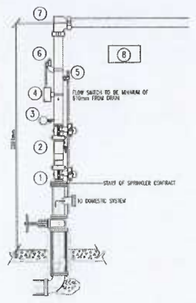
DRAWN BY: SF
CHECKED BY: TV
DATE: 05 AUG 2010
CONT #: 1116
DWG #: FP 1
SCALE: AS NOTED
SHEET NO: 1 OF 4



1 SECOND FLOOR SYSTEM
Scale: 1:100

2 SITE PLAN
Scale: NTS

NOTES:
SITE PLAN FOR HYDRAULIC REFERENCE ONLY
VANDERSTELT FIRE PROTECTION'S CONTRACT STARTS AT DOMESTIC CONNECTION INSIDE MECHANICAL ROOM AS SHOWN ON PLANS



RISER BILL OF MATERIAL

1.) 152mm VIC FLANGE
2.) 152mm COLT C200 BACKFLOW PREVENTER
3.) 300PSI AIR/WATER GAUGE
4.) 152mm POTTER VSR FLOW SWITCH
5.) 50mm ACF TEST & DRAIN
6.) 12mm LISTED RELIEF VALVE
7.) 152mm VIC 90
8.) 12 HEAD SPARE SPRINKLER CABINET

3 MAIN RISER
Scale: NTS

VANDERSTELT FIRE PROTECTION LTD.
BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH. 40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 BLACK STEEL

REQUIRED SERVICES

	VFP	STEEL
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE EXTINGUISHERS	X	
PIPING EXCLUDING RISER/SUPPLY		X

SPRINKLER LEGEND

SYM	TEMP.	MANUFACTURER	MODEL #	DESCRIPTION	K	ORIF.	S.I.N.
⊗	155°	VICTAULIC	V-2708	QUICK RESPONSE CHROME PENDANT	5.6	12mm	
○	155°	VICTAULIC	V-2703	1 STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
⊗	286°	VICTAULIC	V-2703	2 STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
⊼	286°	VICTAULIC	V-2704	2 STANDARD RESPONSE CHROME SIDEWALL	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 215
TOTAL SPRINKLERS THIS PROJECT: 685

No.	BY	REVISIONS	DD/MM/YY
01	SF	PERMIT FOR APPROVAL	22 SEPT 10
02	SF	REVISED FOR INTERIOR FIT-UP	29 APR 11

CONTRACTED BY:
BOTTING & ASSOCIATES, LTD.

PROFESSIONAL SEAL

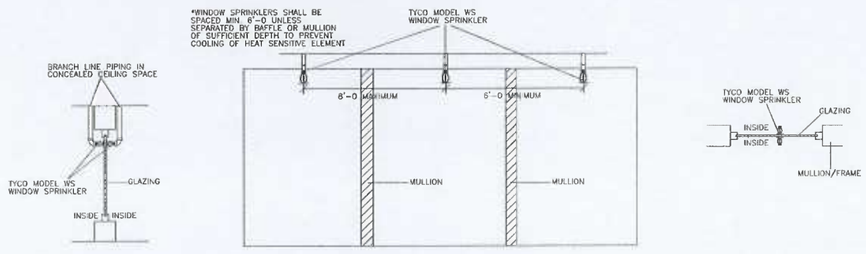
PROJECT NORTH

PROJECT
HUSKY ENERGY
MAIN OFFICE BUILDING
4702-44TH AVENUE
LLOYDMINSTER, SASKATCHEWAN

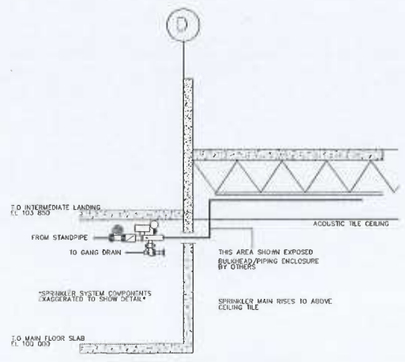
DESCRIPTION
SECOND FLOOR SPRINKLER PLAN

DRAWN BY: SF
CHECKED BY: TV
DATE: 25 AUG 2010
CONT. # 1116
DWG # FP-2
SCALE: AS NOTED
SHEET NO. 2 OF 4

1 THIRD FLOOR SYSTEM
Scale: 1:100



2 GLAZING PROTECTION
Scale: NTS



3 SECTION AT MAIN FLOOR WEST STAIR CORE
Scale: NTS

VANDERSTELT FIRE PROTECTION LTD.

BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH. 40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 BLACK STEEL

REQUIRED SERVICES

	YES	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE	X	
FIRE EXTINGUISHERS		X
PIPING ENCLOSURES / BULKHEADS		X

SPRINKLER LEGEND

SYM.	TEMP.	MANUFACTURER	MODEL #	DESCRIPTION	K	ORIF.	S.I.N
●	155°	VICTAULIC	V-2708.2	QUICK RESPONSE, CHROME, PENDANT	5.6	12mm	
○	155°	VICTAULIC	V-2703.2	STANDARD RESPONSE, BRASS, UPRIGHT	5.6	12mm	
⊗	286°	VICTAULIC	V-2703.2	STANDARD RESPONSE, BRASS, UPRIGHT	5.6	12mm	
△SW	200°	VICTAULIC	V-2709.2	STANDARD RESPONSE, CHROME, SIDEWALL	5.6	12mm	
△SW	286°	VICTAULIC	V-2709.2	STANDARD RESPONSE, CHROME, SIDEWALL	5.6	12mm	
△W	155°	TYCO	WS	WINDOW SPRINKLER	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 255
TOTAL SPRINKLERS THIS PROJECT: 885

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	22 SEPT 10
01	SF	REVISED FOR INTERIOR TIT-UP	29 APR 11

CONTRACTED BY:
BOTTING ASSOCIATES, LTD.

PROFESSIONAL SEAL:

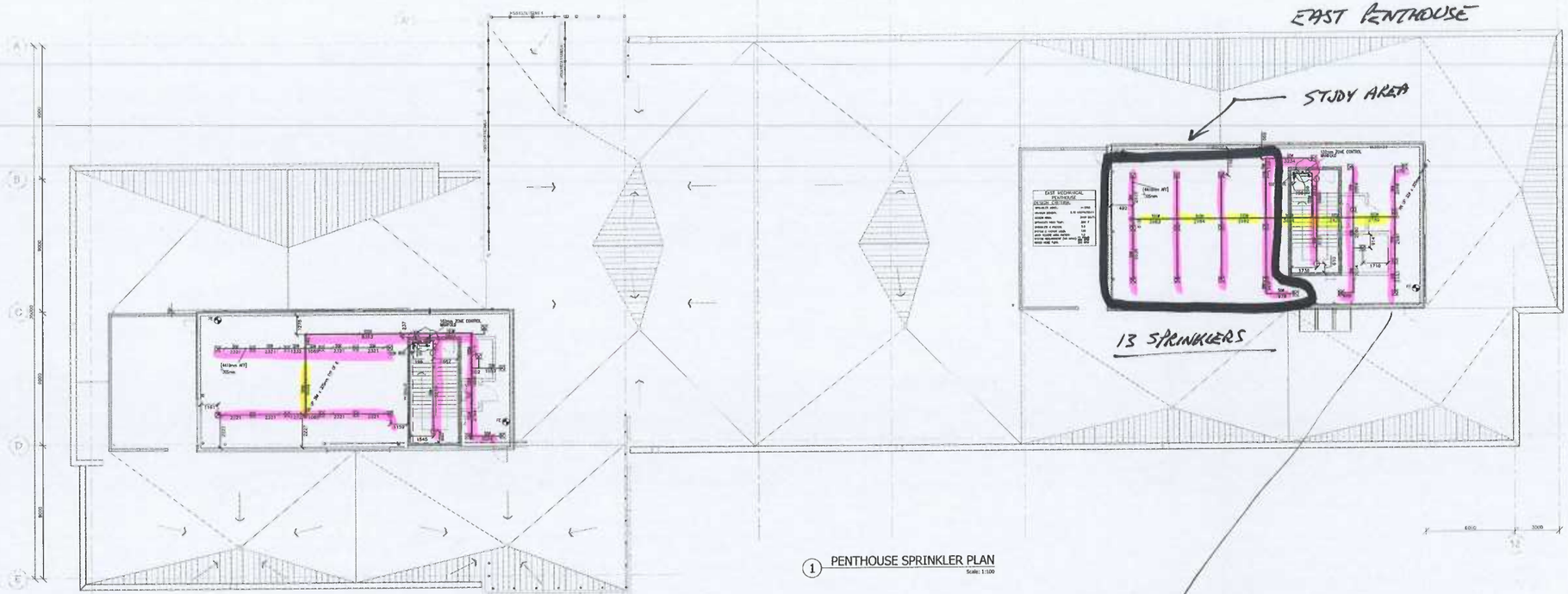
PROJECT NORTH

PROJECT:
HUSKY ENERGY
MAIN OFFICE BUILDING
XXXXXXXXX
XXXXXXXXX

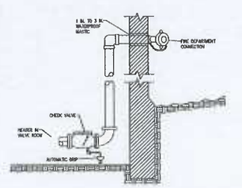
DESCRIPTION:
THIRD FLOOR SPRINKLER PLAN

DISCLAIMER
1.) NO DRAWING IS THE CONSTRUCTING FACILITY' AND/OR CONSTRUCTION MANAGER'S RESPONSIBILITY. DRAWINGS ARE NOT TO BE SCALED. REFER TO DIMENSIONS ONLY.
2.) NO DRAWING SHALL BE USED FOR CONSTRUCTION UNLESS SIGNED AND DATED BY THE CONSULTANT.

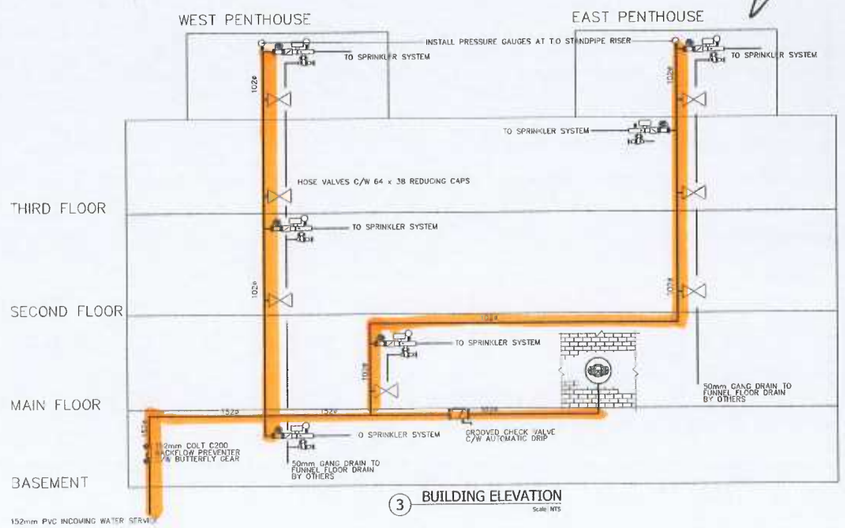
DRAWN BY: SF
CHECKED BY: TV
DATE: 25 AUG 2010
CONT. #: 1116
DWG #: FP-3
SCALE: AS NOTED
SHEET NO: 3 OF 4



1 PENTHOUSE SPRINKLER PLAN
Scale: 1:100



2 FIRE DEPARTMENT CONNECTION
Scale: NTS



3 BUILDING ELEVATION
Scale: NTS

STANDPIPE GENERAL NOTES:

STANDPIPES TO BE LOCATED IN STAIRWELLS AS SHOWN ON PLANS

HOSE VALVES TO BE 2 1/2" CLASS 1, THREADS OF TYPE TO SUIT LOCAL FIRE DEPARTMENT REQUIREMENTS

TEST LOCATION TO BE 2 1/2" HOSE VALVE LOCATED IN MECHANICAL PENTHOUSES

ALL STANDPIPE MAINS AND LINES TO BE DOMESTIC BLACK SCHEDULE 40

MAIN FIRE DEPARTMENT CONNECTION TO SERVE SPRINKLER SYSTEM AND STANDPIPE

ISOLATION VALVES TO BE LOCATED AT BASE OF STANDPIPE RISERS

STANDPIPE CLASSIFIED AS "MANUAL WET", THEREFORE NOT REQUIRED TO MEET NFPA 14 2007 500 GPM @ 100 PSIg STIPULATION, AS PER 2005 EDITION NBC

VANDERSTELT FIRE PROTECTION LTD.
BOX 130
VONDA, SK
S0K 4N0
PH: (306) 258-2290
FAX: (306) 258-2291

NOTES

1.) OWNER RESPONSIBLE FOR MAINTAINING BUILDING TEMPERATURE AT ADEQUETE LEVEL FOR WET PIPE SPRINKLER SYSTEM
2.) NO MATERIAL OTHER THAN THAT INSTALLED BY VANDERSTELT FIRE PROTECTION, LTD. SHALL BE SUPPORTED FROM SPRINKLER PIPING AND COMPONENTS AT ANY TIME
3.) SPRINKLER SYSTEM IS DESIGNED IN CONFORMANCE WITH NFPA #13 2010 EDITION
4.) TAMPER PROOF SWITCHES SHALL BE LOCATED ON ALL SYSTEM CONTROL VALVES
5.) ALL SYSTEM CONTROL VALVES TO BE SUPERVISED OPEN
6.) SYSTEM SHALL BE PRESSURE TESTED UPON COMPLETION PER NFPA #13 2010 REQUIREMENTS
7.) FIRE DEPARTMENT CONNECTION OUTLETS TO BE WESTERN CANADA THREAD PATTERN
8.) MAINS AND BRANCHLINES TO BE SCH.40 DOMESTIC BLACK STEEL
9.) DROPS AND ARM-OVERS TO BE 1" SCH. 40 DOMESTIC BLACK STEEL

REQUIRED SERVICES

	VFF	OTHERS
ELECTRICAL / WIRING		X
INCOMING WATER SERVICE		X
FIRE EXTINGUISHERS	Y	
PIPING ENCLOSURE / BULKHEADS		X

SPRINKLER LEGEND

SYM	TEMP	MANUFACTURER	MODEL #	DESCRIPTION	K	ORIF.	S.I.N.
O	155°	VICTAULIC	V-2701 4	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	
⊠	155°	VICTAULIC	V-2703 40	STANDARD RESPONSE BRASS UPRIGHT	5.6	12mm	

TOTAL SPRINKLERS THIS SHEET: 44
TOTAL SPRINKLERS THIS PROJECT: 888

No.	BY	REVISIONS	DD/MM/YY
00	SF	ISSUED FOR APPROVAL	24 SEP 10
01	SF	REVISED FOR INTERIOR FIT-UP	7 APR 11

CONTRACTED BY:
BOTTING ASSOCIATES, LTD.

PROFESSIONAL SEAL:

PROJECT:
XXXXXXX
1429 14th ST.
XXXXXXX, SASKATCHEWAN

DESCRIPTION:
PENTHOUSE SPRINKLER PLAN

PROJECT NORTH

DISCLAIMER

DRAWN BY: SF
CHECKED BY: TV
DATE: 25 AUG 2010
CONT. /
DWG # FP-4
SCALE: AS NOTED
SHEET No. 4 OF 4

Notes:
Verify all dimensions, elevations, and datum, report any errors and/ or discrepancies to the architect prior to construction

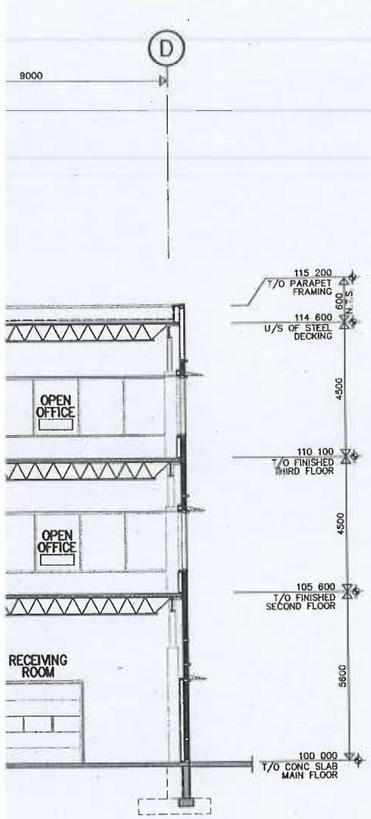
All drawings remain the property of the architect

The design and drawing may not be reproduced without the permission of the architect

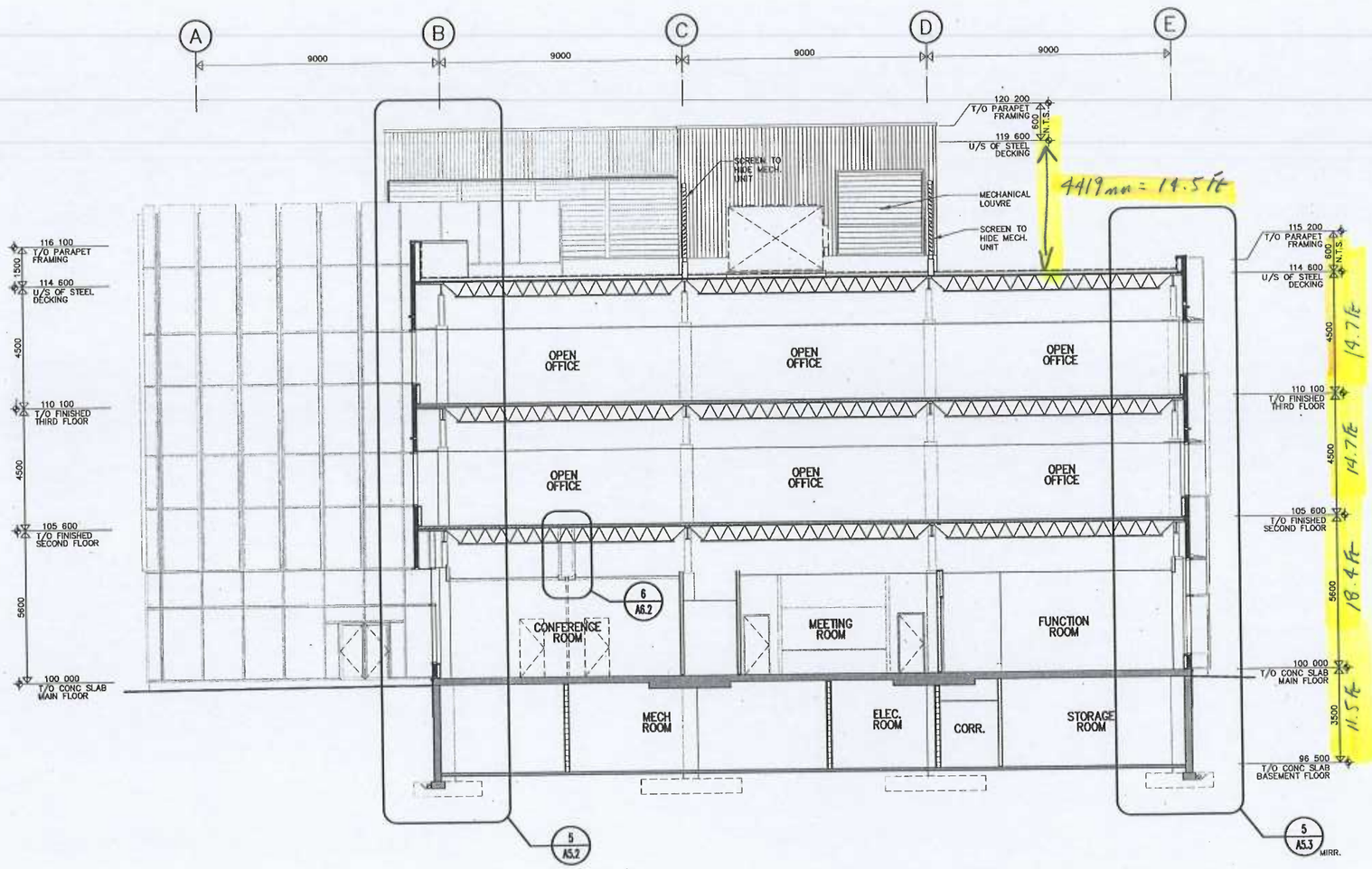
Do not scale Drawings.

This drawing supersedes previous issues.

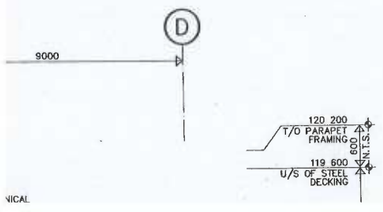
Notes:

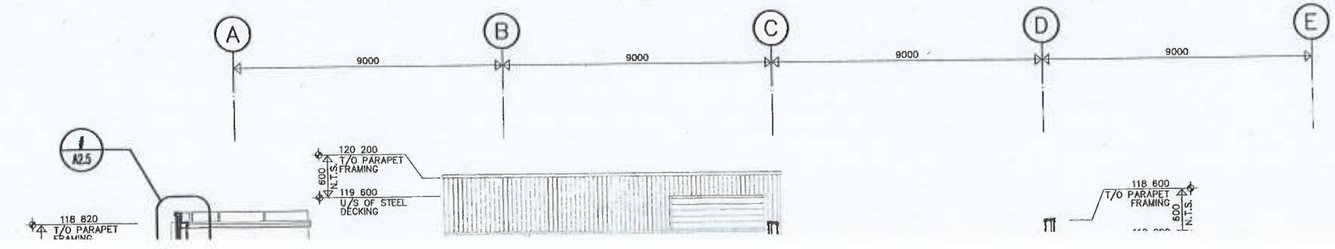


3 A5.1 BUILDING SECTION
1:100
501-100



1 A5.1 BUILDING SECTION
1:100
501-100





XXXXXXXXXXXXXXXXXX

No.	Description	Date (YY-MM-DD)

DRAIN

WEST PENTHOUSE

EAST PENTHOUSE

INSTALL PRESSURE GAUGES AT T.O STANDPIPE RISER

TO SPRINKLER SYSTEM

102ø

to sprinkler at ATRIUM glazing.

TO SPRINKLER SYSTEM

4419

4500

HOSE VALVES C/W 64 x 38 REDUCING CAPS

THIRD FLOOR

TO SPRINKLER SYSTEM

4"

102ø

TOTAL ELEVATION CHANGE: 22,512mm

SECOND FLOOR

102ø

TO SPRINKLER SYSTEM

4"

102ø

up To

5600 mm

50mm GANG DRAIN TO FUNNEL FLOOR DRAIN BY OTHERS

MAIN FLOOR

152ø

6"

152ø

102ø

4"

152ø

152mm COLT C200 BACKFLOW PREVENTER C/W BUTTERFLY GEAR

TO SPRINKLER SYSTEM

up To second floor

GROOVED CHECK VALVE C/W AUTOMATIC DRIP

BASEMENT ZONE

3500

50mm GANG DRAIN TO FUNNEL FLOOR DRAIN BY OTHERS

EAST BASEMENT STAIRWELL

BASEMENT

152mm PVC INCOMING WATER SERVICE

3 BUILDING ELEVATION

Scale: NTS

Appendix 25

Sprinkler - Victaulic Model V2703/V2708

Technical Specifications

http://www.victaulic.com/en/products-services/products/k56-firelock-model-v2703-standard-response-upright/

Appendix 26

Sprinkler - Victaulic Model V3401

Technical Specifications

http://www.victaulic.com/en/search/?keyword=V3401

Appendix 27

Sprinkler - Victaulic Model 2709

Technical Specifications

http://www.victaulic.com/en/products-services/products/k56-firelock-model-v2709-standard-response-horizontal-recessed-horizontal-/

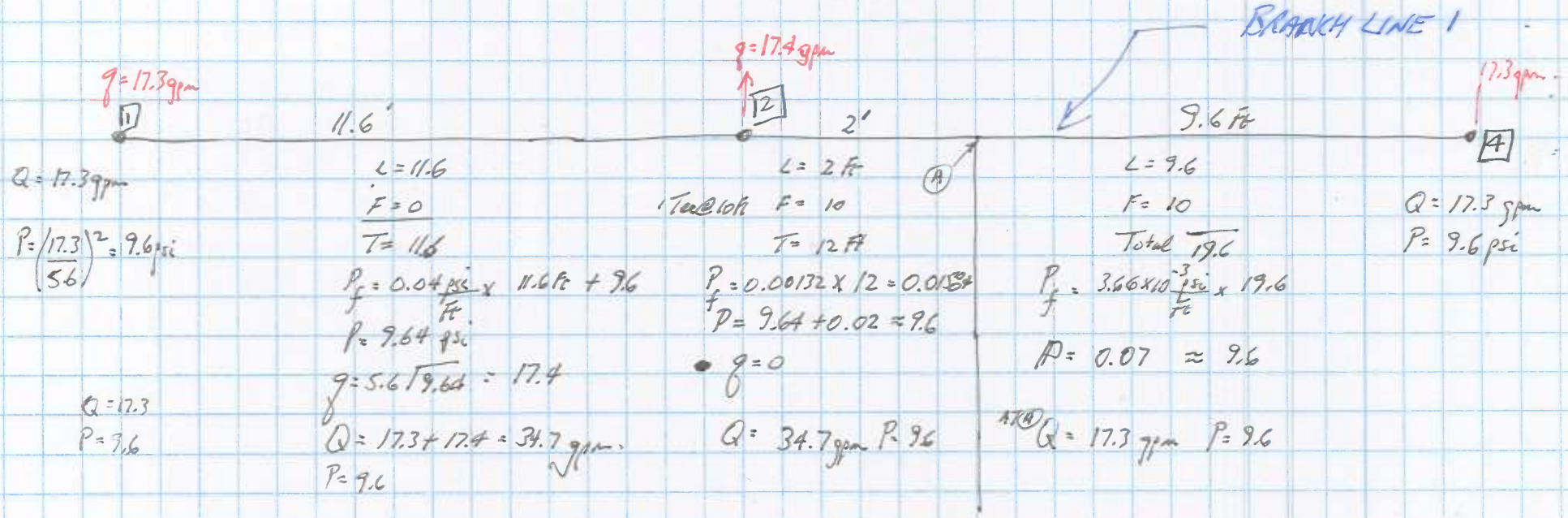
Appendix 28

Hydraulic Analysis

Project name: Project Building

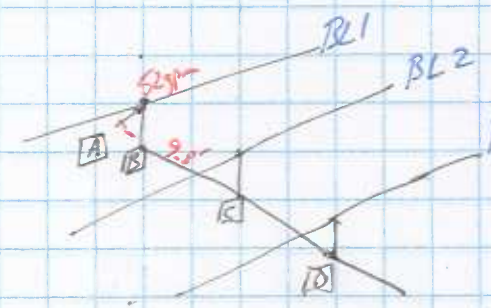
Date: March 19, 2015

Step No.	Nozzle Ident and Location	Flow in gpm		Pipe size	Pipe Fittings and Devices	Equivalent Pipe Length		Friction loss (psi/ft)		Pressure Summary		Notes	
		q		2"		L	0.0	C=	120	Pt	9.5	K =	5.6
				2.067		F	0.0			Pe	-		
	1	Q	17.3			T	0.0	pf	0.00	Pf	0.0		
	2	q	17.3	2"		L	11.6	C=	120	Pt	9.5	K =	5.6
				2.067		F	0.0			Pe	-		
		Q	34.6			T	11.6	pf	0.01	Pf	0.2		
		q	0.0	2"		L	2.0	C=	120	Pt	9.7	K =	5.6
				2.067	1 Tee (2")	F	10.0			Pe	-		
		Q	34.6			T	12.0	pf	0.01	Pf	0.2		
						L	10.0	C=	120	Pt	9.9	K =	5.6
	4	q		2"		L	0.0	C=	120	Pt	9.5	K =	5.6
				2.067		F	0.0			Pe	-		
		Q	17.3			T	0.0	pf	0.00	Pf	0.0		
		q	17.3	2"		L	9.6	C=	120	Pt	9.5	K =	5.6
				2.067	1 Tee (2")	F	10.0			Pe	-		
		Q	17.3			T	19.6	pf	0.00	Pf	0.1		
Combined flow at A										Pt	9.6	K_{BL1}	16.4
34.6 + 17.3 = 52 gpm													
Balanced pressure at 9.6 psi		Q	52.0										
	BL3	q	50.9	4"		L	9.8	C=	120	Pt	9.6	K_{BL2}	16.4
				4.026		F	20.0			Pe	-		
		Q	102.9			T	29.8	pf	0.0039	Pf	0.115		
		q	51.2	4"		L	9.8	C=	120	Pt	9.7	K_{BL3}	16.4
				4.026		F	20			Pe			
		Q	154.0			T	29.8	pf	0.0081	Pf	0.242		
		q				L		C=		Pt	10.0		
						F				Pe			
		Q				T		pf		Pf			
		q		2"		L	9.7	C=	120	Pt	9.5	K =	5.6
	BL4 (Left)			2.067		F	5.0			Pe	-		
		Q	17.3			T	14.7	pf	0.0037	Pf	0.054		
		q	17.3	2"		L	11.6	C=	120	Pt	9.6	K =	5.6
				2.067		F	0.0			Pe	-		
		Q	34.6			T	11.6	pf	0.013	Pf	0.2		
		q	17.5	2"		L	2.0	C=	120	Pt	9.8	K =	5.6
				2.067		F	10.0			Pe			
		Q	52.1			T	12.0	pf	0.0282	Pf			
	BL4 (Right)	q		2"		L	0.0	C=	120	Pt	9.5	K =	5.6
				2.067		F	0.0			Pe	-		
		Q	17.3			T	0.0	pf	0.00	Pf	0.0		
		q				L		C=		Pt	9.5		
						F				Pe			
		Q				T		pf		Pf			
Combined flow at AX		q				L		C=		Pt			
154 + 52.1 + 17.3 = 225.9 gpm						F				Pe			
Balanced pressure at 9.6 psi		Q				T		pf		Pf			
		q		4"	See Appendix for	L	166	C=	120	Pt	9.5		
Calculate Pressure Change Back to BOR				4.026	summary of fittings and	F	188			Pe	32.0		
Not additonal demand		Q	225.9		calculations	T	354	pf	0.02	Pf	5.8		
										Pt	47.4		

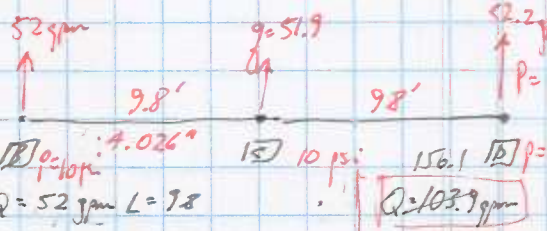


COMBINED FLOW AT A = 34.7 + 17.3 gpm = 52.0 gpm @ 9.6 psi

$K = \frac{Q}{\sqrt{P}} = \frac{52.0}{\sqrt{9.6}} = 16.8 = K$



L = 1 Ft (2" pipe)
F = 0
T = 1
$P_f = 2.8\times10^{-2}$ psi/Ft x 1 Ft
$P_f = 2.8\times10^{-2}$
$P_{elb} = 1$ Ft = 0.433 psi
B Q = 52.0 P = 10.0 psi
$K = \frac{52.0}{\sqrt{10}} = 16.4$

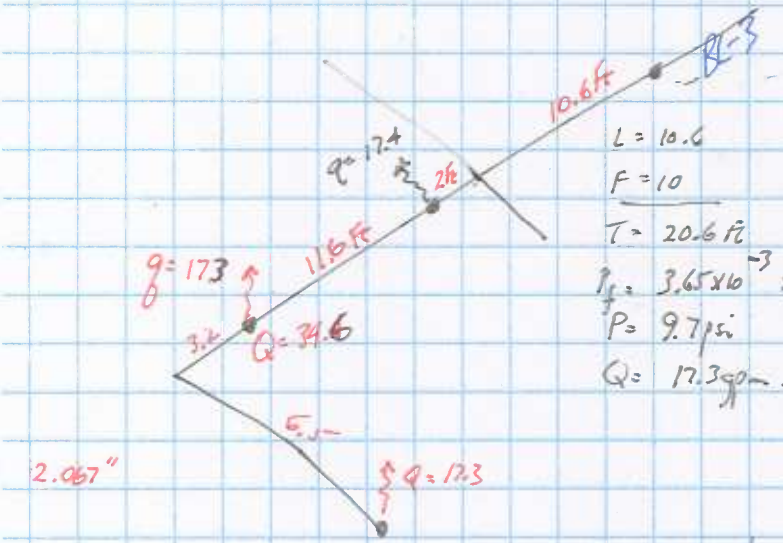


$Q_T = 156.1$ gpm

B Q = 52 gpm L = 9.8
P = 10 psi F 20
T = 29.8
$P_f = 1.09\times10^{-3} \times 29.8 = 0.03$ psi
P = 10 psi Q = 52,
$q = K\sqrt{P} = 16.4\sqrt{10\text{psi}} = 51.9$ gpm
Q = 103.9 gpm

Q = 103.9 gpm
L = 9.8 Ft
F = 20
T = 29.8
$P_f = 3.9\times10^{-3}$
P = 0.12 + 10 psi = 10.1 ps

$q = 16.4\sqrt{10.12}$
52.2 gpm



L = 10.6
F = 10
T = 20.6 ft

$P_f = 3.65 \times 10^{-3} \times 20.6 = 0.075$ psi

P = 9.7 psi

Q = 17.3 gpm.

K = 5.6 Q = 17.3 P = 9.6

Q = 156
P = 10.1 psi

Balance Pressures.

Q = 17.3
P = 9.6

Q = 52.0
P = 10 psi

$K = \frac{52.0}{10} = 16.4$

$K = \frac{Q}{\sqrt{P}} = 5.6$

$Q = 5.6\sqrt{10.1} = 17.8$

Q = 52

DEMAND

TOTAL Q = 156 + 52 + 17.8

Q = 225.9 gpm.

@ 10 psi

K = 5.6 L = 3.2 x 6.5 = 9.7 ft

Q = 17.3 1 @ 30° F = 5

P = 9.6 psi T = 14.7 ft

$P_f = 3.65 \times 10^{-3}$ psi/ft $\times$ 14.7 ft =

P = 0.053

P = 9.6 + 0.05 ≈ 9.6

$q = K\sqrt{P} = 5.6\sqrt{9.6} = 17.3$

Q = 17.3 + 17.3 = 34.6

L = 11.6 ft

F = 0

T = 11.6

$P_f = 1.32 \times 10^{-2} \times 11.6$

P = 0.15 + 9.6

P = 9.7 psi

$q = 5.6\sqrt{9.7}$

q = 17.4

52.0

L = 2 ft

F = 10 ft

T = 12 ft

$P_f = 2.80 \times 10^{-2} \times 12$ ft = 0.34 ft

P = 0.34 + 9.7 = 10 psi

q = 0

Q = 52.0

FROM POINT F

4"

10.15 ft

9.8 ft

14.5 elevation

PIPING FROM BOR TO EAST PENTHOUSE

	4" sched 40 p.p.	45.67 m	149.8 ft
	6" sched 40 p.p.	36.2 m	118.9 ft

CONVERT TO 4" $L_e = L_o \left(\frac{D_e}{D_o}\right)^{4.87}$

$L_e = 118.9 \left(\frac{4.026}{6.065}\right)^{4.87}$

$L_e = 16.1$ Ft OF 4"

BOR. 4" = 149.8 + 16.1 = 165.98 **166 ft of 4"**

FITTINGS

6" E.L.	167 ft	L_e	$167 \left(\frac{4.026}{6.065}\right)^{4.87}$ =	22.7 ft of 4"
4" EL	164 ft			164

SUMMARY.

$L = 149.8 + 16.1 = 166$ ft (4")

$F = 164 + 22.7 = 188$ (EL.4")

TOTAL 354

$Q = 226$ gpm @ 10 psi, $d = 4.026$

$P_f = (1.65 \times 10^{-2})\left(1.65 \times 10^{-2} \frac{ft}{psi}\right)(354 ft) = 5.8$ psi

ELEVATION CHANGE = 73.9 ft x $0.433 \frac{psi}{ft}$ = 31.99 = **32 psi**

$P = 5.8 + 32 = 37.8$ psi

$P = 37.8$ psi + 10 psi = 47.8 psi

SYSTEM DEMAND $Q = 226$ gpm @ 47.8 psi HOSE ALLOW. 250 gpm = 476 gpm

Appendix 29

Sprinkler System – Final Inspection

KEY WEST ENGINEERING LTD.

477 1st Avenue North
SASKATOON, SASKATCHEWAN
CANADA S7K 1X5
PH 306-652-7772 FX 306-664-1906
E-mail: keywest.eng@shaw.ca

January 12, 2012

Our File: 580-113

Vanderstelt Fire Protection Ltd.
Box 130
Vonda SK S0K 4N0

Attention: Mr. Steve Frederick:

Dear Sir:

RE: HUSKY MAIN OFFICE
LLOYDMINSTER, SK

This letter is to confirm that Key West Engineering Ltd. has visited the site to review the fire protection systems for the above noted project. Based on our observations, we believe that the fire protection systems are substantially complete and have been constructed in compliance with the applicable codes and, subject only to approved deviations, in compliance with the drawings and specifications.

This statement must not relieve the Contractor from the responsibility of remedying outstanding deficiencies including those discovered and those unforeseen, and those that may arise in the future, to be in compliance with the requirement of the authorities having jurisdiction, whose opinion supercedes the above noted statements.

Yours truly,

KEY WEST ENGINEERING LTD.

Robert J. Cowan, P.Eng.

RJC/bhm

PROFESSIONAL ENGINEER
R. J. COWAN
SASKATOON
Jan 19/2012
SASKATCHEWAN

KEY WEST ENGINEERING LTD.

477 1st Avenue North
SASKATOON, SASKATCHEWAN
CANADA S7K 1X5
PH 306-652-7772 FX 306- 664-1906
E-mail: keywest.eng@shaw.ca

January 13, 2012

Our File: 580-113

Vanderstelt Fire Protection Ltd.
Box 130
Vonda SK S0K 4N0

Attention: Mr. Steve Frederick:

Dear Sir:

RE: [redacted]
LLOYDMINSTER, SK

This letter is further to our letter of assurance of January 12, 2012 and the January 5, 2012 Field Report.

The deficiencies and/or work remaining to complete listed in our January 5, 2012 field report do not preclude the operation of the sprinkler systems as intended. The sprinkler systems are active and will operate if required.

Yours truly,

KEY WEST ENGINEERING LTD.

Robert J. Cowan, P.Eng.

RJC/bhm

PROFESSIONAL ENGINEER
R. J. COWAN
SASKATOON
Jan 19/2012
SASKATCHEWAN

Appendix 30

Water-Based Fire Protection System

Inspection, Testing and Maintenance (ITM)

Item	Frequency	NFPA 25 (2014) Reference	Comments
Sprinkler System Inspection – timing of inspections is important particularly is regions where freezing temperatures are possible (i.e. fall and spring inspections are recommended)			
Gauges (dry, preaction, and deluge systems)	Weekly/quarterly	5.2.4.2, 5.2.4.3, 5.2.4.4	- normal water pressure maintained
Control Valves		Table 13.1.1.2	- in correct position (open or closed) - seal, locked or supervised - accessible - free from damage or leaks - proper signage
Waterflow alarm devices	Quarterly	5.2.5	- free of damage; accessible - retard chamber/alarm drains not leaking
Valve supervisory signal devices	Quarterly	5.2.5	
Supervisory signal devices (except valve supervisory switches)	Quarterly	5.2.5	
Gauges (wet pipe systems)	Quarterly	5.2.4.1	- replace if not accurate within 3% of full scale
Hydraulic nameplate	Quarterly	5.2.6	- present, securely attached to riser and legible
Buildings	Annually (prior to freezing weather)	4.1.1.1	
Hangers/seismic bracing	Annually	5.2.3	- inspection from the floor level; shall not be damaged, loose, or unattached
Pipe and fittings	Annually	5.2.2	- inspection from the floor level; report on visible condition; corrosion, leaks, mechanical damage, not used to hang other equipment,
Sprinklers	Annually	5.2.1	- inspection from the floor level; report on visible condition e.g. loaded, corroded, leaking, free of paint or physical damage, correct type and orientation; minimum clearance maintained - replace any that show signs of loading, paint or corrosion
Spare sprinklers	Annually	5.2.1.4	- confirm the required number of spares and type are available
Information signs	Annually	5.2.8	
Fire Department connections		Table 13.1.1.2	- visible and accessible - coupling/swivels operating correctly - plugs/caps are in place - gaskets are not damaged - identification signs are in place - ball drip valve is functional
Valves (all types)		Table 13.1.1.2	
Obstructions,(internal inspection of piping)	5 years	14.2	
Heat trace	follow manufacturers requirements	5.2.7	
Waterflow alarm devices			

Sprinkler System Testing			
Mechanical devices	Quarterly	5.3.3.1	
Vane and pressure switch-type devices	Semiannually	5.3.3.2	
Valve supervisory signal devices		Table 13.1.1.2	
Supervisory signal devices (except valve supervisory switches)		Table 13.1.1.2	
Main drain		Table 13.1.1.2	
Antifreeze solutions	Annually	5.3.4	- test before onset of freezing weather
Gauges	5 years	5.3.2	
Sprinklers (extra-high or greater temperature solder type)	5 years	5.3.1.1.1.4	- Sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the AHJ for field service testing - 1% of total number but not less than 4 sprinklers -
Sprinklers (fast response)	At 20 years and every 10 years thereafter	5.3.1.1.1.3	
Sprinklers	At 50 years and every 10 years thereafter	5.3.1.1.1	
Sprinklers	At 75 years and every 5 years thereafter	5.3.1.1.1.5	
Sprinklers (dry)	At 10years and every 10 years thereafter	5.3.1.1.1.6	
Sprinklers (in harsh environments)	5 years	5.3.1.1.2	
Valves (all types)		Table 13.1.1.2	
Valves status test		13.3.1.2.1	
Sprinkler System Maintenance			
Valves (all types)	Annually	Table 13.1.1.2	
Low point drains (dry pipe systems)	Annually	13.4.4.3.2	
Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems	Annually	5.4.1.9	Ensure replacement sprinklers have the proper characteristics for the application intended; utilize a Management of Change process to reduce likelihood of error Ensure inventory of spares is maintained; see NFPA 13 (5.4.1.5.4)

Item	Frequency	Reference from NFPA 25 (2014)	
Standpipe Inspection			
Control Valves		Table 13.1.1.2	
Pressure regulating devices		Table 13.1.1.2	
Piping	Annually	6.2.1	Microbiologically Influenced Corrosion (MIC) and zebra mussels, corrosion deposits, and others
Hose connections		Table 13.1.1.2.1	
Cabinets	Annually	NFPA 1962	
Gauges	Weekly/quarterly	6.2.2	
Hose	Annually	NFPA 1962	Check for cuts, abrasions, deteriorations; missing gaskets, incompatible threads, hose tests out of date
Hose storage device	Annually	NFPA 1962	
Hose nozzles	Annually and after each use	NFPA 1962	
Hydraulic design information sign	Annually	6.2.3	
Hose valves		Table 13.1.1.2	
Hose connection		Table 13.1.1.2	

Standpipe Testing			
Waterflow alarm devices		Table 13.1.1.2	Operational test
Valve supervisory devices		Table 13.1.1.2	
Supervisory signal devices (except valve supervisory switches)		Table 13.1.1.2	
Hose storage devices	Annually	NFPA 1962	
Hoses	5 years/3 years	NFPA 1962	
Pressure control valve		Table 13.1.1.2	
Pressure reducing valve		Table 13.1.1.2	
Hydrostatic test	5 years	6.3.2	- in conformance with NFPA 13
Flow test	5 years	6.3.1	
Main drain test		Table 13.1.1.2	
Hose valves		Table 13.1.1.2	
Hose connections		Table 13.1.1.2	
Valve status test		13.3.1.2.1	
Standpipe Maintenance			
Hose connections	Annually	Table 6.1.2	
Valves (all types)	Annually/ as needed	Table 13.1.1.2	
Hose valves		Table 13.1.1.2	

*Items which do not apply in this building

Item	Frequency	Reference from NFPA 25 (2014)	
Valves, Valve Components and Trim Inspection			
Control Valves			
Sealed	Weekly	13.3.2.1	secured with locks or supervised, accessible (including snow and ice), free of leaks, id tags
Locked or electrically supervised	Monthly	13.3.2.1.1	
Valve Supervisory Signal Initiating Devices	Quarterly	13.3.2.1.2	free of physical damage; normally open or closed
Alarm Valves			
Exterior	Monthly	13.4.1.1	
Interior	5 years	13.4.1.2	
Strainers, filters, orifices	5 years	13.4.1.2	
Check Valves			
Interior	5 years	13.4.2.1	
Preaction/Deluge Valves			
Enclosure (during cold weather)	Daily/weekly	13.4.3.1	
Exterior	Monthly	13.4.3.1.6	
Interior	Annually/5years	13.4.3.1.7	
Strainers, filters, orifices	5 years	13.4.3.1.8	
Dry Pipe Valves/Quick Opening Devices			
Gauges	Weekly/monthly	13.4.4.1.2.4, 13.4.4.1.2.5	
Enclosure (during cold weather)	Daily/weekly	13.4.4.1.1	
Exterior	Monthly	13.4.4.1.4	
Interior	Annually	13.4.4.1.5	
Strainers, filters, orifices	5 years	13.4.4.1.6	
Pressure Reducing and Relief Valves			
Sprinkler systems	Quarterly	13.5.1.1	
Hose connections	Annually	13.5.2.1	
Hose racks	Annually	13.5.3.1	
Fire Pumps			
Casing relief valves	Weekly	13.5.7.1, 13.5.7.1.1	
Pressure relief valves	Weekly	13.5.7.2, 13.5.7.2.1	

Backflow Prevention Assemblies			
Reduced pressure	Weekly/monthly	13.6.1	
Reduced pressure detectors	Weekly/monthly	13.6.1	
Fire Department Connections	Quarterly	13.7.1	
Valves, Valve Components and Trim Testing			
Main Drains	Annually/quarterly	13.2.5, 13.2.5.1, 13.3.3.4	
Gauges	5 years	13.25.7.2	
Waterflow Alarms	Quarterly/semiannually	13.2.6	
Control Valves			- operate through full range and return to normal position
Position	Annually	13.3.3.1	
Operation	Annually	13.3.3.1	
Supervisory	Semiannually	13.3.3.5	
Preaction/Deluges Valves			
Priming water	Quarterly	13.4.3.2.1	
Low air pressure alarms	Quarterly/semiannually	13.4.3.2.13, 13.4.3.2.14	
Full flow	Annually	13.4.3.2.2	
Air leakage	3 years	13.4.3.2.6	
Dry Pipe Valves/Quick-Opening Devices			
Air leakage	3 years	13.4.4.2.9	
Priming water	Quarterly	13.4.4.2.1	
Low air pressure alarms	Quarterly	13.4.4.2.6	
Quick-Opening Devices	Quarterly	13.4.4.2.4	
Trip test	Annually	13.4.4.2.2	
Full flow trip test	3 years	13.4.4.2.2.2	
Pressure-Reducing and Relief Valves			
Sprinkler systems	5 years	13.5.1.2	
Circulation relief	Annually	13.5.7.1.2	
Pressure relief valves	Annually	13.5.7.2.2	
Hose connections	5 years	13.5.2.2	
Hose racks	5 years	13.5.3.2	
Backflow Prevention Assemblies	Annually	13.6.2	
Valves, Valve Components and Trim Maintenance			
Control Valves		13.3.4	
Preaction/Deluge Valves		13.4.3.3.2	
Dry Pipe Valves/Quick Opening Devices		13.4.4.3	

Private Fire Service Mains	Frequency	Reference from NFPA 25 (2014)
Inspection		
Hose hydrants	Quarterly	7.2.2.7
Hydrant (dry barrel and wall)	Annually and after each operation	7.2.2.4
Monitor nozzles*	Semiannually	7.2.2.6
Hydrants (wet barrel)*	Annually and after each operation	7.2.2.5
Mainline strainers	Annually and after each significant flow	7.2.2.3
Piping (exposed)*	Annually	7.2.2.1
Piping (exposed)	see 7.2.2.2	7.2.2.2
Testing		
Monitor nozzles*	Flow annually (range and operation)	7.3.3
Hydrants	Flow, annually	7.3.2
Piping flow test (exposed and underground)	5 years	7.3.1
Valve status test		13.3.1.2.1
Maintenance		
Mainline strainers	Annually and after each operation	7.2.2.3
Hose houses*	Annually	7.2.2.7
Hydrants	Annually	7.4.2
Monitor nozzles*	Annually	7.4.3

*Items which do not apply in this building

Appendix 31

Sample ITM Task Tracking

Task 453

General | Assets (1) | Parts | Scheduled Events | Completed Events | Activity

Task Details

Task #: TSK453

Estimated Time: 2 (hrs per Asset)

Labour Rate/hr: $35.00 Based on Assigned: ☑

Estimated Labour Cost: $70.00

Schedule: Set

the first Monday of every 1 month at 06:00 starting on 2012-04-02

(1 Past due events)

Attachments: Add

Task Status

Status:

Type:

Assigned Group:

Assigned To:

Service Provider:

Reminders

Created:

Last Modified:

Summary

Monthly PM

PM Procedure

Visual Inspection as follows, (to be completed by Building Operator)
- Check and ensure that each control valve is secured in its normal open position by means of a seal, lock or tamper switch.
- Check and ensure that the gauges on the wet sprinkler system register the normal water supply pressure.
- Inspect the fire department connections and ensure they are visible and accessible at all times.
- Check and ensure caps or plugs are in place, threads in good condition, ball drip or drain in working order.
- Check and ensure valves are not leaking.

Task 999

General | Assets (1) | Parts | Scheduled Events | Completed Events | Activity

Task Details

Task #: TSK999

Estimated Time: 3 (hrs per Asset)

Labour Rate/hr: $35.00 Based on Assigned: ☑

Estimated Labour Cost: $105.00

Schedule: Set

the second Monday of every 6 months at 06:00 starting on 2012-08-13

Attachments: Add

Task Status

Status:

Type:

Assigned Group:

Assigned To:

Service Provider:

Reminders

Created:

Last Modified:

Summary

Semi-annual PM

PM Procedure

Perform functional testing as per NFPA 25 (see attached) (to be completed by certified technician)
- vane type flow devices
- supervisory switches

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Alarm Devices and for Events Assigned to Nathan Brock Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-02-05	Completed	Alarm Devices	Quarterly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-05-15	Completed	Alarm Devices	Quarterly PM	Husky Place	Nathan Brock	$70.00	2.00
2014-08-06	Completed	Alarm Devices	Quarterly PM	Husky Place	Nathan Brock	$70.00	2.00
2014-11-05	Completed	Alarm Devices	Quarterly PM	Husky Place	Nathan Brock	$70.00	2.00
Total						**$245.00**	**7**

4 items

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Backflow Preventer - Main Sprinkler and for Events Assigned to Nathan Brock Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-06-09	Completed	Backflow Preventer - Main Sprinkler	Annual PM	Husky Place	Nathan Brock	$35.00	1.00
Total						**$35.00**	**1**

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Fire Alarm System and for Events Assigned to Nathan Brock Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-01-06	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-02-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-03-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$30.00	1.00
2014-04-07	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$30.00	1.00
2014-05-05	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-06-02	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-06-10	Completed	Fire Alarm System	Annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-07-07	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$30.00	1.00
2014-08-04	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-09-01	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$30.00	1.00
2014-10-06	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-11-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
2014-12-01	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$15.00	0.50
Total						**$257.50**	**8.5**

13 items

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Fire Alarm System and for Events Assigned to Nathan Brock Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-01-06	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-02-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-03-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-04-07	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-05-05	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-02	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-10	Completed	Fire Alarm System	Annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-07-07	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-08-04	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-09-01	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-10-06	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-11-03	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-12-01	Completed	Fire Alarm System	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
Total						**$227.50**	**6.5**

13 items

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Fire Extinguishers Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-01-06	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-01-13	Completed	Fire Extinguishers	Annual PM	Husky Place	Nathan Brock	$8.75	0.25
2014-02-03	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-03-03	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-04-14	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$52.50	1.50
2014-05-05	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-06-02	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-07-07	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$70.00	2.00
2014-08-04	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-09-01	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$52.50	1.50
2014-10-06	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$52.50	1.50
2014-11-03	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$70.00	2.00
2014-12-01	Completed	Fire Extinguishers	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
Total						**$551.25**	**15.75**

13 items

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Fire Suppression Sprinkler Systems Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-01-06	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-02-03	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-02-10	Completed	Fire Suppression Sprinkler Systems	Quarterly PM	Husky Place	Nathan Brock	$600.00	4.00
2014-03-03	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-04-07	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-05-05	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-02	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-06-09	Completed	Fire Suppression Sprinkler Systems	Semi-annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-10	Completed	Fire Suppression Sprinkler Systems	Quarterly PM	Husky Place	Nathan Brock	$300.00	2.00
2014-06-10	Completed	Fire Suppression Sprinkler Systems	Annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-11	Completed	Fire Suppression Sprinkler Systems	Semi-annual PM	Husky Place	Nathan Brock	$105.00	3.00
2014-07-07	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-08-04	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$52.50	1.50
2014-08-11	Completed	Fire Suppression Sprinkler Systems	Quarterly PM	Husky Place	Nathan Brock	$300.00	2.00
2014-09-01	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$70.00	2.00
2014-10-06	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$52.50	1.50
2014-11-03	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-11-10	Completed	Fire Suppression Sprinkler Systems	Quarterly PM	Husky Place	Nathan Brock	$300.00	2.00
2014-12-01	Completed	Fire Suppression Sprinkler Systems	Monthly PM	Husky Place	Nathan Brock	$35.00	1.00
2014-12-30	Completed	Fire Suppression Sprinkler Systems	Semi-annual PM	Husky Place	Nathan Brock	$105.00	3.00
Total						**$2,217.50**	**30.5**

20 items

AssetPlanner

EDON MANAGEMENT Facilities & Asset Services

PM Events where Status = Completed for Husky Place and Asset = Fire Suppression Sprinkler Systems - Pre-action Scheduled to start between 2014-01-01 and 2014-12-31

PM Events

Date	Status	Asset Name	Summary	Facility	Assigned To	Total Cost	Actual Time
2014-01-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-02-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-02-10	Completed	Fire Suppression Sprinkler Systems - Pre-action	Quarterly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-03-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-04-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-05-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-09	Completed	Fire Suppression Sprinkler Systems - Pre-action	Quarterly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-09	Completed	Fire Suppression Sprinkler Systems - Pre-action	Annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-06-10	Completed	Fire Suppression Sprinkler Systems - Pre-action	Semi-annual PM	Husky Place	Nathan Brock	$17.50	0.50
2014-07-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-08-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-08-11	Completed	Fire Suppression Sprinkler Systems - Pre-action	Quarterly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-08-11	Completed	Fire Suppression Sprinkler Systems - Pre-action	Semi-annual PM	Husky Place	Nathan Brock	$105.00	3.00
2014-09-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-10-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-11-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-11-10	Completed	Fire Suppression Sprinkler Systems - Pre-action	Quarterly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-12-01	Completed	Fire Suppression Sprinkler Systems - Pre-action	Monthly PM	Husky Place	Nathan Brock	$17.50	0.50
2014-12-30	Completed	Fire Suppression Sprinkler Systems - Pre-action	Semi-annual PM	Husky Place	Nathan Brock	$105.00	3.00
Total						**$525.00**	**15**

20 items

Task 454

General | Assets (1) | Parts | Scheduled Events | Completed Events | Activity

Task Details

Task #: TSK454

Estimated Time: 4 (hrs per Asset)

Labour Rate/hr: $150.00 Based on Assigned: ☐

Estimated Labour Cost: $600.00

Schedule: Set — the second Monday of every 3 months at 06:00 starting on 2012-05-14

Attachments: Add

Task Status

Status:

Type:

Assigned Group:

Assigned To:

Service Provider:

Reminders

Created:

Last Modified:

Summary

Quarterly PM

PM Procedure

Perform visual inspections as per NFPA-25 (see attached) (to be completed by Building Operator)
- alarm devices
- fire department connections
- pressure reducing and relief valves
- sprinkler systems
- hose connections
- fire department connections
- standpipe

Perform functional testing as per NFPA 25 (see attached) (to be completed by certified technician)
- water flow devices
- main drain test

Task 455

General | Assets (1) | Parts | Scheduled Events | Completed Events | Activity

Task Details

Task #: TSK455

Estimated Time: 8 (hrs per Asset)

Labour Rate/hr: $35.00 Based on Assigned: ☑

Estimated Labour Cost: $280.00

Schedule: Set — the second Monday of February at 06:00 starting on 2013-02-11

Attachments: Add

Task Status

Status:

Type:

Assigned Group:

Assigned To:

Service Provider:

Reminders

Created:

Last Modified:

Summary

Annual PM

PM Procedure

- Carry out full sprinkler system inspection by a certified technician in accordance with the authority having jurisdiction and NFPA 25
- Correct all deficiencies stemming from inspection.
- Maintain sprinkler inspection report on file.

Appendix 32

Fire Protection System Impairment

Reporting Requirements

Procedure

Document Title:				Total # of pages
Fire Protection Impairment Notification				7
Organizational Scope:		Knowledge Area / Sub Knowledge Area:		
		Integrity Management Risk Management		
Document Owner (by position):		Project:		
Loss Control Engineer		**n/a**		
Document No:	Document Group	Doc. Type Code	Review Cycle:	Revision No:
	Risk Management	**PR**	**5 years**	**1**

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- *Link to Work Instructions for completing this template*
- *Link to valid tables values for selected fields in this template*
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				Signature block Type A. Name Position	Signature block Type A. Name Position	Signature block Type A. Name Position	Signature block Type A. Name Position
				L Engineer	Enterprise Risk Analyst	Type A. Name Position	Manager, Corporate Risk Department
Rev. 0	**Issue Code**	**Issue Date April 3, 2013**		**Originator**	**Checker**	**QA Reviewer**	**Approver**

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Table of Contents

Table of Figures

1.0 Purpose

The purpose of this document is to define the requirements for using the Corporate Fire Protection Impairment Notice (FPIN). Guidance is offered on the effective management of incidents where the Fire Protection System (FPS) becomes compromised due to planned or unplanned events.

2.0 Scope

The requirement to document and effectively manage FPS impairment is applicable to all facilities. The requirements for communicating FPS impairment to the Corporate risk department are described in Section 5.3 of this document.

3.0 Governing and Reference Documents

3.1 Governing Documents

Governing Document	Document Title
http:/ t/dept_corporate/Real%20Estate%20&%20Risk%20Management/Risk%20Management/pg_hs&e_risk_management.html	Fire Protection Impairment Notice

Table 1: Governing Documents

3.2 Reference Documents

Reference Document	Document Title
NFPA 25 (2011)	Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
NFPA 2001 (2004)	Standard on Clean Agent Fire Extinguishing Systems

Table 2: Reference Documents

4.0 Definitions and Acronyms

Term	Definition
Clean Agent	Electrically nonconducting, volatile, or gaseous fire extinguishing agent that does not leave a residue upon evaporation.
Fire Protection System	Shall include, but shall not be limited to, the following: • Sprinkler system • Standpipe systems • Fire hose systems • Underground fire service mains • Fire pumps • Water storage tanks • Water spray or deluge fixed systems • Foam/water or clean agent systems • Fire service control valves • Gas detection systems including those for flammable or toxic gases
Impairment	A condition where a fire protection system or unit or portion thereof is out of order and the condition can result in the fire protection system or unit not functioning in a fire event or gas release.
Normalization of Deviance	http://wiki gy.com/Pages/Normalization%20of%20Deviance-2154.aspx
Planned Impairment	A condition where a fire protection system or a portion thereof is out-of-service due to work that has been planned in advance, such as revisions to the water supply or sprinkler system piping.
Unplanned Impairment	A condition where a fire protection system or portion thereof is out-of-service due to an unexpected occurrence, such as a ruptured pipe, an operated sprinkler, or an interruption of the water supply to the system.
FPIN	Fire Protection Impairment Notice
FPS	Fire Protection System

Table 3: Terms and Definitions

5.0 Procedure

Fire protection impairment is the temporary, partial or full shutdown of any fire protection system (FPS). Impairment is often associated with sprinkler systems, but it also applies to placing in out-of-service or by-pass mode the following equipment.

- Fire pumps
- Fire water tanks and supply valves
- Standpipes and hoses and hydrants
- Automatic extinguishing systems
- Fire or gas detection and alarm systems
- Emergency power and lighting

5.1 Planned Impairment

Planned impairment is a condition where a component of the fire protection system is out of service due to work that has been planned in advance, such as revisions to the water supply or sprinkler system piping. If possible, plan ahead for the impairment with due consideration of the following points.

- Use the local Management of Change process to ensure all potential impacts of disabling the FPS are explored and understood.
- Where possible, plan to work on FPS when the facility is not operating such as during turnarounds
- Impairments should not continue when the building or facility is unmanned. In other words, a process should not be left unattended if the FPS has been rendered out-of-service. Similarly, an office building should not be left unoccupied if the building fire protection is not functioning as designed. If work on the FPS will take more than one day, then the task should be planned such that the system can be restored each night or a fire watch should be provided.
- Ensure all tools and materials are on hand so that the job can be completed with minimal delay.

- Plan to work continuously until the job is complete, and restore the system as soon as possible.

- Identify out-of-service FPS equipment with highly visible tags. This will reduce the chance of overlooking the prompt restoration of the system.

- Prohibit any process with an inherent ignition source such as hot work in the affected area.

- Plan to have temporary fire protection on hand, such as extra fire extinguishers, charged hose lines, or temporary sprinkler protection.

- Document the planned FPI in the Operations Log and utilize the Operator Shift Handover procedure to communicate the FPS status to the oncoming workers.

- Communicate the planned FPI to all affected parties which may include the local Fire Department.

5.2 Unplanned Impairment

Unplanned impairment is a condition where a FPS or portion thereof is out-of-service due to an unexpected occurrence, such a ruptured pipe, a sprinkler system or an interruption of the water supply to the system.

All affected personnel should be advised of the unplanned FPS impairment. This may include but is not limited to the person(s) in charge of initial response for evacuation procedures, the fire department, alarm and security companies if applicable. Unplanned FPI should be documented in the facility Operations Log and discussed during Operator Shift Handover meetings.

5.3 Corporate Notification Requirements

Corporate Risk Management Department shall be notified of all FPS impairments where the duration is expected to exceed 4 hours. In some cases, it may be difficult to estimate the duration of the impairment period. When in doubt, be conservative and submit the FPIN. The Corporate Risk Department shall be notified using the FPIN.

Use the following steps for submission of the FPIN.

Prior to a planned impairment or on discovery of an unplanned impairment:

1. Complete Part A of the FPIN
2. Email the FPIN to the Corporate Risk Management Department at [redacted].com

On restoration of the FPS:

1. Complete Part B of the FPIN
2. Email the FPIN to the Corporate Risk Management Department at fpin@ y.com

5.4 Post Impairment Follow-up

Consider the following guidelines to reduce the frequency and severity of unplanned FPS impairment:

- Utilize the S Incident Management processes to document nearmiss and actual events. Incidents which lead to unplanned FPS impairment should be thoroughly investigated to determine the root cause(s).

- Be vigilant for nearmiss trends – the investigation of a trend may prevent a future, serious incident.

- Document lessons learned and review them with new workers as a means for passing on organizational learnings.

- Guard against the normalization of deviance where chronic impairments become accepted as routine.

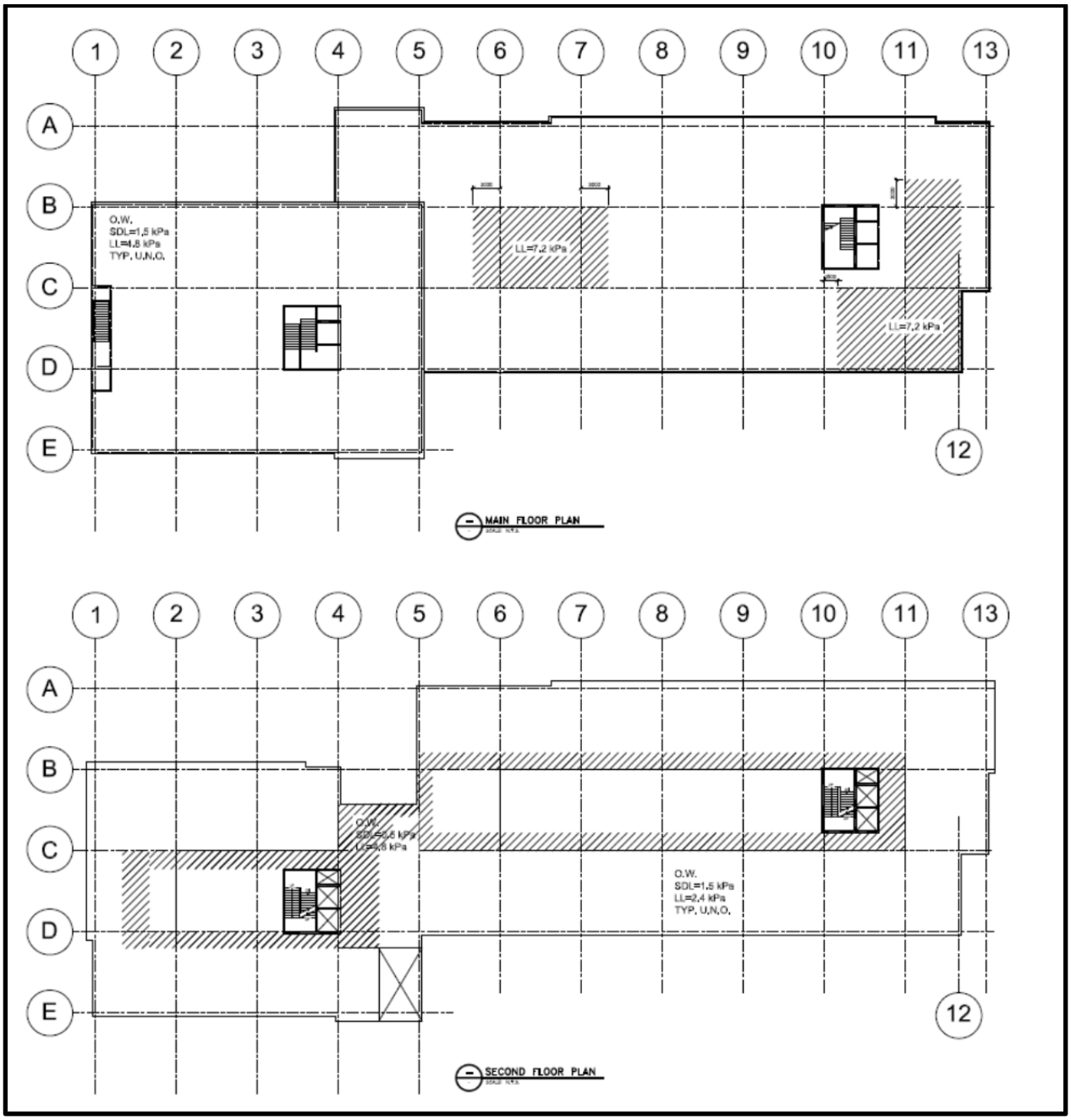
6.0 Document Accountability and Responsibility

If you have questions, comments or suggestions regarding this document please contact one of the positions identified below, which is held by the related person identified on the coversheet.

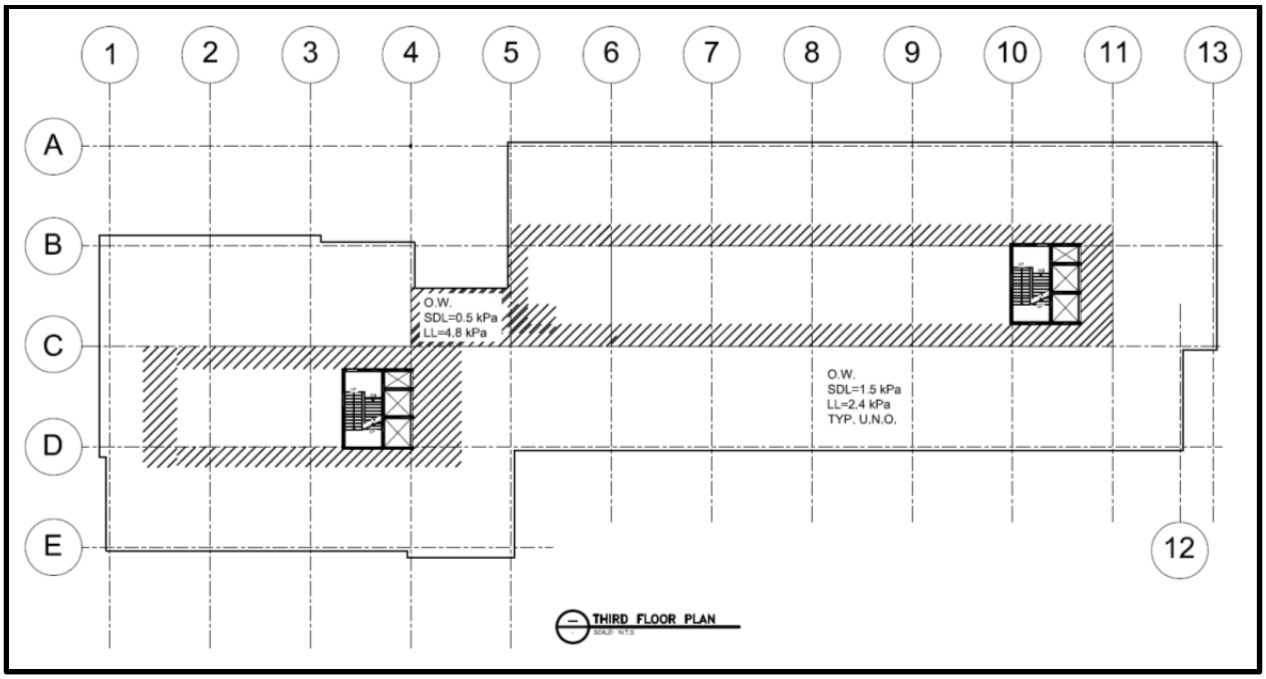
Role	Position Title	Coversheet Approval Role
Document Owner	Loss Control Engineer	Originator
Process Owner	Loss Control Engineer	Originator
Process Steward	Manager, Corporate Risk Department	Approver

Appendix 33

Floor Loading



Main Floor (Top Figure)	Second Floor (Bottom Figure)
Non-hatched area	Non-hatched area
- Live Load = 4.8 kPa (100 lb/ft^2)	- Live Load = 2.4 kPa (50 lb/ft^2)
- Dead Load = 1.5 kPa (30 lb/ft^2)	- Dead Load = 1.5 kPa (30 lb/ft^2)
Hatched area	Hatched area
- Live Load = 7.2 kPa (150 lb/ft^2)	- Live Load = 4.8 kPa (100 lb/ft^2



Third Floor
Non-hatched area
- Live Load = 2.4 kPa (50 lb/ft^2)
- Dead Load = 1.5 kPa (30 lb/ft^2)
Hatched area
- Live Load = 4.8 kPa (100 lb/ft^2

Appendix 34

Sprayed Fire Resistive Material

Technical Specifications

http://www.adfire.com/fp%20products/FP%20Data%20Sheets/AD_Type_FP_data_sheet_211112.pdf

Appendix 35

Design No. W404

Fire Resistance Rating

http://database.ul.com/cgi-bin/XYV/template/LISCANADA/1FRAME/showpage.html?name=BXUVC.W404&ccnshorttitle=Fire+Resistance+Ratings&objid=1076416842&cfgid=1073741824&version=versionless&parent_id=1075952496&sequence=1

Appendix 36

Design No. F818

Fire Resistance Rating

http://www.adfire.com/fp%20products/FP_designs/FP%20Designs/ULC_design_F818.pdf

Appendix 37

3M Fire Barrier Sealant CP 25WB

Technical Specifications

http://solutions.3m.com/wps/portal/3M/en_US/EMDCI/Home/Products/ProductCatalog/~/3M-Fire-Barrier-Sealant-CP-25WB-?N=5430651+3294069363&rt=rud#variantView

Appendix 38

Hilti CP 604 Self-Leveling Firestop Sealant

Technical Specifications

https://www.hilti.ca/medias/sys_master/documents/h11/9078319906846/ASSET_DOC_LOC_1543312_APC_RAW.pdf

END