CALPOLY STUDENT RECREATION CENTER FIRE PROTECTION REVIEW

CULMINATING PROJECT prepared by **Alain N. Mamada**

MSc. FPE PROGRAM

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KEYWORDS

- FDS
- ASET
- RSET
- Pathfinder
- Egress
- Performance-based
- Prescriptive
- Visibility

ABBREVIATIONS

- Rec Center: Recreation Center
- Cal Poly : California Polytechnic State University
- SPL : Sound Pressure Level
- CMDA : Control Mode Density Area

CALPOLY RECREATION CENTER

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EXECUTIVE SUMMARY

This report summarizes the analysis of the existing fire protection features and systems installed in the Recreation Center building on the Cal Poly campus. The analysis is conducted into two different approaches.

A prescriptive analysis approach will examine installed fire protection features and systems in accordance with the International Building Code. The analysis will consider the building as existing building as per IBC provisions.

A performance-based approach will assess whether the building occupants will egress the building before conditions become untenable. Fire dynamic simulations will be used to determine the available safe egress time and evacuation simulations will performed to estimate the required safe egress time.

Two fire scenarios were analyzed to assess tenability conditions. The first fire scenario assuming a stage fire during a fully-packed-gymnasium concert has revealed that conditions become quickly untenable for second floor bleachers top seat occupants. The same conclusion was reached for the assessment of the second fire scenario assuming fire under bleachers on the second floor.

The following recommendations were put forward to enhance safety of personnel and users of the Rec Center:

- Training of personnel in enforcement of life safety management procedures and regular fire safety awareness campaigns were suggested as important tools to improve safety factor between ASET and RSET.
- Re-assessment of installed sprinkler system in the gymnasium as existing system was designed for light hazard occupancy while the bleachers flammability study revealed that the gymnasium should be classified as extra ordinary hazard occupancy.

Performance-based analysis of postulated fire scenarios is encouraged in order to formulate comprehensive improvement life safety measures for the Rec Center.

INTRODUCTION

The Recreation Center opened in 1993 as the first comprehensive facility of its kind in the California State University system. It became an instant recreational hub for California Polytechnic State University students and San Luis Obispo community. As Cal Poly enrollment continued to grow as the usage of the Recreation Center increased to the point of overcrowding; a decision to renovate and expand was taken in 2008 after student protest actions.

In 2009, through the shared vision, hard work and financial commitment of Cal Poly students, the construction works started.

The expanded Recreation Center was opened in January 2012 as a welcoming destination for Cal Poly community to relax, recreate and socialize. The renovated Recreation Center is 165000 square feet of recreation space that includes three separate exercise areas filled with state of the art weight and cardio equipment, three fitness studios for group exercise classes, an indoor track, a lounge area, a leisure pool, locker rooms with individual showers, a martial arts training room and much more variety of fitness and recreation programs that promote lifelong healthy habits.

The project work will analyze the current conditions of the fire protection systems installed in the Recreation Center based on the prescriptive requirements of applicable codes. The fire protection systems that are analyzed include structural fire protection, water-based fire suppression systems, fire alarm and detection systems, and egress systems.

A performance-based analysis will be conducted to assess the gymnasium egress time assuming two fire scenarios. The first scenario assumes a fire emanating from sound equipment on a stage during a concert held in the main gymnasium with all bleachers in fully expanded positions. The other scenario simulates a fire under bleachers on the second floor of the main gymnasium with bleachers on the first floor in retracted position

The following codes and standards, applicable as per August 1st 2007, formed the design basis for the construction and operation of the Recreation Center:

- 2007 California Administration Code, Part 1, Title 24
- 2007 California Building Code (CBC), Part 2, Title 24
  (2006 International Building Code with 2007 California requirements)
- 2007 California Electrical Code (CEC), Part 3, Title 24
  (2005 National Electrical Code with 2007 California requirements)
- 2007 California Mechanical Code (CMC), Part 4, Title 24
  (2006 Uniform Mechanical Code with 2007 California requirements)
- 2007 California Fire Code (CFC), Part 9, Title 24
  (2006 International Fire Code with 2007 California requirements)

- 2007 California Referenced Standards Code, Part 12, Title 24
- Applicable NFPA standards:
    - NFPA 13: Automatic Sprinkler systems (2003 Edition)
    - NFPA 14: Standpipes Systems (2002 Edition)
    - NFPA 72: National Fire Alarm Codes (2007 edition)

PART I: PRESCRIPTIVE APPROACH

CHAPTER 1: STRUCTURAL ANALYSIS

The Cal Poly Recreation Center would be classified as group A in accordance with IBC Use and Occupancy Classification requirements, referring to IBC 2009-Section 303: "*Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purpose such civic, social or religious functions; recreation, food or drink consumption or awaiting transportation".*

In particular, the Rec Center main gymnasium complies with the definition of an atrium (as per ICC-2009, Section 404.1.1); therefore the Rec Center shall comply with requirements as prescribed in section 404.2 to 404.9

However it is recognized that the Rec Center is a mixed and non-separated occupancy building, as defined by IBC section 508.3.1. As such, it shall comply with all requirements that are applicable to each of the purposes for which the room or space will be occupied.

Table 1.1: ***Occupation Classification***

Use of room / Space	Occupancy Classification
Gymnasium	A-3
Fitness	A-3
Offices / Administration	B
Yoga / Meditation	A-3
Storage rooms	S
Mechanical/Electrical Equipment rooms/spaces	Accessory (Incidental use)

Section 503 of IBC-2009 is used to determine what building construction type the Rec Center can be classified into based on its occupancy type and physical dimensions.

The Rec Center has the following physical dimensions:

a) Number of stories: 2
b) Height: 65 ft (average height of highest roof)
c) Total area: 165 715 Square ft

Based on the physical dimensions, the Rec Center can be classified to be Type I-B building construction in accordance with IBC-2009, Table 503. Refer to Table 1.2 below for details.

Table 1.2: ***Extract from Table 503: Allowable Building Heights and Areas***

TABLE 503
ALLOWABLE BUILDING HEIGHTS AND AREAS*
Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane.
Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

		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
GROUP		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
F-1	S	UL	11	4	2	3	2	4	2	1
	A	UL	UL	25,000	15,500	19,000	12,000	33,500	14,000	8,500
F-2	S	UL	11	5	3	4	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	18,000	50,500	21,000	13,000

However with addition of fire protection features, there is a need to check if other building types would have been allowed.

IBC section 504.2 allows for the values specified in Table 503 for maximum building height to be increased by 20 ft and the maximum number of stories to be increased by one, where a building is equipped throughout with an approved automatic sprinkler system in accordance with IBC section 903.1.1.1.

IBC section 506.1, the building areas limited by IBC Table 503 shall be permitted to be increased due to frontage (I_f) and automatic sprinkler system protection (I_s) in accordance with the following formula:

$$A_a = \{A_t + [A_t x I_f] + [A_t x I_s]\}$$

Where a building has more than 25% of its perimeter on a public way or open space having a minimum width of 20 ft, the frontage increase shall be determined in accordance with:

$I_f = [F/ P-0.25] W/30$

Where:

F= Building perimeter that fronts on a public way or open space having 20 ft open minimum width.
P= Perimeter of entire building
W= Width of public way or open space

When a building is equipped throughout with an approved automatic sprinkler system in accordance with IBC Section 903.3.1.1, the building area limitation in Table 503 is permitted to be increased by an additional 200 % for building with more than one story above grade plane.

In our analysis, it appears that the total area of the Rec Center is the driving factor of the building type determination. Calculations were performed to determine the increased areas due to the installation of an approved automatic sprinkler system throughout the building.
Table 1.3 gives a summary of the increased areas of other construction types.

Summary of increased tabular values:

Table 1.3: ***Summary of Increased Areas for Building Construction Types due to Automatic Sprinkler System Installation***

Occupancy Groups	Type II		Type III		Type	Type V	
	A	B	A	B	IV	A	B
Group A-3							
Tabular A	15500	9500	14000	9500	15000	11500	6000
Increased A	49083	30083	44333	30083	47500	36416	19000
Group B							
Tabular A	37500	23000	28500	19000	36000	18000	9000
Increased A	118750	72833	90250	60166	114000	57000	28500

The increased areas and story heights due to frontage and automatic sprinkler system installation revealed that no other building construction types would have been allowed in accordance with IBC provisions; therefore the design selection limiting factor is the building floor area.

FIRE RESISTANCE RATING OF CONSTRUCTION ELEMENTS

Building elements of the Rec Center shall have a fire-resistance rating not less than that specified in IBC-2009, Table 601 and applicable provision of Section 703.2; and non-load bearing exterior walls shall have a fire-resistance rating not less than the specified in Table 602.

Table 1.4: ***Extract from IBC Table 601: Fire Resistance Rating***

Building Element	Fire Resistance Ratings
Primary structural frame	2
Exterior bearing walls	2
Interior bearing walls	2
Exterior nonbearing walls & partitions	See Table 602
Interior nonbearing walls & partitions	0
Floor construction & secondary members	2
Roof construction & secondary members	1

Table 1.5: ***Extract from IBC Table 602: Fire Resistance Rating***

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, e]

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[f]	OCCUPANCY GROUP F-1, M, S-1[g]	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2[g], U[b]
X < 5[c]	All	3	2	1
5 ≤ X < 10	IA Others	3 2	2 1	1 1
10 ≤ X < 30	IA, IB IIB, VB Others	2 1 1	1 0 1	1[d] 0 1[d]
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

IBC-2009, Section 602.1.1 prescribes minimum requirements as the following: "*a building or portion thereof shall not be required to conform to the details of a type of construction higher than that type which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction".*

Building elements in construction Type I-B are of noncombustible materials. The Rec Center building elements shall meet the following minimum fire-resistance ratings in accordance with IBC requirements as shown in Table 1.4 and 1.5.
The following building elements in the Rec Center were selected for assessment:

a) Columns:

Columns are part of the primary structure of the Rec Center; columns are of different physical properties, but they are all protected with a spray applied fire resistive material to meet required fire rating of 2 hours (refer to Table 1.4) and enclosed in concrete, metal cover, glass fiber reinforced gypsum for interior steel columns (GFRG) or in glass fiber reinforced concrete (GFRC) for exterior columns.as shown in the drawings below:

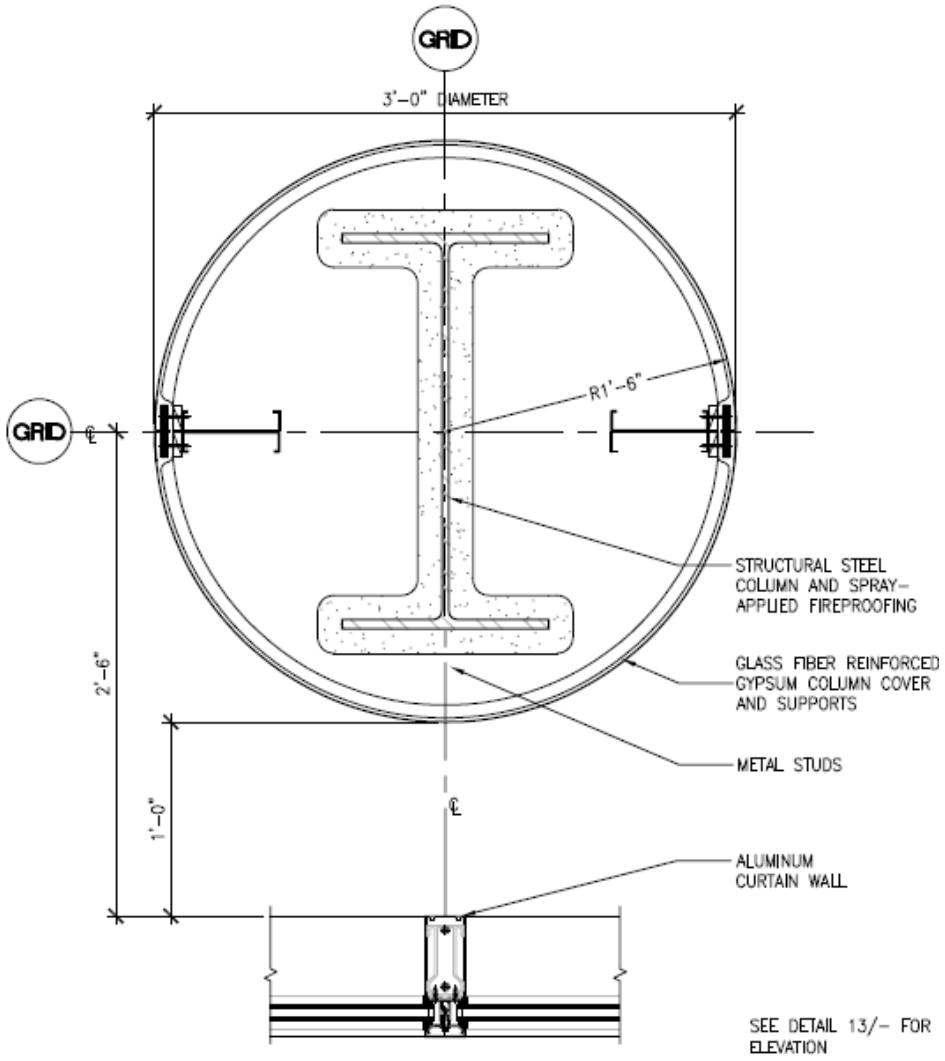


Figure 1.1: ***Typical Interior CFRG Column Cover***

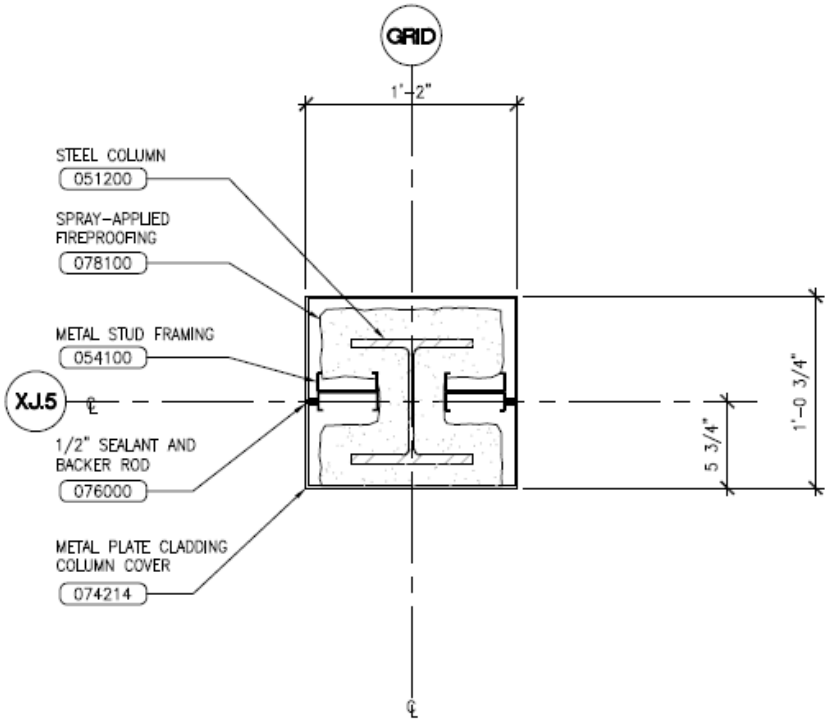


Figure 1.2: ***Typical Interior Metal Column Cover***

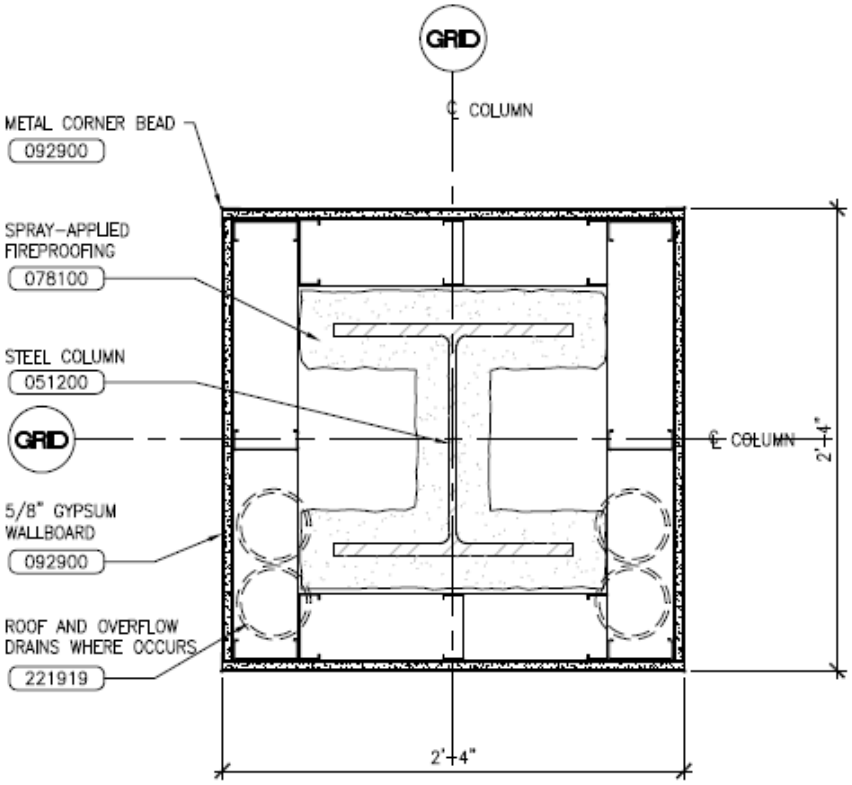


Figure 1.3: ***Typical Gypsum Wallboard Column Cover***

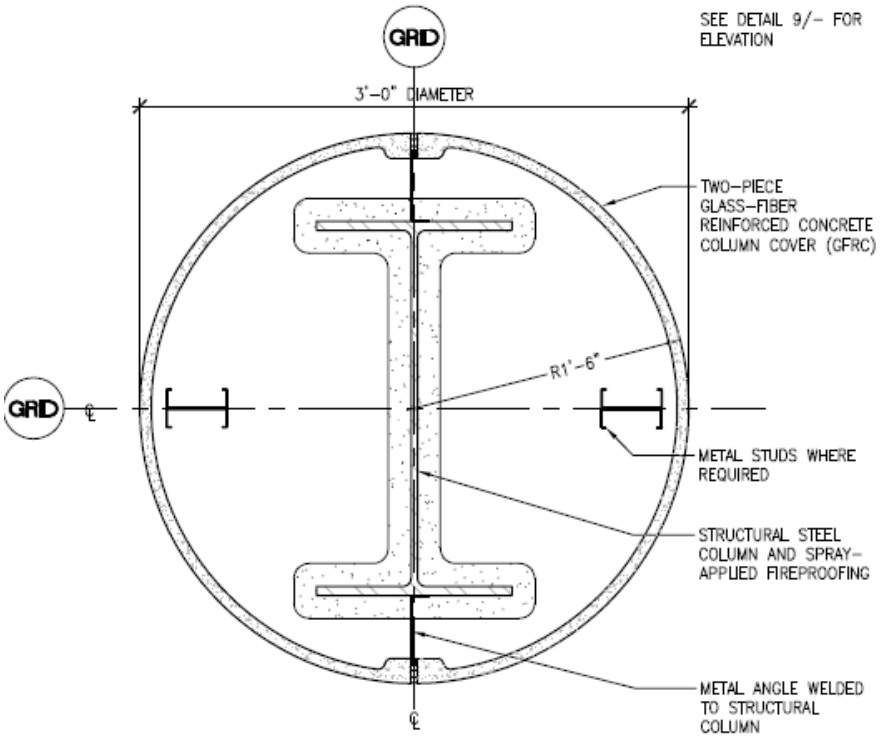


Figure 1.4: ***Typical Exterior GFRC Column Cover***

b) Beams

Columns and beams part of the primary structure are sprayed with a fire resistant material in order to meet the 2 hours fire-resistance rating as required. In addition to SFRM some beams are enclosed in metal cover as shown in the drawing below:

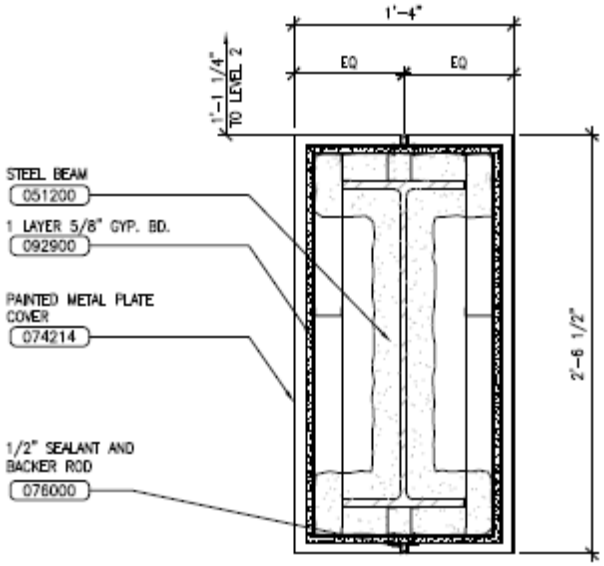


Figure 1.5: ***Typical Beam Metal Cover***

c) Floor and Roof Assemblies

Floor and roof assemblies are rated for 2 hours; different designs are used in order to meet the required fire-resistance of 2 hours. Depending on type of ceiling, suspended floor/ceiling are covered with 5/8” gypsum wallboard or with 7/8” plaster over metal lath

The following drawings illustrate different roof and floor designs used at the Rec Center.

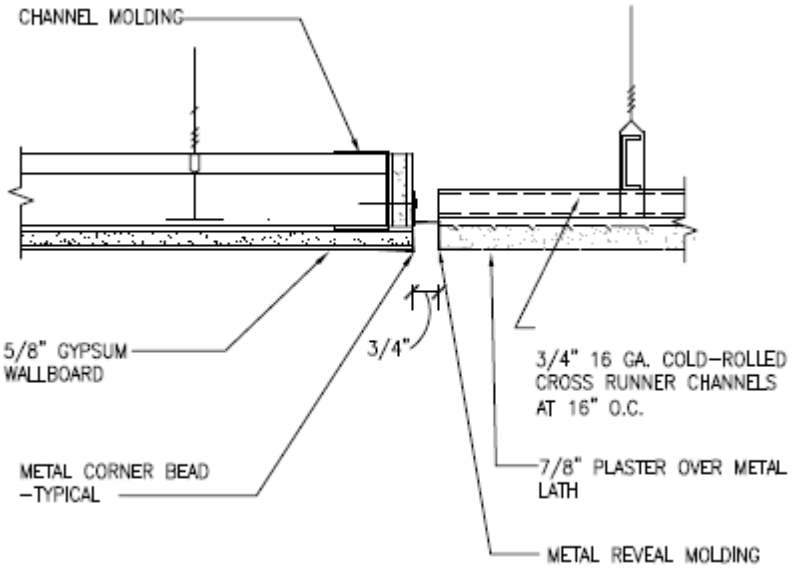


Figure 1.6: ***Typical Suspended Plaster/Gypsum Wallboard***

d) Exterior and Interior Walls

The loading bearing interior and exterior walls are constructed with 2 hours fire-resistance. Several designs are used to achieve the required fire-resistance rating, some walls have 5/8” gypsum wallboard cover over the metal stud framing (Component additive method)

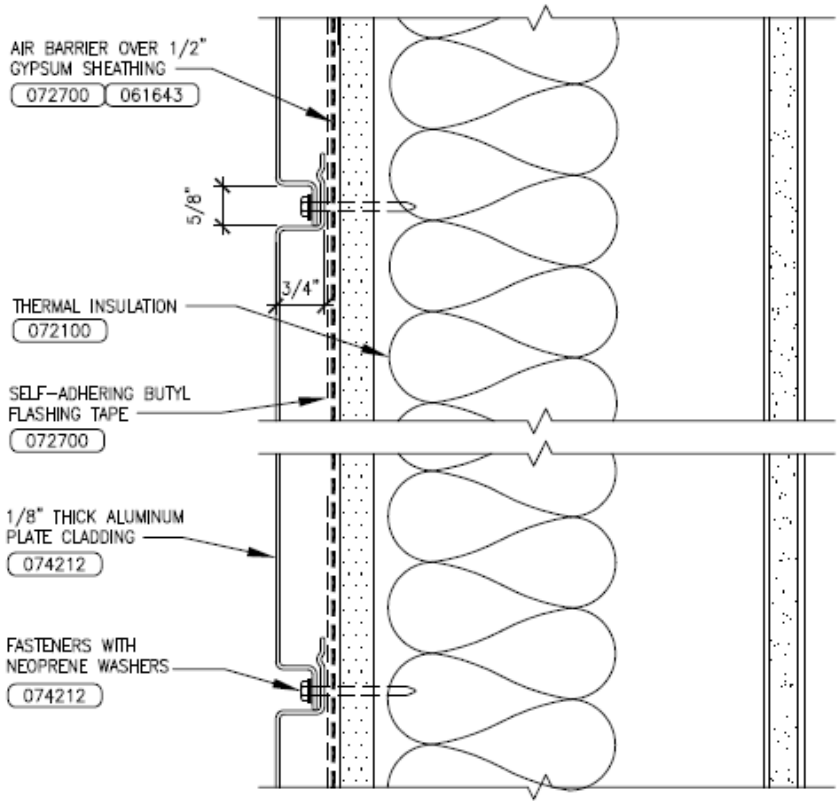
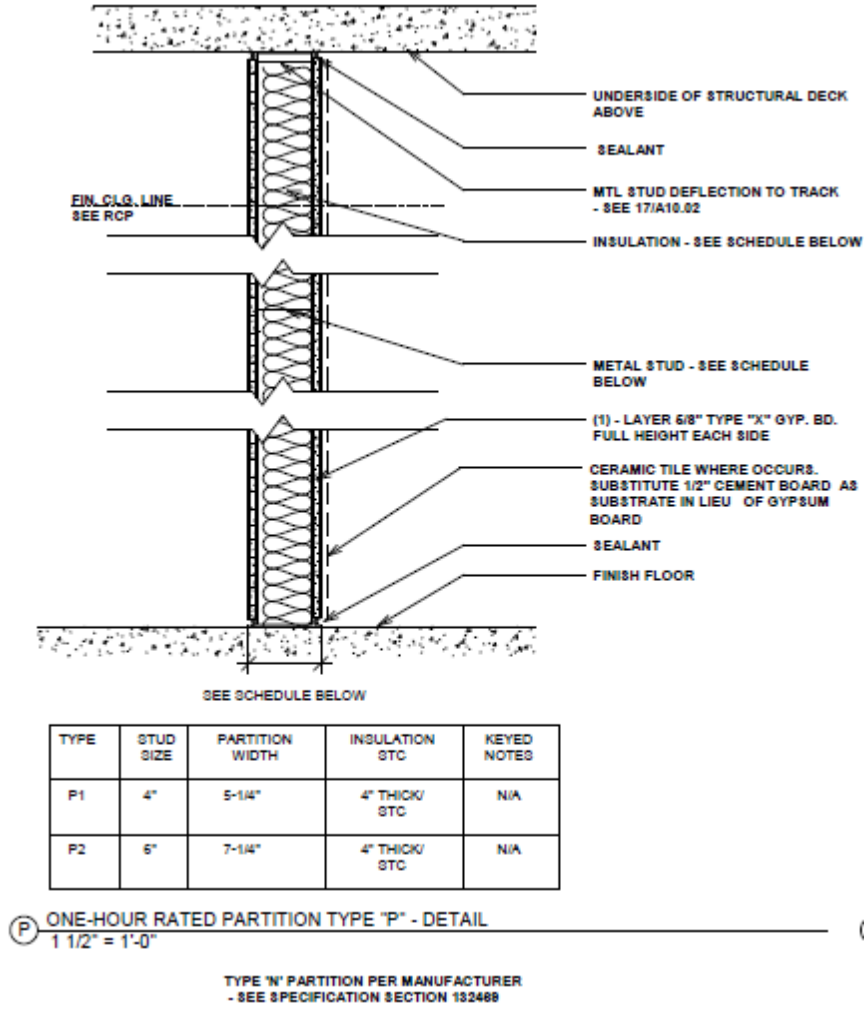


Figure 1.7: ***Typical Metal Plate Wall Cladding***

e) Partitions

There are no fire-resistance requirements for non-load bearing partitions as per IBC-2009, Table 601. However the Rec Center building has non-rated partitions, 1 hour and 2 hour fire-rated (UL system) partitions. See Appendix B for non-rated typical details.



TYPE	STUD SIZE	PARTITION WIDTH	INSULATION STC	KEYED NOTES
P1	4"	5-1/4"	4" THICK/ STC	N/A
P2	6"	7-1/4"	4" THICK/ STC	N/A

Ⓟ ONE-HOUR RATED PARTITION TYPE "P" - DETAIL
1 1/2" = 1'-0"

TYPE 'N' PARTITION PER MANUFACTURER - SEE SPECIFICATION SECTION 132469

Figure 1.8: ***Typical 1 Hour Rated Partition Details***

CHAPTER 2: FIRE ALARM AND DETECTION SYSTEM

TYPES AND OPERATING CHARACTERISTIC OF FIRE ALARM SYSTEM

The fire alarm system in the Rec Center is made of addressable initiating devices and notification appliances. Each device has got a specific electronic address, at any point of time the fire alarm control panel (FACP) gets feedback from those devices and each device status can be checked on the FACP display panel and also is displayed on the fire alarm annunciator display panel. The fire alarm control panel differentiate between three types of signals:

a. Alarm signals: which indicate a fire or fire signature conditions; the fire alarm control panel activates notification appliances (audible and visual) to alert occupants to evacuate. The signals are automatically transmitted to the proprietary supervising station to organize appropriate intervention.
b. Supervisory signals: which are indicative of a need for action in connection with other systems connected to the fire alarm system; the FACP relay automatically the signal to the proprietary supervising station located at the campus police department. The operator in attendance informs the campus Electrical Service Department in order to take appropriate measures (fix the problem).
c. Trouble signals: these signals are initiated by a device or a system to indicate a fault in the monitored device or system. The signals get transmitted to the operator in the proprietary supervising station to organize intervention.

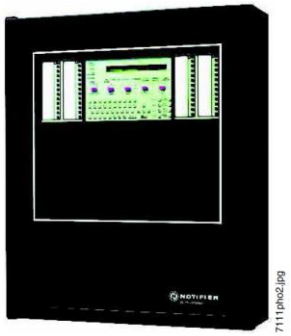
The fire alarm system also interfaces with other auxiliary systems, such as elevator recall system, and smoke management system, which are activated in fire conditions.

The Rec Center fire alarm system is a building fire alarm system as defined in NFPA72 (2010 edition) §**3.3.95.4.1** that is connected to a proprietary supervising station alarm system connecting all the individual building fire alarm systems installed on the Cal Poly campus. The supervising station is located in the university police department building. There are operators in attendance at all times supervising, monitoring and responding to the campus individual building fire alarm system signals.

The campus Electrical Service Department is in charge of maintenance of all the campus building fire alarm systems.

The main purpose of the Rec Center building fire alarm system is to activate local audible and visible alarm notification appliances to notify the occupants that they must evacuate the protected building in a fire condition and to send fire alarm signal to the supervising station.

The building fire alarm system uses Honeywell model NFS2-640 fire alarm control panel; located in the same room as the main electric power supply cabinets. This room is locked and access is limited to authorize people only.



The NFS2-640 intelligent Fire Alarm Control Panel is part of the ONYX® Series of Fire Alarm Controls from NOTIFIER. In stand-alone or network configurations, NOTIFIER claims that this product meets virtually every application requirements. The model is designed with modularity and for ease of system planning, the NFS2-640 can be configured with just a few devices for small building applications, or for a large campus application. The model NFS2-640 is Listed to UL Standard 864, 9th edition.

Figure 2.1: ***Typical FACP NFS2-640 Installed in the Recreation Center***

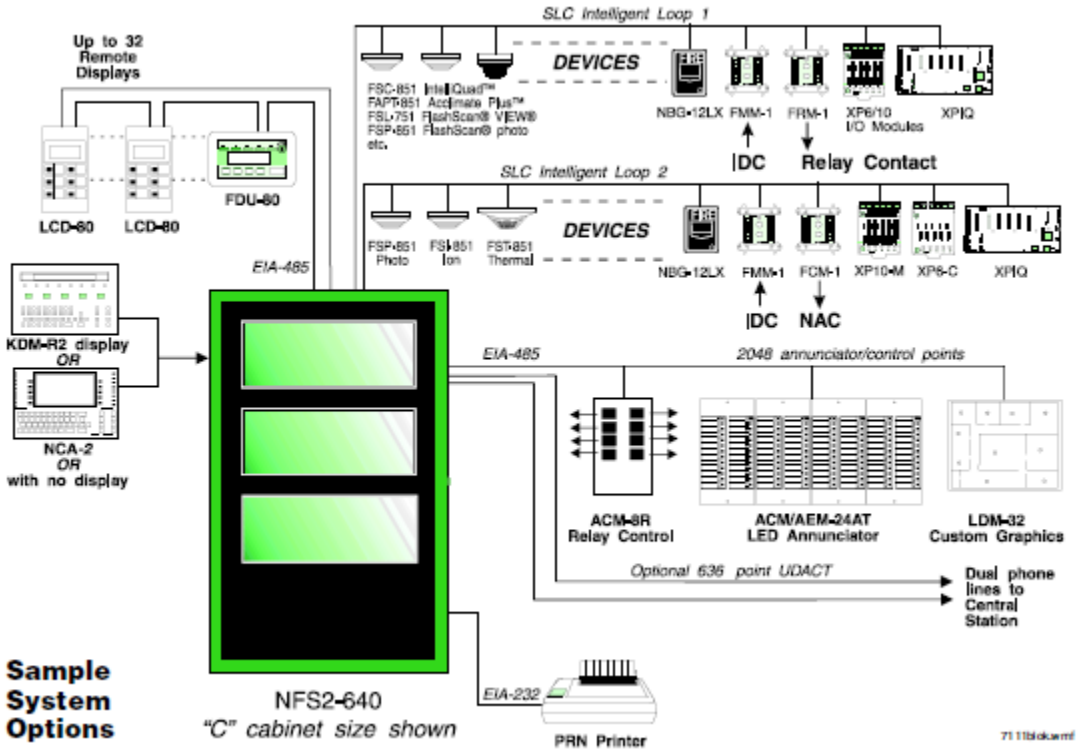


Figure 2.2: ***Typical Sample Connections of NFS2-640 FACP***

A fire alarm annunciator panel is conveniently located in the reception area, behind the front desk counter where selected devices status are displayed. In this location, maintenance people and first fire respondents can assess signal conditions of the building fire alarm system and coordinate actions accordingly.

TYPES AND LOCATION OF INITIATING DEVICES

The initiating devices are located in several rooms and on each floor area.

Most of the initiating devices used in the Rec Center fire alarm system are from a single manufacturer .i.e. Honeywell; this has many advantages as it ensures compatibility, easy integration of the system as whole; hence makes maintenance planning easier as spares management is simplified and provided by one single supplier.

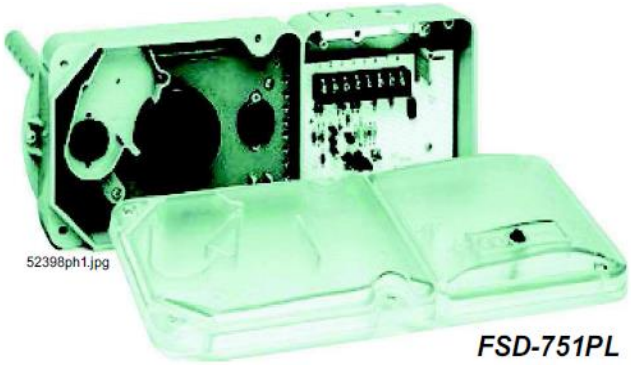
The following devices are installed in the Rec Center building fire alarm system:

a) **Smoke Detector**:
NOTIFIER (by Honeywell): Low-Profile Intelligent Photoelectric Smoke Detector: FSP-851. NOTIFIER 851 Series intelligent (addressable) plug-in smoke detectors with integral communication and detector sensitivity can be programmed in the control panel software. Sensitivity is continuously monitored and reported to the panel. Point ID capability allows each detector's address to be set with decade address switches, providing exact detector location for selective maintenance when chamber contamination reaches an unacceptable level. The FSP-851 photoelectric detector's unique optical sensing chamber is engineered to sense smoke produced by a wide range of combustion sources. FSP-851 detectors are compatible with all NOTIFIER intelligent Fire Alarm Control Panels (FACP).

Figure 2.3: ***Typical Area Smoke Detector in Recreation Center Fire Alarm System***

NOTIFIER model B710LP base is the typical addressable and clip flanged type mounting base used for area smoke and heat detectors installed in the Recreation Center. To the exception of smoke detectors installed inside of air duct, which use B501 type mounting base.

b) **Duct-type Smoke Detector**:
NOTIFIER (by HoneyWell): Intelligent Photoelectric Duct Smoke Detector: FSD-751PL
NOTIFIER FSD-751PL Intelligent (addressable) Photoelectric Smoke Duct Detectors provide low-flow technology that enables duct smoke detection throughout a broad range of airflow environments in HVAC applications. The low-flow technology can detect smoke at air speed velocities of 100 feet per minute (0.5 m/sec) or greater, while continuing the same reliable performance to 4,000 feet per minute (20.32 m/sec). The intelligent low-flow duct detectors sample air currents passing through a duct and gives dependable performance for shutdown of



fans, blowers, and air conditioning systems, preventing the spread of toxic smoke and fire gases through the protected area. FSD-751PL is compatible with all NOTIFIER addressable panels.

Figure 2.4: ***Typical Duct Detector in Recreation Center Fire Alarm System***

c) **Heat Detector**:

NOTIFIER (by HoneyWell): Intelligent Heat Detector: FST-851.

NOTIFIER FST-851 Series intelligent plug-in heat detectors with integral communication provide features that surpass conventional detectors. Detector sensitivity can be programmed in the control panel software. Sensitivity is continuously monitored and reported to the panel. Point ID capability allows each detector's address to be set with decade address switches, providing exact detector locations for selective maintenance when chamber contamination reaches an unacceptable level. FST-851 Series thermal detectors use an innovative thermistor sensing circuit to produce 135°F/57°C fixed-temperature (FST- 851). These thermal detectors provide cost effective, intelligent property protection in a variety of applications. FST-851 Series detectors are compatible with all NOTIFIER Intelligent Fire Alarm Control Panels (FACPs).

Figure 2.5: ***Typical Heat Detector in Recreation Center Fire Alarm System***

d) **Manual Fire Alarm Box**:

NOTIFIER (by HoneyWell) Intelligent Manual Pull Station: NBG-12LX

NOTIFIER model NBG-12LX is a state-of-the-art, dual-action (i.e., requires two motions to activate) pull station that includes an addressable interface for most NOTIFIER intelligent control series panels. Because the NBG-12LX is addressable, the control panel can display the exact location of the activated manual station. This leads fire personnel quickly to the location of the alarm.

The NBG-12LX

Figure 2.6: ***Typical Manual Fire Alarm Box in Recreation Center Fire Alarm System***

e) **Wet-pipe Fire Sprinkler Heads**:

The entire Center is fully covered by a water-based fire suppression system. The sprinkler heads are thermal elements that are activated by heat. When a sprinkler head is activated, water flows through broken thermal glass; and hence a flow switch installed in the sprinkler riser manifold connected to the building FACP initiates an alarm signal.

Water-based fire suppression system installed in the Rec Center is discussed in chapter 3.

f) Supervisory Signal Initiating Devices

I. Gate valve OSY monitoring switch: SYSTEM SENSOR, model OSY2, is equipped with tamper resistant cover screws to prevent unauthorized entry. Inside, two sets of SPDT (Single pole, double throw- a simple type of changeover electrical switch) synchronized switches are enclosed in a durable terminal block to assure reliable performance. There is also a 100 percent synchronization with the installed fire alarm control panel.

Figure 2.11: ***Typical Gate Valve OSY2 Tamper Switch for Recreation Center Fire Alarm***

II. Flow Switch and Tamper Switch: POTTER, model VSC.

The exclusive and dedicated flow switch designed for the riser manifolds has been tested and Listed for use in this specific configuration by UL and FM. The riser manifold connects the sprinkler valve to the rest of wet piping system. The flow switch and tamper switch in a single assembly provides the necessary signals (alarm, supervisory and trouble). The model VSC is suitable for indoor or outdoor use with factory installed gasket and die-cast housing:

• NEMA 4/IP55 rated enclosure - use with appropriate conduit fitting.

• Temperature range: 40°F to 120°F (4.5°C to 49°C)

Figure 2.12: ***Typical Sprinkler Riser Manifold***

The following table summarizes the type and location of signaling devices in the Rec Center building:

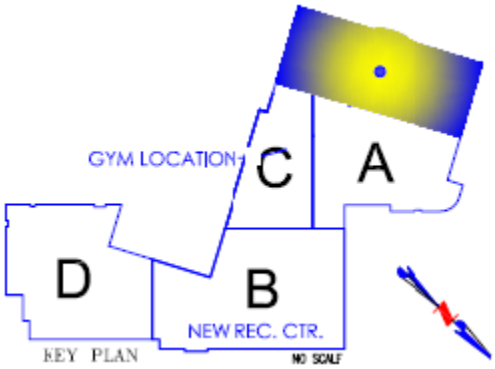


Figure 2.13: ***Rec Center Key Plan – Zone Details (E is Highlighted)***

The table below shall be read with reference to floor maps in Appendix A

Table 2.1: ***Initiating Devices installed in the Recreation Center***

Device Type	**Numbers of devices**				
First Floor	**Zone A**	**Zone B**	**Zone C**	**Zone D**	**Zone E**
Area smoke detectors	0	6	15	1	6
Duct-type air smoke detectors	0	0	1	0	1
Heat detectors	0	1	2	0	0
Manual fire alarm box (manual pull station)	6	3	4	4	1

Device Type	Numbers of devices				
Flow switches and Tamper switches	0	2 and 2	0	0	1 and 1
Second Floor	**Zone A**	**Zone B**	**Zone C**		**Zone E**
Area smoke detectors	4	6	7		0
Duct-type air smoke detectors	0	0	0		0
Heat detectors	0	0	0		0
Manual fire alarm box (manual pull station)	1	2	1		1
Flow switches and Tamper switches	0	0	0		0
Roof	**Common Zone**				
Duct-type air smoke detectors	8				
Manual fire alarm box (manual pull station)	4				

LOCATION, SPACING AND PLACEMENT OF FIRE DETECTORS

The general requirements stipulated in NFPA72, chap 17 will be used in this section to study compliance of fire detectors installed in the Rec Center. We have recognized that the building fire alarm system was designed in accordance with NFPA 72-2007 edition, however for our analysis we are going to use NFPA 72-2010 as tasked.

NFPA 17.4.5 stipulates that initiating devices shall be installed in all areas, compartments, or locations where required by other governing laws, codes, or standards. NFPA 72, chapter 17 answers the questions relative to how many devices are required and how they should be installed.

In the absence of performance objectives of the fire alarm system installed; we can assume however that the system design followed at least the code prescriptive requirements. This assumption enables us to assess the location, spacing and placement of the signaling devices based purely on the prescriptive requirements under applicable sections of NFPA72, chapter 17.

We will assess location, spacing and placement of each installed initiating device in the following order:

- Area smoke detectors;
- Duct-type smoke detectors;
- Heat detectors;
- Manual fire alarm boxes (manual pull station); and
- Devices used for supervisory signals.

The technical specifications of typical initiating devices installed in the Rec Center are summarized below:

a) Smoke detector:

Spot-type, addressable. Photoelectric detector, UL and FM approved for nominal spacing of 30 ft (7.14 m) for ceiling height up to 10 ft (3.148 m) and higher.
There are installed either ceiling mounted or inside of return air ducts:

i. Ceiling mounting
NFPA 72, 2010 edition, §**17.7.3.2.1**: Spot-type smoke detectors shall be located on the ceiling or, if on a sidewall, between the ceiling and 12 in. (300 mm) down from the ceiling to the top of the detector.

ii. Inside of return air ducts

NFPA 72, 2010 edition, §**17.7.5.4.2.2**: Unless otherwise modified by **17.7.5.4.2.2(A)** or **17.7.5.4.2.2(B)**, if the detection of smoke in the return air system is required by other NFPA standards, a detector(s) listed for the air velocity present shall be located where the air leaves each smoke compartment, or in the duct system before the air enters the return air system common to more than one smoke compartment.

A.17.7.5.4.2.2: Detectors listed for the air velocity present can be permitted to be installed at the opening where the return air enters the common return air system. The detectors should be installed up to 12 in. (300 mm) in front of or behind the opening and spaced according to the following opening dimensions [see Figure A.17.7.5.4.2.2(a) through Figure A.17.7.5.4.2.2(c)]:

b) Duct-type smoke detector:
Duct-type smoke detector. Spot-type, photoelectric and addressable. Can operate in duct air velocity: 0.5 to 20.32 m/s and under temperature 32 to 135 ^{0}C.

NFPA 72, 2010 edition, §**17.7.5.5.2 (2)**: Air duct detectors shall be installed in such a way as to obtain a representative sample of the airstream. This installation shall be permitted to be achieved by rigid mounting to the wall of the duct with the sensing element protruding into the duct.
A.17.7.5.5.2: Where duct detectors are used to initiate the operation of smoke dampers, they should be located so that the detector is between the last inlet or outlet upstream of the damper and the first inlet or outlet downstream of the damper.

The assessment of location, spacing and placement of area smoke detectors were based on the available fire alarm system drawings and site walk downs. The following observations were made.

Refer to Appendix C for detector layout floor plan details.

Table 2.2: ***Smoke Detectors installed in the Recreation Center***

Location	Placement and Spacing
First Floor	
Zone A	
No area or air duct smoke detectors. This is deemed adequate as area has got manual pull stations and emergency telephones at each exit door.	

Location	Placement and Spacing
Zone B	
Elevator 2 lobby room 130: L1D016	Located on flat smooth ceiling just above elevator door; placement deemed compliant.
Elevator 2 machine room: L1D017	Located on flat smooth ceiling, spacing compliant as per room size
Intramurals office room 134: L1D019	In-duct smoke detector; placement deemed compliant
Electrical room 136: L1D020 and L1D023	One area smoke detector on ceiling(D020), one in-duct detector; placement deemed compliant as per room size
Work room: DSD022	In-duct smoke detector, placement deemed compliant
Zone C	
Electric room 113: L1D001	Located on flat smooth ceiling, spacing compliant as per room size
Elevator 1 machine room 115: L1D002	Located on level ceiling with beam height greater than 10 percent of ceiling height. §17.7.3.2.4.2.2(b) applied, compliant to the code
Elevator 1 lobby room 111: L1D004	Located on smooth ceiling just above elevator 1 door; placement deemed compliant
Telecom room 114: L1D005, L1D006, L1D007 & L1D008	In-duct smoke detectors, placement deemed compliant
Control room110C: L1D010	Located on flat smooth ceiling, spacing compliant as per room size
Men's locker room 117: L1D011,L1D012 & L1D013	In-duct smoke detectors, placement deemed compliant
Building power supply room 190: L1D014	Above the fire alarm control panel, mounted on flat smooth ceiling, spacing compliant as per room size
Mechanical room 191: L1D025 and L1D102	One air handling unit smoke detector (D025) and the other area smoke detector located on flat smooth ceiling, placement of smoke detector adequate as per room size
1st floor storage room 111: L1D103 and L1D104	Room served by zones (C and E), each zone has two area air smoke detectors. Detectors spacing adequate, extra detectors required
Zone D	
Electrical room 172: L1D021	Located on flat smooth ceiling, spacing complaint as per room size
Zone E	

Location	Placement and Spacing
1st floor storage room 111: L1D105 and L1D106	Room served by zones (C and E), each zone has two area air smoke detectors. Detectors spacing adequate, extra detectors required
Equipment room 187: L1D107	Mounted on flat smooth ceiling, placement adequate as per room size
Corridor C102: L1D108	Mounted on flat smooth ceiling, placement inadequate; detector to be relocated toward the middle of the corridor
Wrestling room (electrical compartment) 100C and 100D: L1D110, L1D109 and L1D114	Area smoke detectors on flat smooth ceiling (D109 and D110) and one air handling unit smoke detector; placement deemed compliant
Main gym room 100: L1D113	Air handling unit smoke detector; placement deemed compliant
Second Floor	
Zone A	
Telecom and data room 210: L1D136, L1D137, L1D138, L1D139 and L1D140	In-duct smoke detectors; placement deemed compliant
Zone B	
Telecom room 226: L1D044 and L1D045	In-duct detectors, placement deemed compliant
Electrical room 227: L1D046, L1D047 and L1D048	One area smoke detector on flat smooth ceiling (D046) and two in-duct air smoke detectors; spacing deemed adequate as per room size
Stretching area 224A: L1D159	Area smoke detector on flat smooth ceiling above elevator door
Zone C	
Women's restroom room 206: L1D031	In-duct air smoke detector, spacing deemed adequate as per room size
Electrical room 208: L1D032	Smoke detector located on flat smooth ceiling, spacing adequate as per room size
Elevator 1 lobby areas: L1D033 and L1D034	Smoke detectors on flat smooth ceiling in passage areas above both East and West elevator doors. Placement adequate
Storage room 213A: L1D041	In-duct air smoke detector, placement deemed compliant
Jogging track 2: L1D042	In-duct air smoke detector, placement deemed compliant

Location	Placement and Spacing
Zone E	
No area or air duct smoke detectors. This is deemed adequate as the gymnasium has manual pull stations and emergency telephones at each exit door.	
Roof	
Roof electrical room: L1D158	Area smoke detector on flat smooth ceiling, spacing adequate as per room size
Air Handling Unit 1: L1D117	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 2: L1D118	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 3: L1D119	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 4: L1D120	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 5: L1D121	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 6: L1D122	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 7: L1D123	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 8: L1D124	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 9: L1D125	Duct-type smoke detector, placement deemed adequate
Air Handling Unit 10: L1D126	Duct-type smoke detector, placement deemed adequate

c) Heat detectors (Spot type detectors)
Spot-type, addressable. Fixed-temperature set point of 135 ^{0}F (57 ^{0}C). UL approved for 50 feet (15.24 m) center to center and FM approved for 25 feet (7.62 x 7.62 m) spacing.

NFPA72, 2010 edition, §**17.6.3.1.1**: One of the following requirements shall apply:
(1) The distance between detectors shall not exceed their listed spacing, and there shall be detectors within a distance of one-half the listed spacing, measured at right angles from all walls or partitions extending upward to within the top 15 percent of the ceiling height.
(2) All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the listed spacing (0.7 S).

The spacing and location were assessed in accordance with the code NFPA72 requirements; the following observations were made:

Table 2.3: ***Heat Detectors installed in the Recreation Center***

Location	Placement and Spacing
Elevator 1 machine room: L1D003 and L1D024	Located on level ceiling with beam height more than 100 mm below ceiling. When §17.6.3.3.1.2 applied, spacing is compliant to the code
Elevator 2 machine room: L1D018	Located on level ceiling with beam height more than 100 mm below ceiling. When §17.6.3.3.1.2 applied, spacing is compliant to the code

d) Manual fire alarm box

Manual pull station. Addressable, suitable for indoors in dry location, ambient temperature range 32 to 120 ^{0}F (0 to 49 ^{0}C). Pushing in and pulling down on the handle for activation. UL and FM approved.

NFPA72, 2010 edition, §**17.14.5**: Manual fire alarm boxes shall be installed so that they are conspicuous, unobstructed, and accessible. NFPA 72, 2010 edition, §**17.14.6**: Manual fire alarm boxes shall be located within 60 in. (1.52 m) of the exit doorway opening at each exit on each floor.

It was observed that placement and location of manual fire alarm boxes (manual pull stations) were compliant to code requirements:

Table 2.4: ***Manual Fire Alarm Boxes (Manual pull stations) installed in the Recreation Center***

Location	Placement
First Floor	
Zone A	
Vestibule area 106: L1M001 and L1M098	Located next to West and East exit doors
Wellness reception area 108: L1M002	Located next to East exit door
Training room 109: L1M03	Located next to East exit door
Pre-function room 101: L1M04	Located next to East exit door
Main Gym room 100: L1M097	Located next to East exit door
Zone B	
Lobby room 110: L1M06 and L1M07	Located next to both North exit doors
Circulation (lobby south) area 130: L1M08	Located next to South exit door

Location	Placement
Zone C	
Hallway area 123: L1M09	Located next to South exit door
Men's vestibule room 117A: L1M010	Located next to South exit door
Women's vestibule room 118A: L1M011	Located next to South exit door
Passageway area 102: L1M012	Located next to South exit door
Zone D	
Circulation area 156B: L1M013	Located next to exit West door
MAC room 170: L1M014 and L1M015	Located next to both South exit doors
MAC lobby area 170D: L1M016	Located next to exit South door
Zone E	
Event storage room 185: L1M05	Located next to North exit door
Pool pump room 180: L1M017 and L1M018	Located next to both West and East exit doors
Pool equipment room 184: L1M019	Located next to East exit door
Main Gym room 100: L1M096	Located next to West exit door
Second Floor	
Zone A	
North stairwell: L1M041	Located at exit door connecting to vestibule 106
Zone B	
Passage stair 201: L1M042	Located next to stairs leading to first floor
Cardio fittingness 2 room 224: L1M023	Located next to stairs leading to first floor
Zone C	
Passage 202: L1M102	Located next South exit door
Zone E	
North Gym 200B: L1M160	Located next to West exit door
Roof	
Roof West: L1M131	Located next to stairs

Location	Placement
Roof East: L1M132	Located next to stairs
Roof North-East: L1M133	Located next to AHU 3
Roof South: L1M134	Located next AHU 2

e) Automatic sprinkler system:
The entire building is protected by an automatic sprinkler system. The sprinkler heads installed are all VIKING with the following head designs:

- Concealed fire sprinkler heads used in suspended metal ceiling
- Upright fire sprinkler heads used in exposed areas with no suspended ceiling like in gymnasium rooms
- Pendant fire sprinkler heads used in suspended ceiling where surface mount ceiling obstruction exists
- Recessed fire sprinkler heads used in suspended ceiling where no surface mount obstruction exists.

f) Sprinkler flow switch alarm initiating devices:
Flow switch model: POTTER model VSC are designed, tested and UL Listed and FM approved for alarm initiating devices.

Table 2.5: ***Sprinkler Flow Switches installed in the Recreation Center***

Location	Placement
East sprinkler connection: L1M023 and L1M026	Each connected to 2” wet-pipe riser manifolds; code compliant
West sprinkler valve connection: L1M028	Connected to 2” wet-pipe riser manifold, code compliant

g) Sprinkler control valve supervisory and trouble signal-initiating devices:

- Sprinkler control valve Outside Screw and York (OSY) tamper switch: SYSTEM SENSOR OSY2 model; reliable performance and UL Listed and FM approved.
- Riser manifold flow switch POTTER, model VSC is equipped with tamper switch cover, UL Listed and FM approved for the application.

Table 2.6: ***Sprinkler Control Valve Supervisory and Trouble Signal-Initiating Devices***

Location	Placement
Main fire water connection: L1M095	Tamper switch connected to main water supply gate valves; code compliant
East sprinkler valve connection: L1M024 and L1M027	Tamper switch covers of flow switches L1M023 and L1M026 respectively; code compliant
West sprinkler valve connection: L1M029	Tamper switch encased in flow switch L1M028; code compliant

ALARM AND NOTIFICATION APPLIANCES

It is a code requirement that actuation of notification appliances, emergency voice communications, fire safety functions, and annunciation at the protected premises shall occur within 10 seconds after the activation of an initiating device. NFPA 72-2010, §**23.8.1.1**.

The Rec Center fire alarm system is equipped with notification appliances in order to provide audible, visual and voice stimuli for initiating emergency actions and to provide information to staffs, users and to emergency response personnel from fire department or dispatch from the supervising station.

A. Types of Signaling Notification Appliances

The following notification appliances are installed in the Recreation Center fire alarm system:

1. Speaker-Strobes (Audible/visible devices)

   SYSTEM SENSOR (SpectrAlert Advance) SPSCW model; a combination speaker strobe listed to UL and approved for fire protection notification systems. These speakers have field selectable sound output power taps which are selected by rotary switches. The Center fire alarm system uses typically two sound outputs settings 1W and ½ W with 82 and 79 dB @10 ft SPL respectively. The strobe light consists of a xenon flash tube and associated lens/reflector system of standard candela range (15 cd to 115 cd).

   There can be wall or ceiling mounted; indoors or outdoors with appropriate weather-resistant back box.

   Figure 2.13: ***Typical speaker strobe installed in the Recreation Center***

2. Horn / Strobes

SYSTEM SENSOR (SpectrAlert Advance) model. Three different models are used in the Center fire alarm installation depending whether they are wall or ceiling mounted, of red or white colors.

These models comply with the American with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe operating voltage range. They have 11 field selectable candela settings. The strobe consists of a xenon flash tune and associated lens/reflector system. The horn has three audibility options and an option to switch between a temporal and a non-temporal (continuous) pattern. Options are set by a multiple position switch. The horn is rated at 88+ dBA at 16 Volts.

Figure 2.14: ***Typical Horn/Strobe installed in the Recreation Center***

B. Location of Signaling Notification Appliances

To convey reliably the intended alarm information to the intended personnel and users of the facility during emergency; the notification appliances installed shall meet requirements of sections 18.4 and 18.5 of NFPA 72.

Audible appliances location shall meet NFPA 72-2010, §**18.4.8.1**: if ceiling heights allow, and unless otherwise permitted by **18.4.8.2** through **18.4.8.5**, wall-mounted appliances shall have their tops above the finished floors at heights of not less than 90 in. (2.29m) and below the finished ceilings at distances of not less than 6 in. (150 mm).

Visible appliances location shall meet NFPA 72-2010, §**18.5.4.1**: wall-mounted appliances shall be mounted such that the entire lens is not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor or at the mounting height specified using the performance-based alternative of **18.5.4.5**.

Recreation Center device mounting elevation details are shown in the figure below, which clearly indicate that NFPA 72 audible and visible requirements were met.

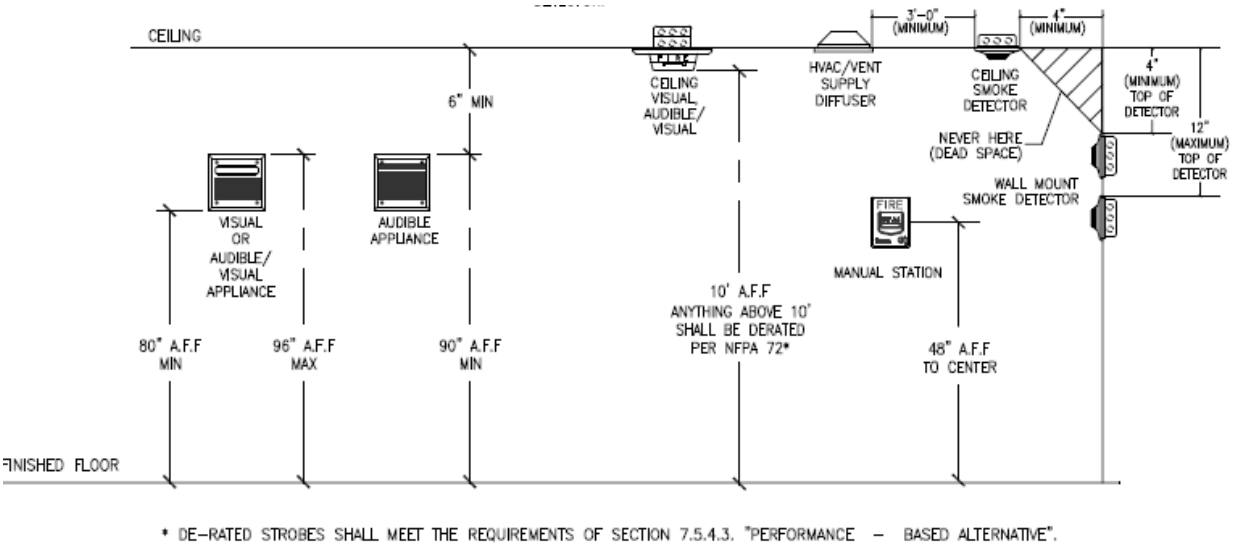


Figure 2.15: ***Device Mounting Elevation Details in the Recreation Center***

C. Spacing and Placement of Notification Appliances

Refer to Appendix C for details of notification appliances installed in the Rec Center.

1) Audible Signaling:
   The Rec Center can be classified as places of assembly in accordance with NFPA 72-2010, Table A.18.4.3.

   Table 2.7: ***Extract from NFPA 72-2010, Table A.18.4.3 Average Ambient Sound Level***

TABLE A.18.4.3 *Average Ambient Sound Level According to Location*

Location	*Average Ambient Sound Level (dBA)*
Business occupancies	55
Educational occupancies	45
Industrial occupancies	80
Institutional occupancies	50
Mercantile occupancies	40
Mechanical rooms	85
Piers and water-surrounded structures	40
Places of assembly	55
Residential occupancies	35
Storage occupancies	30
Thoroughfares, high-density urban	70
Thoroughfares, medium-density urban	55
Thoroughfares, rural and suburban	40
Tower occupancies	35
Underground structures and windowless buildings	40
Vehicles and vessels	50

Audible appliances shall be at least 15 dBA above average ambient sound level. A typical speaker installed in the Center is of minimum sound output (½ W) and 79 dBA. This is greater than the recommended minimum value for the application: 55 + 15 = 70 dBA. Any horn/strobe installed is rated at 88 dBA, which indicates the minimum sound level requirement is met in the entire building.

Using the rule of thumb of 6 dBA method .i.e. in any open room, where sound does not reflect off surfaces, SPL decreases by about 6 dB every time the distance from the source is doubled.

The gymnasium is used in our analysis to illustrate compliance of notification appliance spacing and placement. The gymnasium room 120 is equipped with 7 audible-strobe (speaker/strobe) combination appliances wall mounted of 82 dBA. So as shown in figure 2.16 below; the room is adequately covered.
Each square represents a coverage of 110 cd audible/strobe.

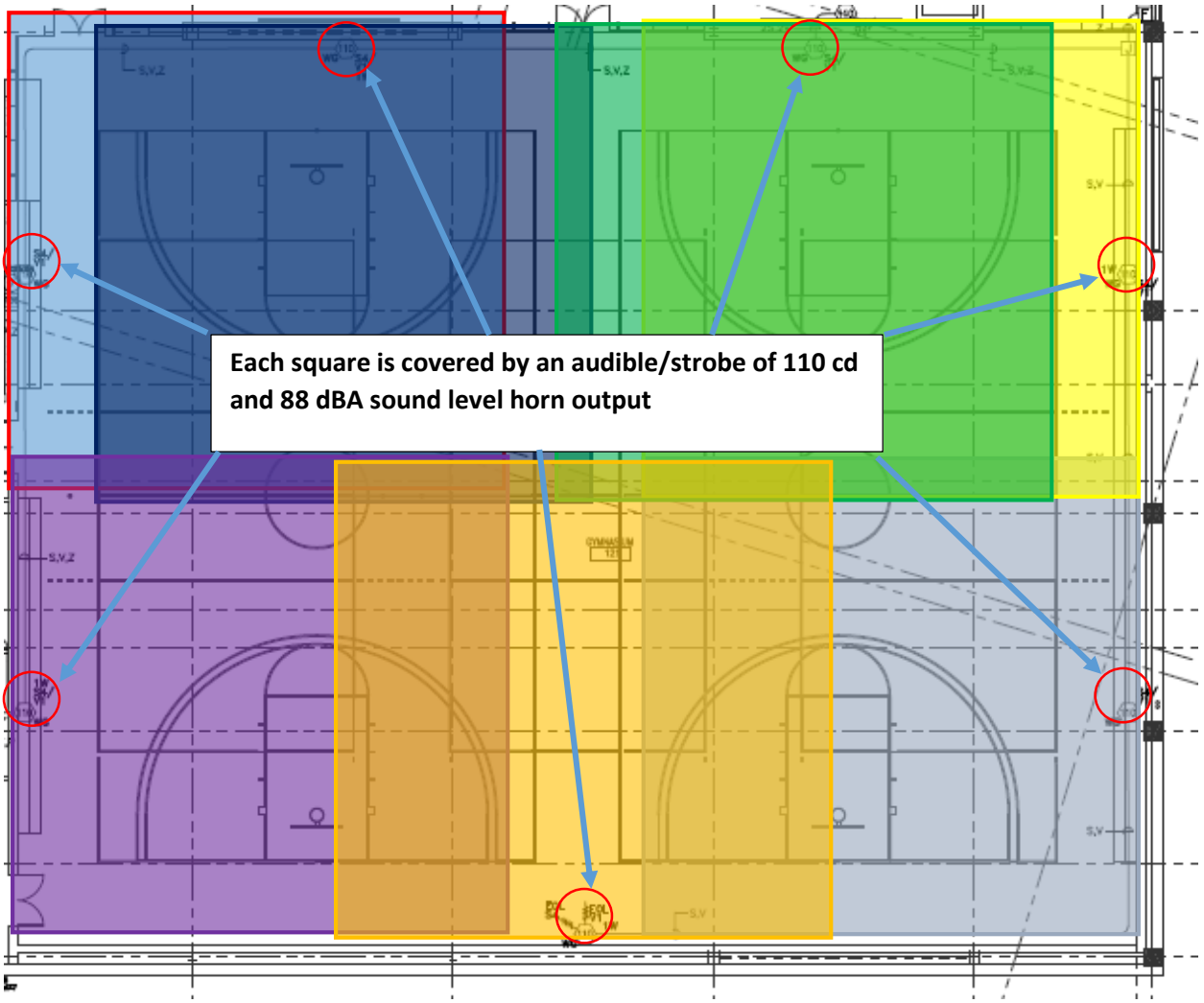


Figure 2.16: ***Typical Center Gymnasium Audible/Visible Appliances Coverage***

2) Visible signaling:
Spacing shall be in accordance with either Table 18.5.4.3.1(a) for wall-mounted visible appliances or Table 18.5.4.3.1(b) for ceiling-mounted visible appliances.

Table 2.8: ***Typical Spacing Requirements for Visible Appliances, NFPA 72-2010***

TABLE 18.5.5.4.1(a) *Room Spacing for Wall-Mounted Visible Appliances*

Maximum Room Size		*Minimum Required Light Output [Effective Intensity (cd)]*	
ft	*m*	*One Light per Room*	*Four Lights per Room (One Light per Wall)*
20 × 20	6.10 × 6.10	15	NA
28 × 28	8.53 × 8.53	30	NA
30 × 30	9.14 × 9.14	34	NA
40 × 40	12.2 × 12.2	60	15
45 × 45	13.7 × 13.7	75	19
50 × 50	15.2 × 15.2	94	30
54 × 54	16.5 × 16.5	110	30
55 × 55	16.8 × 16.8	115	30
60 × 60	18.3 × 18.3	135	30
63 × 63	19.2 × 19.2	150	37
68 × 68	20.7 × 20.7	177	43
70 × 70	21.3 × 21.3	184	60
80 × 80	24.4 × 24.4	240	60
90 × 90	27.4 × 27.4	304	95
100 × 100	30.5 × 30.5	375	95
110 × 110	33.5 × 33.5	455	135
120 × 120	36.6 × 36.6	540	135
130 × 130	39.6 × 39.6	635	185

NA: Not allowable.

The strobes installed in the Center gymnasium are 110 cd, however 95 cd would have been adequate. The coverage as illustrated in figure 2.16 indicates that the spacing of those strobes is code compliant.

D. Voltage Drop Calculations

Due to the size of the facility and number of initiating devices and notification appliances; the building fire alarm system is equipped with remote power supplies in each floor and covering specific areas power needs.
The gymnasium is used for voltage drop calculations as it contains the highest number of strobes of high effective intensity; eight speaker-strobes of 110 cd are connected on this Notification Appliance Circuit powered from RPS located in Electrical room 136.

$$V_{load} = V_{term} - (I_{load} R_{cond})$$

$$R_{cond} = {}^{(V_{term} - V_{load})}/_{I_{load}}$$

Where:

-V_{load} = 16 volt min operating voltage of typical appliance

-V_{tem} = 20.4 volt min operating voltage of control unit

-I_{load} = rated current draw of all connected appliances

-R_{cond} = total conductor resistance in ohms

Table 2.9: ***Extract from Typical SYSTEM SENSOR Speaker-Strobe Average Current Ratings***

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)					
		8–17.5 Volts		16–33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15*	123	128	66	71
	15/75*	142	148	77	81
	30*	NA	NA	94	96
	75*	NA	NA	158	153
	95*	NA	NA	181	176
	110	NA	NA	202	196
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258

Total I_{load} = 8 x 0.202 = 1.616 A; therefore

$$R_{cond} = {}^{(V_{term} - V_{load})}/_{I_{load}} = {}^{(20.4 - 16)}/_{1.616} = 2.72\ ohms$$

The last strobe on this circuit is approximately 135 meters from the remote power supply (in electrical room 136), hence total wire length would be 135 x 2= 270 meters. The resistance of conductor per km would be:

$$R_{cond} = {}^{(2.72\ x\ 1000)}/_{270} = 10.07\ {}^{ohms}/_{Km}$$

Therefore the required wire gauge size would be selected from Table 8 of NEC (NFPA 70):

Table 2.10: ***Extract from NEC-Table 8: Conductor Properties***

TABLE 8 Conductor Properties

Size (AWG or kcmil)	Area		Conductors							Direct-Current Resistance at 75°C (167°F)					
			Stranding			Overall				Copper					
				Diameter		Diameter		Area		Uncoated		Coated		Aluminum	
	mm²	Circular mils	Quantity	mm	in.	mm	in.	mm²	in.²	ohm/ km	ohm/ kFT	ohm/ km	ohm/ kFT	ohm/ km	ohm/ kFT
18	0.823	1620	1	—	—	1.02	0.040	0.823	0.001	25.5	7.77	26.5	8.08	42.0	12.8
18	0.823	1620	7	0.39	0.015	1.16	0.046	1.06	0.002	26.1	7.95	27.7	8.45	42.8	13.1
16	1.31	2580	1	—	—	1.29	0.051	1.31	0.002	16.0	4.89	16.7	5.08	26.4	8.05
16	1.31	2580	7	0.49	0.019	1.46	0.058	1.68	0.003	16.4	4.99	17.3	5.29	26.9	8.21
14	2.08	4110	1	—	—	1.63	0.064	2.08	0.003	10.1	3.07	10.4	3.19	16.6	5.06
14	2.08	4110	7	0.62	0.024	1.85	0.073	2.68	0.004	10.3	3.14	10.7	3.26	16.9	5.17
12	3.31	6530	1	—	—	2.05	0.081	3.31	0.005	6.34	1.93	6.57	2.01	10.45	3.18
12	3.31	6530	7	0.78	0.030	2.32	0.092	4.25	0.006	6.50	1.98	6.73	2.05	10.69	3.25
10	5.261	10380	1	—	—	2.588	0.102	5.26	0.008	3.984	1.21	4.148	1.26	6.561	2.00
10	5.261	10380	7	0.98	0.038	2.95	0.116	6.76	0.011	4.070	1.24	4.226	1.29	6.679	2.04

From the Table 2.10; conductor 12 AWG size would be the appropriate minimum allowable size conductor to be used for this application.
If coated copper is used, resistance would be 6.57 ohms/Km; actual voltage drop would then be

$$V_{drop} = 1.616\, x\, {}^{(6.57\ x\ 270)}/_{1000} = 2.87\ V$$

The actual last speaker-strobe voltage would be

$$V_{load} = V_{term} - V_{drop} = 20.4 - 2.87 = 17.53\ V,$$
$$higher\ than\ minimum\ requirement\ of\ 16V$$

This indicates that there is enough spare capacity on this NAC.

NOTIFICATION APPLIANCE POWER REQUIREMENTS

The provisions of NFPA72-2010, §10.5 shall apply to power supplies used for the Recreation Center.

The NFPA72-2010, §**10.5.2** prescribes: "All power supplies shall be installed in conformity with requirements of NFPA 70, National Electrical Code, for such equipment and with the requirements indicated in this subsection". And §**10.5.3**: Unless configured in compliance with **10.5.4**, at least two independent and reliable power supplies shall be provided, one primary and one secondary.

The Rec Center fire alarm and detection system is supplied with commercial power as primary supply.

The secondary power supply is provided by batteries dedicated to the building fire alarm and communication systems. The secondary power supply is designed such to provide power automatically to the building fire alarm system within 10 seconds whenever the primary power supply fails to provide the minimum voltage required for proper operation.

The proper amount of battery standby capacity for the Rec Center was calculated to include the normal standby supervisory quiescent load for 24 hours as well as the load during 15 minutes period of alarm.

The secondary power supply to the Rec Center fire alarm system consists of 1x (one) power supply dedicated to the main fire alarm control panel supplying the entire building and 5x(five) remote power supplies for audio/visual notification appliances grouped as follows:

- 1 Remote Power Supply located in electrical room 113 to supply NAC zones A,C,E of first floor
- 1 Remote Power Supply located in electrical room 136 to supply NAC zones B of first floor
- 1 Remote Power Supply located in electrical room 172 to supply NAC zones D of first floor
- 1 Remote Power Supply located in electrical room 206 to supply NAC zones A,C and E of second floor
- 1 Remote Power Supply located in electrical room 227 to supply NAC zones B of second floor

The secondary power to building Emergency Communication System is subdivided into two remote power supplies as follows:

- 1 dedicated supply located in electrical room 113
- 1 dedicated supply located in electrical room 136

The Rec Center fire alarm system uses model FCPS-24S8 (8 amps) remote power supplies with battery chargers for supervision and expanded power driving capability of Notification Appliance Circuits. This model provides regulated and filtered 24 VDC power to NAC and also contains a battery charger capable of charging up to 18 amp-hours batteries. The model is UL-listed, FM, CSFM approved for fire protection system applications.

The following extracts illustrate the calculations performed to determine battery sizes:

BATTERY SIZING CALCULATION

CAL POLY SLO – STUDENT RECREATION CENTER

MAIN FIRE ALARM CONTROL PANEL

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	NFS2-640	CPU2-640 w/CPS-24	0.32500	0.32500	0.28500	0.28500
1	NFS2-640	KDM-R2	0.10000	0.10000	0.10000	0.10000
1	Voice	DVC&DVC-KD	0.50000	0.50000	0.50000	0.50000
32	Control Relay	FRM-1	0.00026	0.00816	0.00650	0.20800
11	Duct Det	DNR w/ FSP-851	0.00036	0.00396	0.00686	0.07546
2	Heat Det	FST-851	0.00030	0.00060	0.00650	0.01300
3	Monitor	DIMM	0.00060	0.00180	0.03000	0.09000
4	Monitor	FDM-1	0.00075	0.00300	0.00640	0.02560
9	Monitor	FMM-1	0.00035	0.00315	0.00500	0.04500
4	Pull Station	FMM-101 w/Pull Sta.	0.00038	0.00150	0.00038	0.00150
19	Pull Station	NBG-12LX	0.00038	0.00713	0.00688	0.13063
46	Smoke Det	FSP-851	0.00030	0.01380	0.00680	0.31280
4	Pull Station	NBG-12LOB	0.00000	0.00000	0.00000	0.00000
37	Speaker 25V	Speaker – 1/2 Watt Tap	0.00000	0.00000	0.02000	0.74000
1	Dialer	UDACT	0.04000	0.04000	0.10000	0.10000
7	Relay	PR-1 (Shutdown)	0.00000	0.00000	0.01500	0.10500
23	Remote LED	RA100Z	0.00000	0.00000	0.01000	0.23000
				Standby Load		Alarm Load
				1.008		2.962

Standby Load:	1.008 Amps	Alarm Load:	2.962 Amps
Standby Time:	**24** Hours	Alarm Time:	**15** Minutes
Total Standby Load:	24.19 Amp*Hours	Total Alarm Load:	0.74 Amp*Hours
Batteries Provided:	**(2) BAT-12380**	**Available Battery:**	**30.40** A.H.
Battery Size:	38.00 A.H.	**Load (ALM + STBY)**	**24.93** A.H.
De-Rated Size(80%):	30.40 A.H.	**Spare Capacity**	**5.47** A.H.

Figure 2.17: ***Battery Sizing for Fire Alarm Control Panel***

BATTERY SIZING CALCULATION

CAL POLY SLO – STUDENT RECREATION CENTER

REMOTE POWER SUPPLY – RPS#1 • ELEC ROOM #136

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
5	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (75cd)	0.00000	0.00000	0.15800	0.15800
				Standby Load		Alarm Load
				0.065		2.877

Standby Load:	0.065 Amps	Alarm Load:	2.877 Amps
Standby Time:	**24** Hours	Alarm Time:	**15** Minutes
Total Standby Load:	1.56 Amp*Hours	Total Alarm Load:	0.72 Amp*Hours
Batteries Provided:	**(2) BAT-1270**	**Available Battery:**	**5.60** A.H.
Battery Size:	7.00 A.H.	**Load (ALM + STBY)**	**2.28** A.H.
De-Rated Size(80%):	5.60 A.H.	**Spare Capacity**	**3.32** A.H.

Figure 2.18: ***Battery Sizing for Remote Power Supply from Elec. Room 136 for Notification Appliances***

BATTERY SIZING CALCULATION

CAL POLY SLO - STUDENT RECREATION CENTER

REMOTE POWER SUPPLY - RPS#4 • ELEC. ROOM #115

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
6	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.39600
3	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.28200
4	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.63200
5	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.01000
11	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.72600
3	Strobe	SCW (30cd)	0.00000	0.00000	0.09400	0.28200
13	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.85800
2	Strobe (WP)	SCRK (15cd)	0.00000	0.00000	0.06600	0.13200
				Standby Load		Alarm Load
				0.065		4.463

Standby Load:	0.065 Amps	Alarm Load:	4.463 Amps
Standby Time:	24 Hours	Alarm Time:	15 Minutes
Total Standby Load:	1.56 Amp*Hours	Total Alarm Load:	1.12 Amp*Hours
Batteries Provided:	(2) BAT-1270	**Available Battery:**	**5.60** A.H.
Battery Size:	7.00 A.H.	**Load (ALM + STBY)**	**2.68** A.H.
De-Rated Size(80%):	5.60 A.H.	**Spare Capacity**	**2.92** A.H.

Figure 2.19: ***Battery Sizing for Remote Power Supply from Elec. Room 115 for Notification Appliances***

BATTERY SIZING CALCULATION

CAL POLY SLO - STUDENT RECREATION CENTER

REMOTE POWER SUPPLY - RPS #2 • ELEC. ROOM #172

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.09400
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
9	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.81800
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
5	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load		Alarm Load
				0.065		2.835

Standby Load:	0.065 Amps	Alarm Load:	2.835 Amps
Standby Time:	24 Hours	Alarm Time:	15 Minutes
Total Standby Load:	1.56 Amp*Hours	Total Alarm Load:	0.71 Amp*Hours
Batteries Provided:	(2) BAT-1270	**Available Battery:**	**5.60** A.H.
Battery Size:	7.00 A.H.	**Load (ALM + STBY)**	**2.27** A.H.
De-Rated Size(80%):	5.60 A.H.	**Spare Capacity**	**3.33** A.H.

Figure 2.20: ***Battery Sizing for Remote Power Supply from Elec. Room 172 for Notification Appliances***

BATTERY SIZING CALCULATION

CAL POLY SLO - STUDENT RECREATION CTR

REMOTE POWER SUPPLY - RPS#5 • ELEC ROOM #208

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
2	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.13200
2	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.18800
7	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	1.10600
4	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	0.80800
4	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.63200
4	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.26400
3	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.19800
1	Strobe	SW (30cd)	0.00000	0.00000	0.09400	0.09400
				Standby Load		Alarm Load
				0.065		3.567

Standby Load:	0.065 Amps	Alarm Load:	3.567 Amps
Standby Time:	24 Hours	Alarm Time:	15 Minutes
Total Standby Load:	1.56 Amp*Hours	Total Alarm Load:	0.89 Amp*Hours
Batteries Provided:	(2) BAT-1270	**Available Battery**	**5.60** A.H.
Battery Size:	7.00 A.H.	**Load (ALM + STBY)**	**2.45** A.H.
De-Rated Size(80%):	5.60 A.H.	**Spare Capacity**	**3.15** A.H.

Figure 2.21: ***Battery Sizing for Remote Power Supply from Elec. Room 208 for Notification Appliances***

BATTERY SIZING CALCULATION

CAL POLY SLO - STUDENT RECREATION CENTER

REMOTE POWER SUPPLY - RPS#3 • ELEC ROOM #227

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load		Alarm Load
				0.065		2.389

Standby Load:	0.065 Amps	Alarm Load:	2.389 Amps
Standby Time:	24 Hours	Alarm Time:	15 Minutes
Total Standby Load:	1.56 Amp*Hours	Total Alarm Load:	0.60 Amp*Hours
Batteries Provided:	(2) BAT-1270	**Available Battery**	**5.60** A.H.
Battery Size:	7.00 A.H.	**Load (ALM + STBY)**	**2.16** A.H.
De-Rated Size(80%):	5.60 A.H.	**Spare Capacity**	**3.44** A.H.

Figure 2.22: ***Battery Sizing for Remote Power Supply from Elec. Room 227 for Notification Appliances***

The following extracts will illustrate voltage drop calculations performed for the Recreation Center:

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CENTER

SYSTEM SENSOR RPS #1 @ ELEC ROOM #136

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V1 QTY	V1 CURR.	SIGNAL CIRCUIT V2 QTY	V2 CURR.	SIGNAL CIRCUIT V3 QTY	V3 CURR.	SIGNAL CIRCUIT V4 QTY	V4 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
SPSW (110cd)	0.202	8	1.616	2	0.404		0.000		0.000	10
Strobe										
SW (15cd)	0.066		0.000	5	0.330		0.000		0.000	5
SW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.616 AMPS		1.116 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		445 FT.		300 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.38 VOLTS		1.11 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		**18.02** VOLTS		**19.29** VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		SPARE		

$$\text{VOLTAGE DROP} = \frac{\text{TOTAL CURRENT} \times \text{DISTANCE} \times 21.6}{\text{CIRCULAR MILS}}$$

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)

OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V–33V

File Name: McCal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #1_VD.xls]VD FORM

Figure 2.23: ***Voltage Drop Calculations for NAC supplied from Elec. Room 136***

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR

SYSTEM SENSOR REMOTE POWER SUPPLY – RPS#2 @ ELEC ROOM #172

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V5 QTY	V5 CURR.	SIGNAL CIRCUIT V6 QTY	V6 CURR.	SIGNAL CIRCUIT V7 QTY	V7 CURR.	SIGNAL CIRCUIT V8 QTY	V8 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (30cd)	0.094	1	0.094		0.000		0.000		0.000	1
SPSW (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
SPSW (110cd)	0.202	3	0.606	6	1.212		0.000		0.000	9
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SCW (15cd)	0.066	2	0.132	3	0.198		0.000		0.000	5
SW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.148 AMPS		1.542 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		400 FT.		490 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.52 VOLTS		2.50 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		**18.88** VOLTS		**17.90** VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		S[ARE		

$$\text{VOLTAGE DROP} = \frac{\text{TOTAL CURRENT} \times \text{DISTANCE} \times 21.6}{\text{CIRCULAR MILS}}$$

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE – VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)

OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V–33V

File Name: McCal Poly SLO Rec. Center_20100315[Cal Poly SLO_Rec Ctr_RPS #2_VD.xls]VD FORM

Figure 2.24: ***Voltage Drop Calculations for NAC supplied from Elec. Room 172***

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR

SYSTEM SENSOR REMOTE POWER SUPPLY– RPS#4 @ ELEC ROOM #115

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V13 QTY	SIGNAL CIRCUIT V13 CURR.	SIGNAL CIRCUIT V14 QTY	SIGNAL CIRCUIT V14 CURR.	SIGNAL CIRCUIT V15 QTY	SIGNAL CIRCUIT V15 CURR.	SIGNAL CIRCUIT V16 QTY	SIGNAL CIRCUIT V16 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066	1	0.066	2	0.132		0.000	3	0.198	6
SPSW (30cd)	0.094		0.000	1	0.094	2	0.188		0.000	3
SPSW (75cd)	0.158	2	0.316	1	0.158		0.000	1	0.158	4
SPSW (110cd)	0.202	2	0.404	1	0.202	1	0.202	1	0.202	5
Strobe										
SCW (15cd)	0.066	2	0.132	1	0.066	3	0.198	5	0.330	11
SCW (30cd)	0.094		0.000		0.000	2	0.188	1	0.094	3
SW (15cd)	0.066	3	0.198	7	0.462	2	0.132	1	0.066	13
Strobe (WP)										
SCRK (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
TOTAL CURRENT ON CIRCUIT		1.116 AMPS		1.114 AMPS		1.040 AMPS		1.048 AMPS		
TOTAL WIRE LENGTH		300 FT.		350 FT.		575 FT.		880 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.11 VOLTS		1.29 VOLTS		1.98 VOLTS		3.05 VOLTS		
VOLTAGE @ END OF CIRCUIT		**19.29** VOLTS		**19.11** VOLTS		**18.42** VOLTS		**17.35** VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		1ST FLOOR		1ST FLOOR		

$$\text{VOLTAGE DROP} = \frac{\text{TOTAL CURRENT} \times \text{DISTANCE} \times 21.6}{\text{CIRCULAR MILS}}$$

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE – VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)

OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V–33V

File Name: M:\Cal Poly SLO Rec. Center_2010035\[Cal Poly SLO_Rec Ctr_RPS #4_VD.xls]VD FORM

Figure 2.25: ***Voltage Drop Calculations for NAC supplied from Elec. Room 115***

VOLTAGE DROP CALCULATION 12/07/11

CAL POLY SLO - RECREATION CTR

SYSTEM SENSOR REMOTE POWER SUPPLY #5 @ ELEC ROOM #208

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V17 QTY	V17 CURR.	SIGNAL CIRCUIT V18 QTY	V18 CURR.	SIGNAL CIRCUIT V19 QTY	V19 CURR.	SIGNAL CIRCUIT V20 QTY	V20 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
SPSW (30cd)	0.094	1	0.094	1	0.094		0.000		0.000	2
SPSW (75cd)	0.158	1	0.158	4	0.632	2	0.316		0.000	7
SPSW (110cd)	0.202	3	0.606	1	0.202		0.000		0.000	4
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158		0.000		0.000		0.000	4	0.632	4
Strobe										
SCW (15cd)	0.066		0.000		0.000	4	0.264		0.000	4
SW (15cd)	0.066	1	0.066		0.000	2	0.132		0.000	3
SW (30cd)	0.094		0.000	1	0.094		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		0.924 AMPS		1.022 AMPS		0.844 AMPS		0.632 AMPS		
TOTAL WIRE LENGTH		355 FT.		625 FT.		325 FT.		600 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.09 VOLTS		2.11 VOLTS		0.91 VOLTS		1.25 VOLTS		
VOLTAGE @ END OF CIRCUIT		**19.31** VOLTS		**18.29** VOLTS		**19.49** VOLTS		**19.15** VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		2ND FLOOR		ROOF		

$$\text{VOLTAGE DROP} = \frac{\text{TOTAL CURRENT} \times \text{DISTANCE} \times 21.6}{\text{CIRCULAR MILS}}$$

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)

OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V–33V

File Name: M:\Cal Poly SLO Rec. Center_2010035\[Cal Poly SLO_Rec Ctr_RPS #5_VD.xls]VD FORM

Figure 2.26: ***Voltage drop calculation for NAC supplied from Elec. Room 208***

VOLTAGE DROP CALCULATION 12/06/11

CAL POLY SLO - RECREATION CTR

SYSTEM SENSOR — REMOTE POWER SUPPLY – RPS#3 @ ELEC ROOM #227

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V9 QTY	SIGNAL CIRCUIT V9 CURR.	SIGNAL CIRCUIT V10 QTY	SIGNAL CIRCUIT V10 CURR.	SIGNAL CIRCUIT V11 QTY	SIGNAL CIRCUIT V11 CURR.	SIGNAL CIRCUIT V12 QTY	SIGNAL CIRCUIT V12 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (110cd)	0.202	5	1.010	5	1.010		0.000		0.000	10
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SW (15cd)	0.066	1	0.066		0.000		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.234 AMPS		1.010 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		500 FT.		340 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.04 VOLTS		1.14 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		**18.36** VOLTS		**19.26** VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		SPARE		SPARE		

$$\text{VOLTAGE DROP} = \frac{\text{TOTAL CURRENT} \times \text{DISTANCE} \times 21.6}{\text{CIRCULAR MILS}}$$

CIRC. MILS
18 AWG = 1620
16 AWG = 2580
14 AWG = 4110
12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE – VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)

OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V–33V

File Name: McCal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #3_VD.xls]VD FORM

Figure 2.27: ***Voltage Drop Calculation for NAC from Elec. Room 227***

The above tables have shown that the system designs meet code requirements and in general all the batteries are oversized as the safety margin used in the calculation is far beyond the 20% recommended by the code; reference to NFPA 72-2010, §**10.5.6(1)**.

The batteries used are BAT series sealed, lead-acid batteries provided by NOTIFIER. These batteries are maintenance-free, sealed, overcharge protected, have long service life and easy handled with leak-proof construction.

SYSTEM COMMISIONING, INSPECTION, TESTING AND MAINTENANCE

NFPA 72-2013, Chapter 7 provides minimum documentation requirements for new and existing systems. The Rec Center was designed and installation completed in accordance with NFPA 72, 2010 edition; therefore the documentation required would have been as prescribed in §**10.18.2.3** of the 2010 edition.

Although we could not locate all the documentation cited in NFPA 72-2010, **10.18.2.3** related to the fire alarm and communication system installed in the Rec Center; we are confident that authority having jurisdiction and the owner would not have approved operation of the Center without all code required documentation.

NFPA 72-2013, chapter 7, prescribes more detailed documentation compared to what was required in previous editions of the code. For the Rec Center, the documentation would have been limited only to the following:

(1) An owner's manual and manufacturer's published instructions covering all system equipment
(2) Record drawings
(3) For software-based systems, record copy of the site-specific software
(4) A written sequence of operation

The system commissioning is known to be typically an owner-driven process (requirement); we do not have any documentation records of integrated testing methods or procedures performed for the commissioning of the fire alarm and communication system. However it is assumed that the owner and the authority having jurisdiction were satisfied from initial testing of the system as installed and that it met the intended design purpose.

Nowadays designs refer to NFPA 3-2012 requirements, which prescribe recommended procedures, methods, and documentation for commissioning and integrated testing of active and passive fire protection and life safety systems and their interconnections with other building systems. The recommended practice will ensure fire protection and life safety systems perform in conformity with the design intent.

NFPA 72, chapter 14 covers the minimum requirements for inspection, testing, and maintenance of fire alarm systems, supervising station alarm systems, public emergency alarm reporting systems, emergency communications systems (ECSs), single and multiple-station smoke and heat alarms, and household fire alarm systems.

Cal Poly campus Electrical Service department is responsible for inspection, testing, and maintenance of the system and for alterations or additions to the fire alarm and communication system installed in the Recreation Center as well on all the entire campus proprietary supervising alarm systems.

Cal Poly Environmental Health and Safety department monitors and supervisors inspection and testing performs on fire alarms systems installed on the entire campus.

It was confirmed by the Environmental Health and Safety as well as the Electrical Services departments that annual point by point inspection and testing of initiating devices are performed in accordance with California Code of Regulations Title 19, Section 1.09(a); and NFPA 72, Table 14-3.1. All inspection and testing records are kept in accordance with NFPA 72, chapter 7, section 7-2.

The following special inspection and testing instructions were supplied by the Cal Poly Environmental Health and Safety department:

a) Duct detectors:
    - Magnet test location is lower left
    - Black reset button on device
    - Verify reporting as supervisory at fire alarm control panel
b) Manual fire alarm boxes (manual pull stations) and Detectors
    - Functionally test smoke, heat detectors as per NFPA 72, Table 14-3.1, and each manual pull station; and verify reporting at the fire alarm control panel
c) Flow switch
    - Use top handle to test
    - Put bottom handle into test position

d) Battery
    - Test battery charge with SOCTESTER battery tester
e) Audio and Visual alarms
    - Activate alarm notification appliances and confirm proper operation of all audible and visual alarms. Verify audible alarms are at least 15 dbA above ambient sound levels
    - Verify reporting at fire alarm control panel
    - Test operation of speakers and verify correct reporting at fire alarm control panel
f) Automatic sprinkler systems
    - Operate water flow and alarm switches

The Environmental Health and Safety department does not NFPA 72 ITM forms but they have their customized form, which lists device types and serial numbers. A status is noted for each device either as Pass or Fail; and corrective actions taken (if any) are also included in the records.

Cal Poly campus Electrical Services Department confirmed that they maintain initiating devices, notification appliances and any other equipment related to the Rec Center fire alarm system in accordance with manufacturer's published instructions.

The Rec Center fire alarm system sequence of operation table describes automated actions of the system following initiating devices activation.

Refer to figure 2.28 below for more details.

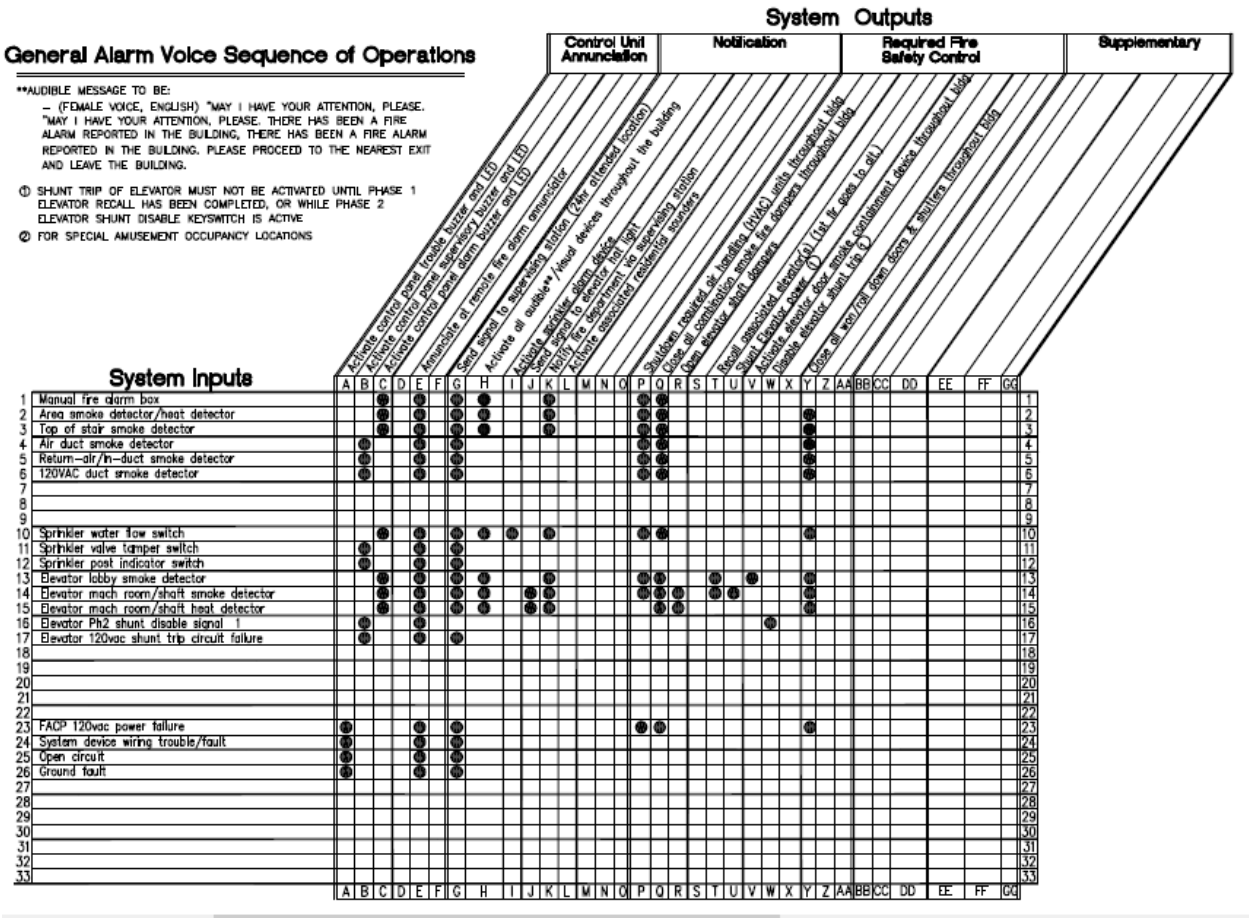


Figure 2.28: ***Sequence of Operation of fire alarm system in the Recreation Center***

CHAPTER 3: WATER-BASED FIRE SUPPRESSION SYSTEM

TYPES AND DESIGN CRITERIA

NFPA 13 defines a sprinkler system as each system riser serving a portion of a single floor of a facility, or the portion(s) of the piping network in multistory buildings where floor control valve assemblies are used to isolate individual floors. Multiple sprinkler systems can be supplied by a common supply main or riser in multistory buildings.

The Rec Center is protected by three wet-pipe automatic sprinkler systems throughout the building.

The type of occupancy hazard classification will influence the system design and installation considerations, such as sprinkler discharge criteria, sprinkler spacing, and water supply requirements.

The occupancy hazard classification for the sprinkler system installed in REC Center building is determining by evaluating the types of hazards, which includes the quantity and combustibility associated with the contents of the building. Examples presented in the NFPA13, 5.2 to 5.4 are used to help in the classification of the occupancy hazard for the Rec Center.

In accordance with NFPA13, 5.2 requirements and A.5.2 examples of similar use and conditions, we can classify the REC Center building as Light Hazard occupancy, except that the storage rooms, mechanical and electrical rooms can be classified as Ordinary Hazard occupancy (Group 1).

NFPA 13, §5.2 provisions define as Light Hazard occupancy, an occupancy or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected.

The storage, mechanical and electrical rooms are classified as Ordinary Hazard occupancy (Group 1) in accordance with NFPA13, §5.3.1.1 that defines portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8ft and fire with moderate rates of heat release are expected.

The water demand design criteria, using the CMDA method approach, will be determined in accordance with NFPA13, 11.2.3.1.1 and figure 11.2.3.1.1:

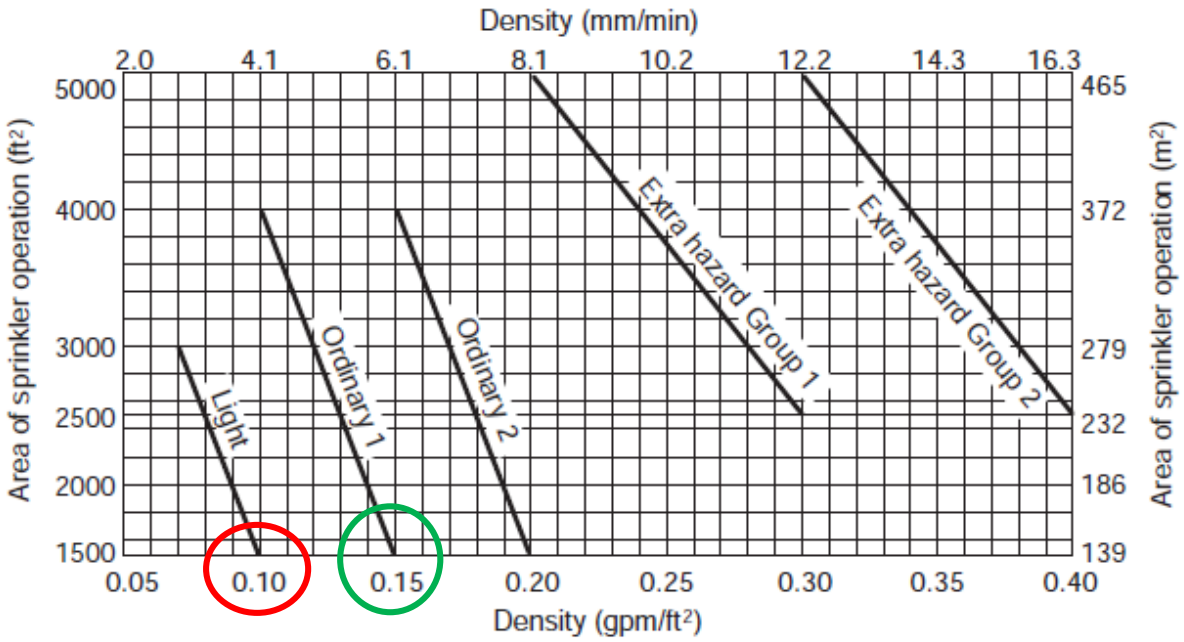


Figure 3.1: ***Extract from NFPA13-Figure 11.2.3.1.1***

Table 3.1: ***Extract from NFPA13, Table 11.2.3.2.1.2: Hose Stream Allowance***

Occupancy	*Inside Hose*		*Total Combined Inside and Outside Hose*		*Duration (minutes)*
	gpm	*L/min*	*gpm*	*L/min*	
Light hazard	0, 50, or 100	0, 189, or 379	100	379	30
Ordinary hazard	0, 50, or 100	0, 189, or 379	250	946	60–90
Extra hazard	0, 50, or 100	0, 189, or 379	500	1893	90–120

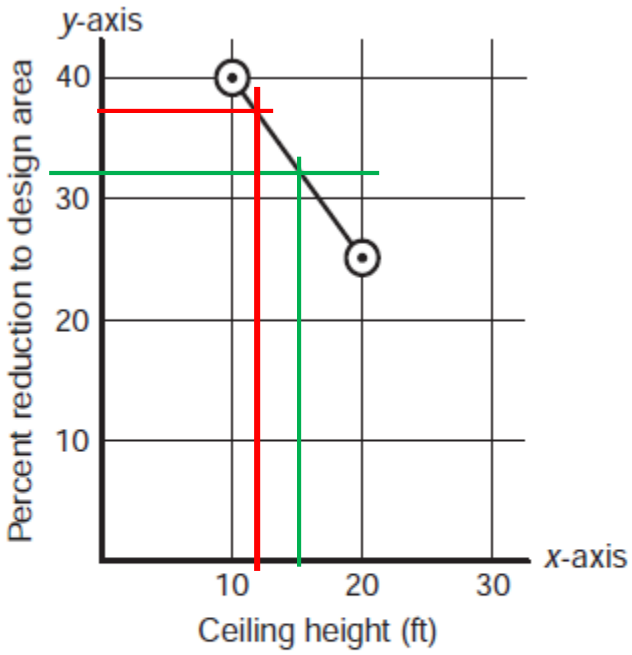
NFPA 13, §11.2.3.2.3.1 provisions allow the hydraulic calculations to satisfy any single point on the appropriate density/area curve.

The selection of the low end that is the smaller operating area is deemed the most economical option. It is generally considered superior in terms of fire control; it is expected to confine the fire to a smaller area by reducing the total number of operating sprinklers.

The wet-pipe automatic sprinkler system installed at the Rec Center uses quick response sprinkler heads standard and extended coverage; therefore in accordance with NFPA13, §11.2.3.2.3, the

system area of operation shall be permitted to be reduced, as per Figure 11.2.3.2.3.1, without revising the density as the system installed satisfied the following conditions:

- Wet-pipe system
- Light hazard or ordinary hazard occupancy
- 20 ft maximum ceiling height (except the gymnasiums)
- And there are no unprotected ceiling pockets exceeding 32 ft^2



LEGEND:

-Green line applicable for Ordinary Hazard (Group 1)

-Red line applicable for Light hazard

Note: $y = \frac{-3x}{2} + 55$

For ceiling height ≥10 ft and ≤20 ft, $y = \frac{-3x}{2} + 55$

For ceiling height <10 ft, $y = 40$

For ceiling height >20, $y = 0$

For SI units, 1 ft = 0.31 m.

Figure 3.2: ***Extract from NFPA13, Design Area Reduction for QRS***

SUMMARY OF DESIGN CRITERIA

Table 3.2: ***Density and Design Area of Operation***

Rooms	Hazard Classifications	Density and Design Area of Operation
• Gymnasiums/MAC • Fitness/Weight rooms • Racquet ball courts • Pre-function areas • Offices/Corridors/Lobbies • Restrooms/Locker rooms	Light Hazard	• 0.10 gpm/ft^2 • 900 ft^2 Reduced area as per NFPA13, Figure 11.2.3.2.3.1 for quick response sprinklers
• Storage rooms • Mechanical/Electrical rooms • Custodian rooms	Ordinary Hazard (Group 1)	• 0.15 gpm/ft^2 • 1013 ft^2 Reduced area as per NFPA13, Figure 11.2.3.2.3.1 for quick response sprinklers

Therefore the storage room shall be protected by the requirements for the highest classified commodity and storage arrangement, as per NFPA13 §5.6.1.2.4.

WATER SUPPLY

The Recreation Center water-based suppression system is connected to the San Luis Obispo municipality water supply.

The city water supply is provided at:

- Static pressure: 140 PSI
- Residual pressure: 132 PSI
- Flow: 1186 GPM

Information collected from provided computer calculated hydraulic report; refer to Appendix D for more details.

The Rec Center building wet-pipe automatic sprinkler system is supplied from three control valves (risers) located at two separated positions.

- One riser supplied the storage area, wrestling room and the main gymnasium on first floor and the two basketball courts on the second floor; it is located West-South side of the main gymnasium building

- Two risers supplying the remaining automatic sprinkler systems, located East of gymnasium storage room

The following tables give further details about the location and sizes of system components:

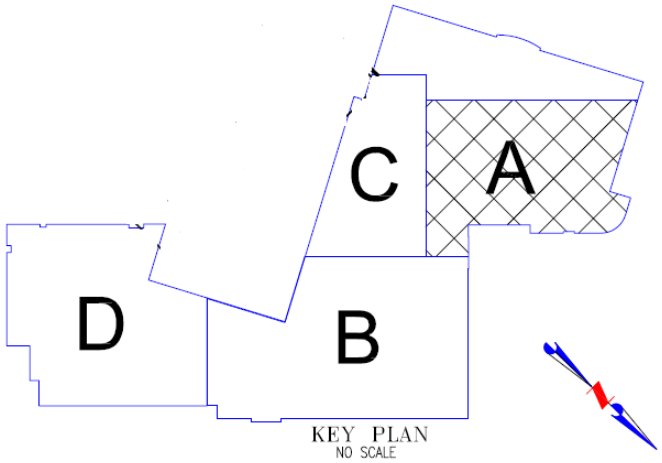


Figure 3.3: ***REC Center Key Plan: Remote Areas A, B, C and D***

Table 3.3: ***Remote Area A***

1st Floor			
Remote Area	A1		
Design	Light Hazard 0.10 gpm		
Area of Operation	900 SQF		
Riser size	4 inches		
Riser location	West Gym storage room 121		
Cross-mains	3 inches (varies)		
branch lines	2 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK634	QREC
		VK302	QRSC
	K-factor	8	QREC
		5.6	QRSC
	Size	3/4" & 1/2"	
	Temperature	155	

Table 3.4: ***Remote area C1***

1st Floor			
Remote Area	C1		
Design	Light Hazard 0.10 gpm		
Area of operation	900 SQF		
Riser size	4 inches		
Riser location	West Gym storage room		
Cross-mains	3 inches (varies)		
branch lines	2 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK634	QREC
		VK302	QRSC
	K-factor	8	QREC
		5.6	QRSC
	Size	3/4" & 1/2"	
	Temperature	155	

Table 3.5: ***Remote area D2***

1st Floor			
Remote Area	D2 high roof		
Design	Light Hazard 0.10 gpm		
Area of operation	1500 SQF		
Riser size	4 inches		
Riser location	West Gym storage room		
Cross-mains	3 inches (varies)		
branch lines	2 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK634	QREC
		VK302	QRSC
	K-factor	8	QREC
		5.6	QRSC
	Size	3/4" & 1/2"	
	Temperature	155	

Table 3.6: ***Remote area B2***

2nd Floor			
Remote Area	B2 high roof		
Design	Light Hazard 0.10 gpm		
Area of Operation	1000 SQF		
Riser size	4 inches		
Riser location	West Gym storage room 121		
Cross-mains	3 inches (varies)		
branch lines	2 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK602	QREC
		VK300	QRSC
	K-factor	8	QREC
		5.6	QRSC
	Size	3/4" & 1/2"	
	Temperature	155	

Table 3.7: ***Remote Area C2***

2nd Floor			
Remote Area	C2		
Design	Light Hazard 0.10 gpm		
Area of Operation	1000 SQF		
Riser size	4 inches		
Riser location	West Gym storage room 121		
Cross-mains	2 1/2 inches (varies)		
branch lines	1 1/2 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK302	QREC
		VK300	QRSC
	K-factor	5.6	QREC
	Size	1/2"	
	Temperature	155	F

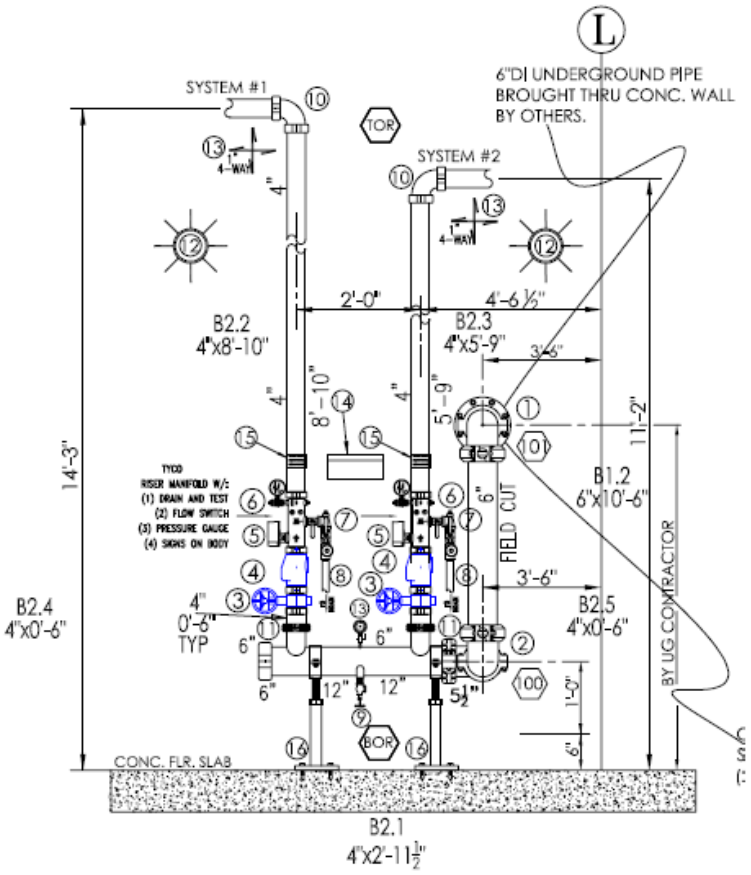


Figure 3.4: ***Risers Details – East Gymnasium Storage Room***

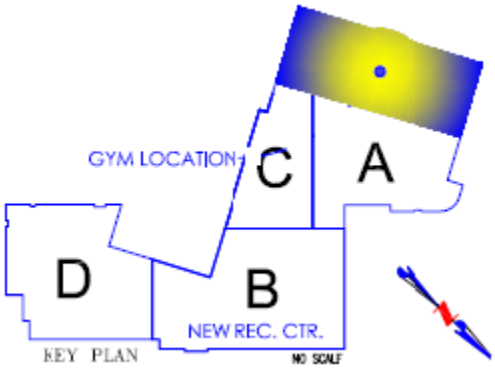


Figure 3.5: ***Key Plan with highlighted Remote Area E***

Table 3.8: ***Remote Area E***

1st Floor			
Remote Area	E Storage		
Design	Ordinary Hazard 0.15 gpm		
Area of Operation	1500 SQF		
Riser size	3 inches		
Riser location	East Main Gym		
Cross-mains	2 1/2 inches (varies)		
branch lines	1 1/4 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK302	QREC
		VK300	QRSC
	K-factor	5.6	QREC
		5.6	QRSC
	Size	1/2"	
	Temperature	155	

Table 3.9: ***Remote Area E1***

1st Floor			
Remote Area	E1 Wrestling		
Design	Light Hazard 0.10 gpm		
Area of Operation	1500 SQF		
Riser size	3 inches		
Riser location	East Main Gym		
Cross-mains	2 1/2 inches (varies)		
branch lines	1 1/4 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK302	QREC
		VK300	QRSC
	K-factor	5.6	QREC
		5.6	QRSC
	Size	1/2"	
	Temperature	155	F

Table 3.10: ***Remote Area E2***

1st Floor			
Remote Area	E2 Main Gym		
Design	Light Hazard 0.10gpm		
Area of Operation	1500 SQF		
Riser size	3 inches		
Riser location	South Main Gym		
Cross-mains	2 1/2 inches (varies)		
branch lines	1 1/4 inches (varies)		
Sprinklers	Make	Viking	
	Model	VK302	QREC
		VK300	QRSC
	K-factor	5.6	QREC
		5.6	QRSC
	Size	1/2"	
	Temperature	155	

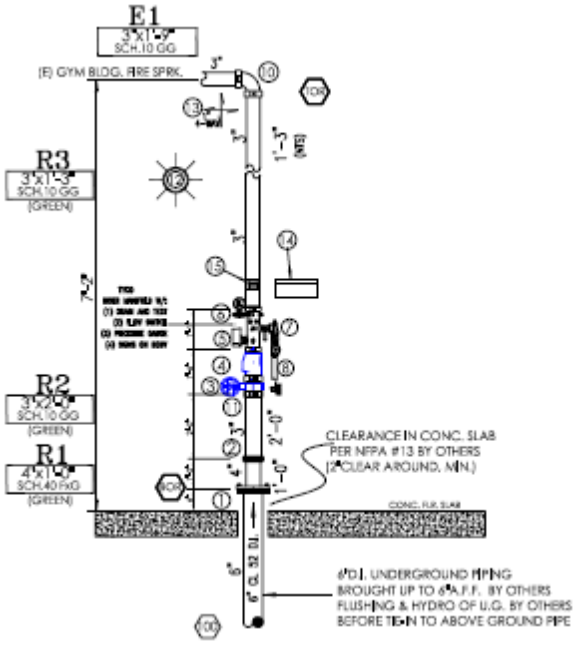


Figure 3.6: ***Riser Details: South West Main Gymnasium Room***

Typical components of the riser:

- 6” underground pipe through concrete slab
- 4” x 3” GRV RC Coupling flexible on Riser
- 3” Tyco GRV butterfly valve BFV-1 with control flow / tamper switch

- 3” Tyco Riser check valve CV with pressure gauges
- 3” water flow indicator
- 3” Tyco test and drain Riser assembly
- Inspector’s test valve & system main drain valve
- 3” GRV 90 elbows
- 3” GRV couplings
- 10” electric bell on building wall
- 4-way earthquake brace
- Fire sprinkler head cabinet mounted on wall by Riser
- Fire sprinkler head design placard on Riser

The REC Center building is fully protected by automatic sprinkler systems (three automatic sprinkler systems). The sprinkler heads installed are all VIKING brand with the following head designs:

- Concealed fire sprinkler heads used in suspended metal ceiling
- Upright fire sprinkler heads used in exposed areas with no suspended ceiling like in gymnasium rooms
- Pendant fire sprinkler heads used in suspended ceiling where surface mount ceiling obstruction exists
- Recessed fire sprinkler heads used in suspended ceiling where no surface mount obstruction exists.

❖ Concealed fire sprinkler concealed head

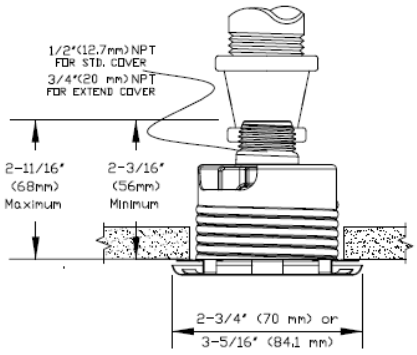


Figure 3.7: ***Viking Concealed Sprinkler Heads***

❖ Upright fire sprinkler ceiling head details

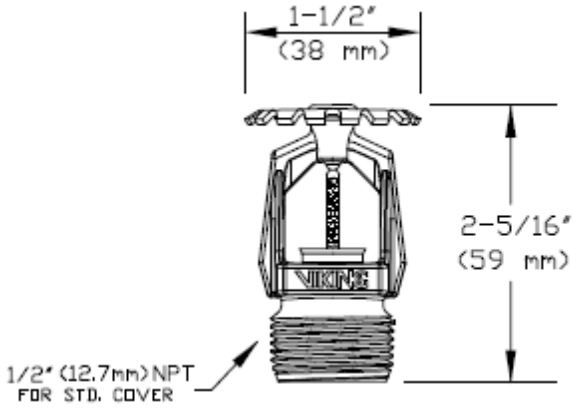


Figure 3.8: ***Viking Upright Sprinkler Heads***

❖ Pendant fire sprinkler pendant heads

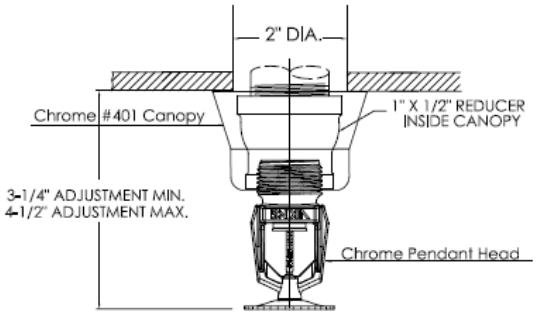


Figure 3.9: ***Viking Pendant Sprinkler Heads***

❖ Recessed fire sprinkler Recessed heads

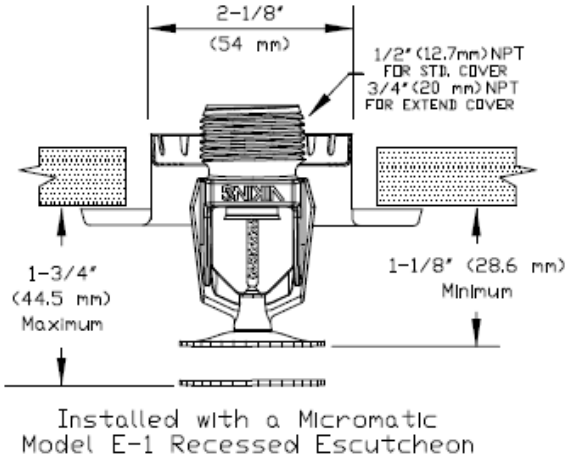


Figure 3.10: ***Viking Recessed Sprinkler Heads***

MANUAL HYDRAULIC CALCULATIONS

We have opted to perform hand hydraulic calculations for the automatic sprinkler system that covers the main gymnasium due to its complexity. The system is supplied with municipality water through a 3” control valve at a riser located south-west of the main gymnasium. Refer to Figure 3.6 for Riser details.

Figure 3.11 below illustrates the general piping arrangement from the riser outside ground floor of the building to the sprinklers on the roof inside the building.

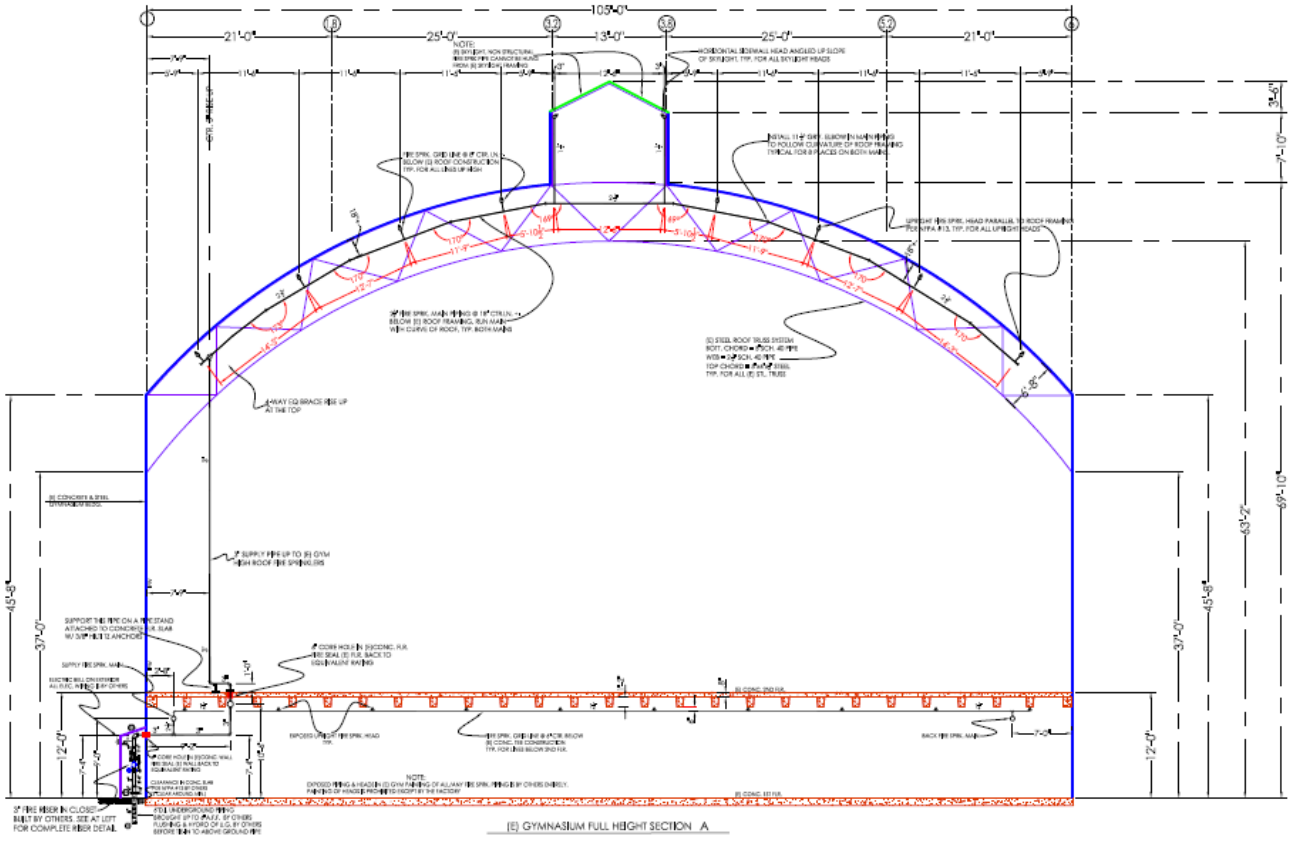


Figure 3.11: ***Gymnasium Sprinkler Piping Arrangement***

The following information were used:

- Piping size 2 and larger are schedule pipe 10
- Piping size small than 2 inches are pipe schedule 40

It is important to note that sprinkler piping for the entire building are configured in loops such that branch lines can be fed through more than one route; in such configuration computer calculations would be more appropriate to execute repetitive calculations and so provide more accurate results as hand calculations for such designs are more complex.

For the purpose of this report, to enable ourselves to perform hand hydraulic calculations, we have selected a water flow path through cross main and branch lines assuming that piping is not configured in loops; hence in our scenario sprinkler heads would be fed through one route only as selected; therefore the total pressure method (ignoring velocity pressures) could be used to estimate the maximum flow and pressure at the bottom of the riser.

Refer to Appendix D, FP-E2 for details of the piping arrangement.

Hand calculations were performed using excel spreadsheet; results are tabulated below.

The following data were used as inputs:

- Density: 0.10 gpm/ft^2
- Area of operation: 1500 ft^2 (no area reduction due to high ceiling height)
- Hose allowance: 100 gpm (inside)
- Sprinkler K-factor: 5.6
- Standard orifice: ½"
- C-factor: 120
- Remote area of operation, as depicted in the fire protection drawing: 156 ft^2
- Area coverage per sprinkler: 156 ft^2 (12 ft x 13 ft)
- Remote area # of sprinklers: 12

The following results were obtained:

Table 3.11: ***System Demand Results***

Manual hydraulic calculations	**Computer hydraulic calculations**
System demand @BOR ✓ System flow: 192.4 gpm ✓ Hose demand: 100 gpm ✓ Total system demand: 292.4 gpm ✓ System pressure: 125 psi	System demand @ BOR: ✓ System flow: 196 gpm ✓ Hose demand: 100 gpm ✓ Total system demand: 296 gpm ✓ System pressure": 78 psi

Table 3.12: ***Individual Sprinkler Performance***

Manual hydraulic calculations	**Computer hydraulic calculations**
Individual sprinkler flows and pressures	Individual sprinkler flows and pressures
S1 Q= 15.6 gpm	S1 Q= 15.87 gpm
P= 7.8 psi	P= 8.03 psi
S2 Q= 15.9 gpm	S2 Q= 15.79 gpm

Manual hydraulic calculations	Computer hydraulic calculations
P= 8.1 psi	P= 7.95 psi
S3 Q= 17 gpm	S3 Q= 15.88 gpm
P= 9.2 psi	P= 8.04 psi
S4 Q= 15.8 gpm	S4 Q= 14.94 gpm
P= 8.0 psi	P= 8.0 psi
S5 Q= 15.6 gpm	S5 Q= 14.82 gpm
P= 7.8 psi	P= 7.8 psi
	S7 Q= 15.75 gpm
S7 = S5 (hydraulically the same)	P= 7.91 psi
S8 = S4 (hydraulically the same)	S8 Q= 15.67 gpm
S9 = S3 (hydraulically the same)	P= 7.83 psi
S10 = S2 (hydraulically the same)	S9 Q= 15.77 gpm
S11 = S1 (hydraulically the same)	P= 7.93 psi
	S10 Q= 15.23 gpm
	P= 7.4 psi
	S11 Q= 15.11 gpm
	P= 7.28 ps i
S12 Q= 15.6 gpm	S12 Q= 20.88 gpm
P= 7.8 psi	P= 13.91 psi
S13 Q= 15.9 gpm	S13 Q= 20.7 gpm
P= 8.1 psi	P= 13.66 psi

Our hand calculations have overestimated the system pressure in comparison to computer model prediction. The system demand flow is qualitatively similar in both manual and hand calculations.

The difference between these two approaches is solemnly due to the fact the computer used the actual water flow paths, analyzing different water routes through the looped piping

arrangement; it has treated each branch line connection with multiple supplies as an hydraulic node, hence balancing pressures and flows in and out of a node in order to estimate actual pressure and flow for a that specific branch line. Therefore the overall system pressure will be minimal in looped systems as water pathway is determined through the least resistant route.

In contrast, our assumptions selected a flow path that required high pressures to overcome piping flow resistance.

Refer to Appendix D for details on the computer hydraulic calculations performed for the gymnasium.

Figure 3.12 illustrates the hydraulic curves for water supply and system water demand.

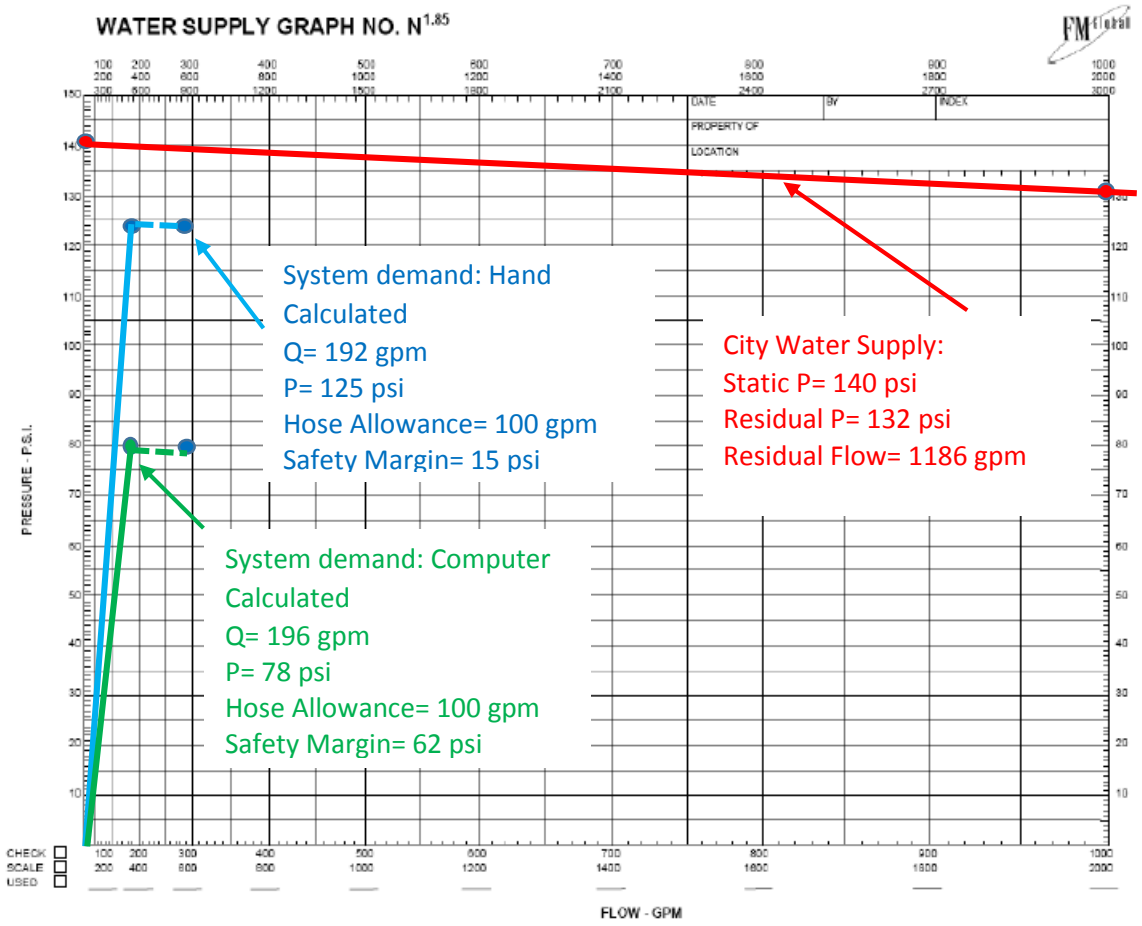


Figure 3.12: ***Water Supply Hydraulic Curve***

INSPECTION, TESTING AND MAINTENANCE

In order to meet both federal certification requirements and state licensure requirements, automatic fire sprinkler systems are required to be inspected, tested and maintained in accordance with NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

In order to follow the requirements of the standard, it's important to have a good understanding of what's meant by "inspection", "testing" and "maintenance". Those terms are defined in NFPA 25, §3.3 as follows:

• Inspection. A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.

• Testing. A procedure used to determine the status of a system as intended by conducting periodic physical checks such as water flow tests, fire pump tests, alarm tests, and trip tests of dry-pipe valves. These tests follow up on the original acceptance test at intervals specified in the appropriate chapter of NFPA 25.

• Maintenance. Work performed to keep equipment operable or to make repairs.

It is the university's responsibility (or the representative, the REC Center manager's responsibility) to ensure that only properly trained and competent persons perform inspections, testing and maintenance on the fire sprinkler system installed throughout the building. NFPA25 simply states, "These tasks shall be performed by personnel who have developed competence through training and experience." [NFPA 25(11), §4.1.1].

SPECIFIC REQUIREMENTS

The inspection, testing and maintenance requirements that apply to a building's fire sprinkler system start from the date of initial installation and continue on at specific intervals throughout the life of the system.

Monthly inspection:

The following monthly inspections can be performed by facility staff:

Visually inspect control valves to ensure that they are:

• In the normal open position

• Accessible

• Properly sealed

• Locked and/or supervised

• Free from leaks

• Provided with appropriate signage identifying the portion of the system they control

Visually inspect gauges on wet pipe systems to verify that they are in good condition and that normal water pressure is being maintained.

Quarterly Inspection

The following quarterly inspections are in addition to those required monthly and can be performed by facility staff:

a. For hydraulically designed sprinkler systems, inspect the hydraulic nameplate to verify that it's securely attached to the sprinkler riser and is legible.

b. Inspect alarm devices to verify that they are free of physical damage.

c. Inspect fire department connections to verify that:

- They are visible and accessible
- Couplings or swivels are not damaged and rotate smoothly
- Plugs or caps are in place and not damaged
- Gaskets are in place and in good condition
- Identification signs are in place
- The check valve is not leaking
- The automatic drain valve is in place and operating properly

With proper training the following quarterly tests can be performed by facility staff:

a. Test the waterflow alarm on wet pipe sprinkler systems by opening the inspector's test connection. This simulates the opening of a sprinkler head.

Annually Inspection

In addition to the monthly and quarterly inspections and tests, NFPA 25 has very detailed and specific inspection, testing and maintenance services that need to be performed on an annual basis. Because of their complexity, and to comply with federal and California state law, these services must be performed by a licensed sprinkler contractor and would include such things as:

- An inspection of the facility's supply of spare sprinkler heads to ensure that there are a minimum of two sprinklers of each type and temperature rating and that there is a sprinkler wrench for each type of sprinkler.
- A check of all sprinklers, hangers, pipe and fittings
- Testing of the main drain
- Testing of any antifreeze solution used
- Testing and maintenance of valves

Long term Inspection

a. Sprinkler system gauges typically have a life expectancy of 10 to 15 years. As a result, these gauges must be replaced every 5 years or tested every 5 years by comparison to a calibrated gauge.

Gauges not accurate to within 3 percent of the full scale must be recalibrated or replaced [Reference NFPA 25(11), §5.3.2].

b. System check valves must be inspected internally every 5 years to verify that all components operate properly, move freely and are in good condition [Reference NFPA 25(11), §12.4.2.1].

c. Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, the sprinklers must be replaced or representative samples tested every 5 years.

Note: "Harsh environments" have been interpreted to include areas exposed to outside weather (e.g. sprinklers installed under exterior canopies) and cold storage areas (e.g. coolers and freezers).

DOCUMENTATION REQUIREMENTS

Just as important as conducting required inspections, testing and maintenance is documenting the fact that they occurred. Both NFPA 13 and NFPA 25 require that these services be properly recorded.

It's important that at least two people in the REC Center know where the ITM records are kept to increase the likelihood that they can be readily provided if requested during an inspection, as the records are requires to be maintained on the premises.

NFPA13, Table A.27.1 provides guidance on the kinds of activities that need to be performed and how frequently such activities should be carried out.

Table 3.13: ***Extract from NFPA13-Maintenance Schedule***

TABLE A.27.1 Maintenance Schedule

Parts	*Activity*	*Frequency*
Flushing piping	Test	5 years
Fire department connections	Inspection	Monthly
Control valves	Inspection	Weekly — sealed
	Inspection	Monthly — locked
	Inspection	Monthly — tamper switch
	Maintenance	Yearly
Main drain	Flow test	Quarterly — annual
Open sprinklers	Test	Annually
Pressure gauge	Calibration test	
Sprinklers	Test	50 years
Sprinklers — high-temperature	Test	5 years
Sprinklers — residential	Test	20 years
Waterflow alarms	Test	Quarterly
Preaction/deluge detection system	Test	Semiannually
Preaction/deluge systems	Test	Annually
Antifreeze solution	Test	Annually
Cold weather valves	Open and close valves	Fall, close; spring, open
Dry/preaction/deluge systems		
Air pressure and water pressure	Inspection	Weekly
Enclosure	Inspection	Daily — cold weather
Priming water level	Inspection	Quarterly
Low-point drains	Test	Fall
Dry pipe valves	Trip test	Annually — spring
Dry pipe valves	Full flow trip	3 years — spring
Quick-opening devices	Test	Semiannually

CHAPTER 4: EGRESS ANALYSIS

OCCUPANCY CLASSIFICATION

Referring to both LSC and IBC Occupancy classifications, it can be said that rooms/spaces inside of the Rec Center are used for different activities and therefore can be classified according to their intended use.

The Rec Center building was designed according to the non-separated occupancy provisions. In accordance with IBC, section 508.3.1:" *Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space except that the most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the building or portion thereof in which the nonseparated occupancies are located".*

Table 4-1*:* ***Room / Space Occupancy Use Classification***

Use of room / Space	Occupancy Classification
Fitness / Gymnasium	A-3
Cafeteria	A-3
Offices / Administration	B
Yoga / Meditation	E
Storage rooms	S
Mechanical/Electrical Equipment rooms/spaces	Accessory (Incidental use)

The following color-code will be used to illustrate different occupancy use of rooms / spaces in the recreation center building.

Space designations	Color codes
Assembly	
Business	
Storage	
Mechanical rooms	
Electrical rooms	
Changing /Restrooms	

Figure 4-1a*: **Color-Coding Of Space Designations: 1st floor***

Figure 4-1b: ***Color-Coding Of Space Designations: 1st floor***

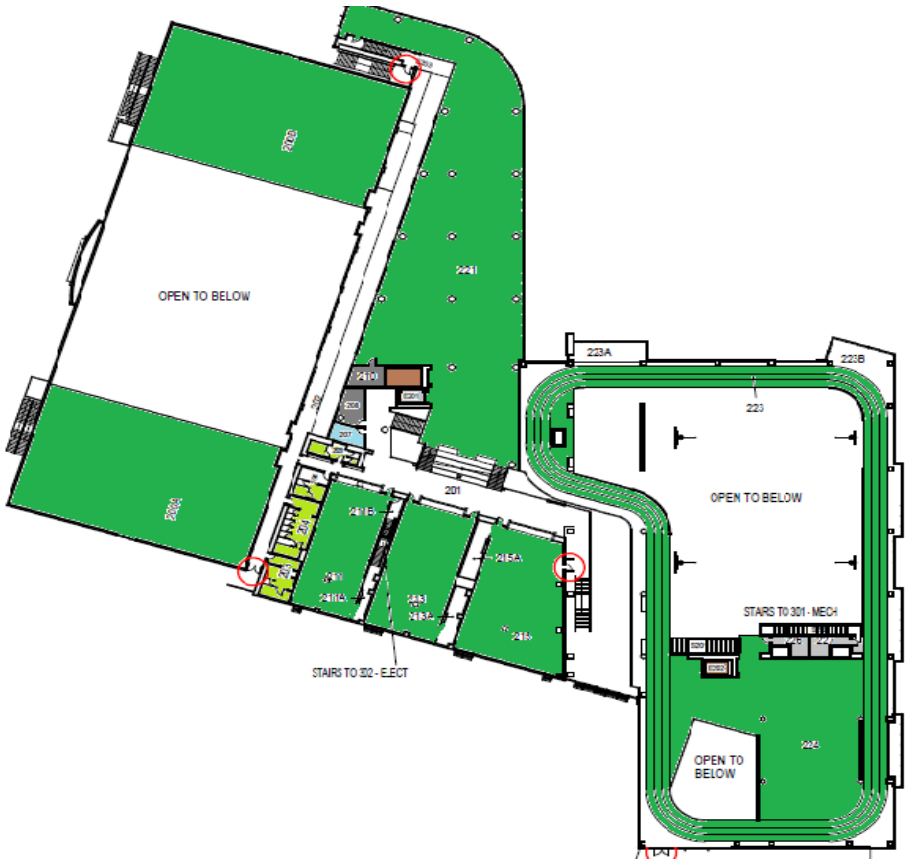


Figure 4-2: ***Color-Coding Of Space Designations: 2nd floor***

As a multiple occupancy building, the Recreation Center shall comply with all requirements that are applicable to each of the purposes for which the room or space will be occupied. The means of egress facilities, construction type, protection, and other safeguards in the building shall comply with the most restrictive fire and life safety requirements of the occupancies involved.

EGRESS CAPACITY CALCULATIONS

Life Safety Code defines the term “means of egress” as a continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three separate and distinct parts:

- Exit access: is that portion of a means of egress that leads to an exit.

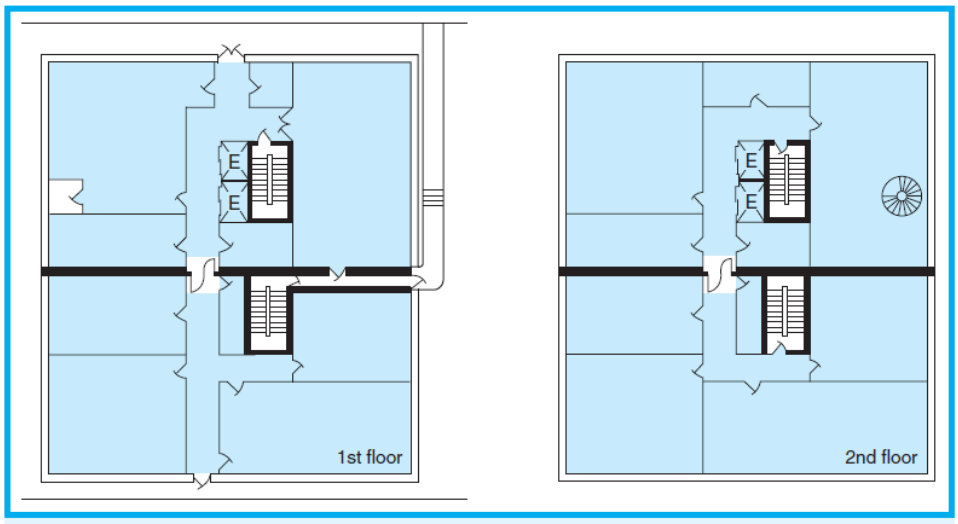


Figure 4-3: ***LSC Exhibit of Exit Access***

- Exit: is that portion of a means of egress that is separated from other building spaces by enclosing it within construction; it can include exterior exit doors, stairs, ramps, smoke proof enclosures, exit passageways, and outside balconies.

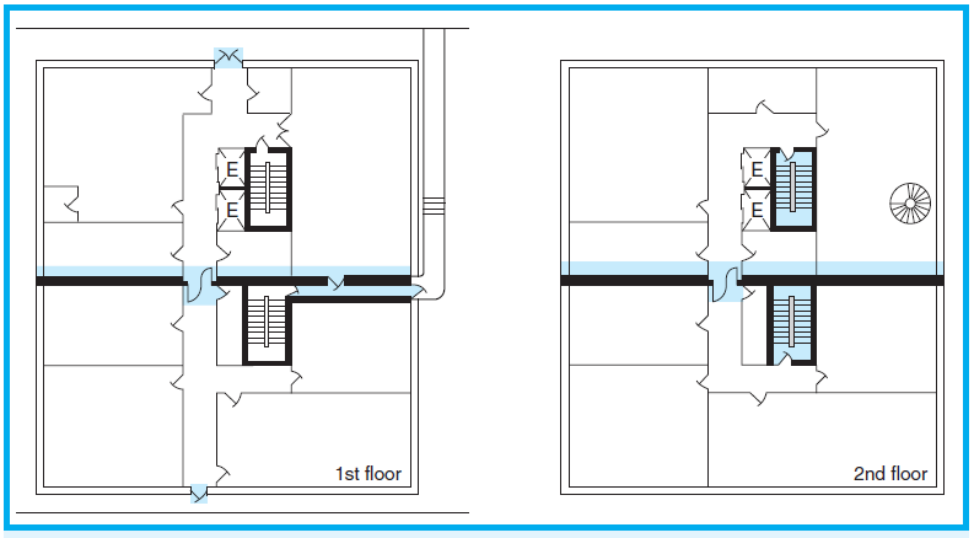


Figure 4-4: ***LSC Exhibit of Various Forms of Exits***

- Exit discharge: that portion of a means of egress between the termination of an exit and a public way. A public way defined as a street, alley, or other similar parcel of land essentially open to the outside air deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width and height of not less than 10 ft (3050 mm).

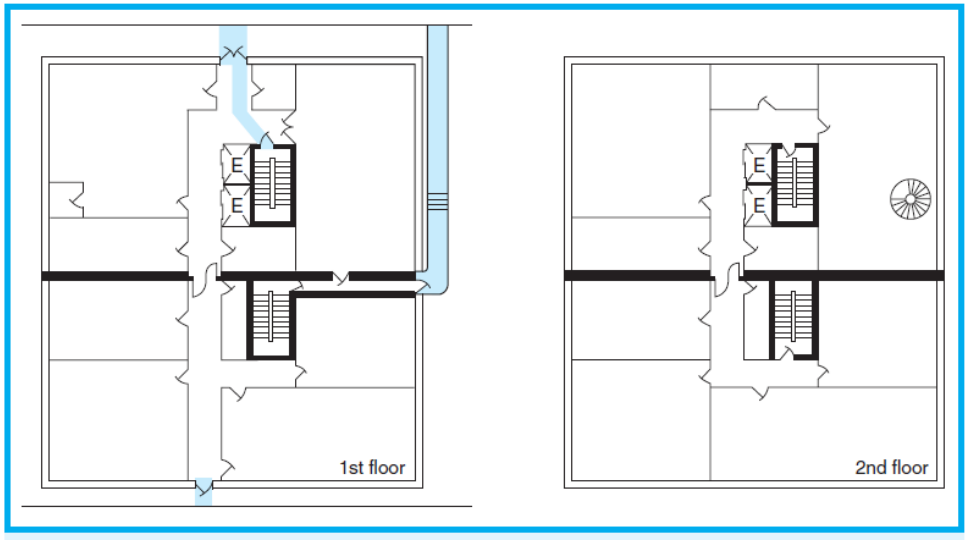


Figure 4-5: ***LSC Exhibit of Spaces Constituting Exit Discharge***

The Life Safety Code §7.3.1.2 stipulates that: "*the occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 7.3.1.2".*

A. Occupant Load for Each Space:

Occupant load factor for each space is obtained from Table 7.3.1.2:

Table 4.3a: ***Extract from LSC –Table 7.3.1.2***

Table 7.3.1.2 Occupant Load Factor

Use	(ft^2/person)[a]	(m^2/person)[a]
Assembly Use		
Concentrated use, without fixed seating	7 net	0.65 net
Less concentrated use, without fixed seating	15 net	1.4 net
Bench-type seating	1 person/18 linear in.	1 person/455 linear mm
Fixed seating	Use number of fixed seats	Use number of fixed seats
Waiting spaces	See 12.1.7.2 and 13.1.7.2.	See 12.1.7.2 and 13.1.7.2.
Kitchens	100	9.3
Library stack areas	100	9.3
Library reading rooms	50 net	4.6 net
Swimming pools	50 (water surface)	4.6 (water surface)
Swimming pool decks	30	2.8
Exercise rooms with equipment	50	4.6
Exercise rooms without equipment	15	1.4
Stages	15 net	1.4 net
Lighting and access catwalks, galleries, gridirons	100 net	9.3 net
Casinos and similar gaming areas	11	1
Skating rinks	50	4.6
Educational Use		
Classrooms	20 net	1.9 net
Shops, laboratories, vocational rooms	50 net	4.6 net

(continues)

Table 7.3.1.2 Continued

Use	(ft^2/person)[a]	(m^2/person)[a]
Day-Care Use	35 net	3.3 net
Health Care Use		
Inpatient treatment departments	240	22.3
Sleeping departments	120	11.1
Ambulatory health care	100	9.3
Detention and Correctional Use	120	11.1
Residential Use		
Hotels and dormitories	200	18.6
Apartment buildings	200	18.6
Board and care, large	200	18.6
Industrial Use		
General and high hazard industrial	100	9.3
Special-purpose industrial	NA	NA
Business Use (other than below)	100	9.3
Air traffic control tower observation levels	40	3.7
Storage Use		
In storage occupancies	NA	NA
In mercantile occupancies	300	27.9
In other than storage and mercantile occupancies	500	46.5
Mercantile Use		
Sales area on street floor[b,c]	30	2.8
Sales area on two or more street floors [c]	40	3.7
Sales area on floor below street floor [c]	30	2.8
Sales area on floors above street floor [c]	60	5.6
Floors or portions of floors used only for offices	See business use.	See business use.
Floors or portions of floors used only for storage, receiving, and shipping, and not open to general public	300	27.9
Mall buildings[d]	Per factors applicable to use of space[e]	

NA: Not applicable. The occupant load is the maximum probable number of occupants present at any time.

Figure 4.3b: ***Extract from LSC-Table 7.3.1.2***

The occupant load of each space will be determined on the basis of the occupant load factors of Table 7.3.1.2 based on the use of the space (not occupancy classification), or shall be determined as the maximum probable population of the space under consideration, whichever is greater. The following definitions clarify the use of occupant load factor:

- Gross Floor Area: The floor area within the inside perimeter of the outside walls of the building under consideration (Recreation Center). This area includes hallways, stairs, closets, and thickness of interior walls, columns or other features. Where the tem floor area used, it means the gross floor area unless otherwise specified.

- Net Floor Area: The floor area within the inside perimeter of the outside walls, or the outside walls and fire walls of the building under consideration with deductions for hallways, stairs, closets, thickness of interior walls, columns, or other features. The actual occupied area/space (associated with Assembly use space)

B. Egress Capacity

Egress capacity of exit in the Rec Center will be calculated in accordance with Life Safety Code provision §7.3.3.1: "*Egress capacity for approved components of means of egress*

shall be based on the capacity factors shown in Table 7.3.3.1, unless otherwise provided in 7.3.3.2".

Table 4.4: ***LSC Egress Capacity Factor***

Table 7.3.3.1 Capacity Factors

Area	Stairways (width/person)		Level Components and Ramps (width/person)	
	in.	mm	in.	mm
Board and care	0.4	10	0.2	5
Health care, sprinklered	0.3	7.6	0.2	5
Health care, nonsprinklered	0.6	15	0.5	13
High hazard contents	0.7	18	0.4	10
All others	0.3	7.6	0.2	5

The minimum required width will be calculated as follows:

- Stairways: 0.3 inches per occupant multiplied by the total number of occupants served
- Other components (e.g. doors): 0.2 inches per occupant multiplied by the total number of occupants served

In egress capacity calculations, the Life Safety Code allows standard rounding.

The required capacity of a corridor shall be the occupant load that utilizes the corridor for exit access divided by the required number of exits to which the corridor connects. The corridor capacity shall be not less than the required capacity of the exit to which the corridor leads.

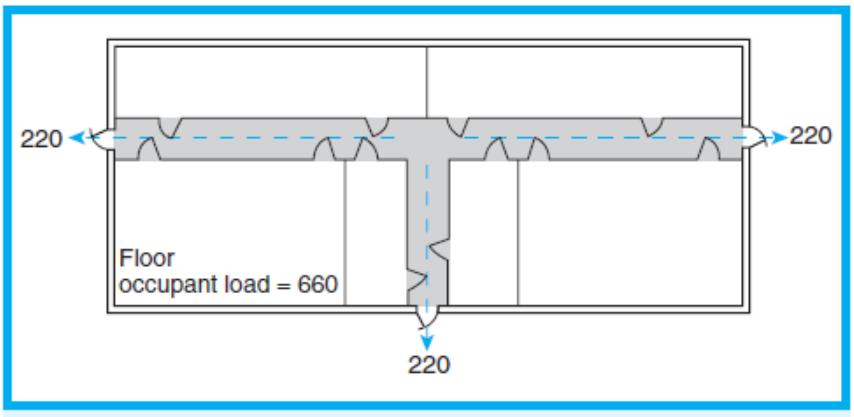


Figure 4-6: ***LSC: Corridor Capacity***

C. Number of Exits

The required number of egress is estimated in accordance with the Life Safety Code Section 7.4.1.2:" *the number of means of egress, from any story or portion thereof, other than for existing buildings, in chapter 11 through 43, shall be as follows:*

(1) Occupant load more than 500 but not more than 1000 — not less than 3
(2) Occupant load more than 1000 — not less than 4".

Table 4-5: ***Number of Exits***

Occupant load served	Number of exits required
< 50 (typical but varies)	1
< 500	2
501-1000	3
> 1000	4

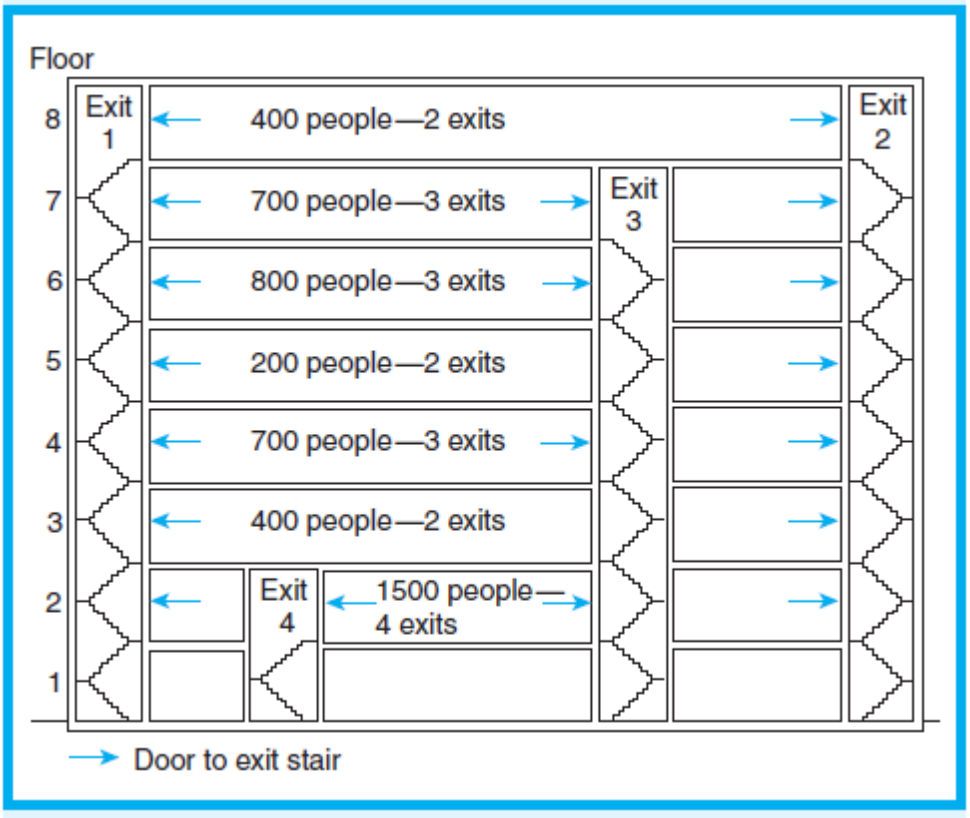


Figure 4-7: ***Extract from LSC Minimum Number of Means of Egress***

D. Multi-Story Egress Capacity

Where an exit serves more than one story, only the occupant load of each story considered individually shall be used in computing the required capacity of the exit at that story, provided that the required egress capacity of the exit is not decreased in the direction of egress travel [Life Safety Code, Section 7.3.1.4].

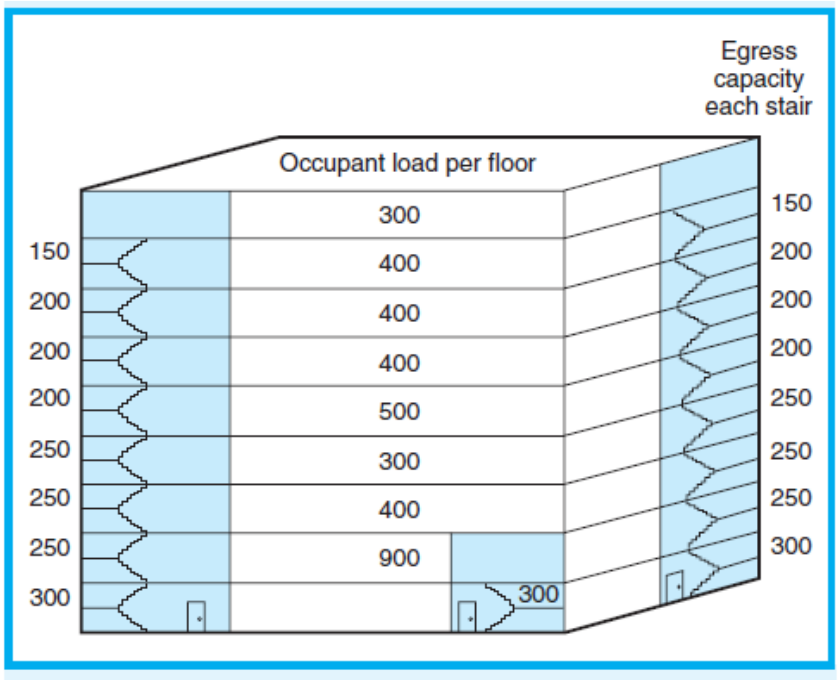


Figure 4-8: ***LSC Capacity of Exit Stairs serving Multiple Floors***

E. Converging Egress Capacity

Where means of egress from the second floor and from the basement converge at the first floor in the Recreation Center, the capacity of the means of egress from the point of convergence shall be not less than the sum of the capacity of the two converging means of egress.

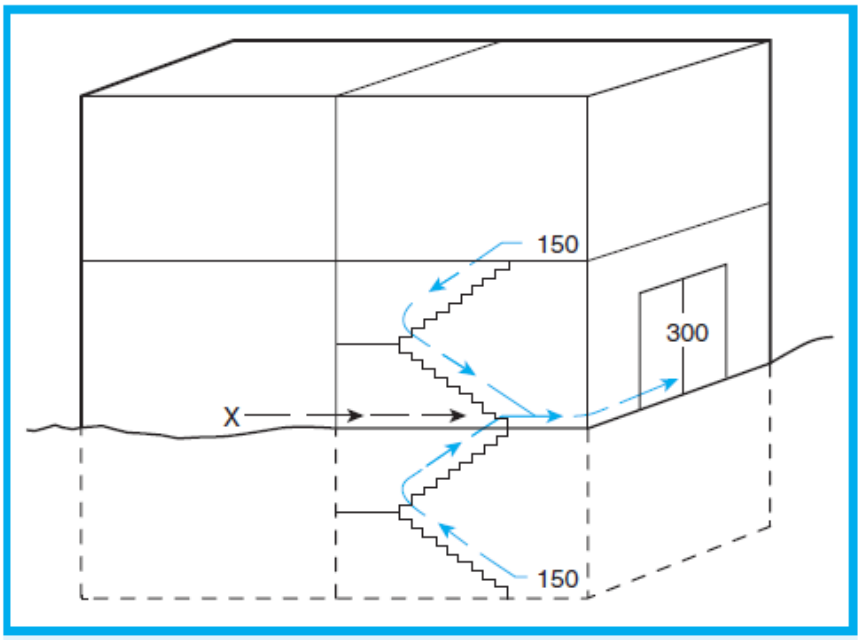


Figure 4-9: *Extract from* ***LSC-Exhibit of converging egress capacity***

F. Minimum Width

- The width of any means of egress in the Rec Center shall be as follows:
  - Not less than that required for a given egress component
  - Not less than 36 in; however for the LSC 2009 edition, allows the width of exit access to be not less than 28 in for building constructed before 2009; as it is the case for the Rec Center built in accordance with 2006 LSC.
- Where more than one exit access leads to an exit, each shall have a width adequate for the number of persons it accommodates.
- Where the total occupant load of all stories served by the stair is fewer than 50, the minimum with shall be 36 in, except for projections more than 4-1/2 in. at or below handrail height on each side
- Where stairs serve occupant loads exceeding 49, the minimum width shall be in accordance with Life Safety Code Table 7.2.2.2.1.2 (B):

Table 4-6: ***Life Safety Code Minimum Stair Width***

Table 7.2.2.2.1.2(B) New Stair Width

Total Cumulative Occupant Load Assigned to the Stair	Width
<2000 persons	44 in. (1120 mm)
≥2000 persons	56 in. (1420 mm)

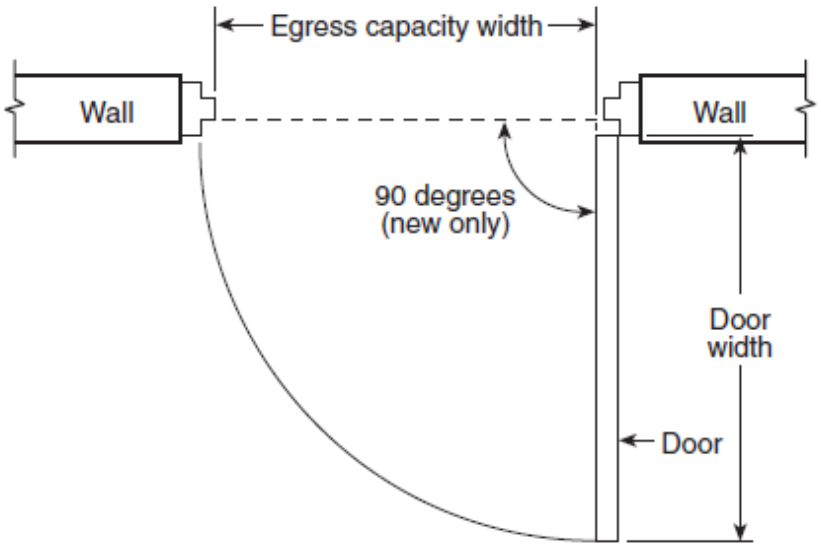


Figure 4-10: ***Life Safety Code Minimum Egress Door Width***

G. Occupant Loads and Egress Capacity Calculation Results

Occupancy load calculations assumed a “non-simultaneous use”, which means that occupants will either be in the occupied space or the circulation space, but not both at the same time.

The reason for this assumption is that occupants of circulation areas, restrooms are accounted for in other occupied areas.

The room or space used, as an assembly space, in the Rec Center, in accordance with LSC provisions 7.10 requirements, has an occupancy load sign posted in a very noticeable location near their exit or exit access doorways.

Table 4-7: ***Occupancy Load calculations for first floor***

A. 1st Floor Life Safety Plan Area

Floor/Space	Occupancy	Area (ft^2)	OLF (ft^2 / OCC)	Calculated Occupant Load	Number of Exits Required
Office 1	B	162	100	2	1
Office 2	B	109	100	2	1
Office 3	B	113	100	2	1
Office 4	B	110	100	2	1
Office 5	B	114	100	2	1
Office 6	B	114	100	2	1
Open Office	B	1041	100	11	1
Gymnasium	A-3	13,453	Max	300	2
FAC Supervisor	B	191	100	2	1
Racquet Ball court (x6)	B	799	100	8	1
Mac Lobby	A-3	1562	15	100	2
Office 7	B	910	300	3	1
Office 8	B	205	100	3	1
Office 9	B	320	100	4	1
Office 10	B	316	100	4	1
Control Room	B	131	100	2	1
Information desk	B	279	100	3	1
First aid room	B	151	100	2	1
Equipment checkout	B	124	100	2	1
Office: coordinator	B	126	100	2	1
Weight fitness	A-3	6462	50	138	2
Office: Players	B	236	15	16	1
Office: players	B	245	15	23	1

Floor/Space	Occupancy	Area (ft^2)	OLF (ft^2 / OCC)	Calculated Occupant Load	Number of Exits Required
MAC	A-3	8313	7	1188	4
Storage/Prep Area	B	874	300	3	1
Aquatic office	B	191	100	2	1
Lifeguard office	B	242	100	3	1
Reception	B	249	100	3	1
Maintenance/Storage	B	239	300	1	1
Equipment/Storage	B	124	100	2	1
Laundry room	B	264	100	3	1
Men's Locker	A-3	2608	50	52	2
Women's Locker	A-3	2106	50	43	1
Pre-Function Area	A-3	4191	15	287	2
Training room	B	903	100	10	1
Personal Fitness	B	149	100	2	1
Message Therapy	B	142	100	2	1
Wellness office	B	124	100	2	1
Office	B	125	100	2	1
Wellness reception	B	431	100	5	1
Ticket office	B	288	100	3	1
Wrestling room	A-3	4006	50	81	2
Main Gymnasium	A-3	13083	Seats	300	2
Pantry	B	122	100	2	1
Office	B	280	100	3	1
Office	B	144	100	2	1
Storage	B	2441	300	9	1
Changing room	B	104	100	2	1
Changing room	B	123	100	2	1

Floor/Space	Occupancy	Area (ft^2)	OLF (ft^2 / OCC)	Calculated Occupant Load	Number of Exits Required
Pool Mechanical	B	1005	300	4	1
Maintenance Office	B	286	100	3	1

B. 2nd Floor Life Safety Plan Area

Table 4-8: ***Occupancy Calculations for 2nd Floor***

Floor/Space	Occupancy	Area (ft^2)	OLF (ft^2 / OCC)	Calculated Occupant Load	Number of Exits Required
Fitness Studio 1	B	1688	50	34	1
Fitness Studio 2	B	1962	50	40	1
Main Gym North	A-3	6396	-	1180	2
Main Gym South	A-3	6414	-	1180	2
Fitness Studio 3	B	2356	50	48	2
Cardio Fitness	A-3	3330	50	67	2
Jogging Track	A-3	2014	-	69	2

H. Exit Stairway Calculations

It is a LSC requirement, when more than one exit is required, the sizing of each exit available is based on the fact that the loss of a single exit will not reduce the available capacity to less than 50 % of the required capacity. [Reference LSC Section 7.3.1.1.2]

Table 4-9: ***Stairway Capacity Calculations***

Stairway	Occupant Load	Required Width	Provided Width
Stair 1	156	156 x 0.2= 32 in	84 inches
Stair 2	156	156 x 0.2= 32 in	78 inches
Stair 3	52	52 x 0.2= 11 in	87 inches
Stair 6	100	100 x 0.2= 20 in	84 inches
Stair 7	86	86 x 0.2= 18 in	84 inches
Stair 8	236	236 x 0.2= 48 in	84 inches
Stair 9	101	101 x 0.2= 21 in	76 inches
Stair 10	236	236 x 0.2= 48 in	96 inches
Stair 11	236	236 x 0.2= 48 in	96 inches
Stair 12	236	236 x 0.2=48 in	106 inches

The stairway width calculations were performed observing IBC/LSC prior edition to 2009 used at the time of the building was designed and built. The LSC 2006 edition gives 0.2 capacity factor for stairway calculations.

Applying current edition of LSC, using capacity factor of 0.3; the following stairway widths would have been required:

Table 4-10: ***Stairway Width Calculations using LSC 2009***

Occupant Load (No of people)	Required Width (inches)	Provided Width (inches)
156	46.8	84
156	46.8	78
52	15.6	87
100	30	84
86	25.8	84
236	70.8	84
101	30.3	76
236	70.8	96
236	70.8	96
236	70.8	106

It can be seen that stairway widths in the Recreation Center are larger and provide adequate egress capacities. The exit capacities are therefore adequate for the application.

I. Arrangement of Exits

It is required that exits are located and exit access are arranged so that exits are readily accessible at all times in accordance with LSC Section 7.5.1.1. Where exits are not immediately accessible from an open floor area, LSC requires that:

- Continuous passageways, aisles, or corridors leading directly to every exit to be maintained and
- To be arranged to provide access for each occupant to not less than two exits by separate ways of travel.

The following assessment were performed from existing Recreation Center floor plans, in order to attest the adequacy in terms of exit remoteness, common path, travel distance to exits, dead end corridors

1) Remoteness of means of egress

- It is required by LSC that where more than one exit, exit access or exit discharge is required from a building or portion thereof, such exits, exit accesses, or exit discharges shall be:
    - Remotely located from each other and
    - Arranged to minimize the possibility that more than one has the potential to be blocked By any one fire or other emergency condition
- The Rec Center is protected throughout by an approved, supervised automatic sprinkler system; in accordance with the LSC Section 7.5.1.3.2, the minimum separation distance between two exits, exit accesses, or discharges, shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.

Figure 4-11: ***Remoteness Assessment of Recreation Center South Exits***

As shown in figure 4-11, the MAC room required 4 exits; these exits are required to be separated by a minimum distance equaled to one third of the diagonal distances, as illustrated in the diagram.

The following calculations were performed:

$$D_1 = 200\ ft, therefore\ d_1 \geq {}^1/_3\ x200 = 66\ ft; measured\ distance\ d_1 = 70\ ft$$

$$D_2 = 230\ ft, therefore\ d_1 \geq {}^1/_3\ x230 = 77\ ft; measured\ distance\ d_2 = 77\ ft$$

Assessing the North, stairway numbers and widths can be checked if compliant:

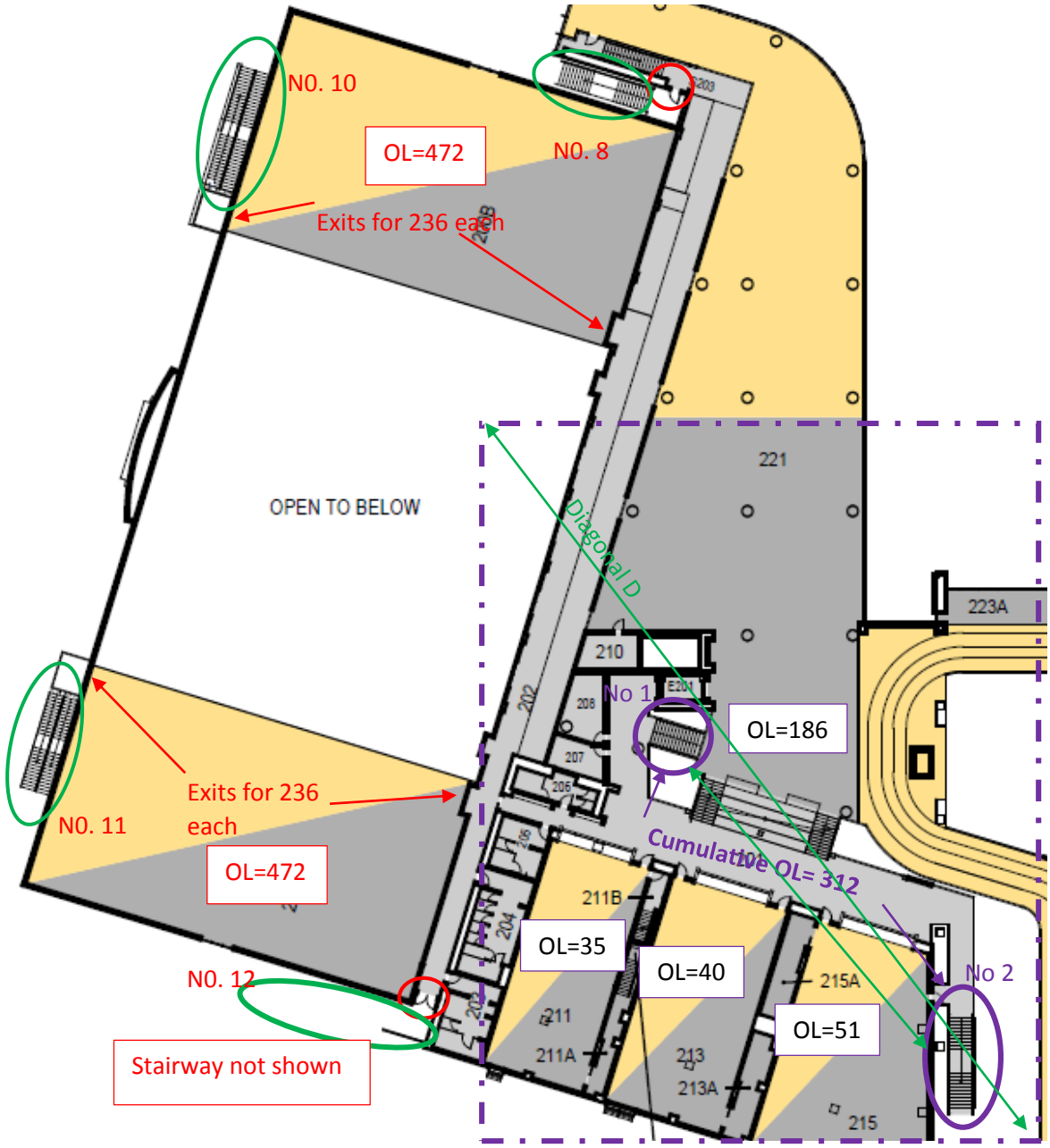


Figure 4-12: ***Extract from Recreation Center 2nd Floor Plan***

Two typical examples were chosen to assess a portion of the Recreation Center.

- Example 1, referring to Figure 4-12, above, for the main GYM, the following calculations can be performed:

Table 4-11: ***Calculations for Main Gym Exit Capacity***

Room	Occupant Load (people)	No of Exits	Required Stairway width (in)	Required Door Width (in)	Remoteness of Exits
Gym 2nd floor	472	2	236x0.2=48 (old code) 236x0.3=71 (2009 LSC)	236x0.15=35 (old code) 236x0.2=48 (2009 LSC)	Room width= 57 ft Length=113ft Diagonal=SQR(57^2+113^2)=127 Distance d for exits >= 1/3x127 = 42 ft

- Referring to Figure 4-12, the following assessment were performed to check compliance to LSC requirement of the area housing cardio fitness machines (demarcated by a square):
  - Cumulative occupant load of that portion of building: 312 people
  - Number of exits required: 2
  - Required stairway width: 156 x 0.3=47 inches
  - Provided stairway width: as shown in Table 4-09, Stairway $N^0$1 measured 78 inches and stairway $N^0$2 = 84 inches.
  - Minimum required exit:
    - Door width: 156 x 0.2= 32 inches
    - Provided exit door width: 36 inches
  - Remoteness of exits: the distance from stairway N_o2 to N_o1 is greater than the 1/3 diagonal distance of the covered area as indicated by dashed lines.

The typical calculations and observations were performed for the entire building; our assessment ascertained that the Rec Center building meet the minimum of requirements minimum egress width capacity and similarly the remoteness of exit locations meet the minimum 1/3 of diagonal distance of the space served.

2) Common paths and Dead end corridors

Common Path of Travel is defined as the portion of exit access that must be traversed before two separate and distinct paths of travel to two exits are available. In simple words, common path of travel is the portion of the exit access travel to which an occupant is steered in one direction only without the option of traveling in another independent direction toward an exit. [Reference LSC Section A.7.5.1.5]

LSC Section A.3.3.42 stipulates that Common path of travel is measured in the same manner as travel distance but terminates at that point where two separate and distinct routes become available.

The Rec Center architecture has a number of common paths of travel.

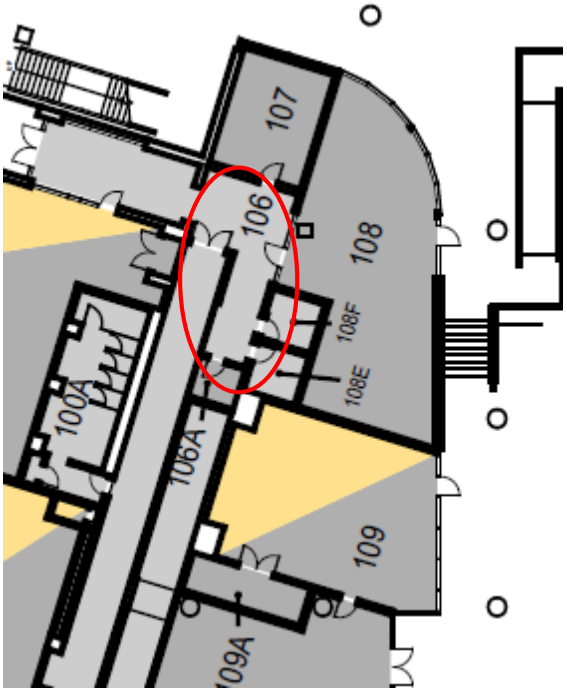


Figure 4-13: ***Extract from 1st floor plan: North-West: Common Path of Travel***

Figure 4-14: ***Extract: 1st floor plan: South West: Common Path of Travel***

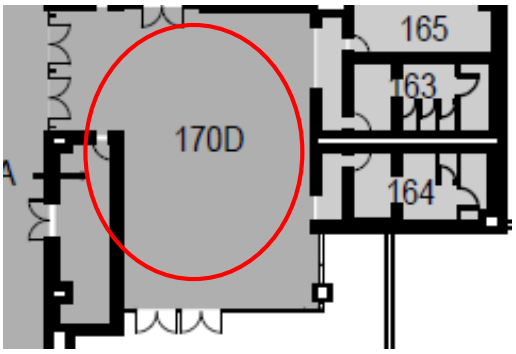


Figure 4-15: ***Extract: 1st floor plan, South East: Common Path of Travel***

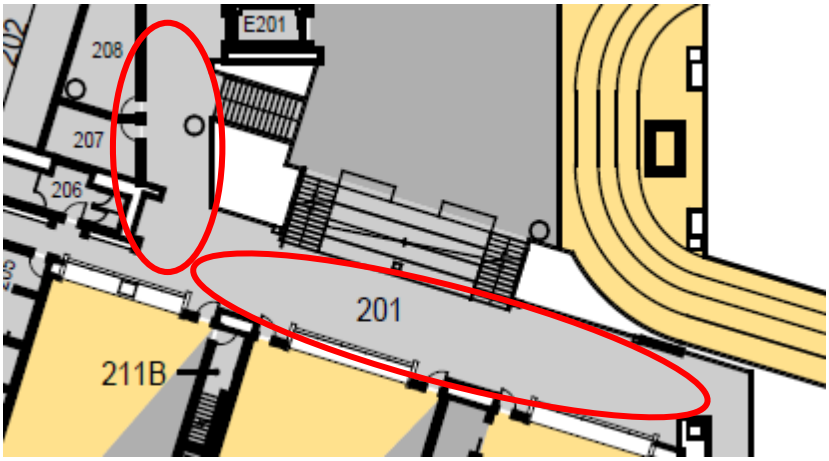


Figure 4-16: ***Extract 2nd floor plan, North East: Common Paths of Travel***

Assessing different common paths of travel found in the Rec Center; the longest was estimated at 57 ft; therefore less than 75 ft maximum allowed by the LSC [reference figure 4-16]. The common paths of travel in the Rec Center are LSC compliant.

LSC requires that exit access to be arranged so that there are no dead ends in corridors. A dead end exists where an occupant enters a corridor thinking there is an exit at the end and, does find none exists.

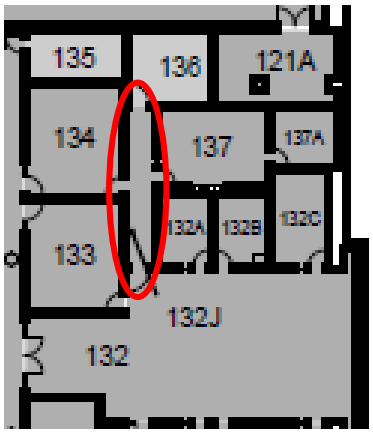


Figure 4-17: ***Extract for 1st floor plan, office area: Dead End Corridor***

Our assessment of the entire building has revealed no other dead end corridor, except the corridor shown in figure 4-17.

The corridor was measured to be 35 ft; therefore complaint to the LSC requirements, which establish the maximum allowable at 50 ft. Refer to Table 4-12 for more details.

3) Travel distance to exits

The travel distance to an exit is required, in accordance with LSC Section 7.6.1, to be measured on the floor or other walking surface as follows:

- Along the centerline of the natural path of travel, starting from the most remote point subject to occupancy
- Curving around any corners or obstructions, with a 12 in clearance therefrom
- Terminating at one of the following:
  - Center of the doorway
  - Other point at which the exit begins

Travel distances in the Recreation Center was evaluated in accordance with LSC requirements shown in Table A.7.6

Table 4-12: ***Extract from LSC: Common Path, Dean-End and Travel Distance***

Table A.7.6 Common Path, Dead-End, and Travel Distance Limits (by occupancy)

	Common Path Limit				Dead-End Limit				Travel Distance Limit			
	Unsprinklered		Sprinklered		Unsprinklered		Sprinklered		Unsprinklered		Sprinklered	
Type of Occupancy	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
Assembly												
New	20/75	6.1/23	20/75	6.1/23[a]	20	6.1[b]	20	6.1[b]	200	61[c]	250	76[c]
Existing	20/75	6.1/23	20/75	6.1/23[a]	20	6.1[b]	20	6.1[b]	200	61[c]	250	76[c]
Educational												
New	75	23	100	30	20	6.1	50	15	150	45	200	61
Existing	75	23	100	30	20	6.1	50	15	150	45	200	61
Day Care												
New	75	23	100	30	20	6.1	50	15	150	45[d]	200	61[d]
Existing	75	23	100	30	20	6.1	50	15	150	45[d]	200	61[d]
Health Care												
New	NR	NR	NR	NR	30	9.1	30	9.1	NA	NA	200	61[d]
Existing	NR	NR	NR	NR	NR	NR	NR	NR	150	45[d]	200	61[d]
Ambulatory Health Care												
New	75	23[e]	100	30[e]	20	6.1	50	15	150	45[d]	200	61[d]
Existing	75	23[e]	100	30[e]	50	15	50	15	150	45[d]	200	61[d]

Table A.7.6 Continued

Type of Occupancy	Common Path Limit				Dead-End Limit				Travel Distance Limit			
	Unsprinklered		Sprinklered		Unsprinklered		Sprinklered		Unsprinklered		Sprinklered	
	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
Business												
New	75	23[l]	100	30[l]	20	6.1	50	15	200	61	300	91
Existing	75	23[l]	100	30[l]	50	15	50	15	200	61	300	91

We have noticed that for the entire building, the longest travel distance of travel was from staff offices to the south east exit as shown by the diagram below:

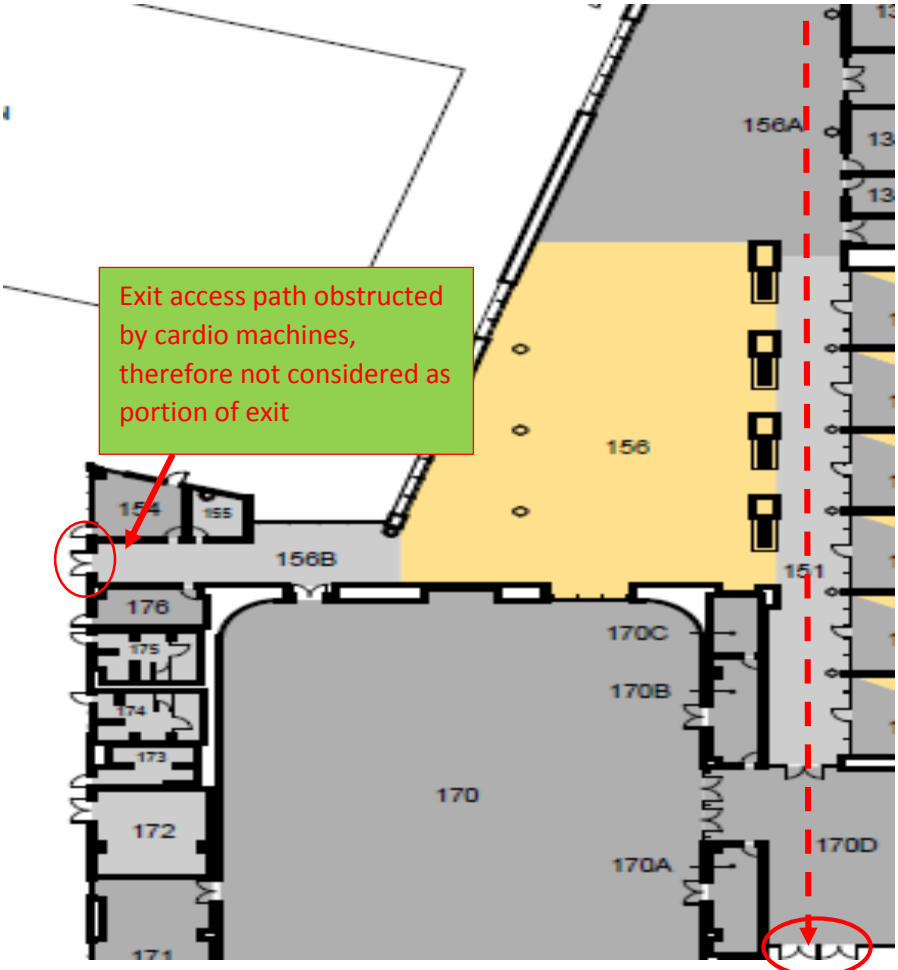


Figure 4-18: ***Extract from 1st floor plan: Exit access path obstructed***

The travel distance was measured and found to be 225 feet, less than 250 ft as per LSC requirements. Therefore the travel distance in the entire building is LSC code complaint.

4) Discharge from exits

The exits from Rec Center terminate at an exterior exit discharge that is continuous to the public way.

All exits in the Rec Center are arranged and marked with exit signs to make clear the direction of egress to a public way.

J. Illumination of Mean of Egress:

In accordance with LSC requirements, the floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge are illuminated as follows:

- The minimum illumination for floors and walking surfaces are required to be values of at least 1 ft-candle (10.8 Lux) measured at the floor
- In assembly occupancies, the illumination of the walking surfaces of exit access shall be at least 0.2 ft candle (2.2 Lux) during periods of performances or projections involving directed light
- The minimum illumination requirements shall not apply where operations or processes required low lighting levels. A desirable form of means of egress lighting is by lights recessed in walls about 12 in (305 mm) above the floor. Such lights are not likely to be obscured by smoke.

All lights, circuits, or auxiliary power must be arranged to ensure continuity of egress lighting, although the performance level is permitted to decline from 1 ft-candle (10.8 Lux) to 0.2 fr-candle (2.2 Lux) if a system element fails. Continuity of egress lighting can be accomplished by means such as use of duplicate light bulbs in fixtures or overlapping light patterns from neighboring fixtures.

All spaces/rooms in the Recreation Center of assembly occupancy use, with an occupant load not exceeding 300 shall not be required to have emergency lighting.

Emergency lighting is required in the Recreation Center for only the designated stairs, corridors, ramps, and passageways leading to an exit and to public way for designated spaces of the exit discharge.

The emergency illumination is required for a minimum of 1 ½ hours (90 min) in the event of failure of normal lighting. Emergency lighting facilities are required to be arranged to provide initial illumination that is not less than an average of 1 ft-canfle (10.8 Lux) and, at any point, not less than 0.1 ft-candle (1,1 Lux), measured along the path of egress at floor level. Illumination levels shall be permitted to decline to not less than an average of 0.6 ft-candle (6.5 Lux) and, at any point, not less than 0.06 ft-candle (0.65 Lux) at the end of 1 ½ hours. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

K. Means Of Egress Components

1) Doors

Door assemblies serve multiple purposes that relate to the comfort and safety of building occupants and provide protection from the following:

i. Weather, drafts, noise, and disturbance from adjoining areas
ii. Trespass by unauthorized persons
iii. Fire and smoke

In accordance with LSC requirements, every door opening and the principal entrance that is required to serve as an exit for the Recreation Center shall be designed and constructed so that the path of egress travel is obvious and direct; easily recognizable as doors. Doors cannot be concealed by curtains, drapes, decorations, mirrors of other similar materials.

Door opening assemblies in a means of egress used in the Recreation Center shall conform to the general requirements of LSC Section 7.1 and special requirements of 7.2.1.
Any door in a required means of egress from an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware complying with LSC Section 7.2.1.7.

Doors in the means of egress shall be permitted to be equipped with an approved access control system complying with 7.2.1.6.2, and such doors shall not be locked from the egress side when the assembly occupancy is occupied (Reference LSC 7.2.1.1.3.).

The measurement of door width shall be as shown in figure xxx: Clear openings of doorways are measured between the face of the door and the stop with the door opened at 90 degrees. The minimum clear opening door width is 32 inches (including a door opening with two door leafs, with no mullion).

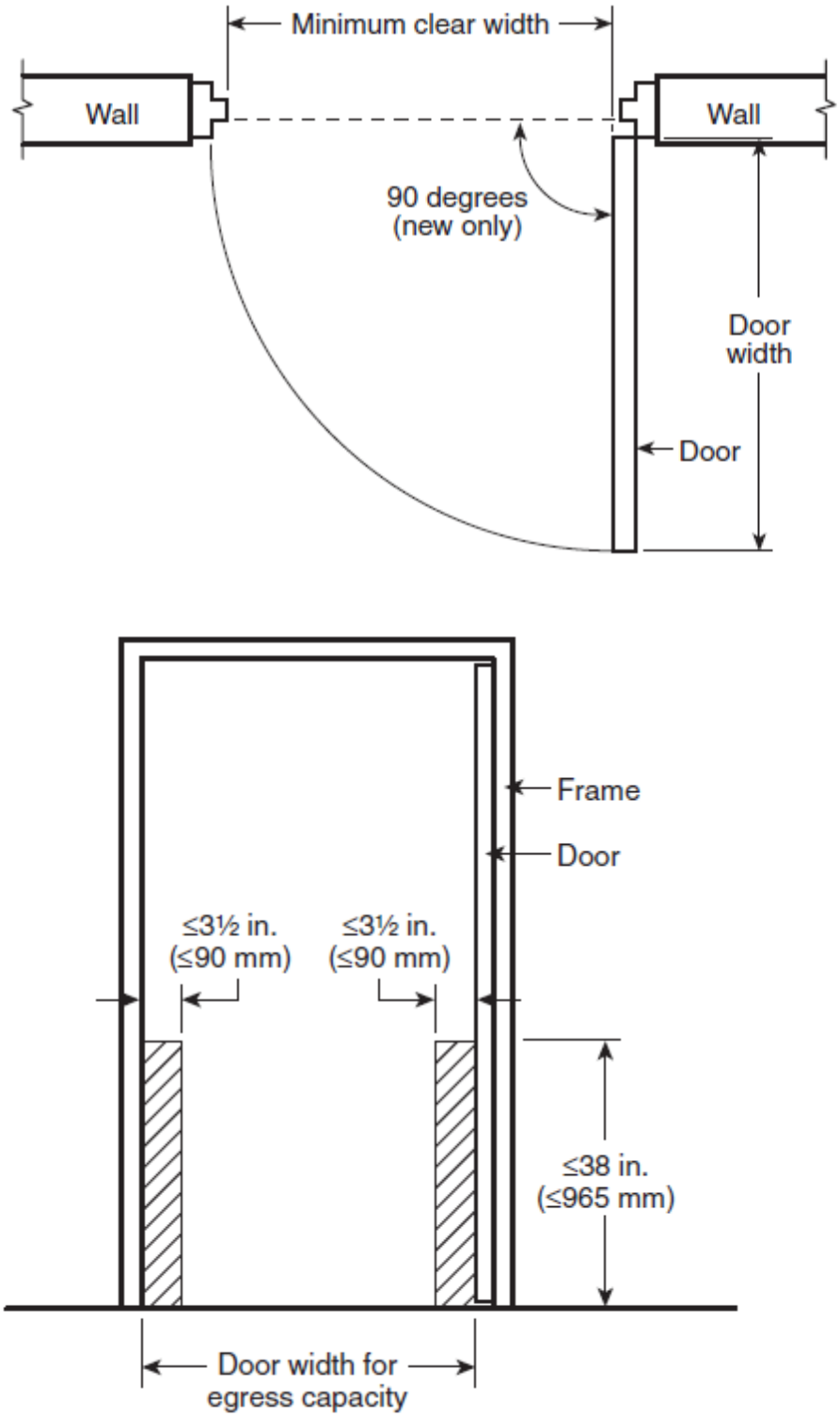


Figure 4-19: ***Egress Capacity and Permitted Obstructions***

The LSC Section 7.2.1.2.3.2 requires that door openings in means of egress to not be less than 32 inches in clear width.
The minimum door width for every door installed in the Rec Center is 36 inches; this means the LSC requirements in terms of means of egress.
The measurement for existing door assembly shall be taken with the door leaf in the fully open position.

Projections are not allowed into the clear opening width for a door lower than 34 inches above the floor. Projections between 34-inches and 80-inches above the floor cannot exceed 4-inches into the clear door opening width. This provision allows for the door hardware to be in the clear opening width.

2) Floor Level

The elevation of the floor surfaces on both sides of a door opening shall not vary by more than ½ in (13 mm). The LSC requires that the elevation of the floor surfaces to be maintained on both sides of the door openings for a distance not less than the width of the widest leaf.

Thresholds at door openings shall not exceed ½ in at door openings shall be beveled with a slope not steeper than 1 in 2.

For the Recreation Center, where the door opening discharges to the outside or to an exterior balcony or exit access, the floor level outside the door opening is permitted to be one step lower than that of the inside, but shall not be more than 8 in lower. [Reference LSC Section 7.2.1.3.1]

3) Swing and Force to Open

Any door assembly in a means of egress installed in the Recreation Center shall meet requirements of LSC Section 7.2.1.4. The door in a meand of egress shall be of the side-hinged or pivoted-swinging type, and shall be installed to be capable of swinging from any position to the full required width of the opening in which it is installed; and in the direction of egress travel where serving an occupant load of 50 or more persons.

The recommended forces required to fully open a door leaf manually in a means of egress prescribed in the LSC, shall not exceed (when applied to the latch side):

- The opening force for the interior-side of swing doors without closures cannot exceed 5 pounds
- For other side-swinging, sliding and folding door, the door latch shall release when subject to a 15 lbf (67 N).
- The door shall be set in motion when subject to a 30 lbf (133 N)
- The door shall open to the minimum required width when subject to a 15 lbf (67 N)
- The opening forces for existing door leaves in existing buildings shall not exceed 50 lbf (222N).

4) Door Leaf Encroachment

To avoid door leaves to protrude into the required corridor width, in general rooms/spaces in the Recreation Center have door leaves that swing within a recessed pocket of the corridor and provide clear passage through an exit access corridor; as it shown in figure 2-23 below. In additional, for those doors that swing into corridor leave at least one-half of the required corridor width unobstructed during the entire swing and project not more than 7 in (180mm) in the required width of a corridor or passageway when fully open; as required in LSC Section 7.2.1.4.3.1.

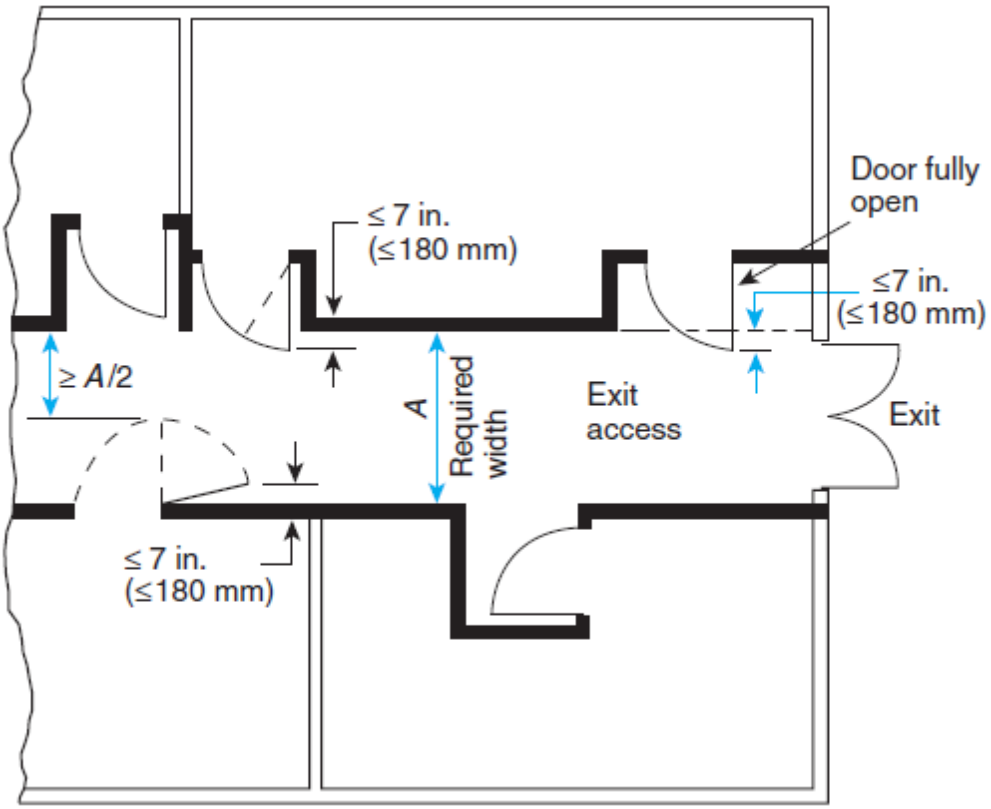


Figure 4-20: ***Extract from LSC: Door-Leaf Encroachment***

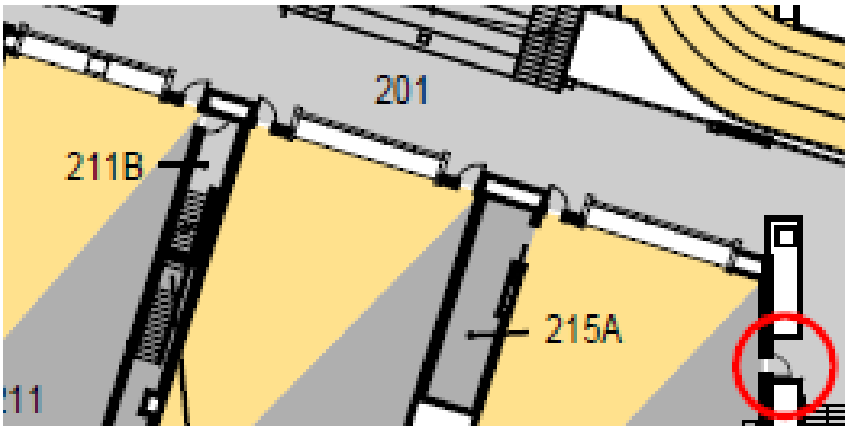


Figure 4-21: ***Extract from Rec Center 2nd floor plan: Recessed Pocket Corridor***

Surface-mounted latch release hardware on the door leaf are not included in the maximum 7 in (180 mm) projection requirement as the hardware is mounted to the side of the door leaf that faces the corridor, passageway when the door leaf is in the open position; and the hardware is mounted not less than 34 in (865 mm) and not more than 48 in (1220 mm) above floor.

Where pairs of door leaves are used, in a means of egress, such as the main GYM exit doors in the Recreation Centre, one of the following criteria shall be met:

- Each leaf of the pair shall be provided with a releasing device that does not depend on the release of one leaf before the other

- Approved automatic flush bolts shall be used and arranged such that:
  - The door leaf equipped with the automatic flush bolts shave no doorknob or surface-mounted hardware
  - Unlatching of any leaf shall not require more than one operation

5) Locks, Latches, and Alarm Devices

It was said that the main entrance and some offices are locked overnight; that is permitted by the LSC provisions 7.2.1.5. Door leaves in the Rec Center shall be then arranged to be opened readily from the egress side whenever the building is occupied; locks when provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side.

For the exterior door assemblies, main entrance and exit, the following will apply:

- A readily visible, durable sign in letters not less than 1 in (25 mm) high on a contrasting background that read as follows is located on or adjacent to the door leaf: THIS DOOR TO REMIAN UNLOCKED WHEN THE BUILDING IS OCCUPIED.
- The locking devise is of a type readily distinguishable type when the door is locked.
- A key is immediately available to occupant inside the building when it is locked.

6) Access-Controlled Egress Door Assemblies

The Rec Center is equipped with entrance and egress access control system for access to the facility beyond the reception area; where the entrance controlled devices prevent access from the outside of the building and requires approved students (registered students to use the facility) and center's staff members magnetic cards to open. Other exterior doors are not equipped with such devices, but are equipped with panic exit or fire exit hardware. The application of such access-controlled egress are permitted by the LSC as long as the following provisions of LSC 7.2.1.2.6 are met:

- A sensor shall be provided on the egress side, arrange to detect an occupant aproaching door leaves that are arranged to unlock in the direction of egress upon detection of an approaching occupant or loss of power to the sensor.
- Door leaves shall be arranged to unlock in the direction of egress from a manual release device located 40 in to 48 in (1050 mm to 1220 mm) veritcalle above the floor and within 60 in (1525 mm) of the secured door openings. The manual release device shall be readily accessible and clearly identified by a sign that reads as follows: PUSH TO EXIT
- The door leaves shall remain unlocked for not less than 30 seconds
- Door leaves shall automatically unlock in the direction of egress at the activation of the building fire alarm system, and shall remain unlocked until the fire –protective signaling system has been manually reset
- Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the door leaves in the direction of egress, and they shall remain unlock until the fire-protective signaling system has been manually reset.

7) Panic Hardware or Fire Exit Hardware

The LSC requires that any door in a means of egress from area having an occupant load of 100 or more persons to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware complying with section 7.2.1.7. The rooms/spaces, with occupant load of 100 or greater, have their doors equipped with approved panic hardware or fire exit hardware.
The LSC defines the following terms:

- Fire exit hardware is a door-latching assembly incorporating an actuating member or bar that releases the latch bolt upon the application of a force in the direction of egress travel ,and additioanlly is tested and listed for use on fire-rated door assemblies
- Panic hardware is a door-latching assembly incorporating an actuating member or bar that releases the latch bolt upon the application of a force in the direction of eress travel, and is not tested or listed

Where the panic hardware or fire exit hardware are installed in the Rec Center, they are not less than 30 in (760 mm), and not more than than 48 in (1220 mm) above the floor. These devices are required to be constructed so that a horizontal force not to exceed 15 lbf (66 N) actuates the cross bar or push pad and latches.

These door assemblies are not equipped with any locking device, set screw, or other arrangement, such as locks, padlocks, bars, chains or any combination of these, that prevents the release of the latch when pressure is applied to the releasing device; and are required not to have devices that hold the latch in the retracted position in compliance with LSC Section 7.2.1.7.4.

8) Self-Closing Or Self-Latching Door Leaf Operation

The exterior main-entrance door assemblies are self-closing and are provided with power-assisted manual operation. The LSC allows the use of such self-closing or self –latching door leaf operation in the means of egress, as per provisions 7.2.1.9.2; when the following criteria are met:

- The door leaves can be opened manually to allow egress travel in the event of power failure
- Door leaves held open for any period of time close, and the power-assist mechanism ceases to function upon operation of approved smoke detectors

9) Inspection of Door Openings

It is required by the LSC that door assemblies for which the door leaf is required to swing in the direction of egress travel to be inspected and tested not less than annually in accordance with Sections 7.2.1.15.2 through 7.2.1.15.8

10) Stairs

Interior and exterior stairs to a building are recognised as very important as they serve multiple functions, such as allowing normal occupant movement among the floors of a building, providing emergencyegress in case of fire, and facilitating rescue and fire control operations conducted by fire fighters.
Unclosed stairs in the Recreation Center serve as exit access and they are not considered as exits. In accordance with the LSC, the stairways in the Recreation Center are required to meet the minimum requirements applicable for existing as shown in figure 2-25:

Table 4-13: ***Existing Stairs Dimensional Requirements***

Table 7.2.2.2.1.1(b) Existing Stairs

Feature	Dimensional Criteria ft/in.	mm
Minimum width clear of all obstructions, except projections not more than 4½ in. (114 mm) at or below handrail height on each side	36 in.	915
Maximum height of risers	8 in.	205
Minimum tread depth	9 in.	230
Minimum headroom	6 ft 8 in.	2030
Maximum height between landings	12 ft	3660
Landing	See 7.2.1.3 and 7.2.1.4.3.1.	

As shown in the calculations in Table 4-9; provided stairways inside the Rec Center meet the minimum width requirements.

i. Stair Details

a. Construction

All stairs serving as means of egress in the Rec Center are required to be of permanent fixed construction in compliance with LSC Section 7.2.2.3.1.1.

b. Landings

The follwoign LSC provisoins are applicable to existing stairs in the Rec Center:

- Stairs and intememediate landing shall continue with no decrease in width along the direction of egress travel
- Landings shall not be required to exceed 48 in (1220 mm) in the direction of travel, provided that the stair has a straight run
- A door assembly at the top of a stair shall be permitted to open directly to the stair, provided that the door leaf does not swing over the stair and the door opening serves an area with anoccupant load of fewer than 50 persons. The case of the stairs connecing the second to the roof.

- The maximum distance between floors without the use of an intermediate landing is 12-feet. A flight of stairs cannot have a vertical run of stairs greater than 12-feet without reaching a landing a floor level or having intermediate landings.

Sloping treads and landings are intentionally used to avoid water accumulation on stairs. However slope is limited to reduce the dimensional nonuniformity of the effective riser heights and to reduce the chance of occupants slipping

c. Riser Height and Tread Depth

The figure below illustrate thread measurement in accordance with LSC Section 7.2.2.3.5.

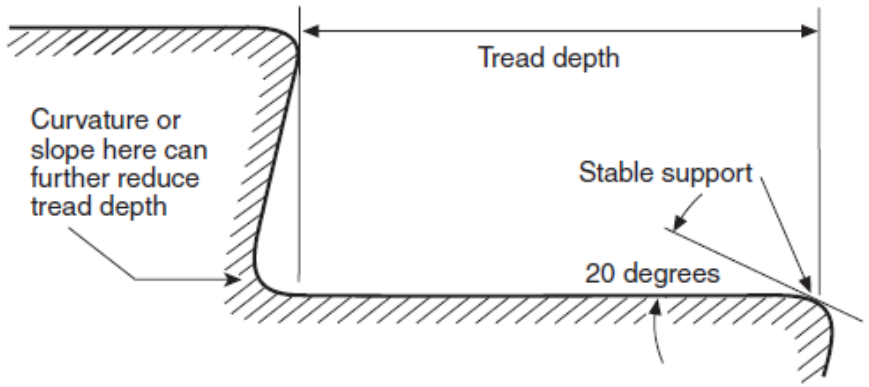


Figure 4-22: ***Extract from LSC: Tread Measurements***

Tabel 4-14: ***Extract from LSC: Existing Stairs Dimensional Details***

Table 7.2.2.2.1.1(b) Existing Stairs

Feature	Dimensional Criteria	
	ft/in.	mm
Minimum width clear of all obstructions, except projections not more than 4½ in. (114 mm) at or below handrail height on each side	36 in.	915
Maximum height of risers	8 in.	205
Minimum tread depth	9 in.	230
Minimum headroom	6 ft 8 in.	2030
Maximum height between landings	12 ft	3660
Landing	See 7.2.1.3 and 7.2.1.4.3.1.	

The typical stairs in the Rec Center are illustrated in figure 2-28 below:

Typical minimum clear width: 36 inches
Typical maximum riser height : 6 inches
Typical maximum tread depth: 14 inches
Equipped with a slip-resistant nosing width: 3 ¼ inches

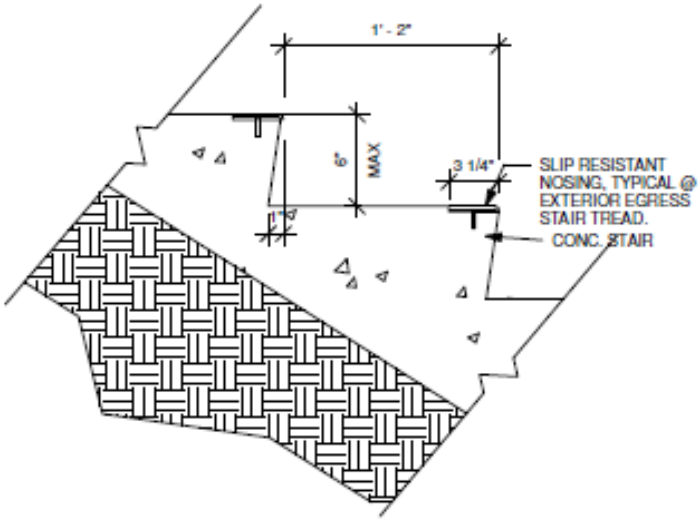


Figure 4-23: ***Typical Stairway Details in the Recreation Center***

d. Dimensionsal Uniformity

Many accidents have resulted from irregularitites in stair geometry from one step to an adjacent step or over an time run of stairs. The LSC permits variation due to construction, provided that the variation between adjacnet treads or adjacent treads or adjacent risers does not exceed 3/16 in (4.8 mm) and that the difference between the largest and smallest riser, as well as the difference between the largest and smallest tread, in any flight of stairs does not exceed 3/8 in (9.5 mm)

ii. Guards and Handrails

All stairs in the Center are equipped with guards (handrails) along the open sides of means of egress pahts where there is a vertical drop of at least 30 in. (760 mm).
The handrails provided meet the following requirements:

- They shall be provided within 44 in (1120 mm) of all portions of the required egress width
- Such stairs shall not have their egress capacity adjusted to a higher occupant load than permitted by the cpacity factor in Table 7.3.3.1 if the stair's clear width between handrails exceed 60 in (1525 mm)

Stairs and ramps are required by the LSC to be installed with handrails on both sides of stairs. LSC Section 7.2.2.4.1.2 requires, in addition to the handrails required at the sides of stairs, the following provisions to be met by the existing stairs:

- handrails to be provided within 44 in. (1220 mm) of all portions of the required egress width; and such stairs shall not have their egress capacity adjusted to a higher occupant load than permitted by the capacity factor in Table 7.3.3.1.

Handrails installed on stairways in the Recreation Center are typically 34 inches above the surface of the tread, measured vertically to the top of the rail from the leading edge of the tread in accordance with LSC Section 7.2.2.4.4.2; as shown in figure Figure 2-29.

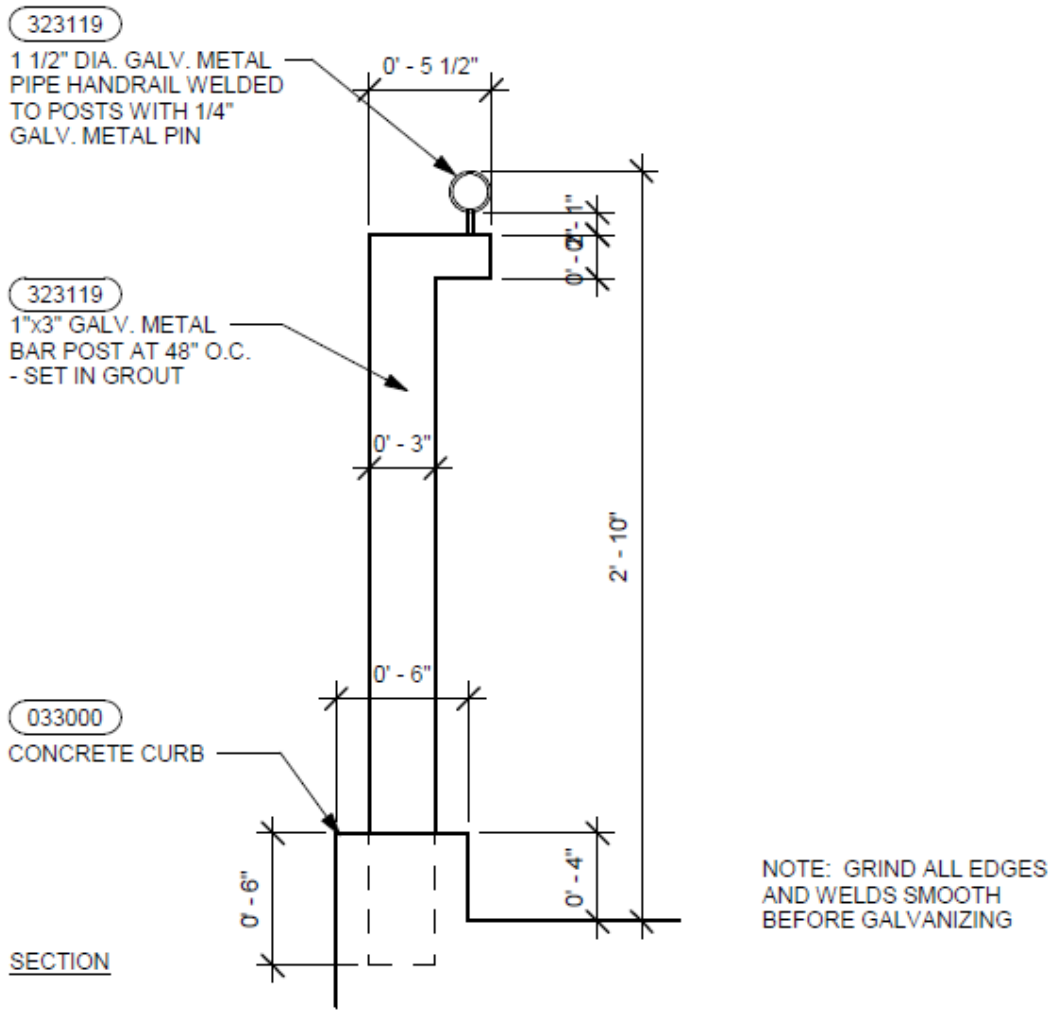


Figure 4-24: ***Typical Handrail Details for the Recreation Center***

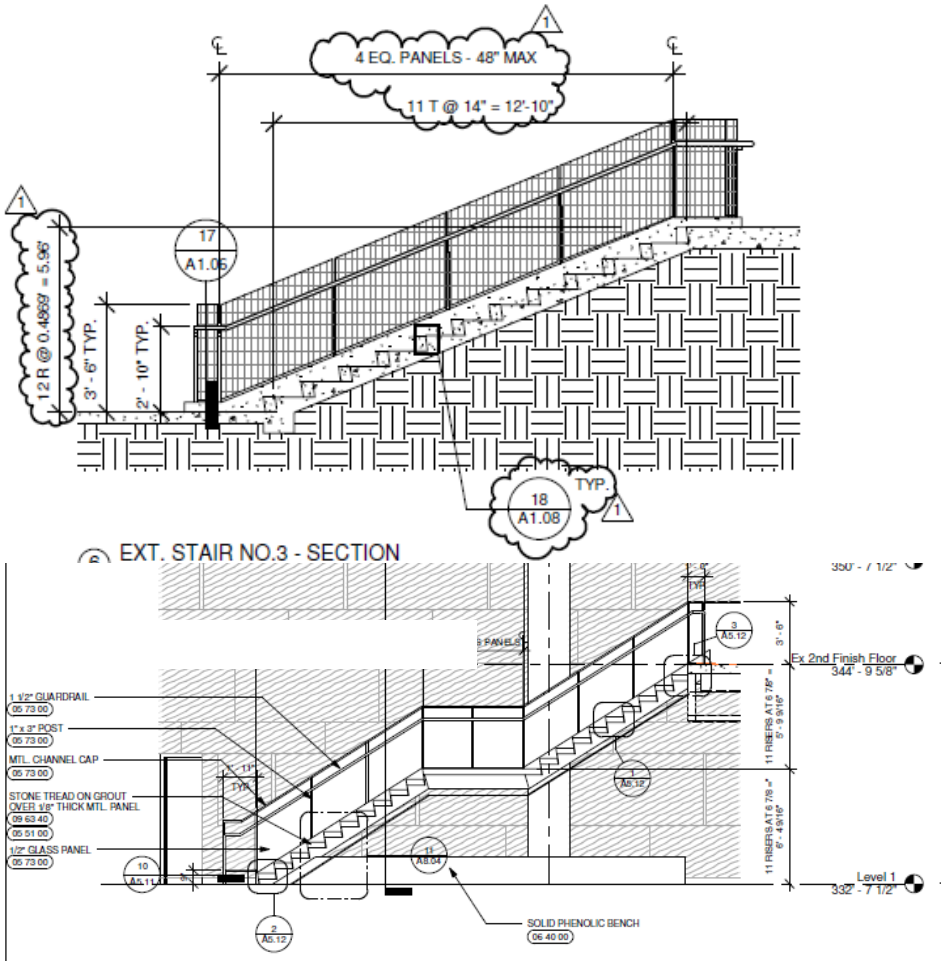


Figure 4-25: ***Typical Stair Section Details of Installed Stairways in the Center***

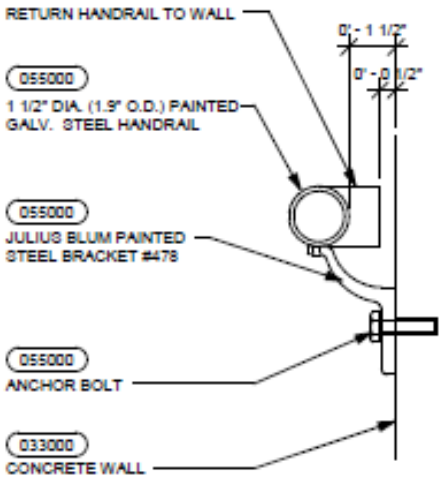


Figure 4-26: ***Wall Mounted Handrail***

Handrails shapes can be:

- Circular cross section with an outside diamter of not less than 1 ¼ in (32 mm) and not more than 2 inches (51 mm).

- Shape that is other than circular with a perimeter diamension of not less than 4 in. (100 mm), but not more than 6 ¼ in. (160 mm), and with the largest cross sectional dimension not more than 2 1/4in (57 mm), provided that graspable edges are rounded so as to provide a radius of not less than 1/8 in (3.2 mm)

As shown in figure 4-26 above; handrails are of circular shape and of 1 ½ in diameter; this design allows a firm grasp with comfortable grip; the fingers of the hand have sufficient space to point downward in a natural grasping position without encountering the handrail bracket.
Provided guards on the staris are 42 in. high in accordance with LSC provisions 7.2.2.4.5.2: " Guards shall not be less than 42in. (1065 mm) high…"

iii. Headroom

Means of egress shall be designed and maintained to provide headroom in accordance with LSC section 7.1.5.1; such headroom shall be not less than 7 ft 6 in (2285 mm), with projections from the ceiling not less than 6 ft 8 in (2030 mm) with a tolerance of -1/4 in (-19mm) above the finished floor, unless otherwise specified by the following:

- The ceiling height shall be not less than 7 ft (2135 mm) from the floor, with projections from the ceiling not less than 6 ft 8 in (2030 mm) nominal measured vertically above a plane parallel to, and tangent with, the most forward projection of the stair tread.

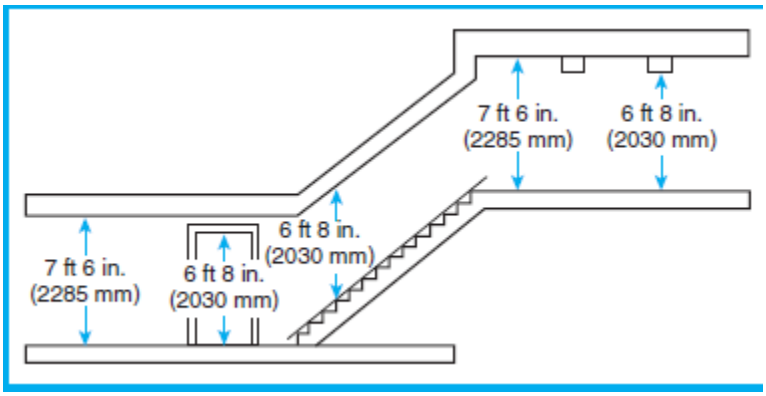


Figure 4-27: ***Extract LSC: Headroom Measurement***

iv. Separation and Protection of Outside Stairs.

The second floor is equipped with four outside exit stairs that are not required to be separated from the interior of the building by fire rated construction in accordance with LSC Section 7.2.2.6.3, which stipulate that:

- *In existing buildings, existing outside stairs serving three or fewer adjacent stories, including the story where the exit discharges, shall be permitted to be unprotected where there is a remote located second exit.*
- *Outside stairs in existing buildings protected throughtout by an approved, surpervised automatic sprinkler system in accordance Section 9.7 shall be permitted to be unprotected*.

11) Ramps

Ramps are permitted as a part of a means of egress and are preferred over stairs under some circumstances.
There are three ramps installed in the Recreation Center, they have all to meet LSC requirements for existing ramps as permitted by the LSC Section 7.2.5.2:

- The slopes shall not be steeper than 1 in 6
- Ramps with slopes not steeper than 1 in 10 shall not be required to be provided with landings.
- Minimum width to be 30 in (760 mm)
- Maximum height between landings 12 ft (3600 m)

i. Ramps Constructions

The ramps installed meet the following constrcution requirements:

- They are part of exit access and are made of permanent fixed construction for Type I.
- The ramp floor and landings are solid and without perforations
- They have landings located at the top, at the bottom, and at door leaves opening onto the ramp
- The change in travel direction are made only at landings, and
- Ramps and intermediate landings shall continue with no decrease in width along the direction of egress travel
- Guards and handrails are provided along both sides of a ramp run with a rise greater than 6 in.(150 mm). The height of handrails and guards are measured vertically to the top of the guard or rail from the walking surface in accordance with LSC provisions 7.2.5.4.3
- The surface of ramps are kept slip-resitant and outdoor ramps are designed such that they minimize water accumulation on walking surfaces.

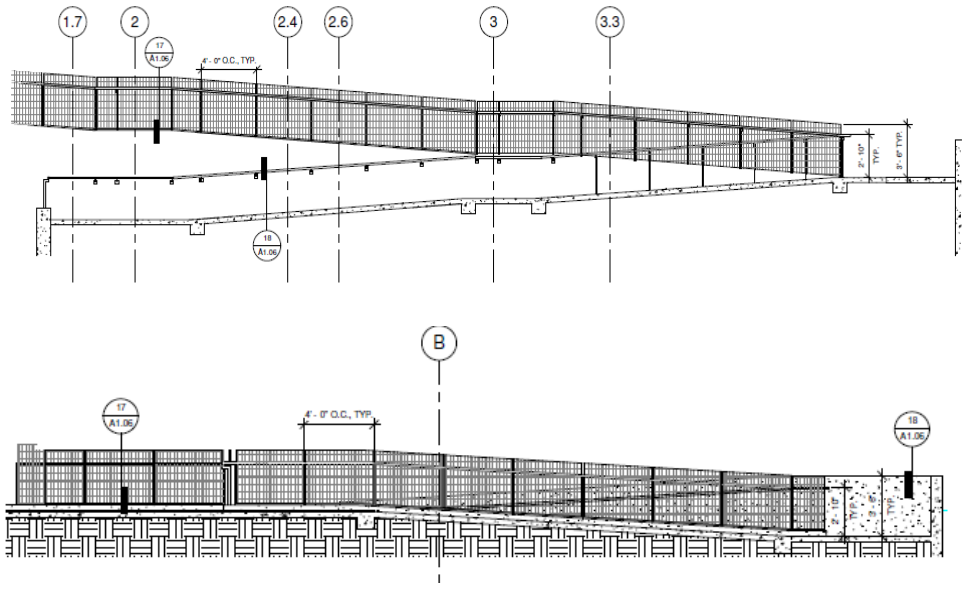


Figure 4-28: ***Typical Ramp Details***

HUMAN BEHAVIOR IN FIRE

A. OCCUPANT CHARACTERISTICS

The selected occupant characteristics include individual physical, cultural, and psychological characteristics and also factors of the occupant's primary group relative to the occupational / cultural setting of the fire. The fire environmental impact includes the evaluation of the susceptibility of the occupants to the heat, flames, smoke, and toxic gases created by the fire incident relative to the locations of the fire effects and the occupants within the Recreation Center.

The following were identified as applicable characteristics of occupants that will influence the egress times of occupants out of the Recreation Center in fire emergency conditions:

a) Occupant number and density: The occupant load calculation has shown that the facility can house more than 4000 people. However the density of occupation is lower due to the large occupiable area of the facility. Even though the density is lower, it is however not evenly spread out the building, hence some spaces/rooms might have much higher density than others. So these factors will affect egress times.

b) Distribution and Activities: The center has equipment for different types of physical activities, for groups or individual activities. From 1st floor to 2nd floor; occupants will react differently to evacuation cues depending on the location and activity performed. As an example, 2nd floor has rooms for Yoga / meditation; reaction times of occupants engaged in Yoga activities will be sensibly different from people using cardio machines; in Yoga activities, people might not be as aware of their surroundings as those engaged in cardio activities.

c) Familiarity and Alertness: Students using the facility are in general alert and many are returning students who have used the facility before and are well familiarized with the egress path; assistance is always available for new students.

d) Physical and cognitive ability: Even though the majority of students using the facility are assumed to be able bodies; the facility can accommodate students with physical impairments. Egress for student with mobility impairments will require assistance during evacuation in fire emergency conditions.

e) Social affiliation, role and responsibility: depending on social ties amongst students using the facility, whether they are from same sport teams or simply from same study classes; their social connections will affect their evacuation reaction times. Several studies have shown that people tend to regroup or discuss the occurrence instead of evacuating immediately upon hearing of fire alarms.

f) Role and Responsibility: How well staff members (fire wardens) are trained for emergency fire evacuations and how well they will be able to get involved in orientating facility users during a fire emergency will impact on the egress time. In general, students will not feel that it is their responsibility to take care of other students; they might delay their egress just waiting to be told what to do next.

g) Commitment and focus: related to activity someone is involved with at the time of a fire emergency; would he/she be committed to complete the task at hand or immediately he/she will react in order to egress?

h) Gender, culture and age: Female students might react differently to male students, as shown in different studies; males have fire-fighting tendencies while females tend to reach out for help first; the age might be a factor too, link to role and responsibility, senior students might feel compelled to assist junior students.

i) Effectiveness of different cues: Alarm devices might sound confusing to occupants if not accompanied by specific actions to be taken as alarm alone do not say what to do when they go off; the emergency voice evacuation system installed in the Rec Center will definitively be effective than just sounding fire alarms.

B. FACTORS AFFECTING PRE-MOVEMENT TIME

There are factors that affect pre-movement times, which are related to the perception of a fire incident by individuals; summarized from Withey's work presented by Dr. Bryan (SFPE Handbook Chapter 3-11):

a) Recognition: A process by which an individual perceives the ambiguous fire cues as indicative of an emergency fire situation, thus becomes aware of the fire.

b) Validation: A process by which an individual attempts to validate an initial perception of the fire cues, primarily by seeking verbal reassurance of the minor and insignificant character of the fire incident; individual tries to obtain more information when the initial cues are ambiguous.

c) Definition: a process by which an individual attempts to relate the information concerning the fire to the perceived and contextual variables, including the qualitative nature of the fire to his/her location. How large is the fire, how he/she can survive in those specific conditions.

d) Evaluation: the individual's process of evaluating the fire incident in terms of how he/she can respond to the threat. This combines psychological and physiological mechanisms that an individual develops to cope with the fire incident, reduce his/her stress and anxiety levels. Obviously the individual needs to accomplish this process in a very short of times.

e) Commitment: a process by which an individual develops mechanisms to initiate the behavior required to fulfill defense plans conceptualized in the evaluation process. If the response strategy developed is not completed, the individual becomes immediately involved in the cognitive process of reassessment and commitment.

f) Reassessment: a most stressful process, with high anxiety levels, as an individual reassesses and overcommits because failure previous attempts to achieve the formulated response strategies. He/she will carry on the process over and over as long as he/she feels still not out of danger.

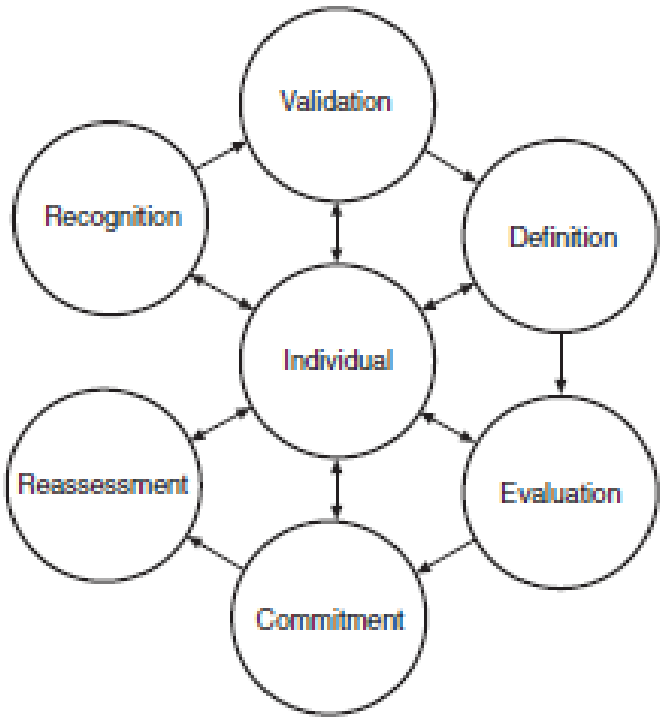


Figure 4-29: ***Extract from SFPE Handbook: Decision Processes in a Fire***

C. PRE-MOVEMENT ACTIVITIES AND TIMES

The egress delay times might be minimized by the following factors observed at the Center:

- An approved fire alarm system is installed in the Center, and equipped with a voice evacuation system,
- The Center is equipped throughout with well illuminated interior exit signs,
- The Center construction has no complexity enclosures,
- The occupant load distribution is spread out, hence low density;
- Fire drills are performed on a continuous basis; and
- Occupants are awake and alerted
- Assistance on evacuation procedures is always available from trained staff members.

The assumption made is that users of the facility are students with a considerable level of understanding of the harms that can be caused by a fire condition. The Rec Center management organized fire drills at least one per trimester; that means it is probable that many of the students using the facility have been involved at least once in a fire drill or fire safety awareness, where they have learned to recognize the alarm sounds and to locate the closest exits depending on their location in the Center.
However it is known that fire behavior in reality or real fire emergency is completely different to set up scenarios in a fire drill.

As the characteristics of occupants were discussed in part A of this chapter, the following pre-movement activities may be associated with users of the Rec Center in a fire emergency:

- Some students will try to get dressed in different attires, at least over cover their sport-appropriate clothing
- Some students will attempt to collect their personal belongings left in secured closet
- Some students will attempt to associate in their respective social circles
- Some students will attempt to notify or discuss with each other.
- Some students might ignore the initial fire cues and continue with their exercise routine
- Some students might completely be lost by their emotions and fail to follow specific instructions from fire wardens
- Staff members might attempt to shutdown computers, collect their belongings

The pre-movement at the Center is estimated to be 0.5 min to 1 min, mostly recorded for people using the swimming pool and women locker rooms; as they tend to dress up before attempting an evacuation. The pre-movement time of people using the swimming pool is not of much concern because the pool is outside, on open air and out of smoke danger.

Calculations of time of evacuation will take into account factors discussed above when estimating delay time.

EMERGENCY MOVEMENT

Prediction of evacuee movement is an essential component of performance-based fire safety analysis. It is said that safe egress from fire is achieved when the required safe egress (RSET) is sufficiently shorter than the available safe egress time (ASET) defined as time when fire-induced conditions within a building become untenable.

Evacuation process is not simply a matter of initiating an evacuation and then controlling the ensuing hysterical crowd response; instead, it is now considered as a more complex event in which people's responses are sensitive to the incident, the information available, and the local conditions. There are many factors that influence human behavior in fire and hence, influence the engineering methods to assess of egress performance.
The factors that can influence behavioral response in fire, and hence influence egress performance are not limited to: active fire protection system, emergency training, distribution and size of population, nature of population, lighting levels, loss of routes, building type, complexity, occupant location, and occupant fatigue, motivation, physical abilities/limitations.

Several approaches have been developed to establish or estimate evacuation time form a building. For our egress assessment, the evacuation time estimation will be established using the first order hydraulic model approach.

The building information required in the time estimation are summarized as follows:

- building number of floors: 2
- number of occupants of second floor: 1920 people
- floor to floor height: 12 ft
- number of stairs: 8
- Width of Stairs: varies; see table 2-3
- Number of landings per floor of stairway travel: 3
- Number and width of ramps: 2 of 44 inches

The following assumptions were used in the process:

- Provided stair risers at the Center are 6 inches and tread depths are 14 inches; these values are not included in the published tables used in the egress estimation; for the purpose of this project, tabulated values of stair risers of 6.5 in and treads of 13.5 in would be used in calculations for simplicity.
- All building occupants start to evacuate same time
- Occupants will use the exits in an optimum balance
- Occupant flow does not involve interruptions caused by evacuee decisions

- The occupants, considered in the estimation, are free of impairments disabilities that impede their movement

Following calculations were performed to estimate the Recreation Center building egress time:

1) **Estimate Flow Capacity through exits**

   Table 4-15: summarizes calculations determining the prime controlling building component:

Table 4-15: ***Flow Capacity Calculations***

Exit Component	Clear width	Boundary layer Widths (in)	Effective Widths (inches)	Effective Widths (ft)	Max Specific Flow (P/min/ft)	Flow Capacity (P/min)
Stairs						
1	84	12	72	6	21.2	127
2	76	12	64	5	21.2	113
3	96	12	84	7	21.2	148
4	96	12	84	7	21.2	148
5	106	12	94	8	21.2	166
6	84	12	72	6	21.2	127
7	78	12	66	6	21.2	117
8	87	12	75	6	21.2	133
Ramps						
1	44	16	28	2	24	56
2	44	16	28	2	24	56
Doors						
1	36	12	24	2	24	48
2	36	12	24	2	24	48
3	72	12	60	5	24	120
4	72	12	60	5	24	120
5	72	12	60	5	24	120

The stairway doors are shown to be the prime controlling factors; therefore the flow capacity through stairway doors will be used in the time estimation calculations.

Boundary layer widths and Maximum specific flow values are obtained from NFPA Handbook Table 4.2.4 and 4.2.8 respectively.

Table 4-16: ***Extract from NFPA Handbook-Boundary Layer Widths***

TABLE 4.2.4 Boundary Layer Widths

Exit Route Element	Boundary Layer *in.*	*cm*
Stairways—walls or side of tread	6.0	15
Railings, handrails*	3.5	9
Theater chairs, stadium benches	0.0	0
Corridor, ramp walls	8.0	20
Obstacles	4.0	10
Wide concourses, passageways	Up to 18	46
Door, archways	6.0	15

*Where handrails are present, use the value if it results in a lesser effective width.

Table 4-17: ***Extract from NFPA Handbook-Maximum Specific Flow***

TABLE 4.2.8 Maximum Specific Flow, F_{sm}

Exit Route Element				Maximum Specific Flow *Persons/ min/ft of Effective Width*	*Persons/ sec/m of Effective Width*
Corridor, Aisle, Ramp, Doorway				24.0	1.30
Stairs					
Riser (in.)	Riser (mm)	Tread (in.)	Tread (mm)		
7.5	(190)	10	(254)	17.1	0.94
7.0	(178)	11	(279)	18.5	1.01
6.5	(165)	12	(305)	20.0	1.09
6.5	(165)	13	(330)	21.2	1.16

Source: Table 3-14.5, *SFPE Handbook of Fire Protection Engineering*, 3rd edition, 2002. Courtesy Society of Fire Protection Engineers.

2) Estimate speed of movement for estimated stairway flow:

$$S = k - akD$$

Where:

K = 242 [reference Table 4.2.5]

.a = 2.86

D = maximum density = 0.175 P/m^2

$$S = k - akD = k(1 - aD) = 242x(1 - 2.86x0.175) = 121\frac{ft}{min}$$

Table 4-18: ***Extract from NFPA Handbook-Constants for Evacuation Speed Equation***

TABLE 4.2.5 Constants for Equation 2, Evacuation Speed

Exit Route Element		k_1	k_s
Corridor, Aisle, Ramp, Doorway		275	1.40
Stairs Riser (in.)	Tread (in.)		
7.5	10	196	1.00
7.0	11	212	1.08
6.5	12	229	1.16
6.5	13	242	1.23

Note: 1 in. = 25.4 mm.

3) Estimate travel distance between floors

Floor-to-floor height = 12; conversion factor [Table 4.2.6] = 2.22
Landings: 3 x 4 = 12 ft
Therefore,

$$Travel\ Distance = (12\ x\ 2.22) + 12 = 38.64\ ft$$

Travel time for a person moving would be:

$$t = \frac{38.64}{121} = 0.32\ \ min$$

Table 4-19: ***Extract from NFPA Handbook-Conversion Factors***

TABLE 4.2.6 Conversion Factors for Relating Line of Travel Distance to Vertical Travel for Various Stair Configurations

Stairs Riser (in. [mm])	*Tread (in. [mm])*	*Conversion Factor*
7.5 (190)	10.0 (254)	1.66
7.0 (178)	11.0 (279)	1.85
6.5 (165)	12.0 (305)	2.08
6.5 (165)	13.0 (330)	2.22

4) Estimate building evacuation time

If all occupants in the Rec Center start evacuation at the same time, each stairway can discharge 48 persons / min; for stairway doors as limiting components; assuming occupant load of a 1920 persons (maximum capacity) ; the slowest time for people to pass through all exit doors:

$$t = \frac{P}{F_c} = {}^{1920}/_{(8x48)} = 5\ minutes$$

Assuming that it takes 0.5 min for the first occupant to move from within the second floor to the stair; it takes 0.32 min to travel from second floor to the exit; therefore the time of evacuation for 1920 occupants would be estimated at:

$$t = 0.5 + 0.32 + 5 = 5.82\ \text{min} \cong 6\ min$$

In our discussions with the Center manager, Mr. Hossein Sedghi, he has confirmed that a fire drill conducted on a very busy activity day (a day of a maximum building users plus staffs closer to 600 people), it takes almost 3 minutes to evacuate the entire building.

The manager comments on egress are very much in line with the theoretical approach discussed in SFPE. Assuming Mr. Sedghi's occupant load of 600 people, applying same process as above, the building evacuation time would be:

$$t = \frac{P}{F_c} = {}^{600}/_{(8x48)} = 1.56\ minutes$$

Assuming that it takes 0.5 min pre-movement time, 0.5 min for the first occupant to move from within the second floor to the stair; and 0.32 min to travel from second floor to the exit; therefore the building evacuation time can be estimated at:

$$t = 0.5 + 0.5 + 0.32 + 1.56 = 2.88\ \text{min} \cong 3\ min$$

This compares with the suggested evacuation time recorded during a fire drill on a busy day at the Recreation Center.

COMPUTER SIMULATION

For my project building, amongst all currently available computer evacuation models, ***Pathfinder*** would be used for the building egress time estimation. The choice is driven by the availability to public and cost (at no cost under the 30-day-trial version).

Pathfinder is an emergency egress simulation that allows evaluation of evacuation models more quickly and produce visual (3D animated) outputs.

Figure 4-30: ***Extract from Theater Evacuation Pathfinder Model***

Pathfinder is a computer evacuation model with the following features:

a) Background of Model:
   i. Developer: RJA Group – US
   ii. Validation: No validation documentation available to public

b) Model Characteristics:
   i. Availability: Available to public for free (30 day license) or on a consultancy basis
   ii. Modeling Method: Movement model
   iii. Refinement of population: microscopic
   iv. Refinement of structure: fine network
   v. Refinement of behavior: does not simulate behavior
   vi. Output: visual output

The computer evacuation model has predicted 3 min for the evacuation of the Recreation center; assuming a total attendance of 4865 people.

The results of the simulation of the evacuation of the Recreation Center is shown in figure 4-31.

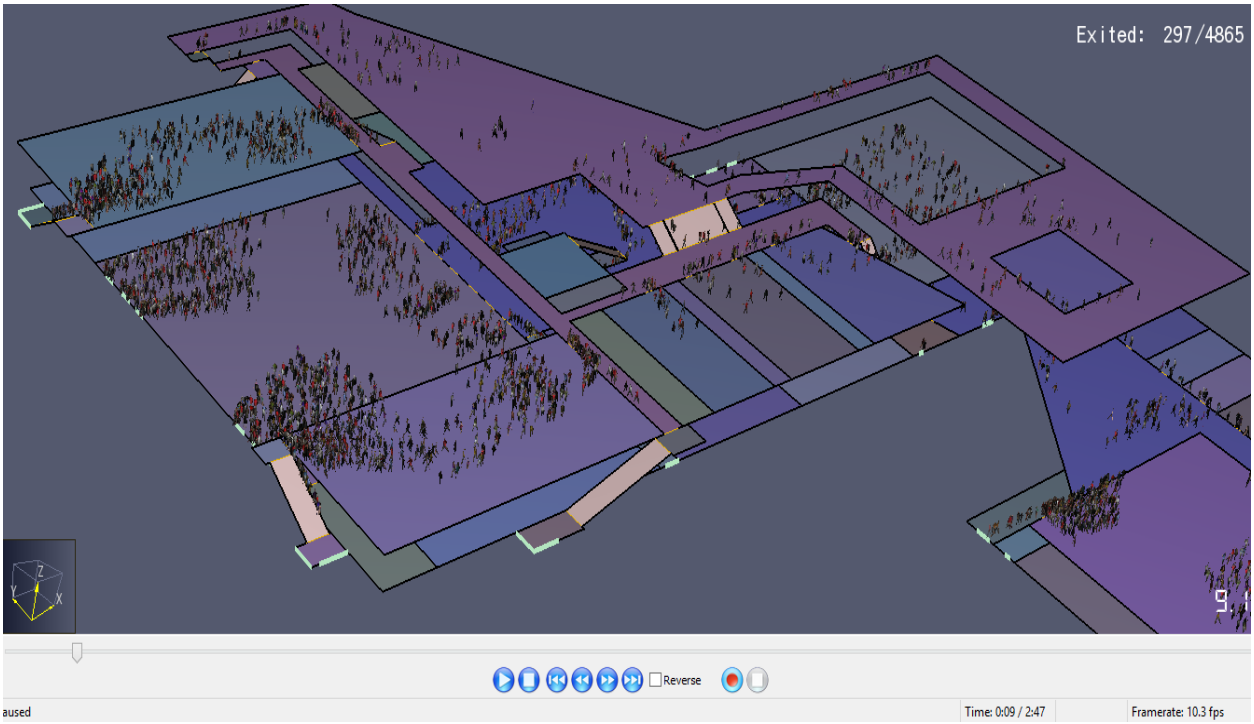


Figure 4-31: ***Pathfinder Model for Recreation Center Building***

PART II: PERFORMANCE-BASED ANALYSIS

GOAL

To demonstrate that occupants in the Rec Center are protected against fire hazards.

OBJECTIVES

To confirm that occupants in the Rec Center are able to evacuate safely and timely i.e. before conditions become untenable during a fire emergency.

PERFORMANCE CRITERIA

Currently, there is not a single set of values for tenability criteria which is universally accepted. The following performance criteria were adopted for the assessment of tenability conditions in the Rec Center under selected scenarios.

a. **Visibility:**
   Different fire researchers present different visibility values for safe fire escape. Experiments have shown that evacuees begin to feel emotional instability in relatively thin smoke. Depending on the degree of familiarity with the internal geometry of the building on fire; Dr. Tadahisa Jin [SFPE Handbook §2-4] has proposed the following limits:
   - Unfamiliar with internal geometry: 13m allowable visibility
   - Familiar with internal geometry: 4 m allowable visibility

   It has been found through experiments that ability of evacuees to think clearly when exposed to fire smoke decreases with increasing smoke density and by hot smoke. It will be reasonable to propose a tenability limit of 5 m for allowable visibility measured at 2m above walking floor.

b. **Exposure to toxic gases:**
   Concentrations of asphyxiants (toxic gases) alone is not generally used by fire engineers in assessing tenability conditions; rather considerations of tenability limits are based on asphyxiant doses, which include concentrations and exposure duration. The time at which the exposure dose of asphyxiant toxic gases reaches a level when occupants are likely to become incapacitated, such that they cannot save themselves and are likely to die unless rescued.
   Studies have shown that exposure dose of carbon monoxide predicted to cause incapacitation in most people to be 35000 ppm.min. Therefore for a 30 min exposure, a limit CO concentration of 1167 ppm can be used as a conservative value.

   Prof. Purser [SFPE Handbook §2-6] has proposed a CO concentration limit of 1400 ppm for a 30 min exposure to cause incapacitation; therefore we propose a concentration of 1200 ppm {for 30 min exposure].

Table II-1: **Tenability Limits for Asphyxiants**

Table 2: Tenability Limits for Exposures to Asphyxiants				
	5 MIN EXPOSURE		30 MIN EXPOSURE	
	INCAPACI-TATION	DEATH	INCAPACI-TATION	DEATH
Carbon Monoxide CO	6,000 ppm	12,000 ppm	1,400 ppm	2,500 ppm
Hydrogen Cyanide CHN	150 ppm	250 ppm	90 ppm	170 ppm
Low Oxygen O2 (Hypoxia)	<13%	<5%	<12%	<7%
Carbon Dioxide CO2	>7%	>10%	>6%	>9%

c. Exposure to Heat/Temperature:

Exposure to a hot environment, especially if the humidity is high and the subject is active, might lead to incapacitation and death due to hyperthermia; which implies a prolonged exposure approximately 15 minutes or more to heated environments at ambient temperatures too low to cause burns.

There are three basic ways in which exposure to heat may lead to incapacitation: through heat stroke (hyperthermia), skin pain and burns, or respiratory tract burns.
A tenability limit of 60^0 C might be proposed for maximum temperature as thermal burns to the respiratory tract may occur on inhalation of air above 60^0C when saturated with water vapor. A tenability limit for exposure of skin to radiant heat could be estimated at 2.5 kW/m^2, below which exposure can be tolerated for at least *several minutes.*

Table II-2: ***Heat Exposure and Tenability Limits***

Table 1: Heat Exposure and Tenability Limits		
EVENT	CAUSE	EXPOSURE LEVEL
Heat stroke (hyperthermia)	Prolonged exposure (more than 15 minutes) to heated environments	60°C - 120°C
Skin pain or burns	Exposure to convected heat (dry air <10% water)	> 120°C
	Exposure to convected heat (water-saturated air)	> 60°C
	Exposure to radiant heat	> 2.5 kW/m2
	Exposure to conducted heat (contact with hot metal surface)	> 60°C
Respiratory tract burns	(same as for skin burns)	(same as for skin burns)

PROCESS SCHEMATIC

The performance-based analysis will the following process:

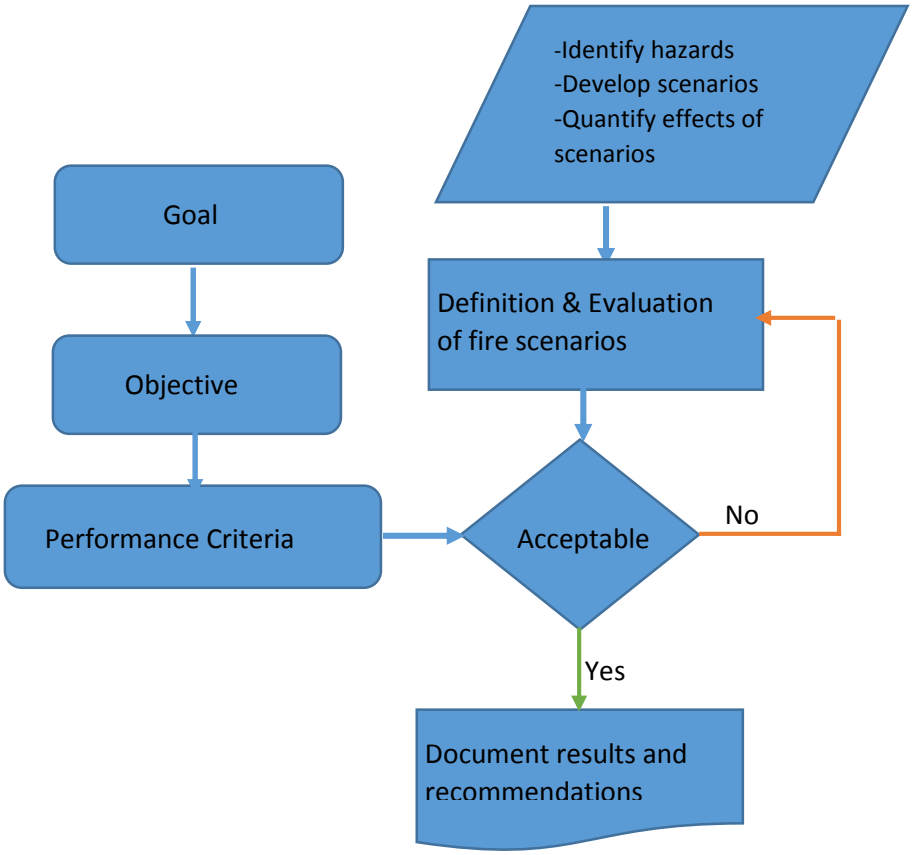
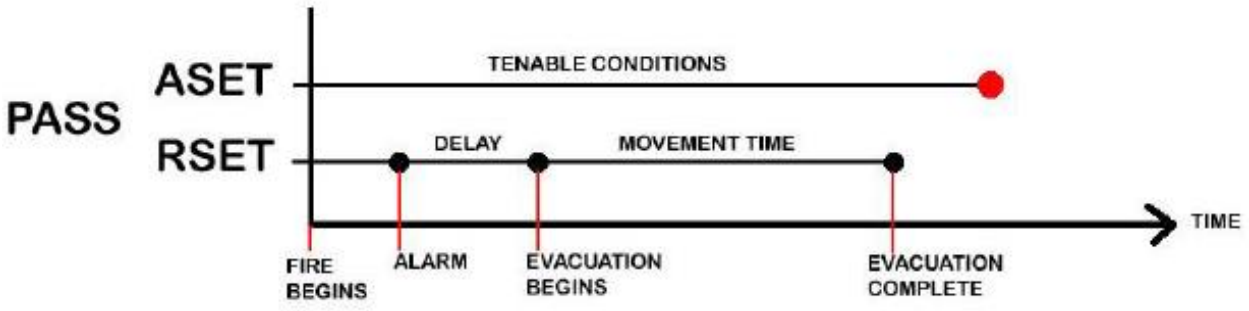


Figure II-1: ***Performance-Based Analysis Schematic***

What is "acceptable" is ultimately defined by the conditions where ASET is greater than the RSET.

The terms ASET and RSET are defined as:

- ✓ ASET: Available Safe Egress Time. This is time from ignition until building become conditions become untenable. This will be demonstrated using FDS modeling.
- ✓ RSET: This is time needed by occupants to evacuate from the building. This is determined by addition of individual times associated with fire detection, alarm activation; pre-movement and travel time obtained either from Pathfinder egress simulation or manual calculations using SFPE proposed process.



$$t_{RSET} = \Delta t_{detection} + \Delta t_{alarm} + \Delta t_{pre-movement} + \Delta t_{travel}$$

Figure II-2: ***Tenability Acceptance Criteria***

EGRESS TIME ANALYSIS ASSUMPTIONS

The following assumptions will apply to the determination time of travel:

- ✓ All building occupants start evacuation at same time
- ✓ Occupants use the exits in an optimum balance
- ✓ Occupant flow does not involve interruptions caused by evacuee decisions
- ✓ Occupants considered are free of physical and mobility impairments

DESIGN SCENARIOS

Several fire scenarios were envisaged for assessment, the figure II-3 depicts locations of the fire scenarios postulated:

- ❑ A concert fire in the main Gym
- ❑ Floor mat fire in the martial arts studio
- ❑ Storage area fire
- ❑ Laundry room fire
- ❑ Administrative office fire
- ❑ Fire under fully extended bleachers

Figure II-3: ***Fire Scenarios on 1st Floor***

Figure II-4: ***Fire Scenario on 2nd Floor***

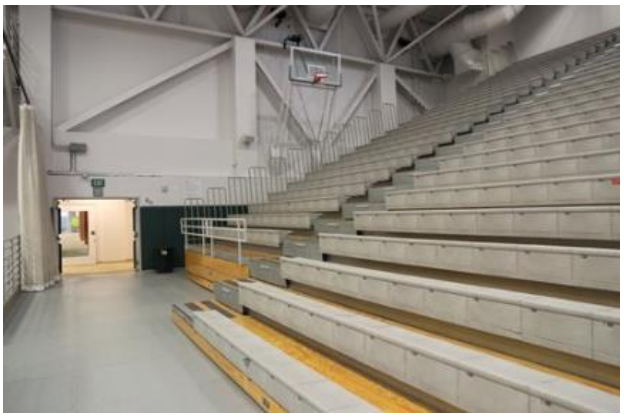


Figure II-5: ***Bleachers fully extended***

Two scenarios were selected for assessment as most challenging with regard to the high potential number of people who might be affected by a fire.

The following fire scenarios were selected:

- Scenario 1: Fire on a stage during a concert held in the main gymnasium
- Scenario 2: Fire under bleachers on second floor in the gymnasium

DESIGN FIRE SCENARIO 1: CONCERT FIRE

The following assumptions were made:

- 3900 people are in attendance
- An electric fault ignited:

- Sound system equipment
- Three computers on the stage

- Fire blocks South-West exit doors
- No automatic fire suppression is available.
- A ultra-fast growing t^2-fire
- Fuel properties: Mixed components

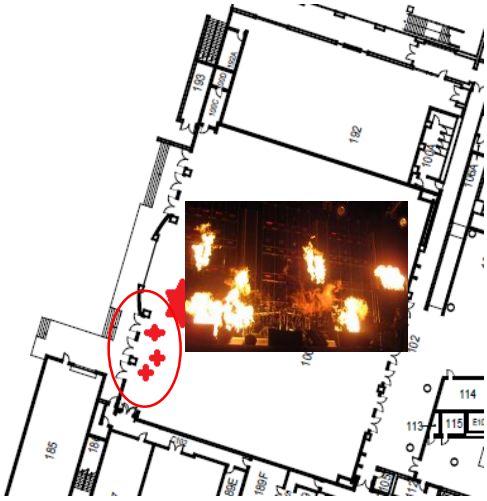


Figure II-6: ***Concert Fire Diagram***

FUEL PROPERTY CALCULATION

Table II-3: ***Fuel Property Calculation***

Equipment Type (Fuel) and Numbers	Heat Release Rate (kW)
Musical keyboards: 2	2 x 480 = 960
Computers (CPU+keyboards+mouse): 3	3 x 400 = 1200
Sound mixers: 2	2 x 400 = 800
Accessories: speakers, microphones, cables…	140
Total Heat Release Rate	3000
Soot Yield estimated for plastic materials (PU)	0.2

Due to a lack of published heat release rates of components included in scenario 1: sound mixers, musical keyboard, speakers and other accessories mentioned above; computer test results were used as benchmarks. For example, a musical keyboard was compared to two computer boards of 240 kW HRR based. SFPE Handbook, Chap 3 and Table 3-4.16 for HRR and Soot yield values.

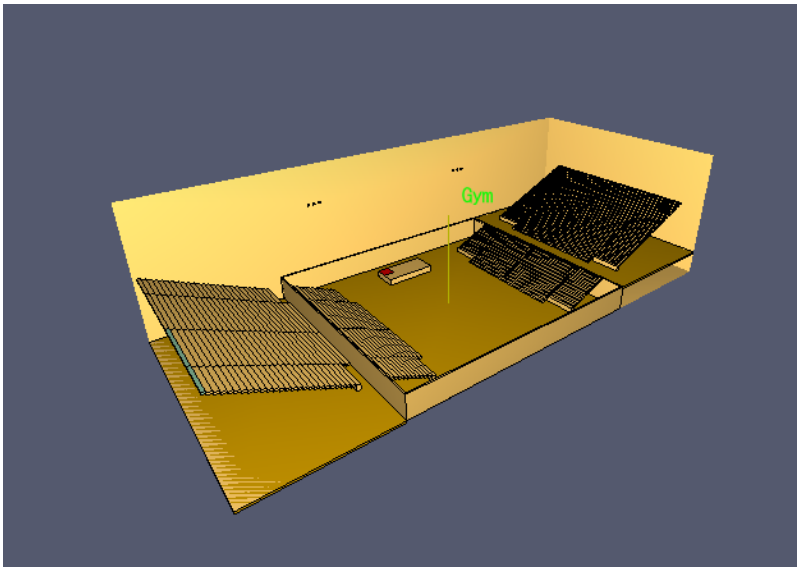


Figure II-7: ***Pyrosim Model-Gymnasium Concert Fire***

EGRESS TIME CALCULATIONS

- RSET Time Analysis
  - Detection: Sprinkler activation time
    - ❖ DETACT prediction:
      - Inputs: QRS; RTI= 50 $(m.s)^{(0.5)}$; Actuation Temperature=155^0F
      - Time of activation: 232 s (4 min)

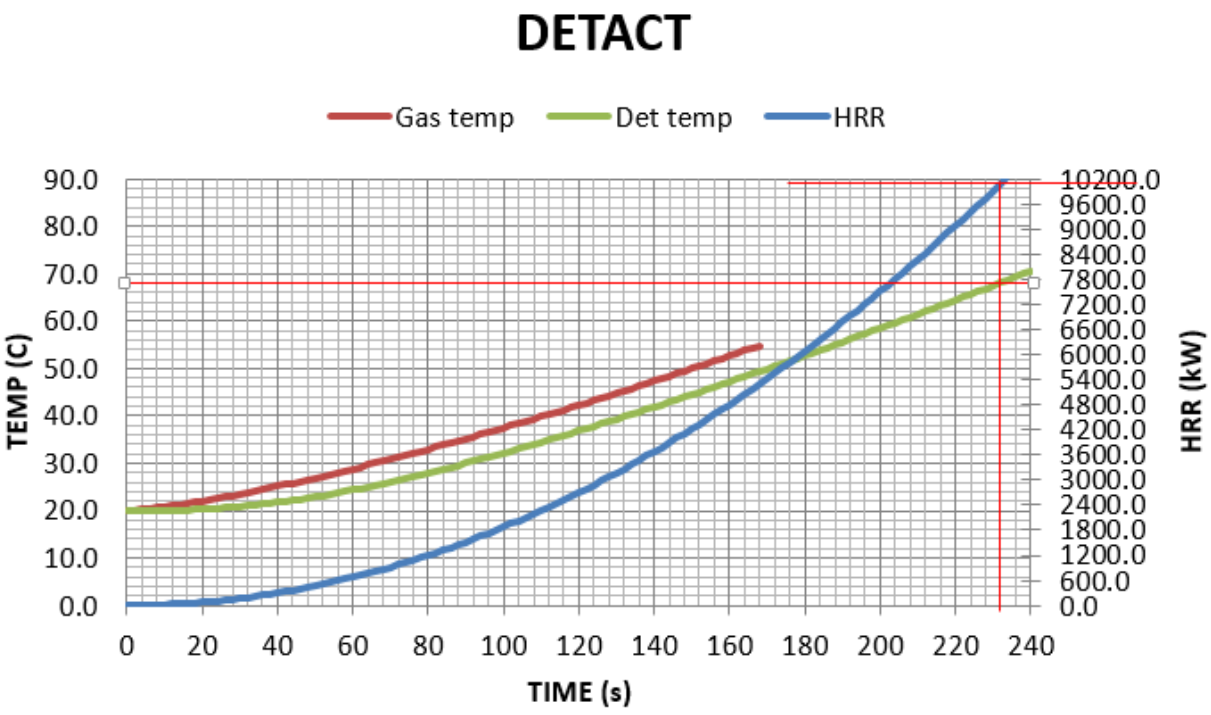


Figure II-8: ***DETACT-Model: Concert Fire Scenario***

- Sprinkler activation time excessive due to high roof; the fire would be 10 MW at the time of sprinkler activation
- Fire detection by occupants (Manual fire box activation): Estimated activation happened 30 sec after fire ignition

- Alarm: Time of activation of Notification Appliances = 10 s [NFPA72,§10.12.1]
- Pre-movement: [<3 min; SFPE-3rd edition, Table 3-13.1]: Estimated 30 sec
- Travel: Determined using Pathfinder simulator: 5 min [Steering Mode]

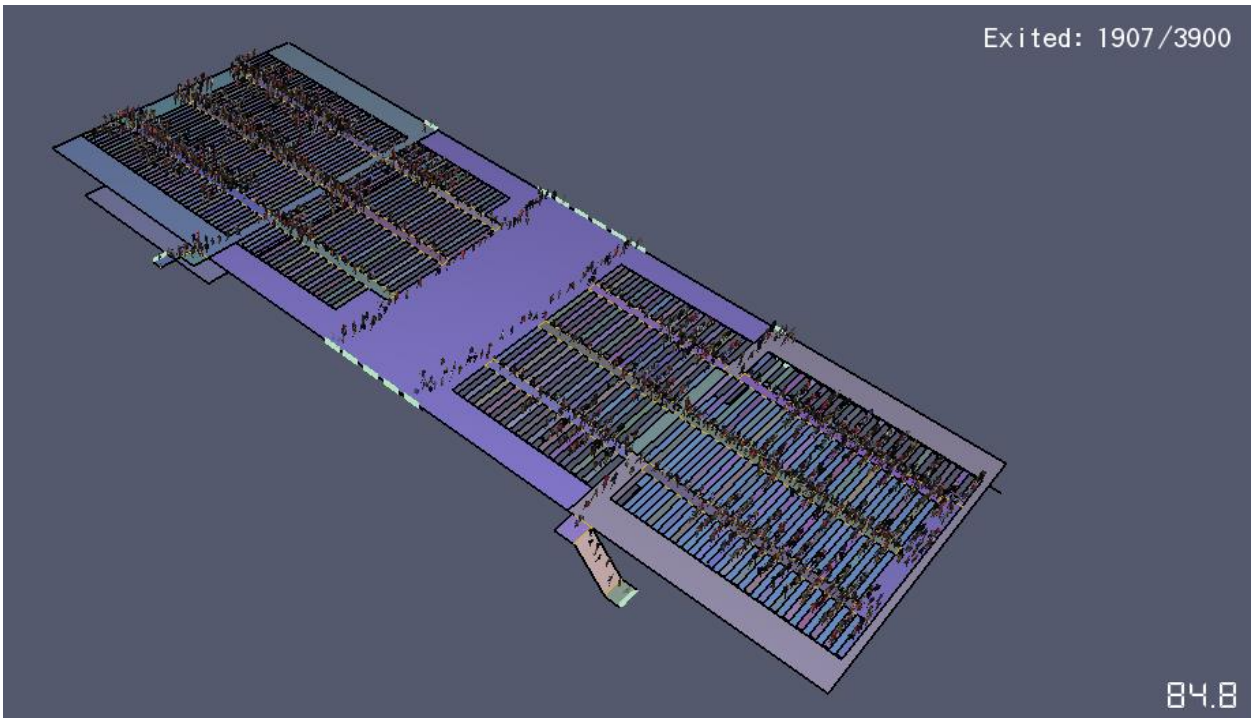


Figure II-9: ***Pathfinder Model – Gymnasium Concert Fire***

- $t_{RSET} = \Delta t_{detection} + \Delta t_{alarm} + \Delta t_{pre-movement} + \Delta t_{travel}$
  - $RSET = {}^{30}/_{60} + {}^{10}/_{60} + {}^{30}/_{60} + 5 \cong 7 \text{ min}$
- ASET Time Analysis: Using FDS, tenability conditions need to be assessed

- **Visibility Assessment**:

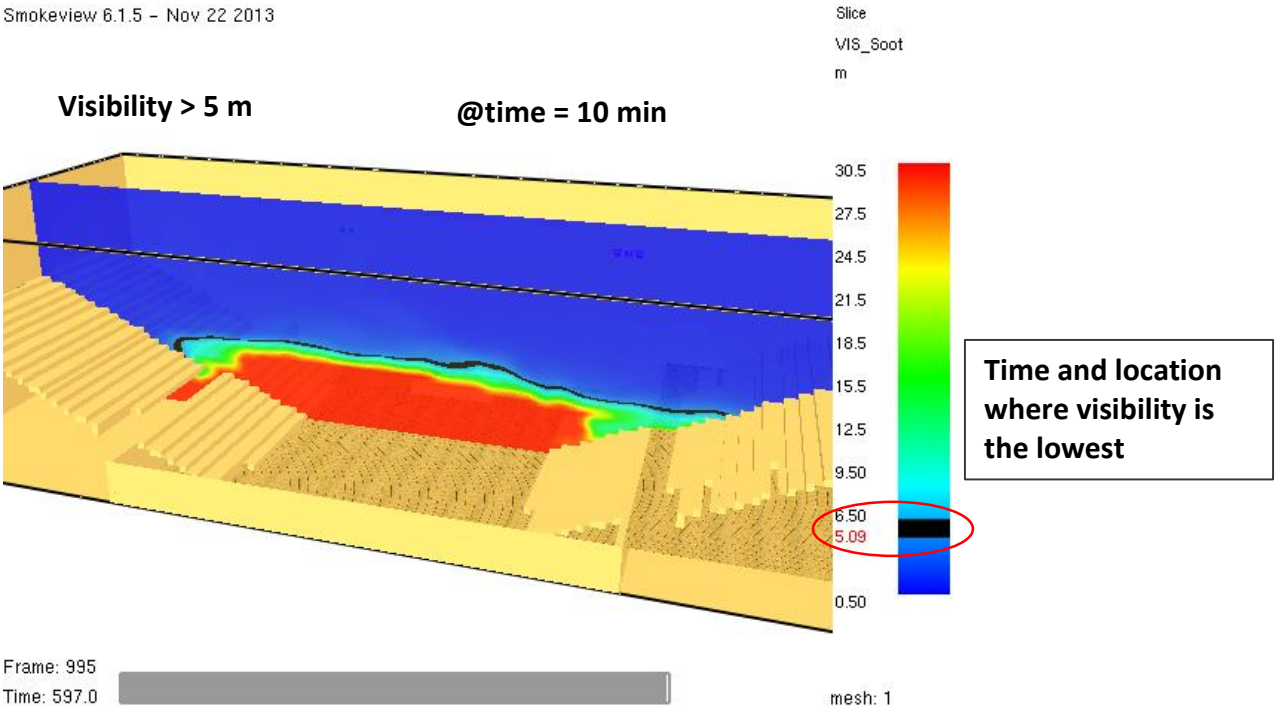


Figure II-10: ***Visibility – above ground floor bleacher top seats***

As shown in figure II-9, visibility measured at 2 m above ground floor is higher than the set minimum criteria, measured 10 min after fire has started.

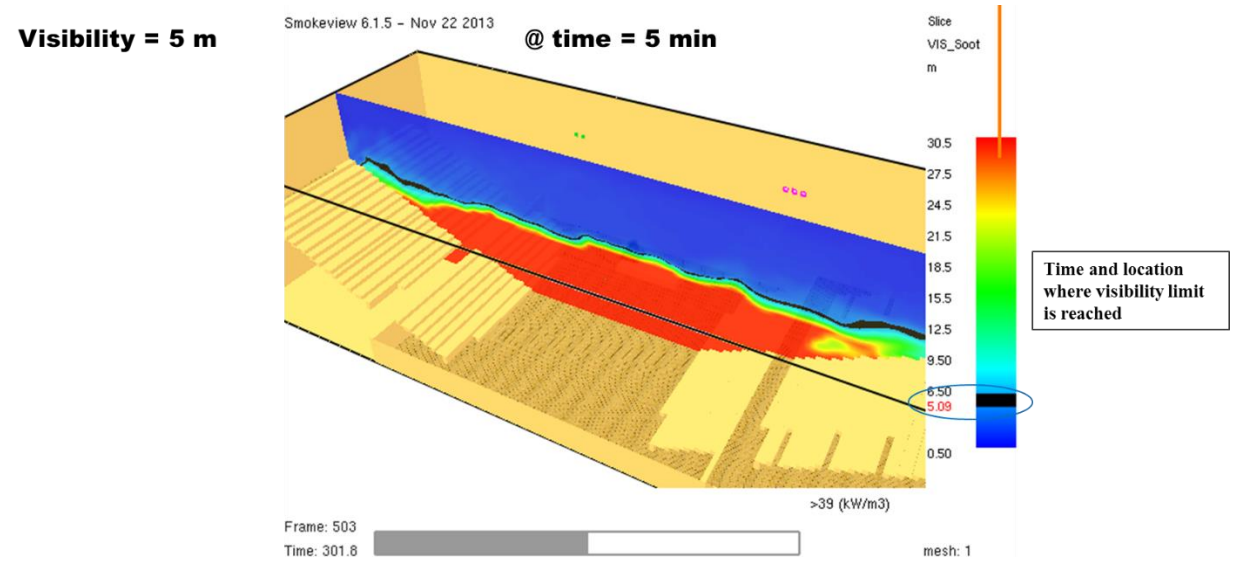


Figure II-11: ***Visibility – 2 m above top seats on second floor***

- **Carbon monoxide concentration**

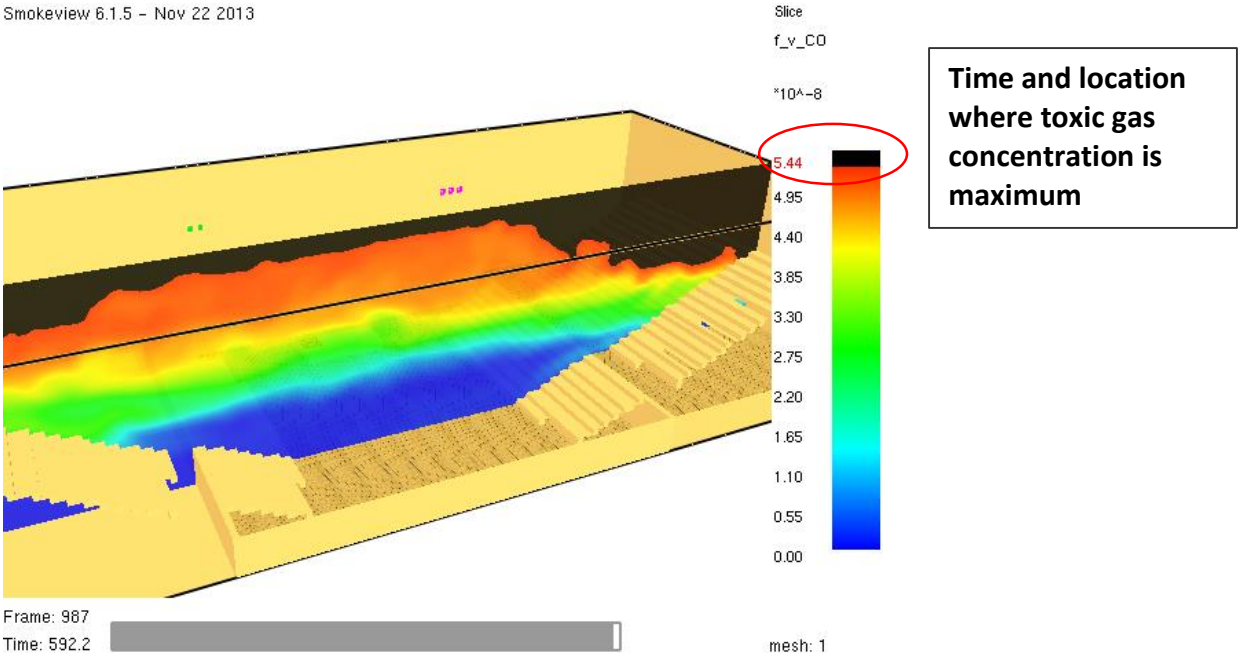


Figure II-12: ***Carbon Monoxide Concentration-Concert Fire***

Highlighted black zone indicates the highest carbon monoxide concentration in the gymnasium measured 10 min after fire occurred; this is much lower than the selected carbon monoxide concentration criteria.

- **Temperature**

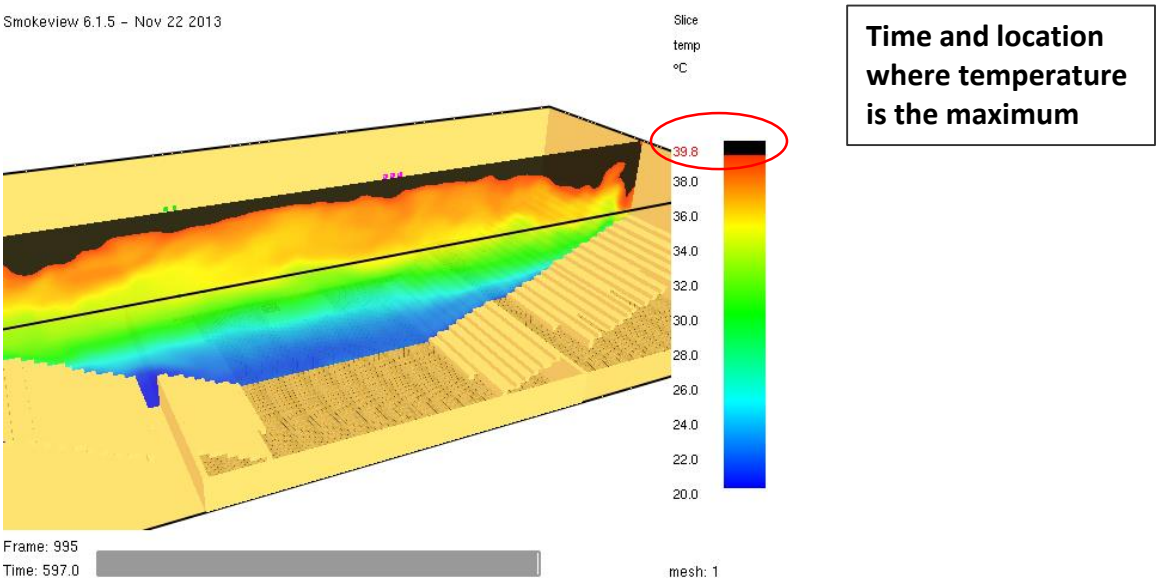


Figure II-12: ***General Area Temperature***

The average hot gas layer temperature is under the selected maximum temperature limit.

- **FDS Summary: Measured at 5 min**

Table II-4: ***FDS Summary***

Visibility		Carbon Monoxide		Temperature	
Limit	Minimum Value	Limit	Maximum Value	Limit	Maximum Value
5 m	5 m	1200 ppm	0.06 ppm	60 Deg C	40 Deg C

- $t_{ASET} = \Delta t_{FDS-visibility}$= 5 min < $\boldsymbol{t_{RSET}}$ [7 min]

$$\boldsymbol{t_{RSET} > t_{ASET}}$$

Concert attendees are unable to evacuate safely and before conditions become untenable.

Two solutions could be recommended:

- **Installation of mechanical exhaust system or,**
- **Improvement of egress time on the second floor**

We select to recommend improvement of egress time on the second floor as most effective rather than installation of mechanical exhaust system.

DESIGN FIRE SCENARIO 2: FIRE under BLEACHERS

The following assumptions were made:

- 926 people occupying second floor bleachers while those on first floor are still in retracted position
- Fire intentionally set under bleachers:
  - Gasoline used as fuel
  - Gasoline quantity 1000 mL
- Fire blocks one of the two exit double doors
- No automatic fire suppression considered available.
- A ultra-fast growing t^2-fire

FUEL PROPERTY CALCULATION

Referring to NIST spill fire testing conducted for the National Institute of Justice (reference NIJ report 604: Flammability and Combustible Liquid spill). Gasoline spill of 1 L produced a peak heat release rate of approximately 770 kW as shown in figure II-13:

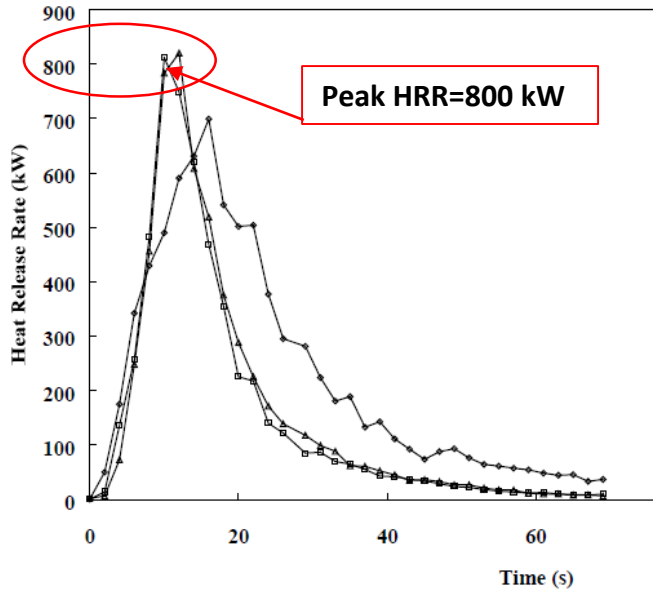


Figure II-13: ***Peak HRR for 1L gasoline spill fire***

The following fuel properties were used in the simulation:

- Chemical formula: C_8H_{18}
- Soot yield: 0.1 [combined soot yield of gasoline and hardwood flooring]
- C0 yield: 0.1 [Reference SFPE 3-4.16]
- Heat of Combustion: 42.4 MJ/kg [Reference SFPE

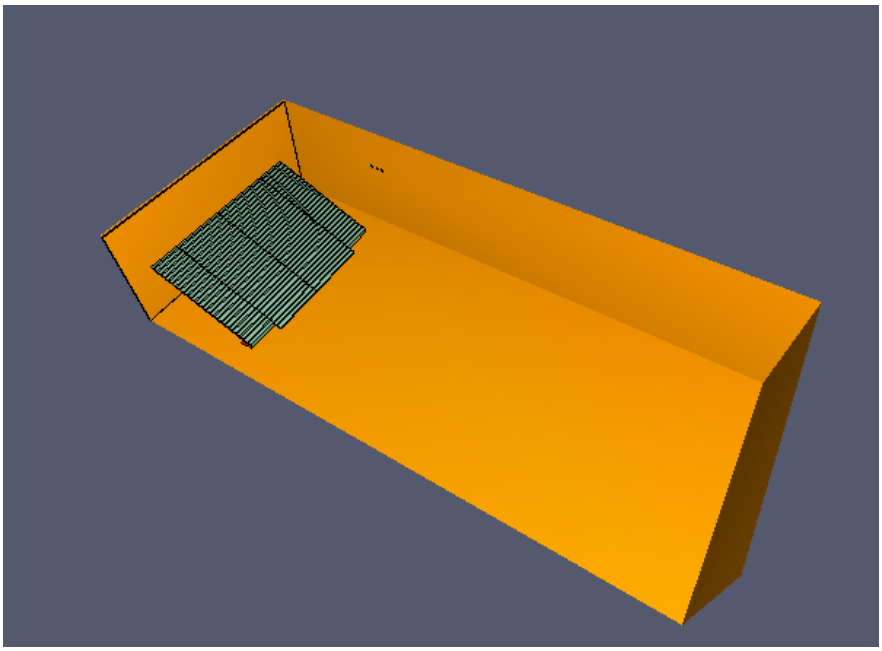


Figure II-14: ***Pyrosim Model-Fire under Bleachers***

EGRESS TIME CALCULATIONS

- RSET Time Analysis
  - Detection: Sprinkler activation time
    - ❖ DETACT prediction:
      - Inputs: QRS; RTI= 50 $(m.s)^{(0.5)}$; Actuation Temperature=155^0F
      - Time of activation: 184 s (3 min)

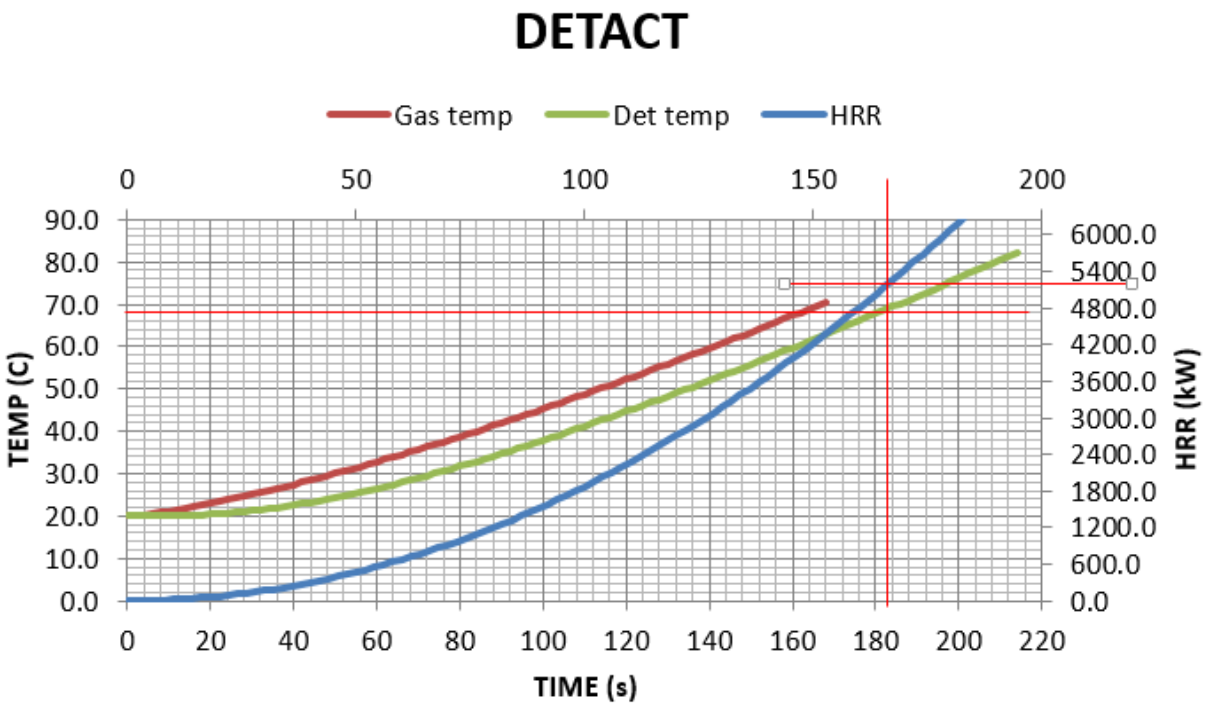


Figure II-15: ***DETACT-Model: Fire under Bleachers***

- Sprinkler activation time excessive due to high roof; the fire would be 5.2 MW at the time of sprinkler activation
- Fire detection by occupants (Manual fire box activation): Estimated activation happened 30 sec after fire ignition

- Alarm: Time of activation of Notification Appliances = 10 s [NFPA72,§10.12.1]
- Pre-movement: [<3 min; SFPE-3rd edition, Table 3-13.1]: Estimated 30 seconds due to the presence of trained fire warders
- Travel: Determined using Pathfinder simulator: 8 min

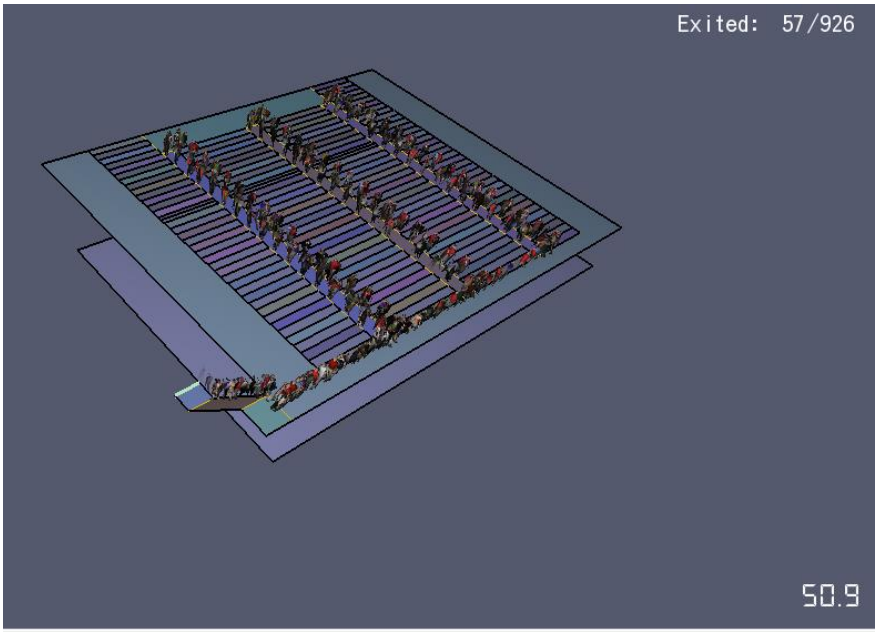
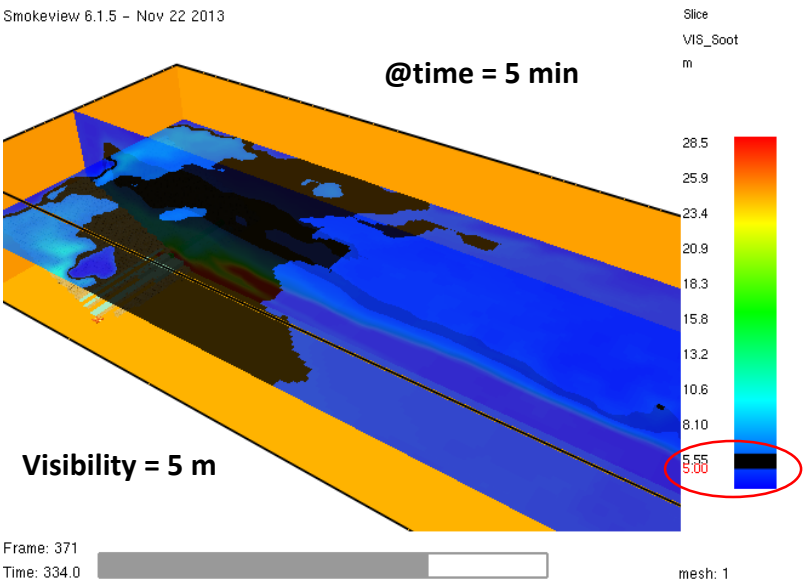


Figure II-16: ***Pathfinder Model – Fire under Bleachers***

- $t_{RSET} = \Delta t_{detection} + \Delta t_{alarm} + \Delta t_{pre-movement} + \Delta t_{travel}$
  - $RSET = {}^{30}/_{60} + {}^{10}/_{60} + {}^{30}/_{60} + 8 \cong 10 \text{ min}$
- ASET Time Analysis: Using FDS, tenability conditions need to be assessed

Visibility Assessment:



Time and location where visibility is reached

Figure II-17: ***Visibility – 2 m above bleacher top seats***

The highlighted area in black indicates location where minimum visibility limit is reached.

- **Carbon monoxide concentration**

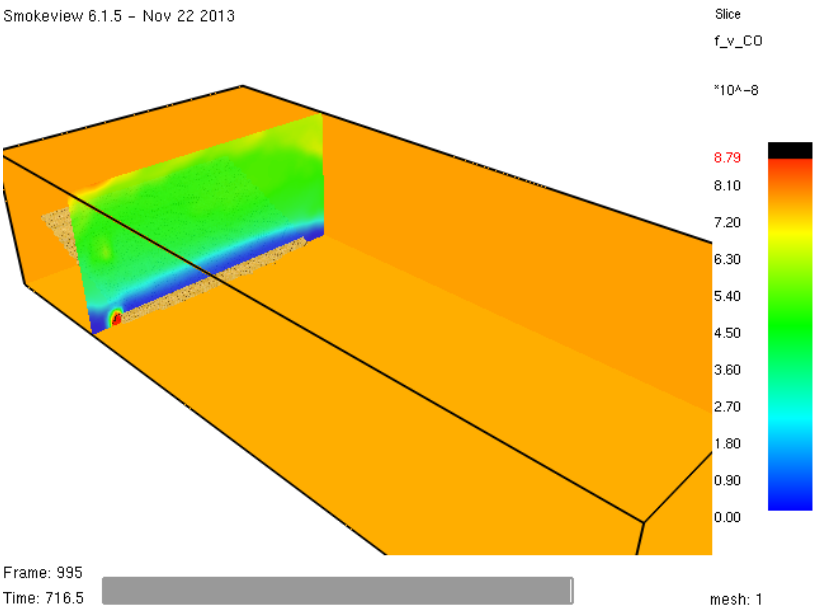


Figure II-18: ***Carbon Monoxide Concentration – Fire under Bleachers***

Highest carbon monoxide concentration in the gymnasium measured 12 min after fire ignition; this is much lower than the maximum carbon monoxide concentration criteria.

- **Temperature**

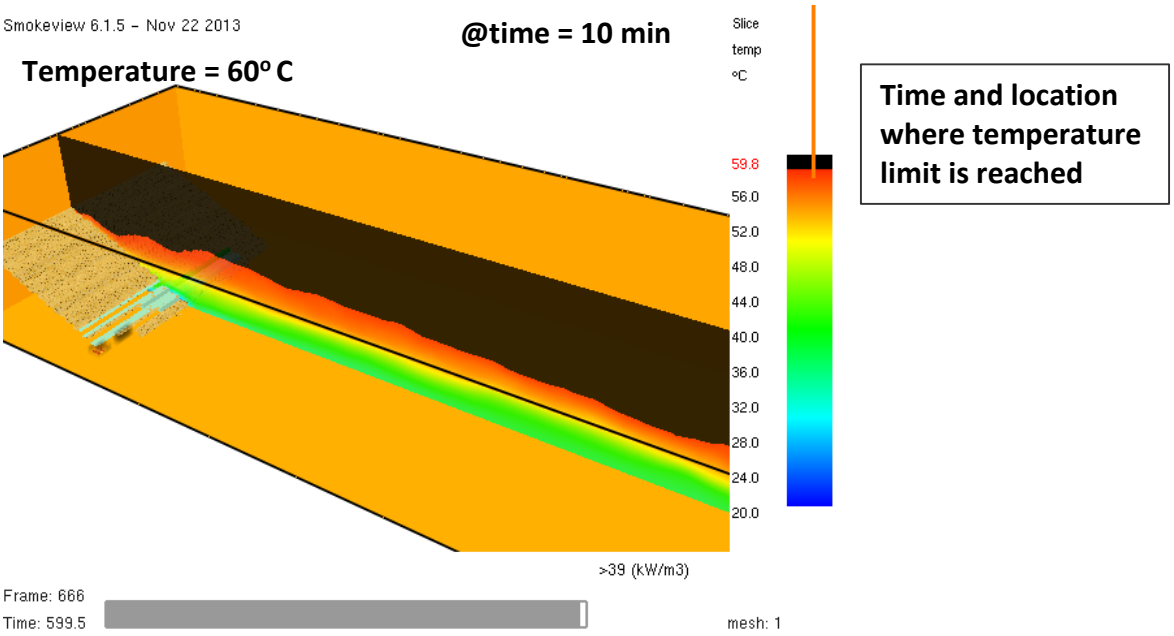


Figure II-19: ***Hot gas layer Temperature***

Ten minutes after fire ignition, the highlighted area indicates location where maximum hot gas layer temperature is reached.

- **FDS Summary: Measured at 5 min**

Table II-4: ***FDS Summary-Fire under Bleachers***

Visibility		Carbon Monoxide		Temperature	
Limit	Minimum Value	Limit	Maximum Value	Limit	Maximum Value
5 m	5 m	1200 ppm	0.07 ppm	60 Deg C	45 Deg C

- $t_{ASET} = \Delta t_{FDS-visibility}$= 334 s (~5 min) < $\boldsymbol{t_{RSET}}$ [10 min]

$$\boldsymbol{t_{RSET} > t_{ASET}}$$

Event attendees are not able to evacuate safely before conditions become untenable

We recommend enforcement of administrative control for occupancy loading of the gymnasium on the second floor.

CONCLUSION AND RECOMMENDATIONS

The culminating project report encompassed the study of the different aspects related to the fire protection systems and life safety measures put in place at the Cal Poly student Recreation Center building. This endeavor was a very beneficial experience that highlighted different features of fire protection systems and the application of different code criteria.

The assessment was performed from information collected from as-built drawings and personal interviews conducted with the Recreation Center personnel and the heads of the Environmental Health and Safety, and the Electrical Services department on Cal Poly campus.

It is very important that all features of the fire protection systems associated with the Recreation Center be properly maintained, inspected and tested in accordance with required approved codes and standards in order for them to serve their vital, indispensable fire and life safety functions at all times.

The following recommendations are put forward to enhance safety of personnel and users of the Rec Center:

- ✓ Safety factor improvement: ASET vs RSET:
    - Reduction of egress time from second floor gymnasium:
        - Training of personnel in life safety management
        - Regular fire safety awareness campaigns for the entire campus
- ✓ Performance re-assessment of installed sprinkler system in the gymnasium
- ✓ Review enforcement of all administrative controls
- ✓ Update document to reflect as-built conditions
- ✓ Encourage further performance-based analysis of fire scenarios not analyzed in this report

APPENDIX

Appendix A: Recreation Center Floor Plans

Appendix B: Partitions and Penetration Enclosure

Appendix C: Fire Alarm and Detection As-built Drawings

Appendix D: Water-Based Fire Suppression – Hydraulic Calculations

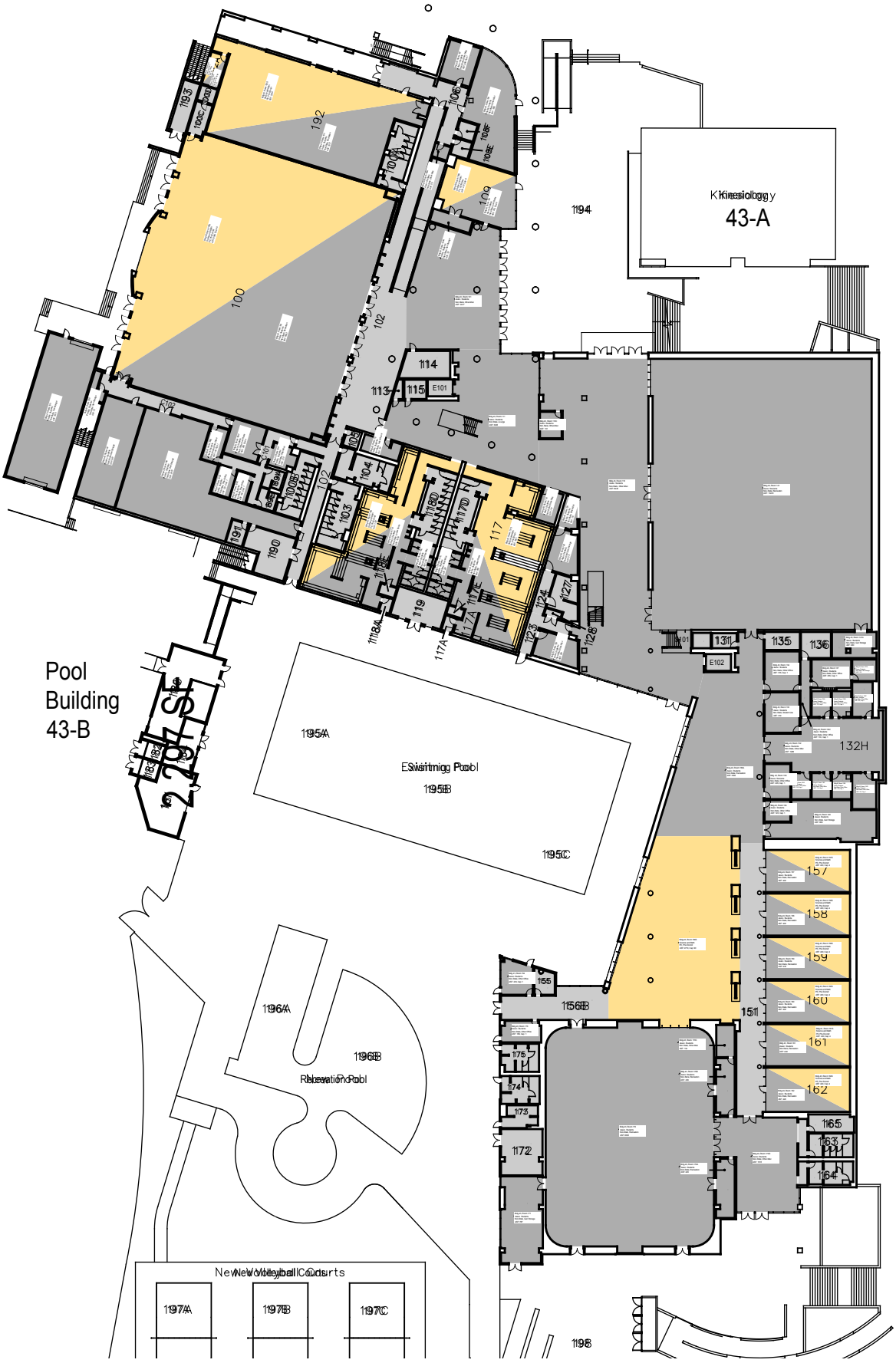
Appendix E: Recreation Center – Sprinkler Piping Arrangement

Appendix F: Recreation Center – Life Safety Drawings

Appendix G: Recreation Center – Fire Safety Management Plan

APPENDIX A

RECREATION CENTER FLOOR PLANS



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Facility Services Facilities Planning and Capital Projects

Recreation Center

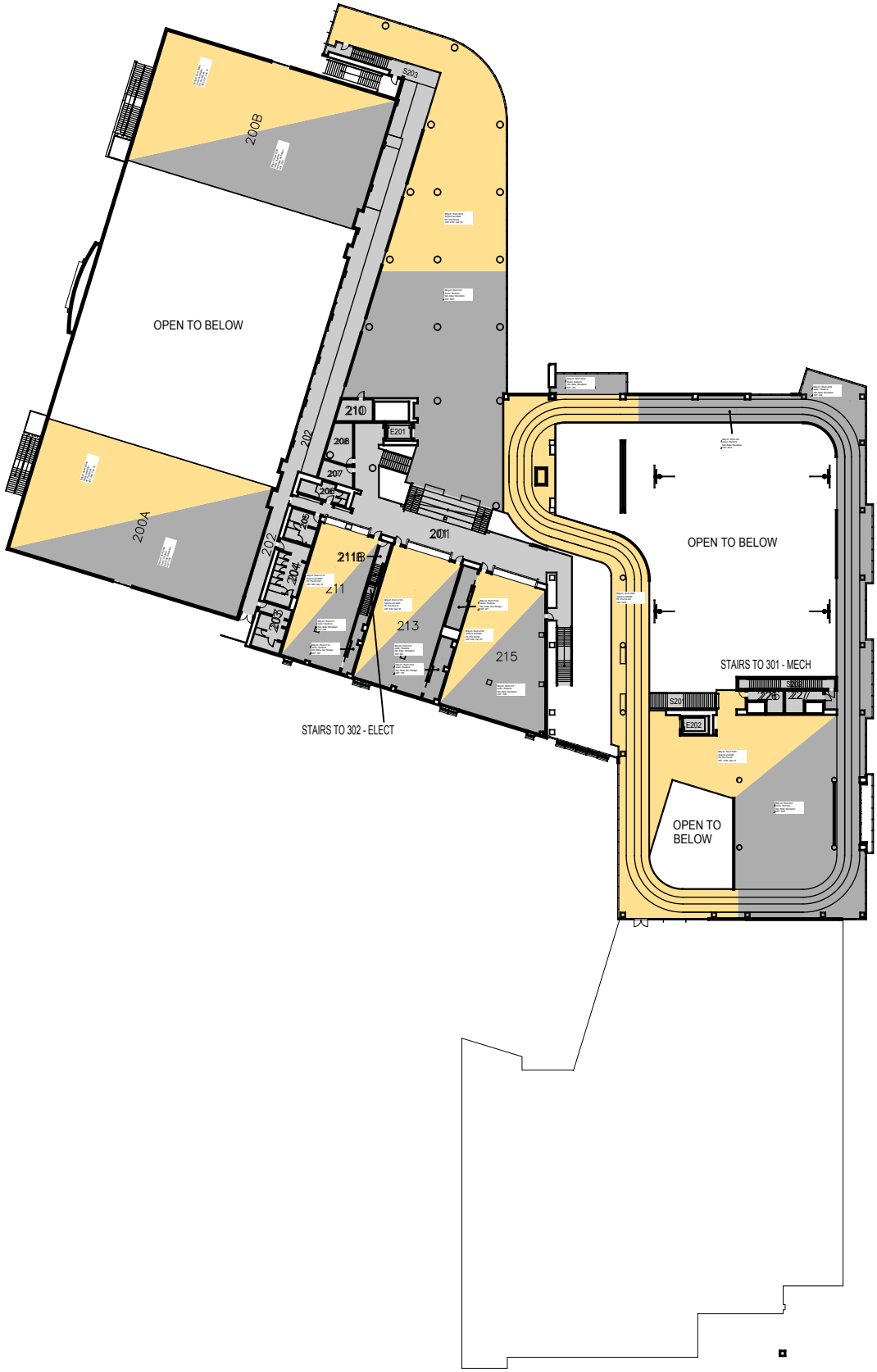
www.facilities.calpoly.edu

Floor 1

CAGR	CLA	
CARCH	CSM	UNIV
CBUS		ADMIN
CENGR	NON STATE	NON ASSIGNABLE

November 2012

1"=70'



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Floor 2

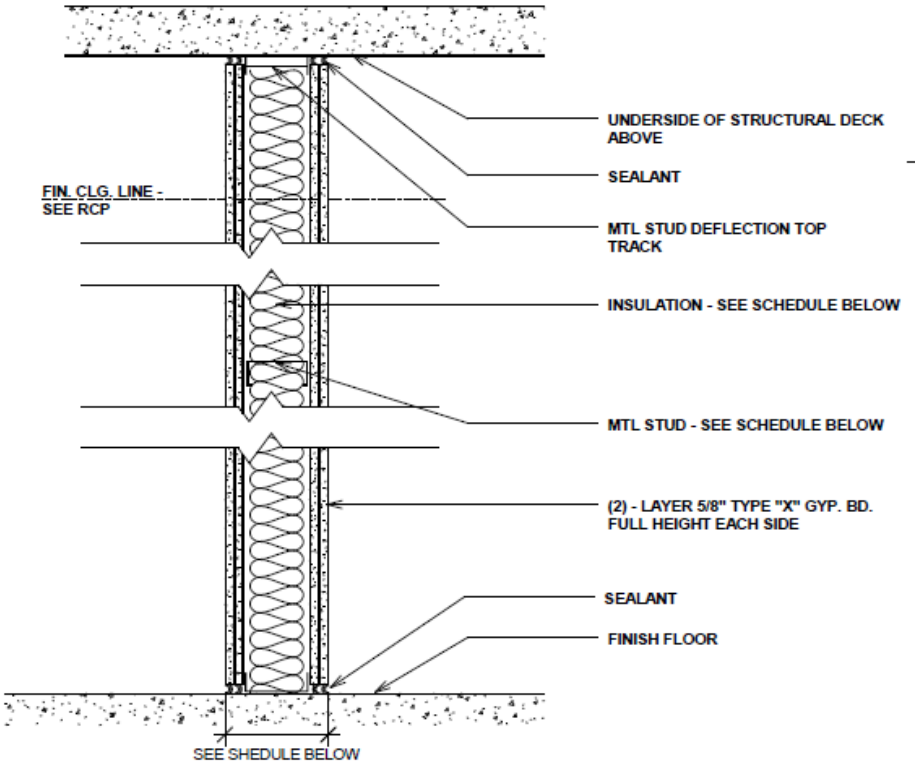
CAGR	CLA	
CARCH	CSM	UNIV
CBUS		ADMIN
CENGR	NON STATE	NON ASSIGNABLE

November 2012

1"=70'

APPENDIX B

PARTITIONS & PENETRATION ENCLOSURE DRAWINGS



TYPE	STUD SIZE	PARTITION WIDTH	INSULATION STC	KEYED NOTES
FI	6"	8-1/2"	4" THICK/ STC	N/A

Figure B-1: Non-rated Partition Typical details

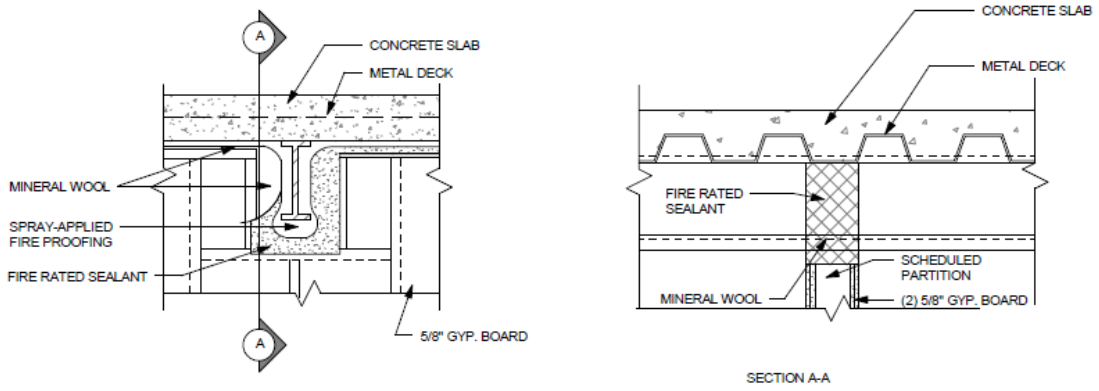
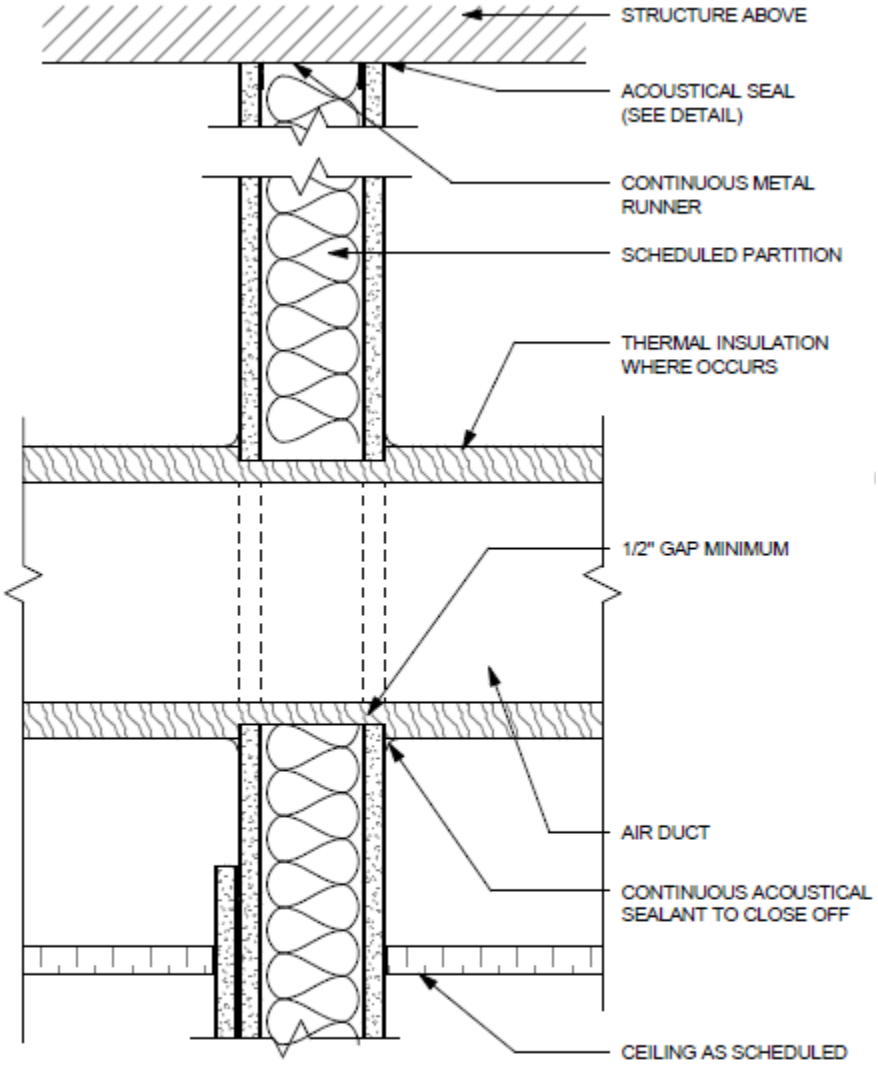


Figure B-2: Penetration UL System No HW-D-0299



PENETRATIONS OF ACOUSTICAL PARTITIONS BY DUCTWORK SHALL BE ACOUSTICALLY SEALED AS SHOWN. ANY GAP LARGER THAN 1/2" SHALL BE COVERED WITH GYPSUM BOARD, LAPPED A MINIMUM OF 2" AND SCREWED BEFORE USING ACOUSTICAL SEALANT.

Figure B-3: Penetrations Enclosure

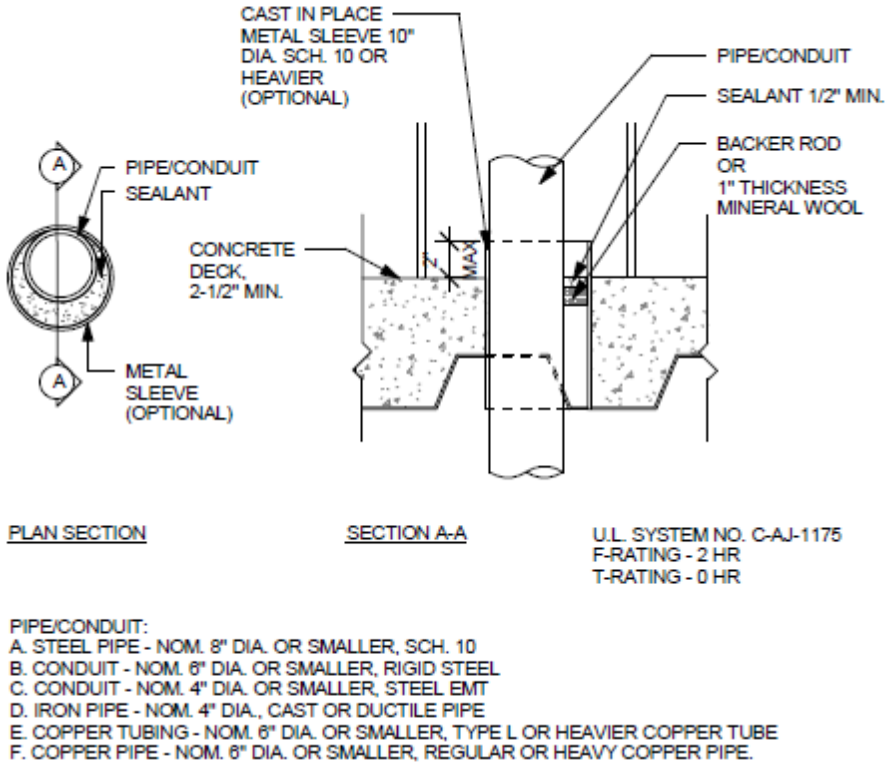


Figure B-4: Single Vertical Fire-Rated Penetration

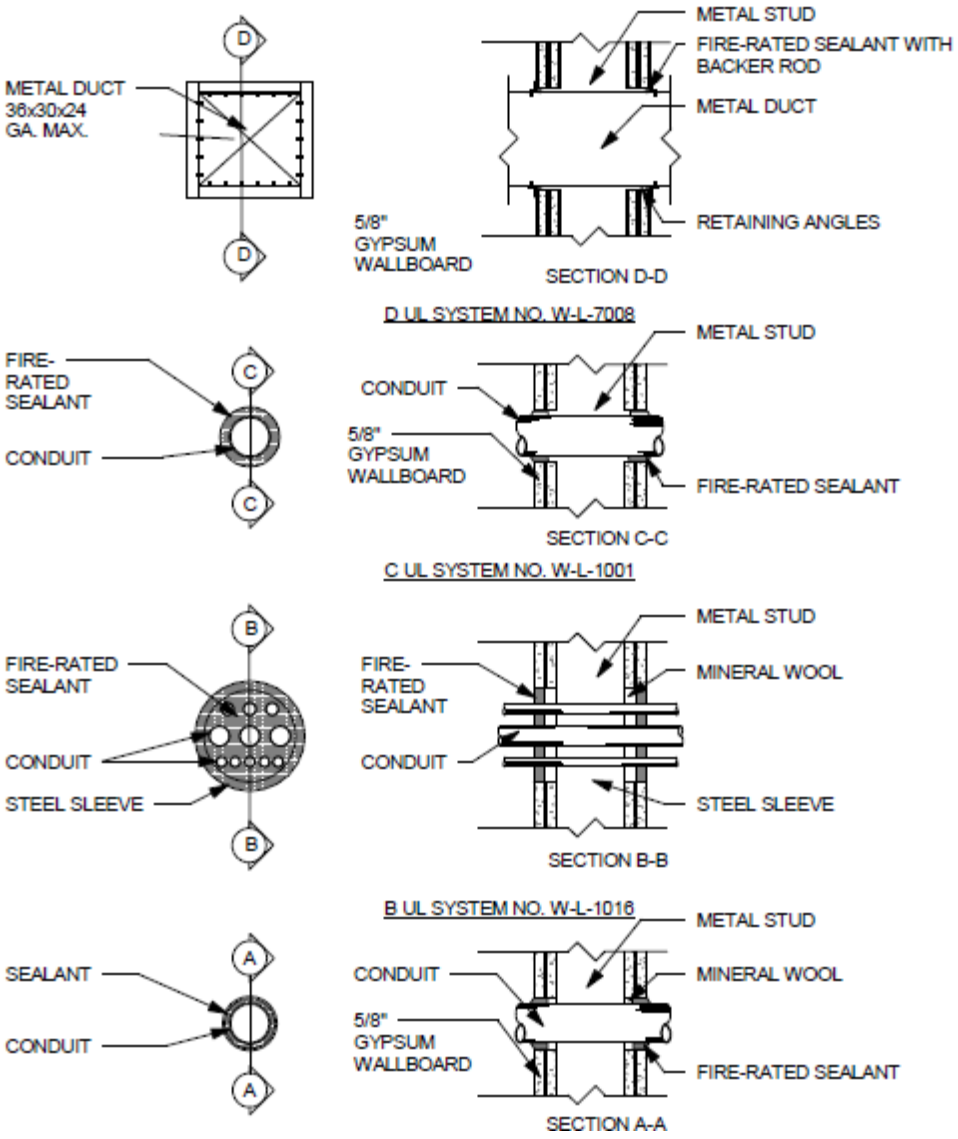


Figure B-5: Typical Fire-Rated Partition Penetrations- UL No W-L.1009

APPENDIX C

FIRE ALARM & DETECTION AS-BUILT DRAWINGS

1. ALL WALL-MOUNTED VISUAL SIGNALING APPLIANCES SHALL BE MOUNTED SUCH THAT THE ENTIRE LENS IS NOT LESS THAN 80 IN. (2.03m) AND NOT GREATER THAN 96 IN. ABOVE THE FINISHED FLOOR (A.F.F.) PER NFPA 72 2007 CH. 7.5.4. ALL WALL MOUNTED AUDIBLE DEVICES SHALL BE A MINIMUM OF 90" A.F.F. TO TOP OF DEVICE PER NFPA 72 2007 (SECTION 7.4.7.1). AREAS HAVING MORE THAN 2 STROBES IN THE FIELD OF VIEW SHALL BE SYNCHRONIZED PER NFPA 72, SECTION 7.5.4.3.2.
2. SMOKE DETECTORS AND HEAT DETECTOR LOCATIONS ARE BASED ON SMOOTH CEILING WITH MAXIMUM HEIGHT OF 10 FEET UNLESS OTHERWISE NOTED.
3. STROBE LOCATION IS BASED ON 10 FOOT CEILING HEIGHT AND ARE INSTALLED ACCORDING TO NFPA 72 REQUIREMENTS UNLESS OTHERWISE NOTED. ANY DEVICES ON CEILINGS OVER 10 FEET WILL BE DERATED PER NFPA-72.
4. STROBES IN SLEEPING AREAS SHALL BE LOCATED WITHIN 16 FEET OF PILLOW AND HAVE MINIMUM INTENSITY OF 110cd. FOR STROBES LOCATED LESS THAN 24 INCHES FROM CEILING, MINIMUM INTENSITY SHALL BE 177cd.
5. CENTER OF MANUAL PULL STATIONS SHALL BE MOUNTED AT 48" ABOVE FLOOR LEVEL.
6. ALL EQUIPMENT SHALL BE U.L. AND C.S.F.M. LISTED.
7. ALL WIRING SHALL BE IN ACCORDANCE WITH THE N.E.C. AND AUTHORITIES HAVING JURISDICTION.
8. ALL JUNCTION BOXES SHALL BE SIZED IN ACCORDANCE WITH THE N.E.C. AND SHALL HAVE THEIR COVERS PAINTED RED WHERE APPLICABLE.
9. ELECTRICAL CONTRACTOR SHALL FURNISH ACCESS PANELS TO AREAS THAT REQUIRE SERVICING, TROUBLE SHOOTING, ETC.
10. DO NOT DEVIATE FROM CONDUIT RUNS AS SHOWN ON FLOOR PLANS WITHOUT PRIOR APPROVAL FROM SYSTEM SUPPLIER (PYRO-COMM SYSTEMS, INC., TEL (714) 902-8000). FACTORS SUCH AS EXCESSIVE VOLTAGE DROP, ADDITIONAL PARTS, ENGINEERING, ETC., THAT ARE A RESULT OF CONDUIT RUN DEVIATIONS SHALL BE THE SOLE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.
11. DETECTORS SHALL NOT BE LOCATED IN A DIRECT AIR-FLOW, NOR CLOSER THAN 3 FEET (900mm) FROM AN AIR SUPPLY DIFFUSER.
12. ALL FAN SHUTDOWN FUNCTIONS, DAMPER CLOSURES AND ASSOCIATED MECHANICAL SYSTEM FIRE ALARM INTERFACE SHALL BE BY MECHANICAL CONTRACTOR.
13. ALL DUCT SMOKE DETECTORS SHALL BE MOUNTED BY THE MECHANICAL OR ELECTRICAL CONTRACTOR. DUCT SMOKE DETECTORS EXPOSED TO THE WEATHER SHALL BE WEATHER PROTECTED BY THE MECHANICAL CONTRACTOR. ALL AIR VELOCITY TESTING SHALL BE PERFORMED BY THE MECHANICAL CONTRACTOR.
14. ALL 120VAC POWER REQUIREMENTS FOR THE FIRE ALARM SYSTEM SHALL BE FURNISHED BY THE ELECTRICAL CONTRACTOR AND SHALL MEET ALL REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION.
15. ALL FIRE ALARM DEVICE BACKBOXES, FIRE ALARM TERMINAL CABINETS, GUTTERS, JUNCTION BOXES AND ASSOCIATED CONDUITS SHALL BE FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED. REFER TO FIRE ALARM SYMBOL LIST AND/OR MOUNTING DETAILS FOR ADDITIONAL INFORMATION. SYSTEM SUPPLIER PROVIDED BACKBOXES SHALL BE INSTALLED BY ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED.
16. SMOKE DETECTOR TESTING SHALL BE ACCOMPLISHED WITH SMOKE OR LISTED AEROSOL APPROVED BY THE MANUFACTURER PER NFPA 72, AS ACCEPTABLE BY THE A.H.J.
17. ALL WIRING, INITIATING DEVICES AND ANNUNCIATOR PANEL SHALL BE SUPERVISED TO THE PRINCIPAL POINT OF ANNUNCIATION. THE FIRE ALARM CONTROL PANEL TO SUPERVISE THE ANNUNCIATOR PANEL, ALL INITIATING AND INDICATING DEVICE CIRCUITS.
18. ALL WIRING SHALL BE CUT FOR IN AND OUT. WIRING SHALL NOT BE LOOPED THROUGH DEVICES.
19. POINT AND COMMON ANNUNCIATION AND T-TAPPING ARE PROHIBITED. (T-TAPPING IS ALLOWABLE ON ADDRESSABLE STYLE 4 SLC LOOPS).
20. PROVIDE 3/4" CONDUIT WITH (2) DEDICATED TELEPHONE LINES WITH RJ-31X PHONE JACKS FROM TELEPHONE BACKBOARD FOR OWNER PROVIDED CENTRAL STATION MONITORING LOCATED ADJACENT TO FIRE ALARM CONTROL PANEL.
21. THE ALARM SYSTEM SHALL HAVE AN AUDIBILITY OF NOT LESS THAN 15dB ABOVE AMBIENT NOISE LEVELS, BUT NOT LESS THAN 75dBA THROUGHOUT AREA OF ALARM. TESTING SHALL BE ACCOMPLISHED WITH A dB METER. WHERE APPLICABLE, AUDIBLE TONE SHALL BE TEMPORAL PATTERN.
22. FIRE ALARM CONTRACTOR SHALL PROVIDE AN IMPEDANCE METER AT THE TIME OF FINAL INSPECTION WHEN REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
23. FIRE ALARM SIGNAL SHALL MEET ANSI S3.41, AUDIBILITY EMERGENCY EVACUATION SIGNAL (TEMPORAL PATTERN)
24. ALL CONDUITS ARE 3/4" UNLESS OTHERWISE NOTED.
25. ALL DEVICES IN THE ALARM SYSTEM SHALL BE COMPATIBLE AND INSTALLED PER MANUFACTURER'S SPECIFICATIONS.
26. SYSTEM SHALL BE FURNISHED AND INSTALLED BY A NESCO AFFILIATE AND AUTHORIZED NOTIFIER DISTRIBUTOR.
27. FIRE ALARM SYSTEM INSTALLATION COMPANY SHALL BE UL LISTED (UUJS/UUFX).
28. TAMPER PROOF SCREWS OR OTHER APPROVED MECHANICAL MEANS SHALL BE USED ON ALL COVERS OF EXTERIOR ELECTRICAL JUNCTION BOXES IN LIEU OF ELECTRICAL SUPERVISION OF THE COVERS, PER THE 2007 NFPA72 6.8.5.11.1.
29. ELECTRICAL POWER SERVICE SHALL BE ON A DEDICATED BRANCH CIRCUIT(S). THE CIRCUIT(S) AND CONNECTIONS SHALL BE MECHANICALLY PROTECTED (CIRCUIT BREAKERS SHALL BE LOCKED IN THE ON POSITION WITH AN APPROVED MECHANICAL CLIP). CIRCUIT DISCONNECTING MEANS SHALL HAVE A RED MARKING, SHALL BE ACCESSIBLE ONLY TO AUTHORIZED PERSONNEL, AND SHALL BE IDENTIFIED AS "FIRE ALARM CIRCUIT." THE LOCATION OF THE CIRCUIT DISCONNECTING MEANS SHALL BE PERMANENTLY IDENTIFIED AT THE FIRE ALARM CONTROL UNIT.[NFPA 72,4.4.1.4.2]
30. UPON COMPLETION OF ALL INSTALLATION AND TESTING, THE CONTRACTOR SHALL PROVIDE TO THE AUTHORITY HAVING JURISDICTION AND THE BUILDING OWNER A COMPLETED AND SIGNED NFPA 72 CERTIFICATE OF COMPLETION.
31. SECTION 5.7.1.11 OF THE 2007 EDITION OF NFPA 72 STATES THAT "DETECTORS SHALL NOT BE INSTALLED UNTIL AFTER THE CONSTRUCTION CLEANUP OF ALL TRADES IS COMPLETE AND FINAL. CLEANING OR REPLACEMENT OF DEVICES THAT WERE MOUNTED AT THE REQUEST OF THE CONTRACTOR WILL NOT BE PERFORMED WITHOUT WRITTEN AUTHORIZATION THAT ASSUMES FINANCIAL RESPONSIBILITY FOR COSTS INCURRED.

GENERAL NOTES

APPLICABLE CODES AS OF AUGUST 1, 2009

2007 California Administrative Code, Part 1, Title 24

2007 California Building Code (CBC), Part 2, Title 24
(2006 International Building Code with 2007 California Amendments)

2007 California Electrical Code (CEC), Part 3, Title 24
(2005 National Electrical Code with 2007 California Amendments)

2007 California Mechanical Code (CMC), Part 4, Title 24
(2006 Uniform Mechanical Code with 2007 California Amendments)

2007 California Fire Code (CFC), Part 9, Title 24
(2006 International Fire Code with 2007 California Amendments)

2007 California Referenced Standards Code, Part 12, Title 24

PARTIAL LIST OF APPLICABLE NFPA STANDARDS:

NFPA 13-Automatic Sprinkler Systems (2002 Edition)
NFPA 14-Standpipes Systems (2002 Edition)
NFPA 72-National Fire Alarm Codes (2007 Edition)

APPLICABLE CODES & STANDARDS

ALARM SERVICE COMPANY
AND SERVICE CENTER : (257057-001)

ADVANCED PROTECTION INDUSTRIES INC, DBA
NATIONAL MONITORING CENTER SUITE 250
26800 ALISO VIEJO PKWY
ALISO VIEJO CA, 92656
PHONE NUMBER: (800) 662-1711

FILE-VOL. NO. CCN
S8126-1 UUFX

LISTING CATEGORY
[SIGNAL AND FIRE ALARM EQUIPMENT AND SERVICES]
(PROTECTIVE SIGNALING SERVICES) CENTRAL STATION

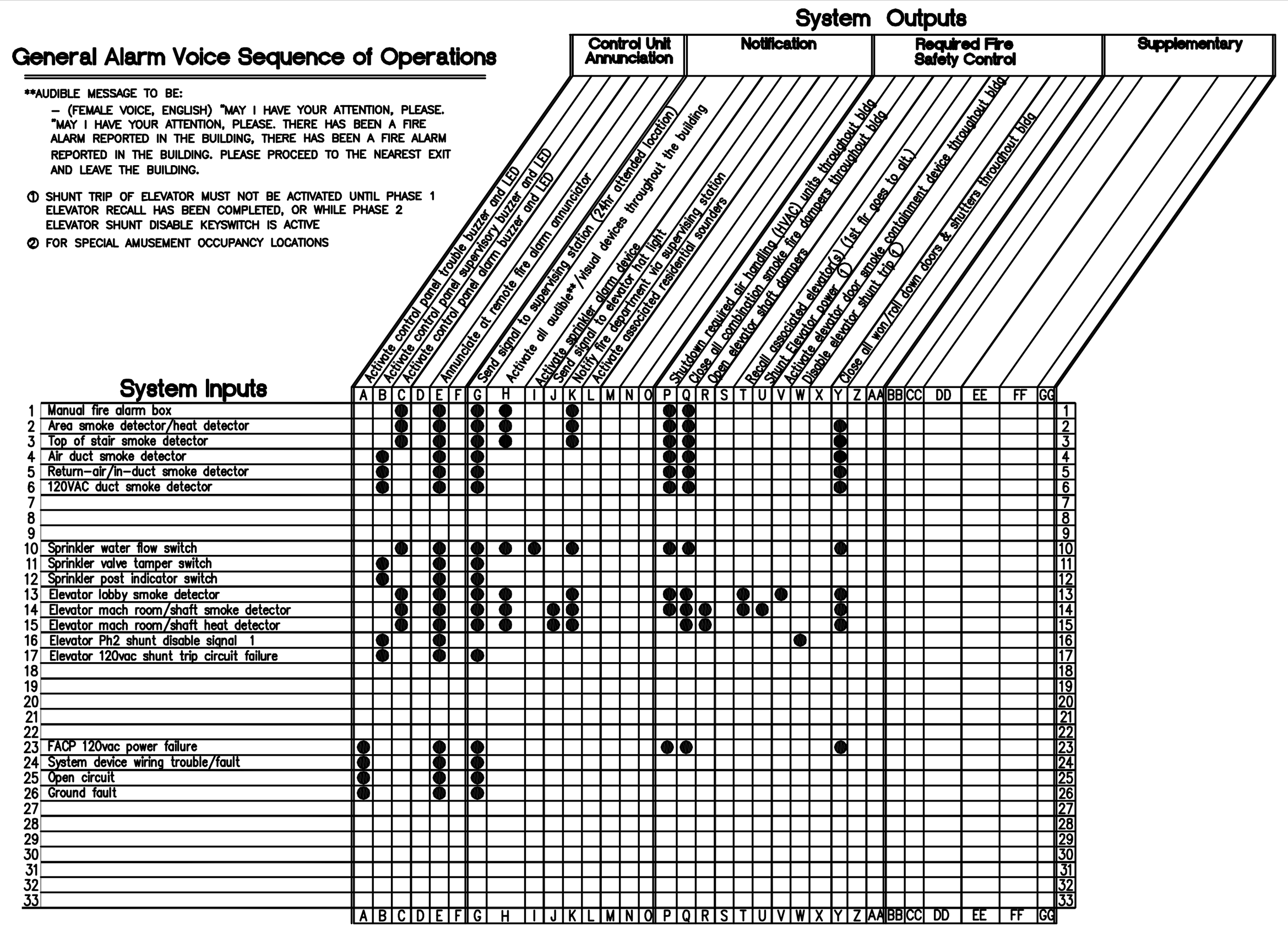
MONITORING INFORMATION

General Alarm Voice Sequence of Operations

**AUDIBLE MESSAGE TO BE:
- (FEMALE VOICE, ENGLISH) "MAY I HAVE YOUR ATTENTION, PLEASE. "MAY I HAVE YOUR ATTENTION, PLEASE. THERE HAS BEEN A FIRE ALARM REPORTED IN THE BUILDING, THERE HAS BEEN A FIRE ALARM REPORTED IN THE BUILDING. PLEASE PROCEED TO THE NEAREST EXIT AND LEAVE THE BUILDING.

① SHUNT TRIP OF ELEVATOR MUST NOT BE ACTIVATED UNTIL PHASE 1 ELEVATOR RECALL HAS BEEN COMPLETED, OR WHILE PHASE 2 ELEVATOR SHUNT DISABLE KEYSWITCH IS ACTIVE

② FOR SPECIAL AMUSEMENT OCCUPANCY LOCATIONS

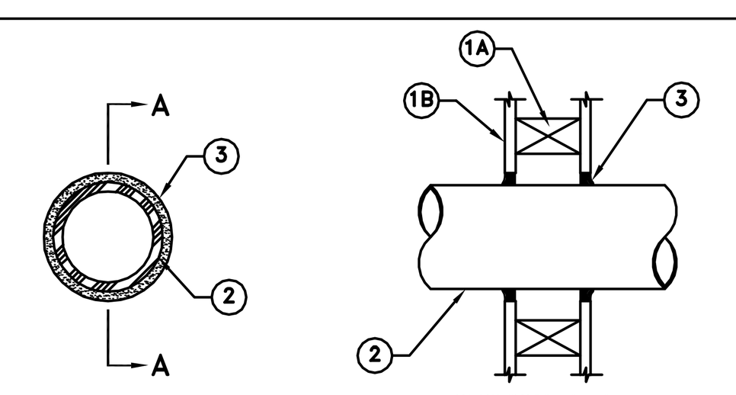


SEQUENCE OF OPERATION

WIRE DESIGNATION	CONDUCTOR COLORS	WIRE IN CONDUIT	UNDERGROUND/WET WIRE DESIGNATION	WIRE IN CONDUIT UNDERGROUND/WET LOC.
ADDRESS. LOOP Z	RED JACKET RED/BLACK	2 CONDUCTOR #16 FPL SOLID TWISTED/UNSHIELDED WEST PENN (.039 sq.in.) #D990	ADDRESS. LOOP ZU	2 CONDUCTOR #16 FPL STRANDED TWISTED/UNSHIIELDED WEST PENN (.068 sq.in.) #AQ225
INITIATION CKT F	YELLOW/PURPLE	(2) #14 STRANDED TYPE THHN	INIT. LOOP FU	(2) #14 STRANDED TYPE THWN
ANNUN. DATA D	RED JACKET RED/BLACK	2 CONDUCTOR #18 FPL SOLID TWISTED/SHIELDED WEST PENN (.035 sq.in.) #D975	ANNUN. DATA DU	2 CONDUCTOR #16 FPL STRANDED TWISTED/SHIELDED WEST PENN (.084 sq.in.) #AQ294
ANNUN. PWR B	YELLOW/BLUE	(2) #14 STRANDED TYPE THHN	ANNUN. PWR BU	(2) #14 STRANDED TYPE THWN
24V POWER P	PINK/PURPLE	(2) #14 STRANDED TYPE THHN	POWER CKT. PU	(2) #14 STRANDED TYPE THWN
AUD/VIS CKT. V	YELLOW/BLUE ORANGE/BROWN RED/BLACK PINK/PURPLE	(2) #12 STRANDED TYPE THHN	VISUAL VU	(2) #12 STRANDED TYPE THWN
SPEAKER CKT. S	RED/BLACK	(2) #14 STRANDED TYPE THHN TWISTED	SPEAKER CKT. SU	(2) #14 STRANDED TYPE THWN TWISTED

NOTES:
ALL WIRE MODEL NUMBERS ARE WEST PENN. EQUIVALENT BY OTHER MANUFACTURER IS ACCEPTABLE.
ALL SHIELDED CABLE MUST HAVE SHIELDS CONNECTED THROUGH AND LANDED AT PANEL.
ALL SQUARE INCH MEASUREMENTS ARE CROSS-SECTION AREA FOR CONDUIT FILLS

WIRE LEGEND



PENETRATION THRU GYPSUM BOARD WALL
NO SCALE
UL #W-L-1001
F Ratings - 1, 2, 3 and 4 Hr (See Items 2 and 3)
T Ratings - 0, 1, 2, 3, and 4 Hr (See Item 3)
L Rating At Ambient - less than 1 CFM/sq ft
L Rating At 400 F - less than 1 CFM/sq ft

1. Wall Assembly -- The 1, 2, 3 or 4 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 or U400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
installed, as tabulated below:

A. Studs -- Wall framing may consist of either wood studs (max 2 h fire rated assemblies) or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm lumber spaced 16 in. (406 mm) OC with nom 2 by 4 in. (51 by 102 mm) lumber end plates and cross braces. Steel studs to be min 3-5/8 in. (92 mm) wide by 1-3/8 in. (35 mm) deep channels spaced max 24 in. (610 mm) OC.

B. Gypsum Board* -- Nom 1/2 or 5/8 in. (13 or 16 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 26 in. (660 mm).

2. Through-Penetrant -- One metallic pipe, conduit or tubing installed either concentrically or eccentrically within the firestop system. The annular space between pipe, conduit or tubing and periphery of opening shall be min of 0 in / (0 mm). (point contact) to max 2 in. (51 mm) Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. Steel Pipe -- Nom 24 in. (610 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Iron Pipe -- Nom 24 in. (610 mm) diam (or smaller) service weight (or heavier) cast iron soil pipe, nom 12 in (305 mm) diam (or smaller) or Class 50 (or heavier) ductile iron pressure pipe.

C. Conduit -- Nom 6 in. (152 mm) diam (or smaller) steel conduit or nom 4 in (102 mm) diam (or smaller) steel electrical metallic tubing

D. Copper Tubing -- Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing

E. Copper Pipe -- Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

F. Through Penetrating Product* -- Flexible Metal Piping The following types of steel flexible metal gas piping may be used:

1. Nom 2 in. (51 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
OMEGA FLEX INC

2. Nom 1 in. (25 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
GASTITE, DIV OF TITEFLEX

3. Nom 1 in. (25 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
WARD MFG INC

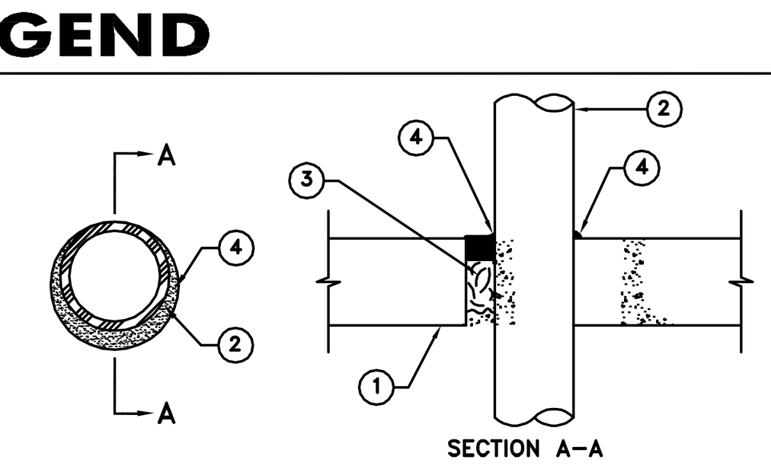
3. Fill, Void or Cavity Material* -- Caulk or Sealant -- Min 5/8. , 1-1/4,1-7/8 and 2-1/2 in. (16, 32, 48 and 64 mm) thickness of caulk for 1, 2, 3 and 4 hr rated assemblies, respectively, applied within annulus, flush with both surfaces of wall. Min 1/4 in. (6 mm) diam bead of caulk applied to gypsum board/penetrant interface at point contact location on both sides of wall. The hourly F Rating of the firestop system is dependent upon the hourly fire rating of the wall assembly in which it is installed, as shown in the following table. The hourly T Rating of the firestop system is dependent upon the type or size of the pipe or conduit and the hourly fire rating of the wall assembly in which it is installed, as tabulated below:

Max Pipe or Conduit Diam In (mm)	F Rating Hr	T Rating Hr
1 (25)	1 or 2	0+, 1 or 2
1 (25)	3 or 4	3 or 4
4 (102)	1 or 2	0
6 (152)	3 or 4	0
12 (305)	1 or 2	0

+When copper pipe is used, T Rating is 0 h.

3M COMPANY - CP 25WB+or FB-3000 WT

*Bearing the UL Classification Mark



PENETRATION THRU CONCRETE
NO SCALE
UL #C-AJ-1044
F Ratings - 2, 3, and 4 Hr (See Items 2A and 4)
T Rating - 0 Hr
L Rating At Ambient - 2 CFM/sq ft
L Rating At 400 F - less than 1 CFM/sq ft
W Rating - Class 1 (See Item 4)

1. Floor or Wall Assembly - Lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete. Except as noted in table under Item 4, min thickness of solid concrete floor or wall assembly is 4-1/2 in. (114 mm). Floor may also be constructed of any min 6 in.(152 mm) thick UL Classified hollow core Precast Concrete Units*. When floor is constructed of hollow core precast concrete units, packing material (Item 3) and caulk fill material (Item 4) to be installed symmetrically on both sides of floor, flush with floor surface. Wall assembly may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is in solid lightweight or normal weight concrete. Floor is 32 in. (813 mm). Max diam of opening in floor constructed of hollow-core precast concrete units is 7 in. (178 mm)

See Concrete Blocks (CAZT) and Precast Concrete Units (CFTV) categories in the Fire Resistance Directory for names of manufacturers.

1A. Steel Sleeve - Max 15 in. (381 mm) ID (or smaller) Schedule 10 (or heavier) steel sleeve cast or grouted into floor or wall assembly. Sleeve may extend a max of 2 in. (51 mm) above top of floor or beyond either surface of wall. Max 16 in. (406 mm) ID (or smaller) min 0.028 (0.71 mm) wall thickness (or heavier) galvanized steel sleeve cast or grouted into floor or wall assembly. Sleeve may extend a max of 1/2 in. (13 mm) beyond either surface of floor or wall.

2. Through Penetrants - One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Max annular space between pipe, conduit or tubing and edge of through opening or sleeve is dependent on the parameters shown in Item 4. Min annular space between pipe or conduit and edge of through opening is 0 in. (0 mm point contact). Pipe conduit or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. Steel Pipe - Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
B. Iron Pipe - Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.
C. Conduit - Nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
D. Conduit - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing.
E. Copper Tubing - Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tube.
F. Copper Pipe - Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

3. Packing Material - Polyethylene backer rod or nom 1 in. (25 mm) thickness of tightly-packed mineral wool batt or glass fiber insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of caulk fill material (Item 4).

4. Fill, Void or Cavity Material* - Caulk, Sealant - Applied to fill the annular space flush with top surface of floor. In wall assemblies, required caulk thickness to be installed symmetrically on both sides of wall, flush with wall surface. At point contact location between penetrant and sleeve or between penetrant and concrete, a min 1/4 in. (6 mm) diam bead of caulk shall be applied at top surface of floor and at both surfaces of wall. The hourly F Ratings and the min required caulk thicknesses are dependent upon a number of parameters, as shown in the following table:

Min Floor or Wall Thkns In.	Nom Pipe Tube or Conduit Diam In.	Max Annular Space In.	Min Caulk Thkns In.	F Rating Hr
2-1/2 (64)	1/2-12 (13-305)	1-3/8 (35)	1/2 (13)	2
2-1/2 (64)	1/2-12 (13-305)	3-1/4 (83)	1 (25)	2
4-1/2 (114)	1/2-6 (13-152)	1-3/8 (35)	1/4 (6) (a)	2
4-1/2 (114)	1/2-12 (13-305)	1-1/4 (32)	1/2 (13)	3
4-1/2 (114)	1/2-20 (13-508)	2 (51)	1 (25)	3
4-1/2 (114)	1/2-20 (13-508)	2 (51)	1 (25)	3
4-1/2 (114)	1/2-12 (13-305)	3-1/4 (83)	1 (25)	3
4-1/2 (114)	22-30 (558-762)	2 (51)	2 (51)	3
5-1/2 (140)	1/2-6 (13-152)	1-3/8 (35)	1 (25) (b)	4

(a)Min 2 in (51 mm) thickness of mineral wool batt insulation required in annular space.

(b)Min 1 in. (25 mm) thickness of mineral wool batt insulation required in annular space on both sides of floor or wall assembly. Min 1 in.(25 mm) thickness of caulk to be installed flush with each surface of floor or wall assembly.

3M COMPANY -- CP 25WB+ or FB-3000 WT.

(Note - W Rating applies only when FB-3000 WT is used.)

FIRE STOP/THRU-PENETRATION DETAIL

QUANTITY	SYMBOL	DESCRIPTION	MODEL	MANUFACTURER	BACKBOX	MOUNTING HEIGHT	C.S.F.M. NUMBER
1	FACP	FIRE ALARM CONTROL PANEL	NFS2-640	NOTIFIER	SBB-D4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	XP-1B	DIGITAL AUDIO AMPLIFIER (70 VOLT)	(1)DAA-5070	NOTIFIER	SBB-A4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	XP-1C	DIGITAL AUDIO AMPLIFIER (70 VOLT)	(1)DAA-5070	NOTIFIER	SBB-A4 PROVIDED	66" A.F.F. TO TOP	7165-0028:243
1	DACT	UNIVERSAL ALARM COMMUNICATOR PANEL	UDACT	NOTIFIER	INSIDE FACP	VERIFY IN FIELD	7300-0028:174
5	RPS	AUDIO/VISUAL POWER SUPPLY	FCPS-24S8	NOTIFIER	FCPS PROVIDED	66" A.F.F. TO TOP	7315-0028:225
1	ANN	FIRE ALARM ANNUNCIATOR PANEL	FDU-80	NOTIFIER	BACKBOX PROVIDED	66" A.F.F. TO TOP	7120-0028:209
1	OSY	BACKFLOW PREVENTOR TAMPER - F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
32	CR	FIRE ALARM RELAY MODULE	FRM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
11	M	FIRE ALARM MONITOR MODULE	FMM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
6	MD	FIRE ALARM DUAL MONITOR MODULE	FDM-1	NOTIFIER	4S DEEP BOX W/ 4S EXTENSION	VERIFY IN FIELD	7300-0028:202
7	R	24VDC RELAY	PR-1	SYSTEM SENSOR	5S DEEP BOX W/ 5S EXTENSION	VERIFY IN FIELD	7300-1653:172
4	F WP	WEATHERPROOF MANUAL PULL STATION	NBG-12LOB w/ FMM-101	NOTIFIER	SB-I/O PROVIDED	48" A.F.F. TO TOP OF BOX	7150-0028:199 7300-0028:202
19	P	AREA SMOKE DETECTOR (ADDRESSABLE - PHOTO)	FSP-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7272-0028:206 7300-0028:173
3	P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)	FSP-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7272-0028:206 7300-0028:173
24	ID	AREA SMOKE DETECTOR (INSIDE DUCT)	FSP-851 B501	NOTIFIER	4-0 PANCAKE BOX w/ 3-0 ADAPTER	INSIDE DUCT (AT TOP)	7272-0028:206 7300-1653:109
3	H	AREA HEAT DETECTOR (ADDRESSABLE)	FST-851 B710LP	NOTIFIER	4S DEEP BOX W/ 3-0 RING	CEILING MOUNTED	7270-0028:196 7300-0028:173
12	DD	DUCT DET. HOUSING w/ SMOKE DETECTOR HEAD	DNR w/ FSP-851	SYSTEM SENSOR NOTIFIER	DNR PROVIDED	VERIFY IN FIELD	3242-1653:209 7272-0028:206
18	F	MANUAL PULL STATION	NBG-12LX	NOTIFIER	4S DEEP BOX W/ SINGLE GANG RING	48" A.F.F. TO CENTER	7150-0028:199
23	I	REMOTE INDICATOR L.E.D.	RA100Z	SYSTEM SENSOR	4S DEEP BOX w/ 1-GANG RING	VERIFY IN FIELD	7300-1653:212
6	S WP	WEATHERPROOF SPEAKER	SPWK (WHITE)	SYSTEM SENSOR	BACKBOX PROVIDED	90" A.F.F. TO BOTTOM	7320-1653:201
17	15	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
6	30	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
15	75	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
50	110	FIRE ALARM SPEAKER/STROBE	SPSW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
11	110 WG	FIRE ALARM SPEAKER/ STROBE W/WIREGUARD	SPSW (WHITE) STI	SYSTEM SENSOR STI	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7320-1653:201
6	75 WP	WEATHERPROOF SPEAKER/STROBE	SPSWK (WHITE)	SYSTEM SENSOR	BACKBOX PROVIDED	90" A.F.F. TO BOTTOM	7320-1653:201
20	15	FIRE ALARM CEILING STROBE	SCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7125-1653:186
3	30	FIRE ALARM CEILING STROBE	SCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7125-1653:186
2	15 WP	FIRE ALARM CEILING STROBE	SCRK (RED)	SYSTEM SENSOR	SA-WBBC PROVIDED	CEILING MOUNTED	7300-1653:187
28	15	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
3	30	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
1	75	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
---	110	FIRE ALARM WALL STROBE	SW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	90" A.F.F. TO BOTTOM	7125-1653:186
7	S	FIRE ALARM SPEAKER	SPCW (WHITE)	SYSTEM SENSOR	4S DEEP BOX W/ 4S EXTENSION	CEILING	7320-1653:201
3 (F.B.O.)	W	SPRINKLER WATER FLOW - F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
3 (F.B.O.)	T	SPRINKLER VALVE TAMPER - F.B.O.	F.B.O.	F.B.O.	F.B.O.	VERIFY IN FIELD	F.B.O.
---	J	FIRE ALARM JUNCTION BOX	N/A	BY ELECTRICIAN	4S BOX U.O.N.	VERIFY IN FIELD	N/A
---	FATC	FIRE ALARM TERMINAL CABINET	N/A	BY ELECTRICIAN	24 x 24 x 6 U.O.N.	VERIFY IN FIELD	N/A
---	A.F.F.	ABOVE FINISHED FLOOR	N/A	N/A	N/A	N/A	N/A
---	EOL	END OF LINE RESISTOR	N/A	N/A	N/A	N/A	N/A
---	EX	EXISTING DEVICE	N/A	N/A	N/A	N/A	N/A
---	F.B.O.	FURNISHED BY OTHERS	N/A	N/A	N/A	N/A	N/A
---	N/A	NOT APPLICABLE	N/A	N/A	N/A	N/A	N/A
---	U.O.N.	UNLESS OTHERWISE NOTED	N/A	N/A	N/A	N/A	N/A
---	VL	VERIFY LOCATION IN FIELD	N/A	N/A	N/A	N/A	N/A
---	WP	WEATHERPROOF DEVICE	N/A	N/A	N/A	N/A	N/A
---	N	NEW DEVICE	N/A	N/A	N/A	N/A	N/A
---	● ○	CONDUIT DOWN CONDUIT UP	N/A	N/A	N/A	N/A	N/A
---		COMBINATION SMOKE/ FIRE DAMPER (F.B.O.)	F.B.O.	BY MECHANICAL	F.B.O.	F.B.O.	F.B.O.
---	⊠	DEDICATED PHONE LINE - F.B.O.	F.B.O.	F.B.O.	F.B.O.	F.B.O.	N/A

SYMBOLS LEGEND

Dimensions of Insulated Conductors and Fixture Wires
(Based on Table 5, Chapter 9, 2007 CEC)

CONDUCTOR SIZE AWG	12 GA. THHN/THWN	14 GA. THHN/THWN	16 GA. TFN/TFFN	18 GA. TFN/TFFN
AREA (in^2)	0.0133	0.0097	0.0072	0.0055

Total Areas of Electrical Metallic Tubing.
(Based on Table 4, Chapter 9, 2007 CEC)

	1/2" CONDUIT	3/4" CONDUIT	1" CONDUIT	1 1/4" CONDUIT	1 1/2" CONDUIT	2" CONDUIT
TOTAL AREA	0.304 in^2	0.533 in^2	0.864 in^2	1.496 in^2	2.036 in^2	3.356 in^2
40% FILL	0.122 in^2	0.213 in^2	0.346 in^2	0.598 in^2	0.814 in^2	1.342 in^2

Maximum Number of Conductors in Trade Sizes of Conduit or Tubing
(Based on 40% Conduit Fill per 2007 CEC)

CONDUCTOR SIZE AWG	1/2" CONDUIT	3/4" CONDUIT	1" CONDUIT	1 1/4" CONDUIT	1 1/2" CONDUIT	2" CONDUIT
18	22	38	62	108	148	244
16	16	29	48	83	113	186
14	12	21	35	61	83	138
12	9	16	26	44	61	100

CONDUIT FILL CHART

BUILDING CONSTRUCTION: TYPE 1B (NEW REMODEL)
TYPE 11-F.R. (EXISTING GYMNASIUM)

BUILDING OCCUPANCY: A3- GYMNASIUM WITHOUT SPECTATOR SEATS (NEW REMODEL)
B- LOCKER ROOM/SHOWERS (NEW REMODEL)
A2.1/B2 (EXISTING GYMNASIUM)

OCCUPANT LOAD: A2.1 (300 OCUPANTS WITHOUT STAGE)

SPRINKLERED: YES

NO. OF STORIES: 2

AREA OF BUILDING: 165,717 S.F.

AREA OF WORK: 165,717 S.F.

PROJECT ADDRESS: CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407

OWNER: CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407

BUILDING INFORMATION

PYRO-COMM SYSTEMS, INC. WILL PROVIDE:

-FIRE ALARM CONTROL PANEL
-REMOTE TRANSPONDERS
-REMOTE POWER SUPPLIES
-AREA SMOKE/HEAT DETECTION
-SMOKE DETECTOR ABOVE FACP & POWER SUPPLIES
-SMOKE DETECTION FOR DAMPER CLOSURE
-DUCT SMOKE DETECTION FOR HVAC SHUTDOWN
-ELEVATOR RECALL
-ELEVATOR SHUNT TRIP
-ELEVATOR HOISTWAY/MACHINE ROOM VISUAL SIGNAL?
-AUDIBLE & VISUAL NOTIFICATION
-MANUAL PULL STATIONS
-REMOTE ANNUNCIATION
-SPRINKLER SYSTEM MONITORING
-DIALER FOR REMOTE MONITORING (24HR ATTENDED LOCATION)

*THIS IS A NEW FIRE ALARM SYSTEM SUBMITTAL. ALL FUTURE TENANT IMPROVEMENTS TO BE SUBMITTED AND PROVIDED UNDER SEPARATE CONTRACT PLANS AND PERMITS.

ALL NEW ADDRESSABLE DEVICES WILL BE CONNECTED TO THE FIRE ALARM CONTROL PANEL INTELLIGENT LOOP. ALL VISUAL & AUDIBLE/VISUAL DEVICES WILL BE CONNECTED TO NOTIFICATION APPLIANCE CIRCUITS FROM THE FIRE ALARM CONTROL PANEL OR REMOTE POWER SUPPLIES, AND WILL BE SYNCHRONIZED IN ACCORDANCE WITH NFPA STANDARDS. ALL DEVICES ARE TO BE COMPATIBLE WITH THE HEAD-END EQUIPMENT AND OTHER DEVICES. ALL DEVICES WILL HAVE A TEXTUAL DISPLAY ON THE FIRE CONTROL PANEL DESCRIBING TYPE OF DEVICE AND LOCATION.

IF THERE ARE ANY QUESTIONS REGARDING THIS SUBMITTAL, PLEASE CONTACT THE FOLLOWING @ (714) 902-8000:
PROJECT ESTIMATOR: GENE KNUST-GRAICHEN
PROJECT SUPERINTENDENT: GREG SHEWMAN
ENGINEERING MANAGER: MARC LOPEZ
PROJECT ENGINEER: JOSE M. AREVALO

SCOPE OF WORK

SHEET INDEX

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001

SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
T(760)930-6014 F(760)930-6015

NOTIFIER by Honeywell
FACTORY AUTHORIZED DISTRIBUTOR
NESCO Affiliate

Signatures

STATE OF CALIFORNIA
LICENSED ELECTRICAL
CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: 0 1
If this scale is not 1", this sheet is Not To Scale

Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM SYSTEM INFORMATION

Drawn By :
J.AREVALO
02/23/10
Cad File :
M:\CAL POLY SLO\ RECREATION CENTER\ FA0.01-REC CTR-SYS

Sheet Number :
FA0.01

ASBUILT SET

ASBUILT SET

M:\Cal Poly SLO Rec. Center_2010035\FA0.01_Cal Poly SLO Recreation Ctr_Sys.dwg, 3/28/2012 9:26:39 AM, jchavez

BATTERY SIZING CALCULATION 02/23/12

CAL POLY SLO - STUDENT RECREATION CENTER
MAIN FIRE ALARM CONTROL PANEL

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	NFS2-640	CPU2-640 w/CPS-24	0.32500	0.32500	0.28500	0.28500
1	NFS2-640	KDM-R2	0.10000	0.10000	0.10000	0.10000
1	Voice	DVC&DVC-KD	0.50000	0.50000	0.50000	0.50000
32	Control Relay	FRM-1	0.00026	0.00816	0.00650	0.20800
11	Duct Det	DNR w/ FSP-851	0.00036	0.00396	0.00686	0.07546
2	Heat Det	FST-851	0.00030	0.00060	0.00650	0.01300
3	Monitor	DIMM	0.00060	0.00180	0.03000	0.09000
4	Monitor	FDM-1	0.00075	0.00300	0.00640	0.02560
9	Monitor	FMM-1	0.00035	0.00315	0.00500	0.04500
4	Pull Station	FMM-101 w/Pull Sta.	0.00038	0.00150	0.00038	0.00150
19	Pull Station	NBG-12LX	0.00038	0.00713	0.00688	0.13063
46	Smoke Det	FSP-851	0.00030	0.01380	0.00680	0.31280
4	Pull Station	NBG-12LOB	0.00000	0.00000	0.00000	0.00000
37	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.74000
1	Dialer	UDACT	0.04000	0.04000	0.10000	0.10000
7	Relay	PR-1 (Shutdown)	0.00000	0.00000	0.01500	0.10500
23	Remote LED	RA100Z	0.00000	0.00000	0.01000	0.23000
				Standby Load 1.008		Alarm Load 2.962

Standby Load: 1.008 Amps — Alarm Load: 2.962 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 24.19 Amp*Hours — Total Alarm Load: 0.74 Amp*Hours

Batteries Provided: (2) BAT-12380 — **Available Battery:** 30.40 A.H.
Battery Size: 38.00 A.H. — **Load (ALM + STBY)** 24.93 A.H.
De-Rated Size(80%): 30.40 A.H. — **Spare Capacity** 5.47 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_Main FACP-BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#1 • ELEC ROOM #136

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
5	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (75cd)	0.00000	0.00000	0.15800	0.15800
				Standby Load 0.065		Alarm Load 2.877

Standby Load: 0.065 Amps — Alarm Load: 2.877 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.72 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.28 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.32 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #1_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS #2 • ELEC. ROOM #172

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
1	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.06600
1	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.09400
1	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.15800
9	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.81800
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
5	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.33000
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load 0.065		Alarm Load 2.835

Standby Load: 0.065 Amps — Alarm Load: 2.835 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.71 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.27 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.33 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #2_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#3 • ELEC ROOM #227

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
10	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	2.02000
1	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.15800
1	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.06600
				Standby Load 0.065		Alarm Load 2.389

Standby Load: 0.065 Amps — Alarm Load: 2.389 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.60 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.16 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.44 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #3_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/06/11

CAL POLY SLO - STUDENT RECREATION CENTER
REMOTE POWER SUPPLY - RPS#4 • ELEC. ROOM #115

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
6	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.39600
3	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.28200
4	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.63200
5	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	1.01000
11	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.72600
3	Strobe	SCW (30cd)	0.00000	0.00000	0.09400	0.28200
13	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.85800
2	Strobe (WP)	SCRK (15cd)	0.00000	0.00000	0.06600	0.13200
				Standby Load 0.065		Alarm Load 4.463

Standby Load: 0.065 Amps — Alarm Load: 4.463 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 1.12 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.68 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 2.92 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #4_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CTR
REMOTE POWER SUPPLY - RPS#5 • ELEC ROOM #208

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
2	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.13200
2	S/S (Strobe ONLY)	SPSW (30cd)	0.00000	0.00000	0.09400	0.18800
7	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	1.10600
4	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	0.80800
4	S/S (WP Strobe)	SPSWK (75cd)	0.00000	0.00000	0.15800	0.63200
4	Strobe	SCW (15cd)	0.00000	0.00000	0.06600	0.26400
3	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.19800
1	Strobe	SW (30cd)	0.00000	0.00000	0.09400	0.09400
				Standby Load 0.065		Alarm Load 3.567

Standby Load: 0.065 Amps — Alarm Load: 3.567 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 0.89 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 2.45 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 3.15 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #5_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
XP-1 DAA2-5025 • ELECTRICAL ROOM #136

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	Voice	DAA2-5025	0.40000	0.40000	0.50000	0.50000
37	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.74000
3	Speaker 25V	Speaker - 1 Watt Tap	0.00000	0.00000	0.04000	0.12000
				Standby Load 0.400		Alarm Load 1.360

Standby Load: 0.400 Amps — Alarm Load: 1.360 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 9.60 Amp*Hours — Total Alarm Load: 0.34 Amp*Hours

Batteries Provided: (2) BAT-12180 — **Available Battery:** 14.40 A.H.
Battery Size: 18.00 A.H. — **Load (ALM + STBY)** 9.94 A.H.
De-Rated Size(80%): 14.40 A.H. — **Spare Capacity** 4.46 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP-1_BATT.xls]BattCalc

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
XP-2 + XP-3 DAA2-5025 • ELECTRICAL ROOM #115

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
2	Voice	DAA2-5025	0.40000	0.80000	0.50000	1.00000
30	Speaker 25V	Speaker - 1/2 Watt Tap	0.00000	0.00000	0.02000	0.60000
9	Speaker 25V	Speaker - 1 Watt Tap	0.00000	0.00000	0.04000	0.36000
				Standby Load 0.800		Alarm Load 1.960

Standby Load: 0.800 Amps — Alarm Load: 1.960 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 19.20 Amp*Hours — Total Alarm Load: 0.49 Amp*Hours

Batteries Provided: (2) BAT-12260 — **Available Battery:** 20.80 A.H.
Battery Size: 26.00 A.H. — **Load (ALM + STBY)** 19.69 A.H.
De-Rated Size(80%): 20.80 A.H. — **Spare Capacity** 1.11 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP-2_BATT.xls]BattCalc

VOLTAGE DROP CALCULATION 12/06/11

SYSTEM SENSOR — **CAL POLY SLO - RECREATION CENTER** — RPS #1 @ ELEC ROOM #136

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V1 QTY	V1 CURR.	SIGNAL CIRCUIT V2 QTY	V2 CURR.	SIGNAL CIRCUIT V3 QTY	V3 CURR.	SIGNAL CIRCUIT V4 QTY	V4 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
SPSW (110cd)	0.202	8	1.616	2	0.404		0.000		0.000	10
Strobe										
SW (15cd)	0.066		0.000	5	0.330		0.000		0.000	5
SW (75cd)	0.158		0.000	1	0.158		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.616 AMPS		1.116 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		445 FT.		300 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.38 VOLTS		1.11 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.02 VOLTS		19.29 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		SPARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS: 18 AWG = 1620; 16 AWG = 2580; 14 AWG = 4110; 12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #1_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

SYSTEM SENSOR — **CAL POLY SLO - RECREATION CTR** — REMOTE POWER SUPPLY - RPS#2 @ ELEC ROOM #172

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V5 QTY	V5 CURR.	SIGNAL CIRCUIT V6 QTY	V6 CURR.	SIGNAL CIRCUIT V7 QTY	V7 CURR.	SIGNAL CIRCUIT V8 QTY	V8 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
SPSW (30cd)	0.094	1	0.094		0.000		0.000		0.000	1
SPSW (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
SPSW (110cd)	0.202	3	0.606	6	1.212		0.000		0.000	9
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SCW (15cd)	0.066	2	0.132	3	0.198		0.000		0.000	5
SW (15cd)	0.066		0.000	1	0.066		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.148 AMPS		1.542 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		400 FT.		490 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.52 VOLTS		2.50 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.88 VOLTS		17.90 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		SPARE		S[ARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS: 18 AWG = 1620; 16 AWG = 2580; 14 AWG = 4110; 12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #2_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

SYSTEM SENSOR — **CAL POLY SLO - RECREATION CTR** — REMOTE POWER SUPPLY - RPS#3 @ ELEC ROOM #227

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V9 QTY	V9 CURR.	SIGNAL CIRCUIT V10 QTY	V10 CURR.	SIGNAL CIRCUIT V11 QTY	V11 CURR.	SIGNAL CIRCUIT V12 QTY	V12 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (110cd)	0.202	5	1.010	5	1.010		0.000		0.000	10
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158	1	0.158		0.000		0.000		0.000	1
Strobe										
SW (15cd)	0.066	1	0.066		0.000		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		1.234 AMPS		1.010 AMPS		0.000 AMPS		0.000 AMPS		
TOTAL WIRE LENGTH		500 FT.		340 FT.		0 FT.		0 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		2.04 VOLTS		1.14 VOLTS		0.00 VOLTS		0.00 VOLTS		
VOLTAGE @ END OF CIRCUIT		18.36 VOLTS		19.26 VOLTS		VOLTS		VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		SPARE		SPARE		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS: 18 AWG = 1620; 16 AWG = 2580; 14 AWG = 4110; 12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #3_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/06/11

SYSTEM SENSOR — **CAL POLY SLO - RECREATION CTR** — REMOTE POWER SUPPLY- RPS#4 @ ELEC ROOM #115

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V13 QTY	V13 CURR.	SIGNAL CIRCUIT V14 QTY	V14 CURR.	SIGNAL CIRCUIT V15 QTY	V15 CURR.	SIGNAL CIRCUIT V16 QTY	V16 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066	1	0.066	2	0.132		0.000	3	0.198	6
SPSW (30cd)	0.094		0.000	1	0.094	2	0.188		0.000	3
SPSW (75cd)	0.158	2	0.316	1	0.158		0.000	1	0.158	4
SPSW (110cd)	0.202	2	0.404	1	0.202	1	0.202	1	0.202	5
Strobe										
SCW (15cd)	0.066	2	0.132	1	0.066	3	0.198	5	0.330	11
SCW (30cd)	0.094		0.000		0.000	2	0.188	1	0.094	3
SW (15cd)	0.066	3	0.198	7	0.462	2	0.132	1	0.066	13
Strobe (WP)										
SCRK (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
TOTAL CURRENT ON CIRCUIT		1.116 AMPS		1.114 AMPS		1.040 AMPS		1.048 AMPS		
TOTAL WIRE LENGTH		300 FT.		350 FT.		575 FT.		880 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.11 VOLTS		1.29 VOLTS		1.98 VOLTS		3.05 VOLTS		
VOLTAGE @ END OF CIRCUIT		19.29 VOLTS		19.11 VOLTS		18.42 VOLTS		17.35 VOLTS		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		1ST FLOOR		1ST FLOOR		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS: 18 AWG = 1620; 16 AWG = 2580; 14 AWG = 4110; 12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #4_VD.xls]VD FORM

VOLTAGE DROP CALCULATION 12/07/11

SYSTEM SENSOR — **CAL POLY SLO - RECREATION CTR** — REMOTE POWER SUPPLY #5 @ ELEC ROOM #208

	DEVICE CURR. (AMPS)	SIGNAL CIRCUIT V17 QTY	V17 CURR.	SIGNAL CIRCUIT V18 QTY	V18 CURR.	SIGNAL CIRCUIT V19 QTY	V19 CURR.	SIGNAL CIRCUIT V20 QTY	V20 CURR.	QTY TOTAL
Speaker/Strobe (Strobe ONLY)										
SPSW (15cd)	0.066		0.000		0.000	2	0.132		0.000	2
SPSW (30cd)	0.094	1	0.094	1	0.094		0.000		0.000	2
SPSW (75cd)	0.158	1	0.158	4	0.632	2	0.316		0.000	7
SPSW (110cd)	0.202	3	0.606	1	0.202		0.000		0.000	4
Speaker/Strobe (WP Strobe ONLY)										
SPSWK (75cd)	0.158		0.000		0.000		0.000	4	0.632	4
Strobe										
SCW (15cd)	0.066		0.000		0.000	4	0.264		0.000	4
SW (15cd)	0.066	1	0.066		0.000	2	0.132		0.000	3
SW (30cd)	0.094		0.000	1	0.094		0.000		0.000	1
TOTAL CURRENT ON CIRCUIT		0.924 AMPS		1.022 AMPS		0.844 AMPS		0.632 AMPS		
TOTAL WIRE LENGTH		355 FT.		625 FT.		325 FT.		600 FT.		
WIRE SIZE		12 AWG		12 AWG		12 AWG		12 AWG		
CIRCULAR MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		6530 CIRC MILS		
VOLTAGE DROP		1.09 VOLTS		2.11 VOLTS		0.91 VOLTS		1.25 VOLTS		
VOLTAGE @ END OF CIRCUIT		19.31 VOLTS		18.29 VOLTS		19.49 VOLTS		19.15 VOLTS		
CIRCUIT LOCATION		2ND FLOOR		2ND FLOOR		2ND FLOOR		ROOF		

VOLTAGE DROP = TOTAL CURRENT x DISTANCE x 21.6 / CIRCULAR MILS

CIRC. MILS: 18 AWG = 1620; 16 AWG = 2580; 14 AWG = 4110; 12 AWG = 6530

VOLTAGE @ END OF CIRCUIT = STARTING CIRCUIT VOLTAGE − VOLTAGE DROP

LISTED CIRCUIT VOLTAGE = 24V
STARTING CIRCUIT VOLTAGE = 20.4V (85% LISTED VOLTAGE)
OPERATING VOLTAGE RANGE FOR 24V NOTIFICATION APPLIANCES TO BE 16V-33V

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #5_VD.xls]VD FORM

dB LINE LOSS CALCULATION 02/23/12

SPEAKERS — **CAL POLY SLO - RECREATION CENTER** — XP-1 @ ELEC ROOM #136 / XP-2 @ ELEC ROOM #115

	DEVICE POWER (WATTS)	SIGNAL CKT S1 QTY	S1 WATTS	SIGNAL CKT S2 QTY	S2 WATTS	SIGNAL CKT S3 QTY	S3 WATTS	SIGNAL CKT S4 QTY	S4 WATTS	SIGNAL CKT S5 QTY	S5 WATTS	SIGNAL CKT S6 QTY	S6 WATTS	SIGNAL CKT S7 QTY	S7 WATTS	SIGNAL CKT S8 QTY	S8 WATTS	QTY TOTAL
Speaker 25V																		
Speaker - 1/2 Watt Tap	0.50	6	3.00	10	5.00	6	3.00	4	2.00	5	2.50	3	1.50	11	5.50	7	3.50	52
Speaker - 1 Watt Tap	1.00	4	4.00	1	1.00	5	5.00	4	4.00	1	1.00	4	4.00	3	3.00	2	2.00	24
TOTAL POWER ON CIRCUIT		7.00 WATTS		6.00 WATTS		8.00 WATTS		6.00 WATTS		3.50 WATTS		5.50 WATTS		8.50 WATTS		5.50 WATTS		
LOAD RESISTANCE		89 OHMS		104 OHMS		78 OHMS		104 OHMS		179 OHMS		114 OHMS		74 OHMS		114 OHMS		
TOTAL WIRE LENGTH		650 FT.		925 FT.		700 FT.		475 FT.		900 FT.		960 FT.		800 FT.		800 FT.		
WIRE SIZE		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		14 AWG		
TOTAL WIRE RESISTANCE		4.238 OHMS		6.031 OHMS		4.564 OHMS		3.097 OHMS		5.868 OHMS		6.2592 OHMS		5.216 OHMS		5.216 OHMS		
POWER LINE LOSS (dB)		-0.40 dB		-0.49 dB		-0.49 dB		-0.25 dB		-0.28 dB		-0.47 dB		-0.60 dB		-0.39 dB		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		2ND FLOOR		SPARE		1ST FLOOR		1ST FLOOR		2ND FLOOR		2ND FLOOR		

WIRE RESISTANCE (OHM / 1000 FT): 18 AWG = 8.08; 16 AWG = 5.08; 14 AWG = 3.26; 12 AWG = 2.05

LOAD RESISTANCE = (VOLTAGE x VOLTAGE) / POWER

POWER LINE LOSS (dB) = 20xLog [LOAD RESISTANCE / (LOAD RESISTANCE + TOTAL WIRE RESISTANCE)]

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XPs_Lineloss.xls]dB LINE LOSS

BATTERY SIZING CALCULATION 12/07/11

CAL POLY SLO - STUDENT RECREATION CENTER
EXISTING REMOTE POWER SUPPLY

Quantity	Device Type	Model Number	Standby Current	Total Standby Current	Alarm Current	Total Alarm Current
1	FCPS-24S8	FCPS-24S8	0.06500	0.06500	0.14500	0.14500
7	S/S (Strobe ONLY)	SPSW (15cd)	0.00000	0.00000	0.06600	0.46200
2	S/S (Strobe ONLY)	SPSW (75cd)	0.00000	0.00000	0.15800	0.31600
23	S/S (Strobe ONLY)	SPSW (110cd)	0.00000	0.00000	0.20200	4.64600
8	Strobe	SW (15cd)	0.00000	0.00000	0.06600	0.52800
2	Strobe	SW (30cd)	0.00000	0.00000	0.09400	0.18800
				Standby Load 0.065		Alarm Load 6.285

Standby Load: 0.065 Amps — Alarm Load: 6.285 Amps
Standby Time: 24 Hours — Alarm Time: 15 Minutes
Total Standby Load: 1.56 Amp*Hours — Total Alarm Load: 1.57 Amp*Hours

Batteries Provided: (2) BAT-1270 — **Available Battery:** 5.60 A.H.
Battery Size: 7.00 A.H. — **Load (ALM + STBY)** 3.13 A.H.
De-Rated Size(80%): 5.60 A.H. — **Spare Capacity** 2.47 A.H.

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_RPS #EX_BATT.xls]BattCalc

dB LINE LOSS CALCULATION 02/23/12

SPEAKERS — **CAL POLY SLO - RECREATION CENTER** — XP-3 @ ELEC ROOM #115

	DEVICE POWER (WATTS)	SIGNAL CKT S9 QTY	S9 WATTS	SIGNAL CKT SPARE QTY	SPARE WATTS	SIGNAL CKT SPARE QTY	SPARE WATTS	SIGNAL CKT SPARE QTY	SPARE WATTS	QTY TOTAL
Speaker 25V										
Speaker - 1/2 Watt Tap	0.50	7	3.50		0.00	0	0.00		0.00	7
Speaker - 1 Watt Tap	1.00	4	4.00		0.00		0.00		0.00	4
TOTAL POWER ON CIRCUIT		7.50 WATTS		0.00 WATTS		0.00 WATTS		0.00 WATTS		
LOAD RESISTANCE		83 OHMS		0 OHMS		0 OHMS		0 OHMS		
TOTAL WIRE LENGTH		450 FT.		0 FT.		0 FT.		0 FT.		
WIRE SIZE		14 AWG		14 AWG		14 AWG		14 AWG		
TOTAL WIRE RESISTANCE		2.934 OHMS		0 OHMS		0 OHMS		0 OHMS		
POWER LINE LOSS (dB)		-0.30 dB		dB		dB		dB		
CIRCUIT LOCATION		1ST FLOOR		1ST FLOOR		2ND FLOOR		SPARE		

WIRE RESISTANCE (OHM / 1000 FT): 18 AWG = 8.08; 16 AWG = 5.08; 14 AWG = 3.26; 12 AWG = 2.05

LOAD RESISTANCE = (VOLTAGE x VOLTAGE) / POWER

POWER LINE LOSS (dB) = 20xLog [LOAD RESISTANCE / (LOAD RESISTANCE + TOTAL WIRE RESISTANCE)]

File Name: M:Cal Poly SLO Rec. Center_2010035[Cal Poly SLO_Rec Ctr_XP3_Lineloss.xls]dB LINE LOSS

SYSTEM BATTERY AND VOLTAGE DROP CALCULATIONS

Pyro-Comm Systems, Inc.
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X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project : CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

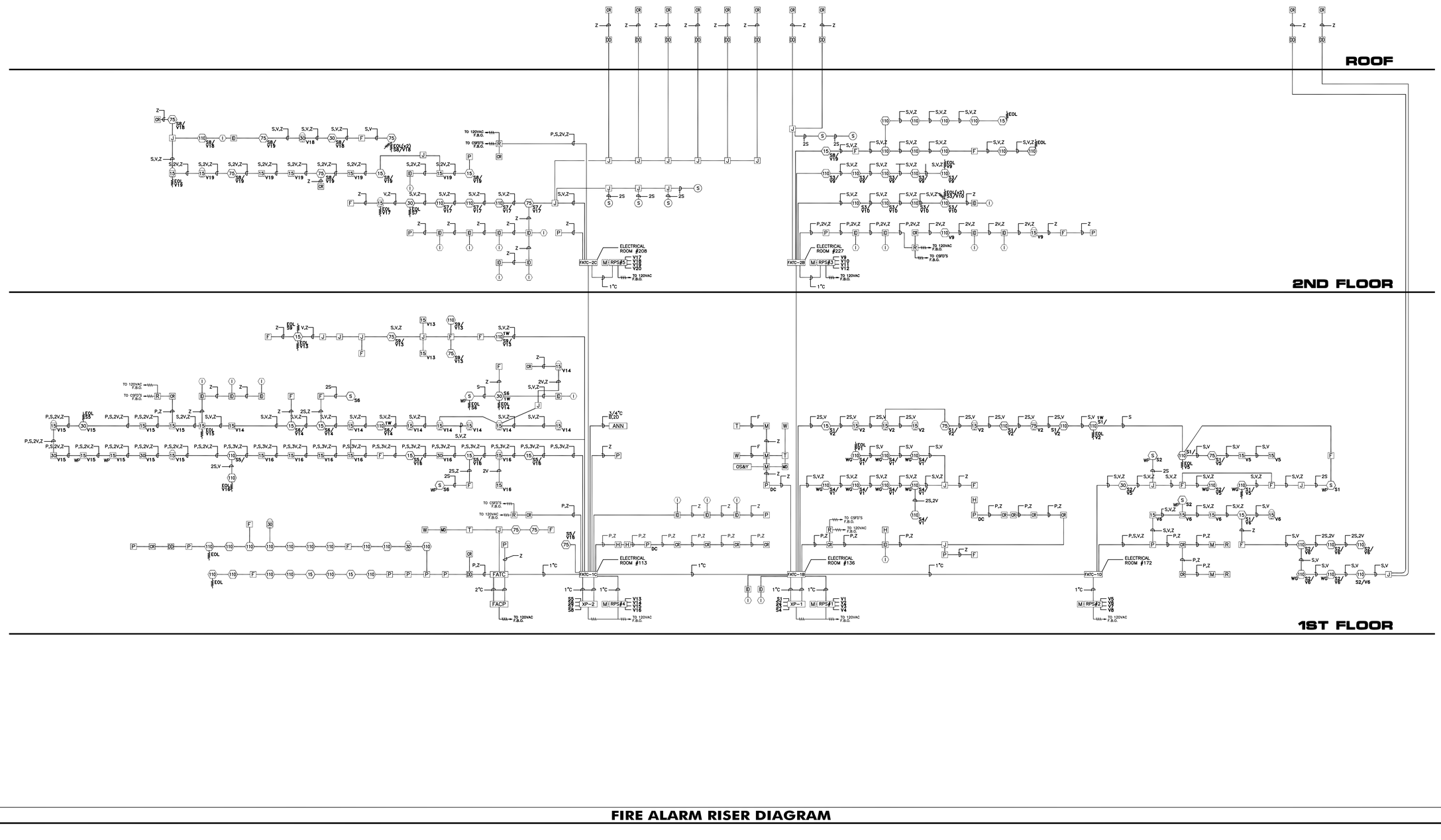
Sheet Title : **FIRE ALARM SYSTEM CALCULATIONS**

Drawn By : **J.AREVALO** 02/23/10
Cad File : M:\CAL POLY SLO\RECREATION CENTER\FA0.02-REC CTR-CALCS

Sheet Number : **FA0.02**

ASBUILT SET

ASBUILT SET



FIRE ALARM RISER DIAGRAM

Pyro-Comm Systems, Inc.
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X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM RISER DIAGRAM

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA0.03-REC CTR-RISER

Sheet Number :
FA0.03
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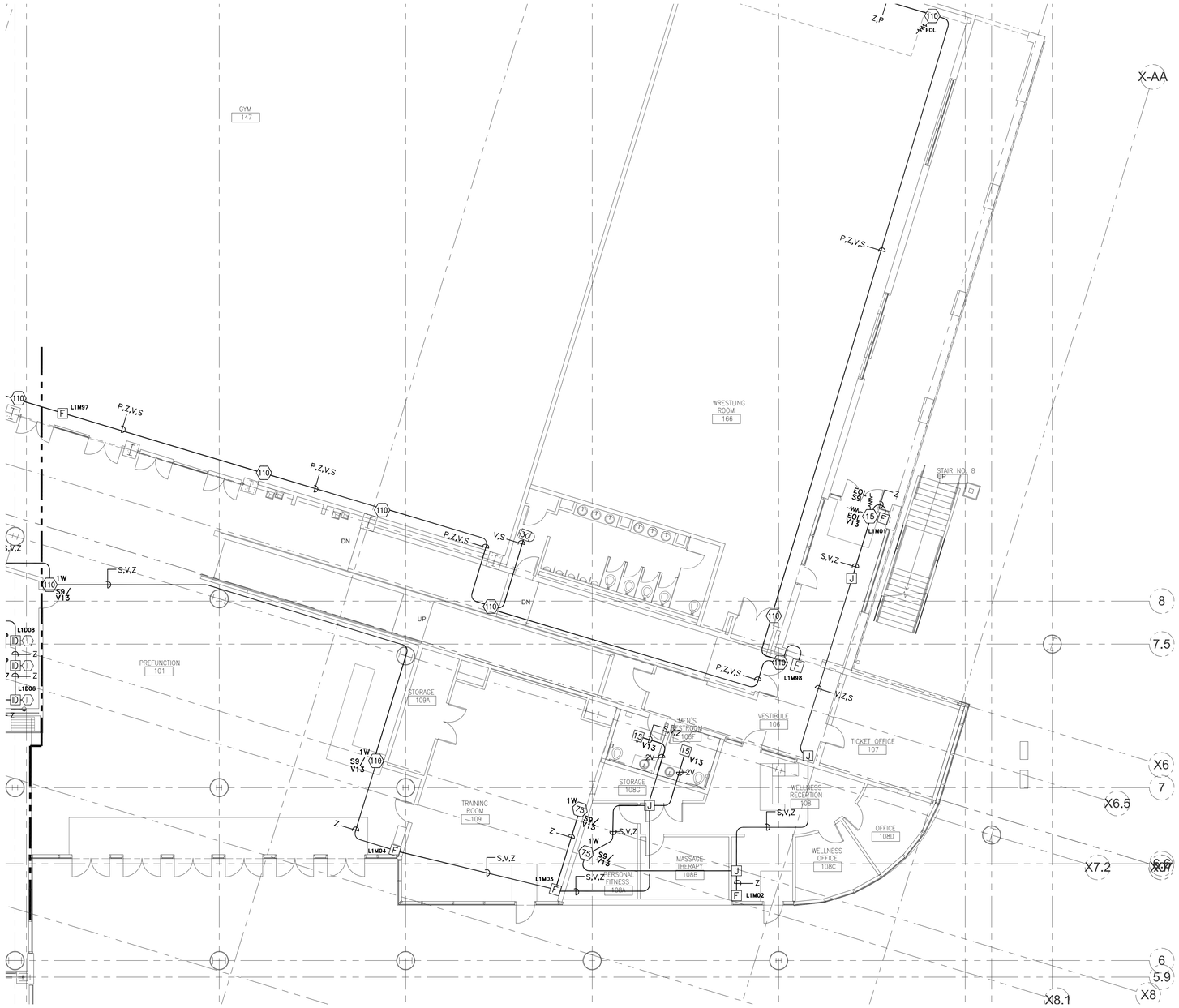
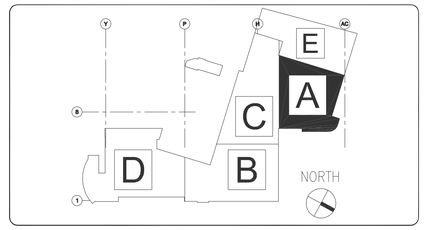
ASBUILT SET



LEVEL 1 FLOOR PLAN - AREA 'A'

SCALE: 1/8"=1'-0"



KEY PLAN

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. N/A
3. FOR POST INDICATOR VALVE (PIV) - VERIFY LOCATION.
4. FOR BACKFLOW PREVENTER (DDCV) - VERIFY LOCATION.

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW — F.B.O.
T	SPRINKLER VALVE TAMPER — F.B.O.
PIV	SPRINKLER POST INDICATOR — F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHER'S
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" — MC CABLE
	PREFIX "C" — CI CABLE
	SUFFIX "U" — UNDERGROUND/ WET LOCATION

WIRE LEGEND

Pyro-Comm Systems, Inc.
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Project :
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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - A

Drawn By : J.AREVALO 02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.10-REC CTR-1ST-A

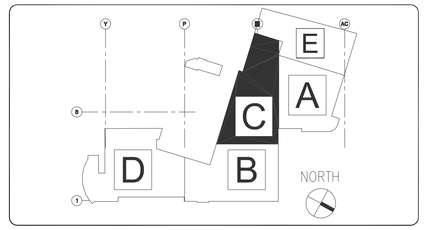
Sheet Number :
FA1.10

ASBUILT SET

ASBUILT SET

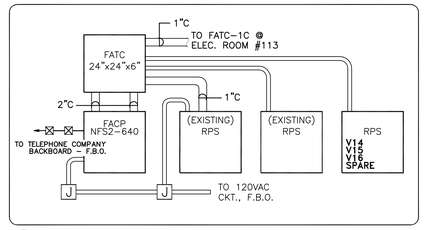
LEVEL 1 FLOOR PLAN - AREA 'C'

SCALE: 1/8"=1'-0"



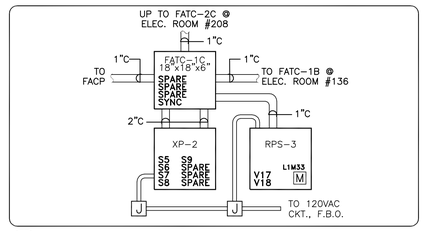
KEY PLAN

SCALE: NONE



1 FA1.11 FIRE ALARM CONTROL PANEL DETAIL

SCALE: NONE



2 FA1.11 ELECTRICAL ROOM #113 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. FOR ACTUATION OF COMBINATION SMOKE/FIRE DAMPERS.
3. FOR ACTUATION OF GATE CONTROLLER DOOR SWING.
4. FOR PIV AND BACKFLOW PREVENTER TAMPER SWITCHES.
5. MOUNT IN SUPPLY AIR DUCT.
6. TO FAN SHUTDOWN - F.B.O.
7. TO PRIMARY ELEVATOR RECALL
8. TO ALTERNATE ELEVATOR RECALL
9. TO BATTERY SHUNT TRIP
10. TO THE ELEVATOR HAT

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P_{DC}	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

WIRE LEGEND

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2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
A	ISSUED FOR PLAN CHECK	02/29/10	JA

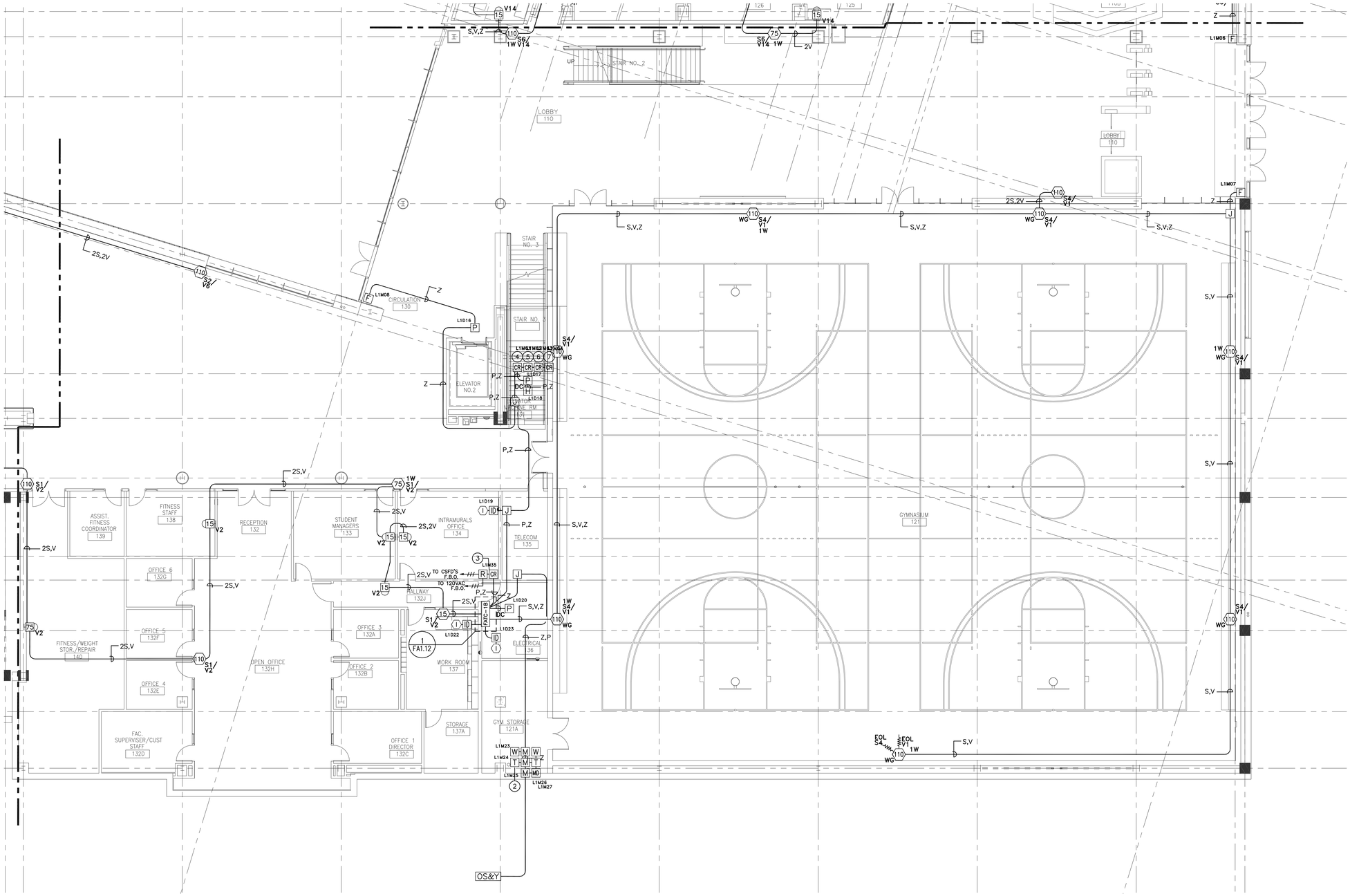
Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - 'C'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.11-REC CTR-1ST-C

Sheet Number :
FA1.11

ASBUILT SET

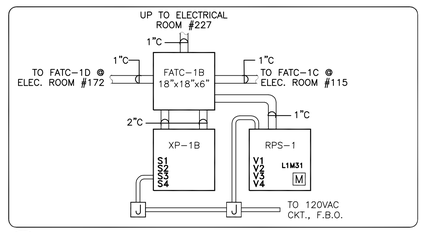


SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 25V UNLESS OTHERWISE NOTED.
2. BUILDING FIRE SPRINKLER RISER.
3. FOR ACTUATION OF SMOKE FIRE DAMPERS.
4. TO PRIMARY ELEVATOR RECALL
5. TO ALTERNATE ELEVATOR RECALL
6. TO BATTERY SHUNT TRIP
7. TO ELEVATOR HAT

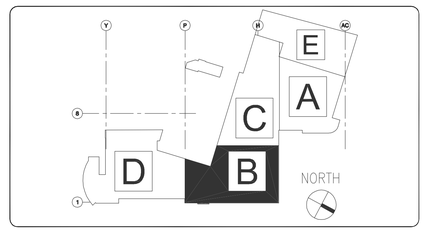
LEVEL 1 FLOOR PLAN - AREA 'B'

SCALE: 1/8"=1'-0"



1/FA1.12 ELECTRICAL ROOM #136 DETAIL

SCALE: NONE



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P_{DC}	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX	FIRE ALARM CEILING STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM CEILING AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

WIRE LEGEND

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STATE OF CALIFORNIA
LICENSED ELECTRICAL CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: 0
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Rev	Issued For	Date	By
X	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
X	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

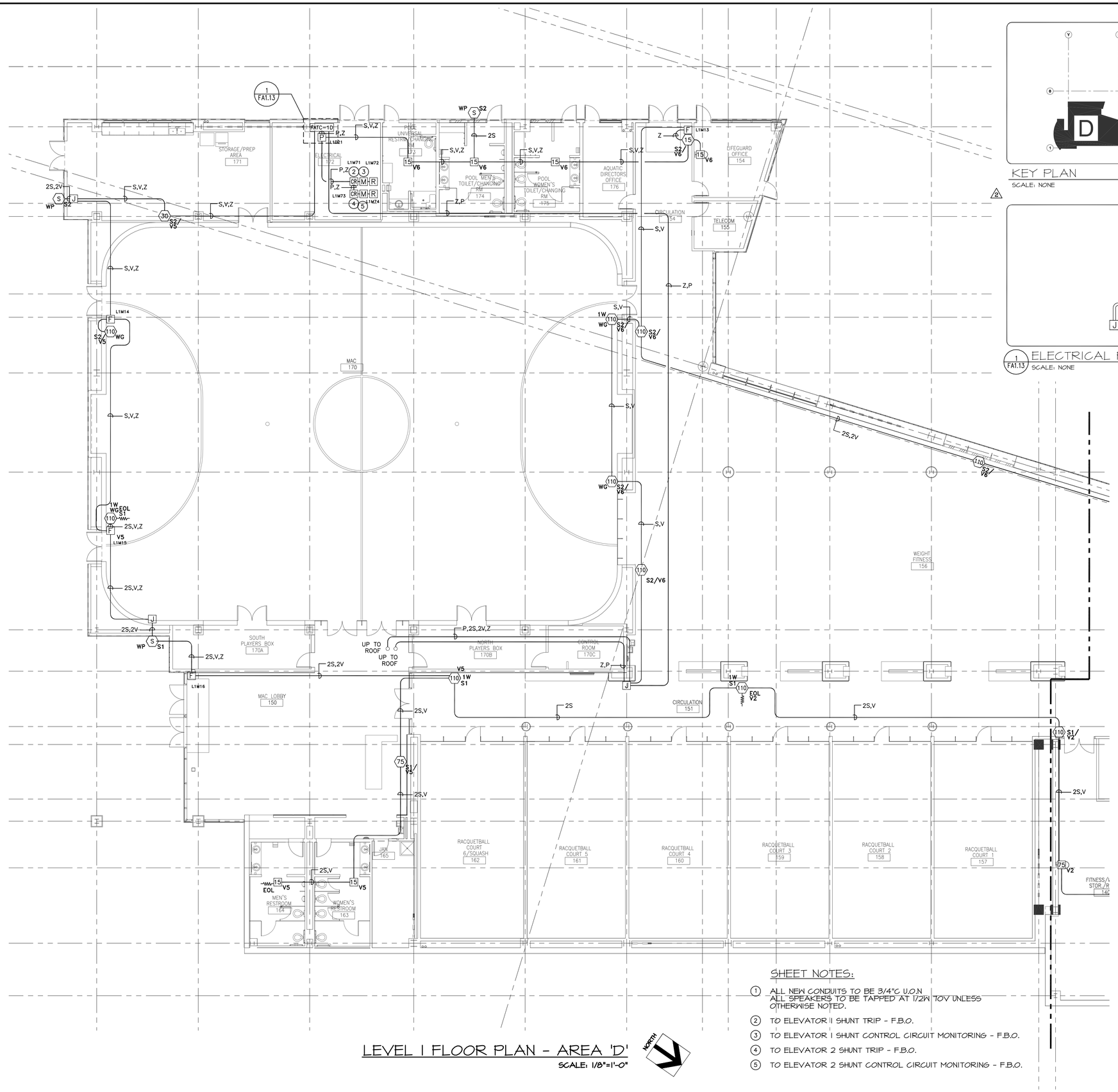
Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - 'B'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.12-REC CTR-B1-B

Sheet Number :
FA1.12

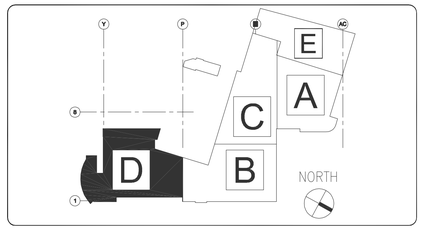
ASBUILT SET

ASBUILT SET



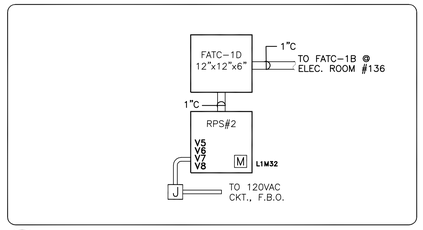
LEVEL 1 FLOOR PLAN - AREA 'D'

SCALE: 1/8"=1'-0"



KEY PLAN

SCALE: NONE



1 FA1.13 ELECTRICAL ROOM #172 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. TO ELEVATOR 1 SHUNT TRIP - F.B.O.
3. TO ELEVATOR 1 SHUNT CONTROL CIRCUIT MONITORING - F.B.O.
4. TO ELEVATOR 2 SHUNT TRIP - F.B.O.
5. TO ELEVATOR 2 SHUNT CONTROL CIRCUIT MONITORING - F.B.O.

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING AUDIBLE/STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" – MC CABLE
	PREFIX "C" – CI CABLE
	SUFFIX "U" – UNDERGROUND/ WET LOCATION

WIRE LEGEND

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231
CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001
SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
T(760)930-6014 F(760)930-6015

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LICENSED ELECTRICAL CONTRACTOR
C10-612153
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CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - D

Drawn By : J.AREVALO 02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.13-REC CTR-1ST-D

Sheet Number :
FA1.13

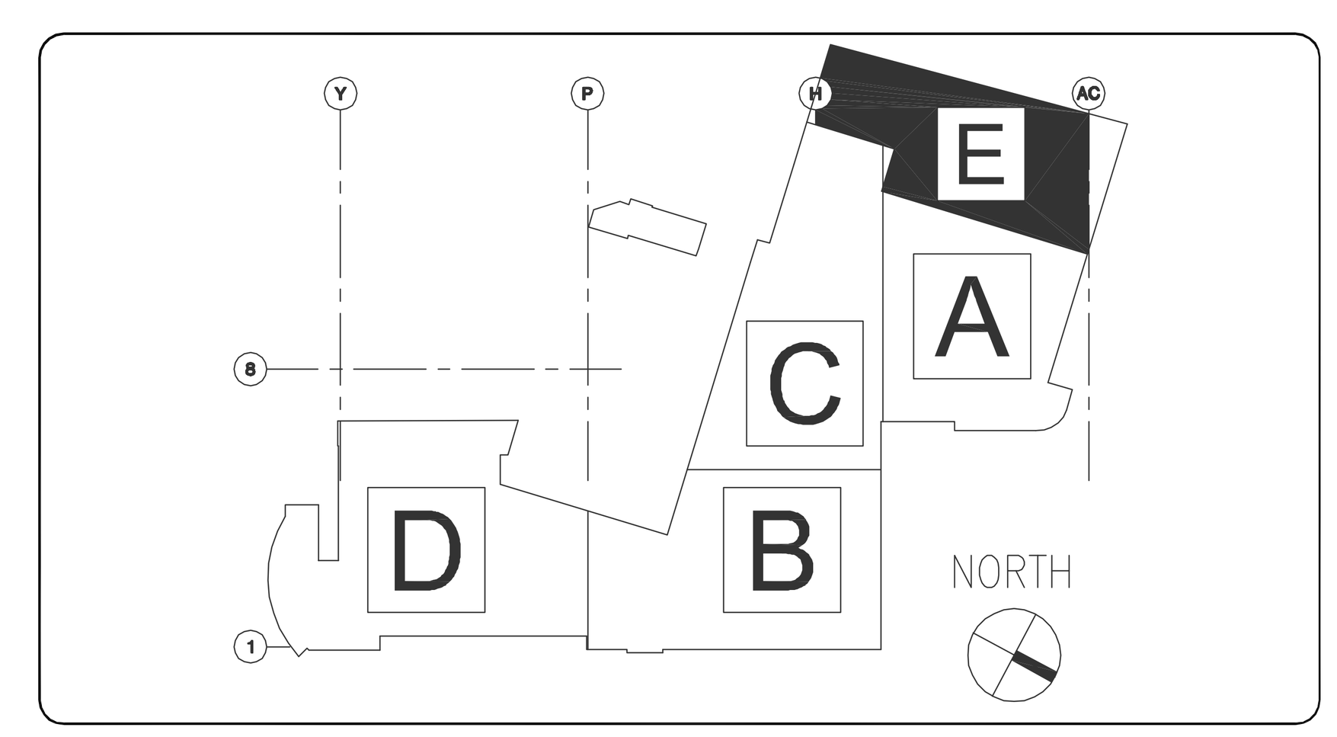
ASBUILT SET

ASBUILT SET

LEVEL 1 FLOOR PLAN - AREA 'E'

SCALE: 1/16"=1'-0"

NORTH



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
● / ○	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
PREFIX "M" –	MC CABLE
PREFIX "C" –	CI CABLE
SUFFIX "U" –	UNDERGROUND/ WET LOCATION

WIRE LEGEND

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CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 1 - E

Drawn By :
J.AREVALO
02/23/10
Cad File :
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Sheet Number :
FA1.14

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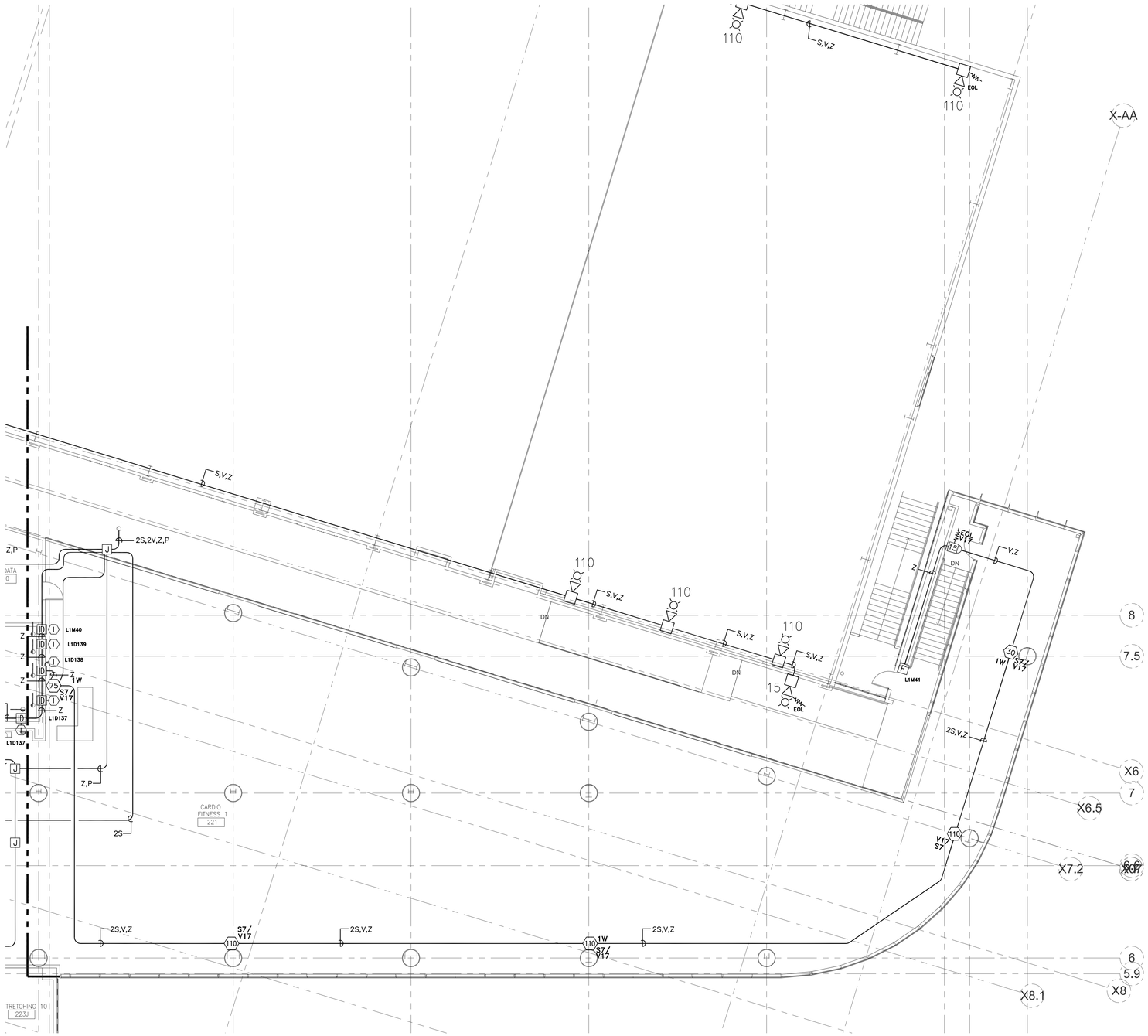

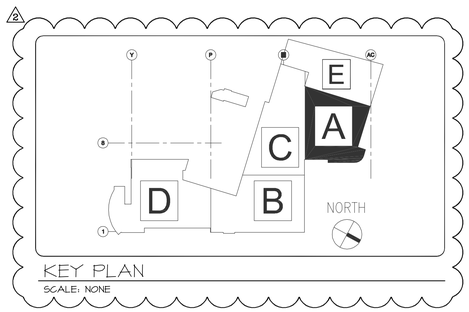

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N
   ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.

LEVEL 2 FLOOR PLAN - AREA 'A'

SCALE: 1/8"=1'-0"

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM CEILING AUDIBLE/STROBE
XX (XX DENOTES CANDELA RATING)	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW – F.B.O.
T	SPRINKLER VALVE TAMPER – F.B.O.
PIV	SPRINKLER POST INDICATOR – F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" – MC CABLE
	PREFIX "C" – CI CABLE
	SUFFIX "U" – UNDERGROUND/ WET LOCATION

WIRE LEGEND

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CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - A

Drawn By :
J.AREVALO
02/23/10
Cad File :
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Sheet Number :
FA1.20

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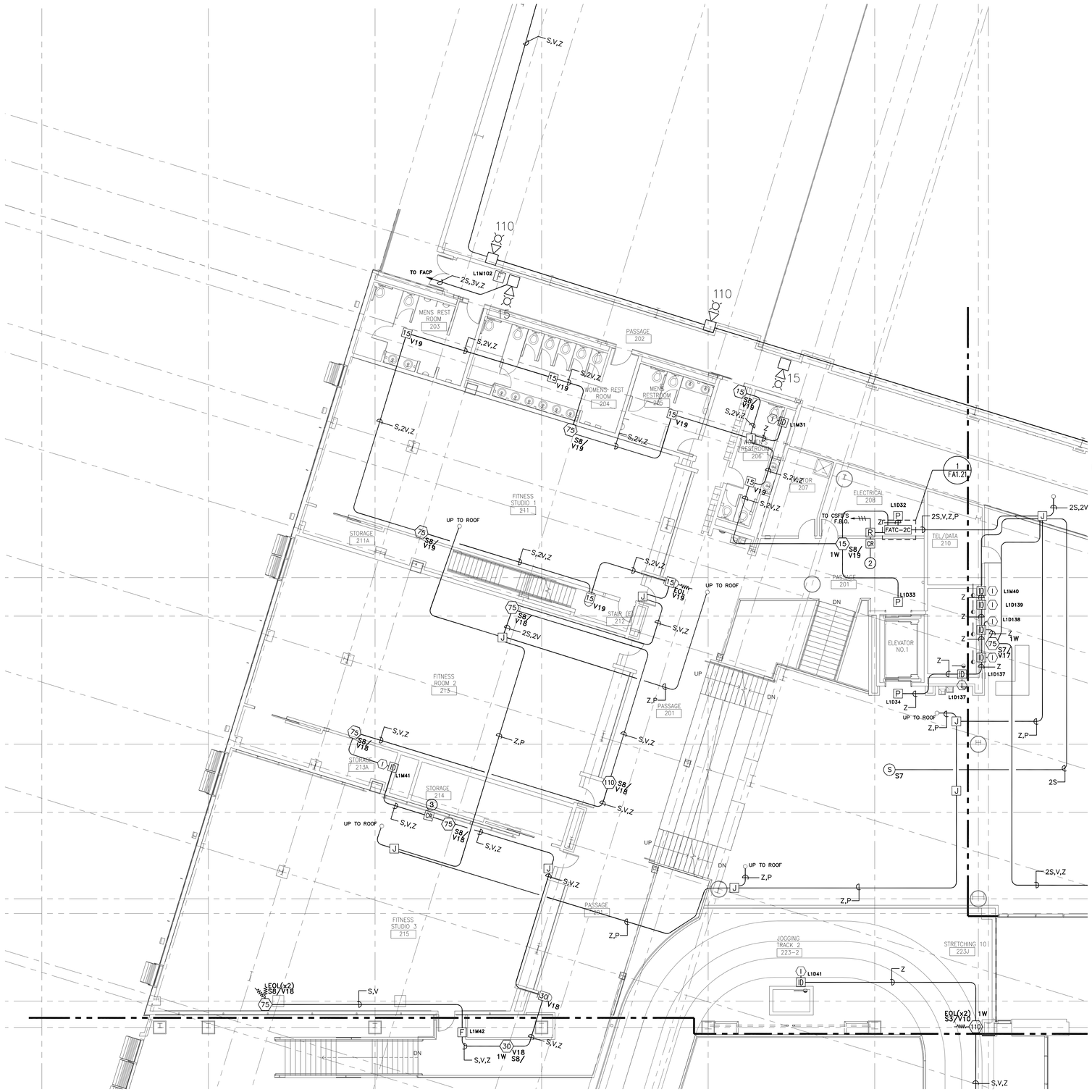


LEVEL 2 FLOOR PLAN - AREA 'C'

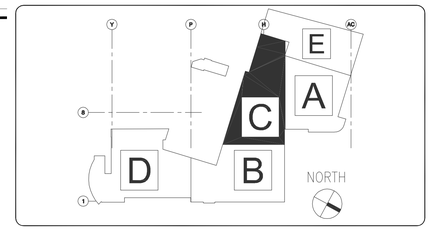
SCALE: 1/8"=1'-0"

1 FA1.21 ELECTRICAL ROOM #206 DETAIL

SCALE: NONE

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N ALL SPEAKERS TO BE TAPPED AT 1/2W 70V UNLESS OTHERWISE NOTED.
2. FOR ACTUATION OF SMOKE FIRE DAMPERS.
3. FOR SHUTDOWN OF AUDIO/VISUAL IN THIS AREA.



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX	FIRE ALARM CEILING STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM CEILING AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
XX	FIRE ALARM WALL AUDIBLE/STROBE (XX DENOTES CANDELA RATING)
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW - F.B.O.
T	SPRINKLER VALVE TAMPER - F.B.O.
PIV	SPRINKLER POST INDICATOR - F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" - MC CABLE
	PREFIX "C" - CI CABLE
	SUFFIX "U" - UNDERGROUND/ WET LOCATION

WIRE LEGEND

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STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - 'C'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA\21-REC CTR-2ND-C

Sheet Number :
FA1.21

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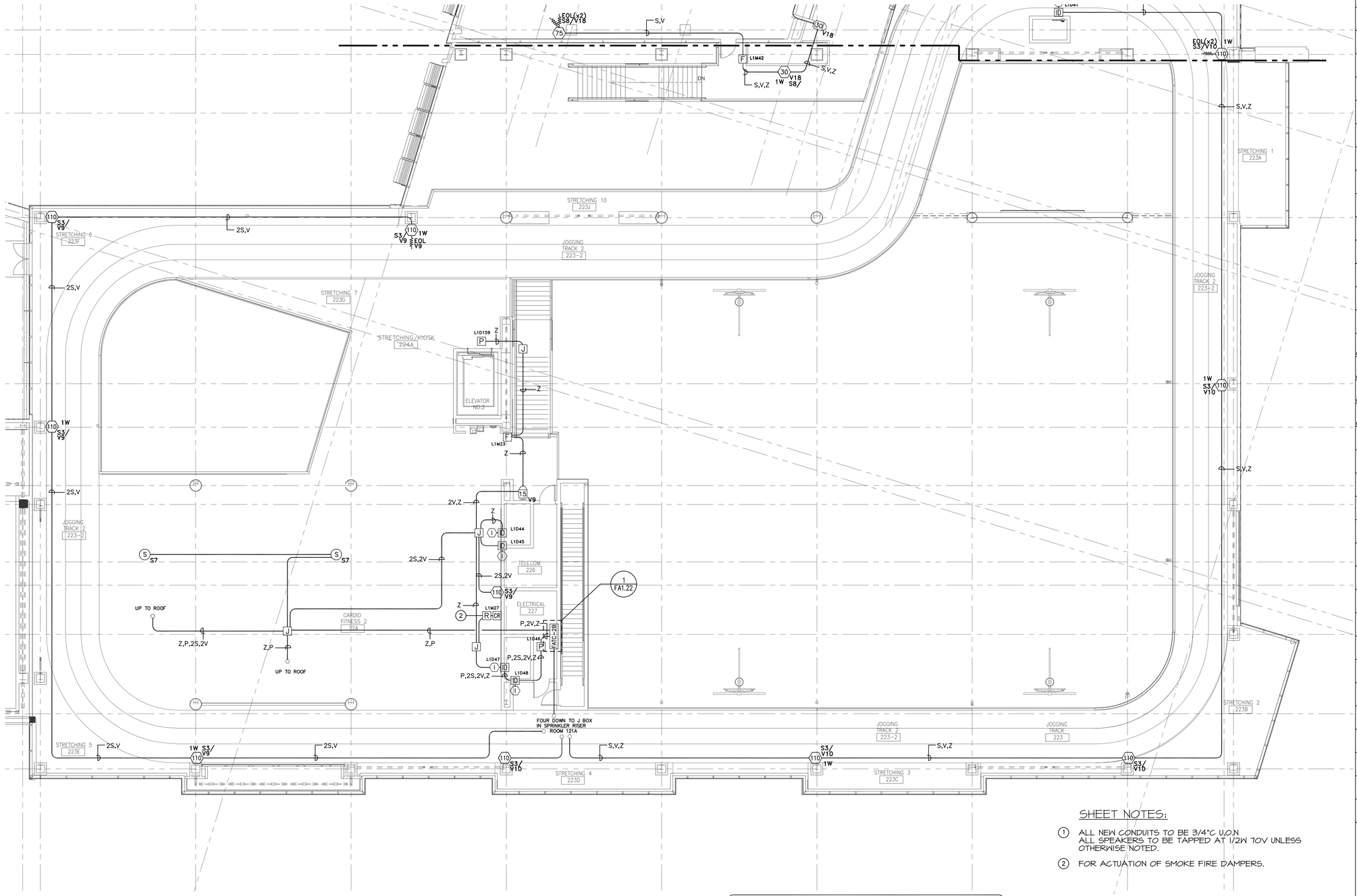
ASBUILT SET



SHEET NOTES:

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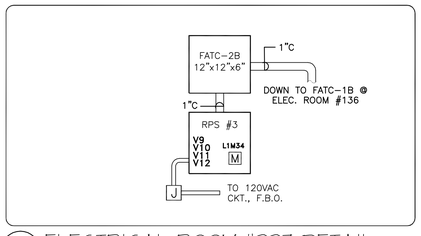
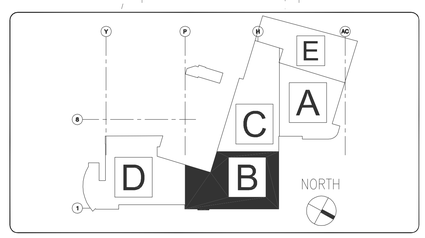


1/FA1.21 ELECTRICAL ROOM #227 DETAIL
SCALE: NONE



KEY PLAN
SCALE: NONE

LEVEL 2 FLOOR PLAN - AREA 'B'
SCALE: 1/8"=1'-0"

NORTH

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
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	CONDUIT DOWN CONDUIT UP

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FN	FIBER NETWORK
	PREFIX "M" – MC CABLE
	PREFIX "C" – CI CABLE
	SUFFIX "U" – UNDERGROUND/ WET LOCATION

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Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN LEVEL 2 - 'B'

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA122-REC CTR-2ND-B

Sheet Number :
FA1.22

ASBUILT SET

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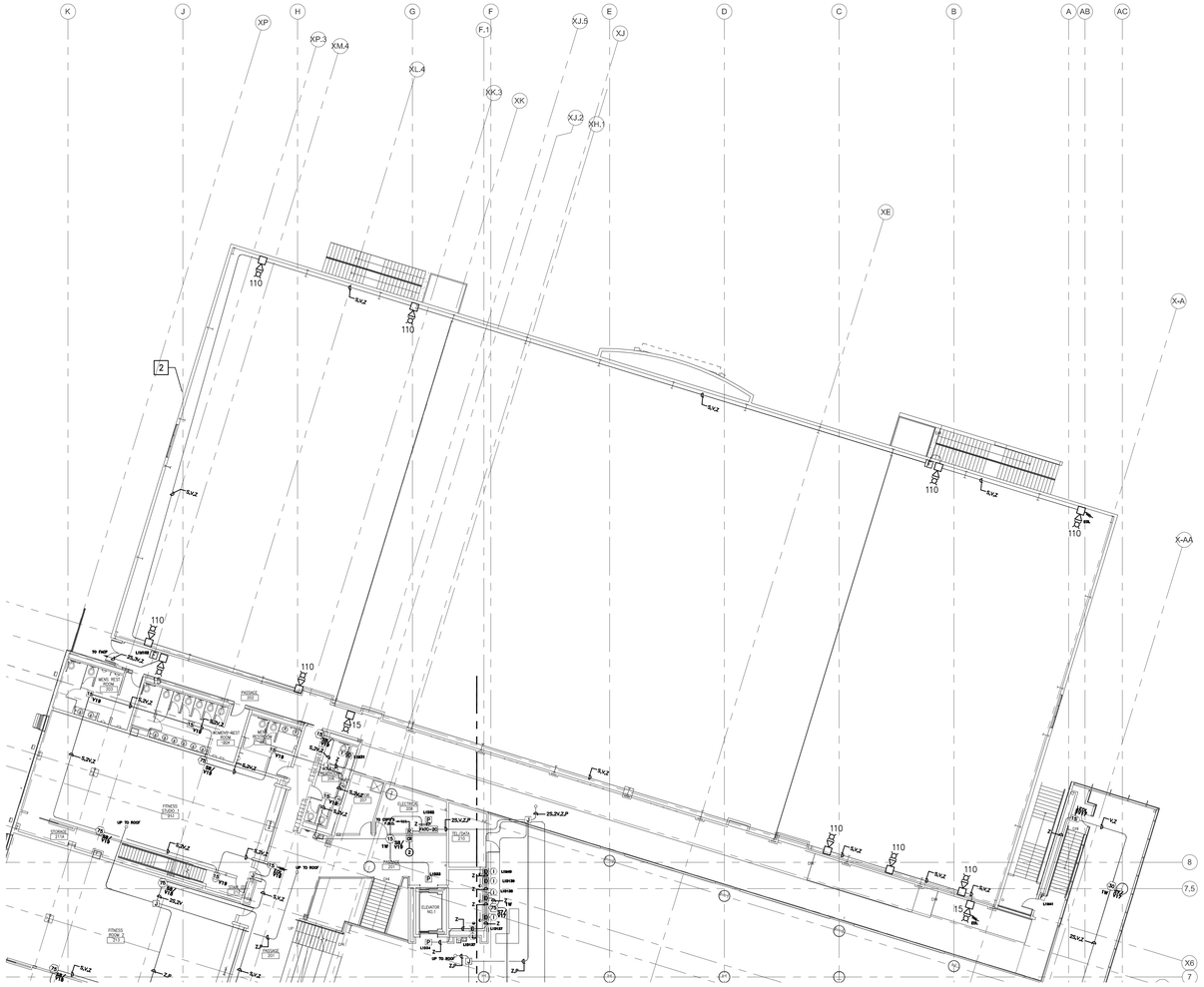
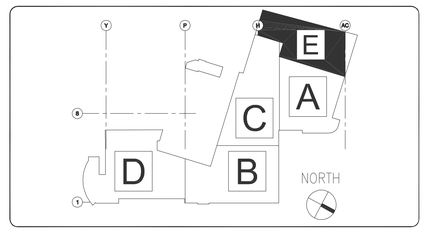


LEVEL 2 FLOOR PLAN - AREA 'E'

SCALE: 1/16"=1'-0"



KEY PLAN

SCALE: NONE

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
ANN	FIRE ALARM ANNUNCIATOR PANEL
BATT	BATTERY BACKBOX CABINET
M	FIRE ALARM MONITOR MODULE
MD	FIRE ALARM DUAL MONITOR MODULE
C	FIRE ALARM CONTROL MODULE
CR	FIRE ALARM RELAY MODULE
R	24VDC RELAY
F	MANUAL PULL STATION
H	AREA HEAT DETECTOR
P	AREA SMOKE DETECTOR (PHOTOELECTRIC)
P DC	AREA SMOKE DETECTOR (FOR DAMPER CONTROL)
ID	IN-DUCT SMOKE DETECTOR (PHOTO)
DD	AIR HANDLING DUCT SMOKE DET. (PHOTO)
I	REMOTE INDICATOR L.E.D.
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM CEILING AUDIBLE/STROBE
XX — XX DENOTES CANDELA RATING	FIRE ALARM WALL AUDIBLE/STROBE
SB	SPRINKLER BELL
W	SPRINKLER WATER FLOW — F.B.O.
T	SPRINKLER VALVE TAMPER — F.B.O.
PIV	SPRINKLER POST INDICATOR — F.B.O.
J	FIRE ALARM JUNCTION BOX
FATC	FIRE ALARM TERMINAL CABINET
A.F.F.	ABOVE FINISHED FLOOR
EOL	END OF LINE RESISTOR
F.B.O.	FURNISHED BY OTHERS
N/A	NOT APPLICABLE
U.O.N.	UNLESS OTHERWISE NOTED
VL	VERIFY LOCATION IN FIELD
WP	WEATHERPROOF DEVICE
N	NEW DEVICE
	COMBINATION FIRE SMOKE DAMPER
● / ○	CONDUIT DOWN / CONDUIT UP

SYMBOLS LEGEND

A	AUDIBLE CIRCUIT
B	ANNUNCIATOR POWER
D	ANNUNCIATOR DATA
F	INITIATION CIRCUIT
H	DOOR HOLDER POWER
P	24V POWER
R	24V RESET. POWER
S	SPEAKER CIRCUIT
V	AUD/VISUAL CIRCUIT
W	FAN SHUTDOWN CIRCUIT
Z	ADDRESSABLE LOOP
FN	FIBER NETWORK
	PREFIX "M" — MC CABLE
	PREFIX "C" — CI CABLE
	SUFFIX "U" — UNDERGROUND/ WET LOCATION

WIRE LEGEND

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001

SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
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Sheet Title :
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Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA1.20-REC CTR-2ND-E

Sheet Number :
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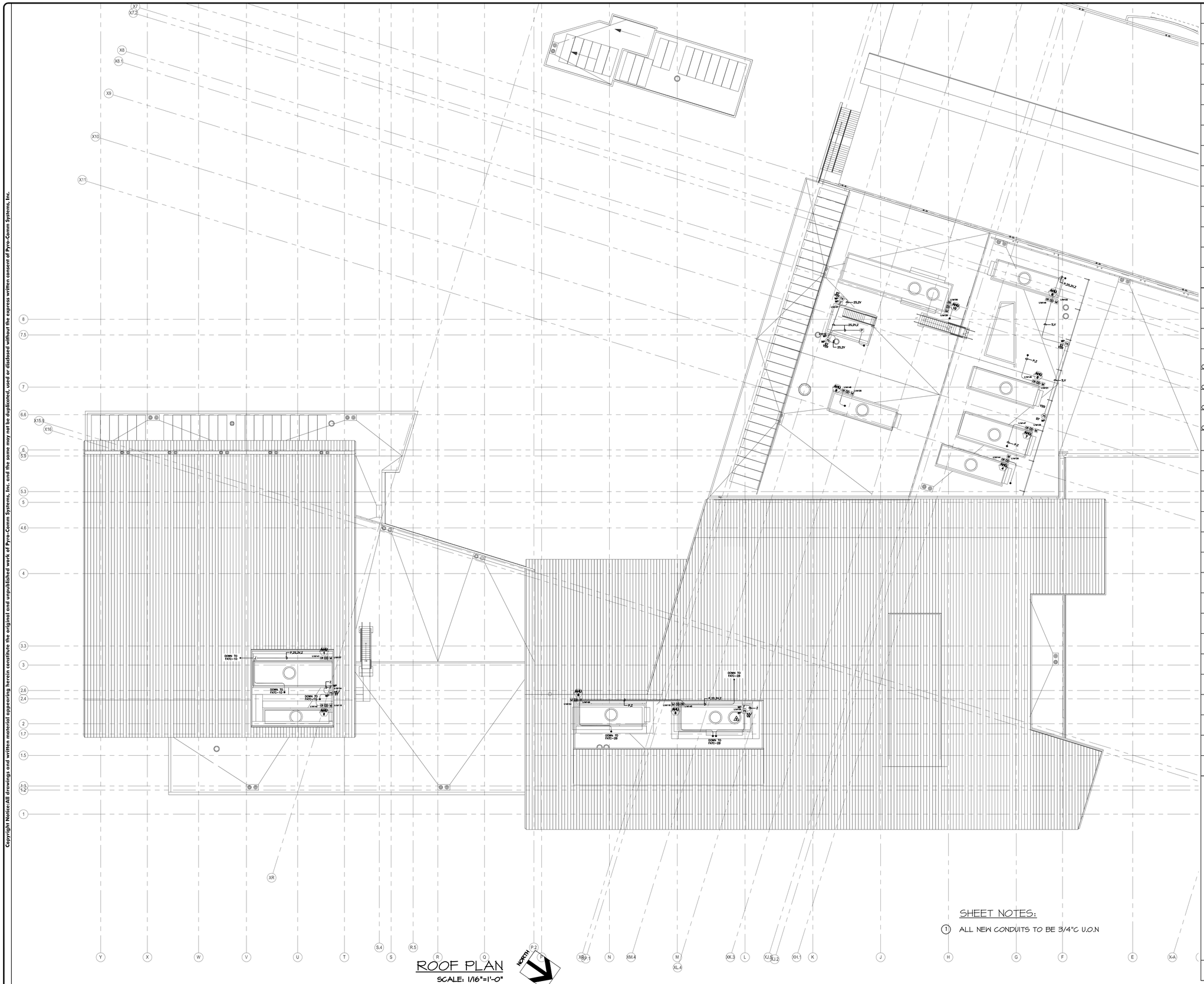

ROOF PLAN
SCALE: 1/16"=1'-0"

NORTH

SHEET NOTES:

1. ALL NEW CONDUITS TO BE 3/4"C U.O.N

FACP	FIRE ALARM CONTROL PANEL
RPS	AUDIO/VISUAL REMOTE POWER SUPPLY
XP	FIRE ALARM TRANSPONDER
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W.O. # : 2010035

Sheet Title :
FIRE ALARM FLOOR PLAN ROOF LEVEL

Drawn By : J.AREVALO
02/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA130-REC CTR-ROOF

Sheet Number :
FA1.30

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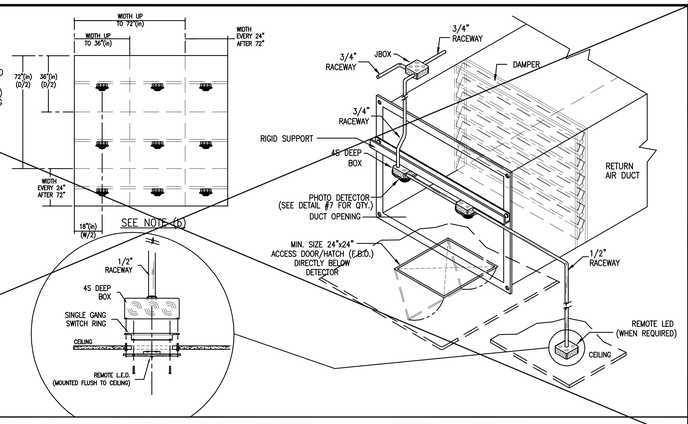
NFPA 72, 2007 ed.
A.5.16.4.2.2– DETECTORS LISTED FOR THE AIR VELOCITY PRESENT CAN BE PERMITTED TO BE INSTALLED AT THE OPENING WHERE THE RETURN AIR ENTERS THE COMMON RETURN AIR SYSTEM. THE DETECTORS SHOULD BE INSTALLED UP TO 300mm (12 in.) ON FRONT OF OR BEHIND THE OPENING AND SPACED ACCORDING TO THE FOLLOWING OPENING DIMENSIONS:

(1) WIDTH (a) UP TO 914mm (36in.) – ONE DETECTOR CENTERED IN OPENING
(b) UP TO 1.829m (72in) – TWO DETECTORS LOCATED AT THE ONE–QUARTER POINTS OF THE OPENING
(c) OVER 1.829m (72in.) – ONE ADDITIONAL DETECTOR FOR EACH FULL 610mm (24in.) OF OPENING

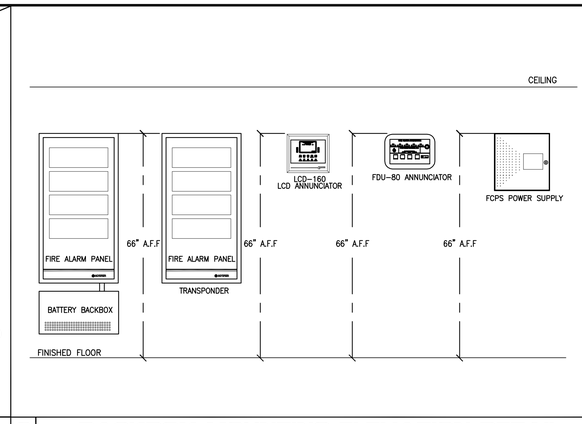
(2) DEPTH THE NUMBER AND SPACING OF DETECTOR(S) IN THE DEPTH (VERTICAL) OF THE OPENING SHOULD BE THE SAME AS THOSE GIVEN FOR THE WIDTH (HORIZONTAL) IN A.5.16.4.2.2(1).

(3) ORIENTATION DETECTORS SHOULD BE ORIENTED IN THE MOST FAVORABLE POSITION FOR SMOKE ENTRY WITH RESPECT TO THE DIRECTION OF AIRFLOW. THE PATH OF A PROJECTED BEAM–TYPE DETECTOR ACROSS THE RETURN AIR OPENINGS SHOULD BE CONSIDERED.

RETURN AIR SMOKE DUCT DETECTOR LOCATION/MOUNTING (RETURN AIR OPENING)

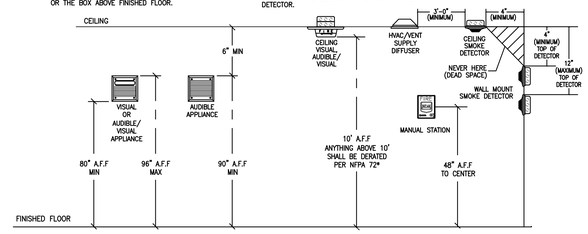


1 RETURN AIR OPENING SMOKE DETECTOR MOUNTING LOCATION



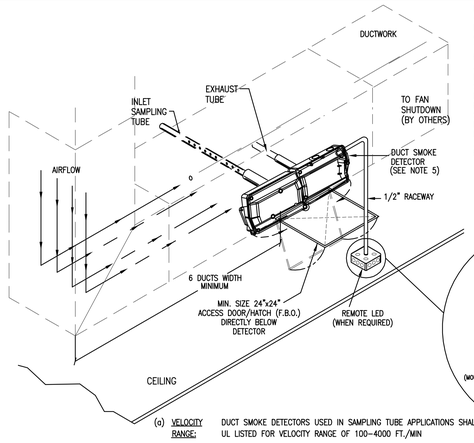
2 BACKBOX MOUNTING ELEVATION DETAIL

NOTES:
1. ALL WALL–MOUNTED VISUAL SIGNALING APPLIANCES SHALL BE MOUNTED SUCH THAT THE ENTIRE BOTTOM LENS IS NOT LESS THAN 80 IN. AND TOP OF LENS IS NOT GREATER THAN 96 IN. ABOVE THE FINISHED FLOOR (A.F.F.) PER NFPA 72 2007 SECTION 7.5.4. ALL WALL MOUNTED AUDIBLE DEVICES SHALL BE A MINIMUM OF 90 IN. A.F.F. TO TOP OF DEVICE PER NFPA 72 2007 CH. 7.4.7.1. AREAS HAVING MORE THAN 2 STROBES IN THE FIELD OF VIEW SHALL BE SYNCRONIZED PER NFPA 72 2007 SECTION 7.5.4.3.2.
2. MANUAL STATION SHALL BE INSTALLED AT 48" CENTER OR THE BOX ABOVE FINISHED FLOOR.
3. WEATHERPROOF HORN/STROBE SHALL BE WALL MOUNTED A MINIMUM OF 90" ABOVE FLOOR OR 6" MINIMUM BELOW THE CEILING, WHICHEVER IS LOWER. MEASUREMENTS ARE TO BE TAKEN FROM THE HIGHEST PORTION OF THE HORN.
4. PER NFPA–72 2007 EDITION, SECTION 5.7.3.2.1 SPOT–TYPE SMOKE DETECTORS SHALL BE LOCATED ON THE CEILING NOT LESS THAN 100mm (4 in.) FROM A SIDEWALL TO THE NEAR EDGE OR, IF ON A SIDEWALL, BETWEEN 100mm AND 300mm (4 in. AND 12 in.) DOWN FROM FROM THE CEILING TO THE TOP OF THE DETECTOR.



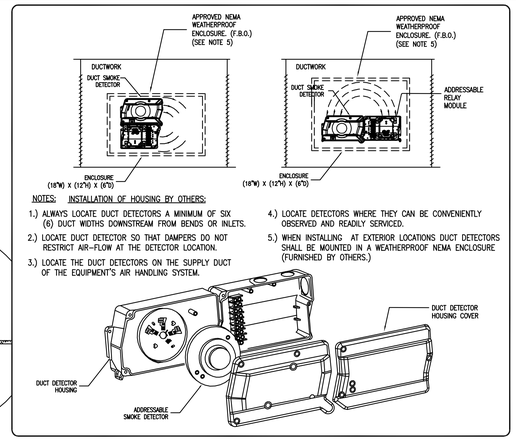
* DE–RATED STROBES SHALL MEET THE REQUIREMENTS OF SECTION 7.5.4.3. "PERFORMANCE – BASED ALTERNATIVE".

3 DEVICE MOUNTING ELEVATION DETAILS



(a) VELOCITY RANGE: DUCT SMOKE DETECTORS USED IN SAMPLING TUBE APPLICATIONS SHALL BE UL LISTED FOR VELOCITY RANGE OF 100–4000 FT./MIN

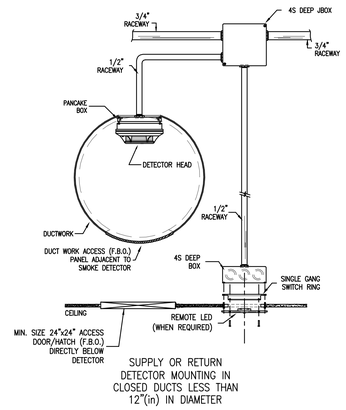
NFPA–72, 2007 EDITION, 5.16.5.8 – WHERE IN–DUCT SMOKE DETECTORS ARE INSTALLED IN CONCEALED LOCATIONS MORE THAN 3m (10ft) ABOVE THE FINISHED FLOOR OR IN ARRANGEMENTS WHERE THE DETECTOR'S ALARM OR SUPERVISORY INDICATOR IS NOT VISIBLE TO RESPONDING PERSONNEL, THE DETECTORS SHALL BE PROVIDED WITH REMOTE ALARM OR SUPERVISORY INDICATION IN A LOCATION ACCEPTIBLE TO THE AUTHORITY HAVING JURISDICTION.



NOTES: INSTALLATION OF HOUSING BY OTHERS:
1.) ALWAYS LOCATE DUCT DETECTORS A MINIMUM OF SIX (6) DUCT WIDTHS DOWNSTREAM FROM BENDS OR INLETS.
2.) LOCATE DUCT DETECTOR SO THAT DAMPERS DO NOT RESTRICT AIR–FLOW AT THE DETECTOR LOCATION.
3.) LOCATE THE DUCT DETECTORS ON THE SUPPLY DUCT OF THE EQUIPMENT'S AIR HANDLING SYSTEM.
4.) LOCATE DETECTORS WHERE THEY CAN BE CONVENIENTLY OBSERVED AND READILY SERVICED.
5.) WHEN INSTALLING AT EXTERIOR LOCATIONS DUCT DETECTORS SHALL BE MOUNTED IN A WEATHERPROOF NEMA ENCLOSURE (FURNISHED BY OTHERS.)

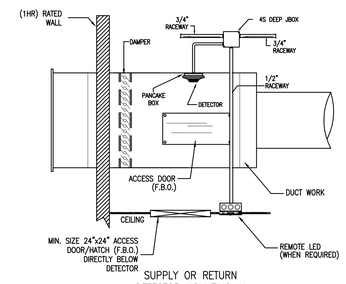
4 DUCT SMOKE DETECTOR MOUNTING/LOCATION INFORMATION

(a) VELOCITY RANGE: DETECTORS TO BE USED FOR IN–DUCT APPLICATIONS SHALL BE UL LISTED FOR VELOCITY RANGE OF 0–4000 FT./MIN

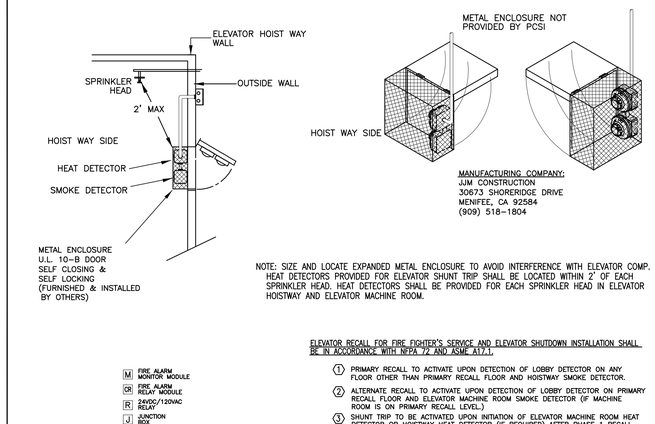


SUPPLY OR RETURN DETECTOR MOUNTING IN CLOSED DUCTS LESS THAN 12"(in) IN DIAMETER

NFPA–72, 2007 EDITION, 5.16.5.8 – WHERE IN–DUCT SMOKE DETECTORS ARE INSTALLED IN CONCEALED LOCATIONS MORE THAN 3m (10ft) ABOVE THE FINISHED FLOOR OR IN ARRANGEMENTS WHERE THE DETECTOR'S ALARM OR SUPERVISORY INDICATOR IS NOT VISIBLE TO RESPONDING PERSONNEL, THE DETECTORS SHALL BE PROVIDED WITH REMOTE ALARM OR SUPERVISORY INDICATION IN A LOCATION ACCEPTIBLE TO THE AUTHORITY HAVING JURISDICTION.



SUPPLY OR RETURN DETECTOR MOUNTING IN CLOSED DUCTS GREATER THAN 12"(in) IN DIAMETER



MANUFACTURING COMPANY:
JJM CONSTRUCTION
30673 SHORERIDGE DRIVE
MENIFEE, CA 92584
(909) 518–1804

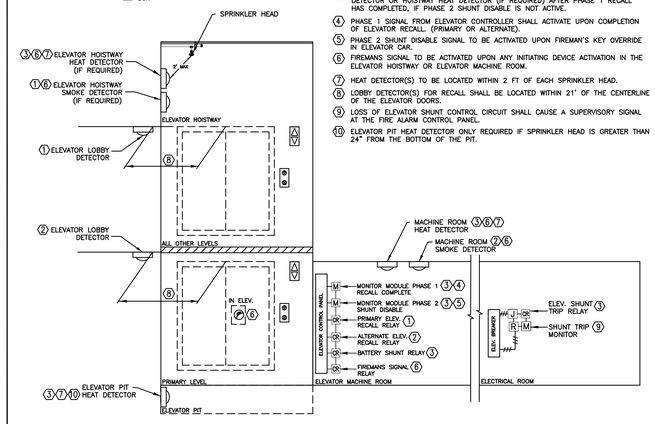
NOTE: SIZE AND LOCATE EXPANDED METAL ENCLOSURE TO AVOID INTERFERENCE WITH ELEVATOR COMP. HEAT DETECTORS PROVIDED FOR ELEVATOR SHUNT TRIP SHALL BE LOCATED WITHIN 2' OF EACH SPRINKLER HEAD. HEAT DETECTORS SHALL BE PROVIDED FOR EACH SPRINKLER HEAD IN ELEVATOR HOISTWAY AND ELEVATOR MACHINE ROOM.

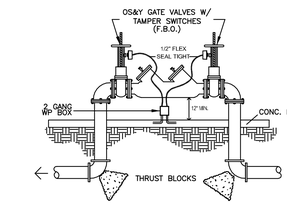
8 ELEVATOR EQUIPMENT DETAIL

ELEVATOR RECALL FOR FIRE FIGHTER'S SERVICE AND ELEVATOR SHUTDOWN INSTALLATION SHALL BE IN ACCORDANCE WITH NFPA 72 AND ASME A17.1.

1. PRIMARY RECALL TO ACTIVATE UPON DETECTION OF LOBBY DETECTOR ON ANY FLOOR OTHER THAN PRIMARY RECALL FLOOR AND HOISTWAY SMOKE DETECTOR.
2. ALTERNATE RECALL TO ACTIVATE UPON DETECTION OF LOBBY DETECTOR ON PRIMARY RECALL FLOOR AND ELEVATOR MACHINE ROOM SMOKE DETECTOR (IF MACHINE ROOM IS ON PRIMARY RECALL LEVEL.)
3. SHUNT TRIP TO BE ACTIVATED UPON INITIATION OF ELEVATOR MACHINE ROOM HEAT DETECTOR OR HOISTWAY HEAT DETECTOR (IF REQUIRED) AFTER PHASE 1 RECALL HAS COMPLETED, IF PHASE 2 SHUNT DISABLE IS NOT ACTIVE.
4. PHASE 1 SIGNAL FROM ELEVATOR CONTROLLER SHALL ACTIVATE UPON COMPLETION OF ELEVATOR RECALL. (PRIMARY OR ALTERNATE).
5. PHASE 2 SHUNT DISABLE SIGNAL TO BE ACTIVATED UPON FIREMAN'S KEY OVERRIDE IN ELEVATOR CAR.
6. FIREMANS SIGNAL TO BE ACTIVATED UPON ANY INITIATING DEVICE ACTIVATION IN THE ELEVATOR HOISTWAY OR ELEVATOR MACHINE ROOM.
7. HEAT DETECTOR(S) TO BE LOCATED WITHIN 2 FT OF EACH SPRINKLER HEAD.
8. LOBBY DETECTOR(S) FOR RECALL SHALL BE LOCATED WITHIN 21' OF THE CENTERLINE OF THE ELEVATOR DOORS.
9. LOSS OF ELEVATOR SHUNT CONTROL CIRCUIT SHALL CAUSE A SUPERVISORY SIGNAL AT THE FIRE ALARM CONTROL PANEL.
10. ELEVATOR PIT HEAT DETECTOR ONLY REQUIRED IF SPRINKLER HEAD IS GREATER THAN 24" FROM THE BOTTOM OF THE PIT.

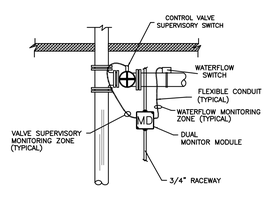
M FIRE ALARM MONITOR MODULE
CR FIRE ALARM RELAY MODULE
R 24VDC/120VAC RELAY
J JUNCTION BOX



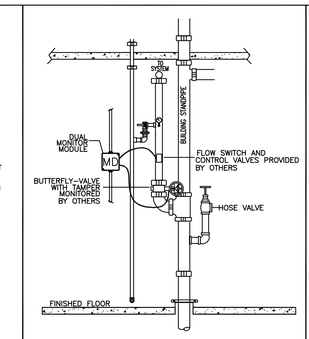


**MODULE FOR OS&Y VALVE TO BE MOUNTED ON THE INSIDE OF THE BUILDING

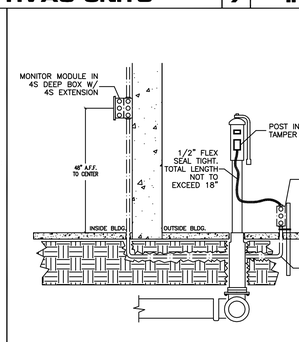
9 OS & Y VALVE



10 HORIZONTAL RISER

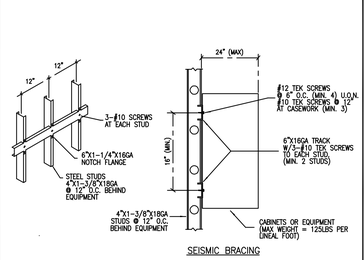


11 VERTICAL RISER



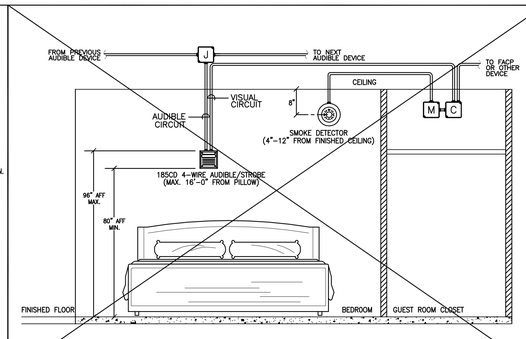
12 PIV VALVE

WORST CASE OPERATING WEIGHTS:
FACP: 175 lbs. IN CABINET SBB–D4
VOICE TRANSPONDER: 227 lbs. IN CABINET SBB–D4
BATTERY CABINET: 114 lbs. IN CAB NFS–LBB
FCPS POWER SUPPLY: 35 lbs.



SEISMIC BRACING

13 SEISMIC BRACING DETAIL



14 HANDICAP/HEARING IMPAIRED RM DETAIL

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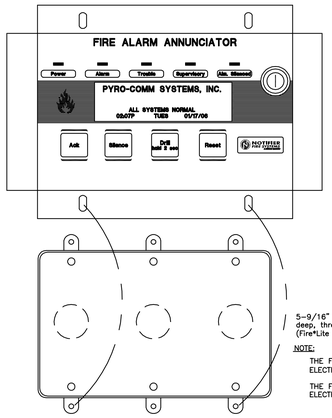
W.O. # : 2010035

Sheet Title :
FIRE ALARM MOUNTING DETAILS

Drawn By :
J.AREVALO
02/23/10
Cad File :
M:\CAL POLY SLO\ RECREATION CENTER\ FA2.01-REC CTR-MTG

Sheet Number :
FA2.01

ASBUILT SET

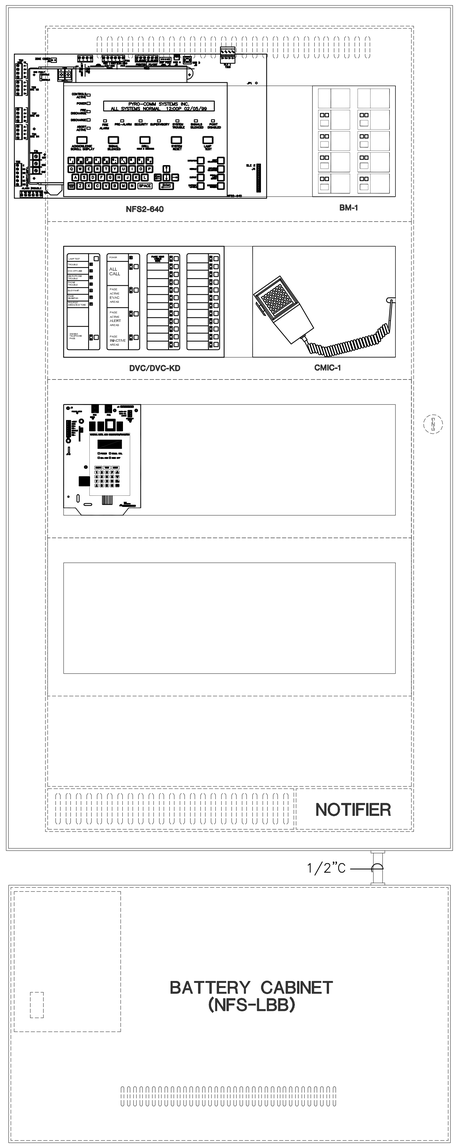


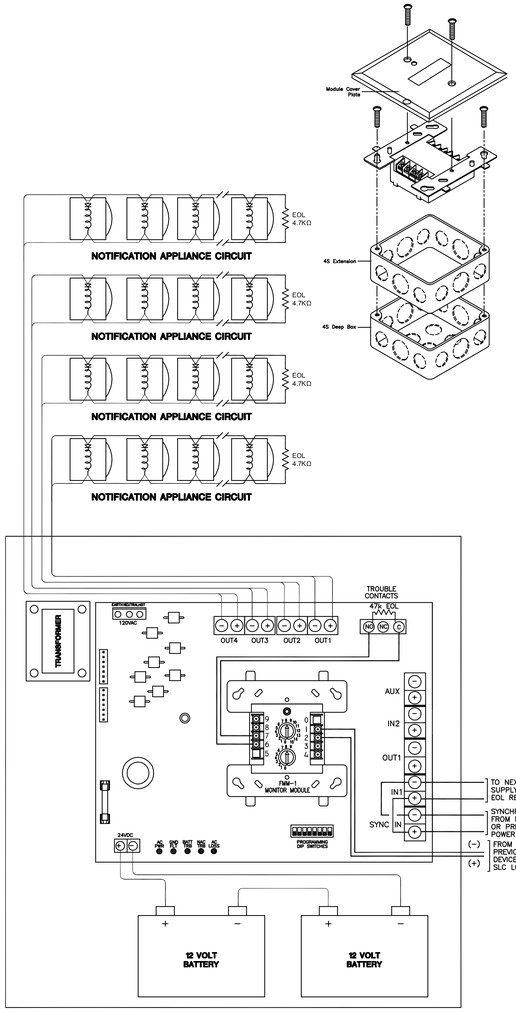
5-9/16" wide x 3-3/4" high x 2-1/2" deep, three-gang electrical box (FireLite P/N 10103 or equivalent)

NOTE:
THE FDU-80 CAN ONLY BE MOUNTED IN A 3-GANG ELECTRICAL BOX WITH A MINIMUM DEPTH OF 2-1/2".

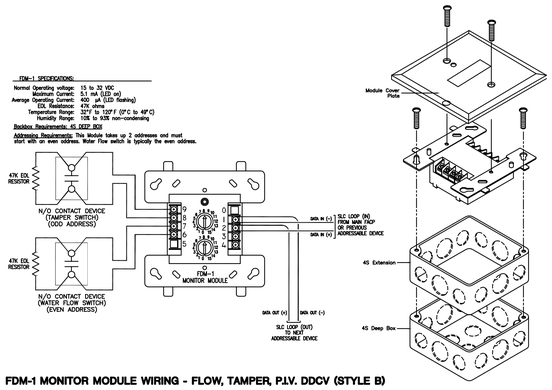
THE FDU-80 CANNOT BE MOUNTED IN THREE GANGABLE ELECTRICAL SWITCH BOXES CONNECTED TOGETHER.

FDU-80 FIRE ALARM ANNUNCIATOR

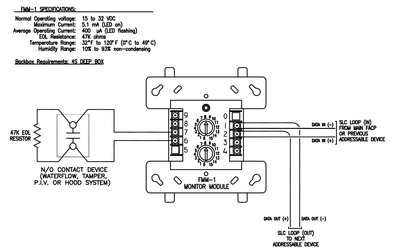




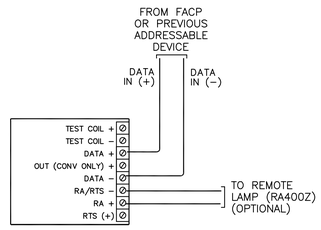
POWER SUPPLY WIRING (SYNC TURN-ON)



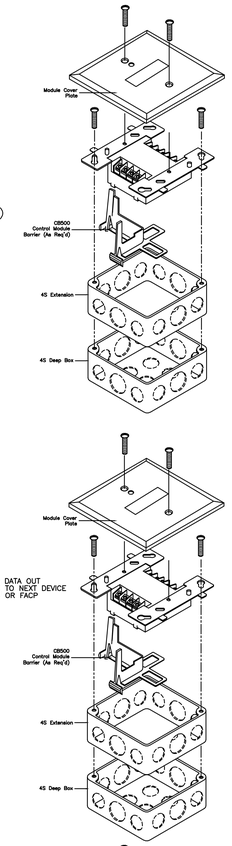
FDM-1 MONITOR MODULE WIRING - FLOW, TAMPER, P.I.V. DDCV (STYLE B)

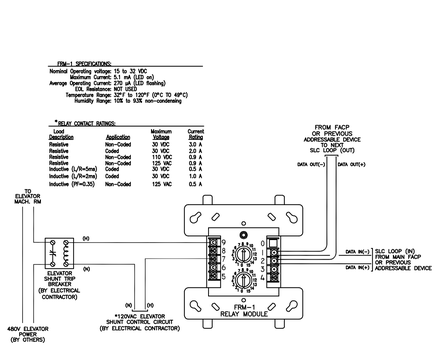


FMM-1 MONITOR MODULE WIRING - FLOW, TAMPER, P.I.V. (STYLE B)



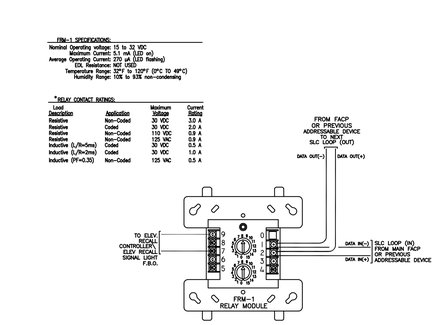
DNR DUCT DETECTOR WIRING (WITH OPTIONAL REMOTE LED)



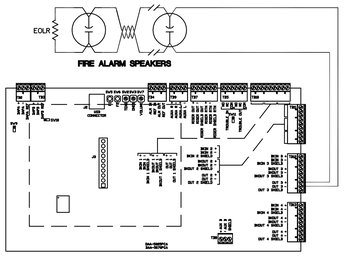


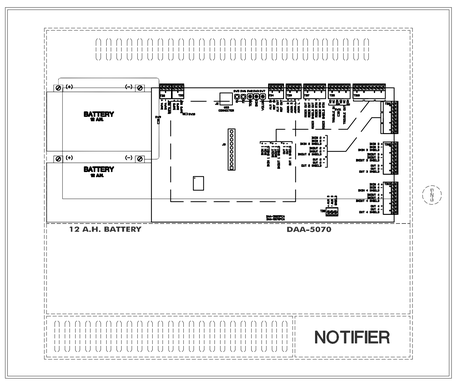
FRM-1 RELAY MODULE WIRING (ELEVATOR SHUNT TRIP)

NBG-12LX MANUAL STATION WIRING

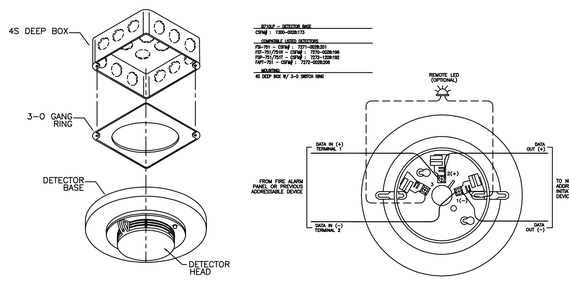


FRM-1 RELAY MODULE WIRING (ELEVATOR RECALL\RECALL SIGNAL LIGHT)

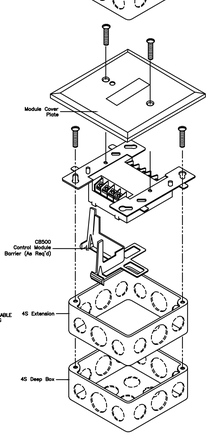


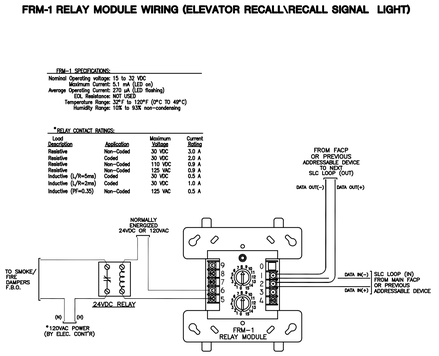


TRANSPONDER (TYP)



B710LP ADDRESSABLE SMOKE/HEAT DETECTOR BASE WIRING





FRM-1 RELAY MODULE WIRING (DAMPER CONTROL)

Pyro-Comm Systems, Inc.
Fire, Life Safety and Security System Design and Installation
C-10 #612153 ACO 3231

CORPORATE OFFICE
15531 Container Lane
Huntington Beach, CA 92649
T(714)902-8000 F(714)902-8001

SAN DIEGO REGIONAL OFFICE
5115 Avenida Encinas Ste.G
Carlsbad, CA 92008
T(760)930-6014 F(760)930-6015

NOTIFIER by Honeywell
FACTORY AUTHORIZED DISTRIBUTOR
NESCO Affiliate

Signatures

STATE OF CALIFORNIA
LICENSED ELECTRICAL CONTRACTOR
C10-612153
EXP. 02-28-11

Approvals

NOTE: If this scale is not 1" this sheet is Not To Scale

Rev	Issued For	Date	By
4	AS BUILTS	3/7/12	JC
3	PER PCO#551	12/06/11	BKR
2	FIRE DEPT. COMMENTS	12/06/11	BKR
1	ENGINEER REVIEW COMMENTS	05/10/10	MAL
A	ISSUED FOR PLAN CHECK	02/29/10	JA

Project :
CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO, CA 93407
STUDENT RECREATION CENTER EXPANSION AND REMODEL
W.O. # : 2010035

Sheet Title :
FIRE ALARM WIRING DETAILS

Drawn By : J.AREVALO
DATE : 08/23/10
Cad File : M:\CAL POLY SLO\ RECREATION CENTER\ FA2.02-REC CTR-WR

Sheet Number :
FA2.02

ASBUILT SET

ASBUILT SET

APPENDIX D

WATER-BASED SUPPRESSION SYSTEM – HYDRAULIC CALCULATIONS

SUBMITTAL REVIEW

Date: November 17, 2010

Project: California Polytechnic State University SLO Recreation Center Expansion & Remodel
CPSUSLO Project No MAJ08-MJ0043

Contractor: Sundt Construction Inc.

Section: **21 12 00**
Submittal: **#211200-01-1**

Reviewed by: Mirno Del Rosario

The submittals have been reviewed for conformance to the Contract Documents. Our review is contingent on the fact that the Contractor has reviewed and certified submittals as conforming to the Drawings and Specifications and shall be responsible for verifying conformance of equipment as delivered with final shop submittals and Contract Documents per Section 01300.

This document has been reviewed for general conformance and compliance with the design concept of the project and information given in the Contract Documents. Any action shown is subject to the requirements of the Contract Documents. Approval of a specific item does not include approval of the assembly of which the item is a component. Contractor is responsible for: Confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating and performing the Work with that of all other trades and performing all Work in a safe and satisfactory manner. Any discrepancies between the Contract Documents and Contractor's submittal shall be the responsibility of the Contractor.

Section: 21 12 00 **Action:** REV, RNR
Paragraph: 1.3A, 1.4A, B, C, D and E
Description: Existing Gymnasium Fire Sprinkler Piping Shop Drawings, Product Data and Hydraulic Calculation.
Notes: Subject to the Approval of The Fire Department. Accepted as Submitted

---

LEGEND:

REV:	Reviewed	RES:	Resubmit
NC:	Note Corrections	RNR:	Resubmittal Not Required
REJ:	Rejected		

21 12 00-0-01-1

CANNONDESIGN

A. ■ NO EXCEPTIONS TAKEN
No further review of Submittal is required.

B. ☐ MAKE CORRECTIONS NOTED
Incorporate corrections in work; resubmission is not required, unless otherwise noted.

C. ☐ REVISE AND RESUBMIT
Revise as noted and resubmit for further review.

D. ☐ REJECTED
Submittal is not in compliance with Contract Documents.

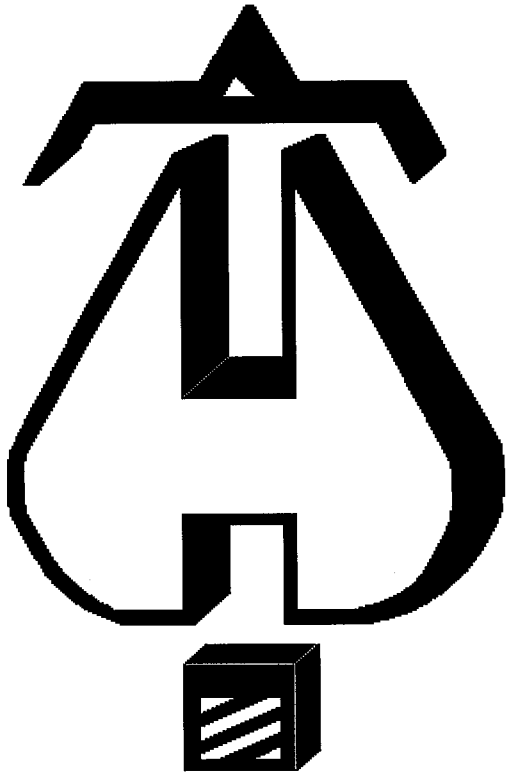
E. ☐ FOR RECORD ONLY
Received for record purposes only.

Review is for conformance with the design concept of this project. This Submittal has been reviewed for general compliance with Contract Documents. Contractor is responsible for quantities, dimensions and compliance with Contract Documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if Submittal deviates from Contract Documents and does not indicate of note deviations.

BY LTaniguchi DATE 11/18/10

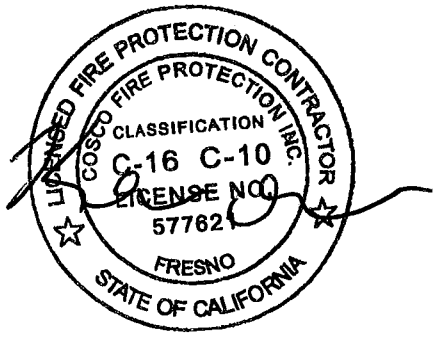
P2S Engineering, Inc.
5000 East Spring Street, 8th Floor
Long Beach, CA USA 90815-5218

T 562.497.2999
F 562.497.2990
www.p2seng.com



. . . Fire Protection by Computer Design

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE AVE.
SUITE #108
FRESNO, CA. 93722
(559) 275-3795



Job Name	:	CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407
Building	:	EXIST GYM, HIGH ROOF, REMOTE AREA E1
Location	:	RECREATION CENTER EXPANSION
System	:	E-HIGH
Contract	:	FD-1075
Data File	:	CALPOLY-E1HIGHROOF.WXF

Hydraulic Design Information Sheet

Name - CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407 Date - 11-04-2010
Location - RECREATION CENTER EXPANSION
Building - EXIST GYM, HIGH ROOF, REMOTE AREA E1 System No. - E-HIGH
Contractor - COSCO FIRE PROTECTION INC. Contract No. - FD-1075
Calculated By - KO Drawing No. - FP-E2 PIPE
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 65'-6"
Occupancy - LIGHT HAZARD

SYSTEM DESIGN

(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other
Specific Ruling Made By Date

Area of Sprinkler Operation	- 1500	System Type	Sprinkler/Nozzle
Density	- .10	(X) Wet	Make VIKING
Area Per Sprinkler	- 163	( ) Dry	Model UPRIGHT
Elevation at Highest Outlet	- 65'-6"	( ) Deluge	Size 1/2"
Hose Allowance - Inside	- 100	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance	- NA	( ) Other	Temp.Rat.155
Hose Allowance - Outside	- 0		

Note NFPA #13 2002, 11.2.3.2

Calculation Summary: Flow Required - 278.75 Press Required - 60.20 BOR
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:		Pump Data:		Tank or Reservoir:
Date of Test	- 3-8-2010			Cap. -
Time of Test	- 3 PM	Rated Cap.-		Elev.-
Static Press	- 140	@ Press	-	
Residual Press	- 132	Elev.	-	Well
Flow	- 1186			Proof Flow
Elevation	- 0			

Location - FIRE HYDRANT #47 & #51 ON SITE

Source of Information - FLOW TEST PERFORMED ON SITE 3-8-2010
BY CANNON ENGINEERING , RESULTS ATTACHED TO CALCS.

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

	( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
R	( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
A	( ) Mult. Row		( ) Open Shelf	
C				
K	Flue Spacing		Clearance:Storage to Ceiling	
	Longitudinal		Transverse	

Horizontal Barriers Provided:

Water Supply Curve (C)

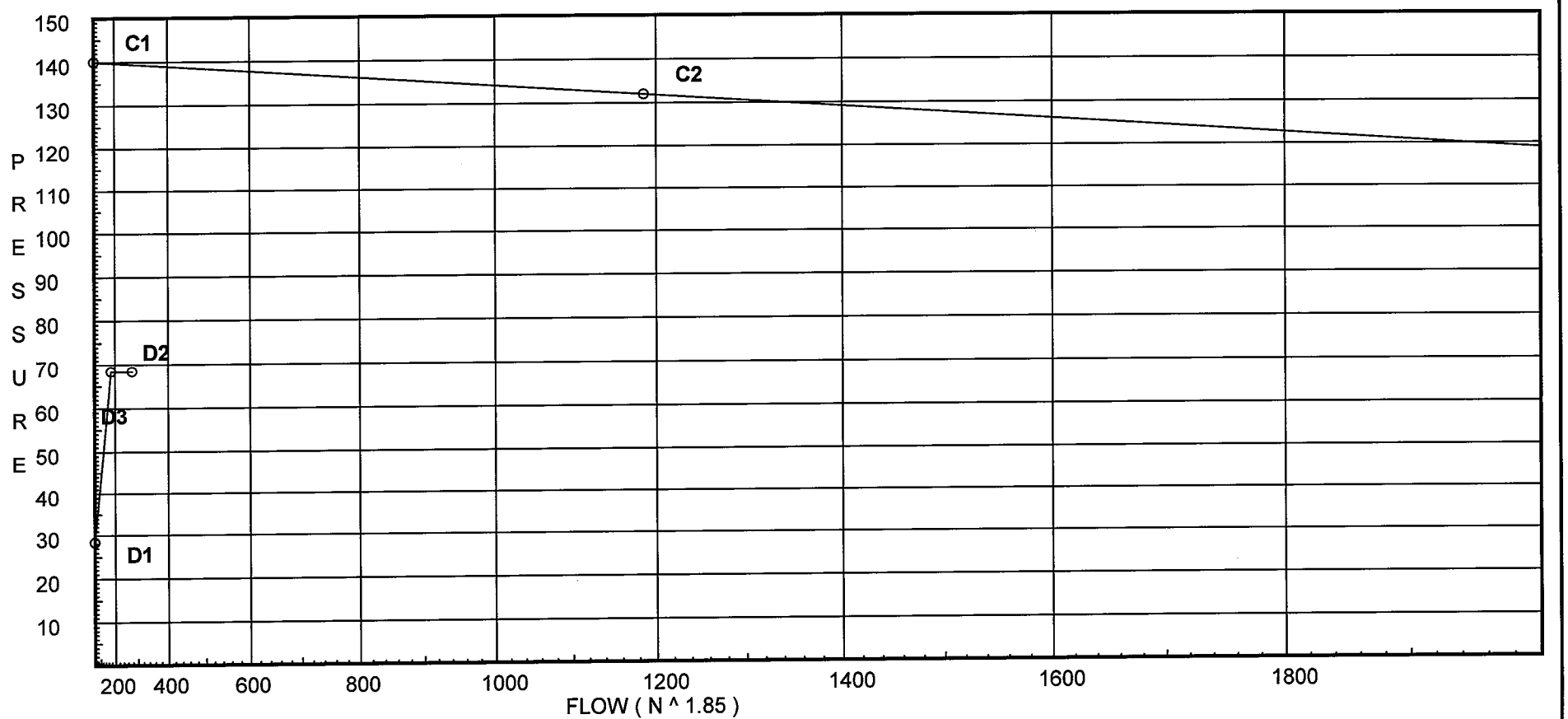
COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

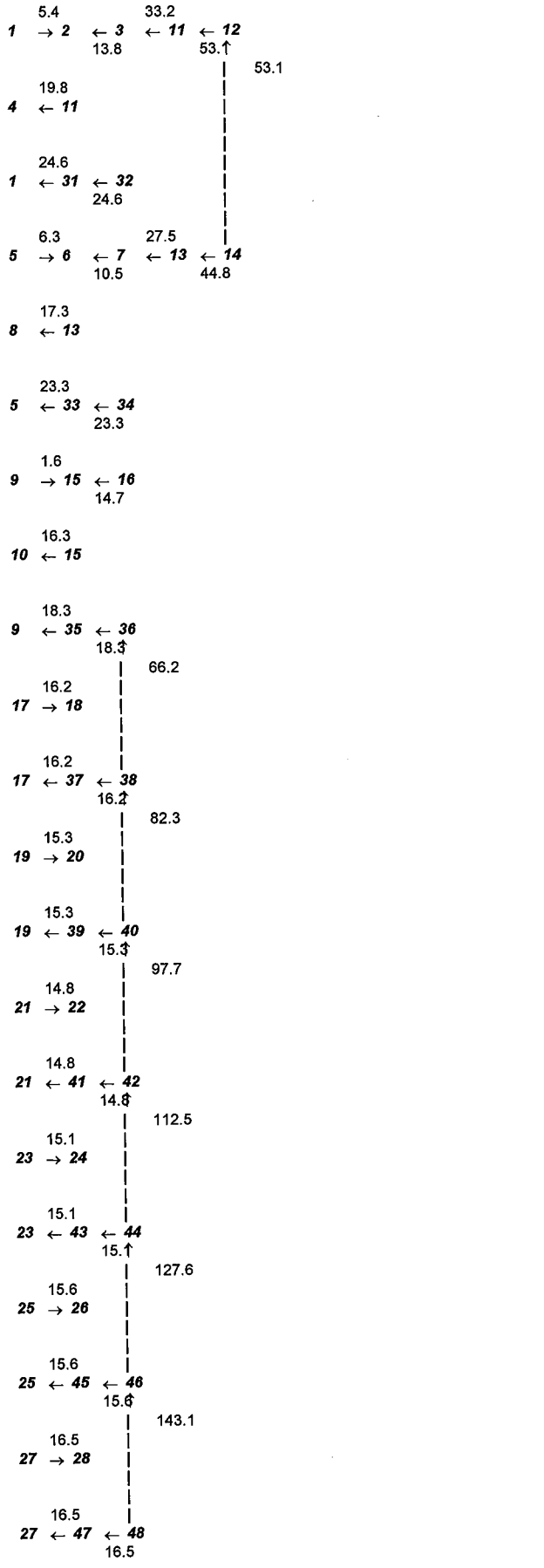
Date 11-04-2010

City Water Supply:
- C1 - Static Pressure : 140
- C2 - Residual Pressure: 132
- C2 - Residual Flow : 1186

Demand:

D1 - Elevation	:	28.368
D2 - System Flow	:	178.749
D2 - System Pressure	:	68.392
Hose (Adj City)	:	
Hose (Demand)	:	100
D3 - System Demand	:	278.749
Safety Margin	:	71.058

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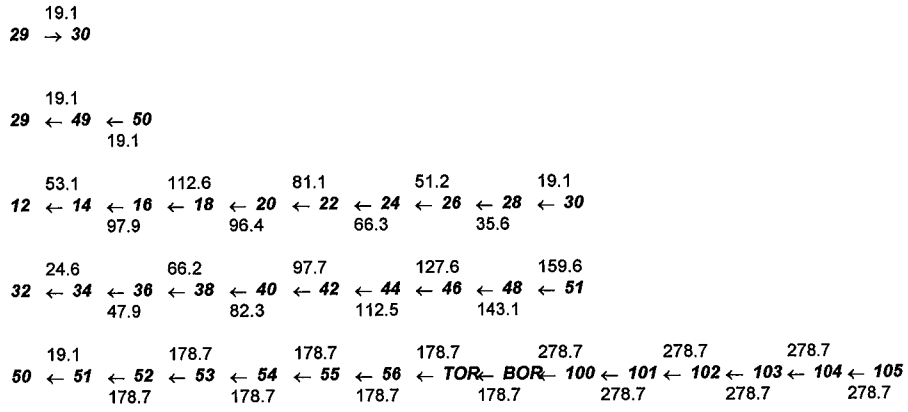
1 → 2 ← 3
13.8
33.2
← 11 ← 12
53.1
53.1
19.8
4 ← 11
24.6
1 ← 31 ← 32
24.6
6.3
5 → 6 ← 7
10.5
27.5
← 13 ← 14
44.8
17.3
8 ← 13
23.3
5 ← 33 ← 34
23.3
1.6
9 → 15 ← 16
14.7
16.3
10 ← 15
18.3
9 ← 35 ← 36
18.3
66.2
16.2
17 → 18
16.2
17 ← 37 ← 38
16.2
82.3
15.3
19 → 20
15.3
19 ← 39 ← 40
15.3
97.7
14.8
21 → 22
14.8
21 ← 41 ← 42
14.8
112.5
15.1
23 → 24
15.1
23 ← 43 ← 44
15.1
127.6
15.6
25 → 26
15.6
25 ← 45 ← 46
15.6
143.1
16.5
27 → 28
16.5
27 ← 47 ← 48
16.5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29 → 30
19.1
29 ← 49 ← 50
19.1
53.1 112.6 81.1 51.2 19.1
12 ← 14 ← 16 ← 18 ← 20 ← 22 ← 24 ← 26 ← 28 ← 30
97.9 96.4 66.3 35.6
24.6 66.2 97.7 127.6 159.6
32 ← 34 ← 36 ← 38 ← 40 ← 42 ← 44 ← 46 ← 48 ← 51
47.9 82.3 112.5 143.1
19.1 178.7 178.7 178.7 278.7 278.7 278.7
50 ← 51 ← 52 ← 53 ← 54 ← 55 ← 56 ← TOR ← BOR ← 100 ← 101 ← 102 ← 103 ← 104 ← 105
178.7 178.7 178.7 178.7 278.7 278.7 278.7

Fittings Used Summary

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Fitting Legend Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
Avk	Alarm Viking J1								10		13		20	23							
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Pressure / Flow Summary - STANDARD

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Date 11-04-2010

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
1	51.0	5.6	11.81	na	19.25	0.1	163	7.0
2	51.0	5.6	11.77	na	19.21	0.1	163	7.0
3	51.0	5.6	12.02	na	19.41	0.1	163	7.0
11	51.0		13.07	na				
4	51.0	5.6	12.56	na	19.85	0.1	163	7.0
31	51.0		20.98	na				
5	59.5	5.6	9.12	na	16.91	0.1	163	7.0
6	59.5	5.6	9.06	na	16.86	0.1	163	7.0
7	59.5	5.6	9.21	na	17.0	0.1	163	7.0
13	59.5		9.95	na				
8	59.5	5.6	9.56	na	17.32	0.1	163	7.0
33	59.5		17.36	na				
9	65.5	5.6	8.83	na	16.64	0.1	163	7.0
15	65.5		8.82	na				
10	65.5	5.6	8.47	na	16.3	0.1	163	7.0
35	65.5		14.92	na				
17	69.0		8.58	na				
37	69.0		13.58	na				
19	78.0		5.19	na				
39	78.0		9.72	na				
21	78.0		5.85	na				
41	78.0		10.09	na				
23	69.0		9.88	na				
43	69.0		14.29	na				
25	65.5		11.66	na				
45	65.5		16.32	na				
27	59.5		14.41	na				
47	59.5		19.59	na				
29	51.0		18.17	na				
49	51.0		24.99	na				
12	50.0		14.38	na				
14	58.5		11.03	na				
16	64.5		9.34	na				
18	68.0		8.92	na				
20	70.0		8.48	na				
22	70.0		9.15	na				
24	68.0		10.23	na				
26	64.5		12.0	na				
28	58.5		14.74	na				
32	58.5		17.95	na				
34	64.5		15.38	na				
36	68.0		13.96	na				
38	70.0		13.25	na				
40	70.0		13.37	na				
42	68.0		14.59	na				
44	64.5		16.32	na				
46	58.5		19.44	na				
48	58.5		20.13	na				
50	53.0		24.26	na				
51	53.0		24.29	na				
52	53.0		26.77	na				
53	50.0		29.97	na				
54	8.3		49.85	na				
55	8.3		50.86	na				
56	7.2		52.12	na				
TOR	11.2		51.42	na				
BOR	0.0		60.2	na	100.0			
100	0.0		60.46	na				
101	0.0		60.6	na				
102	0.0		60.85	na				
103	0.0		67.95	na				
104	0.0		68.19	na				

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
105	0.0		68.39	na				

The maximum velocity is 10.52 and it occurs in the pipe between nodes 51 and 52

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
1	-5.40	1.38		0.0	14.200	11.815		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
2	-5.4	-0.0030		0.0	14.200	-0.043		Vel = 1.16
2	19.21	1.38		0.0	14.200	11.772		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
3	13.81	0.0173		0.0	14.200	0.245		Vel = 2.96
3	19.42	1.38	1T	6.0	6.000	12.017		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
11	33.23	0.0875		0.0	12.000	1.050		Vel = 7.13
11	19.84	1.61	1T	8.0	1.000	13.067		
to		120.0		0.0	8.000	0.433		
12	53.07	0.0983		0.0	9.000	0.885		Vel = 8.36
	0.0							
	53.07					14.385		K Factor = 13.99
4	19.85	1.38	1T	6.0	9.000	12.561		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
11	19.85	0.0337		0.0	15.000	0.506		Vel = 4.26
	0.0							
	19.85					13.067		K Factor = 5.49
1	24.65	1.38	1T	6.0	176.000	11.815		
to		120.0		0.0	6.000	0.0		
31	24.65	0.0504		0.0	182.000	9.170		Vel = 5.29
31	0.0	1.61	1T	8.0	1.000	20.985		
to		120.0		0.0	8.000	-3.248		
32	24.65	0.0238		0.0	9.000	0.214		Vel = 3.88
	0.0							
	24.65					17.951		K Factor = 5.82
5	-6.34	1.38		0.0	14.200	9.123		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
6	-6.34	-0.0041		0.0	14.200	-0.058		Vel = 1.36
6	16.86	1.38		0.0	14.200	9.065		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
7	10.52	0.0104		0.0	14.200	0.148		Vel = 2.26
7	17.00	1.38	1T	6.0	6.000	9.213		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
13	27.52	0.0618		0.0	12.000	0.741		Vel = 5.90
13	17.31	1.61	1T	8.0	1.000	9.954		
to		120.0		0.0	8.000	0.433		
14	44.83	0.0719		0.0	9.000	0.647		Vel = 7.06
	0.0							
	44.83					11.034		K Factor = 13.50
8	17.32	1.38	1T	6.0	9.000	9.561		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
13	17.32	0.0262		0.0	15.000	0.393		Vel = 3.72
	0.0							
	17.32					9.954		K Factor = 5.49
5	23.25	1.38	1T	6.0	176.000	9.123		
to		120.0		0.0	6.000	0.0		
33	23.25	0.0452		0.0	182.000	8.233		Vel = 4.99

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
33	0.0	1.61	1T	8.0	1.000	17.356		
to		120.0		0.0	8.000	-2.166		
34	23.25	0.0213		0.0	9.000	0.192		Vel = 3.66
	0.0							
	23.25					15.382		K Factor = 5.93
9	-1.63	1.38	1T	6.0	6.000	8.828		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
15	-1.63	-0.0003		0.0	12.000	-0.004		Vel = 0.35
15	16.30	1.61	1T	8.0	1.000	8.824		
to		120.0		0.0	8.000	0.433		
16	14.67	0.0091		0.0	9.000	0.082		Vel = 2.31
	0.0							
	14.67					9.339		K Factor = 4.80
10	16.30	1.38	1T	6.0	9.000	8.472		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
15	16.3	0.0235		0.0	15.000	0.352		Vel = 3.50
	0.0							
	16.30					8.824		K Factor = 5.49
9	18.27	1.38	1T	6.0	204.400	8.828		
to		120.0		0.0	6.000	0.0		
35	18.27	0.0289		0.0	210.400	6.089		Vel = 3.92
35	0.0	1.61	1T	8.0	1.000	14.917		
to		120.0		0.0	8.000	-1.083		
36	18.27	0.0137		0.0	9.000	0.123		Vel = 2.88
	0.0							
	18.27					13.957		K Factor = 4.89
17	-16.17	1.61	1T	8.0	1.000	8.581		
to		120.0		0.0	8.000	0.433		
18	-16.17	-0.0109		0.0	9.000	-0.098		Vel = 2.55
	0.0							
	-16.17					8.916		K Factor = -5.42
17	16.17	1.38	1T	6.0	210.400	8.581		
to		120.0		0.0	6.000	0.0		
37	16.17	0.0231		0.0	216.400	4.999		Vel = 3.47
37	0.0	1.61	1T	8.0	1.000	13.580		
to		120.0		0.0	8.000	-0.433		
38	16.17	0.0109		0.0	9.000	0.098		Vel = 2.55
	0.0							
	16.17					13.245		K Factor = 4.44
19	-15.34	1.61	1T	8.0	10.000	5.191		
to		120.0		0.0	8.000	3.465		
20	-15.34	-0.0099		0.0	18.000	-0.178		Vel = 2.42
	0.0							
	-15.34					8.478		K Factor = -5.27
19	15.34	1.38	1T	6.0	210.400	5.191		
to		120.0		0.0	6.000	0.0		
39	15.34	0.0209		0.0	216.400	4.532		Vel = 3.29

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
39	0.0	1.61	1T	8.0	10.000	9.723		
to		120.0		0.0	8.000	3.465		
40	15.34	0.0099		0.0	18.000	0.178		Vel = 2.42
	0.0							
	15.34					13.366		K Factor = 4.20
21	-14.79	1.61	1T	8.0	10.000	5.853		
to		120.0		0.0	8.000	3.465		
22	-14.79	-0.0093		0.0	18.000	-0.167		Vel = 2.33
	0.0							
	-14.79					9.151		K Factor = -4.89
21	14.79	1.38	1T	6.0	210.400	5.853		
to		120.0		0.0	6.000	0.0		
41	14.79	0.0196		0.0	216.400	4.240		Vel = 3.17
41	0.0	1.61	1T	8.0	10.000	10.093		
to		120.0		0.0	8.000	4.331		
42	14.79	0.0093		0.0	18.000	0.167		Vel = 2.33
	0.0							
	14.79					14.591		K Factor = 3.87
23	-15.10	1.61	1T	8.0	1.000	9.885		
to		120.0		0.0	8.000	0.433		
24	-15.1	-0.0096		0.0	9.000	-0.086		Vel = 2.38
	0.0							
	-15.10					10.232		K Factor = -4.72
23	15.10	1.38	1T	6.0	210.400	9.885		
to		120.0		0.0	6.000	0.0		
43	15.1	0.0203		0.0	216.400	4.401		Vel = 3.24
43	0.0	1.61	1T	8.0	1.000	14.286		
to		120.0		0.0	8.000	1.949		
44	15.1	0.0096		0.0	9.000	0.086		Vel = 2.38
	0.0							
	15.10					16.321		K Factor = 3.74
25	-15.56	1.61	1T	8.0	1.000	11.660		
to		120.0		0.0	8.000	0.433		
26	-15.56	-0.0101		0.0	9.000	-0.091		Vel = 2.45
	0.0							
	-15.56					12.002		K Factor = -4.49
25	15.56	1.38	1T	6.0	210.400	11.660		
to		120.0		0.0	6.000	0.0		
45	15.56	0.0215		0.0	216.400	4.657		Vel = 3.34
45	0.0	1.61	1T	8.0	1.000	16.317		
to		120.0		0.0	8.000	3.032		
46	15.56	0.0101		0.0	9.000	0.091		Vel = 2.45
	0.0							
	15.56					19.440		K Factor = 3.53
27	-16.49	1.61	1T	8.0	1.000	14.408		
to		120.0		0.0	8.000	0.433		
28	-16.49	-0.0112		0.0	9.000	-0.101		Vel = 2.60

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	-16.49					14.740		K Factor = -4.30
27	16.49	1.38	1T	6.0	210.400	14.408		
to		120.0		0.0	6.000	0.0		
47	16.49	0.0240		0.0	216.400	5.184		Vel = 3.54
47	0.0	1.61	1T	8.0	1.000	19.592		
to		120.0		0.0	8.000	0.433		
48	16.49	0.0113		0.0	9.000	0.102		Vel = 2.60
	0.0							
	16.49					20.127		K Factor = 3.68
29	-19.13	1.61	1T	8.0	1.000	18.172		
to		120.0		0.0	8.000	13.426		
30	-19.13	-0.0149		0.0	9.000	-0.134		Vel = 3.01
	0.0							
	-19.13					31.464		K Factor = -3.41
29	19.13	1.38	1T	6.0	210.400	18.172		
to		120.0		0.0	6.000	0.0		
49	19.13	0.0315		0.0	216.400	6.819		Vel = 4.10
49	0.0	1.61	1T	8.0	1.000	24.991		
to		120.0		0.0	8.000	-0.866		
50	19.13	0.0148		0.0	9.000	0.133		Vel = 3.01
	0.0							
	19.13					24.258		K Factor = 3.88
12	53.07	2.157		0.0	14.000	14.385		
to		120.0		0.0	0.0	-3.681		
14	53.07	0.0236		0.0	14.000	0.330		Vel = 4.66
14	44.84	2.157		0.0	12.300	11.034		
to		120.0		0.0	0.0	-2.599		
16	97.91	0.0735		0.0	12.300	0.904		Vel = 8.60
16	14.67	2.157		0.0	11.500	9.339		
to		120.0		0.0	0.0	-1.516		
18	112.58	0.0950		0.0	11.500	1.093		Vel = 9.88
18	-16.17	2.157		0.0	6.000	8.916		
to		120.0		0.0	0.0	-0.866		
20	96.41	0.0713		0.0	6.000	0.428		Vel = 8.46
20	-15.34	2.157		0.0	13.000	8.478		
to		120.0		0.0	0.0	0.0		
22	81.07	0.0518		0.0	13.000	0.673		Vel = 7.12
22	-14.79	2.157		0.0	6.000	9.151		
to		120.0		0.0	0.0	0.866		
24	66.28	0.0358		0.0	6.000	0.215		Vel = 5.82
24	-15.10	2.157		0.0	11.500	10.232		
to		120.0		0.0	0.0	1.516		
26	51.18	0.0221		0.0	11.500	0.254		Vel = 4.49
26	-15.56	2.157		0.0	12.300	12.002		
to		120.0		0.0	0.0	2.599		
28	35.62	0.0113		0.0	12.300	0.139		Vel = 3.13

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
28	-16.49	2.157		0.0	14.000	14.740		
to		120.0		0.0	0.0	16.674		
30	19.13	0.0036		0.0	14.000	0.050		Vel = 1.68
	0.0							
	19.13					31.464		K Factor = 3.41
32	24.65	2.635		0.0	14.000	17.951		
to		120.0		0.0	0.0	-2.599		
34	24.65	0.0021		0.0	14.000	0.030		Vel = 1.45
34	23.25	2.635		0.0	12.300	15.382		
to		120.0		0.0	0.0	-1.516		
36	47.9	0.0074		0.0	12.300	0.091		Vel = 2.82
36	18.27	2.635		0.0	11.500	13.957		
to		120.0		0.0	0.0	-0.866		
38	66.17	0.0134		0.0	11.500	0.154		Vel = 3.89
38	16.17	2.635		0.0	6.000	13.245		
to		120.0		0.0	0.0	0.0		
40	82.34	0.0202		0.0	6.000	0.121		Vel = 4.84
40	15.34	2.635		0.0	13.000	13.366		
to		120.0		0.0	0.0	0.866		
42	97.68	0.0276		0.0	13.000	0.359		Vel = 5.75
42	14.79	2.635		0.0	6.000	14.591		
to		120.0		0.0	0.0	1.516		
44	112.47	0.0357		0.0	6.000	0.214		Vel = 6.62
44	15.10	2.635		0.0	11.500	16.321		
to		120.0		0.0	0.0	2.599		
46	127.57	0.0452		0.0	11.500	0.520		Vel = 7.51
46	15.56	2.635		0.0	12.300	19.440		
to		120.0		0.0	0.0	0.0		
48	143.13	0.0559		0.0	12.300	0.687		Vel = 8.42
48	16.49	2.635	1T	16.474	9.500	20.127		
to		120.0		0.0	16.474	2.382		
51	159.62	0.0684		0.0	25.974	1.777		Vel = 9.39
	0.0							
	159.62					24.286		K Factor = 32.39
50	19.13	2.635	1T	16.474	4.500	24.258		
to		120.0		0.0	16.474	0.0		
51	19.13	0.0013		0.0	20.974	0.028		Vel = 1.13
51	159.62	2.635	2E	16.474	13.000	24.286		
to		120.0		0.0	16.474	0.0		
52	178.75	0.0844		0.0	29.474	2.487		Vel = 10.52
52	0.0	2.635	2E	16.474	6.000	26.773		
to		120.0		0.0	16.474	1.299		
53	178.75	0.0844		0.0	22.474	1.896		Vel = 10.52
53	0.0	3.26	2E	18.815	42.000	29.968		
to		120.0		0.0	18.815	18.060		
54	178.75	0.0299		0.0	60.815	1.820		Vel = 6.87
54	0.0	3.26	2E	18.815	15.000	49.848		
to		120.0		0.0	18.815	0.0		
55	178.75	0.0299		0.0	33.815	1.011		Vel = 6.87

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
55	0.0	3.26	1T	20.159	6.000	50.859		
to		120.0		0.0	20.159	0.476		
56	178.75	0.0299		0.0	26.159	0.783		Vel = 6.87
56	0.0	3.26	1T	20.159	5.000	52.118		
to		120.0	1E	9.408	29.567	-1.732		
TOR	178.75	0.0299		0.0	34.567	1.034		Vel = 6.87
TOR	0.0	3.26	1E	9.408	7.000	51.420		
to		120.0	1Fsp	0.0	24.192	7.851		* Fixed loss = 3
BOR	178.75	0.0299	1G	1.344	31.192	0.933		Vel = 6.87
			1Avk	13.44				
BOR	100.00	6.357	3E	52.808	6.000	60.204		Qa = 100
to		120.0	1T	37.72	90.528	0.0		
100	278.75	0.0026		0.0	96.528	0.254		Vel = 2.82
100	0.0	6.16	4L	51.645	10.000	60.458		
to		140.0		0.0	51.645	0.0		
101	278.75	0.0023		0.0	61.645	0.142		Vel = 3.00
101	0.0	6.16	6L	77.467	30.000	60.600		
to		140.0		0.0	77.467	0.0		
102	278.75	0.0023		0.0	107.467	0.248		Vel = 3.00
102	0.0	6.16	2E	40.168	6.000	60.848		
to		140.0		0.0	40.168	7.000		* Fixed loss = 7
103	278.75	0.0023		0.0	46.168	0.107		Vel = 3.00
103	0.0	6.16	1G	4.304	30.000	67.955		
to		140.0	2L	25.822	73.163	0.0		
104	278.75	0.0023	1T	43.037	103.163	0.238		Vel = 3.00
104	0.0	8.27	2L	41.12	260.000	68.193		
to		140.0	1G	6.326	102.800	0.0		
105	278.75	0.0005	1T	55.354	362.800	0.199		Vel = 1.66
	0.0							
	278.75					68.392		K Factor = 33.71

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 4:40 PM
Hydrant Site ID#: 47 **Class**_____ **Elev. @ Hydrant:** 330.57
Street Address Adjacent to Hydrant: Campus Way
Number of ports flowed: 1

Static:	150	*psi before flowing*
Residual:		*psi while flowing*
Pitot:	50	*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	1186.48	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

Number of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is opened.

Field Notes:

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 5:00 PM
Hydrant Site ID#: 51 **Class**_____ **Elev. @ Hydrant:** 346.00
Street Address Adjacent to Hydrant: Adjacent to new pool
Number of ports flowed: 1

Static:	140	*psi before flowing*
Residual:	132	*psi while flowing*
Pitot:		*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	0.00	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

# of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is

Field Notes:

VIKING

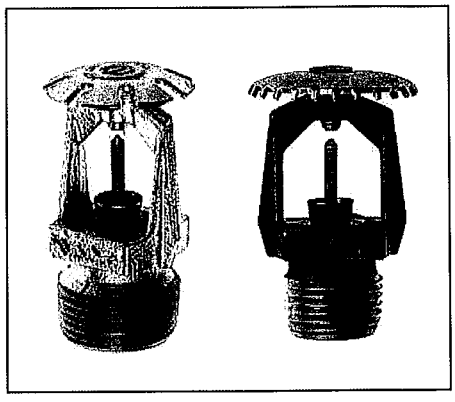
TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Microfast® and MicrofastHP® Quick Response Upright and Conventional (Old Style) Sprinklers are small, thermosensitive, glass-bulb spray sprinklers available in several different finishes, temperature ratings, and K-Factors to meet design requirements. The special Polyester and Teflon® coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are cULus listed as corrosion resistant as indicated in the Approval Chart. (Note: FM Global has no approval classification for Teflon® and Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Class 2020
NYC Approved: Calendar Number 219-76-SA and MEA 89-92-E, Volume 16
ABS Certified: Certificate 04-HS407984B-PDA
VdS Approved: Certificate G4060054, G4060056, G4880046, G4930039, and G4980020
LPC Approved: Ref. No. 096e/03, TE30401, and TE30872
CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001, 0832-CPD-2003, 0786-CPD-40131, and 0786-CPD-40171
MED Certified: Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008
NOTE: Other International approval certificates are available upon request.

Refer to the Approval Chart on page 51d and Design Criteria on page 51e for cULus and FM approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 1987.
Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: Sprinklers VK315 and VK340 are rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. All other Part Nos. not mentioned above are rated to a maximum 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: Refer to the Approval Chart
Nominal K-Factor: Refer to the Approval Chart
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: Refer to the Approval Chart

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass for Sprinklers 06661B, 06766B, 07060, and 12281. Brass UNS-C84400 for all other sprinklers.
Deflector: Brass UNS-C23000 or Copper UNS-C19500 for Sprinklers 06661B and 12281. Copper UNS-C19500 for Sprinklers 06665B, 06764B, and 07060. Brass UNS-C26000 for all other Sprinklers.
Bushing (for Sprinklers 06719B, 06717B, and 12286): Brass UNS-C36000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Screw: Brass UNS-C36000

Form No. F_080488 Replaces page 51a-e, dated April 25, 2008. (Updated sprinkler materials. Min. operating pressure for LPCB and CE approval ONLY is 5 psi (0.35 bar). Added alternate frame material for Sprinklers 06661B, 06766B, 07060, and 12281. Removed VdS Approval from Sprinklers 06665B, 06764B, and 14817.)

VIKING | TECHNICAL DATA | MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Pip Cap Attachment (for Sprinklers VK300 and VK325): Brass UNS-C36000
For Teflon® Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-Teflon® Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed

Ordering Information: (Also refer to the current Viking price list.)
Order Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome-Enloy® = F, White Polyester = M-/W, Black Polyester = M-/B, and Black Teflon® = N
Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK300 with a 1/2" thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 06661BAB

Available Finishes And Temperature Ratings:
Refer to Table 1

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:
Standard Wrench: Part No. 10896W/B (available since 2000)

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION
Refer to appropriate NFPA Installation Standards.

5. OPERATION
During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE
Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY
The Viking Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE
For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome-Enloy®, White Polyester, Black Polyester, and Black Teflon®
Corrosion-Resistant Coatings[4]: White Polyester, Black Polyester, and Black Teflon®

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated on pages 51d. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and Teflon® coatings.

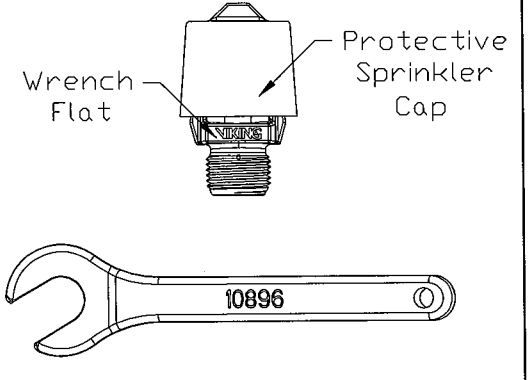


Figure 1:
Standard Sprinkler Wrench 10896W/B

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart

Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers
Maximum 175 PSI (12 bar) WWP

KEY: Temperature, Finish, Escutcheon (if applicable) — e.g. VK300 A1X

Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 51e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM[7]	NYC[8]	VdS	LPCB	CE	⚙
Upright-Standard Orifice														
06661B	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A2	A3	A2	--	--	--	--
07060	VK345	--	15 mm	5.6	80.6	2-3/16	56	--	A3	--	A3	A3	B3[12]	B3[14]
Conventional-Standard Orifice														
06766B	VK310	1/2"	15 mm	5.6	80.6	2-3/16	56	A3	--	A3	--	A3	B3[12]	B3[14]
Upright-Large Orifice														
06665B	VK350	3/4"	--	8.0	115.2	2-5/16	59	A2	A3	A2	--	A3	B3[12]	--
14817	VK350	--	20 mm	8.0	115.2	2-5/16	59	A2	A3	A2	--	A3	B3[12]	--
06764B	VK350	1/2"	15 mm	8.0	115.2	2-5/16	59	A2	--	A2	--	--	--	--
Conventional-Large Orifice														
06768B	VK354	3/4"	20 mm	8.0	115.2	2-5/16	59	A2	--	A3	--	A3	B3[12]	--
Upright-Small Orifice[10]														
06717B[11]	VK325	1/2"	15 mm	2.8	40.3	2-3/16	56	A2	A1	A2	--	--	--	--
06719B[11]	VK327	1/2"	15 mm	4.2	60.0	2-3/16	56	A2	--	A2	--	--	--	--
06931B[11]	VK327	--	10 mm	4.2	60.0	2-3/16	56	--	--	--	A3	--	E1[13]	--

Maximum 250 PSI (17 bar) WWP
Upright-Standard Orifice

Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 51e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM	NYC[9]	VdS	LPCB	CE	⚙
12281	VK315	1/2"	15 mm	5.6	80.6	2-3/16	56	A2	--	A2	--	--	--	--
Upright-Small Orifice[10]														
12286[11]	VK340	1/2"	15 mm	2.8	40.3	2-3/16	56	A2	--	A2	--	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
C - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 286 °F (141°C)
D - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
E - 155 °F (68 °C)

Approved Finishes

1 - Brass and Chrome-Enloy®
2 - Brass, Chrome-Enloy®, White Polyester[5,6], Black Polyester[5,6], and Black Teflon®[5]
3 - Brass, Chrome-Enloy®, White Polyester[5,6], and Black Polyester[5,6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.

[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.

[5] cULus Listed as corrosion resistant.

[6] Other colors are available on request with the same Listings and Approvals as the standard colors.

[7] For installation in accordance with the latest applicable FM Loss Prevention Data Sheets and Technical Advisory Bulletins.

[8] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA.

[9] Accepted for use, City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

[10] Listings and Approvals limited to Light Hazard Occupancies where allowed by the installation standards being applied, with hydraulically calculated wet systems only. **Exception:** 4.2K sprinklers may be installed on hydraulically calculated dry pipe systems where piping is corrosion resistant or internally galvanized.

[11] The sprinkler orifice is bushed.

[12] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0832-CPD-2003.

[13] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40131.

[14] ⚙ MED Certified, Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008.

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA

(We refer to the Approval Chart on page 3.)

cULus Listing Requirements:

Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers are cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers, or old style (conventional) sprinklers.

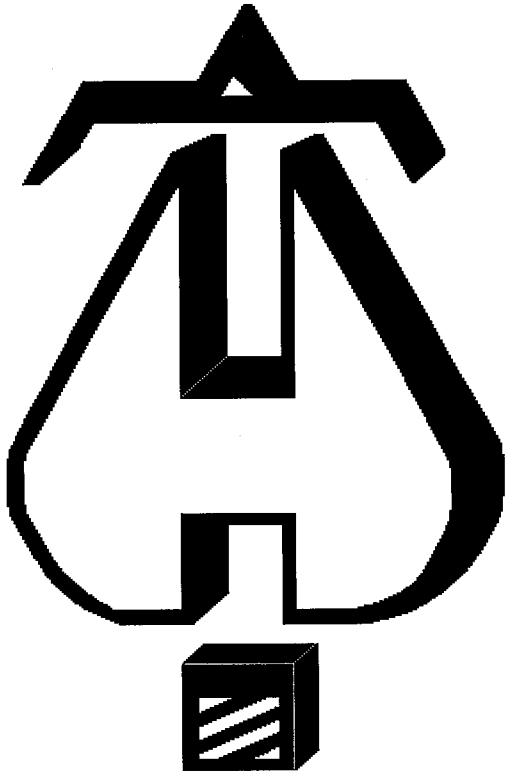
- Designed for use in Light and Ordinary Hazard occupancies *(exception: small orifice sprinklers are limited to Light Hazard where allowed by the installation standards being applied, with hydraulically calculated wet systems only).*
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed. For conventional sprinklers, refer to the installation guidelines for old style (conventional) sprinklers.

FM Approval Requirements:

For installation in accordance with the latest applicable FM Loss Prevention Data Sheets (including 2-8N) and Technical Advisory Bulletins. FM Global Loss Prevention Data Sheets and Technical Advisory Bulletins contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



. . . Fire Protection by Computer Design

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE AVE.
SUITE #108
FRESNO, CA. 93722
(559) 275-3795

Job Name	:	CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407
Building	:	EXIST GYM, HIGH ROOF, REMOTE AREA E2
Location	:	RECREATION CENTER EXPANSION
System	:	E-HIGH
Contract	:	FD-1075
Data File	:	CALPOLY-E2HIGHROOF.WXF

Hydraulic Design Information Sheet

Name - CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407 Date - 11-04-2010
Location - RECREATION CENTER EXPANSION
Building - EXIST GYM, HIGH ROOF, REMOTE AREA E2 System No. - E-HIGH
Contractor - COSCO FIRE PROTECTION INC. Contract No. - FD-1075
Calculated By - KO Drawing No. - FP-E2 PIPE
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 78'
Occupancy - LIGHT HAZARD

SYSTEM DESIGN

(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other
Specific Ruling Made By Date

Area of Sprinkler Operation	- 1500	System Type	Sprinkler/Nozzle
Density	- .10	(X) Wet	Make VIKING
Area Per Sprinkler	- 163	( ) Dry	Model UPRIGHT
Elevation at Highest Outlet	- 78'	( ) Deluge	Size 1/2"
Hose Allowance - Inside	- 100	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance	- NA	( ) Other	Temp.Rat.155
Hose Allowance - Outside	- 0		

Note NFPA #13 2002, 11.2.3.2

Calculation Summary: Flow Required - 296.40 Press Required - 69.33 BOR
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 3-8-2010		Cap. -
Time of Test - 3 PM	Rated Cap.-	Elev.-
Static Press - 140	@ Press -	
Residual Press - 132	Elev. -	Well
Flow - 1186		Proof Flow
Elevation - 0		

Location - FIRE HYDRANT #47 & #51 ON SITE

Source of Information - FLOW TEST PERFORMED ON SITE 3-8-2010
BY CANNON ENGINEERING , RESULTS ATTACHED TO CALCS.

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
( ) Mult. Row		( ) Open Shelf	

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

Horizontal Barriers Provided:

Water Supply Curve (C)

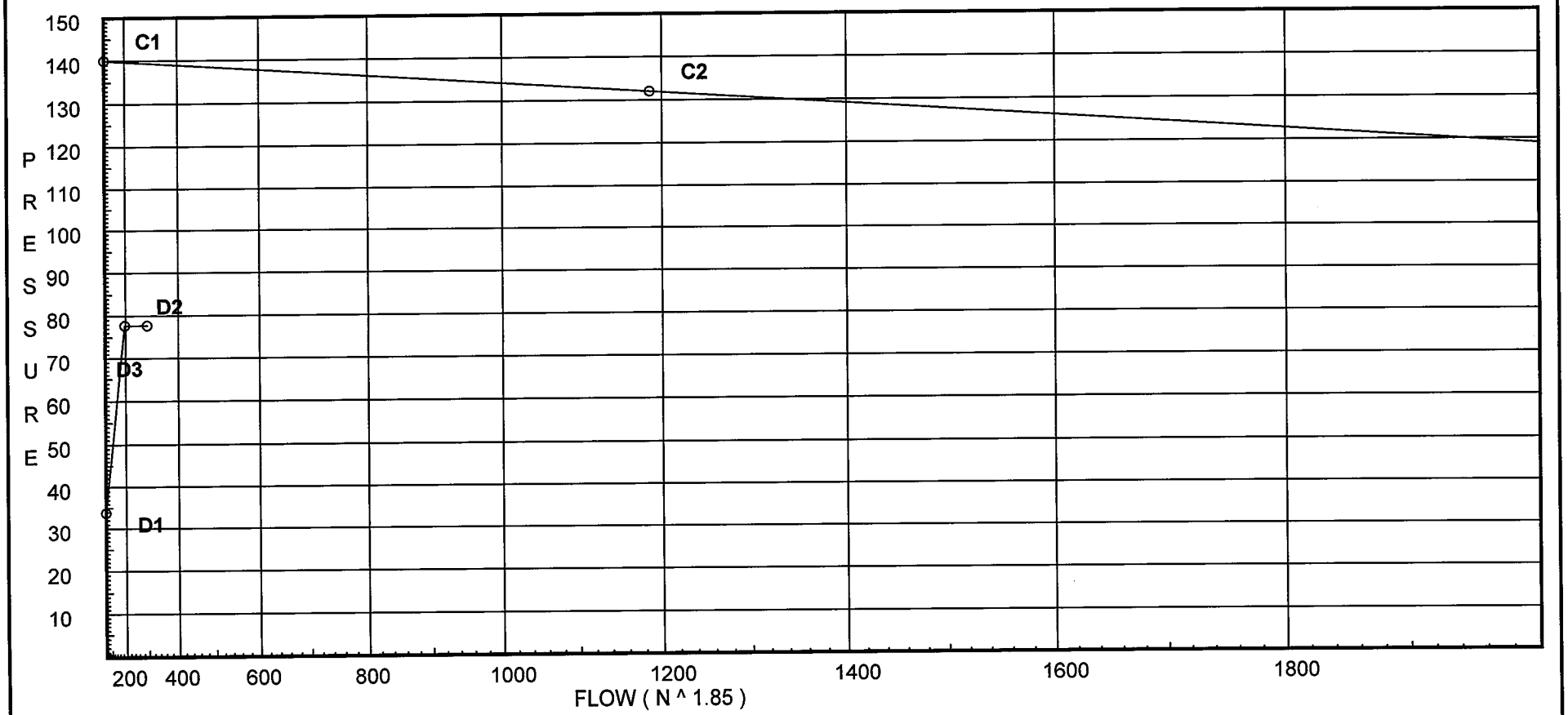
COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

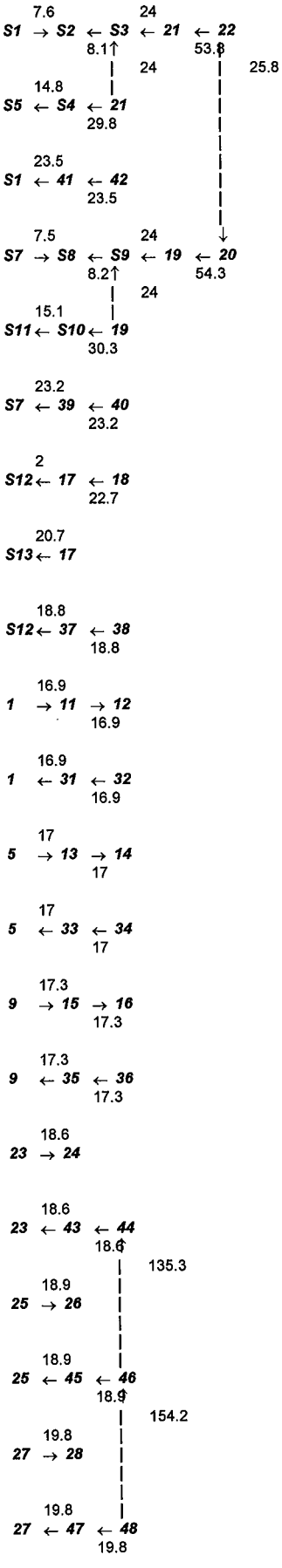
Date 11-04-2010

City Water Supply:
- C1 - Static Pressure : 140
- C2 - Residual Pressure: 132
- C2 - Residual Flow : 1186

Demand:

D1 - Elevation	:	33.782
D2 - System Flow	:	196.403
D2 - System Pressure	:	77.663
Hose (Adj City)	:	
Hose (Demand)	:	100
D3 - System Demand	:	296.403
Safety Margin	:	61.722




7.6
24
S1 → S2 ← S3 ← 21 ← 22
8.1↑
53.8
24
25.8
14.8
S5 ← S4 ← 21
29.8
23.5
S1 ← 41 ← 42
23.5
7.5
24
S7 → S8 ← S9 ← 19 ← 20
8.2↑
54.3
24
15.1
S11← S10← 19
30.3
23.2
S7 ← 39 ← 40
23.2
2
S12← 17 ← 18
22.7
20.7
S13← 17
18.8
S12← 37 ← 38
18.8
16.9
1 → 11 → 12
16.9
16.9
1 ← 31 ← 32
16.9
17
5 → 13 → 14
17
17
5 ← 33 ← 34
17
17.3
9 → 15 → 16
17.3
17.3
9 ← 35 ← 36
17.3
18.6
23 → 24
18.6
23 ← 43 ← 44
18.6↑
135.3
18.9
25 → 26
18.9
25 ← 45 ← 46
18.9↑
154.2
19.8
27 → 28
19.8
27 ← 47 ← 48
19.8

22.4
29 → 30

22.4
29 ← 49 ← 50
22.4

16.9 51.2 25.8 61.1 22.4
12 → 14 → 16 → 18 → 20 ← 22 ← 24 ← 26 ← 28 ← 30
33.9 28.5 79.6 42.2

16.9 51.2 93.3 135.3 174
32 ← 34 ← 36 ← 38 ← 40 ← 42 ← 44 ← 46 ← 48 ← 51
33.9 70.1 116.8 154.2

22.4 196.4 196.4 196.4 296.4 296.4 296.4
50 ← 51 ← 52 ← 53 ← 54 ← 55 ← 56 ← TOR ← BOR ← 100 ← 101 ← 102 ← 103 ← 104 ← 105
196.4 196.4 196.4 196.4 296.4 296.4 296.4

Fittings Used Summary

Fitting Legend Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
Avk	Alarm Viking J1								10		13		20	23							
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Pressure / Flow Summary - STANDARD

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Date 11-04-2010

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	78.0	5.6	8.03	na	15.87	0.1	91	7.0
S2	78.0	5.6	7.95	na	15.79	0.1	91	7.0
S3	78.0	5.6	8.04	na	15.88	0.1	91	7.0
21	78.0		8.42	na				
S5	78.0	5.6	7.0	na	14.82	0.1	91	7.0
S4	78.0	5.6	7.12	na	14.94	0.1	91	7.0
41	78.0		16.61	na				
S7	78.0	5.6	7.91	na	15.75	0.1	91	7.0
S8	78.0	5.6	7.83	na	15.67	0.1	91	7.0
S9	78.0	5.6	7.93	na	15.77	0.1	91	7.0
19	78.0		8.31	na				
S11	78.0	5.6	7.28	na	15.11	0.1	91	7.0
S10	78.0	5.6	7.4	na	15.23	0.1	91	7.0
39	78.0		16.29	na				
S12	69.0	5.6	13.91	na	20.88	0.1	163	7.0
17	69.0		13.91	na				
S13	69.0	5.6	13.66	na	20.7	0.1	163	7.0
37	69.0		20.35	na				
1	51.0		23.44	na				
11	51.0		22.42	na				
31	51.0		28.01	na				
5	59.5		19.73	na				
13	59.5		18.7	na				
33	59.5		24.35	na				
9	65.5		16.29	na				
15	65.5		15.98	na				
35	65.5		21.79	na				
23	69.0		14.56	na				
43	69.0		21.01	na				
25	65.5		16.43	na				
45	65.5		23.1	na				
27	59.5		19.23	na				
47	59.5		26.48	na				
29	51.0		23.02	na				
49	51.0		32.17	na				
12	50.0		22.75	na				
14	58.5		19.03	na				
16	64.5		16.3	na				
18	68.0		14.53	na				
20	70.0		13.62	na				
22	70.0		13.7	na				
24	68.0		14.87	na				
26	64.5		16.74	na				
28	58.5		19.53	na				
32	58.5		24.87	na				
34	64.5		22.29	na				
36	68.0		20.82	na				
38	70.0		20.05	na				
40	70.0		20.14	na				
42	68.0		21.34	na				
44	64.5		23.08	na				
46	58.5		26.26	na				
48	58.5		27.05	na				
50	53.0		31.48	na				
51	53.0		31.52	na				
52	53.0		34.48	na				
53	50.0		38.03	na				
54	8.3		58.26	na				
55	8.3		59.46	na				
56	7.2		60.87	na				
TOR	11.2		60.37	na				
BOR	0.0		69.33	na	100.0			

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
100	0.0		69.62	na				
101	0.0		69.78	na				
102	0.0		70.05	na				
103	0.0		77.17	na				
104	0.0		77.44	na				
105	0.0		77.66	na				

The maximum velocity is 11.55 and it occurs in the pipe between nodes 51 and 52

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S1	-7.64	1.38		0.0	14.000	8.029		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S2	-7.64	-0.0057		0.0	14.000	-0.080		Vel = 1.64
S2	15.79	1.38		0.0	14.000	7.949		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S3	8.15	0.0065		0.0	14.000	0.091		Vel = 1.75
S3	15.88	1.38	1T	6.0	2.000	8.040		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
21	24.03	0.0480		0.0	8.000	0.384		Vel = 5.15
21	29.75	1.61	1T	8.0	10.000	8.424		
to		120.0		0.0	8.000	3.465		
22	53.78	0.1007		0.0	18.000	1.813		Vel = 8.48
	0.0							
	53.78					13.702		K Factor = 14.53
S5	14.82	1.38		0.0	6.000	7.000		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S4	14.82	0.0197		0.0	6.000	0.118		Vel = 3.18
S4	14.94	1.38	1T	6.0	12.300	7.118		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
21	29.76	0.0714		0.0	18.300	1.306		Vel = 6.38
	0.0							
	29.76					8.424		K Factor = 10.25
S1	23.51	1.38	1T	6.0	180.000	8.029		
to		120.0		0.0	6.000	0.0		
41	23.51	0.0462		0.0	186.000	8.585		Vel = 5.04
41	0.0	1.61	1T	8.0	10.000	16.614		
to		120.0		0.0	8.000	4.331		
42	23.51	0.0218		0.0	18.000	0.392		Vel = 3.71
	0.0							
	23.51					21.337		K Factor = 5.09
S7	-7.46	1.38		0.0	14.000	7.911		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S8	-7.46	-0.0055		0.0	14.000	-0.077		Vel = 1.60
S8	15.68	1.38		0.0	14.000	7.834		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S9	8.22	0.0066		0.0	14.000	0.092		Vel = 1.76
S9	15.76	1.38	1T	6.0	2.000	7.926		K Factor = 5.60
to		120.0		0.0	6.000	0.0		
19	23.98	0.0479		0.0	8.000	0.383		Vel = 5.14
19	30.34	1.61	1T	8.0	10.000	8.309		
to		120.0		0.0	8.000	3.465		
20	54.32	0.1026		0.0	18.000	1.847		Vel = 8.56
	0.0							
	54.32					13.621		K Factor = 14.72
S11	15.11	1.38		0.0	6.000	7.277		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
S10	15.11	0.0203		0.0	6.000	0.122		Vel = 3.24
S10	15.23	1.38		0.0	12.300	7.399		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
19	30.34	0.0740		0.0	12.300	0.910		Vel = 6.51

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*******	Notes	******
	0.0									
	30.34					8.309		K Factor = 10.53		
S7	23.21	1.38	1T	6.0	180.000	7.911				
to		120.0		0.0	6.000	0.0				
39	23.21	0.0451		0.0	186.000	8.383		Vel = 4.98		
39	0.0	1.61	1T	8.0	10.000	16.294				
to		120.0		0.0	8.000	3.465				
40	23.21	0.0212		0.0	18.000	0.382		Vel = 3.66		
	0.0									
	23.21					20.141		K Factor = 5.17		
S12	2.05	1.38	1T	6.0	6.000	13.908		K Factor = 5.60		
to		120.0		0.0	6.000	0.0				
17	2.05	0.0005		0.0	12.000	0.006		Vel = 0.44		
17	20.69	1.61	1T	8.0	1.000	13.914				
to		120.0		0.0	8.000	0.433				
18	22.74	0.0206		0.0	9.000	0.185		Vel = 3.58		
	0.0									
	22.74					14.532		K Factor = 5.97		
S13	20.70	1.38	1T	6.0	1.000	13.659		K Factor = 5.60		
to		120.0		0.0	6.000	0.0				
17	20.7	0.0364		0.0	7.000	0.255		Vel = 4.44		
	0.0									
	20.70					13.914		K Factor = 5.55		
S12	18.84	1.38	1T	6.0	204.400	13.908				
to		120.0		0.0	6.000	0.0				
37	18.84	0.0306		0.0	210.400	6.447		Vel = 4.04		
37	0.0	1.61	1T	8.0	1.000	20.355				
to		120.0		0.0	8.000	-0.433				
38	18.84	0.0144		0.0	9.000	0.130		Vel = 2.97		
	0.0									
	18.84					20.052		K Factor = 4.21		
1	-16.93	1.38	1T	6.0	34.400	23.439				
to		120.0		0.0	6.000	0.0				
11	-16.93	-0.0251		0.0	40.400	-1.016		Vel = 3.63		
11	0.0	1.61	1T	8.0	1.000	22.423				
to		120.0		0.0	8.000	0.433				
12	-16.93	-0.0118		0.0	9.000	-0.106		Vel = 2.67		
	0.0									
	-16.93					22.750		K Factor = -3.55		
1	16.93	1.38	1T	6.0	176.000	23.439				
to		120.0		0.0	6.000	0.0				
31	16.93	0.0251		0.0	182.000	4.576		Vel = 3.63		
31	0.0	1.61	1T	8.0	1.000	28.015				
to		120.0		0.0	8.000	-3.248				
32	16.93	0.0118		0.0	9.000	0.106		Vel = 2.67		
	0.0									
	16.93					24.873		K Factor = 3.39		

Hyd. Ref. Point	Qa / Qt	Dia. "C" / Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
5	-17.02	1.38	1T	6.0	34.400	19.728		
to		120.0		0.0	6.000	0.0		
13	-17.02	-0.0254		0.0	40.400	-1.025		Vel = 3.65
13	0.0	1.61	1T	8.0	1.000	18.703		
to		120.0		0.0	8.000	0.433		
14	-17.02	-0.0120		0.0	9.000	-0.108		Vel = 2.68
	0.0							
	-17.02					19.028		K Factor = -3.90
5	17.02	1.38	1T	6.0	176.000	19.728		
to		120.0		0.0	6.000	0.0		
33	17.02	0.0254		0.0	182.000	4.620		Vel = 3.65
33	0.0	1.61	1T	8.0	1.000	24.348		
to		120.0		0.0	8.000	-2.166		
34	17.02	0.0120		0.0	9.000	0.108		Vel = 2.68
	0.0							
	17.02					22.290		K Factor = 3.60
9	-17.29	1.38	1T	6.0	6.000	16.294		
to		120.0		0.0	6.000	0.0		
15	-17.29	-0.0262		0.0	12.000	-0.314		Vel = 3.71
15	0.0	1.61	1T	8.0	1.000	15.980		
to		120.0		0.0	8.000	0.433		
16	-17.29	-0.0123		0.0	9.000	-0.111		Vel = 2.72
	0.0							
	-17.29					16.302		K Factor = -4.28
9	17.29	1.38	1T	6.0	204.400	16.294		
to		120.0		0.0	6.000	0.0		
35	17.29	0.0261		0.0	210.400	5.500		Vel = 3.71
35	0.0	1.61	1T	8.0	1.000	21.794		
to		120.0		0.0	8.000	-1.083		
36	17.29	0.0123		0.0	9.000	0.111		Vel = 2.72
	0.0							
	17.29					20.822		K Factor = 3.79
23	-18.55	1.61	1T	8.0	1.000	14.562		
to		120.0		0.0	8.000	0.433		
24	-18.55	-0.0140		0.0	9.000	-0.126		Vel = 2.92
	0.0							
	-18.55					14.869		K Factor = -4.81
23	18.55	1.38	1T	6.0	210.400	14.562		
to		120.0		0.0	6.000	0.0		
43	18.55	0.0298		0.0	216.400	6.446		Vel = 3.98
43	0.0	1.61	1T	8.0	1.000	21.008		
to		120.0		0.0	8.000	1.949		
44	18.55	0.0140		0.0	9.000	0.126		Vel = 2.92
	0.0							
	18.55					23.083		K Factor = 3.86
25	-18.89	1.61	1T	8.0	1.000	16.435		
to		120.0		0.0	8.000	0.433		
26	-18.89	-0.0146		0.0	9.000	-0.131		Vel = 2.98

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	-18.89					16.737		K Factor = -4.62
25	18.89	1.38	1T	6.0	210.400	16.435		
to		120.0		0.0	6.000	0.0		
45	18.89	0.0308		0.0	216.400	6.664		Vel = 4.05
45	0.0	1.61	1T	8.0	1.000	23.099		
to		120.0		0.0	8.000	3.032		
46	18.89	0.0144		0.0	9.000	0.130		Vel = 2.98
	0.0							
	18.89					26.261		K Factor = 3.69
27	-19.76	1.61	1T	8.0	1.000	19.235		
to		120.0		0.0	8.000	0.433		
28	-19.76	-0.0158		0.0	9.000	-0.142		Vel = 3.11
	0.0							
	-19.76					19.526		K Factor = -4.47
27	19.76	1.38	1T	6.0	210.400	19.235		
to		120.0		0.0	6.000	0.0		
47	19.76	0.0335		0.0	216.400	7.241		Vel = 4.24
47	0.0	1.61	1T	8.0	1.000	26.476		
to		120.0		0.0	8.000	0.433		
48	19.76	0.0158		0.0	9.000	0.142		Vel = 3.11
	0.0							
	19.76					27.051		K Factor = 3.80
29	-22.42	1.61	1T	8.0	1.000	23.021		
to		120.0		0.0	8.000	13.426		
30	-22.42	-0.0200		0.0	9.000	-0.180		Vel = 3.53
	0.0							
	-22.42					36.267		K Factor = -3.72
29	22.42	1.38	1T	6.0	210.400	23.021		
to		120.0		0.0	6.000	0.0		
49	22.42	0.0423		0.0	216.400	9.145		Vel = 4.81
49	0.0	1.61	1T	8.0	1.000	32.166		
to		120.0		0.0	8.000	-0.866		
50	22.42	0.0199		0.0	9.000	0.179		Vel = 3.53
	0.0							
	22.42					31.479		K Factor = 4.00
12	-16.93	2.157		0.0	14.000	22.750		
to		120.0		0.0	0.0	-3.681		
14	-16.93	-0.0029		0.0	14.000	-0.041		Vel = 1.49
14	-17.01	2.157		0.0	12.300	19.028		
to		120.0		0.0	0.0	-2.599		
16	-33.94	-0.0103		0.0	12.300	-0.127		Vel = 2.98
16	-17.29	2.157		0.0	11.500	16.302		
to		120.0		0.0	0.0	-1.516		
18	-51.23	-0.0221		0.0	11.500	-0.254		Vel = 4.50
18	22.74	2.157		0.0	6.000	14.532		
to		120.0		0.0	0.0	-0.866		
20	-28.49	-0.0075		0.0	6.000	-0.045		Vel = 2.50

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
20	54.32	2.157		0.0	13.000	13.621		
to		120.0		0.0	0.0	0.0		
22	25.83	0.0062		0.0	13.000	0.081		Vel = 2.27
22	53.79	2.157		0.0	6.000	13.702		
to		120.0		0.0	0.0	0.866		
24	79.62	0.0502		0.0	6.000	0.301		Vel = 6.99
24	-18.56	2.157		0.0	11.500	14.869		
to		120.0		0.0	0.0	1.516		
26	61.06	0.0306		0.0	11.500	0.352		Vel = 5.36
26	-18.89	2.157		0.0	12.300	16.737		
to		120.0		0.0	0.0	2.599		
28	42.17	0.0154		0.0	12.300	0.190		Vel = 3.70
28	-19.75	2.157		0.0	14.000	19.526		
to		120.0		0.0	0.0	16.674		
30	22.42	0.0048		0.0	14.000	0.067		Vel = 1.97
	0.0							
	22.42					36.267		K Factor = 3.72
32	16.93	2.635		0.0	14.000	24.873		
to		120.0		0.0	0.0	-2.599		
34	16.93	0.0011		0.0	14.000	0.016		Vel = 1.00
34	17.01	2.635		0.0	12.300	22.290		
to		120.0		0.0	0.0	-1.516		
36	33.94	0.0039		0.0	12.300	0.048		Vel = 2.00
36	17.29	2.635		0.0	11.500	20.822		
to		120.0		0.0	0.0	-0.866		
38	51.23	0.0083		0.0	11.500	0.096		Vel = 3.01
38	18.84	2.635		0.0	6.000	20.052		
to		120.0		0.0	0.0	0.0		
40	70.07	0.0148		0.0	6.000	0.089		Vel = 4.12
40	23.21	2.635		0.0	13.000	20.141		
to		120.0		0.0	0.0	0.866		
42	93.28	0.0254		0.0	13.000	0.330		Vel = 5.49
42	23.51	2.635		0.0	6.000	21.337		
to		120.0		0.0	0.0	1.516		
44	116.79	0.0383		0.0	6.000	0.230		Vel = 6.87
44	18.55	2.635		0.0	11.500	23.083		
to		120.0		0.0	0.0	2.599		
46	135.34	0.0503		0.0	11.500	0.579		Vel = 7.96
46	18.89	2.635		0.0	12.300	26.261		
to		120.0		0.0	0.0	0.0		
48	154.23	0.0642		0.0	12.300	0.790		Vel = 9.07
48	19.76	2.635	1T	16.474	9.500	27.051		
to		120.0		0.0	16.474	2.382		
51	173.99	0.0802		0.0	25.974	2.084		Vel = 10.24
	0.0							
	173.99					31.517		K Factor = 30.99
50	22.42	2.635	1T	16.474	4.500	31.479		
to		120.0		0.0	16.474	0.0		
51	22.42	0.0018		0.0	20.974	0.038		Vel = 1.32

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
51	173.98	2.635	2E	16.474	13.000	31.517		
to		120.0		0.0	16.474	0.0		
52	196.4	0.1004		0.0	29.474	2.960		Vel = 11.55
52	0.0	2.635	2E	16.474	6.000	34.477		
to		120.0		0.0	16.474	1.299		
53	196.4	0.1004		0.0	22.474	2.257		Vel = 11.55
53	0.0	3.26	2E	18.815	42.000	38.033		
to		120.0		0.0	18.815	18.060		
54	196.4	0.0356		0.0	60.815	2.166		Vel = 7.55
54	0.0	3.26	2E	18.815	15.000	58.259		
to		120.0		0.0	18.815	0.0		
55	196.4	0.0356		0.0	33.815	1.204		Vel = 7.55
55	0.0	3.26	1T	20.159	6.000	59.463		
to		120.0		0.0	20.159	0.476		
56	196.4	0.0356		0.0	26.159	0.932		Vel = 7.55
56	0.0	3.26	1T	20.159	5.000	60.871		
to		120.0	1E	9.408	29.567	-1.732		
TOR	196.4	0.0356		0.0	34.567	1.231		Vel = 7.55
TOR	0.0	3.26	1E	9.408	7.000	60.370		
to		120.0	1Fsp	0.0	24.192	7.851		* Fixed loss = 3
BOR	196.4	0.0356	1G	1.344	31.192	1.110		Vel = 7.55
			1Avk	13.44				
BOR	100.00	6.357	3E	52.808	6.000	69.331		Qa = 100
to		120.0	1T	37.72	90.528	0.0		
100	296.4	0.0030		0.0	96.528	0.285		Vel = 3.00
100	0.0	6.16	4L	51.645	10.000	69.616		
to		140.0		0.0	51.645	0.0		
101	296.4	0.0026		0.0	61.645	0.159		Vel = 3.19
101	0.0	6.16	6L	77.467	30.000	69.775		
to		140.0		0.0	77.467	0.0		
102	296.4	0.0026		0.0	107.467	0.278		Vel = 3.19
102	0.0	6.16	2E	40.168	6.000	70.053		
to		140.0		0.0	40.168	7.000		* Fixed loss = 7
103	296.4	0.0026		0.0	46.168	0.120		Vel = 3.19
103	0.0	6.16	1G	4.304	30.000	77.173		
to		140.0	2L	25.822	73.163	0.0		
104	296.4	0.0026	1T	43.037	103.163	0.266		Vel = 3.19
104	0.0	8.27	2L	41.12	260.000	77.439		
to		140.0	1G	6.326	102.800	0.0		
105	296.4	0.0006	1T	55.354	362.800	0.224		Vel = 1.77
	0.0							
	296.40					77.663		K Factor = 33.63

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 4:40 PM
Hydrant Site ID#: 47 **Class**_____ **Elev. @ Hydrant:** 330.57
Street Address Adjacent to Hydrant: Campus Way
Number of ports flowed: 1

Static:	150	*psi before flowing*
Residual:		*psi while flowing*
Pitot:	50	*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	1186.48	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

Number of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is opened.

Field Notes:

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 5:00 PM
Hydrant Site ID#: 51 **Class**_____ **Elev. @ Hydrant:** 346.00
Street Address Adjacent to Hydrant: Adjacent to new pool
Number of ports flowed: 1

Static:	140	*psi before flowing*
Residual:	132	*psi while flowing*
Pitot:		*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	0.00	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

# of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is

Field Notes:

VIKING

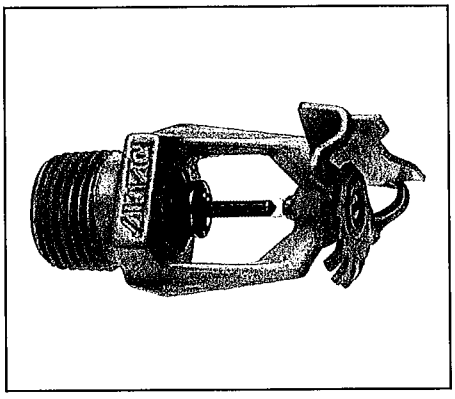
TECHNICAL DATA

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Microfast® and MicrofastHP® Quick Response Horizontal Sidewall Sprinklers are small thermosensitive glass bulb spray sprinklers available with various finishes and temperature ratings to meet design requirements. The special Polyester and Teflon® coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are cULus listed as corrosion resistant as indicated in the Approval Chart. (Note: FM Global has no approval classification for Teflon® and Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Class 2020
Refer to the Approval Chart on page 52d and Design Criteria on page 52e for cULus and FM approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:
Available since 1987.
Minimum Operating Pressure: 7 psi (0.5 bar)
Maximum Working Pressure: Sprinkler VK344 is rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. Sprinklers VK304, VK333, and VK335 are rated to a maximum 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Nominal K-Factor: Refer to the Approval Chart
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: Refer to the Approval Chart

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:
Frame Casting: Brass UNS-C84400
Deflector: Copper UNS-C19500
Bushing (for sprinklers VK333 and VK344): Brass UNS-C36000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Pip Cap Attachment (for sprinklers VK333 and VK344): Brass UNS-C36000
For Teflon® Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-Teflon® Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed

Ordering Information: (Also refer to the current Viking price list.)
Order Quick Response Horizontal Sidewall Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome-Enloy® = F, White Polyester = M-/W, Black Polyester = M-/B, and Black Teflon® = N
Temperature Suffix (°F/°C): 135°/68° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK304 with a Brass finish and a 155 °F/68 °C temperature rating = Part No. 06725BAB

Replaces page 52a-f, dated March 7, 2008. (Revised FM Design Criteria and added the Model G-1 Escutcheon.)

VIKING TECHNICAL DATA

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Available Finishes And Temperature Ratings:

Refer to Table 1

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for recessed sprinklers with protective shields: Part No. 13655W/B** (available since 2003)
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Quick Response Horizontal Sidewall Sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

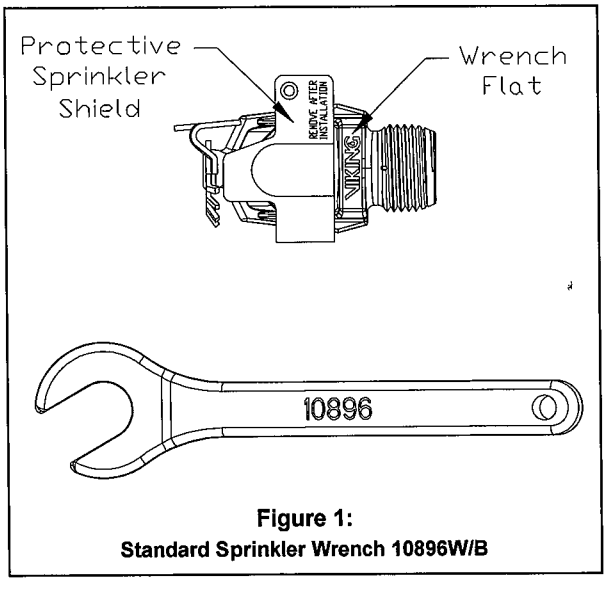


Figure 1:
Standard Sprinkler Wrench 10896W/B

VIKING

TECHNICAL DATA

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome-Enloy®, White Polyester, Black Polyester, and Black Teflon®
Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black Teflon®

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and Teflon® coatings. For Teflon® coated open sprinklers only, the waterway is coated.

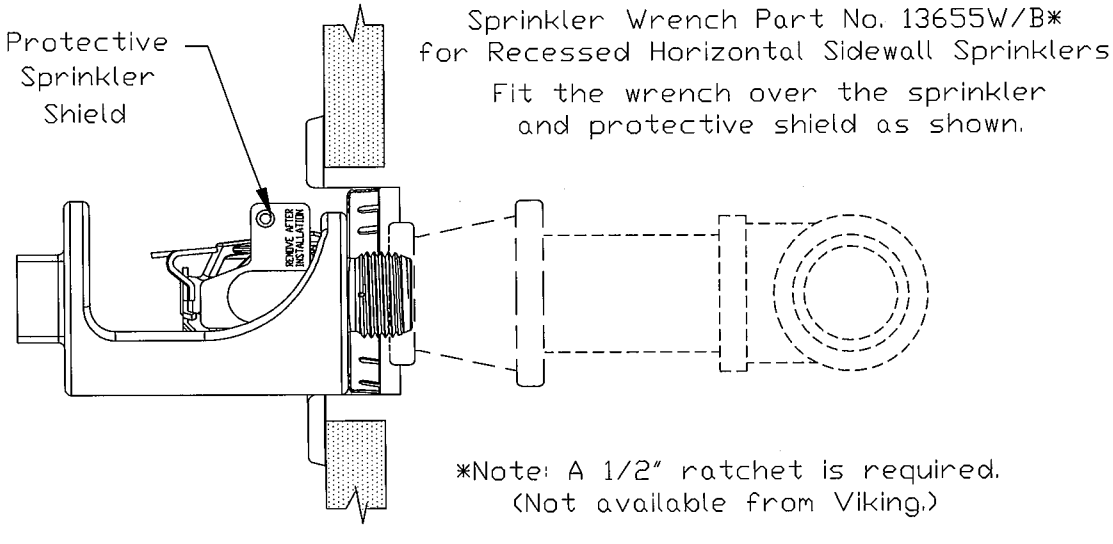


Figure 2: Wrench 13655W/B for Recessed Horizontal Sidewall Sprinklers

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TECHNICAL DATA

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

Approval Chart

Microfast® and Microfast HP® Quick Response Horizontal Sidewall Sprinklers
For Light Hazard Occupancies Only

KEY: A1X — Temperature, Finish, Escutcheon (if applicable)

Maximum 175 PSI (12 Bar) WWP
Standard Orifice, Deflector must be located 4" to 6" (102 mm to 152 mm) below the ceiling.

Base Part Number[1]	SIN	Maximum Pressure	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on pg 52e.)					
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM[5]	NYC[6]	LPCB	CE	
06725B	VK304	175 psi	1/2"	15 mm	5.6	80.6	2-1/2	64	A1X, B1W	A2X, B2Z	A1X, B1Y	--	--	--
Standard Orifice, Deflector must be located 6" to 12" (152 mm to 304 mm) below the ceiling.														
06725B	VK304	175 psi	1/2"	15 mm	5.6	80.6	2-1/2	64	A1X	--	A1X	--	--	--
Small Orifice[8], Deflector must be located 4" to 6" (102 mm to 152 mm) below the ceiling.														
Base Part Number[1]	**SIN**	**Maximum Pressure**	**Thread Size**		**Nominal K-Factor**		**Overall Length**		**Listings and Approvals[3] (Refer also to Design Criteria on pg 52e.)**					
			NPT	**BSP**	**U.S.**	**metric[2]**	**Inches**	**mm**	**cULus[4]**	**FM**	**NYC[7]**	**LPCB**	**CE**	
10035[9]	VK333	175 psi	1/2"	15 mm	2.8	40.3	2-1/2	64	A1X, B1W	--	A1X	--	--	--
08983	VK335	175 psi	3/8"	10 mm	4.2	60.5	2-1/2	64	--	--	--	--	--	--
Maximum 250 PSI WWP														
Small Orifice[8], Deflector must be located 4" to 6" (102 mm to 152 mm) below the ceiling.														
12287[9]	VK344	250 psi	1/2"	15 mm	2.8	40.3	2-1/2	64	A1X, B1W	--	A1X	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome-Enloy®, White Polyester[10], Black Polyester[10], and Black Teflon®[10]
2 - Brass and Chrome-Enloy®

Approved Escutcheons

W - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon[11], or recessed with the Viking Micromatic® Model E-1, E-2, or G-1 Recessed Escutcheon
X - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon[11]
Y - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon[11], or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Installed with the Viking Model G-1 Recessed Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.

[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.

[5] FM Approved for installation in accordance with the latest applicable FM Loss Prevention Data Sheets and Technical Advisory Bulletins.

[6] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA.

[7] Accepted for use, City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

[8] Listings are limited to Light Hazard Occupancies, with hydraulically calculated wet systems. **Exception:** 4.2K sprinklers may be installed on hydraulically calculated dry pipe systems where piping is corrosion resistant or internally galvanized.

[9] The sprinkler orifice is bushed.

[10] cULus Listed as corrosion-resistant.

[11] The Viking Microfast® Model F-1 Adjustable Escutcheon is considered a surface-mounted escutcheon because it does not allow the fusible element of the sprinkler to be recessed behind the face of the wall or ceiling.

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA

(Also refer to the Approval Chart on page 52e.)

cULus Listing Requirements:

Microfast® and MicrofastHP® Quick Response Horizontal Sidewall Sprinklers are cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for sidewall standard spray sprinklers.

- Limited to Light Hazard occupancies only *(Small orifice sprinklers are limited to Light Hazard where allowed by the installation standards being applied, with hydraulically calculated wet systems only. Exception: 4.2K sprinklers may be installed on hydraulically calculated dry pipe systems where piping is corrosion resistant or internally galvanized.)*
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13. Minimum spacing allowed is 6 ft. (1.8 m).
- Refer to the Approval Chart for allowable deflector distance below the ceiling. Align with the leading edge of the deflector parallel to the ceiling.
- Maximum distance from end walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall. Minimum distance from end walls is 4 in. (102 mm).
- The sprinkler installation and obstruction rules contained in NFPA 13 for sidewall standard spray sprinklers must be followed.

FM Approval Requirements:

For installation in accordance with the latest applicable FM Loss Prevention Data Sheets and Technical Advisory Bulletins. FM Global Loss Prevention Data Sheets (including 2-8N) and Technical Advisory Bulletins contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

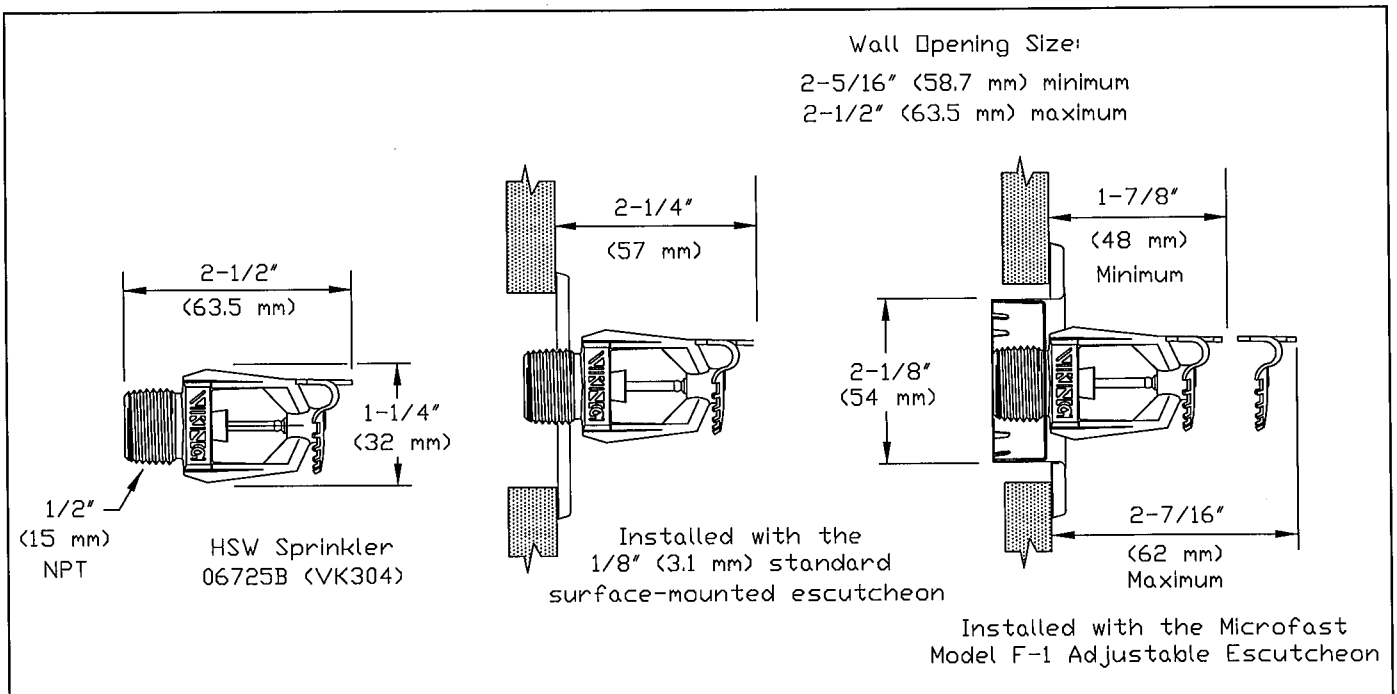

Figure 3: Sidewall Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

VIKING

TECHNICAL DATA

MICROFAST® AND MICROFASTHP® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLERS

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Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

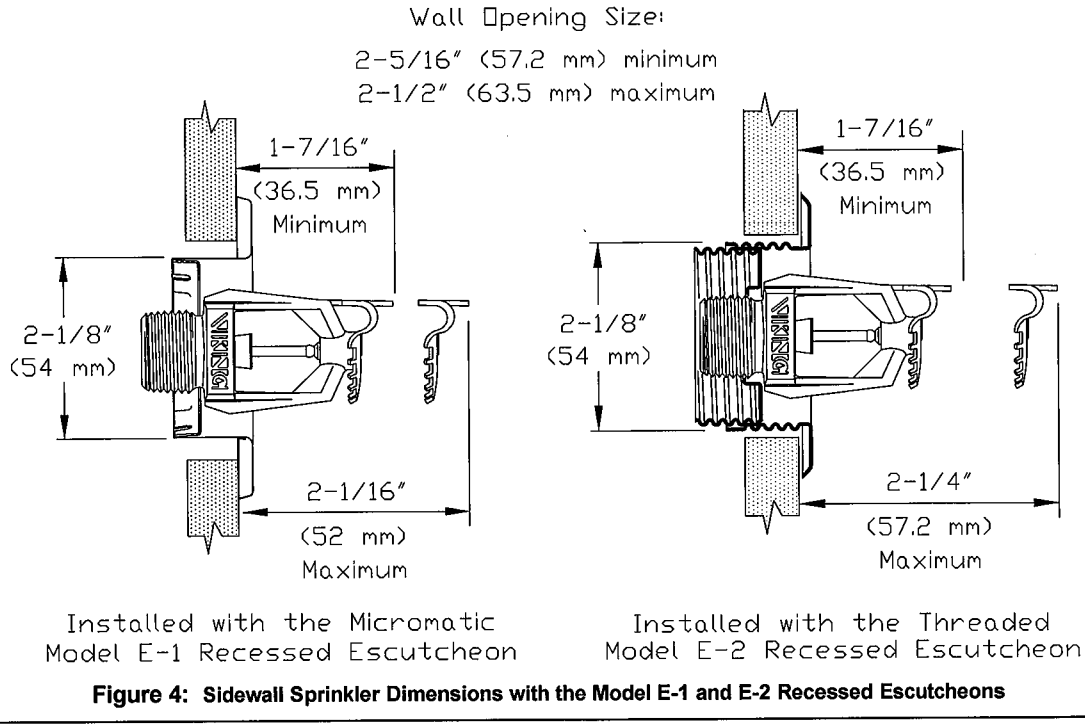


Figure 4: Sidewall Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

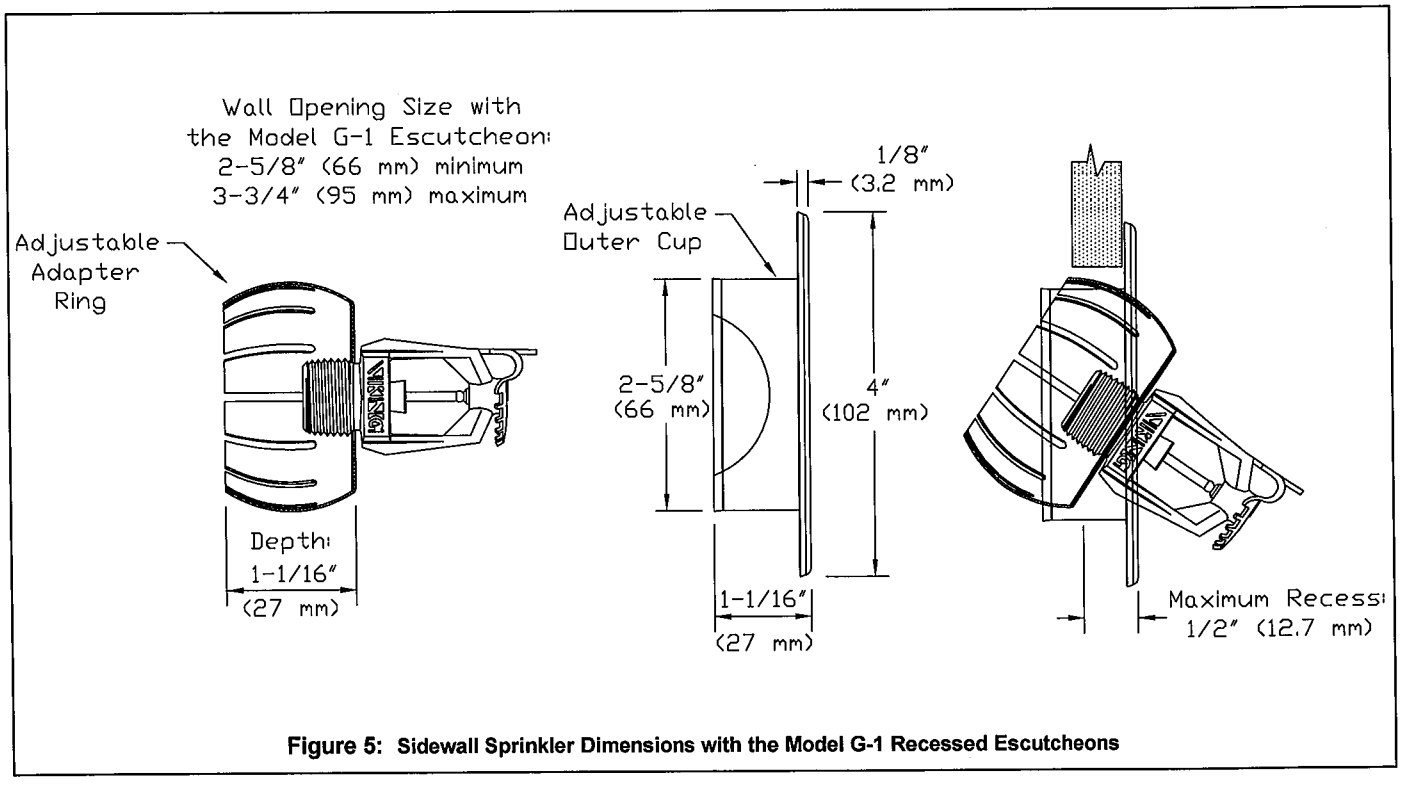
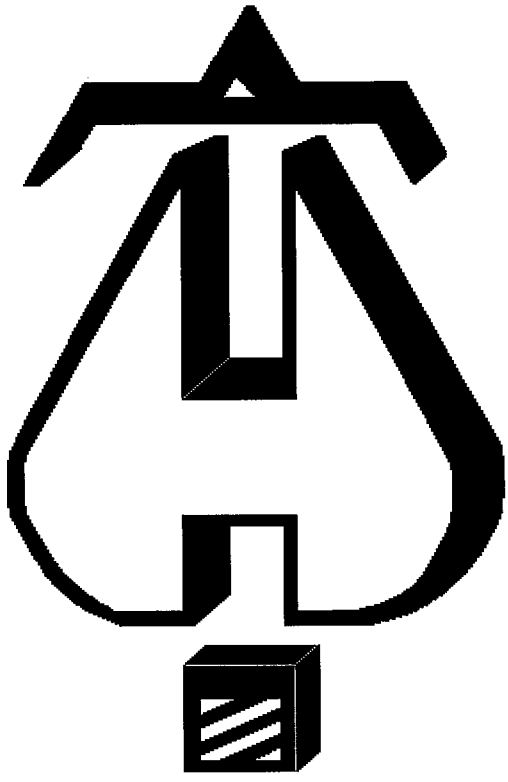
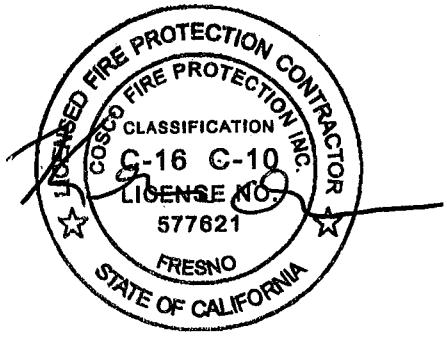


Figure 5: Sidewall Sprinkler Dimensions with the Model G-1 Recessed Escutcheons



. . . Fire Protection by Computer Design

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE AVE.
SUITE #108
FRESNO, CA. 93722
(559) 275-3795



Job Name	:	CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407
Building	:	EXIST GYM, WRESTLING RM, REMOTE AREA E3
Location	:	RECREATION CENTER EXPANSION
System	:	E-WRESTLE
Contract	:	FD-1075
Data File	:	CALPOLY-E3WRESTLING.WXF

Hydraulic Design Information Sheet

Name - CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407 Date - 11-04-2010
Location - RECREATION CENTER EXPANSION
Building - EXIST GYM, WRESTLING RM, REMOTE AREA E3 System No. - E-WRESTLE
Contractor - COSCO FIRE PROTECTION INC. Contract No. - FD-1075
Calculated By - KO Drawing No. - FP-E1 PIPE
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 13'-4"
Occupancy - LIGHT HAZARD

SYSTEM DESIGN

(X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other
Specific Ruling Made By Date

Area of Sprinkler Operation - 1500	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make VIKING
Area Per Sprinkler - 120	( ) Dry	Model UPRIGHT
Elevation at Highest Outlet - 13'-4"	( ) Deluge	Size 1/2"
Hose Allowance - Inside - 100	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance - NA	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 0		

Note NFPA #13 2002, 11.2.3.2

Calculation Summary: Flow Required - 312.40 Press Required - 94.10 BOR
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 3-8-2010		Cap. -
Time of Test - 3 PM	Rated Cap.-	Elev.-
Static Press - 140	@ Press -	
Residual Press - 132	Elev. -	Well
Flow - 1186		Proof Flow
Elevation - 0		

Location - FIRE HYDRANT #47 & #51 ON SITE

Source of Information - FLOW TEST PERFORMED ON SITE 3-8-2010
BY CANNON ENGINEERING , RESULTS ATTACHED TO CALCS.

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
( ) Mult. Row		( ) Open Shelf	

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

Horizontal Barriers Provided:

Water Supply Curve (C)

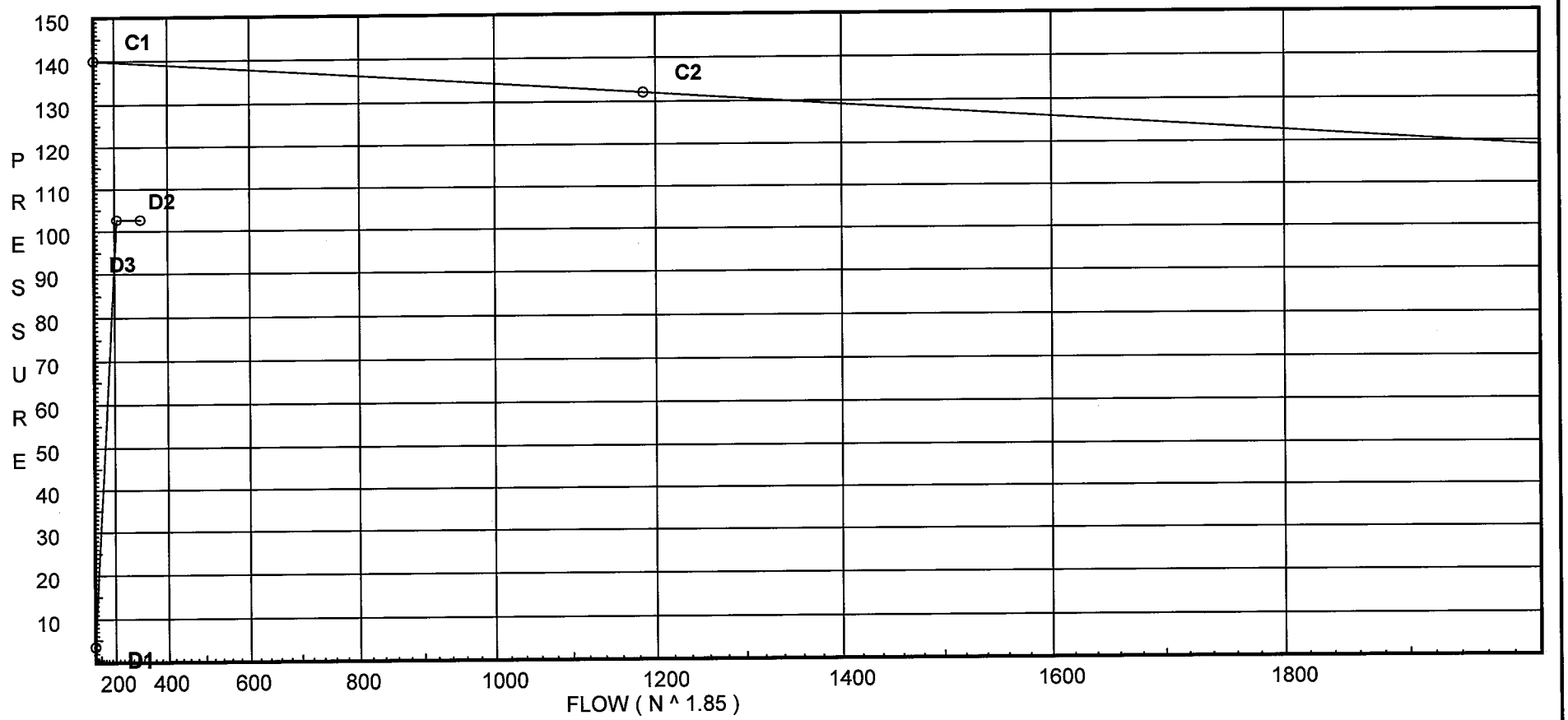
COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

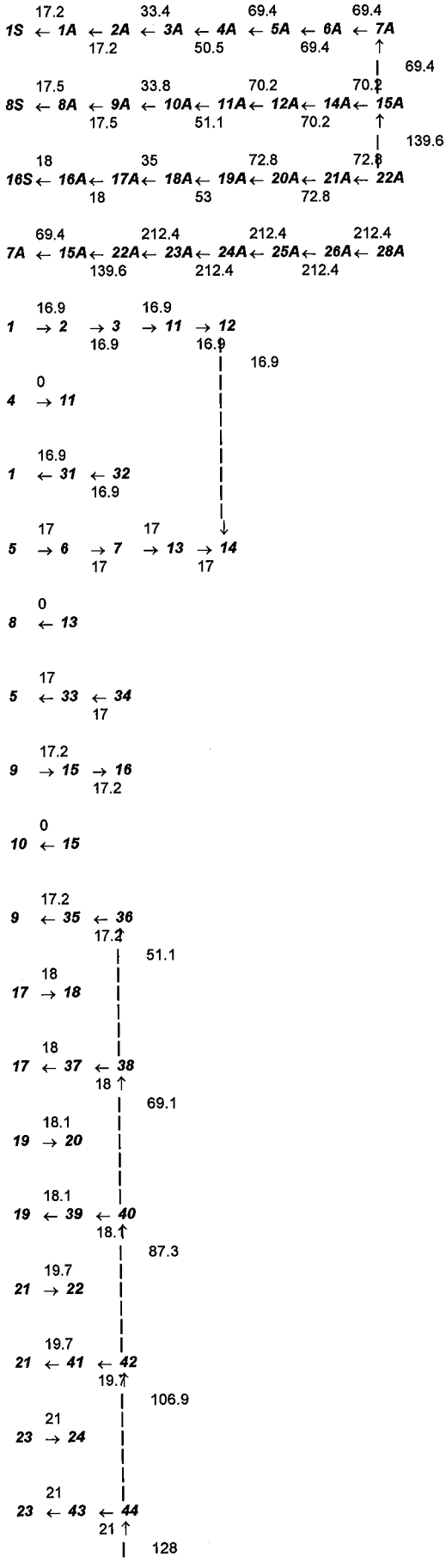
Date 11-04-2010

City Water Supply:
- C1 - Static Pressure : 140
- C2 - Residual Pressure: 132
- C2 - Residual Flow : 1186

Demand:

D1 - Elevation	:	3.465
D2 - System Flow	:	212.397
D2 - System Pressure	:	102.577
Hose (Adj City)	:	_____
Hose (Demand)	:	100
D3 - System Demand	:	312.397
Safety Margin	:	36.745

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69.4
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8S ← 8A ← 9A ← 10A ← 11A ← 12A ← 14A ← 15A
17.5 51.1 70.2
139.6
18 35 72.8 72.8
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18 53 72.8
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7A ← 15A ← 22A ← 23A ← 24A ← 25A ← 26A ← 28A
139.6 212.4 212.4
16.9 16.9
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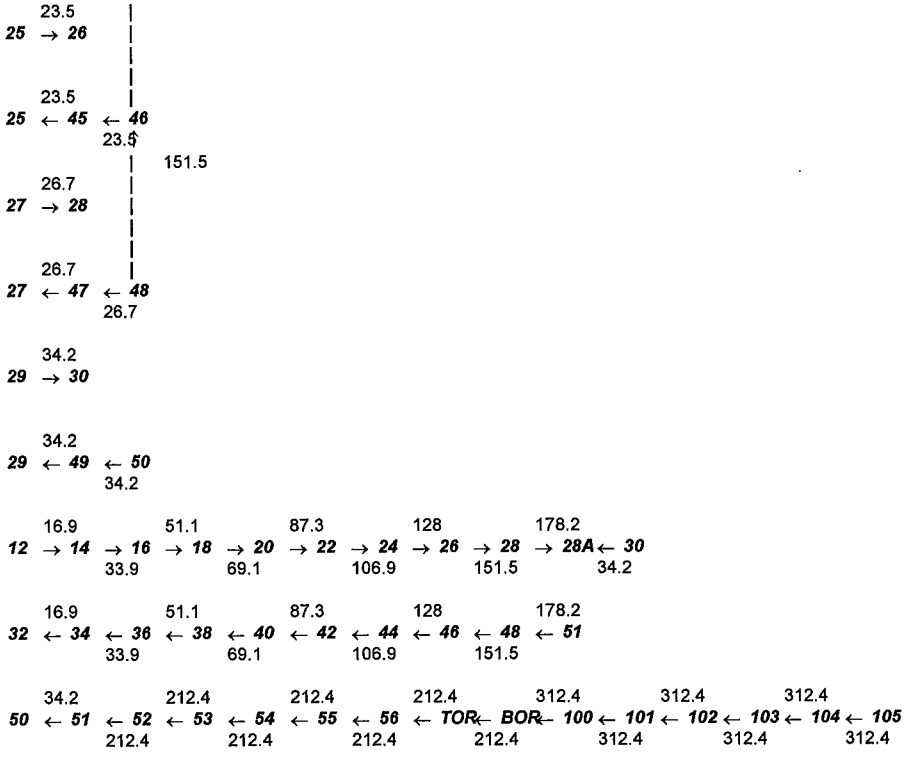
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26.7
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34.2
29 ← 49 ← 50
34.2
16.9 51.1 87.3 128 178.2
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33.9 69.1 106.9 151.5 34.2
16.9 51.1 87.3 128 178.2
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33.9 69.1 106.9 151.5
34.2 212.4 212.4 212.4 312.4 312.4 312.4
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212.4 212.4 212.4 212.4 312.4 312.4 312.4

Fittings Used Summary

Fitting Legend Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
Avk	Alarm Viking J1								10		13		20	23							
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Pressure / Flow Summary - STANDARD

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Date 11-04-2010

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
1S	8.0	5.6	9.45	na	17.21	0.1	100	7.0
1A	13.4		7.8	na				
2A	13.4	5.6	8.32	na	16.15	0.1	120	7.0
3A	13.4	5.6	9.33	na	17.11	0.1	120	7.0
4A	13.4	5.6	11.42	na	18.92	0.1	120	7.0
5A	13.4		13.35	na				
6A	13.4		16.82	na				
8S	8.0	5.6	9.74	na	17.48	0.1	168	7.0
8A	13.4		8.11	na				
9A	13.4	5.6	8.49	na	16.31	0.1	120	7.0
10A	13.4	5.6	9.52	na	17.28	0.1	120	7.0
11A	13.4	5.6	11.66	na	19.12	0.1	120	7.0
12A	13.4		13.64	na				
14A	13.4		17.18	na				
16S	8.0	5.6	10.33	na	18.0	0.1	180	7.0
16A	13.4		8.74	na				
17A	13.4	5.6	9.19	na	16.98	0.1	120	7.0
18A	13.4	5.6	10.3	na	17.97	0.1	120	7.0
19A	13.4	5.6	12.58	na	19.86	0.1	120	7.0
20A	13.4		14.7	na				
21A	13.4		18.49	na				
7A	12.8		18.53	na				
15A	12.8		18.92	na				
22A	12.8		20.34	na				
23A	12.8		33.35	na				
24A	12.8		39.21	na				
25A	12.8		41.7	na				
26A	51.0		30.99	na				
1	51.0		46.46	na				
2	51.0		46.1	na				
3	51.0		45.75	na				
11	51.0		45.45	na				
4	51.0		45.45	na				
31	51.0		51.01	na				
5	59.5		42.75	na				
6	59.5		42.39	na				
7	59.5		42.03	na				
13	59.5		41.73	na				
8	59.5		41.73	na				
33	59.5		47.34	na				
9	65.5		39.32	na				
15	65.5		39.0	na				
10	65.5		39.0	na				
35	65.5		44.79	na				
17	69.0		37.24	na				
37	69.0		43.36	na				
19	78.0		33.24	na				
39	78.0		39.43	na				
21	78.0		32.51	na				
41	78.0		39.68	na				
23	69.0		35.76	na				
43	69.0		43.89	na				
25	65.5		35.93	na				
45	65.5		45.9	na				
27	59.5		36.56	na				
47	59.5		49.21	na				
29	51.0		34.82	na				
49	51.0		54.84	na				
12	50.0		45.77	na				
14	58.5		42.05	na				
16	64.5		39.33	na				
18	68.0		37.56	na				

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
20	70.0		36.46	na				
22	70.0		35.69	na				
24	68.0		36.04	na				
26	64.5		36.17	na				
28	58.5		36.74	na				
28A	53.0		33.54	na				
32	58.5		47.87	na				
34	64.5		45.28	na				
36	68.0		43.82	na				
38	70.0		43.05	na				
40	70.0		43.13	na				
42	68.0		44.29	na				
44	64.5		46.0	na				
46	58.5		49.12	na				
48	58.5		49.89	na				
50	53.0		54.36	na				
51	53.0		54.45	na				
52	53.0		57.87	na				
53	50.0		61.78	na				
54	8.3		82.34	na				
55	8.3		83.73	na				
56	7.2		85.28	na				
TOR	11.2		84.97	na				
BOR	0.0		94.11	na	100.0			
100	0.0		94.42	na				
101	0.0		94.6	na				
102	0.0		94.9	na				
103	0.0		102.04	na				
104	0.0		102.33	na				
105	0.0		102.58	na				

The maximum velocity is 18.65 and it occurs in the pipe between nodes 22A and 23A

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
1S	17.21	1.049	1E	2.0	5.000	9.447		K Factor = 5.60
to		120.0		0.0	2.000	-2.339		
1A	17.21	0.0986		0.0	7.000	0.690		Vel = 6.39
1A	0.0	1.38	1E	3.0	11.000	7.798		
to		120.0	1T	6.0	9.000	0.0		
2A	17.21	0.0259		0.0	20.000	0.518		Vel = 3.69
2A	16.15	1.38		0.0	11.500	8.316		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
3A	33.36	0.0883		0.0	11.500	1.015		Vel = 7.16
3A	17.11	1.38		0.0	11.000	9.331		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
4A	50.47	0.1896		0.0	11.000	2.086		Vel = 10.83
4A	18.92	1.61		0.0	12.000	11.417		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
5A	69.39	0.1613		0.0	12.000	1.936		Vel = 10.94
5A	0.0	1.61	1T	8.0	13.500	13.353		
to		120.0		0.0	8.000	0.0		
6A	69.39	0.1613		0.0	21.500	3.469		Vel = 10.94
6A	0.0	1.61	1T	8.0	1.000	16.822		
to		120.0		0.0	8.000	0.260		
7A	69.39	0.1614		0.0	9.000	1.453		Vel = 10.94
	0.0							
	69.39					18.535		K Factor = 16.12
8S	17.48	1.049	1E	2.0	5.000	9.741		K Factor = 5.60
to		120.0		0.0	2.000	-2.339		
8A	17.48	0.1014		0.0	7.000	0.710		Vel = 6.49
8A	0.0	1.38	1E	3.0	11.000	8.112		
to		120.0		0.0	3.000	0.0		
9A	17.48	0.0267		0.0	14.000	0.374		Vel = 3.75
9A	16.31	1.38		0.0	11.500	8.486		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
10A	33.79	0.0903		0.0	11.500	1.038		Vel = 7.25
10A	17.28	1.38		0.0	11.000	9.524		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
11A	51.07	0.1939		0.0	11.000	2.133		Vel = 10.95
11A	19.12	1.61		0.0	12.000	11.657		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
12A	70.19	0.1648		0.0	12.000	1.978		Vel = 11.06
12A	0.0	1.61	1T	8.0	13.500	13.635		
to		120.0		0.0	8.000	0.0		
14A	70.19	0.1649		0.0	21.500	3.545		Vel = 11.06
14A	0.0	1.61	1T	8.0	1.000	17.180		
to		120.0		0.0	8.000	0.260		
15A	70.19	0.1648		0.0	9.000	1.483		Vel = 11.06
	0.0							
	70.19					18.923		K Factor = 16.14
16S	18.00	1.049	1E	2.0	5.000	10.332		K Factor = 5.60
to		120.0		0.0	2.000	-2.339		
16A	18.0	0.1070		0.0	7.000	0.749		Vel = 6.68

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
16A	0.0	1.38	1E	3.0	13.000	8.742		
to		120.0		0.0	3.000	0.0		
17A	18.0	0.0282		0.0	16.000	0.451		Vel = 3.86
17A	16.98	1.38		0.0	11.500	9.193		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
18A	34.98	0.0963		0.0	11.500	1.107		Vel = 7.50
18A	17.97	1.38		0.0	11.000	10.300		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
19A	52.95	0.2074		0.0	11.000	2.281		Vel = 11.36
19A	19.86	1.61		0.0	12.000	12.581		K Factor = 5.60
to		120.0		0.0	0.0	0.0		
20A	72.81	0.1764		0.0	12.000	2.117		Vel = 11.47
20A	0.0	1.61	1T	8.0	13.500	14.698		
to		120.0		0.0	8.000	0.0		
21A	72.81	0.1764		0.0	21.500	3.792		Vel = 11.47
21A	0.0	1.61	1T	8.0	1.000	18.490		
to		120.0		0.0	8.000	0.260		
22A	72.81	0.1764		0.0	9.000	1.588		Vel = 11.47
	0.0							
	72.81					20.338		K Factor = 16.14
7A	69.39	2.157		0.0	10.000	18.535		
to		120.0		0.0	0.0	0.0		
15A	69.39	0.0388		0.0	10.000	0.388		Vel = 6.09
15A	70.19	2.157		0.0	10.000	18.923		
to		120.0		0.0	0.0	0.0		
22A	139.58	0.1415		0.0	10.000	1.415		Vel = 12.25
22A	72.82	2.157	1T	12.307	30.000	20.338		
to		120.0		0.0	12.307	0.0		
23A	212.4	0.3076		0.0	42.307	13.015		Vel = 18.65
23A	0.0	2.635	2E	16.474	34.000	33.353		
to		120.0		0.0	16.474	0.0		
24A	212.4	0.1161		0.0	50.474	5.858		Vel = 12.50
24A	0.0	2.635	2E	16.474	5.000	39.211		
to		120.0		0.0	16.474	0.0		
25A	212.4	0.1160		0.0	21.474	2.492		Vel = 12.50
25A	0.0	2.635	1E	8.237	42.000	41.703		
to		120.0		0.0	8.237	-16.544		
26A	212.4	0.1160		0.0	50.237	5.830		Vel = 12.50
26A	0.0	2.635	1T	16.474	13.000	30.989		
to		120.0		0.0	16.474	-0.866		
28A	212.4	0.1160		0.0	29.474	3.420		Vel = 12.50
	0.0							
	212.40					33.543		K Factor = 36.67
1	-16.88	1.38		0.0	14.200	46.457		
to		120.0		0.0	0.0	0.0		
2	-16.88	-0.0250		0.0	14.200	-0.355		Vel = 3.62
2	0.0	1.38		0.0	14.200	46.102		
to		120.0		0.0	0.0	0.0		
3	-16.88	-0.0250		0.0	14.200	-0.355		Vel = 3.62

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
3	0.0	1.38	1T	6.0	6.000	45.747		
to		120.0		0.0	6.000	0.0		
11	-16.88	-0.0250		0.0	12.000	-0.300		Vel = 3.62
11	0.0	1.61	1T	8.0	1.000	45.447		
to		120.0		0.0	8.000	0.433		
12	-16.88	-0.0119		0.0	9.000	-0.107		Vel = 2.66
	0.0							
	-16.88					45.773		K Factor = -2.49
4	0.0	1.38	1T	6.0	9.000	45.447		
to		120.0		0.0	6.000	0.0		
11	0.0	0.0		0.0	15.000	0.0		Vel = 0
	0.0							
	0.0					45.447		K Factor = 0
1	16.88	1.38	1T	6.0	176.000	46.457		
to		120.0		0.0	6.000	0.0		
31	16.88	0.0250		0.0	182.000	4.554		Vel = 3.62
31	0.0	1.61	1T	8.0	1.000	51.011		
to		120.0		0.0	8.000	-3.248		
32	16.88	0.0118		0.0	9.000	0.106		Vel = 2.66
	0.0							
	16.88					47.869		K Factor = 2.44
5	-16.97	1.38		0.0	14.200	42.747		
to		120.0		0.0	0.0	0.0		
6	-16.97	-0.0253		0.0	14.200	-0.359		Vel = 3.64
6	0.0	1.38		0.0	14.200	42.388		
to		120.0		0.0	0.0	0.0		
7	-16.97	-0.0252		0.0	14.200	-0.358		Vel = 3.64
7	0.0	1.38	1T	6.0	6.000	42.030		
to		120.0		0.0	6.000	0.0		
13	-16.97	-0.0253		0.0	12.000	-0.304		Vel = 3.64
13	0.0	1.61	1T	8.0	1.000	41.726		
to		120.0		0.0	8.000	0.433		
14	-16.97	-0.0119		0.0	9.000	-0.107		Vel = 2.67
	0.0							
	-16.97					42.052		K Factor = -2.62
8	0.0	1.38	1T	6.0	9.000	41.726		
to		120.0		0.0	6.000	0.0		
13	0.0	0.0		0.0	15.000	0.0		Vel = 0
	0.0							
	0.0					41.726		K Factor = 0
5	16.97	1.38	1T	6.0	176.000	42.747		
to		120.0		0.0	6.000	0.0		
33	16.97	0.0253		0.0	182.000	4.596		Vel = 3.64
33	0.0	1.61	1T	8.0	1.000	47.343		
to		120.0		0.0	8.000	-2.166		
34	16.97	0.0120		0.0	9.000	0.108		Vel = 2.67
	0.0							

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	16.97					45.285		K Factor = 2.52
9	-17.24	1.38	1T	6.0	6.000	39.317		
to		120.0		0.0	6.000	0.0		
15	-17.24	-0.0261		0.0	12.000	-0.313		Vel = 3.70
15	0.0	1.61	1T	8.0	1.000	39.004		
to		120.0		0.0	8.000	0.433		
16	-17.24	-0.0122		0.0	9.000	-0.110		Vel = 2.72
	0.0							
	-17.24					39.327		K Factor = -2.75
10	0.0	1.38	1T	6.0	9.000	39.004		
to		120.0		0.0	6.000	0.0		
15	0.0	0.0		0.0	15.000	0.0		Vel = 0
	0.0							
	0.0					39.004		K Factor = 0
9	17.24	1.38	1T	6.0	204.400	39.317		
to		120.0		0.0	6.000	0.0		
35	17.24	0.0260		0.0	210.400	5.472		Vel = 3.70
35	0.0	1.61	1T	8.0	1.000	44.789		
to		120.0		0.0	8.000	-1.083		
36	17.24	0.0123		0.0	9.000	0.111		Vel = 2.72
	0.0							
	17.24					43.817		K Factor = 2.60
17	-18.03	1.61	1T	8.0	1.000	37.245		
to		120.0		0.0	8.000	0.433		
18	-18.03	-0.0133		0.0	9.000	-0.120		Vel = 2.84
	0.0							
	-18.03					37.558		K Factor = -2.94
17	18.03	1.38	1T	6.0	210.400	37.245		
to		120.0		0.0	6.000	0.0		
37	18.03	0.0283		0.0	216.400	6.115		Vel = 3.87
37	0.0	1.61	1T	8.0	1.000	43.360		
to		120.0		0.0	8.000	-0.433		
38	18.03	0.0132		0.0	9.000	0.119		Vel = 2.84
	0.0							
	18.03					43.046		K Factor = 2.75
19	-18.15	1.61	1T	8.0	10.000	33.238		
to		120.0		0.0	8.000	3.465		
20	-18.15	-0.0135		0.0	18.000	-0.243		Vel = 2.86
	0.0							
	-18.15					36.460		K Factor = -3.01
19	18.15	1.38	1T	6.0	210.400	33.238		
to		120.0		0.0	6.000	0.0		
39	18.15	0.0286		0.0	216.400	6.188		Vel = 3.89
39	0.0	1.61	1T	8.0	10.000	39.426		
to		120.0		0.0	8.000	3.465		
40	18.15	0.0135		0.0	18.000	0.243		Vel = 2.86
	0.0							

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	18.15					43.134		K Factor = 2.76
21	-19.66	1.61	1T	8.0	10.000	32.505		
to		120.0		0.0	8.000	3.465		
22	-19.66	-0.0157		0.0	18.000	-0.282		Vel = 3.10
	0.0							
	-19.66					35.688		K Factor = -3.29
21	19.66	1.38	1T	6.0	210.400	32.505		
to		120.0		0.0	6.000	0.0		
41	19.66	0.0331		0.0	216.400	7.173		Vel = 4.22
41	0.0	1.61	1T	8.0	10.000	39.678		
to		120.0		0.0	8.000	4.331		
42	19.66	0.0157		0.0	18.000	0.282		Vel = 3.10
	0.0							
	19.66					44.291		K Factor = 2.95
23	-21.04	1.61	1T	8.0	1.000	35.763		
to		120.0		0.0	8.000	0.433		
24	-21.04	-0.0178		0.0	9.000	-0.160		Vel = 3.32
	0.0							
	-21.04					36.036		K Factor = -3.50
23	21.04	1.38	1T	6.0	210.400	35.763		
to		120.0		0.0	6.000	0.0		
43	21.04	0.0376		0.0	216.400	8.131		Vel = 4.51
43	0.0	1.61	1T	8.0	1.000	43.894		
to		120.0		0.0	8.000	1.949		
44	21.04	0.0177		0.0	9.000	0.159		Vel = 3.32
	0.0							
	21.04					46.002		K Factor = 3.10
25	-23.48	1.61	1T	8.0	1.000	35.929		
to		120.0		0.0	8.000	0.433		
26	-23.48	-0.0218		0.0	9.000	-0.196		Vel = 3.70
	0.0							
	-23.48					36.166		K Factor = -3.90
25	23.48	1.38	1T	6.0	210.400	35.929		
to		120.0		0.0	6.000	0.0		
45	23.48	0.0461		0.0	216.400	9.967		Vel = 5.04
45	0.0	1.61	1T	8.0	1.000	45.896		
to		120.0		0.0	8.000	3.032		
46	23.48	0.0218		0.0	9.000	0.196		Vel = 3.70
	0.0							
	23.48					49.124		K Factor = 3.35
27	-26.71	1.61	1T	8.0	1.000	36.556		
to		120.0		0.0	8.000	0.433		
28	-26.71	-0.0276		0.0	9.000	-0.248		Vel = 4.21
	0.0							
	-26.71					36.741		K Factor = -4.41
27	26.71	1.38	1T	6.0	210.400	36.556		
to		120.0		0.0	6.000	0.0		
47	26.71	0.0585		0.0	216.400	12.650		Vel = 5.73

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
47	0.0	1.61	1T	8.0	1.000	49.206		
to		120.0		0.0	8.000	0.433		
48	26.71	0.0276		0.0	9.000	0.248		Vel = 4.21
	0.0							
	26.71					49.887		K Factor = 3.78
29	-34.23	1.61	1T	8.0	1.000	34.818		
to		120.0		0.0	8.000	13.426		
30	-34.23	-0.0437		0.0	9.000	-0.393		Vel = 5.39
	0.0							
	-34.23					47.851		K Factor = -4.95
29	34.23	1.38	1T	6.0	210.400	34.818		
to		120.0		0.0	6.000	0.0		
49	34.23	0.0925		0.0	216.400	20.019		Vel = 7.34
49	0.0	1.61	1T	8.0	1.000	54.837		
to		120.0		0.0	8.000	-0.866		
50	34.23	0.0437		0.0	9.000	0.393		Vel = 5.39
	0.0							
	34.23					54.364		K Factor = 4.64
12	-16.88	2.157		0.0	14.000	45.773		
to		120.0		0.0	0.0	-3.681		
14	-16.88	-0.0029		0.0	14.000	-0.040		Vel = 1.48
14	-16.97	2.157		0.0	12.300	42.052		
to		120.0		0.0	0.0	-2.599		
16	-33.85	-0.0102		0.0	12.300	-0.126		Vel = 2.97
16	-17.25	2.157		0.0	11.500	39.327		
to		120.0		0.0	0.0	-1.516		
18	-51.1	-0.0220		0.0	11.500	-0.253		Vel = 4.49
18	-18.03	2.157		0.0	6.000	37.558		
to		120.0		0.0	0.0	-0.866		
20	-69.13	-0.0387		0.0	6.000	-0.232		Vel = 6.07
20	-18.15	2.157		0.0	13.000	36.460		
to		120.0		0.0	0.0	0.0		
22	-87.28	-0.0594		0.0	13.000	-0.772		Vel = 7.66
22	-19.65	2.157		0.0	6.000	35.688		
to		120.0		0.0	0.0	0.866		
24	-106.93	-0.0863		0.0	6.000	-0.518		Vel = 9.39
24	-21.04	2.157		0.0	11.500	36.036		
to		120.0		0.0	0.0	1.516		
26	-127.97	-0.1205		0.0	11.500	-1.386		Vel = 11.24
26	-23.48	2.157		0.0	12.300	36.166		
to		120.0		0.0	0.0	2.599		
28	-151.45	-0.1646		0.0	12.300	-2.024		Vel = 13.30
28	-26.71	2.157	1T	12.307	12.800	36.741		
to		120.0		0.0	12.307	2.382		
28A	-178.16	-0.2222		0.0	25.107	-5.580		Vel = 15.64
28A	212.39	2.157		0.0	1.500	33.543		
to		120.0		0.0	0.0	14.292		
30	34.23	0.0107		0.0	1.500	0.016		Vel = 3.01

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	34.23					47.851		K Factor = 4.95
32	16.88	2.635		0.0	14.000	47.869		
to		120.0		0.0	0.0	-2.599		
34	16.88	0.0011		0.0	14.000	0.015		Vel = 0.99
34	16.97	2.635		0.0	12.300	45.285		
to		120.0		0.0	0.0	-1.516		
36	33.85	0.0039		0.0	12.300	0.048		Vel = 1.99
36	17.25	2.635		0.0	11.500	43.817		
to		120.0		0.0	0.0	-0.866		
38	51.1	0.0083		0.0	11.500	0.095		Vel = 3.01
38	18.03	2.635		0.0	6.000	43.046		
to		120.0		0.0	0.0	0.0		
40	69.13	0.0147		0.0	6.000	0.088		Vel = 4.07
40	18.15	2.635		0.0	13.000	43.134		
to		120.0		0.0	0.0	0.866		
42	87.28	0.0224		0.0	13.000	0.291		Vel = 5.14
42	19.65	2.635		0.0	6.000	44.291		
to		120.0		0.0	0.0	1.516		
44	106.93	0.0325		0.0	6.000	0.195		Vel = 6.29
44	21.04	2.635		0.0	11.500	46.002		
to		120.0		0.0	0.0	2.599		
46	127.97	0.0455		0.0	11.500	0.523		Vel = 7.53
46	23.48	2.635		0.0	12.300	49.124		
to		120.0		0.0	0.0	0.0		
48	151.45	0.0620		0.0	12.300	0.763		Vel = 8.91
48	26.71	2.635	1T	16.474	9.500	49.887		
to		120.0		0.0	16.474	2.382		
51	178.16	0.0839		0.0	25.974	2.178		Vel = 10.48
	0.0							
	178.16					54.447		K Factor = 24.14
50	34.23	2.635	1T	16.474	4.500	54.364		
to		120.0		0.0	16.474	0.0		
51	34.23	0.0040		0.0	20.974	0.083		Vel = 2.01
51	178.17	2.635	2E	16.474	13.000	54.447		
to		120.0		0.0	16.474	0.0		
52	212.4	0.1161		0.0	29.474	3.421		Vel = 12.50
52	0.0	2.635	2E	16.474	6.000	57.868		
to		120.0		0.0	16.474	1.299		
53	212.4	0.1161		0.0	22.474	2.609		Vel = 12.50
53	0.0	3.26	2E	18.815	42.000	61.776		
to		120.0		0.0	18.815	18.060		
54	212.4	0.0412		0.0	60.815	2.503		Vel = 8.16
54	0.0	3.26	2E	18.815	15.000	82.339		
to		120.0		0.0	18.815	0.0		
55	212.4	0.0412		0.0	33.815	1.392		Vel = 8.16
55	0.0	3.26	1T	20.159	6.000	83.731		
to		120.0		0.0	20.159	0.476		
56	212.4	0.0412		0.0	26.159	1.077		Vel = 8.16

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
56	0.0	3.26	1T	20.159	5.000	85.284		
to		120.0	1E	9.408	29.567	-1.732		
TOR	212.4	0.0412		0.0	34.567	1.423		Vel = 8.16
TOR	0.0	3.26	1E	9.408	7.000	84.975		
to		120.0	1Fsp	0.0	24.192	7.851		* Fixed loss = 3
BOR	212.4	0.0411	1G	1.344	31.192	1.283		Vel = 8.16
			1Avk	13.44				
BOR	100.00	6.357	3E	52.808	6.000	94.109		Qa = 100
to		120.0	1T	37.72	90.528	0.0		
100	312.4	0.0033		0.0	96.528	0.314		Vel = 3.16
100	0.0	6.16	4L	51.645	10.000	94.423		
to		140.0		0.0	51.645	0.0		
101	312.4	0.0029		0.0	61.645	0.176		Vel = 3.36
101	0.0	6.16	6L	77.467	30.000	94.599		
to		140.0		0.0	77.467	0.0		
102	312.4	0.0028		0.0	107.467	0.306		Vel = 3.36
102	0.0	6.16	2E	40.168	6.000	94.905		
to		140.0		0.0	40.168	7.000		* Fixed loss = 7
103	312.4	0.0029		0.0	46.168	0.132		Vel = 3.36
103	0.0	6.16	1G	4.304	30.000	102.037		
to		140.0	2L	25.822	73.163	0.0		
104	312.4	0.0028	1T	43.037	103.163	0.294		Vel = 3.36
104	0.0	8.27	2L	41.12	260.000	102.331		
to		140.0	1G	6.326	102.800	0.0		
105	312.4	0.0007	1T	55.354	362.800	0.246		Vel = 1.87
	0.0							
	312.40					102.577		K Factor = 30.85

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 4:40 PM
Hydrant Site ID#: 47 **Class**_____ **Elev. @ Hydrant:** 330.57
Street Address Adjacent to Hydrant: Campus Way
Number of ports flowed: 1

Static:	150	*psi before flowing*
Residual:		*psi while flowing*
Pitot:	50	*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	1186.48	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

Number of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is opened.

Field Notes:

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 5:00 PM
Hydrant Site ID#: 51 **Class**_____ **Elev. @ Hydrant:** 346.00
Street Address Adjacent to Hydrant: Adjacent to new pool
Number of ports flowed: 1

Static:	140	*psi before flowing*
Residual:	132	*psi while flowing*
Pitot:		*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	0.00	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

# of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is

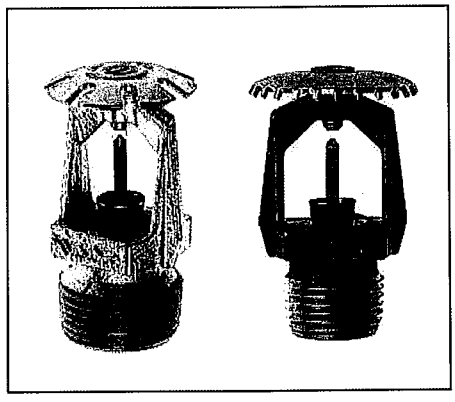
Field Notes:

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking Microfast® and MicrofastHP® Quick Response Upright and Conventional (Old Style) Sprinklers are small, thermosensitive, glass-bulb spray sprinklers available in several different finishes, temperature ratings, and K-Factors to meet design requirements. The special Polyester and Teflon® coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are cULus listed as corrosion resistant as indicated in the Approval Chart. (Note: FM Global has no approval classification for Teflon® and Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Class 2020
NYC Approved: Calendar Number 219-76-SA and MEA 89-92-E, Volume 16
ABS Certified: Certificate 04-HS407984B-PDA
VdS Approved: Certificate G4060054, G4060056, G4880046, G4930039, and G4980020
LPC Approved: Ref. No. 096e/03, TE30401, and TE30872
CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001, 0832-CPD-2003, 0786-CPD-40131, and 0786-CPD-40171
MED Certified: Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008
NOTE: Other International approval certificates are available upon request.

Refer to the Approval Chart on page 51d and Design Criteria on page 51e for cULus and FM approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 1987.
Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: Sprinklers VK315 and VK340 are rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. All other Part Nos. not mentioned above are rated to a maximum 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: Refer to the Approval Chart
Nominal K-Factor: Refer to the Approval Chart
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: Refer to the Approval Chart

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass for Sprinklers 06661B, 06766B, 07060, and 12281. Brass UNS-C84400 for all other sprinklers.
Deflector: Brass UNS-C23000 or Copper UNS-C19500 for Sprinklers 06661B and 12281. Copper UNS-C19500 for Sprinklers 06665B, 06764B, and 07060. Brass UNS-C26000 for all other Sprinklers.
Bushing (for Sprinklers 06719B, 06717B, and 12286): Brass UNS-C36000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Screw: Brass UNS-C36000

Form No. F_080488 Replaces page 51a-e, dated April 25, 2008. (Updated sprinkler materials. Min. operating pressure for LPCB and CE approval ONLY is 5 psi (0.35 bar). Added alternate frame material for Sprinklers 06661B, 06766B, 07060, and 12281. Removed VdS Approval from Sprinklers 06665B, 06764B, and 14817.)

VIKING TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Pip Cap Attachment (for Sprinklers VK300 and VK325): Brass UNS-C36000
For Teflon® Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-Teflon® Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed

Ordering Information: (Also refer to the current Viking price list.)
Order Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome-Enloy® = F, White Polyester = M-/W, Black Polyester = M-/B, and Black Teflon® = N
Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK300 with a 1/2" thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 06661BAB

Available Finishes And Temperature Ratings:

Refer to Table 1

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:
Standard Wrench: Part No. 10896W/B (available since 2000)

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome-Enloy®, White Polyester, Black Polyester, and Black Teflon®
Corrosion-Resistant Coatings[4]: White Polyester, Black Polyester, and Black Teflon®

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated on pages 51d. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and Teflon® coatings.

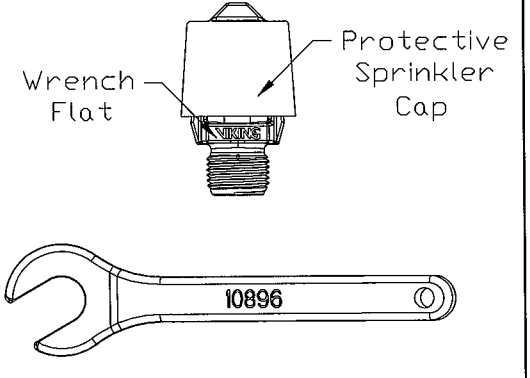


Figure 1:
Standard Sprinkler Wrench 10896W/B

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart

Microfast® and Microfast® HP Quick Response Upright and Conventional Sprinklers
Maximum 175 PSI (12 bar) WWP

KEY: Temperature, Finish, Escutcheon (if applicable) — e.g. A1X

Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 51e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM[7]	NYC[8]	VdS	LPCB	CE	⚙
Upright-Standard Orifice														
06661B	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A2	A3	A2	--	--	--	--
07060	VK345	--	15 mm	5.6	80.6	2-3/16	56	--	A3	--	A3	A3	B3[12]	B3[14]
Conventional-Standard Orifice														
06766B	VK310	1/2"	15 mm	5.6	80.6	2-3/16	56	A3	--	A3	--	A3	B3[12]	B3[14]
Upright-Large Orifice														
06665B	VK350	3/4"	--	8.0	115.2	2-5/16	59	A2	A3	A2	--	A3	B3[12]	--
14817	VK350	--	20 mm	8.0	115.2	2-5/16	59	A2	A3	A2	--	A3	B3[12]	--
06764B	VK350	1/2"	15 mm	8.0	115.2	2-5/16	59	A2	--	A2	--	--	--	--
Conventional-Large Orifice														
06768B	VK354	3/4"	20 mm	8.0	115.2	2-5/16	59	A2	--	A3	--	A3	B3[12]	--
Upright-Small Orifice[10]														
06717B[11]	VK325	1/2"	15 mm	2.8	40.3	2-3/16	56	A2	A1	A2	--	--	--	--
06719B[11]	VK327	1/2"	15 mm	4.2	60.0	2-3/16	56	A2	--	A2	--	--	--	--
06931B[11]	VK327	--	10 mm	4.2	60.0	2-3/16	56	--	--	--	A3	--	E1[13]	--

Maximum 250 PSI (17 bar) WWP

Upright-Standard Orifice

Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 51e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM	NYC[9]	VdS	LPCB	CE	⚙
12281	VK315	1/2"	15 mm	5.6	80.6	2-3/16	56	A2	--	A2	--	--	--	--
Upright-Small Orifice[10]														
12286[11]	VK340	1/2"	15 mm	2.8	40.3	2-3/16	56	A2	--	A2	--	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
C - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 286 °F (141°C)
D - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
E - 155 °F (68 °C)

Approved Finishes

1 - Brass and Chrome-Enloy®
2 - Brass, Chrome-Enloy®, White Polyester[5,6], Black Polyester[5,6], and Black Teflon®[5]
3 - Brass, Chrome-Enloy®, White Polyester[5,6], and Black Polyester[5,6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.

[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.

[5] cULus Listed as corrosion resistant.

[6] Other colors are available on request with the same Listings and Approvals as the standard colors.

[7] For installation in accordance with the latest applicable FM Loss Prevention Data Sheets and Technical Advisory Bulletins.

[8] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA.

[9] Accepted for use, City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

[10] Listings and Approvals limited to Light Hazard Occupancies where allowed by the installation standards being applied, with hydraulically calculated wet systems only. **Exception:** 4.2K sprinklers may be installed on hydraulically calculated dry pipe systems where piping is corrosion resistant or internally galvanized.

[11] The sprinkler orifice is bushed.

[12] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0832-CPD-2003.

[13] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40131.

[14] ⚙ MED Certified, Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008.

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE UPRIGHT AND CONVENTIONAL SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA

(Also refer to the Approval Chart on page 3 of)

cULus Listing Requirements:

Microfast® and MicrofastHP® Quick Response Upright and Conventional Sprinklers are cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers, or old style (conventional) sprinklers.

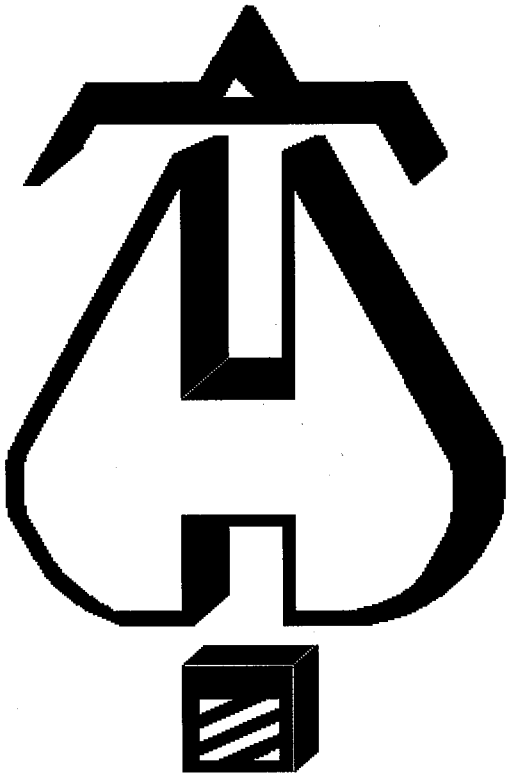
- Designed for use in Light and Ordinary Hazard occupancies *(exception: small orifice sprinklers are limited to Light Hazard where allowed by the installation standards being applied, with hydraulically calculated wet systems only).*
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed. For conventional sprinklers, refer to the installation guidelines for old style (conventional) sprinklers.

FM Approval Requirements:

For installation in accordance with the latest applicable FM Loss Prevention Data Sheets (including 2-8N) and Technical Advisory Bulletins. FM Global Loss Prevention Data Sheets and Technical Advisory Bulletins contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

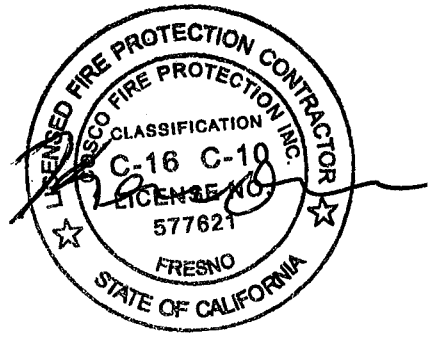
NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



. . . Fire Protection by Computer Design

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE AVE.
SUITE #108
FRESNO, CA. 93722
(559) 275-3795



Job Name	:	CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407
Building	:	EXIST GYM, OFFICES, REMOTE AREA E4
Location	:	RECREATION CENTER EXPANSION
System	:	E-OFFICE
Contract	:	FD-1075
Data File	:	CALPOLY-E4OFFICES.WXF

Hydraulic Design Information Sheet

Name - CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407 Date - 11-04-2010
Location - RECREATION CENTER EXPANSION
Building - EXIST GYM, OFFICES, REMOTE AREA E4 System No. - E-OFFICE
Contractor - COSCO FIRE PROTECTION INC. Contract No. - FD-1075
Calculated By - KO Drawing No. - FP-E1 PIPE
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 10'
Occupancy - LIGHT HAZARD, but Calced at higher ORD. HZD. 1

SYSTEM DESIGN

(X) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. (x) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Quick Response reduction utilized per NFPA#13-2002, 11.2.3.2.3.1
Specific Ruling Made By Date

Area of Sprinkler Operation - 900	System Type	Sprinkler/Nozzle
Density - .15	(X) Wet	Make VIKING
Area Per Sprinkler - 100	( ) Dry	Model PENDANT
Elevation at Highest Outlet - 10'	( ) Deluge	Size 1/2"
Hose Allowance - Inside - 100	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance - NA	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 150		

Note Offices are light hazard, but calced at higher Ord. Hzd.1 occupancy.

Calculation Summary

Flow Required - 337.57 Press Required - 45.23 BOR
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 3-8-2010		Cap. -
Time of Test - 3 PM	Rated Cap.-	Elev.-
Static Press - 140	@ Press -	
Residual Press - 132	Elev. -	Well
Flow - 1186		Proof Flow
Elevation - 0		

Location - FIRE HYDRANT #47 & #51 ON SITE

Source of Information - FLOW TEST PERFORMED ON SITE 3-8-2010
BY CANNON ENGINEERING , RESULTS ATTACHED TO CALCS.

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
( ) Mult. Row		( ) Open Shelf	

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

Horizontal Barriers Provided:

Water Supply Curve (C)

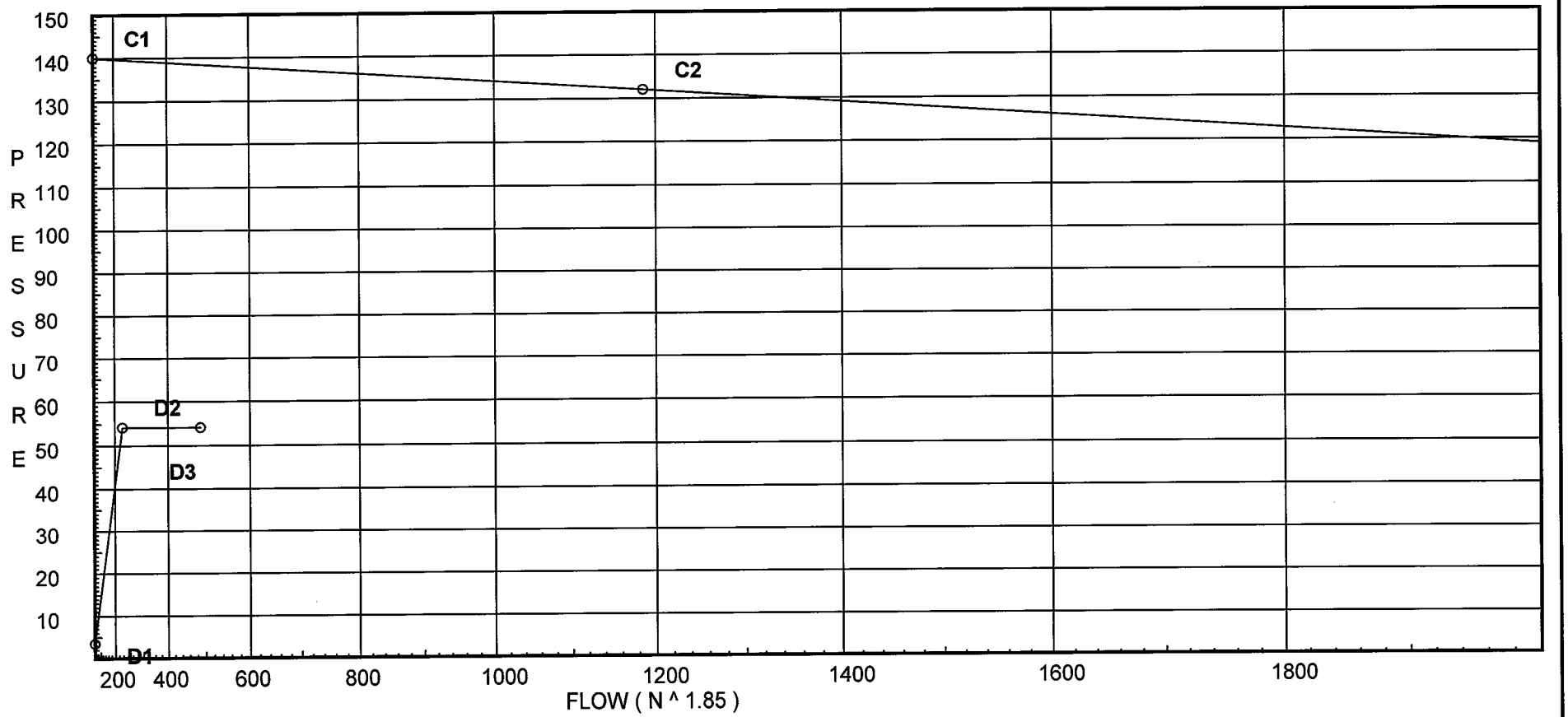
COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

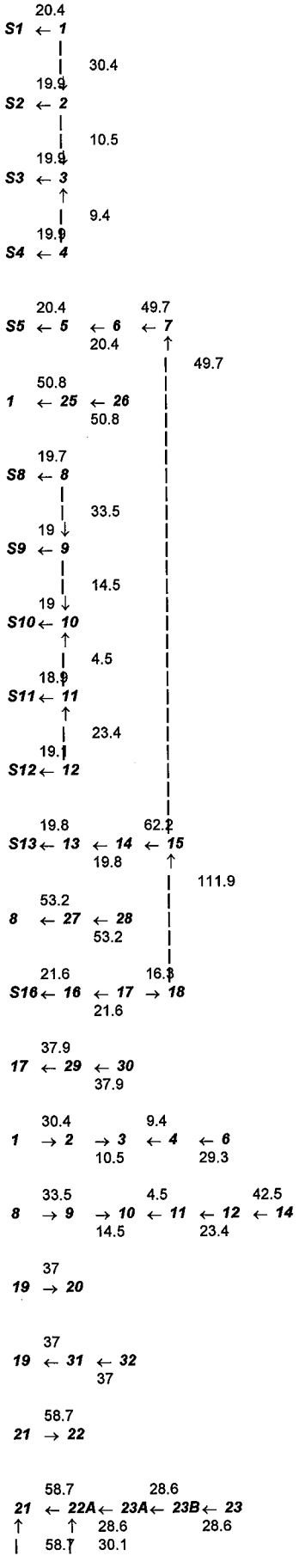
Date 11-04-2010

City Water Supply:
- C1 - Static Pressure : 140
- C2 - Residual Pressure: 132
- C2 - Residual Flow : 1186

Demand:

D1 - Elevation	:	3.465
D2 - System Flow	:	237.572
D2 - System Pressure	:	54.199
Hose (Adj City)	:	
Hose (Demand)	:	250
D3 - System Demand	:	487.572
Safety Margin	:	84.256

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30.4
19.9
S2 ← 2
10.5
19.9
S3 ← 3
9.4
19.9
S4 ← 4
20.4
S5 ← 5
← 6
20.4
49.7
← 7
49.7
50.8
1 ← 25
← 26
50.8
19.7
S8 ← 8
33.5
19
S9 ← 9
14.5
19
S10 ← 10
4.5
18.9
S11 ← 11
23.4
19.1
S12 ← 12
19.8
S13 ← 13
← 14
19.8
62.2
← 15
111.9
53.2
8 ← 27
← 28
53.2
21.6
S16 ← 16
← 17
21.6
16.3
→ 18
37.9
17 ← 29
← 30
37.9
30.4
1 → 2
→ 3
10.5
9.4
← 4
← 6
29.3
33.5
8 → 9
→ 10
14.5
4.5
← 11
← 12
23.4
42.5
← 14
37
19 → 20
37
19 ← 31
← 32
37
58.7
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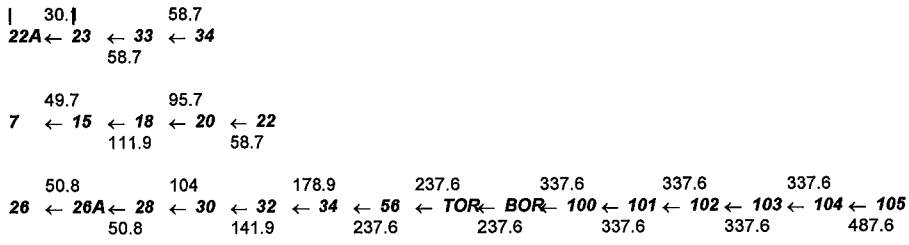
← 23B
← 23
28.6
58.7
30.1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58.7
22A ← 23 ← 33 ← 34
58.7
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95.7
7 ← 15 ← 18 ← 20 ← 22
111.9
58.7
50.8
104
178.9
237.6
337.6
337.6
337.6
26 ← 26A ← 28 ← 30 ← 32 ← 34 ← 56 ← TOR ← BOR ← 100 ← 101 ← 102 ← 103 ← 104 ← 105
50.8
141.9
237.6
237.6
337.6
337.6
487.6

Fittings Used Summary

Fitting Legend Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
Avk	Alarm Viking J1								10		13		20	23							
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Pressure / Flow Summary - STANDARD

COSCO FIRE PROTECTION INC.
CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA. 93407

Date 11-04-2010

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	8.0	5.6	13.32	na	20.44	0.15	100	7.0
S2	8.0	5.6	12.64	na	19.91	0.15	100	7.0
S3	8.0	5.6	12.59	na	19.87	0.15	100	7.0
S4	8.0	5.6	12.66	na	19.92	0.15	100	7.0
S5	8.0	5.6	13.23	na	20.37	0.15	100	7.0
5	9.8		14.07	na				
6	9.8		14.32	na				
1	9.8		13.9	na				
25	9.8		26.96	na				
S8	8.0	5.6	12.38	na	19.7	0.15	100	7.0
S9	8.0	5.6	11.57	na	19.05	0.15	100	7.0
S10	8.0	5.6	11.46	na	18.96	0.15	100	7.0
S11	8.0	5.6	11.37	na	18.88	0.15	100	7.0
S12	8.0	5.6	11.65	na	19.12	0.15	100	7.0
S13	8.0	5.6	12.44	na	19.75	0.15	100	7.0
13	9.8		13.89	na				
14	9.8		14.12	na				
8	9.8		12.87	na				
27	9.8		27.1	na				
S16	8.0	5.6	14.88	na	21.6	0.15	144	7.0
16	9.8		15.97	na				
17	9.8		16.35	na				
29	9.8		27.83	na				
2	9.8		13.16	na				
3	9.8		13.09	na				
4	9.8		13.17	na				
9	9.8		11.98	na				
10	9.8		11.86	na				
11	9.8		11.87	na				
12	9.8		12.19	na				
19	9.8		17.41	na				
31	9.8		28.4	na				
21	9.8		18.3	na				
22A	9.8		22.09	na				
23A	9.8		22.72	na				
23B	9.8		28.22	na				
23	9.8		28.79	na				
33	9.8		29.31	na				
7	9.0		15.45	na				
15	9.0		15.66	na				
18	9.0		16.6	na				
20	9.0		17.3	na				
26	9.0		28.12	na				
26A	9.0		28.27	na				
28	9.0		28.34	na				
30	9.0		28.65	na				
32	9.0		29.2	na				
34	9.0		30.04	na				
56	7.2		35.78	na				
TOR	11.2		35.8	na				
BOR	0.0		45.23	na	100.0			
100	0.0		45.59	na				
101	0.0		45.79	na				
102	0.0		46.15	na				
103	0.0		53.3	na				
104	0.0		53.64	na	150.0			
105	0.0		54.2	na				

The maximum velocity is 13.98 and it occurs in the pipe between nodes 34 and 56

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S1	20.44	1.049	1E	2.0	3.000	13.321		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
1	20.44	0.1355		0.0	10.000	1.355		Vel = 7.59
	0.0							
	20.44					13.896		K Factor = 5.48
S2	19.91	1.049	1E	2.0	3.000	12.644		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
2	19.91	0.1291		0.0	10.000	1.291		Vel = 7.39
	0.0							
	19.91					13.155		K Factor = 5.49
S3	19.87	1.049	1E	2.0	3.000	12.587		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
3	19.87	0.1286		0.0	10.000	1.286		Vel = 7.38
	0.0							
	19.87					13.093		K Factor = 5.49
S4	19.92	1.049	1E	2.0	3.000	12.657		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
4	19.92	0.1292		0.0	10.000	1.292		Vel = 7.39
	0.0							
	19.92					13.169		K Factor = 5.49
S5	20.37	1.049	2E	4.0	3.000	13.232		K Factor = 5.60
to		120.0	1T	5.0	9.000	-0.780		
5	20.37	0.1347		0.0	12.000	1.616		Vel = 7.56
5	0.0	1.38	1T	6.0	1.000	14.068		
to		120.0		0.0	6.000	0.0		
6	20.37	0.0354		0.0	7.000	0.248		Vel = 4.37
6	29.33	1.61	1T	8.0	1.000	14.316		
to		120.0		0.0	8.000	0.346		
7	49.7	0.0871		0.0	9.000	0.784		Vel = 7.83
	0.0							
	49.70					15.446		K Factor = 12.65
1	50.81	1.38	1T	6.0	62.000	13.896		
to		120.0		0.0	6.000	0.0		
25	50.81	0.1921		0.0	68.000	13.062		Vel = 10.90
25	0.0	1.61	1T	8.0	1.000	26.958		
to		120.0		0.0	8.000	0.346		
26	50.81	0.0908		0.0	9.000	0.817		Vel = 8.01
	0.0							
	50.81					28.121		K Factor = 9.58
S8	19.70	1.049	1E	2.0	3.000	12.380		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
8	19.7	0.1266		0.0	10.000	1.266		Vel = 7.31
	0.0							
	19.70					12.866		K Factor = 5.49
S9	19.05	1.049	1E	2.0	3.000	11.567		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
9	19.05	0.1189		0.0	10.000	1.189		Vel = 7.07

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	19.05					11.976		K Factor = 5.50
S10	18.96	1.049	1E	2.0	3.000	11.464		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
10	18.96	0.1179		0.0	10.000	1.179		Vel = 7.04
	0.0							
	18.96					11.863		K Factor = 5.50
S11	18.88	1.049	1E	2.0	4.000	11.366		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
11	18.88	0.1169		0.0	11.000	1.286		Vel = 7.01
	0.0							
	18.88					11.872		K Factor = 5.48
S12	19.12	1.049	1E	2.0	4.000	11.654		K Factor = 5.60
to		120.0	1T	5.0	7.000	-0.780		
12	19.12	0.1198		0.0	11.000	1.318		Vel = 7.10
	0.0							
	19.12					12.192		K Factor = 5.48
S13	19.75	1.049	2E	4.0	8.500	12.442		K Factor = 5.60
to		120.0	1T	5.0	9.000	-0.780		
13	19.75	0.1272		0.0	17.500	2.226		Vel = 7.33
13	0.0	1.38	1T	6.0	1.000	13.888		
to		120.0		0.0	6.000	0.0		
14	19.75	0.0334		0.0	7.000	0.234		Vel = 4.24
14	42.47	1.61	1T	8.0	1.000	14.122		
to		120.0		0.0	8.000	0.346		
15	62.22	0.1319		0.0	9.000	1.187		Vel = 9.81
	0.0							
	62.22					15.655		K Factor = 15.73
8	53.23	1.38	1T	6.0	62.000	12.866		
to		120.0		0.0	6.000	0.0		
27	53.23	0.2094		0.0	68.000	14.237		Vel = 11.42
27	0.0	1.61	1T	8.0	1.000	27.103		
to		120.0		0.0	8.000	0.346		
28	53.23	0.0989		0.0	9.000	0.890		Vel = 8.39
	0.0							
	53.23					28.339		K Factor = 10.00
S16	21.60	1.049	2E	4.0	8.500	14.878		K Factor = 5.60
to		120.0		0.0	4.000	-0.780		
16	21.6	0.1501		0.0	12.500	1.876		Vel = 8.02
16	0.0	1.38	1T	6.0	3.500	15.974		
to		120.0		0.0	6.000	0.0		
17	21.6	0.0394		0.0	9.500	0.374		Vel = 4.63
17	-37.86	1.61	1T	8.0	1.000	16.348		
to		120.0		0.0	8.000	0.346		
18	-16.26	-0.0109		0.0	9.000	-0.098		Vel = 2.56
	0.0							
	-16.26					16.596		K Factor = -3.99

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
17	37.86	1.38	1T	6.0	97.000	16.348		
to		120.0		0.0	6.000	0.0		
29	37.86	0.1115		0.0	103.000	11.481		Vel = 8.12
29	0.0	1.61	1T	8.0	1.000	27.829		
to		120.0		0.0	8.000	0.346		
30	37.86	0.0527		0.0	9.000	0.474		Vel = 5.97
	0.0							
	37.86					28.649		K Factor = 7.07
1	-30.37	1.38		0.0	10.000	13.896		
to		120.0		0.0	0.0	0.0		
2	-30.37	-0.0741		0.0	10.000	-0.741		Vel = 6.51
2	19.91	1.38		0.0	6.000	13.155		
to		120.0		0.0	0.0	0.0		
3	-10.46	-0.0103		0.0	6.000	-0.062		Vel = 2.24
3	19.87	1.38		0.0	9.000	13.093		
to		120.0		0.0	0.0	0.0		
4	9.41	0.0084		0.0	9.000	0.076		Vel = 2.02
4	19.92	1.38	1T	6.0	10.500	13.169		
to		120.0		0.0	6.000	0.0		
6	29.33	0.0695		0.0	16.500	1.147		Vel = 6.29
	0.0							
	29.33					14.316		K Factor = 7.75
8	-33.53	1.38		0.0	10.000	12.866		
to		120.0		0.0	0.0	0.0		
9	-33.53	-0.0890		0.0	10.000	-0.890		Vel = 7.19
9	19.04	1.38		0.0	6.000	11.976		
to		120.0		0.0	0.0	0.0		
10	-14.49	-0.0188		0.0	6.000	-0.113		Vel = 3.11
10	18.97	1.38		0.0	4.500	11.863		
to		120.0		0.0	0.0	0.0		
11	4.48	0.0020		0.0	4.500	0.009		Vel = 0.96
11	18.87	1.38		0.0	7.000	11.872		
to		120.0		0.0	0.0	0.0		
12	23.35	0.0457		0.0	7.000	0.320		Vel = 5.01
12	19.12	1.38	1T	6.0	8.000	12.192		
to		120.0		0.0	6.000	0.0		
14	42.47	0.1379		0.0	14.000	1.930		Vel = 9.11
	0.0							
	42.47					14.122		K Factor = 11.30
19	-36.98	1.61	1T	8.0	1.000	17.406		
to		120.0		0.0	8.000	0.346		
20	-36.98	-0.0503		0.0	9.000	-0.453		Vel = 5.83
	0.0							
	-36.98					17.299		K Factor = -8.89
19	36.98	1.38	1T	6.0	97.000	17.406		
to		120.0		0.0	6.000	0.0		
31	36.98	0.1067		0.0	103.000	10.993		Vel = 7.93
31	0.0	1.61	1T	8.0	1.000	28.399		
to		120.0		0.0	8.000	0.346		
32	36.98	0.0504		0.0	9.000	0.454		Vel = 5.83

COSCO FIRE PROTECTION INC.
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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*******	Notes	******
	0.0									
	36.98					29.199		K Factor = 6.84		
21	-58.68	1.61	1T	8.0	1.000	18.302				
to		120.0		0.0	8.000	-4.418				
22	-58.68	-0.1182		0.0	9.000	-1.064		Vel = 9.25		
	0.0									
	-58.68					12.820		K Factor = -16.39		
21	58.68	1.61	1T	8.0	24.000	18.302				
to		120.0		0.0	8.000	0.0				
22A	58.68	0.1183		0.0	32.000	3.787		Vel = 9.25		
22A	-30.08	1.61	1T	8.0	12.000	22.089				
to		120.0		0.0	8.000	0.0				
23A	28.6	0.0313		0.0	20.000	0.626		Vel = 4.51		
23A	0.0	1.38	4E	12.0	65.000	22.715				
to		120.0	1T	6.0	18.000	0.0				
23B	28.6	0.0663		0.0	83.000	5.507		Vel = 6.13		
23B	0.0	1.61	1T	8.0	10.000	28.222				
to		120.0		0.0	8.000	0.0				
23	28.6	0.0313		0.0	18.000	0.564		Vel = 4.51		
	0.0									
	28.60					28.786		K Factor = 5.33		
22A	30.07	1.38	6E	18.0	68.000	22.089				
to		120.0	1T	6.0	24.000	0.0				
23	30.07	0.0728		0.0	92.000	6.697		Vel = 6.45		
23	28.61	2.067	1E	5.0	10.000	28.786				
to		120.0		0.0	5.000	0.0				
33	58.68	0.0351		0.0	15.000	0.526		Vel = 5.61		
33	0.0	2.067	1T	10.0	1.000	29.312				
to		120.0		0.0	10.000	0.346				
34	58.68	0.0351		0.0	11.000	0.386		Vel = 5.61		
	0.0									
	58.68					30.044		K Factor = 10.71		
7	49.70	2.157		0.0	10.000	15.446				
to		120.0		0.0	0.0	0.0				
15	49.7	0.0209		0.0	10.000	0.209		Vel = 4.36		
15	62.22	2.157		0.0	10.000	15.655				
to		120.0		0.0	0.0	0.0				
18	111.92	0.0941		0.0	10.000	0.941		Vel = 9.83		
18	-16.26	2.157		0.0	10.000	16.596				
to		120.0		0.0	0.0	0.0				
20	95.66	0.0703		0.0	10.000	0.703		Vel = 8.40		
20	-36.98	2.157		0.0	10.000	17.299				
to		120.0		0.0	0.0	-4.764				
22	58.68	0.0285		0.0	10.000	0.285		Vel = 5.15		
	0.0									
	58.68					12.820		K Factor = 16.39		
26	50.81	2.635	1T	16.474	2.000	28.121				
to		120.0		0.0	16.474	0.0				
26A	50.81	0.0082		0.0	18.474	0.152		Vel = 2.99		

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
26A	0.0	2.635		0.0	8.000	28.273		
to		120.0		0.0	0.0	0.0		
28	50.81	0.0082		0.0	8.000	0.066		Vel = 2.99
28	53.24	2.635		0.0	10.000	28.339		
to		120.0		0.0	0.0	0.0		
30	104.05	0.0310		0.0	10.000	0.310		Vel = 6.12
30	37.86	2.635		0.0	10.000	28.649		
to		120.0		0.0	0.0	0.0		
32	141.91	0.0550		0.0	10.000	0.550		Vel = 8.35
32	36.98	2.635		0.0	10.000	29.199		
to		120.0		0.0	0.0	0.0		
34	178.89	0.0845		0.0	10.000	0.845		Vel = 10.52
34	58.68	2.635	1E	8.237	10.000	30.044		
to		120.0	1T	16.474	24.711	0.780		
56	237.57	0.1428		0.0	34.711	4.956		Vel = 13.98
56	0.0	3.26	1T	20.159	5.000	35.780		
to		120.0	1E	9.408	29.567	-1.732		
TOR	237.57	0.0506		0.0	34.567	1.750		Vel = 9.13
TOR	0.0	3.26	1E	9.408	7.000	35.798		
to		120.0	1Fsp	0.0	24.192	7.851		* Fixed loss = 3
BOR	237.57	0.0506	1G	1.344	31.192	1.579		Vel = 9.13
			1Avk	13.44				
BOR	100.00	6.357	3E	52.808	6.000	45.228		Qa = 100
to		120.0	1T	37.72	90.528	0.0		
100	337.57	0.0038		0.0	96.528	0.362		Vel = 3.41
100	0.0	6.16	4L	51.645	10.000	45.590		
to		140.0		0.0	51.645	0.0		
101	337.57	0.0033		0.0	61.645	0.203		Vel = 3.63
101	0.0	6.16	6L	77.467	30.000	45.793		
to		140.0		0.0	77.467	0.0		
102	337.57	0.0033		0.0	107.467	0.353		Vel = 3.63
102	0.0	6.16	2E	40.168	6.000	46.146		
to		140.0		0.0	40.168	7.000		* Fixed loss = 7
103	337.57	0.0033		0.0	46.168	0.152		Vel = 3.63
103	0.0	6.16	1G	4.304	30.000	53.298		
to		140.0	2L	25.822	73.163	0.0		
104	337.57	0.0033	1T	43.037	103.163	0.339		Vel = 3.63
104	150.00	8.27	2L	41.12	260.000	53.637		Qa = 150
to		140.0	1G	6.326	102.800	0.0		
105	487.57	0.0015	1T	55.354	362.800	0.562		Vel = 2.91
	0.0							
	487.57					54.199		K Factor = 66.23

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 4:40 PM
Hydrant Site ID#: 47 **Class**_____ **Elev. @ Hydrant:** 330.57
Street Address Adjacent to Hydrant: Campus Way
Number of ports flowed: 1

Static:	150	*psi before flowing*
Residual:		*psi while flowing*
Pitot:	50	*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	1186.48	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

Number of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is opened.

Field Notes:

Cannon

Fire Hydrant Flow & Pressure Test

Date of test: 3/8/2010 **Time of test:** 5:00 PM
Hydrant Site ID#: 51 **Class**_____ **Elev. @ Hydrant:** 346.00
Street Address Adjacent to Hydrant: Adjacent to new pool
Number of ports flowed: 1

Static:	140	*psi before flowing*
Residual:	132	*psi while flowing*
Pitot:		*pitot gauge reading*
Nozzle Coefficient:	0.9	*(Note 3)*
Diameter:	2.5	*size of opening tested*
This hydrant is flowing:	0.00	*GPM from the test outlet*
Projected available hydrant flow @ 20psi:		*GPM (Note 1)*
2nd Static: (with handheld pitot gauge)		*secondary psi before flowing*
2nd Residual:		*secondary psi while flowing*
The main can be expected to flow about:		*GPM*

# of Tanks in System: 2
Tank No. 1: N/A
Tank No. 2: N/A
Water Main Size:___12"_____

Pumps:

Notes:

1. Projected available flows calculated at 20 psi residual, or ½ the static pressure for low pressure hydrants having static pressures of less than 40 psi.

2. This calculator is based on established Hazen-Williams formulas and is provided for convenience and estimation purposes only. The author and Cannon express no warranty for its suitability for any particular purpose.

3. Since hydrant nozzles typically don't produce perfect discharge columns, this is a correction factor which is often used to compensate for errant pitot readings. Hydrant manufacturers should be able to provide coefficients for their products. For hydrants where the coefficient is unknown, we use .95 or .9 depending upon how uniform the discharge stream looks when the hydrant is

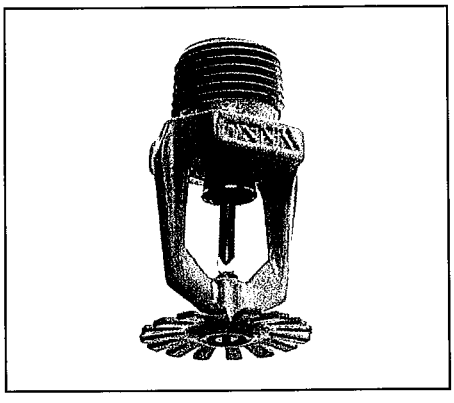
Field Notes:

VIKING | TECHNICAL DATA | **MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS**

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Microfast® and MicrofastHP® Quick Response Pendent Sprinklers are small, thermosensitive, glass-bulb spray sprinklers available in several different finishes and temperature ratings and K-Factors to meet design requirements. The special Polyester and Teflon® coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are cULus listed as corrosion resistant as indicated in the Approval Chart. (Note: FM Global has no approval classification for Teflon® and Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Class 2020
NYC Approved: Calendar Number 219-76-SA and MEA 89-92-E, Volume 16
ABS Certified: Certificate 04-HS407984C-PDA
VdS Approved: Certificate G4040095, G4040097, G4060056, G4060057, G4880045, G4930038, and G4980021
LPC Approved: Ref. No. 096e/03 and 096e/04
CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001, 0832-CPD-2003, 0786-CPD-40130, and 0786-CPD-40170
MED Certified: Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008
NOTE: Other International approval certificates are available upon request.

Refer to the Approval Chart on page 41d and Design Criteria on page 41e for cULus and FM approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 1987.
Minimum Operating Pressure: 7 psi (0.5 bar)
Maximum Working Pressure: Sprinklers 12282 and 12290 are rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. All other Part Nos. not mentioned above are rated to a maximum 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: Refer to the Approval Chart
Nominal K-Factor: Refer to the Approval Chart
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: Refer to the Approval Chart

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:

Frame Casting: Brass UNS-C84400
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500 for Sprinklers 06662B, 06666B, 06765B, and 12104. Copper UNS-C19500 for Sprinkler 12282. Brass UNS-C26000 for all other Sprinklers.
Bushing (for Sprinklers 06718B, 06720B, and 12290): Brass UNS-C36000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Pip Cap Attachment: Brass UNS-C36000
Ejector Spring (for Sprinkler 12104): Stainless Steel

VIKING | TECHNICAL DATA | MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

For Teflon® Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-Teflon® Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed

Ordering Information: (Also refer to the current Viking price list.)
Order Microfast® and MicrofastHP® Quick Response Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome-Enloy® = F, White Polyester = M-/W, Black Polyester = M-/B, and Black Teflon® = N
Temperature Suffix (°F/°C): 135°/68° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK302 with a 1/2" thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 06662BAB

Available Finishes And Temperature Ratings:

Refer to Table 1

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:
A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for coated and/or recessed sprinklers: Part No. 12144W/B** (available since 2003)
NOTE: RECESSED PENDENT SPRINKLERS WITH PROTECTIVE CAPS MUST USE WRENCH 12144W/B.
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION
Refer to appropriate NFPA Installation Standards.

5. OPERATION
During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE
Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY
The Viking Microfast® and MicrofastHP® Quick Response Pendent Sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE
For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

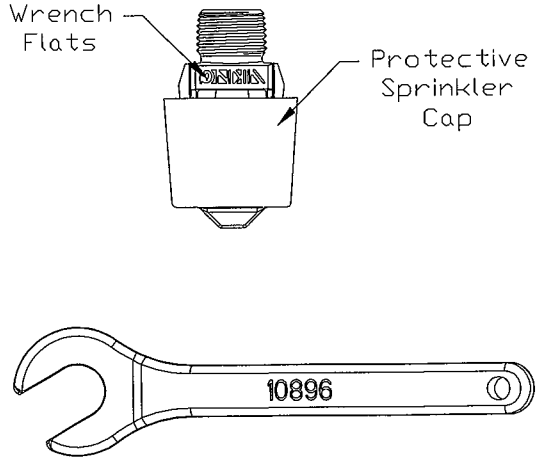


Figure 1:
Standard Sprinkler Wrench 10896W/B

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome-Enloy®, White Polyester, Black Polyester, and Black Teflon®
Corrosion-Resistant Coatings[4]: White Polyester, Black Polyester, and Black Teflon®

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated on pages 41d. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and Teflon® coatings.

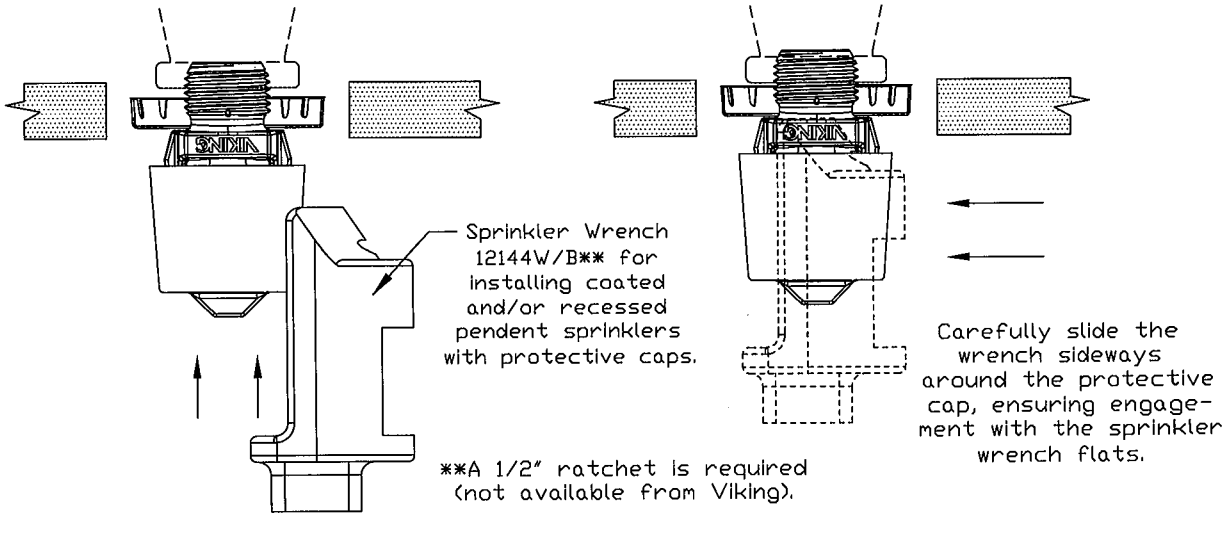


Figure 2: Wrench 12144W/B for Coated and/or Recessed Pendent Sprinklers

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TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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Approval Chart

Microfast® and MicrofastHP® Quick Response Pendent Sprinklers
Maximum 175 PSI (12 bar) WWP

KEY: Temperature, Finish, Escutcheon (if applicable) — e.g. X, A1X

Sprinkler Base Part No.[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 41e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM[5]	NYC[6]	VdS	LPCB	CE	
Standard Orifice														
06662B	VK302	1/2"	15 mm	5.6	80.6	2-1/4"	58	A1X, B1Y	A3X, B3Y	A1X, B1Y	A3	A3X, B3Y	C3X, E3Y[13]	C3X, E3Y[15]
Large Orifice														
06666B	VK352	3/4"	20 mm	8.0	115.2	2-3/8"	60	A1X, B1Y	A2X, B2Y	A1X, B1Y	--	A3X	C3[13]	--
12104	VK352	3/4"	20 mm	8.0	115.2	2-1/4"	58	--	--	--	G3	--	--	--
06765B	VK352	1/2"	15 mm	8.0	115.2	2-3/8"	60	A1X, B1Y	--	A1X, B1Y	A3	--	--	--
Small Orifice[9]														
06718B[10]	VK329	1/2"	15 mm	2.8	40.3	2-3/16"	56	A1X, B1Y	A2X	A1X, B1Y	--	--	--	--
06720B[10]	VK331	1/2"	15 mm	4.2	60.5	2-1/4"	58	A1X, B1Y	--	A1X, B1Y	--	--	--	--
06932B	VK331	--	10 mm	4.2	60.5	2-3/8"	60	--	--	--	A3	--	G2[14]	--

Maximum 250 PSI (17 bar) WWP
Standard Orifice

Sprinkler Base Part No[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 41e.)						
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	FM	NYC[11]	VdS	LPCB	CE	
12282	VK317	1/2"	15 mm	5.6	80.6	2-1/4"	58	A1X, B1Y	--	A1X	--	--	--	--
Maximum 250 PSI (17 bar) WWP **Small Orifice[9]**														
12290[10]	VK342	1/2"	15 mm	2.8	40.3	2-3/16"	56	A1X, B1Y	--	A1X	--	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
D - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 286 °F (141 °C)
E - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
F - 155 °F (68 °C), 175 °F (79 °C), and 286 °F (141 °C)
G - 155 °F (68 °C)

Approved Finishes

1 - Brass, Chrome-Enloy®, White Polyester[7,8], Black Polyester[7,8], and Black Teflon®[7]
2 - Brass and Chrome-Enloy®
3 - Brass, Chrome-Enloy®, White Polyester[8], and Black Polyester[8]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon[12]
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon[12] **or** recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking's current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] FM Approved for use only in wet-pipe sprinkler systems (or preaction systems qualifying as wet systems) for protection of occupancies described in the Factory Mutual Engineering and Research Loss Prevention Data Sheets and Technical Advisory Bulletins.
[6] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA.
[7] cULus Listed as corrosion resistant.
[8] Other colors are available on request with the same Listings and Approvals as the standard colors.
[9] Listings and Approvals limited to Light Hazard Occupancies where allowed by the installation standards being applied, with hydraulically calculated wet systems only. **Exception:** 4.2K sprinklers may be installed on hydraulically calculated dry pipe systems where piping is corrosion resistant or internally galvanized.
[10] The sprinkler orifice is bushed.
[11] Accepted for use, City of New York Department of Buildings, MEA Number 89-92-E, Vol. 16.
[12] The Viking Microfast® Model F-1 Adjustable Escutcheon is considered a surface-mounted escutcheon because it does not allow the fusible element of the sprinkler to be recessed behind the face of the wall or ceiling.
[13] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0832-CPD-2003.
[14] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40130 and 0786-CPD-40170.
[15] MED Certified, Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008.

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA

(Also refer to the Approval Chart on page 7)

cULus Listing Requirements:

Microfast® and MicrofastHP® Quick Response Pendent Sprinklers are cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies *(exception: small orifice sprinklers are limited to Light Hazard where allowed by the installation standards being applied, with hydraulically calculated wet systems only).*
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

FM Approval Requirements:

For installation in accordance with the latest applicable FM Loss Prevention Data Sheets (including 2-8N) and Technical Advisory Bulletins. FM Global Loss Prevention Data Sheets and Technical Advisory Bulletins contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

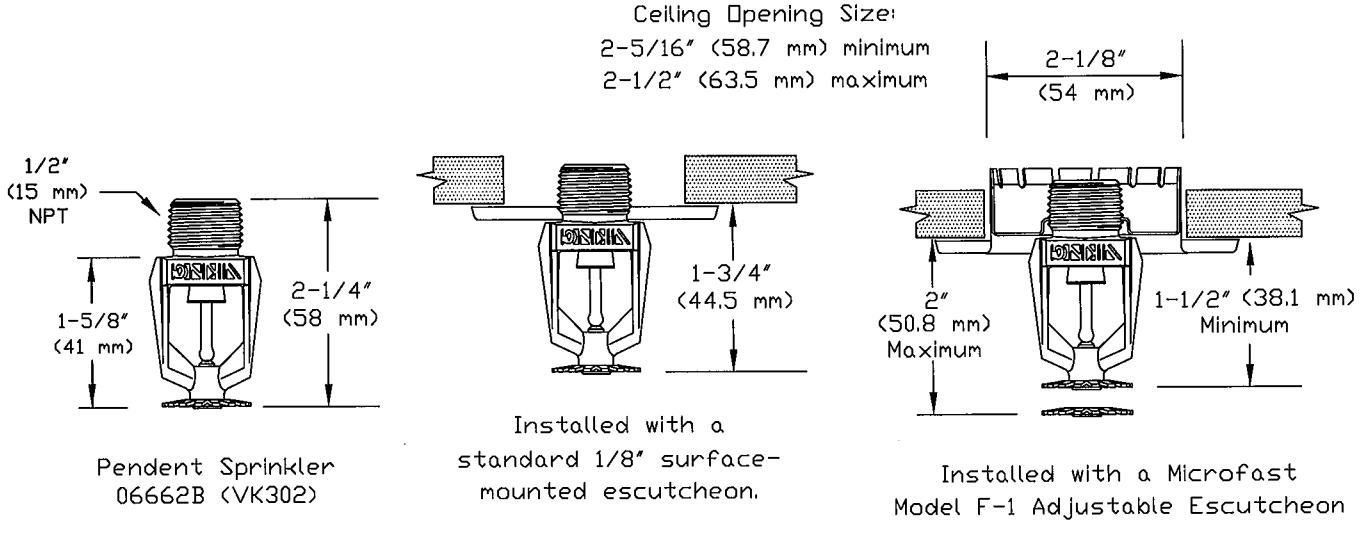


Figure 3: Sprinkler VK302 Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

VIKING

TECHNICAL DATA

MICROFAST® AND MicrofastHP® QUICK RESPONSE PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

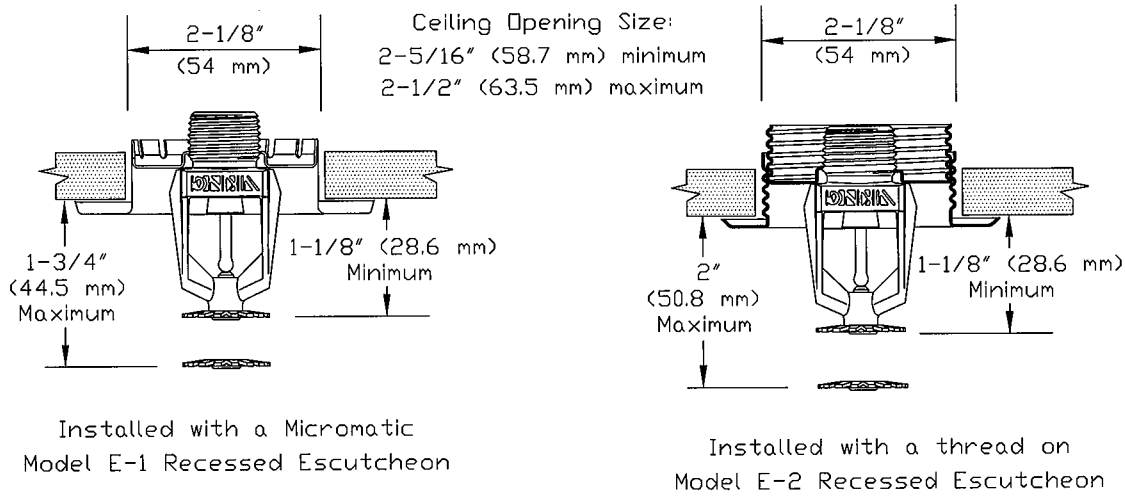


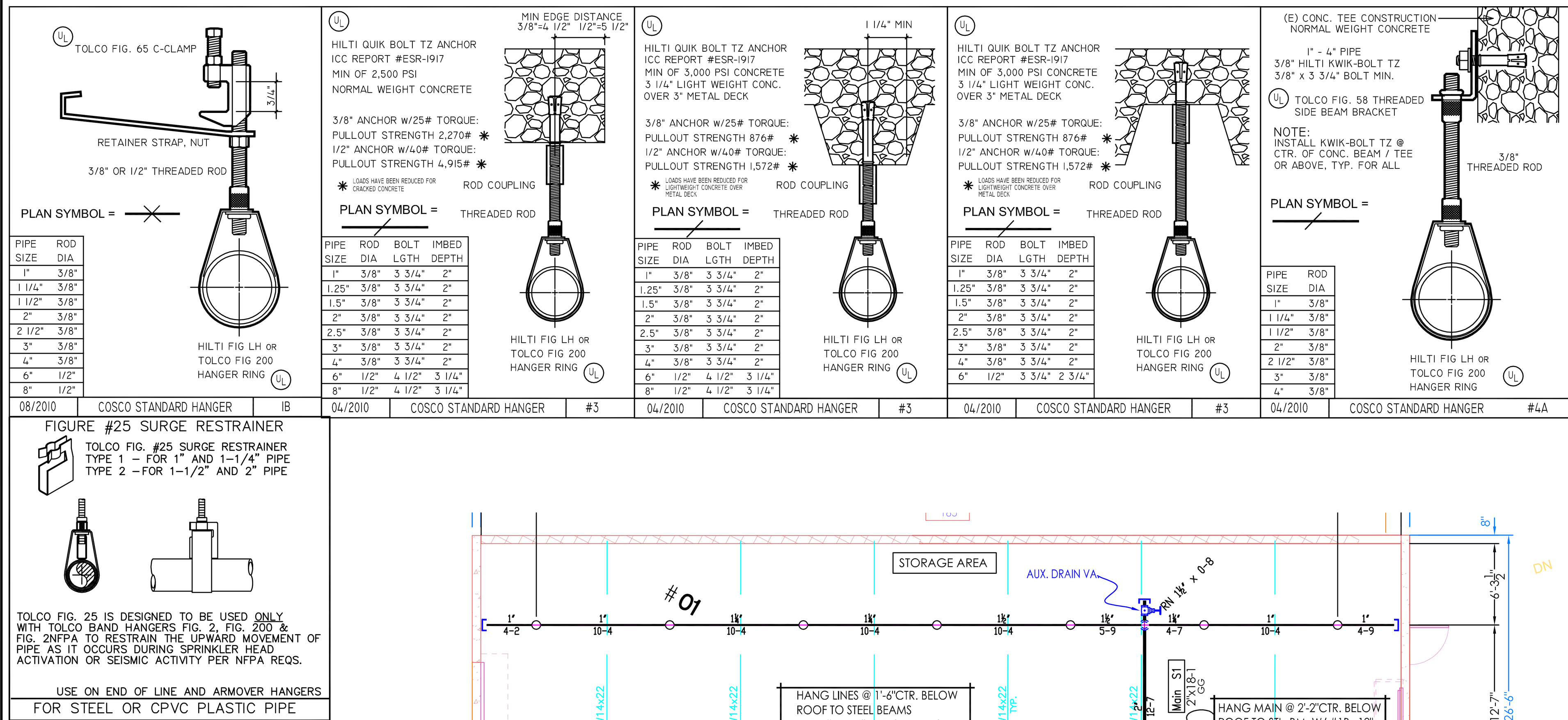
Figure 4: Sprinkler VK302 Dimensions with the Model E-1 and E-2 Recessed Escutcheons

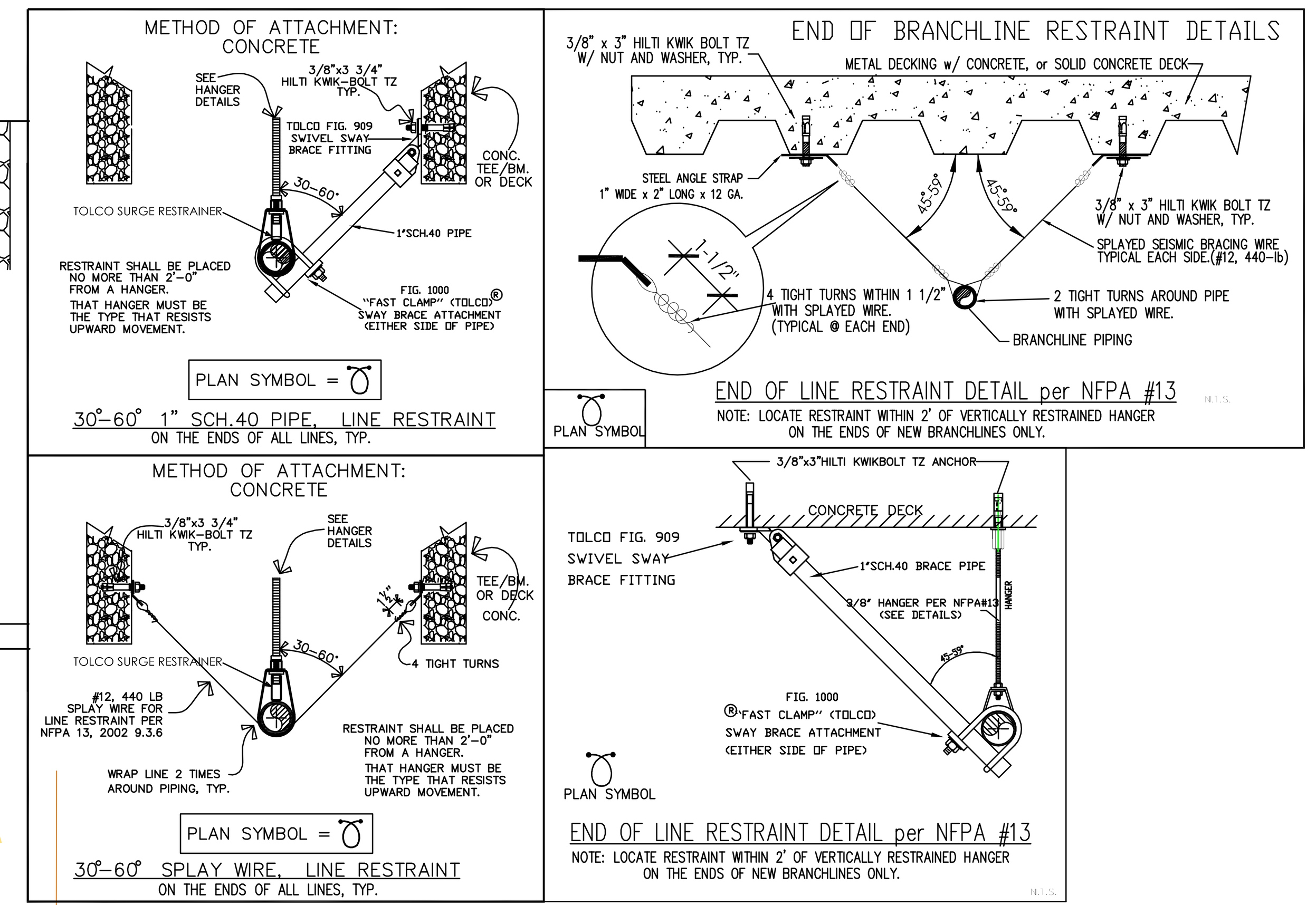
APPENDIX E

RECREATION CENTER – SPRINKLER PIPING ARRANGEMENT

HANGER DETAILS PER CBC, CFC 2007, & NFPA #13 2002

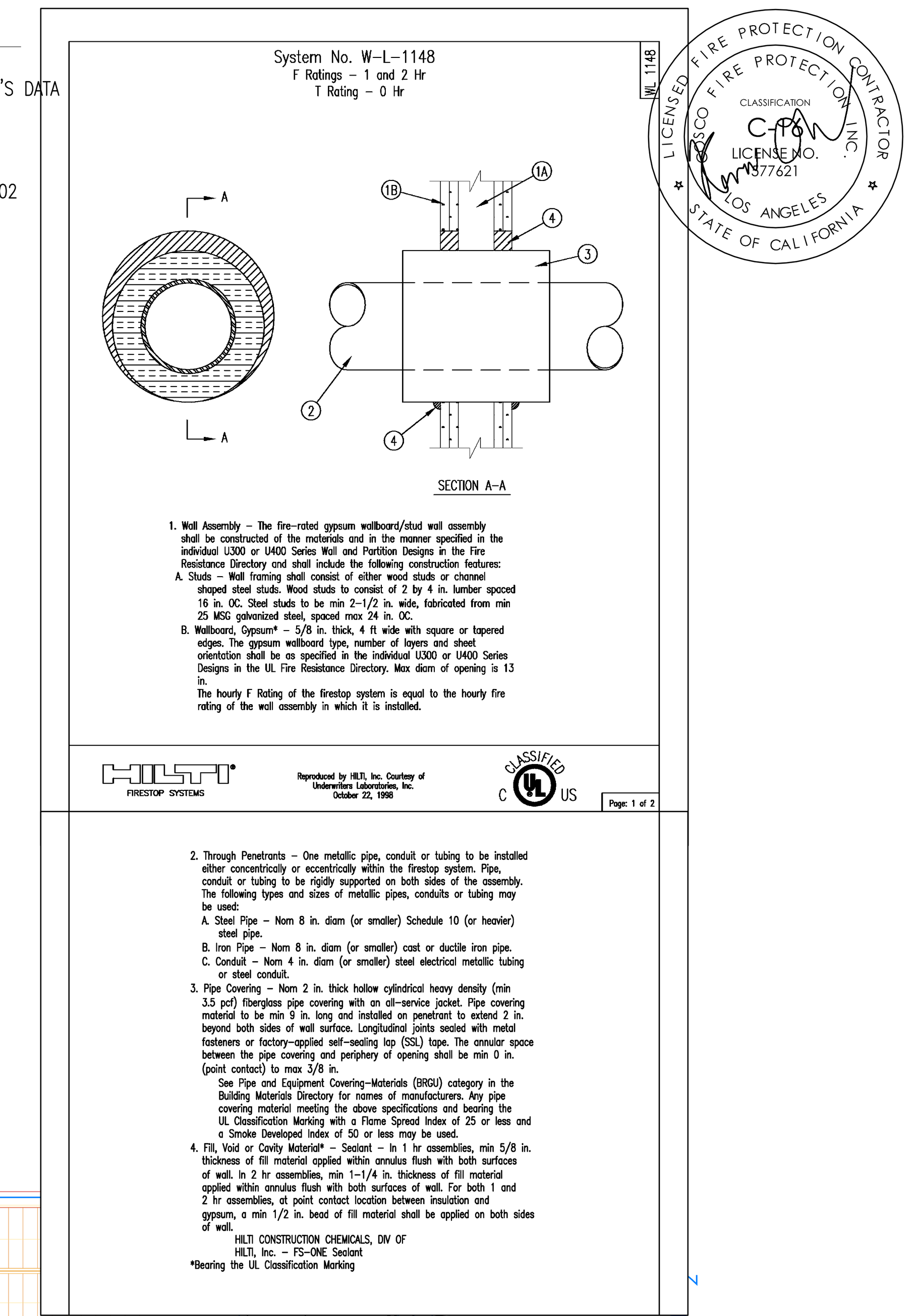
ALL HANGERS, RESTRAINTS, & SEISMIC BRACING ARE TO USE U.L. LISTED AND FM APPROVED COMPONENTS. ALL ARE TO BE INSTALLED PER CBC, AND CFC-2007, ALL SFM AND DSA REGULATIONS, NFPA #13-2002, CHAPTER 9, AND ALL MANUFACTURE'S REQUIREMENTS AND GUIDELINES.
SEE DETAIL SHEET FP-E3 FOR ADDITIONAL HANGER, RESTRAINT, AND SEISMIC DETAILS AND CALCULATIONS.

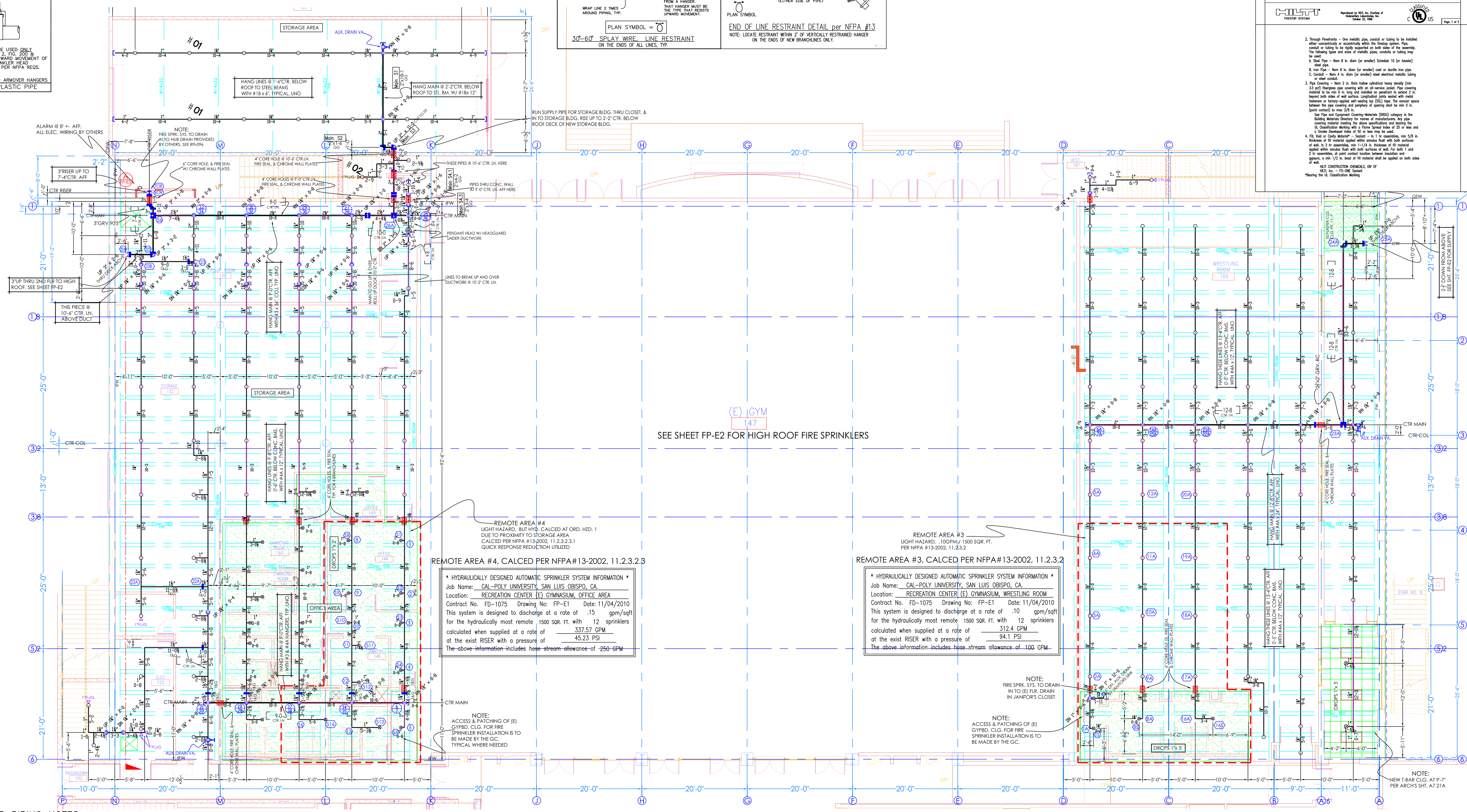




FIRE SPRK. PIPING SYMBOL LEGEND

- ○ ○ ● = NEW FIRE SPRINKLER HEADS, TYPE AS NOTED, LOCATIONS AS SHOWN ON PLAN MAX. HEAD SPACING FOR NEW HEADS IS PER NFPA #13 2002 AND MANUFACTURE'S DATA
- ——— = NEW FIRE SPRK. PIPING, SCH.#10 OR SCH.#40 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH CAST IRON/DUCTILE IRON FITTINGS, OR WELDED AND GROOVED FITTINGS, TYCO BRAND-U.L.LISTED & F.M. APPROVED, TYP. FOR ALL.
- LATERAL = E.Q.SWAY BRACE DESIGNATIONS, ALL E.Q.SWAY BRACING TO BE PER NFPA #13-2002 SECTION 9.3.5.2, SEE SHEET FP-2 FOR NOTES, DETAILS AND CALCULATIONS.
- = END OF LINE RESTRAINT DESIGNATIONS, ALL TO BE PER NFPA #13-2002, 9.3.6.3 USE TOLCO SURGE RESTRAINERS ON THE ENDS OF BRANCHLINES AND ARMOVERS.
- / / = HANGER DESIGNATIONS, ALL TO BE PER NFPA #13-2002, SECTION 9.1 ALL ARMOVERS OVER 1'-0"LONG ARE TO HAVE A HANGER ON THEM, TYP.
- 4 = FIRE SPRINKLER HYDRAULIC CALC NODE
- 0 = GROOVED COUPLINGS, RIGID THRU-OUT EXCEPT FLEXIBLE ON THE RISER PER NFPA #13-2002, 9.3.2
- = WALL PENETRATION, FIRE SEAL/FIRE SAFE BACK TO EQUIVALENT RATING WITH HILTI FS-ONE OR 3M FIRE SEALANT, INSTALLED PER MANUFACTURES REQS. SEE FIRE SEAL/FIRE SAFE DETAIL ON THIS SHEET FOR ALL INFORMATION.
- A2 3"x21'-0" SCH.10 = FIRE MAIN PIECE DESIGNATION
- #1 = FIRE BRANCHLINE DESIGNATION
- 8'-8" = CTR. LINE OF FIRE SPRK. PIPE AFF. SEE PLAN FOR ELEVATIONS





REMOTE AREA #4, CALCED PER NFPA#13-2002, 11.2.3.2.3

* HYDRAULICALLY DESIGNED AUTOMATIC SPRINKLER SYSTEM INFORMATION *
Job Name: CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA.
Location: RECREATION CENTER (E) GYMNASIUM, OFFICE AREA
Contract No. FD-1075 Drawing No: FP-E1 Date: 11/04/2010
This system is designed to discharge at a rate of .15 gpm/sqft for the hydraulically most remote 1500 SQR. FT. with 12 sprinklers calculated when supplied at a rate of 337.57 GPM at the exist RISER with a pressure of 45.23 PSI
The above information includes hose stream allowance of 250 GPM

REMOTE AREA #3, CALCED PER NFPA#13-2002, 11.2.3.2

* HYDRAULICALLY DESIGNED AUTOMATIC SPRINKLER SYSTEM INFORMATION *
Job Name: CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA.
Location: RECREATION CENTER (E) GYMNASIUM, WRESTLING ROOM
Contract No. FD-1075 Drawing No: FP-E1 Date: 11/04/2010
This system is designed to discharge at a rate of .10 gpm/sqft for the hydraulically most remote 1500 SQR. FT. with 12 sprinklers calculated when supplied at a rate of 312.4 GPM at the exist RISER with a pressure of 94.1 PSI
The above information includes hose stream allowance of 100 GPM

(E) GYM BUILDING 1ST FLR FIRE SPRK. PIPE PLAN

SCALE: 1/8"=1'-0"

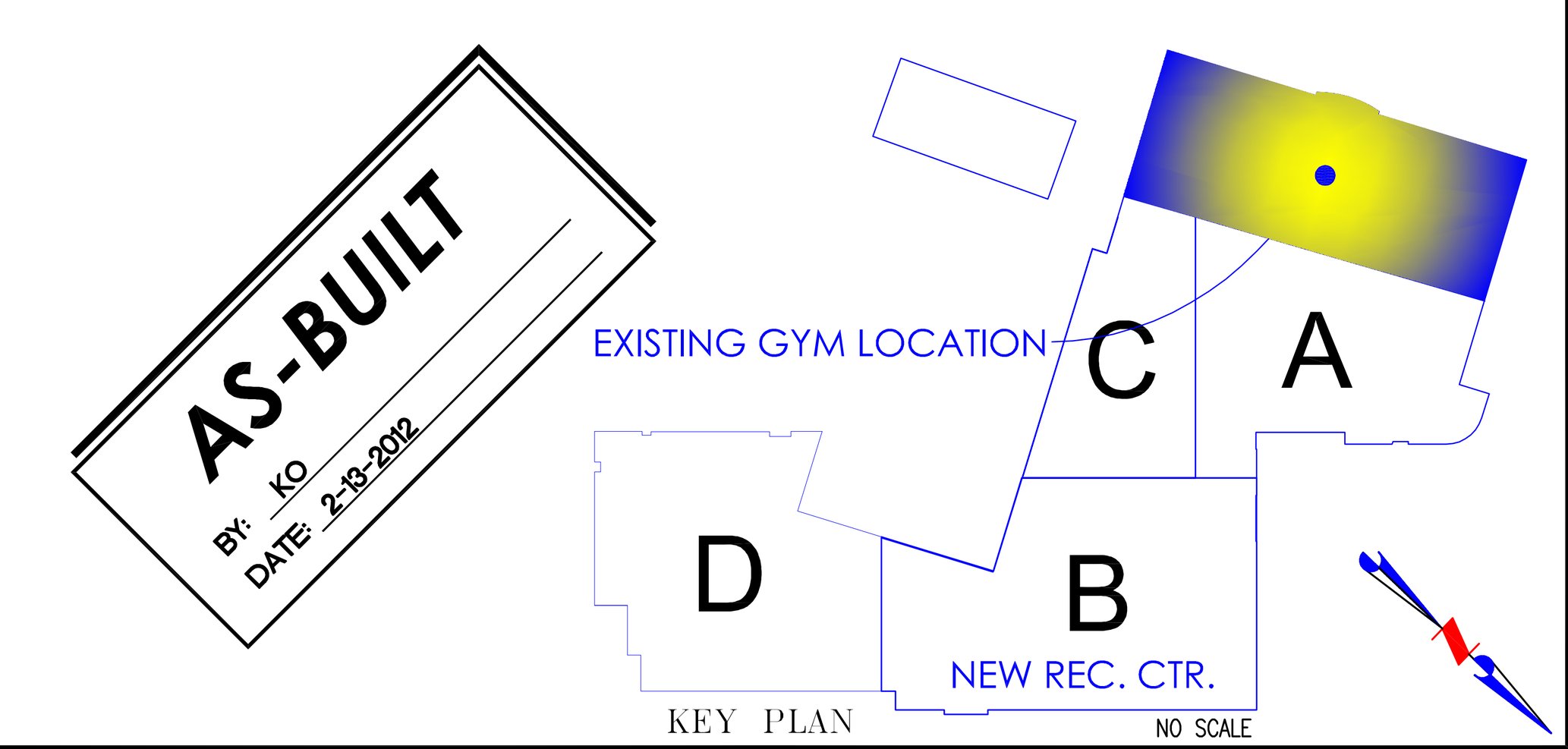
FIRE SPRINKLER PIPING NOTES:

1. COSCO FIRE PROTECTION SCOPE OF WORK FOR THIS PLAN, IS FOR THE EXISTING GYM BUILDING ONLY. RETRO-FIT FIRE SPRINKLERS. ALL OTHER NEW OR EXISTING CAL-POLY BUILDINGS ARE NOT IN SCOPE OF WORK OR IN CONTRACT.
2. COSCO FIRE PROTECTION SCOPE OF WORK STARTS AT 6" AFF. ALL OVERHEAD FIRE SPRINKLER SYSTEM DESIGN AND INSTALLATION IS TO BE PER CBC & CFC-2007, NFPA #13-2002, SFM REQUIREMENTS, AND SPEC. SECTIONS 211200 AND 211313 .
3. ALL FIRE SPRINKLER PIPING IS TO BE AS FOLLOWS: BRANCHLINES - SCH.#40 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH DUCTILE OR CAST IRON CLASS 125 THREAD FITTINGS - ASME B16.4 RATED FOR 175 PSI MIN. WELDED OUTLETS - ASME B16.9, WELDING PER AWS B2.1 AND ALL. MAIN PIPING IS TO BE SCH.#10 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH WELDED OUTLETS - ASME B16.9 WELDING TO BE PER AWS B2.1, U.L. LISTED, FM APPROVED GROOVED FITTINGS AND COUPLINGS, TYCO BRAND TYPICAL FOR ALL.
4. SEE ABOVE FOR SPECIFIC HANGER DETAILS FOR THIS AREA. SEE SHEET FP-E3 FOR ALL HANGER, RESTRAINT, AND SESIMIC BRACING NOTES, DETAILS, CALCULATIONS, AND INFORMATION. ALL HANGERS AND SEISMIC BRACING ARE TO BE PER CBC & CFC-2007, NFPA #13-2002 CHAPTER 9 INCLUSIVE, ALL SFM REQUIREMENTS, AND MANUFACTURES GUIDELINES AND RECOMMENDATIONS.
5. ALL ARMOVERS OVER 1'-0" LONG ARE TO HAVE A HANGER ON THEM WITH RODS TO WITHIN 1/16" TO TOP OF PIPE OR USE TOLCO SURGE RESTRAINER ON THEM. TYPICAL FOR ARMOVERS AND ON THE ENDS OF ALL BRANCHLINES.
6. INSTALL SEISMIC BRACING PER NFPA #13-2002, SECTION 9.3.5. INSTALL RESTRAINTS ON ENDS OF BRANCHLINES PER NFPA #13-2002, SECTION 9.3.6.3
7. HYDROSTATIC TESTING SHALL BE IN ACCORDANCE WITH CBC & CFC-2007, NFPA #13-2002, AND ALL SFM REQUIREMENTS.
8. FIRESTOP/FIRESEAL ALL/ANY PENETRATIONS THRU FIRE RATED PARTITIONS BACK TO THE EQUIVALENT RATING WITH HILTI FS-ONE FIRE CAULKING. TO BE INSTALLED PER MANUFACTURES RECOMMENDATIONS AND NFPA #13-2002 STANDARDS. SEE FIRE STOPPING DETAIL ABOVE AND IN THE EQUIPMENT SUBMITTAL FOR INSTALLATION INFORMATION AND U.L. LISTING SPECIFICATIONS AND DATA.
9. FIRE SPRINKLER PIPING AND HEADS WILL BE EXPOSED IN THE FOLLOWING AREAS OR ROOMS: MECHANICAL, ELECTRICAL, JANITORIAL, STORAGE, WATER HEATER, (E) GYMNASIUM, AND ALL OTHER ROOMS/AREAS WITHOUT SUSPENDED CEILINGS. PAINTING OF ANY FS PIPING IS BY OTHERS ENTIRELY. PAINTING OF FIRE SPRINKLER HEADS IS PROHIBITED, EXCEPT BY THE FACTORY

(E) GYM BLDG. FIRE SPRK. SHEET LEGEND

FP-E1 = (E) GYM 1ST FLR. FIRE SPRK. PIPING PLAN
FP-E2 = (E) GYM ROOF FIRE SPRK. PIPING PLAN
FP-E3 = E.Q. SWAY BRACE DETAILS, AND BLDG. SECTIONS
NOTE: SEE THE CIVIL SITE PLANS FOR ALL FIRE PROTECTION UNDERGROUND LAYOUT, NOTES, DETAILS, AND INFORMATION

AS-BUILT
BY: KO
DATE: 2-13-2012



SFM #18-40-03-0001

SPRINKLER HEAD LEGEND :	SYMBOL	S/N	ORIFICE	NPT	K-FACT.	HEAD FINISH	PLATE FINISH	TEMP.	QUAN.
VIKING CONCEALED QREC FIRE SPRK HEAD	●	VK634	3/4"	3/4"	8.0	BRASS	CHROME	155	0
VIKING RECESSED QREC FIRE SPRK HEAD	◐	VK602	3/4"	3/4"	8.0	CHROME	CHROME	155	1
VIKING SIDEWALL QREC FIRE SPRK HEAD	▲	VK606	3/4"	3/4"	8.0	CHROME	CHROME	155	0
VIKING RECESSED QR FIRE SPRK HEAD	⊗	VK302	1/2"	1/2"	5.6	CHROME	CHROME	155	32
VIKING CONCEALED QRSC FIRE SPRK HEAD	● SC	VK462	1/2"	1/2"	5.6	BRASS	CHROME	155	0
VIKING UPRIGHT QR FIRE SPRK HEAD	○	VK300	1/2"	1/2"	5.6	BRASS	NA	155	122

APPROVALS BY: ARCH. & STATE FIRE MARSHAL
TOTAL SPRINKLERS THIS SHEET = 155

NO.	DESCRIPTION	DATE	BY

REVISIONS

COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
California C-16
LIC. # 577621
www.coscofire.com
SAN DIEGO • LOS ANGELES • FRESNO • SAN FRANCISCO • SACRAMENTO • PORTLAND • SEATTLE • ANCHORAGE

PROJECT: CAL POLY UNIVERSITY, RECREATION CENTER
SAN LUIS OBISPO, CALIFORNIA 93407

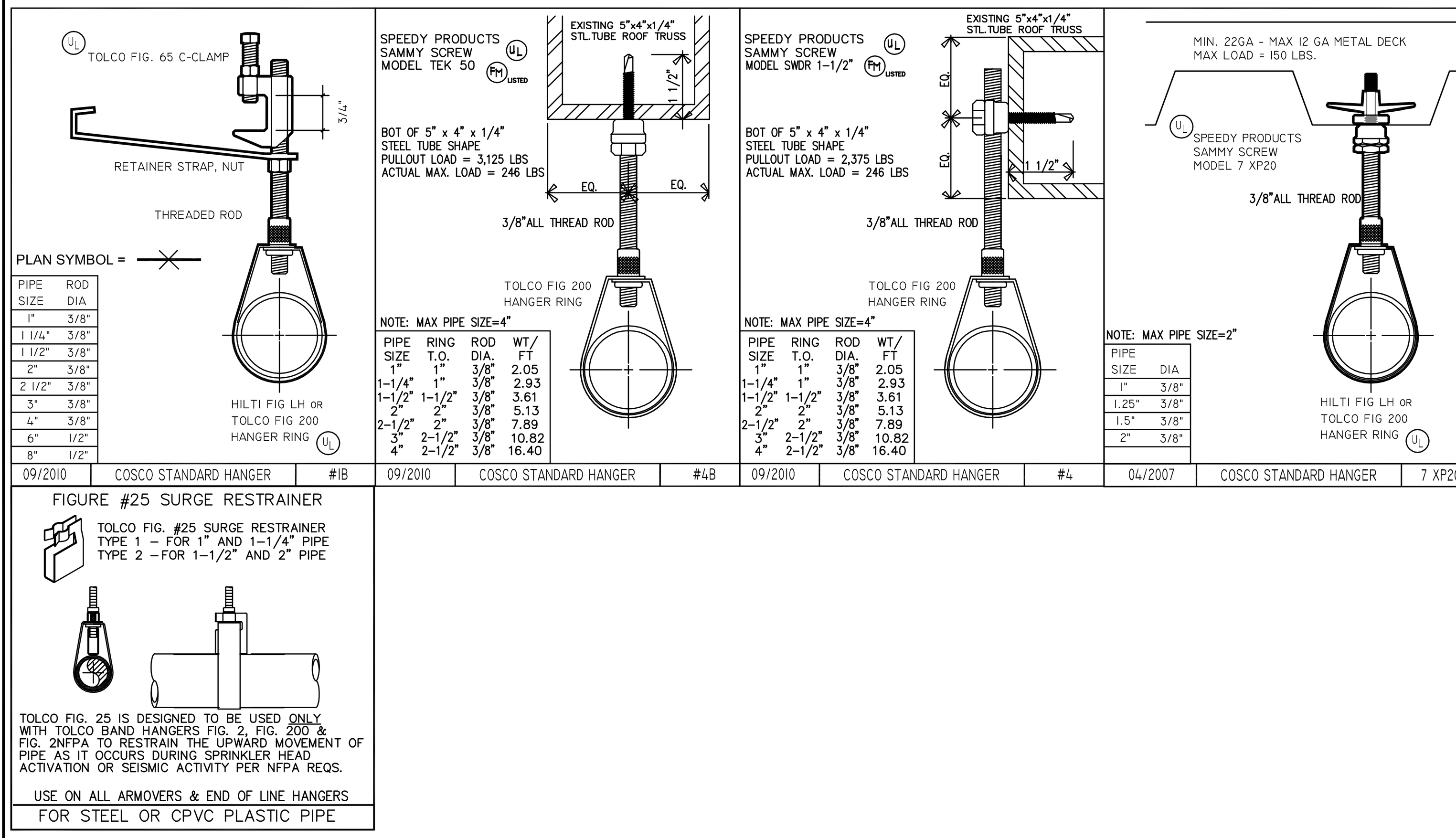
CONTRACT WITH: SUNDT CONSTRUCTION INC.
1 GRAND AVE. G2 PARKING LOT
SAN LUIS OBISPO, CA. 93407

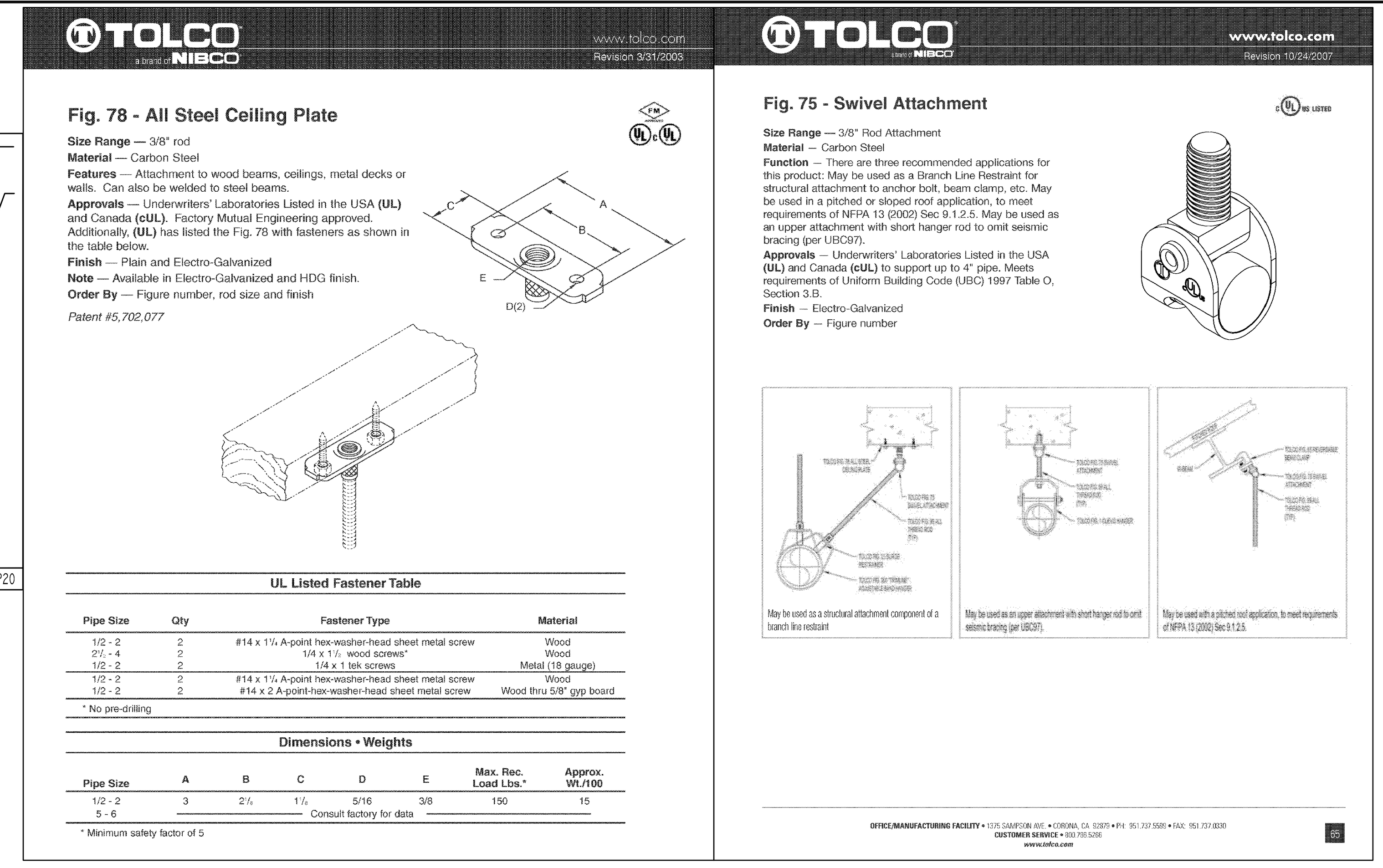
DRAWING TITLE: FIRE SPRK. PIPING PLAN, (E) GYM BLDG. 1ST FLR.

DATE : 9-1-2010
SCALE : 1/8"= 1'-0"
DRAWN BY : KO
JOB NO. FD-1075
SHEET NO. FP-E1

HANGER DETAILS PER CBC, CFC 2007, & NFPA #13 2002

ALL HANGERS, RESTRAINTS, & SEISMIC BRACING ARE TO USE U.L. LISTED AND FM APPROVED COMPONENTS. ALL ARE TO BE INSTALLED PER CBC, AND CFC-2007, ALL SFM AND DSA REGULATIONS, NFPA #13-2002, CHAPTER 9, AND ALL MANUFACTURE'S REQUIREMENTS AND GUIDELINES.
SEE DETAIL SHEETS FP-D1 THRU FP-D3 FOR ALL HANGER, RESTRAINT, AND SEISMIC DETAILS AND CALCULATIONS.



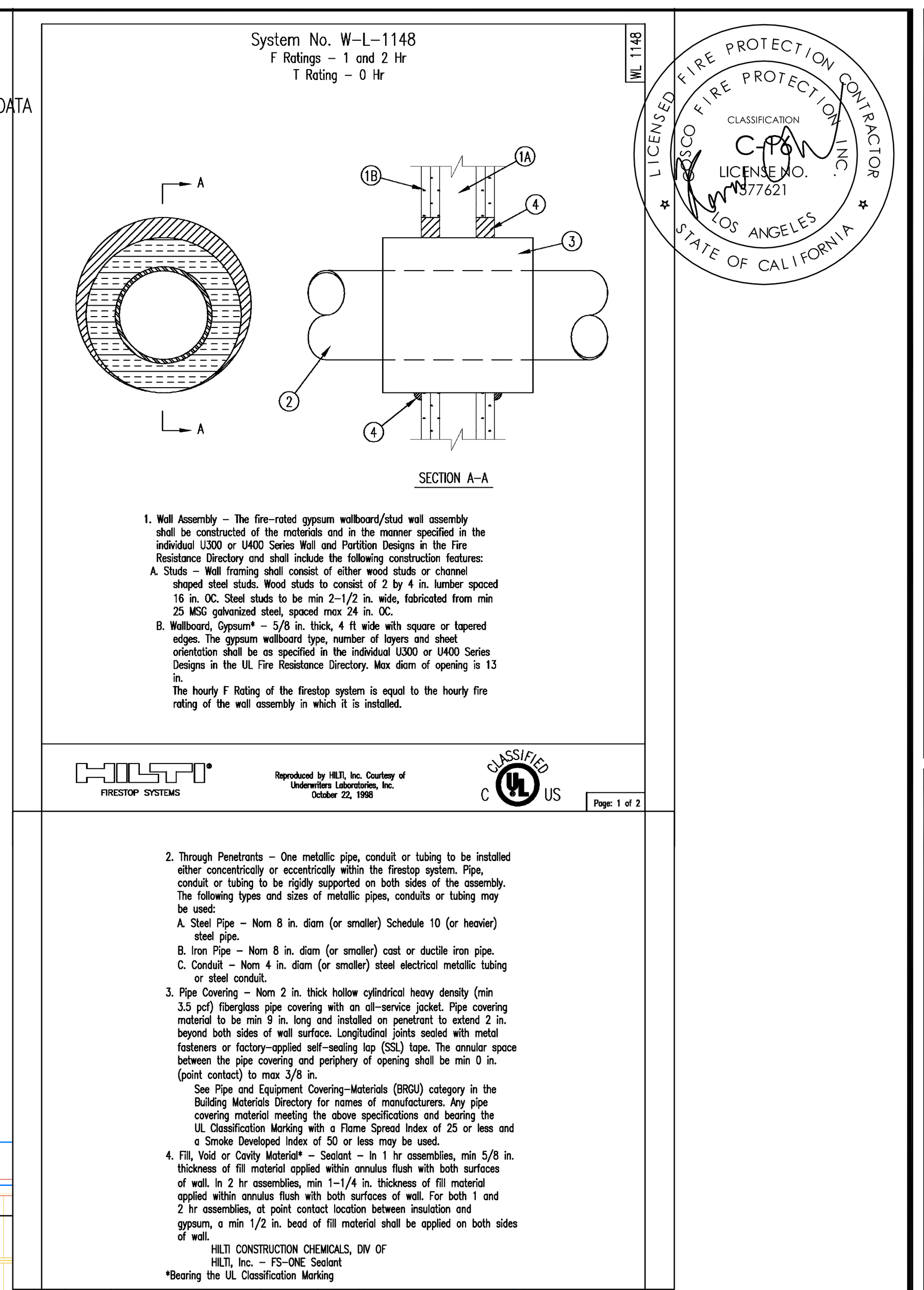


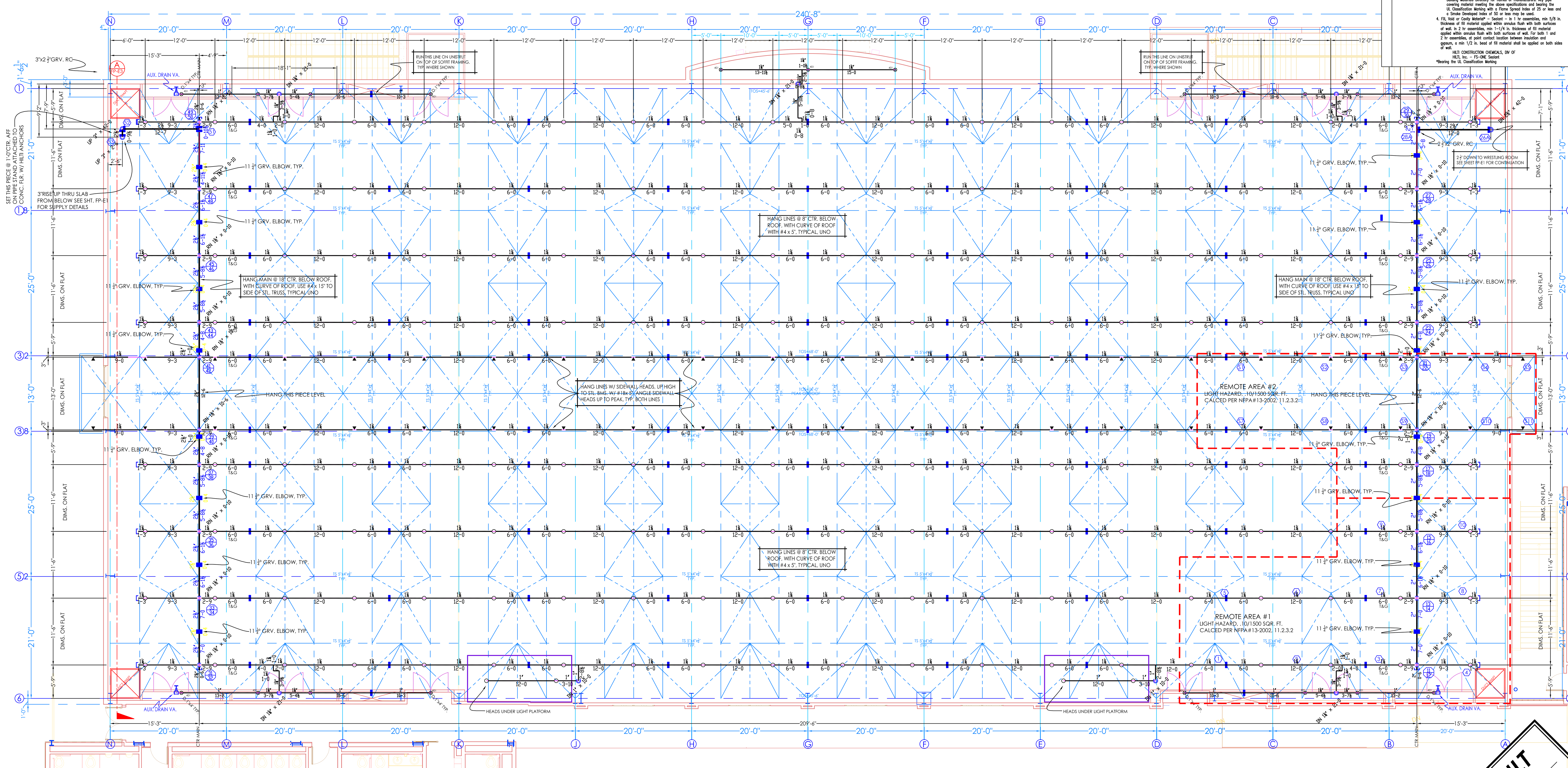
FIRE SPRK. PIPING SYMBOL LEGEND

- ○ ⊗ ● = NEW FIRE SPRINKLER HEADS, TYPE AS NOTED, LOCATIONS AS SHOWN ON PLAN MAX. HEAD SPACING FOR NEW HEADS IS PER NFPA #13 2002 AND MANUFACTURE'S DATA
- (line) = NEW FIRE SPRK. PIPING, SCH.#10 OR SCH.#40 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH CAST IRON/DUCTILE IRON FITTINGS, OR WELDED AND GROOVED FITTINGS, TYCO BRAND-U.L.LISTED & F.M. APPROVED, TYP. FOR ALL.
- LATERAL = E.Q.SWAY BRACE DESIGNATIONS, ALL E.Q.SWAY BRACING TO BE PER NFPA #13-2002 SECTION 9.3.5.2, SEE SHEET FP-2 FOR NOTES, DETAILS AND CALCULATIONS.
- = END OF LINE RESTRAINT DESIGNATIONS, ALL TO BE PER NFPA #13-2002, 9.3.6.3 USE TOLCO SURGE RESTRAINERS ON THE ENDS OF BRANCHLINES AND ARMOVERS.
- / / = HANGER DESIGNATIONS, ALL TO BE PER NFPA #13-2002, SECTION 9.1 ALL ARMOVERS OVER 1'-0" LONG ARE TO HAVE A HANGER ON THEM, TYP.
- (4) = FIRE SPRINKLER HYDRAULIC CALC NODE
- 0 = GROOVED COUPLINGS, RIGID THRU-OUT EXCEPT FLEXIBLE ON THE RISER PER NFPA #13-2002, 9.3.2
- (hatched) = WALL PENETRATION, FIRE SEAL/FIRE SAFE BACK TO EQUIVALENT RATING WITH HILTI FS-ONE OR 3M FIRE SEALANT, INSTALLED PER MANUFACTURES REQS. SEE FIRE SEAL/FIRE SAFE DETAIL ON THIS SHEET FOR ALL INFORMATION.
- A2 3"x21'-0" SCH.10 = FIRE MAIN PIECE DESIGNATION; #1 = FIRE BRANCHLINE DESIGNATION
- [8'-8"] = CTR. LINE OF FIRE SPRK. PIPE AFF. SEE PLAN FOR ELEVATIONS

REMOTE AREA #2, CALCED PER NFPA#13-2002, 11.2.3.2

* HYDRAULICALLY DESIGNED AUTOMATIC SPRINKLER SYSTEM INFORMATION *
Job Name: CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA.
Location: RECREATION CENTER (E) GYMNASIUM, HIGH ROOF
Contract No. FD-1075 Drawing No: FP-E2 Date: 11/04/2010
This system is designed to discharge at a rate of .10 gpm/sqft for the hydraulically most remote 1500 SQR. FT. with 12 sprinklers calculated when supplied at a rate of 296.4 GPM at the exist RISER with a pressure of 69.33 PSI
The above information includes hose stream allowance of 100 GPM





FIRE SPRINKLER PIPING NOTES:

1. COSCO FIRE PROTECTION SCOPE OF WORK FOR THIS PLAN, IS FOR THE EXISTING GYM BUILDING ONLY. RETRO-FIT FIRE SPRINKLERS. ALL OTHER NEW OR EXISTING CAL-POLY BUILDINGS ARE NOT IN SCOPE OF WORK OR IN CONTRACT.
2. COSCO FIRE PROTECTION SCOPE OF WORK STARTS AT 6" AFF. ALL OVERHEAD FIRE SPRINKLER SYSTEM DESIGN AND INSTALLATION IS TO BE PER CBC & CFC-2007, NFPA #13-2002, SFM REQUIREMENTS, AND SPEC. SECTIONS 211200 AND 211313 .
3. ALL FIRE SPRINKLER PIPING IS TO BE AS FOLLOWS: BRANCHLINES - SCH.#40 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH DUCTILE OR CAST IRON CLASS 125 THREAD FITTINGS - ASME B16.4 RATED FOR 175 PSI MIN. WELDED OUTLETS - ASME B16.9, WELDING PER AWS B2.1 AND ALL. MAIN PIPING IS TO BE SCH.#10 BLACK STEEL PIPE ASTM A53 OR ASTM A135 WITH WELDED OUTLETS - ASME B16.9 WELDING TO BE PER AWS B2.1, U.L. LISTED, FM APPROVED GROOVED FITTINGS AND COUPLINGS, TYCO BRAND TYPICAL FOR ALL.
4. SEE ABOVE FOR SPECIFIC HANGER DETAILS FOR THIS AREA. SEE SHEET FP-E3 FOR OTHER HANGER, RESTRAINT, AND SESIMIC BRACING NOTES, DETAILS, CALCULATIONS, AND INFORMATION. ALL HANGERS AND SEISMIC BRACING ARE TO BE PER CBC & CFC-2007, NFPA #13-2002 CHAPTER 9 INCLUSIVE MAX. HANGER SPACING FOR MAINS IS 10'-0", MAX. HANGER SPACING FOR LINES IS 12'-0"
5. ALL ARMOVERS OVER 1'-0" LONG ARE TO HAVE A HANGER ON THEM WITH RODS TO WITHIN 1/16" TO TOP OF PIPE OR USE TOLCO SURGE RESTRAINER ON THEM. TYPICAL FOR ARMOVERS AND ON THE ENDS OF ALL BRANCHLINES.
6. INSTALL SEISMIC BRACING PER NFPA #13-2002, SECTION 9.3.5. INSTALL RESTRAINTS ON ENDS OF BRANCHLINES PER NFPA #13-2002, SECTION 9.3.6.3
7. HYDROSTATIC TESTING SHALL BE IN ACCORDANCE WITH CBC & CFC-2007, NFPA #13-2002, AND ALL SFM REQUIREMENTS.
8. FIRESTOP/FIRESEAL ALL/ANY PENETRATIONS THRU FIRE RATED PARTITIONS BACK TO THE EQUIVALENT RATING WITH HILTI FS-ONE FIRE CAULKING. TO BE INSTALLED PER MANUFACTURES RECOMMENDATIONS AND NFPA #13-2002 STANDARDS. SEE FIRE STOPPING DETAIL ABOVE AND IN THE EQUIPMENT SUBMITTAL FOR INSTALLATION INFORMATION AND U.L. LISTING SPECIFICATIONS AND DATA.
9. FIRE SPRINKLER PIPING AND HEADS WILL BE EXPOSED IN THE FOLLOWING AREAS OR ROOMS: MECHANICAL, ELECTRICAL, JANITORIAL, STORAGE, WATER HEATER, (E) GYMNASIUM, AND ALL OTHER ROOMS/AREAS WITHOUT SUSPENDED CEILINGS. PAINTING OF ANY FS PIPING IS BY OTHERS ENTIRELY. PAINTING OF FIRE SPRINKLER HEADS IS PROHIBITED, EXCEPT BY THE FACTORY

REFERENCE NORTH

(E) GYM BUILDING ROOF FIRE SPRK. PIPE PLAN

SCALE: 1/8"=1'-0"

(E) GYM BLDG. FIRE SPRK. SHEET LEGEND

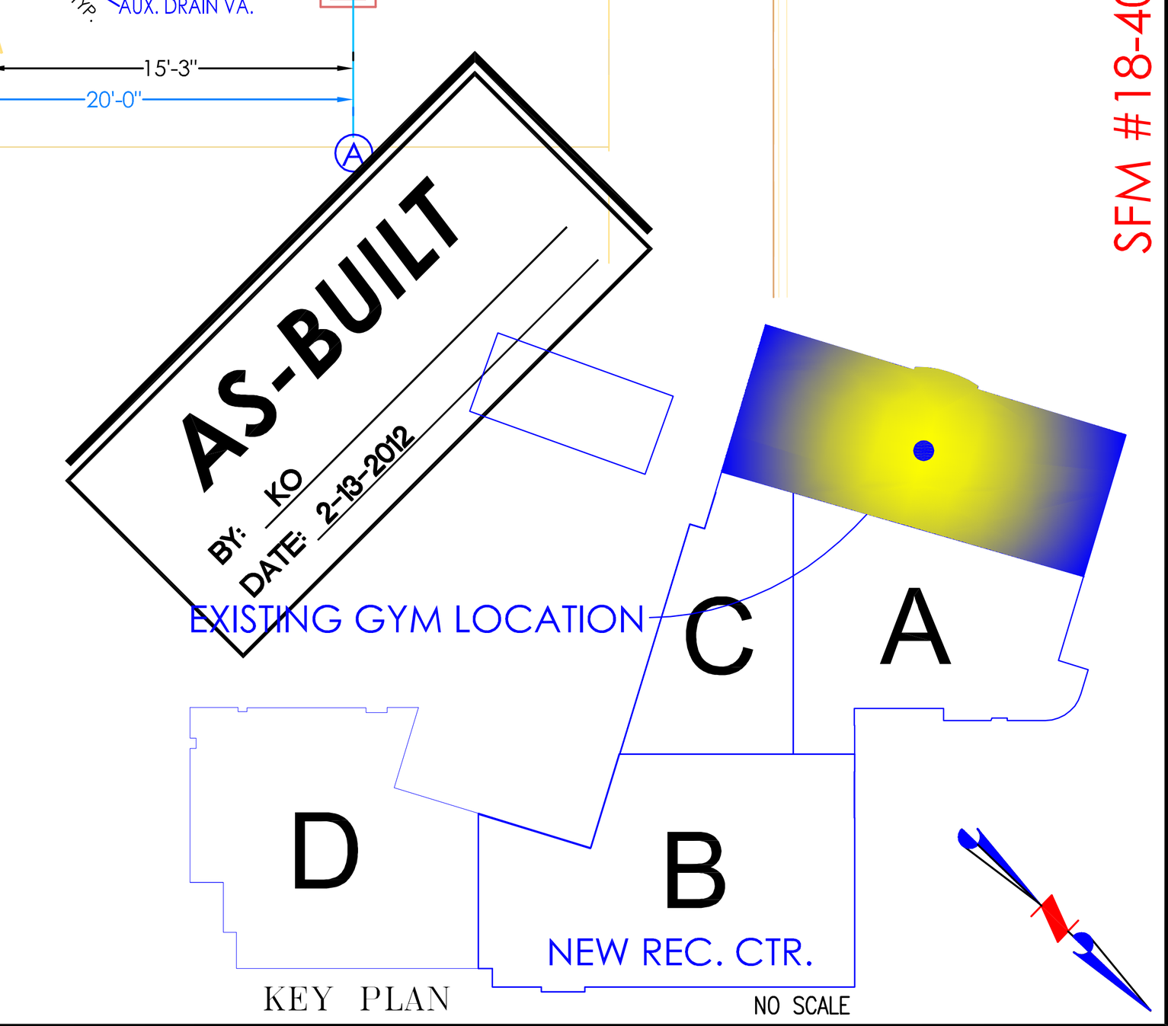
FP-E1 = (E) GYM 1ST FLR. FIRE SPRK. PIPING PLAN
FP-E2 = (E) GYM ROOF FIRE SPRK. PIPING PLAN
FP-E3 = E.Q. SWAY BRACE DETAILS, AND BLDG. SECTIONS

NOTE: SEE THE CIVIL SITE PLANS FOR ALL FIRE PROTECTION UNDERGROUND LAYOUT, NOTES, DETAILS, AND INFORMATION

REMOTE AREA #1, CALCED PER NFPA#13-2002, 11.2.3.2

* HYDRAULICALLY DESIGNED AUTOMATIC SPRINKLER SYSTEM INFORMATION *
Job Name: CAL-POLY UNIVERSITY, SAN LUIS OBISPO, CA.
Location: RECREATION CENTER (E) GYMNASIUM, HIGH ROOF
Contract No. FD-1075 Drawing No: FP-E2 Date: 11/04/2010
This system is designed to discharge at a rate of .10 gpm/sqft for the hydraulically most remote 1500 SQR. FT. with 10 sprinklers calculated when supplied at a rate of 278.75 GPM at the exist RISER with a pressure of 60.20 PSI
The above information includes hose stream allowance of 100 GPM

AS-BUILT BY: KO DATE: 2-13-2012



KEY PLAN

NO SCALE

SFM #18-40-03-0001

SPRINKLER HEAD LEGEND :	SYMBOL	S/N	ORIFICE	NPT	K-FACT.	HEAD FINISH	PLATE FINISH	TEMP.	QUAN.
VIKING CONCEALED QREC FIRE SPRK HEAD	●	VK634	3/4"	3/4"	8.0	BRASS	CHROME	155	0
VIKING RECESSED QREC FIRE SPRK HEAD	◔	VK602	3/4"	3/4"	8.0	CHROME	CHROME	155	0
VIKING SIDEWALL QR FIRE SPRK HEAD	▲	VK304	1/2"	1/2"	5.6	BRASS	NA	200	40
VIKING RECESSED QR FIRE SPRK HEAD	⊗	VK302	1/2"	1/2"	5.6	CHROME	CHROME	155	19
VIKING CONCEALED QRSC FIRE SPRK HEAD	✱	VK462	1/2"	1/2"	5.6	BRASS	CHROME	155	0
VIKING UPRIGHT QR FIRE SPRK HEAD	○	VK300	1/2"	1/2"	5.6	BRASS	NA	155	136
APPROVALS BY: ARCH. & STATE FIRE MARSHAL					TOTAL SPRINKLERS THIS SHEET =				195

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

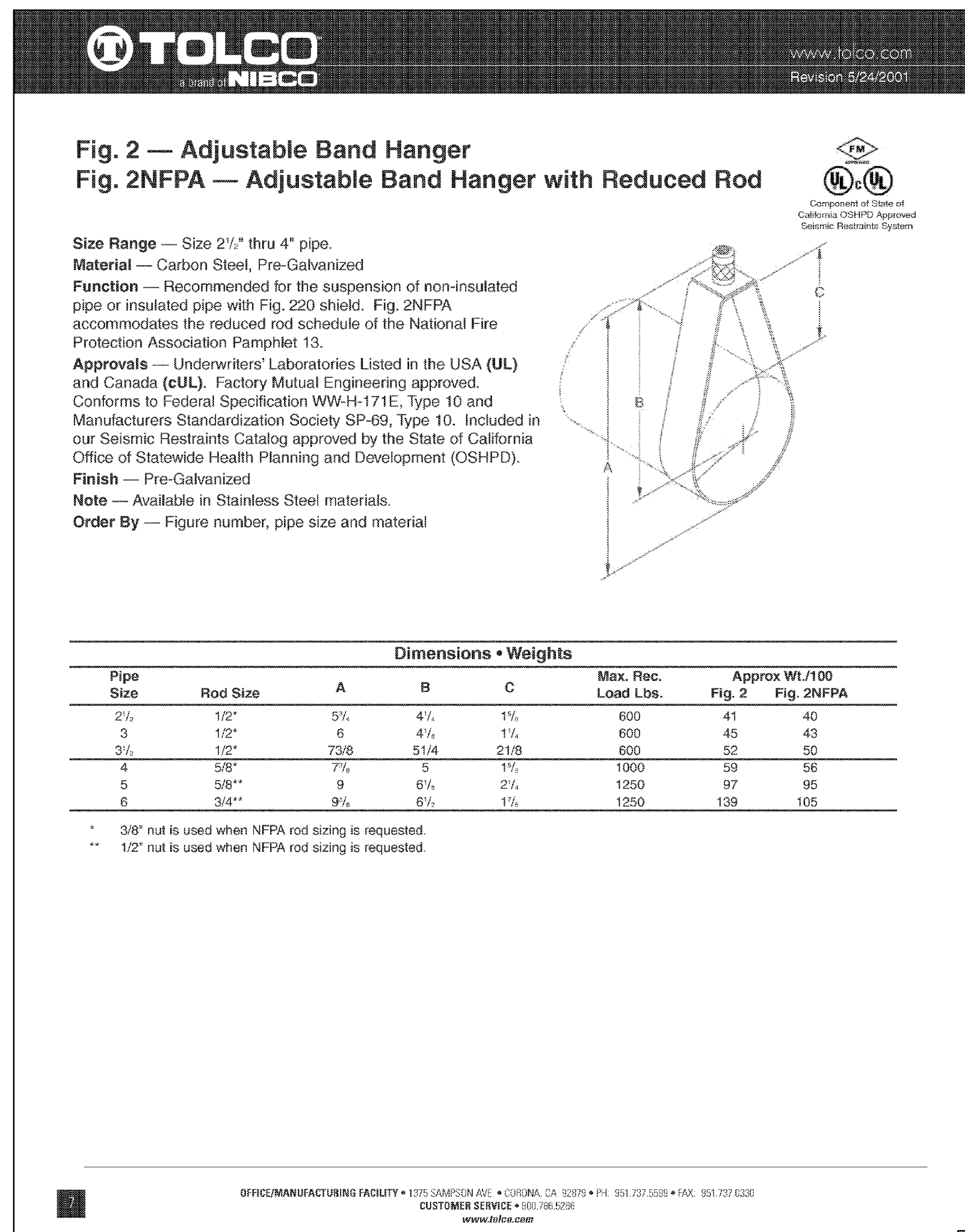
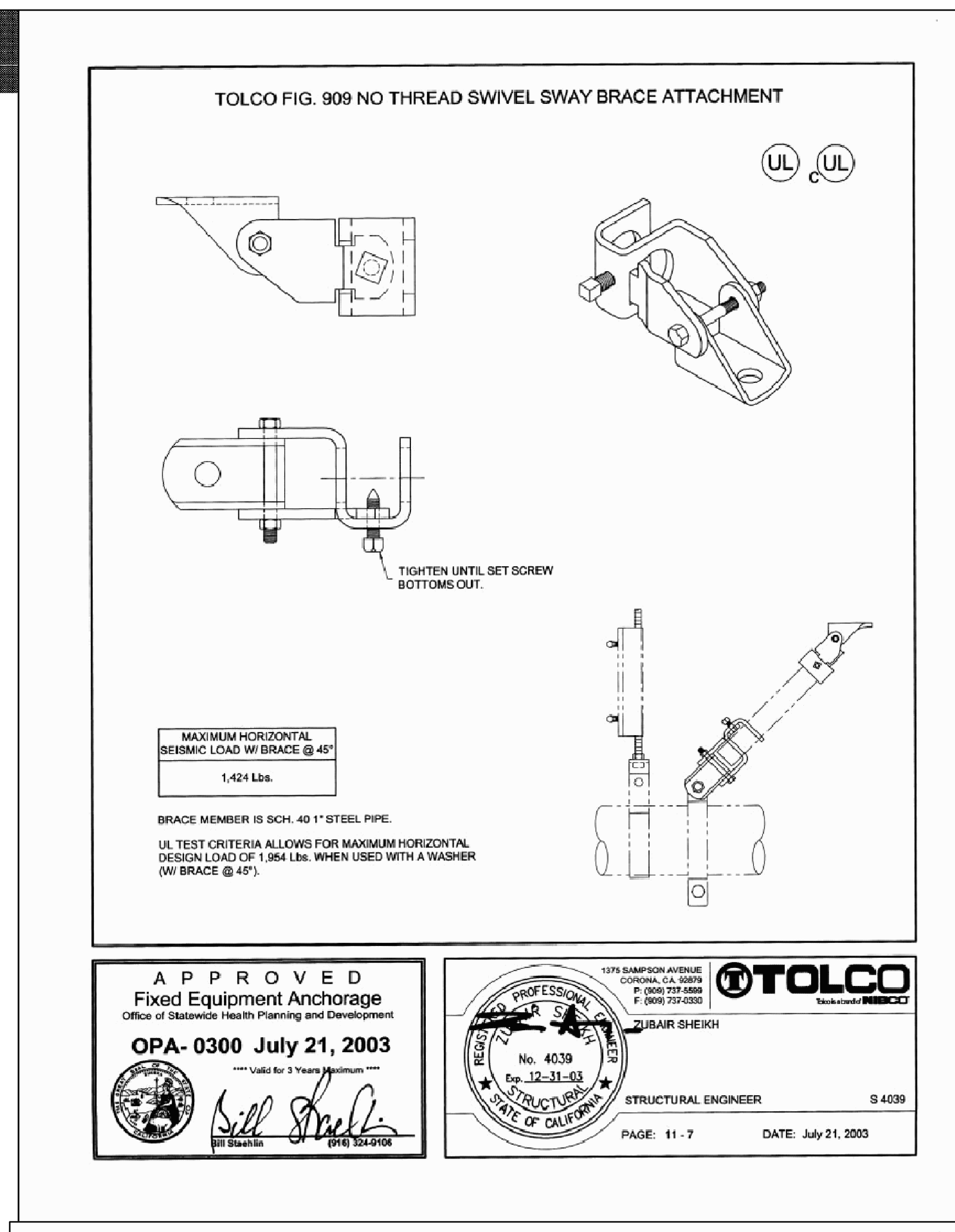
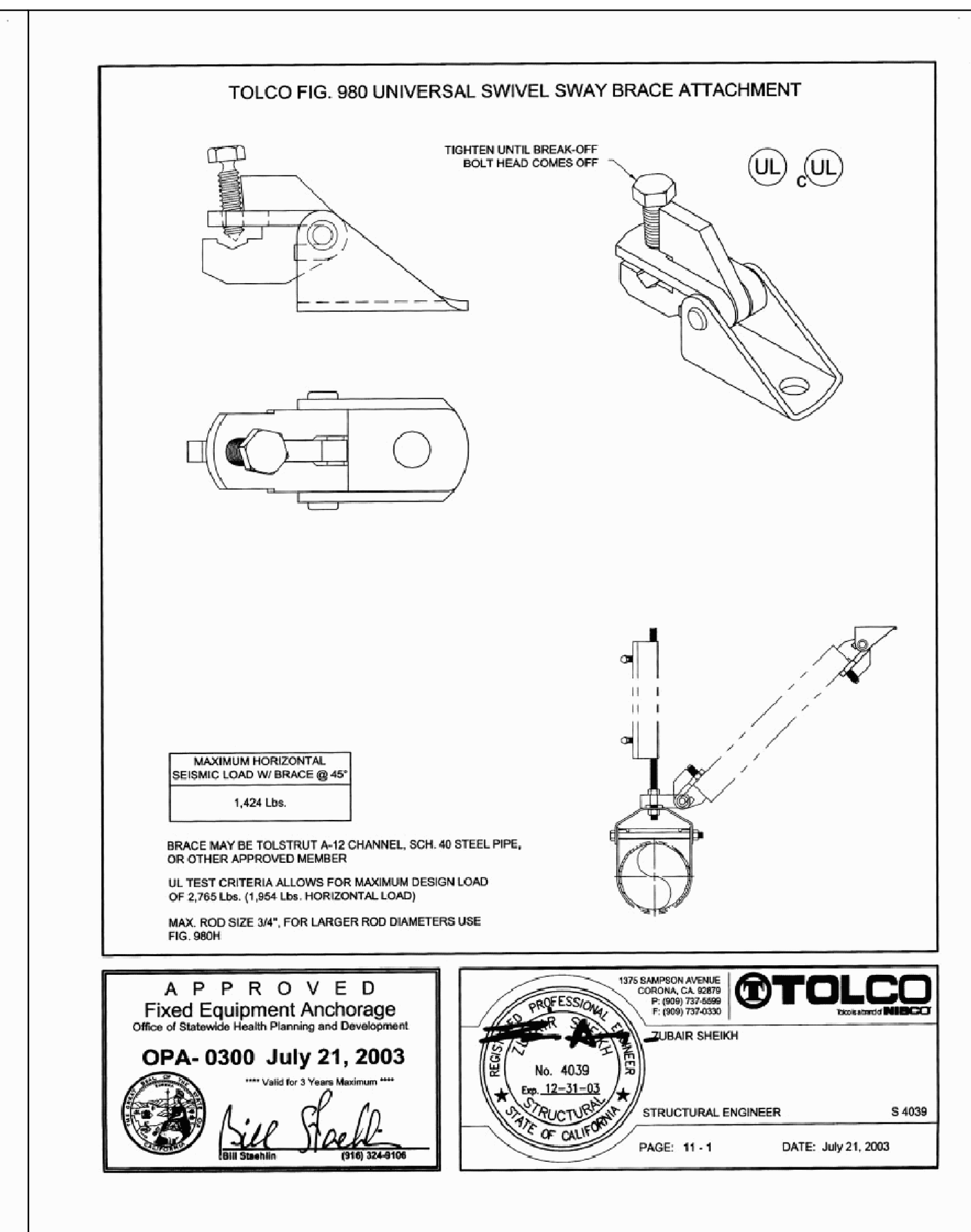
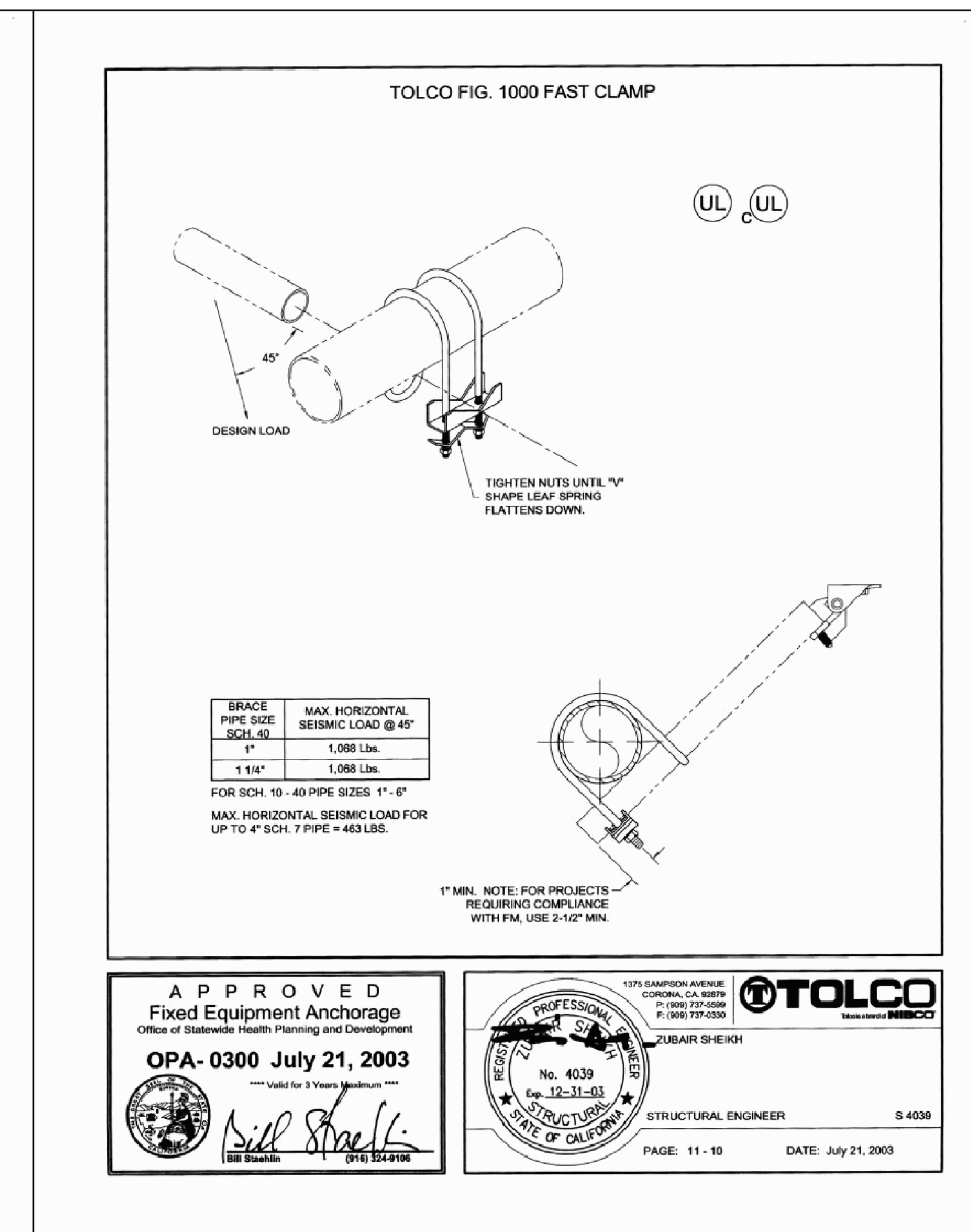
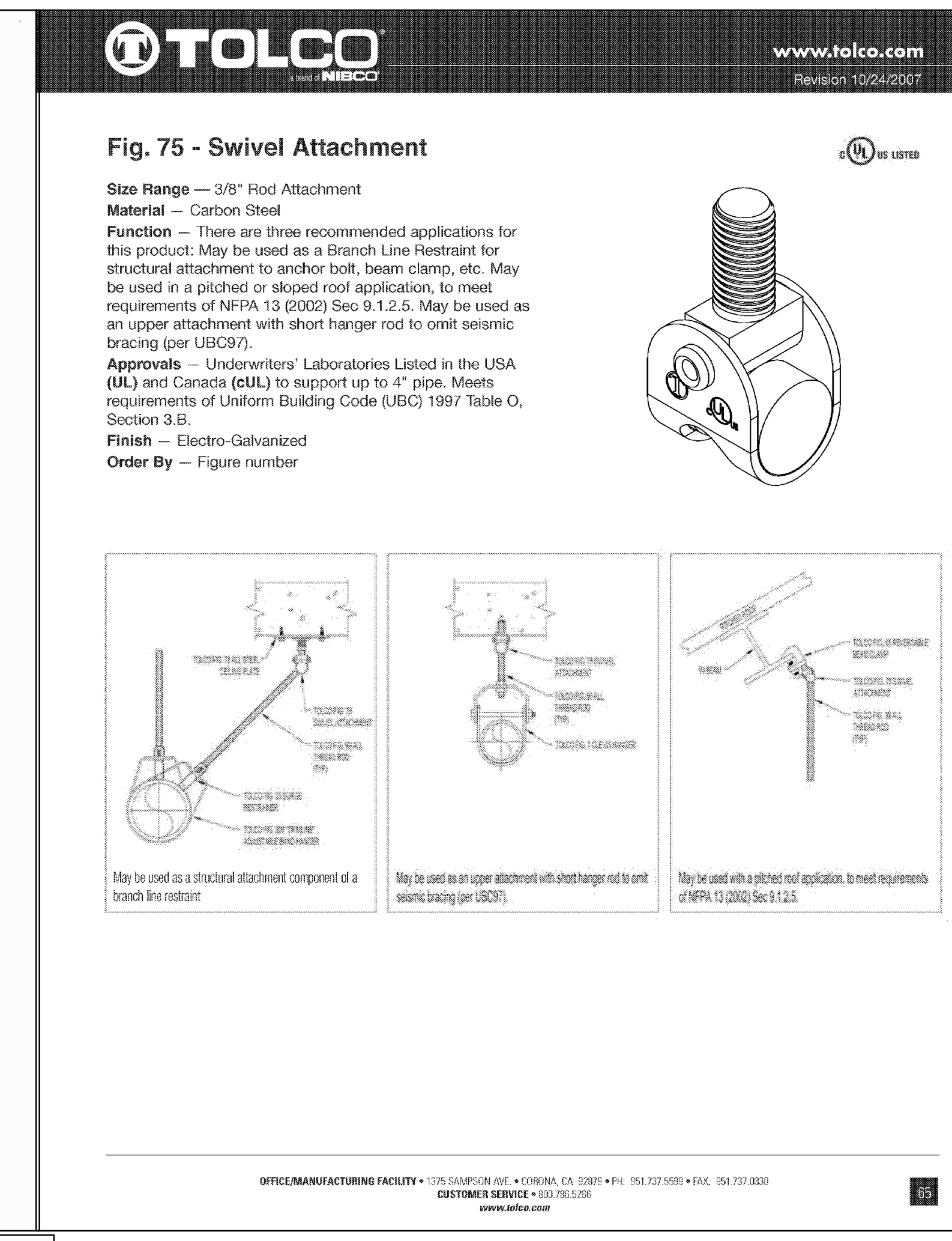
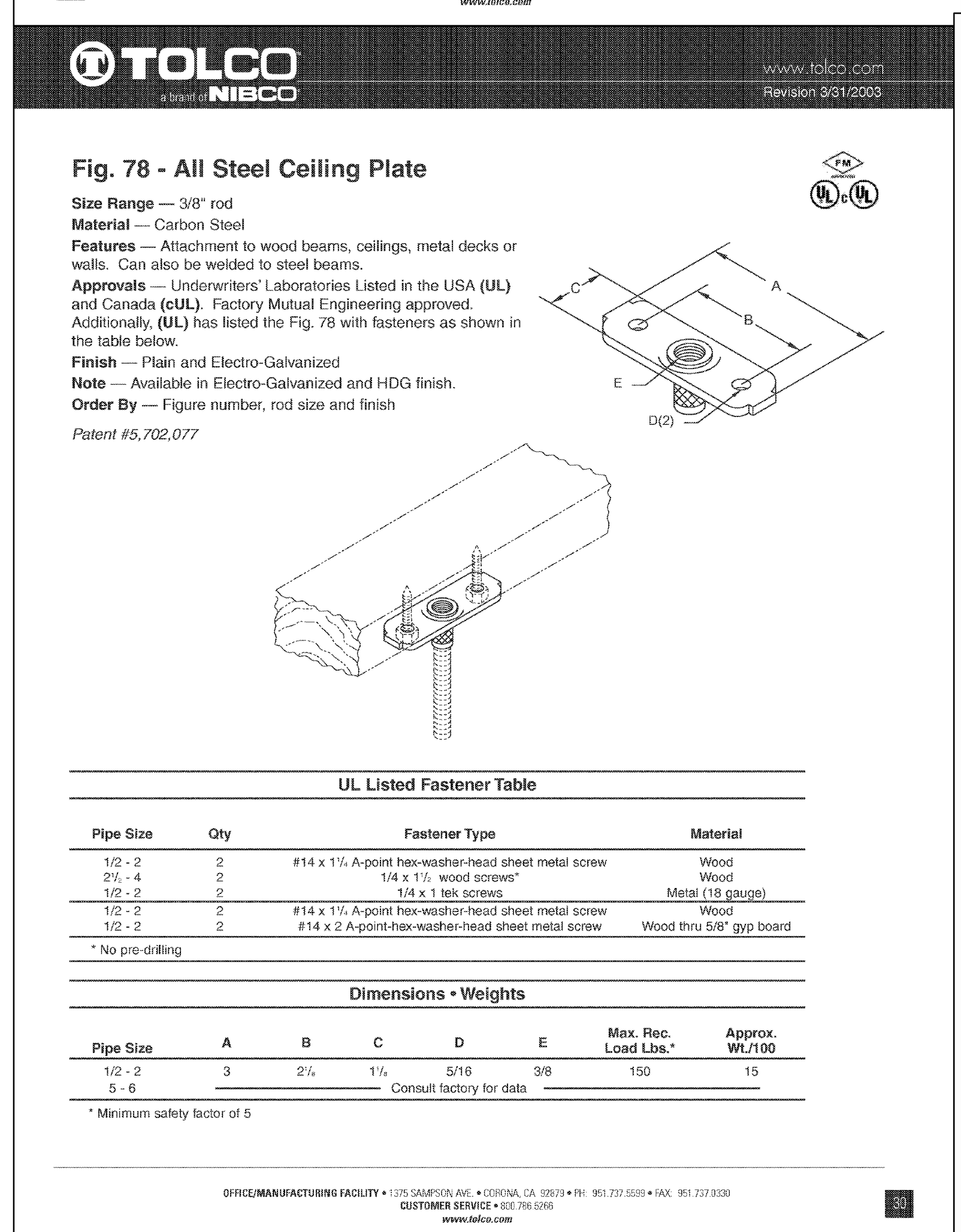
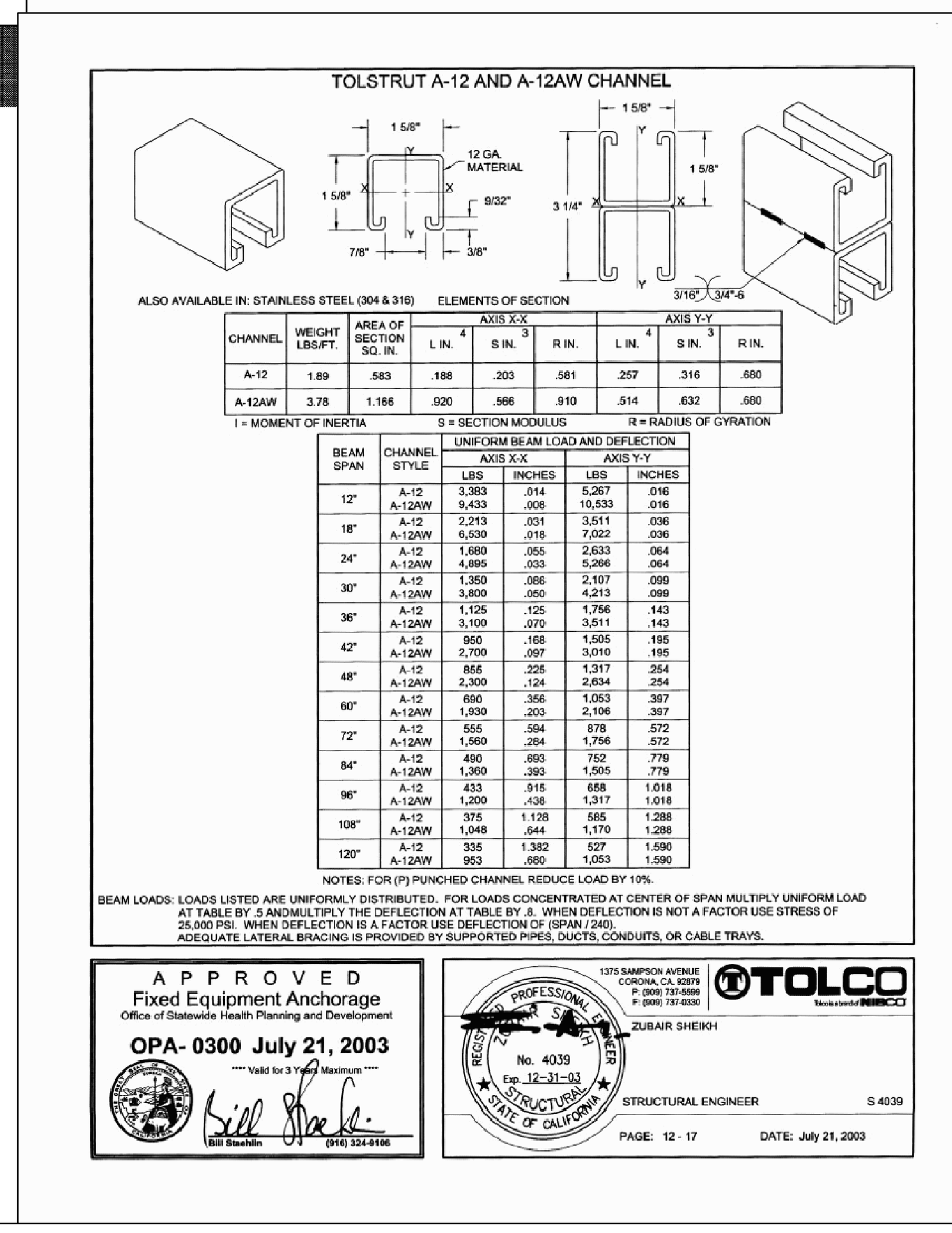
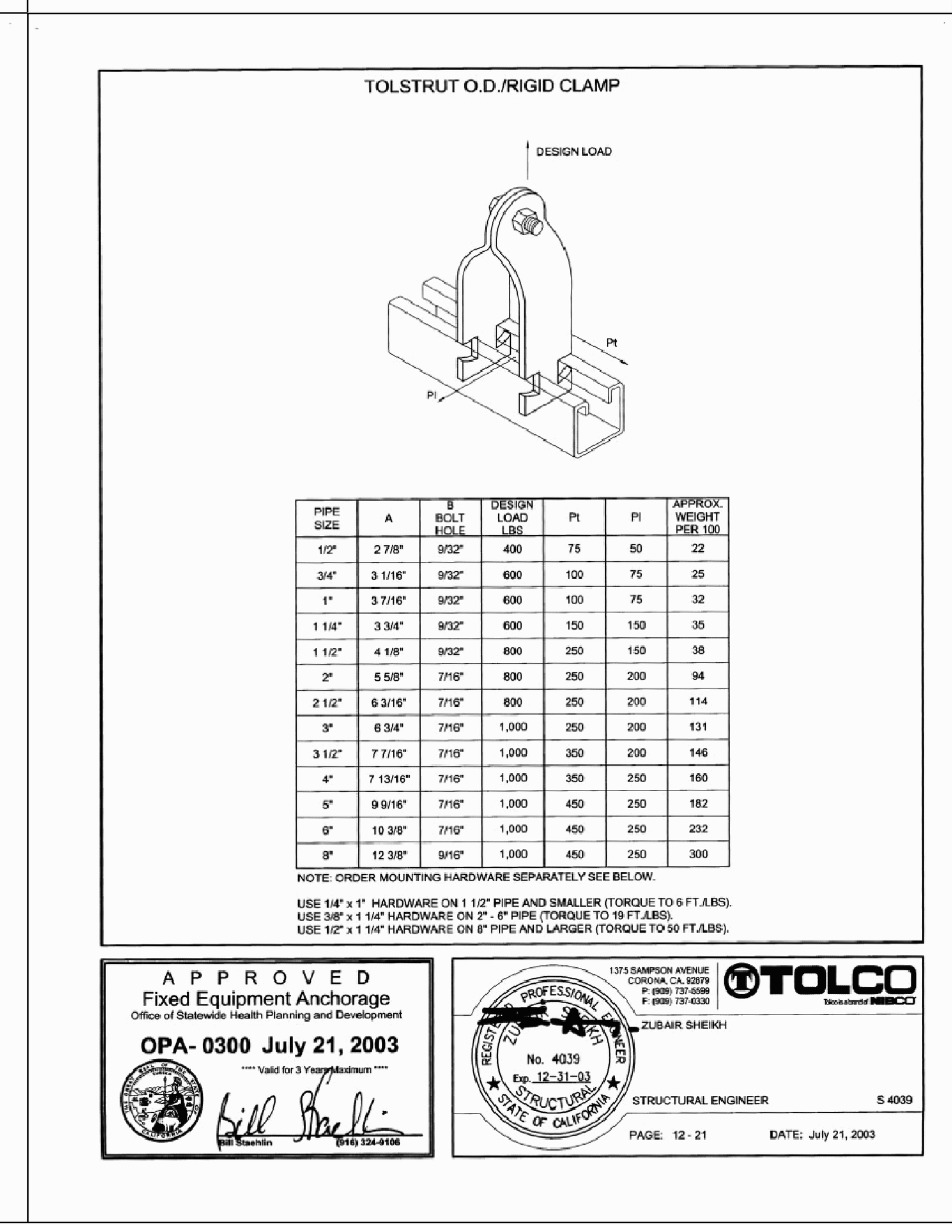
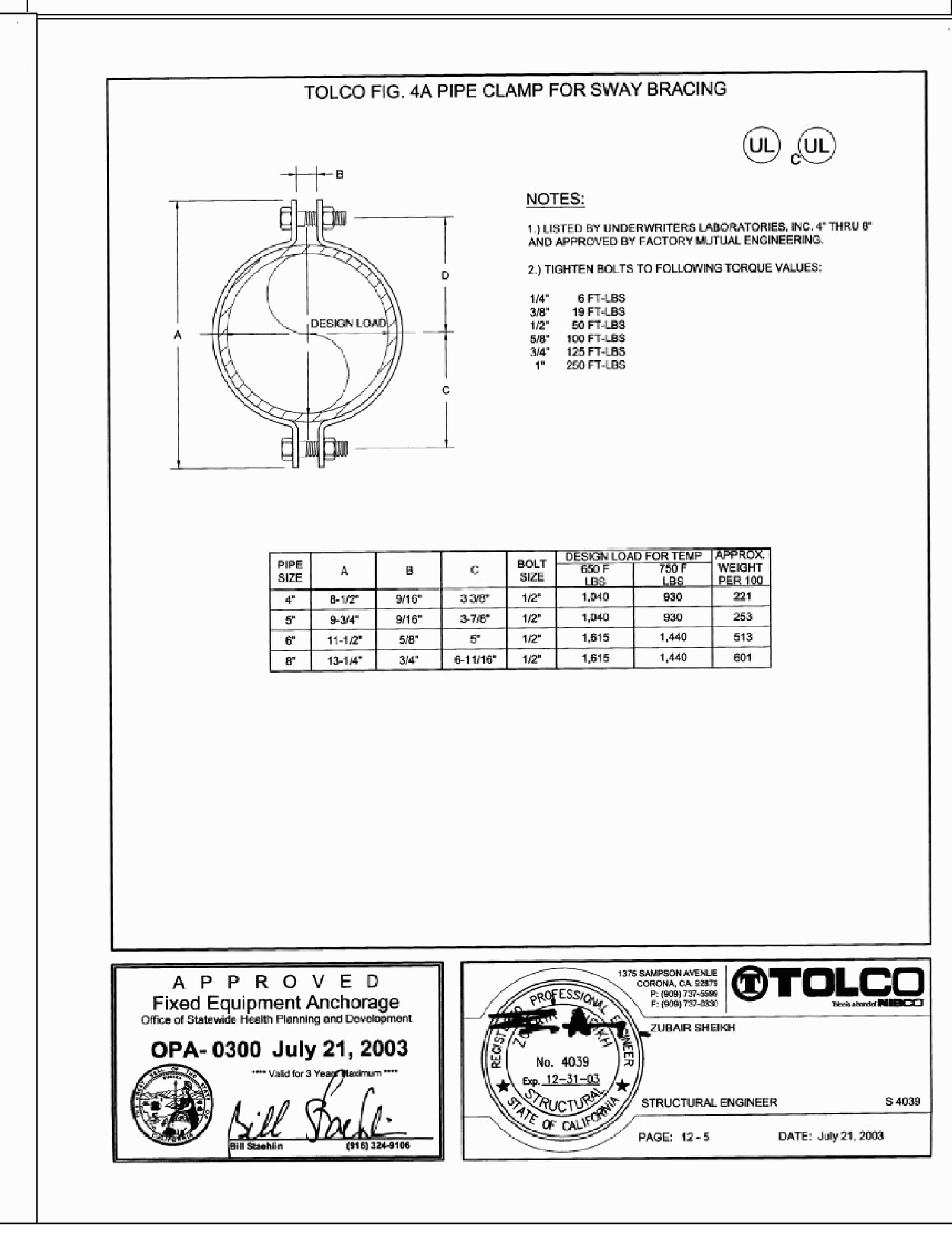
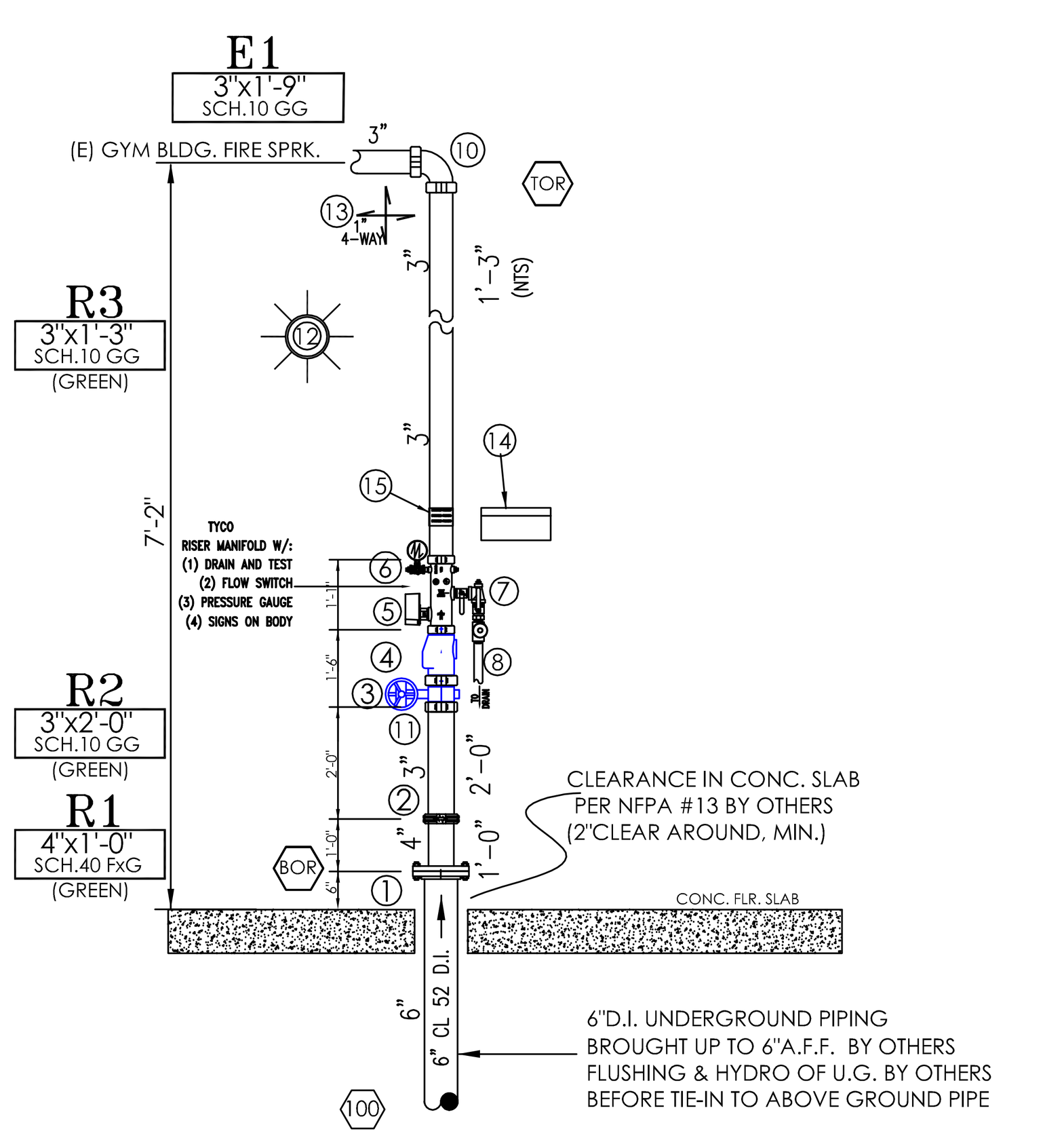
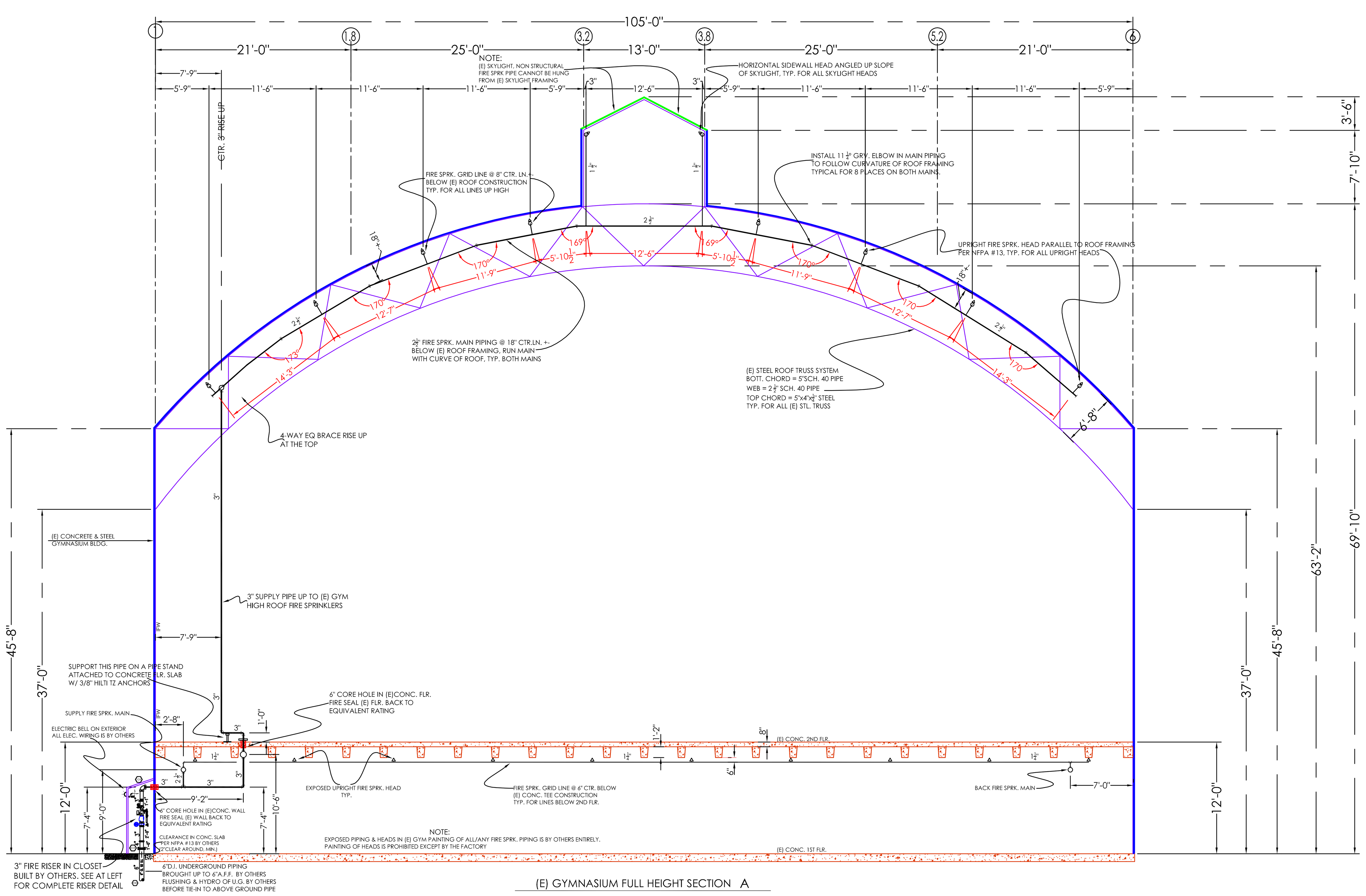
COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
FRESNO OFFICE
4233 W. Sierra Madre, Suite 108
Fresno, California 93722
call (559) 275-3795 • fax (559) 275-8006
www.coscofire.com
California C-16
LIC. # 577621
SAN DIEGO • LOS ANGELES • FRESNO • SAN FRANCISCO • SACRAMENTO • PORTLAND • SEATTLE • ANCHORAGE

PROJECT: CAL POLY UNIVERSITY, RECREATION CENTER
SAN LUIS OBISPO, CALIFORNIA 93407

CONTRACT WITH: SUNDT CONSTRUCTION INC.
1 GRAND AVE. G2 PARKING LOT
SAN LUIS OBISPO, CA. 93407

DRAWING TITLE: FIRE SPRK. PIPING PLAN, (E) GYM BLDG. ROOF

DATE : 9-1-2010
SCALE : 1/8"= 1'-0"
DRAWN BY : KO
JOB NO. FD-1075
SHEET NO. FP-E2

Tol-Brace Seismic Calculations

Project Information:

CAL–POLY UNIVERSITY
RECREATION CTR. (E) GYM
SAN LUIS OBISPO, CA.

TOL–BRACE 4.0 Seismic Calculation Software for the Fire Protection Industry www.tolco.com Corona, Ca. 92879 (909) 737–5599

Contractor Information:

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE #108
FRESNO. CA. 93722
(559) 275–3795

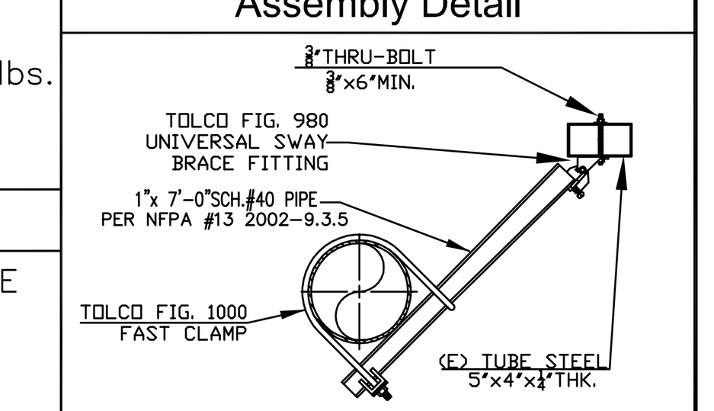
Brace Information

Maximum Spacing = 40 Feet
Length of Brace = 7'–0"
Bracing Material = 1" Sch.#40
Angle from Vert. = 45° Min.
Least Radius of Gyration =.42"
L/R Value = 200
Max. Horizontal Load = 2500 lbs.

Tolco Brace Components

Fig.1000 Sway Brace Clamp = 2015 lbs.
Fig. 980 Universal Swivel = 2765 lbs.
Fig. 909 Universal Swivel = 2015 lbs.
Weekest component Load = 2015 lbs.
Adjusted Load Per 9.3.5.10.3 = 1425 lbs.

Assembly Detail



Brace Identification	LATERAL
Orientation of Brace	LATERAL

Fastener Information

Fastener Orientation=NFPA Type E
Type of Fastener= THRU–BOLT
Diameter of Fastener= 3/8"
Length of Fastener= 6"
Maximum Load = 1200 lbs.

Load Information

Size, Type, and Length of Pipe in Zone of Influence		Wp = .5
2 1/2" Sch.10 Pipe	40 Ft. x 2.95 lbs.	118.0 lbs.
1-1/2" Sch.40 Pipe	10 Ft. x 1.81 lbs.	18.1 lbs.
1-1/4" Sch.40 Pipe	250 Ft. x 1.47 lbs.	367.5 lbs.
1" Sch.40 Pipe	0 Ft.	0.0 lbs.
Percentage added for Fittings and Sprinklers	15%	75.0 lbs.
Total Load of all Pipe within Zone Of Influence		578.6 lbs.

Tol-Brace Seismic Calculations

Project Information:

CAL–POLY UNIVERSITY
RECREATION CTR. (E) GYM
SAN LUIS OBISPO, CA.

TOL–BRACE 4.0 Seismic Calculation Software for the Fire Protection Industry www.tolco.com Corona, Ca. 92879 (909) 737–5599

Contractor Information:

COSCO FIRE PROTECTION INC.
4233 W. SIERRA MADRE #108
FRESNO. CA. 93722
(559) 275–3795

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Maximum Spacing = 40 Feet
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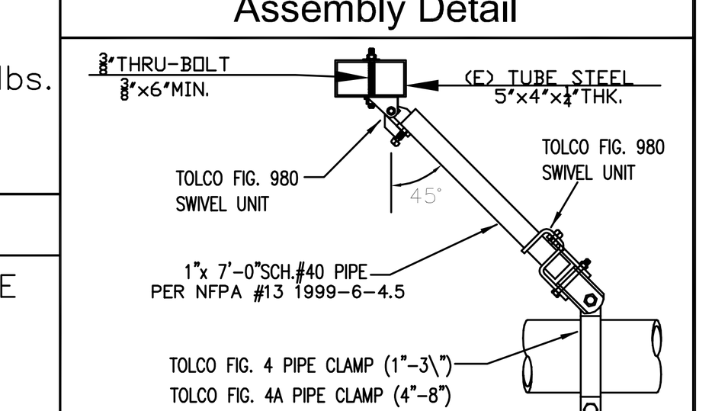
Bracing Material = 1" Sch.#40
Angle from Vert. = 45° Min.
Least Radius of Gyration =.42"
L/R Value = 200
Max. Horizontal Load = 2500 lbs.

Tolco Brace Components

Fig.1000 Sway Brace Clamp = 2015 lbs.
Fig. 980 Universal Swivel = 2765 lbs.
Fig. 909 Universal Swivel = 2015 lbs.
Weekest component Load = 2015 lbs.
Adjusted Load Per 9.3.5.10.3 = 1425 lbs.

Assembly Detail



Brace Identification	BRACEID
Orientation of Brace	BRACEORIENT

Fastener Information

Fastener Orientation=NFPA Type E
Type of Fastener= THRU–BOLT
Diameter of Fastener= 3/8"
Length of Fastener= 6"
Maximum Load = 1200 lbs.

Load Information

Size, Type, and Length of Pipe in Zone of Influence		Wp = .5
2 1/2" Sch.10 Pipe	80 Ft. x 2.95 lbs.	236.0 lbs.
Percentage added for Fittings and Sprinklers	15%	35.4 lbs.
Total Load of all Pipe within Zone Of Influence		271.4 lbs.

6"D.I. UNDERGROUND PIPING BROUGHT UP TO 6"A.F.F. BY OTHERS FLUSHING & HYDRO OF U.G. BY OTHERS BEFORE TIE-IN TO ABOVE GROUND PIPE

RISER DETAIL IN RISER CLOSET

NO SCALE

FIRE RISER COMPONENT LIST

1. 6" DI PIPE THRU CONC. SLAB BY OTHERS, 6"x4" FLG. FOR CONNECT
2. 4"x3" GRV. RC CPLG. FLEXIBLE ON RISER PER NFPA #13
3. 3"TYCO GRV. BUTTERFLY BFV-1 FOR WET SYS. CONTROL W/ TAMPER SWITCH (ALL ELECTRIC WIRING IS BY OTHERS)
4. 3"TYCO GRV. RISER CHECK VA. CV-1FR WITH PSI GAUGES & OUTLET FOR MAIN DRAIN VALVE, FOR WET FIRE SPRK. SYS.
5. 3" WATER FLOW INDICATOR. (ALL ELECTRIC WIRING IS BY OTHERS)
6. 3" TYCO TEST N DRAIN RISER ASSEMBLY
7. INSPECTOR'S TEST VALVE & SYSTEM MAIN DRAIN VALVE
8. SYSTEM MAIN DRAIN TO DRAIN IN TO HUB DRAIN THAT IS TO BE PROVIDED BY OTHERS, SEE RFI 096
9. NOT USED
10. 3" GRV. 90 ° ELL TYCO #510 WITH FLEX GRV. CPLG. #705 ON RISER
11. 3" FLEX GRV. CPLG. #705 ON RISER, PER NFPA #13
12. 10"ELECTRIC BELL AT 10'-0"+- A.F.F. ON BLDG. WALL (ALL ELECTRIC WIRING IS BY OTHERS)
13. 4-WAY EARTH QUAKE SWAY BRACE PER NFPA #13-2002
14. FIRE SPRK. HEAD CABINET MOUNTED ON WALL BY RISER
15. FIRE SPRK. DESIGN PLACARD ON RISER, TYP.

(E) GYMNASIUM FULL HEIGHT SECTION A

SFM #18-40-03-0001

AS-BUILT BY: KO DATE: 2-3-2012

KEY PLAN NO SCALE

EXISTING GYM LOCATION
NEW REC. CTR.

REVISIONS

NO.	DESCRIPTION	DATE	BY

SPRINKLER HEAD LEGEND:
VIKING CONCEALED QREC FIRE SPRK HEAD
VIKING RECESSED QREC FIRE SPRK HEAD
VIKING SIDEWALL QREC FIRE SPRK HEAD
VIKING RECESSED QR FIRE SPRK HEAD
VIKING CONCEALED QRSC FIRE SPRK HEAD
VIKING UPRIGHT QR FIRE SPRK HEAD
APPROVALS BY:
ARCH. & STATE FIRE MARSHAL

COSCO Fire Protection
FIRE PROTECTION AND LIFE SAFETY SPECIALISTS
FRESNO OFFICE
4233 W. Sierra Madre, Suite 108
Fresno, California 93722
call (559) 275-3795•fax (559) 275-8006
www.coscofire.com
California C-16 LIC. # 577621
SAN DIEGO • LOS ANGELES • FRESNO • SAN FRANCISCO • SACRAMENTO • PORTLAND • SEATTLE • ANCHORAGE

PROJECT:
CAL POLY UNIVERSITY, RECREATION CENTER
SAN LUIS OBISPO, CALIFORNIA 93407

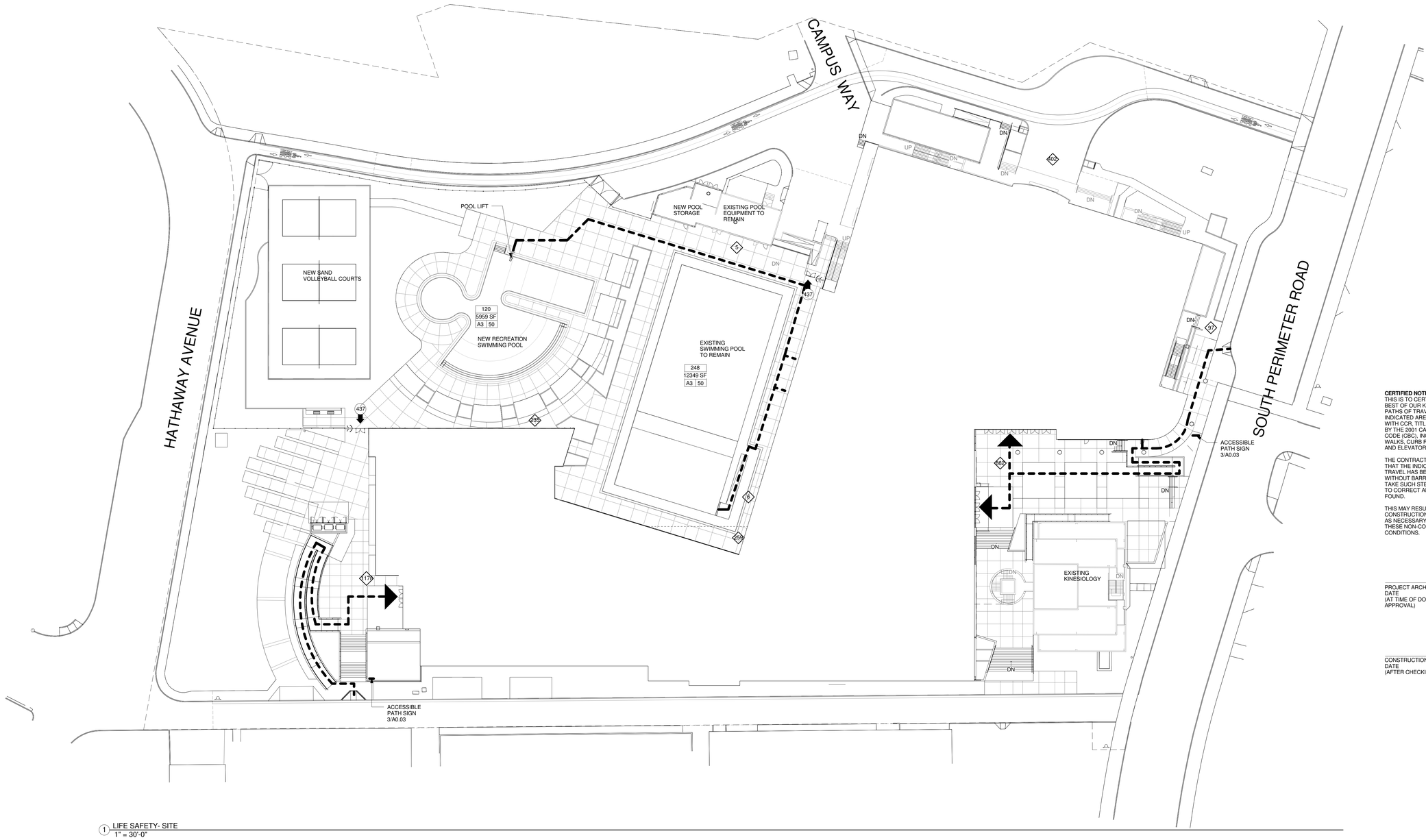
CONTRACT WITH:
SUNDT CONSTRUCTION INC.
1 GRAND AVE. G2 PARKING LOT
SAN LUIS OBISPO, CA. 93407

DRAWING TITLE
HANGER & BRACING DETAILS FOR (E) GYM BLDG.

DATE : 9-1-2010
SCALE : 1/8"= 1'-0"
DRAWN BY KO
JOB NO. FD-1075
SHEET NO. FP-E3

APPENDIX F

RECREATION CENTER – LIFE SAFETY DRAWINGS



1 LIFE SAFETY- SITE
1" = 30'-0"

MAJOR ACCESSIBLE BUILDING ENTRY

ACCESSIBLE PATH OF TRAVEL (5% MAXIMUM SLOPE)

XXX OCCUPANT LOAD USING EXIT

NOTES:
1. PATH OF TRAVEL (P.O.T.) INDICATED IS BARRIER-FREE ACCESS

2. PATH OF TRAVEL INDICATED IS 48" WIDE MINIMUM WITHOUT ANY ABRUPT CHANGES EXCEEDING 1/2" AT 1:2 MAXIMUM SLOPE, EXCEPT THAT LEVEL CHANGES DO NOT EXCEED 1/4" VERTICAL.

3. MAXIMUM CROSS-SLOPE 2% TYPICAL.

CERTIFIED NOTE:
THIS IS TO CERTIFY THAT, TO THE BEST OF OUR KNOWLEDGE, ALL PATHS OF TRAVEL (P.O.T.) INDICATED ARE IN COMPLIANCE WITH CCR, TITLE-24 AS DEFINED BY THE 2001 CALIFORNIA BUILDING CODE (CBC), INCLUDING ALL WALKS, CURB RAMP(S), LIFT(S) AND ELEVATORS (AS APPLY).

THE CONTRACTOR SHALL VERIFY THAT THE INDICATED PATH OF TRAVEL HAS BEEN CONSTRUCTED WITHOUT BARRIERS, AND SHALL TAKE SUCH STEPS AS REQUIRED TO CORRECT ANY DEFICIENCIES FOUND.

THIS MAY RESULT IN CONSTRUCTION CHANGE ORDERS AS NECESSARY TO MITIGATE THESE NON-COMPLYING CONDITIONS.

PROJECT ARCHITECT
DATE
(AT TIME OF DOCUMENT APPROVAL)

CONSTRUCTION SUPERVISOR
DATE
(AFTER CHECKING THE SITE)

CAL POLY

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO, CA

CANNONDESIGN

1901 Avenue of the Stars, Suite 175
Los Angeles, California 90067 310.229.2700

Boston ■ New York ■ Baltimore ■ Washinton DC ■ Jacksonville ■ Albany ■ Buffalo ■ Toronto Hamilton ■ Chicago ■ St. Louis Vancouver ■ Victoria ■ San Francisco ■ Los Angeles

LICENSED ARCHITECT C-18404 RENEWAL 9-30-09 STATE OF CALIFORNIA

100% CONSTRUCTION DOCUMENTS (CD)

No.	Description	Date

BID SET

Drawing Title:
LIFE SAFETY PLAN - SITE

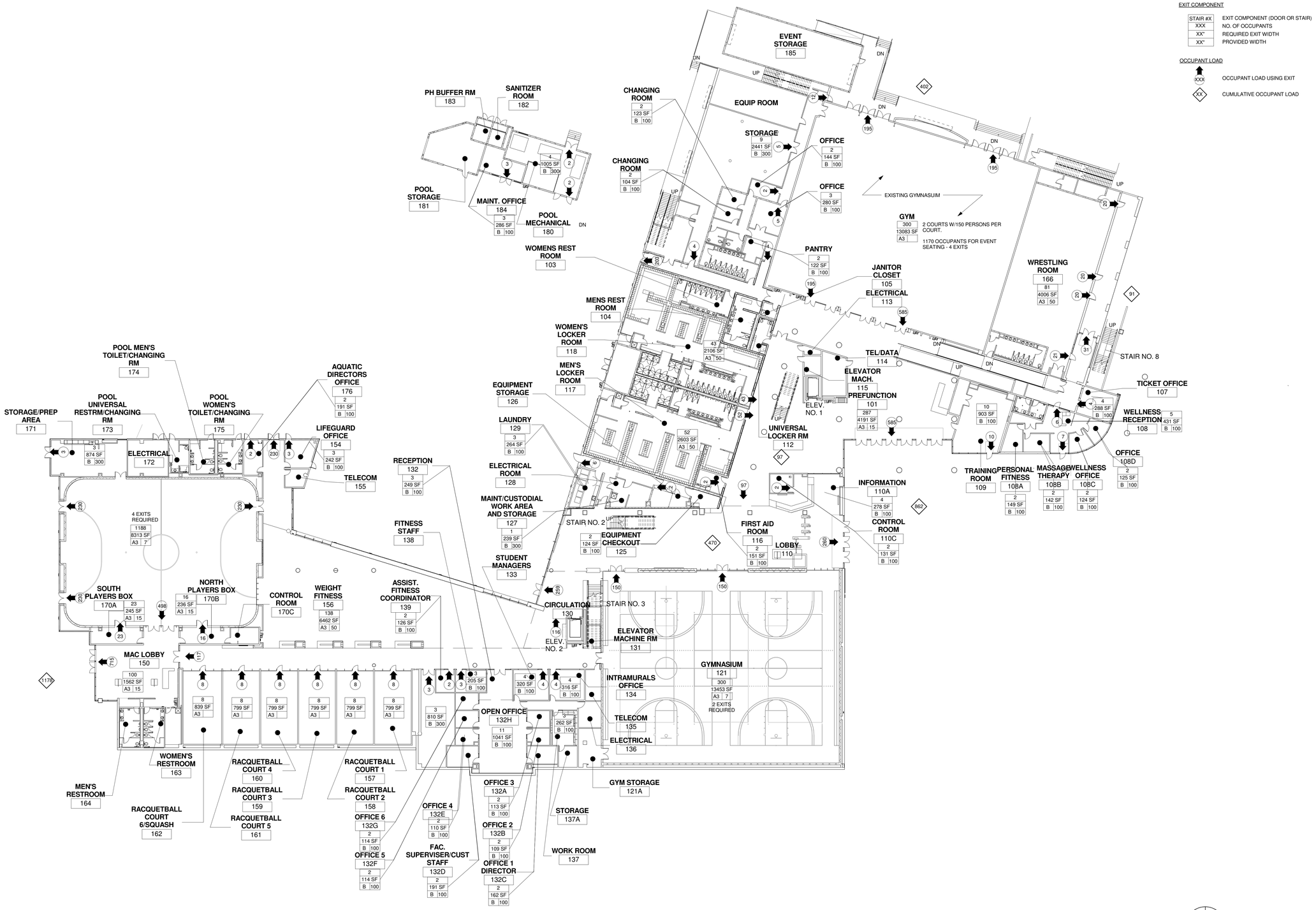
Issue Date: 07.24.09

Drawn by: Author | Checked by: Checker

Project No.: 03053.00 | Scale: As indicated

LS1.10

7/21/2009 3:38:23 PM



1 LIFE SAFETY - LEVEL 1
3/64" = 1'-0"

7/22/2009 10:17:46 AM

CAL POLY

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO, CA

CANNONDESIGN

1901 Avenue of the Stars, Suite 175
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LICENSED ARCHITECT C-18404 REN. 9-30-09 STATE OF CALIFORNIA

100% CONSTRUCTION DOCUMENTS (CD)

No.	Description	Date

BID SET

Drawing Title:
LIFE SAFETY PLAN - LEVEL 1

Issue Date: 07.24.09
Drawn by: Author
Checked by: Checker
Project No.: 03053.00
Scale: As indicated

LS1.11

OCCUPANTS

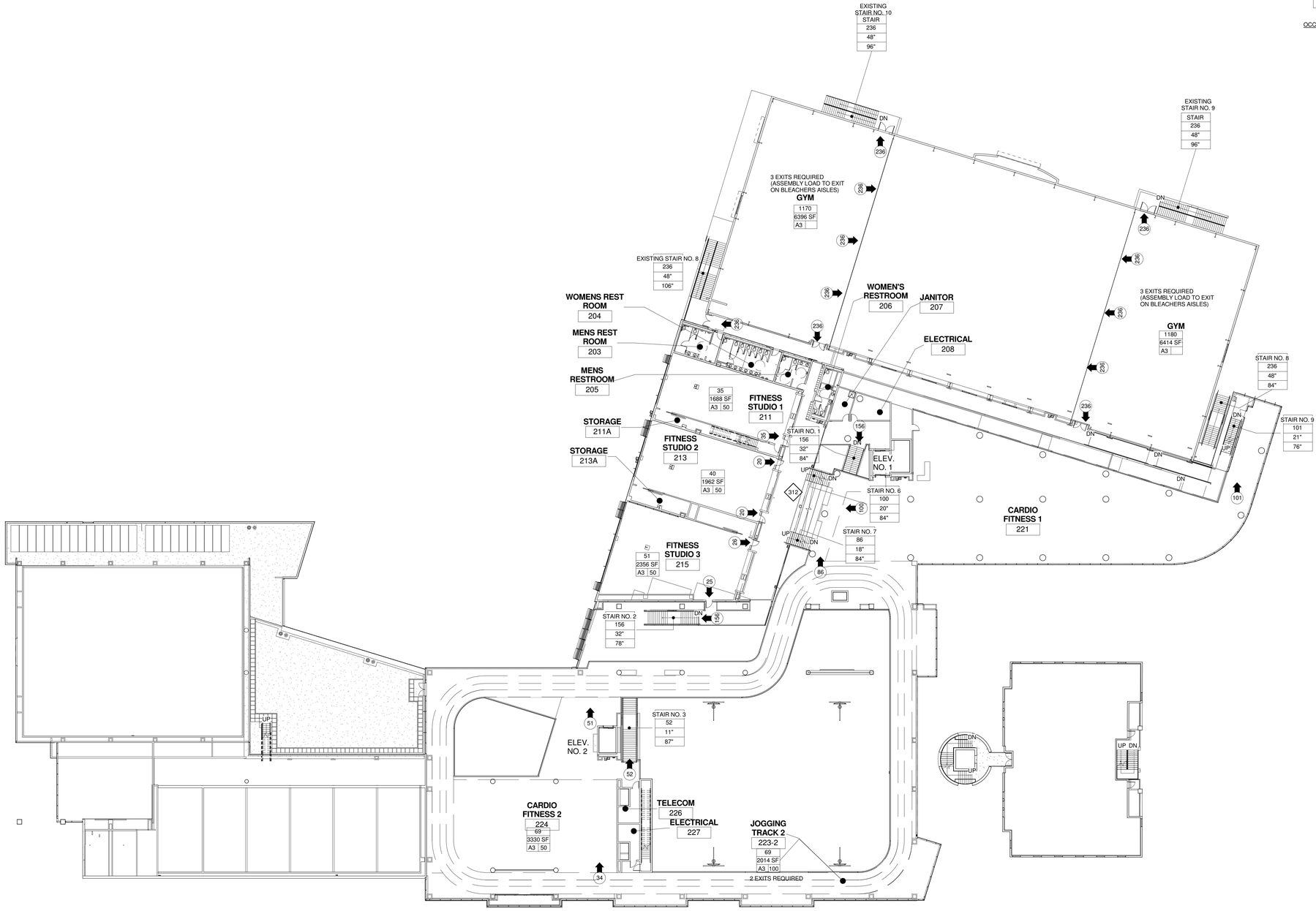
XXXX	NO. OF OCCUPANTS
150 SF	AREA OF ROOM/ SPACE
OCCUPANCY TYPE A3 X	OCCUPANT LOAD FACTOR
ROOM	ROOM NAME
101	ROOM NUMBER

EXIT COMPONENT

STAIR #X	EXIT COMPONENT (DOOR OR STAIR)
XXX	NO. OF OCCUPANTS
XX"	REQUIRED EXIT WIDTH
XX"	PROVIDED WIDTH

OCCUPANT LOAD

XXX	OCCUPANT LOAD USING EXIT
XXX	CUMULATIVE OCCUPANT LOAD



1 LIFE SAFETY - LEVEL 2
3/64" = 1'-0"

7/21/2009 3:51:40 PM

CAL POLY

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO

CALIFORNIA POLYTECHNIC STATE UNIVERSITY SAN LUIS OBISPO, CA

CANNONDESIGN

1901 Avenue of the Stars, Suite 175
Los Angeles, California 90067 310.229.2700

Boston ■ New York ■ Baltimore ■ Washinton DC ■ Jacksonville ■ Albany ■ Buffalo ■ Toronto Hamilton ■ Chicago ■ St. Louis Vancouver ■ Victoria ■ San Francisco ■ Los Angeles

LICENSED ARCHITECT
RENEWAL 9-30-09
C-18404

100% CONSTRUCTION DOCUMENTS (CD)

No.	Description	Date

BID SET

Drawing Title:
LIFE SAFETY - LEVEL 2

Issue Date: 07.24.09
Drawn by: Author Checked by: Checker
Project No.: 03053.00 Scale: As indicated

LS1.12

APPENDIX G

RECREATION CENTER – FIRE SAFETY MANAGEMENT PLAN

TABLE OF CONTENTS

INTRODUCTION

The Recreation Center opened in 1993 as the first comprehensive facility of its kind in the CSU system. In January 2012, the renovated Recreation Center opened its doors after major expanding works, which some old sections were to be demolished, re-modeled and re-built.

The Center is a welcoming destination for Cal Poly community to relax, recreate and socialize. The renovated Recreation Center is a two-story building of 165 000 square feet recreation space that includes three separate exercise areas filled with state of the art weight and cardio equipment, three fitness studios for group exercise classes, an indoor track, a lounge area, a leisure pool, locker rooms with individual showers, a martial arts training room and much more variety of fitness and recreation programs that promote lifelong healthy habits.

The report covers the Fire Safety management plan for the recreation center building in two aspects:

- Part I: The section covers applicable IFC provisions during construction of the recreation center
- Part II: The section covers the fire safety management plan during occupancy

The applicable IFC provisions are summarized in part 1 to illustrate what code provisions need to be observed in order to comply with IFC code regulations with regards to fire safety during construction and occupancy.

The fire safety plan is developed to provide occupant safety in the event of a fire, to provide effective utilization of the fire safety features of the building or to minimize the possibility of fires.

PART I: APPLICABLE IFC PROVISIONS

FIRE SAFETY PLANS DURING CONSTRUCTION

The fire safety management plan for the recreation center applicable during construction is essentially based on IFC, chapter 14 provisions.

The following provisions are included in the fire safety management to be applied during the construction of the recreation center:

A. PRECAUTIONS AGAINST FIRE

- Smoking shall be prohibited except in approved areas. Signs shall be posted in approved areas where smoking is permitted and approved ashtrays shall be provided.
- Combustible debris shall not be accumulated within buildings. Combustible debris, rubbish and waste material shall be removed from buildings at the end of each shift of work. Combustible debris, rubbish and waste material shall not be disposed of by burning on the site unless approved.
- Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container.
- Operations involving the use of cutting and welding shall be done in accordance with Chapter 26.
- Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment or similar activities shall comply with NFPA 70.
- Open burning that is offensive or objectionable because of smoke emissions or when atmospheric conditions or local circumstances make such fire hazardous shall be prohibited.

B. FLAMMABLE AND COMBUSTIBLE LIQUIDS

- Storage of flammable and combustible liquids shall be in accordance with section 3404
- The storage, use and handling of flammable and combustible liquids at construction sites shall be in accordance with section 3406.2. Ventilation shall be provided for operations involving the application of materials containing flammable solvents.
- Sources of ignition and smoking shall be prohibited in flammable and combustible liquid storage areas. Sign shall be posted in accordance with section 310.
- Class I and II liquids shall be kept in approved safety containers.
- Leaking vessels shall be immediately repaired or taken out of service and spills shall be cleaned up and disposed of property.

C. OWNER'S RESPONSIBILITY FOR FIRE

- CalPoly University, as owner, shall designate a person to be the fire prevention program superintendent who shall have authority and be responsible for the fire prevention program and ensure that it is carried out through completion of the construction project. Where guard service is provided, the superintendent shall be responsible for the guard service.
- Training of responsible personnel in the use of fire protection equipment shall be the responsibility of the fire prevention program superintendent.

- The fire prevention program superintendent shall develop and maintain an approved pre-fire plan in cooperation with the fire chief. The fire chief and the fire code official shall be notified of changes affecting the utilization of information contained in such pre-fire plans.
- The fire prevention program superintendent shall determine that all fire protection equipment is maintained and serviced in accordance with the IFC code. The quantity and type of fire protection equipment shall be approved.
- The fire prevention program superintendent shall be responsible for supervising the permit system for hot work operations in accordance with chapter 26
- Coverings placed on or over fire protection devices to protect them from damage during construction processes shall be immediately removed upon the completion of the construction processes in the room or area in which the devices are installed.

D. FIRE REPORTING

- Readily accessible emergency telephone facilities shall be provided in approved location at the construction site. The street address of the construction site and the emergency telephone number of the fire department shall be posted adjacent of the telephone.

E. ACCESS FOR FIRE FIGHTING

- Approved vehicle access for firefighting shall be provided to all construction. Vehicle access shall be provided to within 100 feet (30480 mm) of temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads, capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.
-

F. MEANS OF EGRESS

- Where a building has been constructed to a building height of 50 feet (15240 mm) or four stories, or where an existing building exceeding 50 feet (15240mm) in building heights altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.
- Required means of egress shall be maintained during construction, remodeling or alterations and additions to any building.
  The recreation center project will not meet this provision during construction due to its limited height.

G. WATER SUPPLY FOR FIRE PROTECTION

- An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on the site.

H. STANDPIPES

- The recreation center shall be equipped with not less than one standpipe during construction. Such standpipes shall be installed when the progress of construction is not more than 40 feet in height above the lowest level of fire department vehicle access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs. Such standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.
- For the old sections of the recreation center that will be demolished, if a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.
- Standpipes shall be installed in accordance with the provision of Section 905. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of Section 905 as to capacity, outlets and materials.

I. AUTOMATIC SPRINKLER SYSTEM

- It shall be unlawful to occupy a portion of the recreation center until the automatic sprinkler system installation has been tested and approved.
- Operation of sprinkler valve shall be allowed only by property authorized personnel and shall be accompanied by notification of duty designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

J. PORTABLE FIRE EXTINGUISHERS

- The recreation center construction site shall be provided with not less than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:
    - Each stairway, on all floor levels where combustible materials have accumulated
    - Every storage and construction shed
    - Where special hazards exist such, not limited to, storage and use of flammable and combustible liquids

K. MOTORIZED EQUIPMENT

- Internal-combustion powered construction equipment shall be used in accordance with all of the following conditions:
    - Equipment shall be located so that exhausts do not discharge against combustible material
    - Exhausts shall be piped to the outside of the building
    - Equipment shall not be refueled while in operation
    - Fuel for equipment shall be stored in an approved area

L. SAFEGUARDING ROOFING OPERATIONS

- Roofing operations utilizing heat-producing systems or other ignition sources shall be conducted in accordance with Sections 1417.2 and 1417.3 and Chapter 26.
- Asphalt and tar kettles, if used, shall be operates in accordance with Section 303.
- They shall be not less than one multipurpose portable fire extinguisher with a minimum 3-A 40-B:C rating on the roof being covered or repaired.

PART II: FIRE SAFETY PLAN FOR CALPOLY RECREATION CENTER

This Fire Safety Plan is required in accordance with IFC Section 404.2: *"An approved fire safety and evacuation plan shall be prepared and maintained for the following occupancies and buildings. Group A, other than Group A occupancies used exclusively for purposes of religious worship that have an occupant load less than 2000"*.

This Fire Safety plan is designed to provide center's occupants safety in the event of a fire, to provide effective utilization of the fire safety features of the building or to minimize the possibility of fires.

The plan discusses what occupants need to do in the event of a fire, fire safety, supervisory shift or related duties, and other related issues.

This Fire Safety Plan will also assist fire-fighters in the performance of their duties by providing floor plans and office staffs and users information if an emergency ever occurs.

1 BUILDING INFORMATION

Building Name	Cal Poly Rec Center
Building Location	1 Grand Avenue, San Luis Obispo. Calpoly main campus
Building Owner	CalPoly University
Building Manager	Hossein Sedghi
Building Deputy Manager	TBC
Building Floor Area	a) Number of stories: 2 plus basement b) Height: 49 ft (average height of highest roof) c) Total area: 165 715 Square ft

2 LIST OF FIRE SAFETY EQUIPMENT

Refer to Appendix 3 for more details

3 PROPOSED MAINTENANCE SCHEDULE

Installation	Tests and Frequency	Competent Person
Fire Detection and Smoke Alarm Systems	As per NFPA 72 and IFC chapter 9 requirements	Calpoly Electrical Department
Fire Sprinkler Systems	As per NFPA 25 and IFC chapter 9 requirements	Licensed Fire Sprinkler Contractor
Portable Fire Extinguishers	As per NFPA 10 and IFC chapter 9 requirements	Licensed Fire Appliance Contractor
Exit Signs and Emergency Lighting	As NFPA 70 and IFC chapter 9 requirements	Licensed Fire Contractor
Manual Fire boxes	As per NFPA 72 and IFC chapter 9 requirements	Licensed Fire Appliance Contractor
Exit Door Hardware	Ensure correct operation all the times	Manager's appointed personnel

Table 3-1: *Proposed Maintenance Schedule*

Figure 3.1: *Fire sprinkler maintenance works*

Figure 3.2: *Fire alarm system maintenance works*

Figure 3.3: *Fire extinguisher maintenance works*

Figure 3.4: *Exit signs and emergency lighting*

4 FIRE AND EVACUATION PLAN

This section includes emergency evacuation procedures for all recreation center's personnel and center's users, and their visitors. The procedures describe what to do when discovering a fire or smoke; and hearing the fire alarm.

EMERGENCY PROCEDURE CHECKLIST FOR CENTER'S USERS

In an **emergency**, phone **911**. Building Manager – **Hoss Sedghi**

Smoke Alarms Sounding or Evidence of Fire Occurring

Evacuate to assembly area, closing doors and windows, if possible

Contact the Calpoly Campus UPD (Fire Service) on 911

FIRE	NO FIRE
Assist people to evacuate to assembly point area without endangering yourself	**If the fire service has already been called, notify them of the situation**
Fight fire if safe & you are trained	**Help to reassure residents of situation**
Remain in assembly area until everyone is accounted for and the manager has arrived	**Allow fire service to enter building on their arrival to investigate the situation**
Await arrival of fire service	**Manager will attend to deal with the situation and rectify any problems or system faults**
Do not re-enter building until advised by the fire service	

FIRE ALARM PROCEDURES

A. IN FIRE EMERGENCIES:

When the smoke alarms activate, students using the center and building staff shall leave the building immediately, in orderly manner and gather at a predetermined assembly point area.

The following actions shall be performed (unless otherwise instructed by the Fire Service) by the building manager or his/her appointed assistant in attendance:

- Investigate the fire situation. Go to fire alarm annunciator panel behind the reception desk. Look for red light on annunciator panel zones. Should there be red light, that light will tell you what location to go look at, and verify you have a fire or smoke.
- If there is a fire, ensure the Fire Department has been called. If there is any doubt regarding whether there is a fire situation, the Fire Department should still be notified by the dispatcher from the University Central Control room.
- Ensure the safe evacuation of all building personnel and students using the center from the building.
- Ensure the Fire Department has been notified and provided with information regarding the incident.
- Account for all occupants at the assembly area following the entrance registry.
- If required and safe to do, conduct a search for any missing persons.
- Meet the first fire respondents and advise them of any information relevant to the emergency.

B. IN REAL FIRE EMERGENCIES (when a fire event has been confirmed):

The building manager or his/her appointed assistance in attendance will:

- Ensure the evacuation of the building – manually activate voice evacuation system if not automatically activated yet; in order to alert all building attendants without further delay that can compromise life
- Attempt to extinguish the fire if safe to do so – If the fire is small enough, use a nearby fire extinguisher to control and extinguish the fire. However no attempt to extinguish the fire in any of the following conditions:
    - ❖ You have not been trained or instructed in using a fire extinguisher
    - ❖ You do not know what's burning
    - ❖ The fire is spreading rapidly
    - ❖ You don't have the proper equipment
    - ❖ You cannot do so with your back to an exit
    - ❖ The fire might block your means of escape
    - ❖ You might inhale toxic smoke
    - ❖ Your instincts tell you not to do so
    - ❖ If the first attempts to put out the fire do not succeed, evacuate the building immediately.
- Meet the Fire Service on arrival and inform them of the situation; regardless whether the fire has been extinguished or not

C. IN NO FIRE SITUATION (in event fire was not found after a nuisance alarm):

The building manager or his/her appointed deputy in attendance should:

- Inform building attendants of the situation
- Meet the Fire Service on arrival and inform them of the situation
- Authorize recreation center's personnel and users to re-enter the building after the Fire Department has confirmed that it is safe to do so.

D. RESPONSIBILITY OF THE CENTER'S MANAGER: The manager is responsible for:

- All personnel and procedures until the arrival of the Fire Department
- Maintaining of an up-to date registry of personnel and students using the Center
- Appointing a person to assume the emergency duties of the Manager in his/her absence
- Logging accurately any problems encountered, performance of fire alerting and extinguishing systems, the egress performance of building attendants, the conduct of a debriefing with everyone involved in the event, and the continual improvement of the effectiveness of the evacuation plan

E. OCCUPANT FIRE PROCEDURE SIGNAGE

IN CASE OF FIRE

UPON DISCOVERY OF FIRE

LEAVE FIRE AREA IMMEDIATELY
CLOSE DOORS BEHIND YOU
ACTIVATE THE FIRE ALARM SYSTEM – USE MANUAL PULL STATION
LEAVE CENTER VIA NEAREST EXIT
CALL CAMPUS UPD AT 911 (FROM A SAFE LOCATION)

DO NOT USE ELEVATORS

UPON HEARING FIRE ALARM
LEAVE BUILDING VIA NEAREST EXIT
CLOSE DOORS BEHIND YOU

CAUTION

IF SMOKE IS HEAVY IN THE CORRIDOR OR STAIRWAY IT MAY BE SAFER TO STAY IN YOUR AREA, CLOSE DOOR AND PLACE WET TOWEL AT BACK OF DOOR; OR USE ALTERNATE EXIT; OR FIND NEAREST REFUGE

IN ALL CASES:

REMAIN CALM

The above emergency procedure shall be posted by each manual pull station, within elevator lobbies and places agreed upon with fire official.

The following emergency evacuation plan will posted along with a pictogram showing assembly point. See Attachment 3 for details of emergency assembly areas

EMERGENCY EVACUATION PLAN

In case of
FIRE

Leave through the nearest

EXIT

- If you see **SMOKE, FLAMES** or hear the **FIRE ALARM, leave** the building **immediately**
- If safe, close any windows and doors to confine the fire.
- Follow the **EXIT** signs to locate and leave through the nearest emergency exit and proceed to the assembly point**.**
- **TELEPHONE THE CALPOLY UPD at 911**
- If unable to safely evacuate, stay in your room, close the door, and signal your presence at a window.
- Calmly follow instructions given by staff or the attending fire fighters.
- **Do not re-enter the building** until you are **told to do so** by the building manager or his/her deputy in charge or by the fire fighter in command.
- The building manager or his appointed assistant in attendance will account for all occupants and report persons missing to the fire fighters.

F. PERSONS REQUIRING ASSISTANCE

Staff members who will require assistance in emergency situations shall fill out a form to be handed to the building manager. The building manager will make readily available to the fire service upon their arrival, a list of all those members with conditions requiring assistance.

Figure 4.1: *Fire evacuation of assisted employee*

5 EMPLOYEE TRAINING ON FIRE RESPONSE

- The frequency of fire drills are set in IFC code section 405; the recreation center shall conduct fire drills at least quarterly or with cooperation with the fire code official.
- The building manager shall appoint fire safety assistants to be trained to assist with fire drills.
- The building staff members shall be trained in the fire emergency procedures described in the fire evacuation and fire safety plans. Records of staff members shall be kept updated and available to the fire code official upon. The training will include:
    - The procedure to follow in an emergency
    - The location of emergency exits
    - The paths of travel to exits
    - The location of firefighting equipment
    - The method of raising the alarm if the smoke alarms do not activate
    - The location of the assembly area
- Personnel assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers or other manual fire-fighting equipment and the protective clothing or equipment required for its safe and proper use.
- Permanent Employees of the recreation center shall receive instruction within 1 month of commencing work, and repeated at intervals of no more than 12 months.
- The instructions given are the procedure to be followed in the event of fire, means of escape from the building in the event of fire and the location and method of operation of firefighting equipment and fire alarms or equipment for warning of fire.
- A record of worker instruction will be retained with the original Fire Safety Management Plan and kept by the building manager.

Figure 5.1: *Employee training on fire emergency response*

6 FIRE DRILLS

- The fire drills shall be conduct on a date decided in cooperation with the campus UPD, which exact time shall not be revealed to the building fire safety assistants or students using the facility in order to simulate real emergency event.
- The building manager will manually activate the evacuation alarm system; no fire alarms shall be utilized during drills that automatically notifies fire service of potential fire.
- Staff members and students using the center shall leave the center immediately and in orderly manner upon hearing the alarm.
- The fire safety assistants shall guide building occupants as they leave and gather in assembly points allocated in specific areas around the center
- The fire safety manager will time the egress of building occupants, and encourage people to leave the building in orderly manner and as fast as they could.
- Fire safety assistants shall observe that staff members and students take the fire drill seriously.
- When a fire drill is conducted, all emergency procedures for an actual fire shall be followed with the exception of the notification of actual emergency to fire department.
- Records shall be maintained of required emergency evacuation drills and include the following information:
    - Identify of the person conducting the drill
    - Date and time of the drill
    - Notification method used
    - Staff members on duty and participating
    - Number of occupants evacuated
    - Special conditions simulated
    - Problems encountered
    - Weather conditions when occupants were evacuated
    - Time spent to accomplish complete evacuation

Figure 6.1: *Fire drills*

7 CONTROL OF FIRE HAZARDS

- Staff members shall be trained to identify the fire hazards of materials to which they are exposed to.
- The building manager shall make readily available Material safety Data Sheets (MSDS) for all hazardous materials stored or used in the recreation center. The MSDS shall be available on on the premise as a paper copy, or where approved shall be permitted to be ready retrievable by electronic access.
- Staff members shall be encouraged to practice basic measures to avoid any potential fire hazards and hence they should assist center's users to practice best practice for the disposal of any combustible materials.
- Building workers shall use appropriate individual containers of hazardous materials, cartons or packages clearly labeled in accordance with applicable federal regulations.
- Staff members responsible for the operation of areas in which hazardous materials are stored, dispensed, handled or used shall be familiar with the chemical nature of the materials and the appropriate mitigating actions necessary in the event of fire, leak or spill. Responsible persons shall be designated and trained to be liaison personnel for the fire department.

Figure 7.1: *Control of fire hazard materials*

APPENDICES

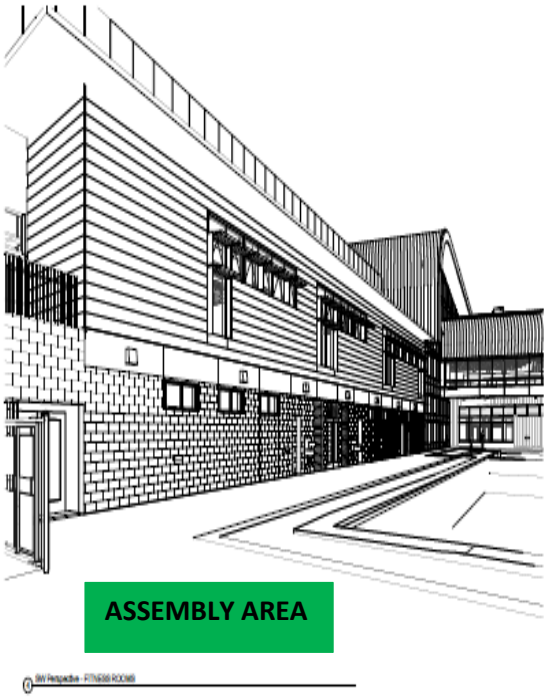
APPENDIX 1: RECREATION CENTER PERSPECTIVE DIAGRAMS

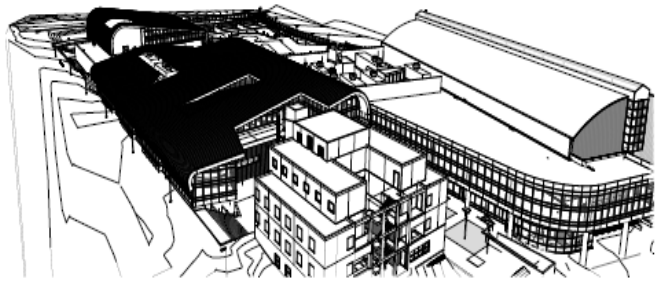
APPENDIX 2: LIFE SAFETY SITE PLANS:

- Fire Department Access Routes
- Fire Evacuation Plans

APPENDIX 3: LIST OF FIRE SAFETY EQUIPMENT

APPENDIX 1: RECREATION CENTER PERSPECTIVE DIAGRAMS





APPENDIX 2: LIFE SAFETY SITE PLAN: FIRE DEPARTMENT ACCESS

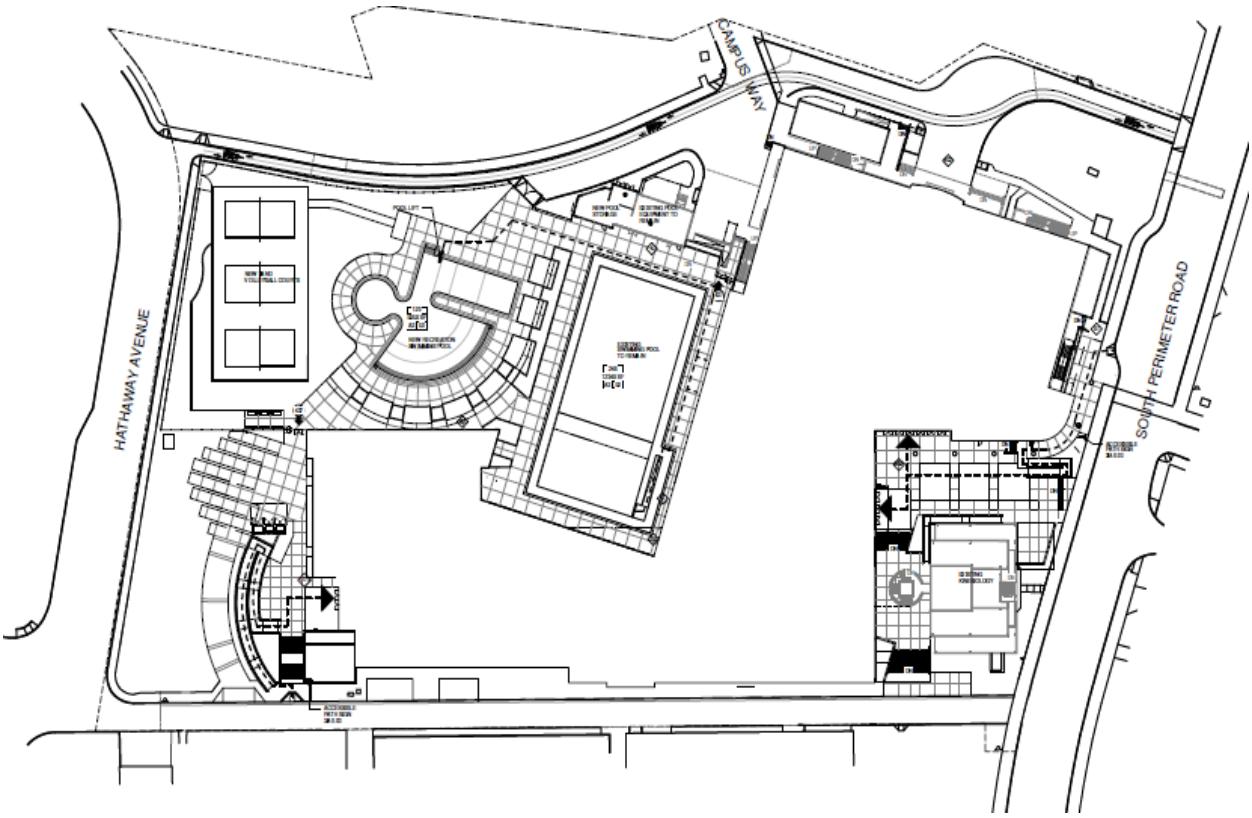


Figure A-2.1: ***Fire Department Access Routes***

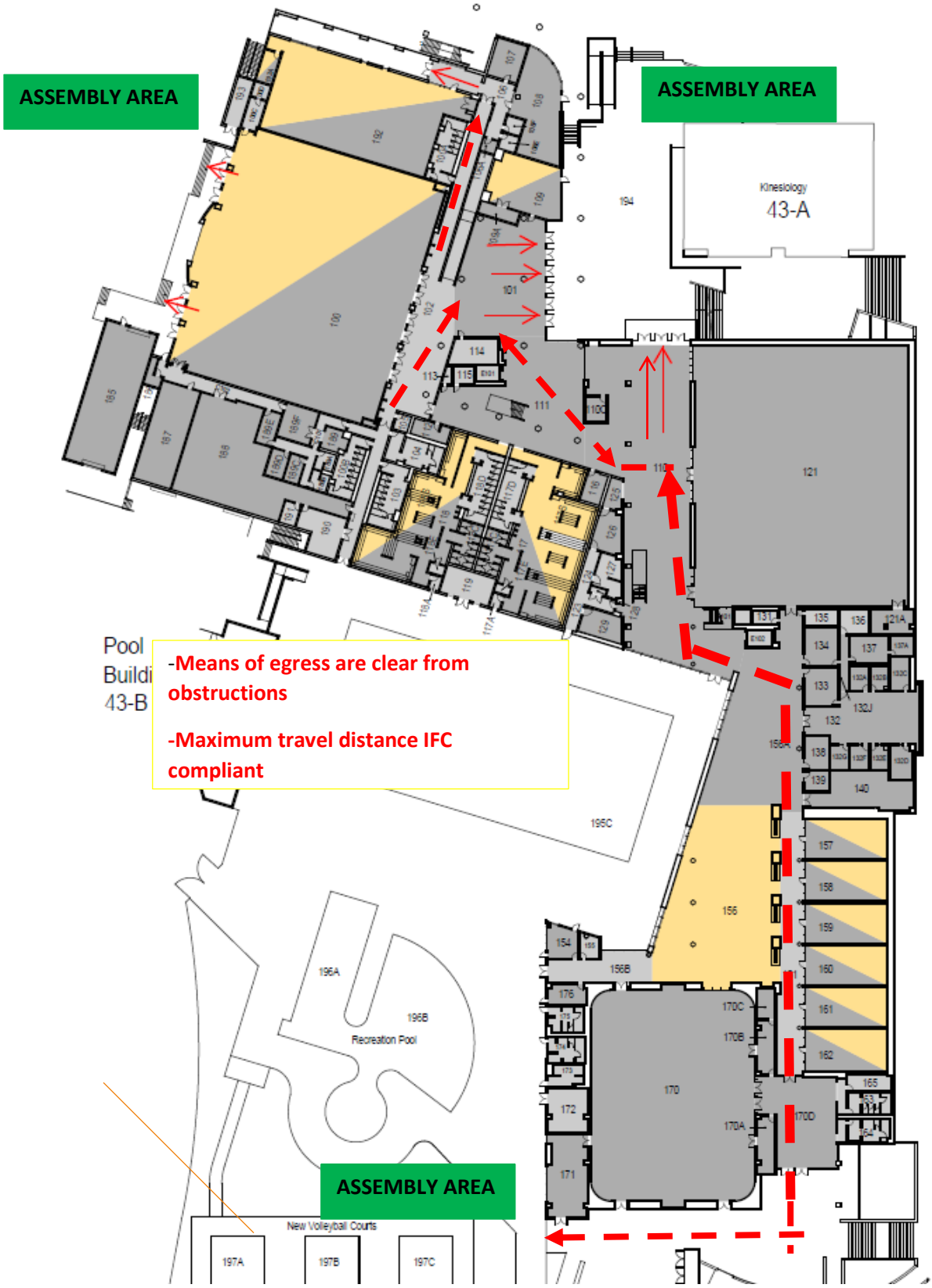


Figure A-2.2: ***1st floor fire evacuation plan***

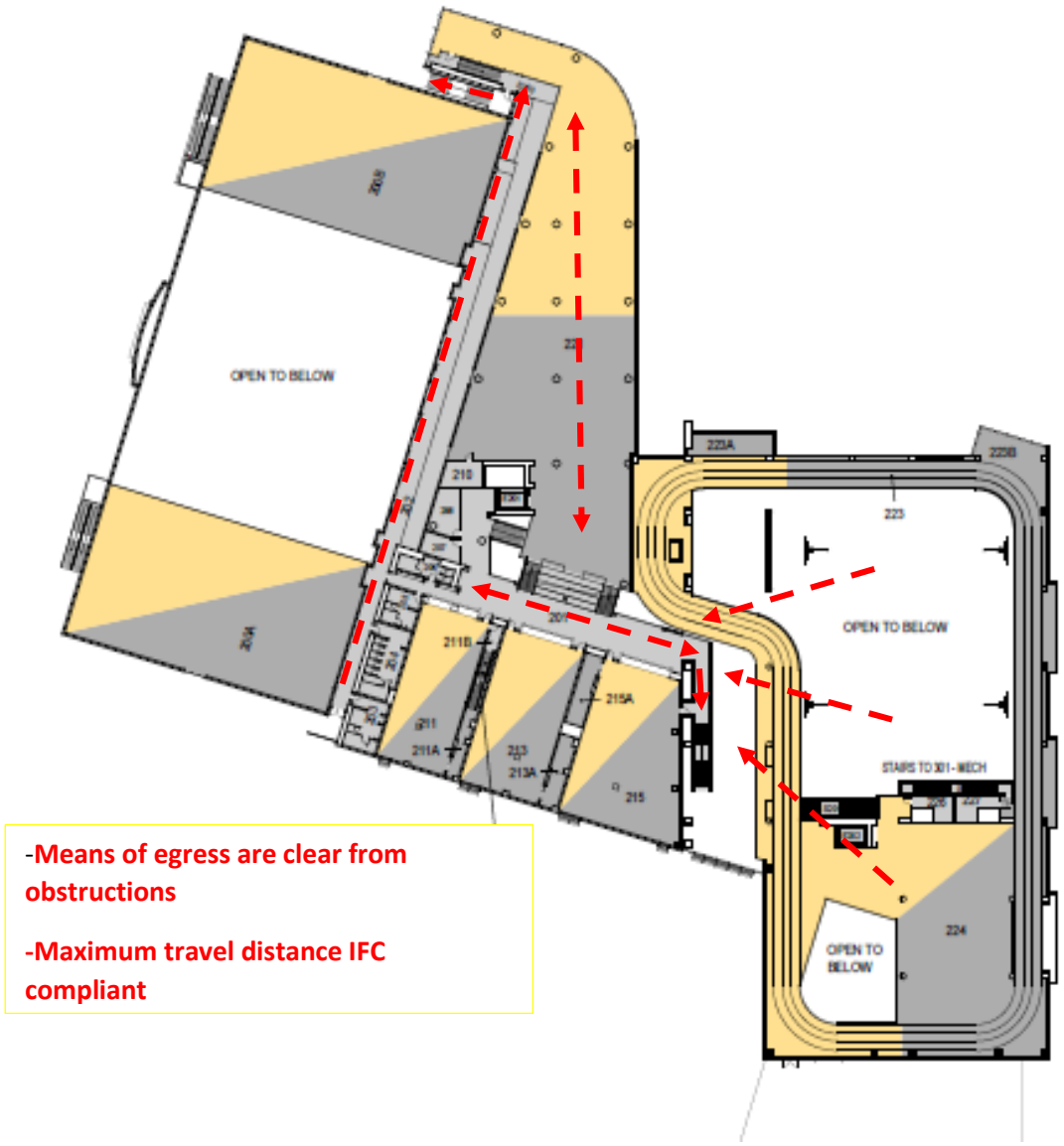


Figure A-2.3: ***2nd floor fire evacuation plan***

APPENDIX 3: LIST OF FIRE SAFETY EQUIPMENT

The following tables summarize the different types and locations of fire safety equipment installed in the recreation center.

The entire recreation center is fully protected by fire sprinkler systems

1. **Table 3.1: LIST OF EQUIPMENT**

Device Type	Numbers of devices				
First Floor	**Zone A**	**Zone B**	**Zone C**	**Zone D**	**Zone E**
Area smoke detectors	0	6	15	1	6
Duct-type air smoke detectors	0	0	1	0	1
Heat detectors	0	1	2	0	0
Manual fire alarm box (manual pull station)	6	3	4	4	1
Flow switches and Tamper switches	0	2 and 2	0	0	1 and 1
Fire extinguishers	8	4	6	6	4
Second Floor	**Zone A**	**Zone B**	**Zone C**		**Zone E**
Area smoke detectors	4	6	7		0
Duct-type air smoke detectors	0	0	0		0
Heat detectors	0	0	0		0
Manual fire alarm box (manual pull station)	1	2	1		1
Flow switches and Tamper switches	0	0	0		0
Fire extinguishers	2	4	4		4
Roof	**Common Zone**				
Duct-type air smoke detectors	8				
Manual fire alarm box (manual pull station)	4				

2. **Table 3.2: EQUIPMENT LOCATION**

Location	Placement and Spacing
First Floor	
Fire Alarm Smoke Detectors	
.	
Zone B	
Elevator 2 lobby room 130: L1D016	Located on flat smooth ceiling just above elevator door
Elevator 2 machine room: L1D017	Located on flat smooth ceiling
Intramurals office room 134: L1D019	In-duct smoke detector
Electrical room 136: L1D020 and L1D023	One area smoke detector on ceiling(D020), one in-duct detector
Work room: DSD022	In-duct smoke detector
Zone C	
Electric room 113: L1D001	Located on flat smooth ceiling
Elevator 1 machine room 115: L1D002	Located on level ceiling
Elevator 1 lobby room 111: L1D004	Located on smooth ceiling just above elevator 1 door
Telecom room 114: L1D005, L1D006, L1D007 & L1D008	In-duct smoke detectors
Control room110C: L1D010	Located on flat smooth ceiling
Men's locker room 117: L1D011,L1D012 & L1D013	In-duct smoke detectors
Building power supply room 190: L1D014	Above the fire alarm control panel, mounted on flat smooth ceiling
Mechanical room 191: L1D025 and L1D102	One air handling unit smoke detector (D025) and the other area smoke detector located on flat smooth ceiling
1st floor storage room 111: L1D103 and L1D104	Room served by zones (C and E), each zone has two area air smoke detectors
Zone D	
Electrical room 172: L1D021	Located on flat smooth ceiling
Zone E	
1st floor storage room 111: L1D105 and L1D106	Room served by zones (C and E), each zone has two area air smoke detectors
Equipment room 187: L1D107	Mounted on flat smooth ceiling
Corridor C102: L1D108	Mounted on flat smooth ceiling
Wrestling room (electrical compartment) 100C and 100D: L1D110, L1D109 and L1D114	Area smoke detectors on flat smooth ceiling (D109 and D110) and one air handling unit smoke detector
Main gym room 100: L1D113	Air handling unit smoke detector

Location	Placement and Spacing
Second Floor	
Zone A	
Telecom and data room 210: L1D136, L1D137, L1D138, L1D139 and L1D140	In-duct smoke detectors
Zone B	
Telecom room 226: L1D044 and L1D045	In-duct detectors
Electrical room 227: L1D046, L1D047 and L1D048	One area smoke detector on flat smooth ceiling (D046) and two in-duct air smoke detectors
Stretching area 224A: L1D159	Area smoke detector on flat smooth ceiling above elevator door
Zone C	
Women's restroom room 206: L1D031	In-duct air smoke detector
Electrical room 208: L1D032	Smoke detector located on flat smooth ceiling
Elevator 1 lobby areas: L1D033 and L1D034	Smoke detectors on flat smooth ceiling in passage areas above both East and West elevator doors
Storage room 213A: L1D041	In-duct air smoke detector
Jogging track 2: L1D042	In-duct air smoke detector
Roof	
Roof electrical room: L1D158	Area smoke detector on flat smooth ceiling
Air Handling Unit 1: L1D117	Duct-type smoke detector
Air Handling Unit 2: L1D118	Duct-type smoke detector
Air Handling Unit 3: L1D119	Duct-type smoke detector
Air Handling Unit 4: L1D120	Duct-type smoke detector
Air Handling Unit 5: L1D121	Duct-type smoke detector
Air Handling Unit 6: L1D122	Duct-type smoke detector
Air Handling Unit 7: L1D123	Duct-type smoke detector
Air Handling Unit 8: L1D124	Duct-type smoke detector
Air Handling Unit 9: L1D125	Duct-type smoke detector
Air Handling Unit 10: L1D126	Duct-type smoke detector
Location	**Placement and Spacing**
Elevator 1 machine room: L1D003 and L1D024	Located on level ceiling
Elevator 2 machine room: L1D018	Located on level ceiling

Location	Placement
First Floor	
Zone A	
Vestibule area 106: L1M001 and L1M098	Located next to West and East exit doors
Wellness reception area 108: L1M002	Located next to East exit door
Training room 109: L1M03	Located next to East exit door
Pre-function room 101: L1M04	Located next to East exit door
Main Gym room 100: L1M097	Located next to East exit door
Zone B	
Lobby room 110: L1M06 and L1M07	Located next to both North exit doors
Circulation (lobby south) area 130: L1M08	Located next to South exit door
Zone C	
Hallway area 123: L1M09	Located next to South exit door
Men's vestibule room 117A: L1M010	Located next to South exit door
Women's vestibule room 118A: L1M011	Located next to South exit door
Passageway area 102: L1M012	Located next to South exit door
Zone D	
Circulation area 156B: L1M013	Located next to exit West door
MAC room 170: L1M014 and L1M015	Located next to both South exit doors
MAC lobby area 170D: L1M016	Located next to exit South door
Zone E	
Event storage room 185: L1M05	Located next to North exit door
Pool pump room 180: L1M017 and L1M018	Located next to both West and East exit doors
Pool equipment room 184: L1M019	Located next to East exit door
Main Gym room 100: L1M096	Located next to West exit door
Second Floor	
Zone A	
North stairwell: L1M041	Located at exit door connecting to vestibule 106
Zone B	
Passage stair 201: L1M042	Located next to stairs leading to first floor
Cardio fittingness 2 room 224: L1M023	Located next to stairs leading to first floor
Zone C	
Passage 202: L1M102	Located next South exit door
Zone E	
North Gym 200B: L1M160	Located next to West exit door
Roof	
Roof West: L1M131	Located next to stairs
Roof East: L1M132	Located next to stairs
Roof North-East: L1M133	Located next to AHU 3
Roof South: L1M134	Located next AHU 2
Location	**Placement**
East sprinkler connection: L1M023 and L1M026	Each connected to 2" wet-pipe riser manifolds
West sprinkler valve connection: L1M028	Connected to 2" wet-pipe riser manifold

Location	Placement
Main fire water connection: L1M095	Tamper switch connected to main water supply gate valves
East sprinkler valve connection: L1M024 and L1M027	Tamper switch covers of flow switches L1M023 and L1M026 respectively
West sprinkler valve connection: L1M029	Tamper switch encased in flow switch L1M028