

Fire Protection Life Safety Analysis

Bachelor Enlisted Quarters



PGAL Architecture

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March 27, 2014

Statement of Disclaimer

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Keywords

Life Safety Code
Performance Based Design
Fire Dynamics Simulator (FDS)
Required Safe Egress Time (RSET)
Available Safe Egress Time (ASET)

Acknowledgements

Sincere thank you to the following mentors and supporters:

Professor Fred Mowrer
Professor Christopher Pascual
Professor David Rich
Professor Chris Lautenberger
Professor Francisco Joglar
Professor Kevin Dong
Professor Lonny Simonian
Professor Thomas Korman
Veltre Engineering, Inc. – Mr. John Veltre

About the Author

As a junior engineer at Veltre Engineering, Inc., Kyle Leadon provides fire protection and life safety consulting services to public and private sector clients. He specializes in fire protection engineering and building code consulting, with specific technical knowledge of local and national codes and standards. His primary responsibilities include preparation of Life Safety Code drawings and reports, multi-discipline design reviews, construction supervision services, and fire protection system design. For the past four years as a member of design-build teams, he has provided engineering and consulting services for over 50 DoD projects.

Kyle started his fire protection career as a service technician and system designer at ABC Fire Control, Inc. His responsibilities included inspecting, testing, and maintaining fire protection systems throughout eastern Washington, northern Idaho, and eastern Oregon. Clients included school districts, universities, assisted living facilities, hospitals, detention facilities, shopping centers, U.S. Department of Energy, industrial and manufacturing facilities, and hundreds of restaurants and small businesses. Kyle installed, inspected, tested, and repaired water-based fire sprinkler systems including wet-pipe, dry-pipe, and preaction systems, fire service and domestic backflow assemblies, clean agent fire suppression systems, industrial dry chemical fire suppression systems, restaurant wet chemical fire suppression systems, and handheld portable fire extinguishers.

Kyle lives in San Diego and is married to his high school sweetheart, Lynn. Lynn and Kyle are proud parents to a beautiful seven week old daughter, Annie Elizabeth. Kyle loves spending his time away from work and school with his family. Together they enjoy hiking, golfing, walks along San Diego beaches, watching Blackhawks hockey and Seahawks football, Go Hawks!

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Executive Summary

This Bachelor Enlisted Quarters (BEQ) shall be constructed, arranged, equipped, maintained, and operated in accordance with this report and applicable criteria to ensure a minimum level of life safety and property protection is provided from actual and potential fire hazards. The goal is to ensure the occupants are provided with an environment that is reasonably safe from fire. We accomplish this goal by protecting occupants not intimate with the initial fire development, and by improving the survivability of occupants intimate with the initial fire development.

The protection described in this report takes on many forms, from active protection, such as fire protection systems, to passive protection, such as fire resistive construction. The applicable prescriptive-based design requirements outlined in the building and life safety codes are summarized, as well as a detailed description of the active fire protection systems provided in the BEQ.

A performance-based analysis was utilized to evaluate the effectiveness of the prescriptive-based requirements. Fire behavior predictions and fire protection response time estimates were compared to Computational Fluid Dynamic simulated results. The performance-based evaluation determined the required safe egress time (RSET) versus the available safe egress time (ASET). Based upon the results, the BEQ was designed and constructed to provide sufficient egress time to occupants prior to them being exposed to untenable conditions.

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Project Description

This 125 million dollar, LEED Platinum, Design-Build project located on a Marine Corps Base in Southern California concluded January 2014. Construction included three four-story Bachelor Enlisted Quarters (BEQ), a dining facility, a multi-level parking structure, and a 12,000 sq-ft shade structure. Each BEQ is provided with a Common Building, where laundry services and community center are located. Although this project has many unique fire risks associated with its use, this report focuses on the BEQ.

Applicable Criteria

The fire protection criteria shall conform to the requirements of UFC 3-600-01, *Fire Protection Engineering for Facilities*, 26 September 2006 Change 1, 14 July 2009. UFC 3-600-01 requires compliance with the latest editions of the National Fire Codes published by the National Fire Protection Association (NFPA) and portions of the International Building Code (IBC), 2009 Edition, except as modified by UFC 3-600-01. Additional criteria include the following:

Unified Facilities Criteria (UFC)

- UFC 3-600-10N, *Fire Protection Engineering*
- UFC 3-601-02, *Operation and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems*
- UFC 3-301-01, *Structural Engineering*
- UFC 3-500-10N, *Electrical Engineering*
- UFC 3-520-01, *Interior Electrical Systems*
- UFC 3-580-10, *Navy and Marine Corps Internet Standard Construction Practices*
- UFC 4-021-01, *Mass Notification Systems*

National Fire Protection Association (NFPA)

- NFPA 1, *Fire Code*
- NFPA 10, *Standard for Portable Fire Extinguishers*
- NFPA 13, *Standard for the Installation of Sprinkler Systems*
- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*
- NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*
- NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*
- NFPA 70, *National Electrical Code (NEC)*
- NFPA 72, *National Fire Alarm Code*
- NFPA 80, *Standard for Fire Doors and Other Opening Protectives*
- NFPA 90A, *Installation of Air Conditioning and Ventilating Systems*
- NFPA 101, *Life Safety Code*

If conflicts exist between UFC 3-600-01 and any other Department of Defense (DoD) document, referenced code, standard, or publication, UFC 3-600-01 takes precedence.

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Building Code Summary

Per UFC 3-600-01, the occupancy classifications in the IBC shall be used to determine the type of construction, allowable floor area, building height limitations, required fire resistance, and building separation distance. NFPA 101 shall be utilized for building construction related to means of egress and life safety. If conflicts exist between the IBC and NFPA 101 related to fire resistance ratings, NFPA 101 and applicable criteria contained in UFC 3-600-01 take precedence. The fire resistance requirements of the IBC for permanent partitions do not apply to nonbearing partitions. The provisions of NFPA 101 shall be utilized for fire resistance ratings of non-bearing partitions.

Building Description

The BEQs have 192 two-occupant living units with multiple community areas much like an apartment complex or college campus. All three BEQ projects are arranged using a combination of modules which are flipped and rotated in various configurations.

Occupancy Classification per IBC

Mixed Non-separated Residential Group R-1 and Business Group B
with Accessory Assembly Group A-3

Construction Type

Type IIA

Fire Resistance Ratings

Structural Frame	1 Hour	(IBC Tables 601)
Exterior Bearing Walls	1 Hour	(IBC Tables 601)
Interior Bearing Walls	1 Hour	(IBC Tables 601)
Exterior Nonbearing Walls and Partitions	1 Hour	(IBC Tables 602)
Interior Nonbearing Walls and Partitions	None	(IBC Tables 601)
Floor Construction	1 Hour	(IBC Tables 601)
Roof Construction	1 Hour	(IBC Tables 601)
Exterior Exposure Protection	None	(IBC Tables 704.8)

Protection of Structural Steel

Fireproofing shall be provided to structural steel components based upon the construction type (Type IIA). Per IBC Section 721.5.2.2, larger or smaller structural steel beam and girder shapes shall be permitted to be substituted for beams specified in approved unrestrained or restrained fire resistance rated assemblies, provided that the thickness of the fire resistant material is adjusted in accordance with the following expression:

$$h_2 = [((W/D)_1 + 0.6) / ((W/D)_2 + 0.6)] (h_1)$$

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Where,

h = thickness of sprayed fire resistant material in inches

W = weight of the structural steel beam or girder in pounds per linear foot

D = heated perimeter of the structural steel beam in inches

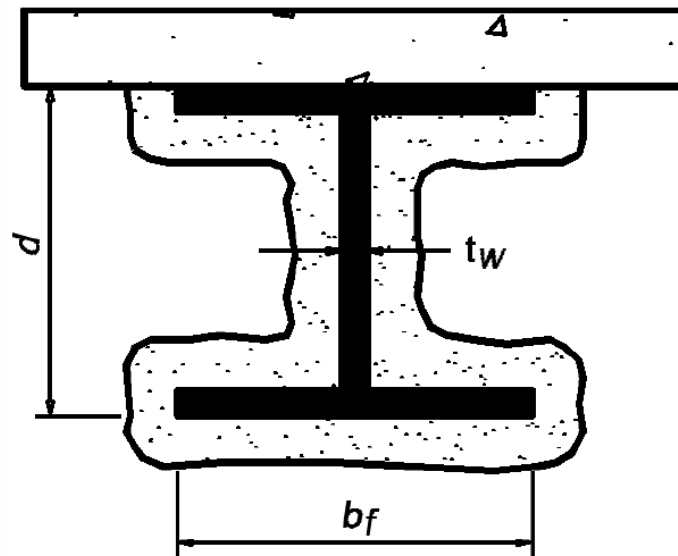


Figure 1 – IBC Figure 721.5.2

Figure 1 illustrates the determination of the heated perimeter of structural steel beams and girders.

Based upon the structural design for the BEQ, the following steel beam and girder sizes are present and serve as components of the primary structural system.

W12x50	1.04	(IBC Table 721.5.1(4))
W10x39	0.94	(IBC Table 721.5.1(4))

Per UL Design No. 782, the minimum steel beam size is W8x28. The minimum weight to heated perimeter ratio (W/D) is 0.80, and 5/16 in. thickness provides a 1-hour fire resistance rating. The minimum thickness of spray-applied fire resistive materials shall be the following:

$$\begin{aligned} \text{W12x50: } h_2 &= [(0.80 + 0.6) / (1.04 + 0.6)] (5/16) \\ h_2 &= 0.27 \rightarrow 5/16 \text{ in.} \end{aligned}$$

$$\begin{aligned} \text{W10x39: } h_2 &= [(0.80 + 0.6) / (0.94 + 0.6)] (5/16) \\ h_2 &= 0.28 \rightarrow 5/16 \text{ in.} \end{aligned}$$

Monokote (MK-6/HY) cementitious fireproofing shall be provided. Refer to Appendix A for product data sheet and UL Design No. 782 approval sheet.

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Allowable Floor Area

Tabular Area per Story – Group A-3	15,500 sq-ft	(IBC Table 503)
Tabular Area per Story – Group B	37,500 sq-ft	(IBC Table 503)
Tabular Area per Story – Group R-1	24,000 sq-ft	(IBC Table 503)
Area Increase – Frontage	18,000 sq-ft	(IBC Section 506.2)
Area Increase – Sprinkler	Not Permitted	(IBC Sections 504.2 & 506.3)
Allowable Area per Story	42,000 sq-ft	(IBC Section 506.1)
Total Allowable Area	126,000 sq-ft	(IBC Section 506.4(2))

Actual Floor Area

1ST Floor Assembly (Common Building)	1,284 sq-ft
1ST Floor Business (Common Building)	4,668 sq-ft
1ST Floor Residential (BEQ)	28,187 sq-ft
2ND Floor Residential (BEQ)	27,033 sq-ft
3RD Floor Residential (BEQ)	25,363 sq-ft
4TH Floor Residential (BEQ)	19,778 sq-ft
Total Building Area	106,931 sq-ft

Actual Floor Area Percentage of Total

Percent Assembly (1ST Floor)	3.8% (less than 10%)
Percent Business (1ST Floor)	13.7%
Percent Residential (1ST Floor)	77.8%

Allowable Mezzanine Area

The aggregate area of the mezzanine within the Common Building is not permitted to exceed one-third of the floor area in which it is located. (IBC Section 505.2)

Actual Mezzanine Area

Open Floor Area	2630 sq-ft.
Mezzanine Area	618 sq-ft
Percent of Open Floor Area	23.5% (less than 33.3%)

Building Height Limitations

Allowable Average Roof Height	60 ft	(IBC Table 503 and Section 504.2)
Actual Average Height to Roof Peak	59 ft	
Allowable Number of Stories	4 Stories	(IBC Table 503 and Section 504.2)
Actual Number of Stories	4 Stories	

Building Code Notes

1. Floor and roof construction includes supporting beams and joints.
2. Exterior exposure protection is based on a fire separation distance in excess of 30-ft.
3. Actual building area was measured in accordance with IBC Section 502.
4. Automatic sprinkler increase is not permitted for buildings protected throughout with an automatic sprinkler system designed in accordance with NFPA 13R. (IBC Section 504.2)
5. Accessory Group A-3 is subsidiary to the main occupancy of the building. The aggregate accessory area does not occupy more than ten percent of the area of the story in which it is located. (IBC Section 508.2.1)
6. No separation is required between accessory occupancies and the main occupancy; exception: dwelling units are required to be separated from other dwelling units and from accessory occupancies contiguous to them. (IBC Section 508.2.4 exc.3)
7. For separation of incidental accessory occupancies, e.g. mechanical, storage, and laundry rooms in accordance with IBC Table 805.2.5, refer to the Separation of Hazardous Areas section of the Life Safety Code Summary.
8. Allowable height is limited to 60 ft. and the number of stories increase is not permitted for buildings protected throughout with an automatic sprinkler system designed in accordance with NFPA 13R. (IBC Section 504.2)
9. The mezzanine does not contribute to either the building area or number of stories. (IBC Section 505.1)

Life Safety Code Summary

The primary goal of the Life Safety Code (NFPA 101) is to provide an environment that is reasonably safety from fires by protecting occupants not intimate with the fire source and by improving the survivability of occupants intimate with the initial fire development. The facility shall be designed, constructed, and maintained to protect occupants for the time needed to evacuate, relocate, or defend in place. This is accomplished based upon the provisions of the Life Safety Code.

To ensure that the life safety goals are met, NFPA 101 has established the minimum requirements for means of egress, construction type, protection systems, and other safeguards in the facility. These safeguards shall comply with the most restrictive fire protection and life safety requirements of the occupancies involved. (NFPA 101 Section 6.1.14.3.2)

Classification of Occupancy

Where incidental to another occupancy, business, industrial or storage use areas shall be permitted to be considered part of the predominate occupancy and shall be subject to the provisions of NFPA 101 for the predominate occupancy. (NFPA Section 6.1.14.1.3)

Bachelor Enlisted Quarters (BEQ)

Residential – New Hotel and Dormitory Occupancy (NFPA 101 Chapter 28)
with Incidental Business, Industrial, and Storage Use

Common Building

Mixed New Assembly and Business Occupancies (NFPA 101 Chapters 12 and 38)
with Incidental Industrial and Storage Use

Minimum Construction Requirements

Type IIA construction is permitted with no special requirements.
(NFPA 101 Sections 12.1.6, 28.1.6, and 38.1.6)

Classification of Hazard of Contents

The contents of the facility are classified as Ordinary Hazard
(NFPA 101 Sections 6.2.2, 12.1.5, 28.1.5.1, and 38.1.5)

Occupant Load

Table 1 – Bachelor Enlisted Quarter (BEQ) Occupant Load	Floor Area (sq-ft)	Load Factor (Occ./sq-ft)	Assigned Occupant Load
1 ST Floor: Residential Use – Hotel and Dormitory	26570	200 Gross	133 Occ.
1 ST Floor: Special Purpose Industrial	1617	N/A	7 Occ.
2 ND Floor: Residential Use – Hotel and Dormitory	26707	200 Gross	134 Occ.
2 ND Floor: Special Purpose Industrial	326	N/A	4 Occ.
3 RD Floor: Residential Use – Hotel and Dormitory	25037	200 Gross	125 Occ.
3 RD Floor: Special Purpose Industrial	326	N/A	4 Occ.
4 TH Floor: Residential Use – Hotel and Dormitory	19452	200 Gross	97 Occ.
4 TH Floor: Special Purpose Industrial	326	N/A	4 Occ.
Total Occupant Load (BEQ)			508 Occ.

**Table 2 – Common Building
Occupant Load**

Multi-Purpose Room: Assembly Use – Less Concentrated Use	1284	15 Net	86 Occ.
Classroom / Theatre: Assembly Use – Less Concentrated Use	683	15 Net	46 Occ.
Learning Center: Assembly Use – Less Concentrated Use	293	15 Net	20 Occ.
Mezzanine: Assembly Use – Less Concentrated Use	618	15 Net	41 Occ.
Electrical / Telecom Rooms: Special Purpose Industrial	239	N/A	2 Occ.
Bulk Storage: Storage Use	130	500 Gross	1 Occ.
All Other Areas: Business Use	3941	100 Gross	39 Occ.
Total Occupant Load (Common Building)			235 Occ.

Occupant Load Table Notes:

1. N/A – Occupant load is the maximum probable Number of occupants present at any time.
2. The occupant loads were determined based on occupant load factors in NFPA 101 Table 7.3.1.2

Arrangement of Means of Egress

Where two exits, exit accesses, or exit discharges are required, they shall be located at a distance from one another not less one-third the length of the maximum overall diagonal dimension of the building or area to be served. (NFPA 101 Section 7.5.1.3.3)

Travel Distance – BEQ

Within a living unit to the corridor door shall not exceed 175 ft. (NFPA 101 Section 28.2.6.2)

The actual maximum travel distance within a living unit is 25 ft., see Appendix B.

From the corridor door of a living unit to the nearest exit shall not exceed 200 ft.
(NFPA 101 Section 28.2.6.3.3.1)

The actual maximum travel distance from the corridor door of a living unit is 70 ft., see Appendix B.

Common Path of Travel – BEQ

The common path of travel shall not exceed 50 ft. in the BEQ. Travel within the living unit shall not be included when determining common path of travel. (NFPA 101 Section 28.2.5.4)

The actual maximum common path of travel in the BEQ is 44 ft., see Appendix B.

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Dead-End Corridors – BEQ

Dead-end corridors in the BEQ shall not exceed 50 ft. (NFPA 101 Section 28.2.5.6)

The actual maximum dead-end corridor in the BEQ is 16 ft., see Appendix B.

Required Number of Exits – BEQ

At least two exits shall be provided from all portions of the BEQ. In the event one of the exits is compromised, the available egress width and capacity shall not be less than 50 percent of the required capacity. (NFPA 101 Section 7.3.1.1.2)

A single means of egress provided within the distance permitted as common path of travel is permitted. (NFPA 101 Section 7.4.1.1)

At least two exits are remotely provided from every BEQ living unit, see Appendix B.

Travel Distance – Common Building

Travel distance in the Common Building shall not exceed 250 ft. (NFPA 101 Section 12.2.6.2(1))

The actual maximum travel distance in the Common Building is 45 ft., see Appendix B.

Common Path of Travel – Common Building

A common path of travel is permitted for the first 20 ft from any point where the common path serves any number of occupants, and for the first 75 ft from any point where the common path serves not more than 50 occupants. (NFPA 101 Section 12.2.5.1.2)

The actual common path of travel in the Common Building is 70 ft where serving less than 50 occupants, see Appendix B.

Dead-End Corridors – Common Building

Dead-end corridors in the Common Building shall not exceed 20 ft.
(NFPA 101 Section 12.2.5.1.3)

The actual dead-end corridor in the Common Building is 12 ft - 6 in., see Appendix B.

Number of Exits – Common Building

At least two exits shall be provided from all portions of the Common Building. In the event one of the exits is compromised, the available egress width and capacity shall not be less than 50 percent of the required capacity. (NFPA 101 Section 7.3.1.1.2)

A single means of egress provided within the distance permitted as common path of travel is permitted. (NFPA 101 Section 7.4.1.1)

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The Common Building has six remotely located exits that lead directly to the exterior from normally occupied spaces.

The mezzanine located in the Common Building is permitted to be served by a single means of egress because the occupant load does not exceed 50, and means of egress leads to the floor below. (NFPA 101 Section 12.2.4.5)

Where there is no well-defined main entrance / exit, exits shall be permitted to be distributed around the perimeter of the building, provided that the total exit width furnishes not less than 100 percent of the width needed to accommodate the permitted occupant load. (NFPA 101 Section 12.2.3.6.6)

Based upon the number and distribution of exits, the Common Building does not have main entrance / exit as defined by NFPA 101.

Means of Egress Components

Components of means of egress were analyzed in to ensure the design satisfied the prescriptive requirements of the Life Safety Code. The analysis focused the following prescriptive requirements:

Doors

Door openings in means of egress shall not be less than 32 in. clear width. (NFPA 101 Section 7.2.1.2.3.2)

The actual minimum clear width is 34 in. (See Appendix B)

Door swings shall be in the direction of egress for areas serving more than 50 occupants or into exit enclosures. (NFPA 101 Section 7.2.1.4.2)

Door leafs shall not encroach greater than one-half the required egress width, and will not project not more than 7 in. when fully open. (NFPA 101 Section 7.2.1.4.3.1)

Refer to fire and smoke resistive construction section of this report for fire-rated door assembly requirements.

Locks, Latches, and Alarm Devices

No door in any means of egress shall be locked against egress when the facility is occupied. (NFPA 101 Section 28.2.2.2.2)

Door leaves shall be arranged to be opened readily from the egress side whenever the building is occupied. (NFPA 101 Section 7.2.1.5.1)

Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side. (NFPA 101 Section 7.2.1.5.2)

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A latch or other fastening device on a door leaf shall be provided with a releasing device that has an obvious method of operation and that is readily operated under all lighting conditions; including complete darkness. (NFPA 101 Section 7.2.1.5.9)

The releasing mechanism shall open the door leaf with not more than one releasing operation. (NFPA 101 Section 7.2.1.5.9.2)

Egress door assemblies from individual living units shall be permitted with devices, including automatic latching devices, which require no more than one additional releasing operation, provided that such device is operable from the inside without the use of a key or tool and is mounted at a height not exceeding 48 in. above the finished floor. (NFPA 101 Section 7.2.1.5.9.3)

Special Locking Arrangements

The use of dead bolts, exit access controlled doors, delayed egress doors, or any other means of delaying egress shall be permitted; however not utilized in this project.

Panic Hardware and Fire Exit Hardware

Panic hardware shall be provided in the means of egress where serving an area with an occupant load of 100 or more. (NFPA 101 Section 12.2.2.2.3)

Where a door assembly is required to be equipped with panic or fire exit hardware, such hardware shall meet the following criteria: (NFPA 101 Section 7.2.1.7.1)

1. It shall consist of a cross bar or a push pad, the actuation portion of which extends across not less than one-half of the width of the door leaf.
2. Installations shall be mounted not less than 34 in., and not more than 48 in. above the floor.
3. It shall be constructed such that a horizontal force not to exceed 15 lbf. actuates the cross bar or push pad, and latches.

Stairs (NFPA 101 Section 7.2.2)

Minimum Width:	44 in (NFPA 101 Table 7.2.2.2.1.2(b))
Maximum Height of Risers:	7 in
Minimum Height of Risers:	4 in
Minimum Tread Depth:	11 in
Minimum Headroom:	6 ft - 8 in
Maximum Height Between Landings:	12 ft

Refer to the fire and smoke resistive construction section of this report for protection of stair requirements.

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Handrails

Handrails on stairs shall be not less than 34 in, and not more than 38 in, above the surface of the tread, measured vertically to the top of the rail from the leading edge of the tread. (NFPA 101 Section 7.2.2.4.4.1)

The height of required handrails that form part of a guard shall be permitted to exceed 38 in, but shall not exceed 42 in measured vertically to the top of the rail from the leading edge of the tread. (NFPA 101 Section 7.2.2.4.4.3)

Handrails shall be installed to provide a clearance of not less than 2 1/4 in. between the handrail and the wall to which it is fastened. (NFPA 101 Section 7.2.2.4.4.5)

Handrails shall have a circular cross section with an outside diameter of not less than 1 1/4 in. and not more than 2 in. (NFPA 101 Section 7.2.2.4.4.6)

Handrails shall be continuously graspable along their entire length. (NFPA 101 Section 7.2.2.4.4.7)

Handrail ends shall be returned to the wall or floor or shall terminate at newel posts. (NFPA 101 Section 7.2.2.4.4.9)

In other than living units, handrails that are not continuous between flights shall extend horizontally, at the required height, not less than 12 in. beyond the top riser and continue to slope for a depth of one tread beyond the bottom riser. (NFPA 101 Section 7.2.2.4.4.10)

Guards

Guards shall be not less than 42 in. high. (NFPA 101 Section 7.2.2.4.5.2)

Open guards shall have intermediate rails or an ornamental pattern such that a sphere 4 in. in diameter is not able to pass through any opening up to a height of 34 in. (NFPA 101 Section 7.2.2.4.5.3)

Visual Protection for Outside Stairs

Outside stairs shall be arranged to avoid any impediments to their use by occupants having a fear of high places. Outside stairs more than 36 ft. above the finished ground level shall be provided with an opaque visual obstruction not less than 48 in. in height. (NFPA 101 Section 7.2.2.6.2)

Capacity of Means of Egress

Street floor exits shall be sufficient for the occupant load of the street floor plus the required capacity of stairs discharging onto the street floor. (NFPA 101 Section 28.2.3.2)

Exit access corridors within the BEQ, other than those within individual living units, shall be sufficient width to accommodate the required occupant load and shall be not less than 44 in. (NFPA 101, Section 28.2.3.3)

The width of any exit access corridors located in mixed assembly and business occupancies serving 50 or more persons shall be not less than 44 in. (NFPA 101 Sections 12.2.3.8 and 38.2.3.2)

Capacity Factor: (NFPA 101 Table 7.3.3.1)

Doorways, Passageways, and Ramps:	0.20 in. per person
Stairs:	0.30 in. per person

Refer to Appendix B for egress capacity analysis.

Illumination of Means of Egress

Illumination of means of egress shall be provided. Exit access shall include only designated stairs, aisles, and corridors leading to an exit. Exit discharge shall include only designated stairs, aisles, corridors, and walkways leading to a public way. (7.8.1.1)

The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge shall be illuminated as follows: (7.8.1.3)

1 ft-candle for floors
10 ft-candle for stairs
0.2 ft-candle due to failure of any single lighting unit

Emergency Lighting

Emergency illumination shall include all required means of egress lighting, illuminated exit signs and all other lights specified as necessary to provide required illumination. Emergency lighting systems shall be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency illumination. (NEC 700.16)

Emergency illumination of means of egress shall be provided. Exit access shall include only designated stairs, aisles, and corridors leading to an exit. Exit discharge shall include only designated stairs, aisles, corridors, and walkways leading to a public way. (NFPA 101 Section 7.9.1.2)

Emergency illumination shall be provided for a minimum of 1-½ hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than 0.1 ft-candle, 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 and, at any point, not less than 0.06 ft-candle at the end of 1.5 hours. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded. (NFPA 101 Section 7.9.2.1)

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Exit Signs

Access to exits shall be marked by approved, readily visible signs in all cases where the exit or way to reach the exit is not readily apparent to the occupants. (7.10.1.5.1)



Figure 2 – Emergency Exit Sign

New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 ft, whichever is less, from the nearest sign. (7.10.1.5.2)

Figure 2 is an example of an emergency exit sign utilized in this project.

Fire and Smoke Resistive Construction

The passive fire protection systems shall be effective in mitigating hazards, shall be reliable, and shall be maintained to the level at which they were designed, such that they remain operational in a fire event. The passive fire protection systems include the structural integrity of the facility and fire resistive construction, e.g. fire barriers and fire doors, which are used to contain the fire to the room of origin.

Subdivision of Living Units and Corridors

In accordance with NFPA 101 Section 28.3.6.1.3, the BEQ corridor walls shall have a minimum ½-hour fire resistance rating, but based upon the construction type, the IBC requires interior bearing walls (corridor walls) to be constructed with a 1-hour fire resistance rating. The corridor walls are constructed with 8-inch concrete masonry units (CMU block). Per IBC Table 720.1(2) Item No. 3-1.2, expanded clay, shale, or slate CMU 2.6 in. thick provides a 1-hour fire resistance rating; therefore, the required fire resistance has been provided at BEQ corridor walls.

Per NFPA 101 Section 28.3.7.2, each BEQ living unit shall be separated from other living units by walls and floors constructed as fire barriers having a minimum ½-hour fire resistance rating, but again based on the construction type, the walls separating the BEQ living units were constructed with 1-hour fire barriers. Similar to the corridor walls, the walls separating the living units were constructed with 8-inch CMU block; therefore the required fire resistance has been provided.

Doors that open onto the exit access corridors or into other BEQ living units shall have not less than a 20-minute fire resistance rating and provided with self-closing and self-latching fire-rated hardware. (NFPA 101 Sections 28.3.6.2.1, 28.3.6.2.3, and 28.3.7.3)

In accordance with IBC Table 720.1(3) Item No. 4-1.1, the BEQ floor slab assemblies between floors shall be provided with a minimum 2½ in. lightweight concrete slab with a minimum ¾ in. cover of reinforcing steel in order to provide a 1-hour fire resistance rating. In general, the BEQ floor slab assemblies are designed and constructed with a minimum 3½ in. lightweight concrete slab on top of fluted metal decks. The reinforcing steel is covered with approximately 1¼ in. (top and bottom) of lightweight concrete.

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Protection of Vertical Openings

Per NFPA 101 Section 28.3.1.1.3, the walls and opening protectives enclosing vertical openings (shaft enclosure) shall have a minimum 1-hour fire resistance rating, with 60-minute opening protectives. Where environmental air ducts pass through floors of the facility they shall be enclosed within fire-rated construction and protected as vertical openings. Shaft enclosures for environmental air are regulated by NFPA 90A; not NFPA 101.

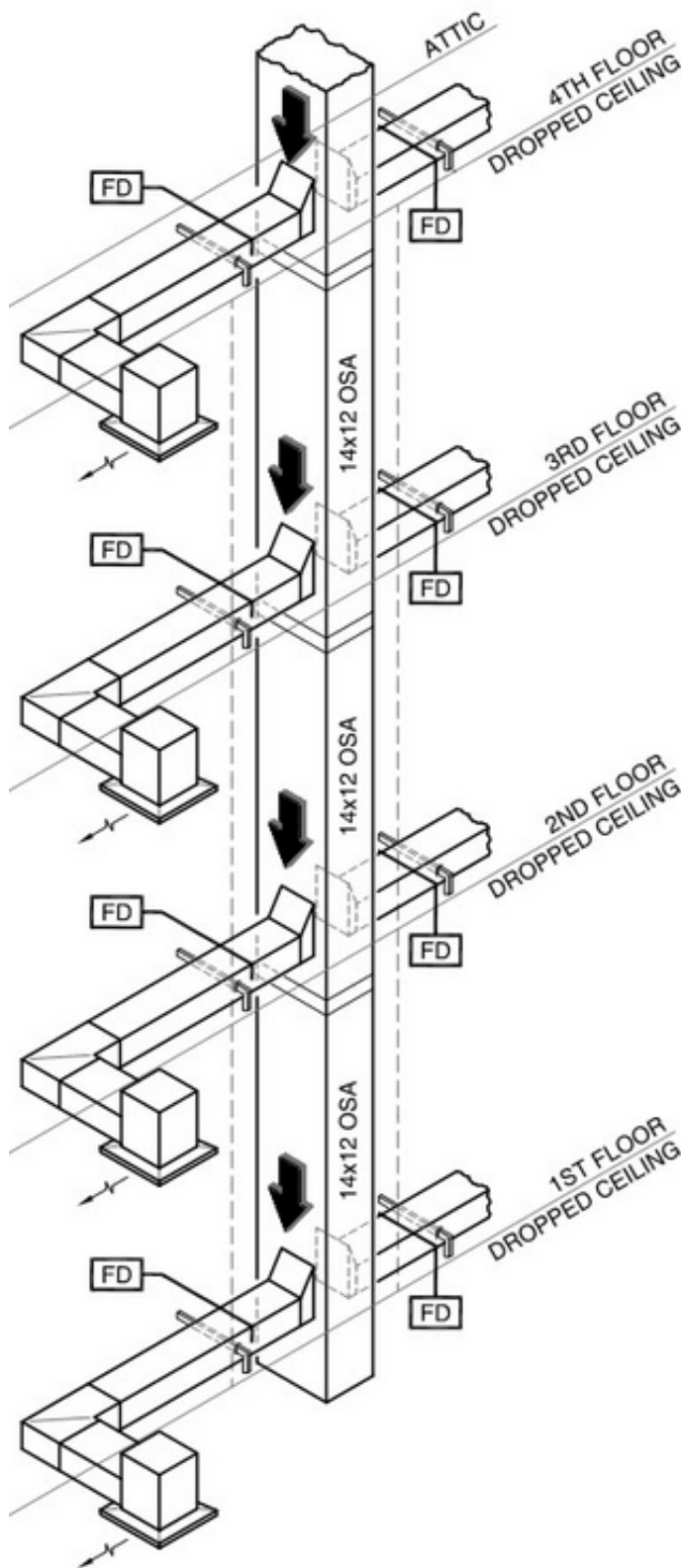
Per NFPA 90A Section 5.3.4.3, shaft enclosures for environmental air shall have a minimum 2-hour fire resistance rating where located in facilities four stories or more in height.

The provisions in NFPA 90A conflict with the Life Safety Code; the more restrictive requirement shall take precedence. The required fire resistance rating is accomplished via 2-hour gypsum shaft wall assemblies.

Refer to Appendix A for details related to the shaft wall assemblies.

Per NFPA 90A Section 5.3.4.6, fire dampers shall be installed at each direct or ducted opening into and out of fire-rated shaft enclosures. Figure 3 on the right illustrates a typical HVAC supply duct located within a 2-hour fire rated shaft. The air handlers are located within the attic space which supply heated or cooler air to the four levels below.

Fire dampers shall be installed in accordance with NFPA 90A and tested in accordance with NFPA 80. All fire dampers shall be operated prior to the occupancy of the facility. (NFPA 90A Section 7.2)

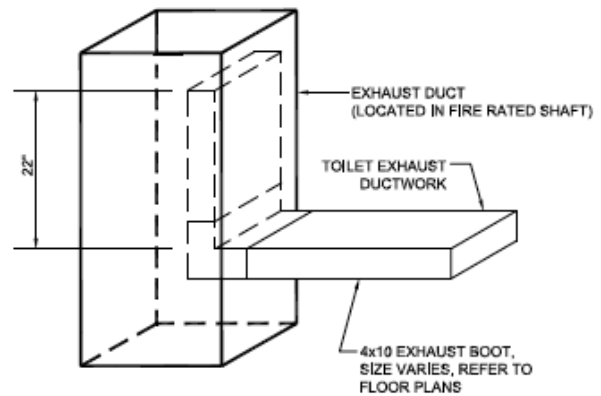


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**Figure 3 – Typical HVAC Supply Duct
and Fire Damper Locations**

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Exhaust ducts are also located within the 2-hour fire rated shaft. In lieu of fire dampers, NFPA 90A Section 5.3.4.6.2 permits subducts at ducted openings. Where subducts at least 22 in. in length are carried up inside the riser from each inlet, and the riser is appropriately sized to accommodate the flow restriction created by the subduct, fire dampers are not required. This exception requires continuous air movement in the vertical direction until the exhaust air reaches the exhaust fan at the roof.



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Figure 4 – Exhaust Subduct

Shaft enclosures shall be enclosed at the lowest and upper most level with fire resistive construction or fire dampers. Shafts shall be permitted to terminate in a room or space having a use related to the purpose of the shaft, provided that the room or space is separated from the remainder of the facility by construction having the same fire resistance rating. (NFPA 101 Section 8.6.4) The non-combustible concealed attic houses mechanical equipment for the environmental air systems. Shaft enclosures throughout the BEQ terminate at the attic; therefore, as required by NFPA 90A, the upper most living units shall be separated from the attic by a minimum 2-hour fire resistance rating.

As previously discussed, the floor the BEQ floor slab assemblies are designed and constructed with a minimum 3½ in. lightweight concrete slab on top of fluted metal decks. The reinforcing steel is covered with approximately 1¼ in. (top and bottom) of lightweight concrete. Per IBC Table 720.1(3) Item No. 4-1.1, a 2-hour floor slab assembly requires 3.6 in. of lightweight concrete; therefore, the BEQ floor slab assemblies originally did not provide the required thickness for a 2-hour fire resistance rating. Based upon the IBC requirements, an additional tenth of an inch was added to the upper most levels.

Other vertical openings include a two-story convenience opening at the BEQ 1ST and 2nd Floor lobbies. In accordance with NFPA 101 Section 8.6.8.1, the convenience opening shall be permitted open on the 1st Floor and protected on the 2nd Floor as required for a shaft enclosure with a minimum of 1-hour fire resistance rating. The required fire resistance rating is accomplished via a 1-hour fire-rated roll up fire door assembly at the 2nd Floor balcony.

Per UFC 3-600-01 Section 6-30.1, elevator shafts are required to be provided with a 2-hour fire resistance rating. The required fire resistance rating at the elevator shafts was accomplished via 8 in. CMU.

Protection from Hazardous Areas

Areas of the facility with a higher hazard level than the predominate use shall be separated as required by IBC Table 508.2 for incidental use and NFPA 101 Table 28.3.2 and Sections 8.7.1.2, 28.3.2.2.3, and 38.3.2.1 for hazardous areas.

In addition, rooms dedicated for Navy and Marine Corps Internet (NMCI) equipment shall be separated from the rest of the building with fire barriers having a minimum of 1-hour fire

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resistance rating. Per UFC 3-600-01 Section 6-30.1, elevator machine equipment shall be located within a 2-hour fire resistance rated enclosure, with 90 minute opening protectives.

Table 3 summarizes the fire resistance rating requirements.

Table 3 – Required Protection from Hazardous Areas	Minimum Separation
Storage Rooms	Smoke Partition
Mechanical Rooms other than Boiler Rooms	Smoke Partition
Boiler and Fuel-Fired Heater Rooms	1-Hour Fire Barrier
Communication Rooms (NMCI Rooms)	1-Hour Fire Barrier
Laundry Rooms	1-Hour Fire Barrier
Elevator Machine Room	2-Hour Fire Barrier
Electrical Rooms with dry transformer rating less than or equal to 112½ kVA	Smoke Partition
Electrical Rooms with dry transformer rating greater than or equal to 112½ kVA	1-Hour Fire Barrier

Protection of Stairs

All inside stairs serving as an exit or exit component shall be enclosed with a minimum of 1-hour fire resistive construction. Inside stairs not serving as an exit or exit component shall be protected as a vertical opening. (NFPA 101 Section 7.2.2.5)

Each BEQ has one inside stair located near the elevator lobby. The required fire resistance rating is accomplished via 8 in. CMU walls and 60 minute opening protectives.

Where nonrated walls or unprotected openings enclose the exterior of a stairway, and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees, the enclosure wall within 10 ft. horizontally of the nonrated wall or unprotected opening shall be constructed as required for a stair enclosure, including opening protectives. Rated construction shall extend vertically from the finish ground level to a point 10 ft. above the upper most landing of the stairs, or to the roofline, whichever is lower. The fire resistance rating shall also extending 10 ft. horizontally from the stair, and shall not be required to exceed 1-hour fire resistance rating where openings have a minimum 45 minute fire resistance rating. (NFPA 101 Section 7.2.2.5)

Breezeways and unoccupied rooms, e.g. electrical and telecom rooms shall be separated from the outside stairs with a minimum of 1-hour fire resistive construction. The required fire resistance rating is accomplished via 8 in. CMU walls, and 60 minute opening protectives.

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Electrical Rooms

Where dry-type transformers rated for less than or equal to 112½kVA are provided within electrical room, the enclosure shall be constructed as smoke partitions. Where dry-type transformers are rated for over 112½ kVA, 1-hour fire barriers shall be provided. (NEC 450.21(B))

Utilities shall not be routed within/over dedicated electrical spaces unless permitted by NEC 110.26(F)(1).

Provide panic hardware or fire exit hardware where equipment rated 1200 amps or more that contain over-current devices, switching devices, or control devices are installed, and there is an egress door within 25 ft. of the nearest edge of the working space. (NEC 110.26(C)(3))

Provide at least one entrance / egress at each end of the working space unless permitted otherwise by NEC 110.26(C)(2)(a) or 110.26(C)(2)(b).

Firestopping

An approved firestop system shall be provided at all through penetrations and joints in fire resistive construction. (NFPA 101 Section 8.5.6)

Penetrations include metallic and non-metallic conduit, pipe, and sleeves. UL System No. W-L-7026 is shown in Figure 5 to represent a typical firestop system for a 1 or 2 hour fire-rated gypsum wallboard/stud wall assembly. Refer to Appendix A for additional examples and specific details of firestop systems approved for this project.

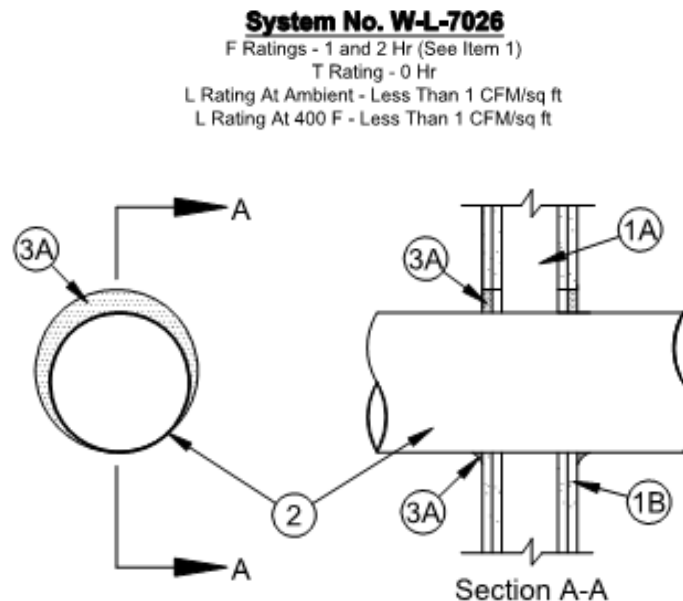


Figure 5 – Firestop System No. W-L-7026

Openings within Fire Resistive Construction

Openings, e.g. doors, access hatched, duct penetrations, etc. create serious vulnerabilities to fire resistive construction structural integrity, and puts the entire facility at risk if a fire occurs within the fire-rated enclosure or separation. The requirements of opening protectives are summarized in Table 4.

Table 4 – Required Opening Protectives

Opening Protection	Door Assembly	Door Undercut	Door Louver	Duct Penetration	Air Transfer Opening
Smoke Partition	Self or Automatic Closing Hardware	$\frac{3}{4}$ in. Maximum	NP	Caulk at Perimeter	Damper per UL 555S
Smoke Barrier	Self or Automatic Closing Hardware	$\frac{3}{4}$ in. Maximum	NP	Damper per UL 555S	Damper per UL 555S
1-Hour Fire Barrier	45-Minutes or 60-Minutes	$\frac{3}{4}$ in. Maximum	Fire Rated Louver	Fire-Stop Penetration	Damper per UL 555
2-Hour Fire Barrier	90-Minutes	$\frac{3}{4}$ in. Maximum	Fire Rated Louver	Damper per UL 555	Damper per UL 555
1-Hour Fire / Smoke Barrier	45-Minutes or 60-Minutes	$\frac{3}{4}$ in. Maximum	NP	Damper per UL 555S	Damper per UL 555 and UL 555S
2-Hour / Smoke Barrier	90-Minutes	$\frac{3}{4}$ in. Maximum	NP	Damper per UL 555 and UL 555S	Damper per UL 555 and UL 555S

Table Notes:

1. N/P – Not Permitted

Typical BEQ Module – Fire Resistive Construction

An enlarged typical BEQ module is illustrated below in Figure 6 to represent the required fire resistive separation at living units, corridors, vertical shafts, and outside stairs.



Figure 6 – Typical Fire Resistive Construction

Interior Finishes, Contents, and Furnishings

Interior Finishes

Interior wall and ceiling finishes shall be classified as the following:
(NFPA 101 section 10.2.8.1)

Class A Interior Wall and Ceiling Finish:

Flame spread index, 0 - 25
Smoke developed index, 0 - 450

Class B Interior Wall and Ceiling Finish:

Flame spread index, 26 - 75
Smoke developed index, 0 - 450

Class C Interior Wall and Ceiling Finish:

Flame spread index, 76 - 200
Smoke developed index, 0 - 450

Wherever the use of Class C interior wall and ceiling finish is required, Class A or Class B shall be permitted. Where Class B is required, Class A shall be permitted.
(NFPA 101 Section 10.2.3.6)

Interior wall and ceiling finish materials will be as follows:
(NFPA 101 Sections 10.2.8.1, 10.2.8.2, and 28.3.3.2)

Exit Enclosures	Class A or B
Lobbies and Corridors	Class A, B, or C
Other Spaces	Class A, B, or C

Interior Floor Finish

Interior floor finishes shall be classified as follows in accordance with the critical radiant flux ratings: (NFPA 101 Section 10.2.7.4)

Class I interior floor finish shall be characterized by a critical radiant flux not less than 0.45 W/sq-cm

Class II interior floor finish shall be characterized by a critical radiant flux not less than 0.22 W/sq-cm but less than 0.45 W/sq-cm.

Wherever the use of Class II interior is required, Class I interior floor finish shall be permitted. (NFPA 101 Section 10.2.7.5)

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Interior floor finish materials shall be not less than Class II in exit enclosures.
(NFPA 101 Sections 12.3.3.5.3 and 28.3.3.3)

In all other areas, no critical radiant flux rating is required. (NFPA 101 Section 10.2.8.2)

Carpet and carpet-like interior floor finishes shall comply with ASTM D 2859.
(NFPA 101 Sections 10.2.7.1 and 28.3.3.3.3)

Contents and Furnishings

New draperies, curtains, and other similar loosely hanging furnishings and decorations shall be flame resistant as demonstrated by testing in accordance with NFPA 701.
(NFPA 101 Section 28.7.6.1)

Newly introduced upholstered furniture shall be resistant to a cigarette ignition (i.e., smoldering) in accordance with one of the following:
(NFPA 101 Sections 10.3.2.1 and 28.7.6.2.1)

1. Meet requirements of Class I when tested in accordance with NFPA 260 or with ASTM E 1353.
2. Will have a char length not exceeding 1½ in. when tested in accordance with NFPA 261 or with ASTM E 1352.

Newly introduced mattresses shall have a char length not exceeding 2 in. when tested in accordance with 16 CFR 1632. (NFPA 101 Sections 10.3.2.2 and 28.7.6.2.2)

Projection screens shall comply with requirements of Class A or Class B interior finishes. (NFPA 101 Section 12.3.3.4)

Emergency Instructions for BEQ Living Units

A floor diagram reflecting the actual floor arrangement, exit locations, and room identification shall be posted in a location and manner acceptable to the authority having jurisdiction on, or immediately adjacent to, every living unit door.
(NFPA 101 Section 28.7.4.1)

Fire safety information shall be provided to allow guests to make a decision to evacuate to the outside, to evacuate to an area of refuge, to remain in place, or to employ any combination of the three options. (NFPA 101 Section 28.7.4.2)

Signage

Signage shall be provided for rooms containing fire alarm control units, fire sprinkler risers, inspection test valves, and as required by the applicable criteria.

Active Fire Protection Systems

Site Fire Protection and Features

All-weather ground access shall be provided to allow emergency vehicles unimpeded access to the facility. The access road shall be paved, start from the road, and terminate no farther than 33 ft. from the facility and no farther than 50 ft. from at least one exterior entrance. The entrance shall open from the outside and provide access to the interior of the facility. The access road shall be provided on three sides of the BEQ, with a minimum of two sides having access to sleeping rooms. Aerial apparatus access shall be provided on a minimum of two sides of the BEQ perimeter. (UFC 3-600-01 and NFPA 1)

Fire hydrants shall be provided in accordance with NFPA 24, as modified by UFC 3-600-01. A summary of the spacing requirements are shown below:

- Fire hydrants shall be provided within 350 ft. of all portions of the building exterior.
- Fire hydrants shall be located within 3 to 7 ft. of fire department access roads. The pumper ports shall face the access road without obstructions.
- At least one fire hydrant shall be located within 150 ft of the fire department connection.

Concrete thrust blocks shall be placed between undisturbed soil and restrained pipe fittings in accordance with NFPA 24. The restraint is needed to resist the calculated thrust forces generated as water flow changes direction in the water distribution system. Thrust block calculations take into account the following factors: pipe size, water pressure, soiling bearing strength, and a safety factor (usually 1.5). Site visits were performed during construction to verify that the provided thrust blocks are shaped and sized properly in accordance with NFPA 24 and the approved drawings. Figure 7 illustrates the thrust forces acting on a bend. Shown on the next page, Figure 8 illustrates the typical thrust block shape and configuration, and Figure 9 is a photo taken at a thrust block inspection.

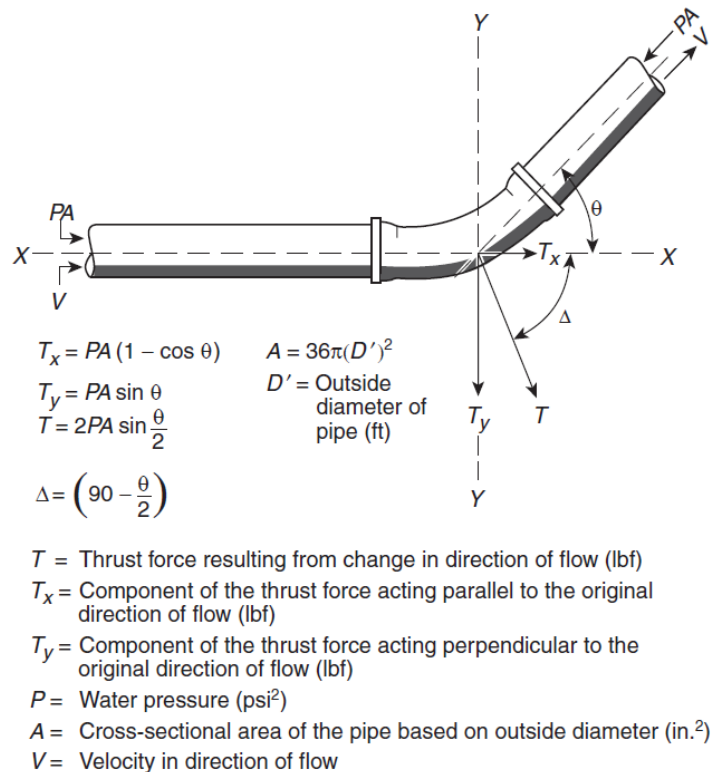


Figure 7 – NFPA 24 Figure A.10.8.2(a)

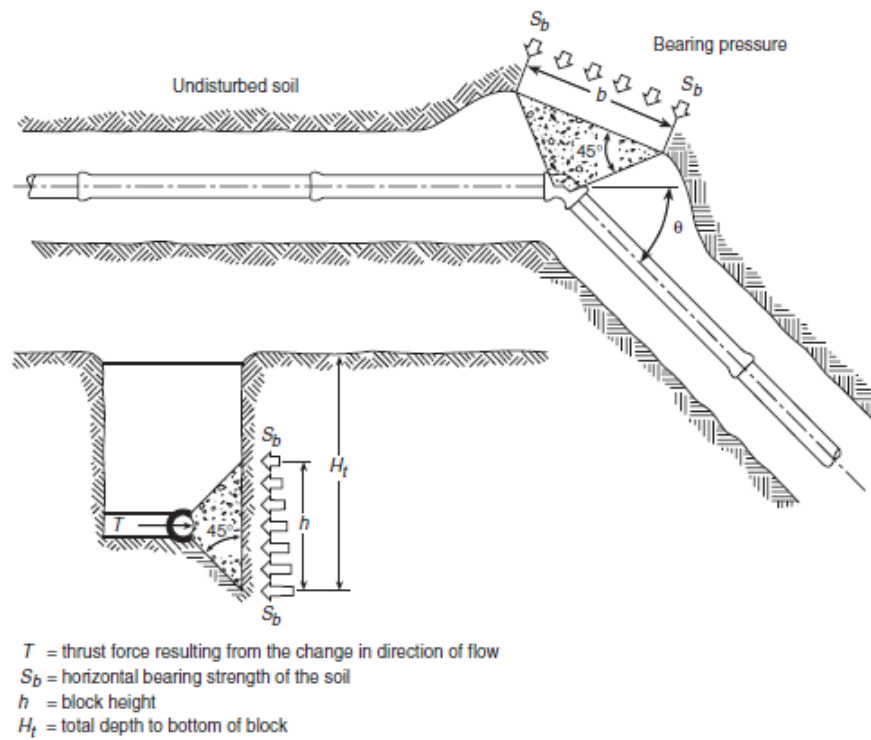


Figure 8 – NFPA 24 Figure A.10.8.2(b)



Figure 9 – Site Visit – Thrust Block Inspection

Automatic Fire Sprinkler / Standpipe

A combination automatic wet-pipe fire sprinkler and manual Class I wet standpipe system shall be provided throughout for the BEQ and Common Building in accordance with the applicable criteria.

A fire department connection shall be provided within 150 ft. of a fire hydrant and shall face the access road without obstructions. (UFC 3-600-01)

Water Supply

A hydrant flow test in accordance with NFPA 291 was performed adjacent the project site. The following water supply data was utilized in the design of the automatic fire sprinkler and standpipe systems.

Static Pressure	100 psi
Residual Pressure	73 psi
Flowing	2500 GPM
Estimated Fire Flow at 20 psi	4494 GPM

The water supply has been described as reliable. The site water service is supplied by the base domestic water system, which includes elevated tanks and pump stations. Figure 10 graphically represents the available water supply vs. the system demand at the most hydraulically remote design area.

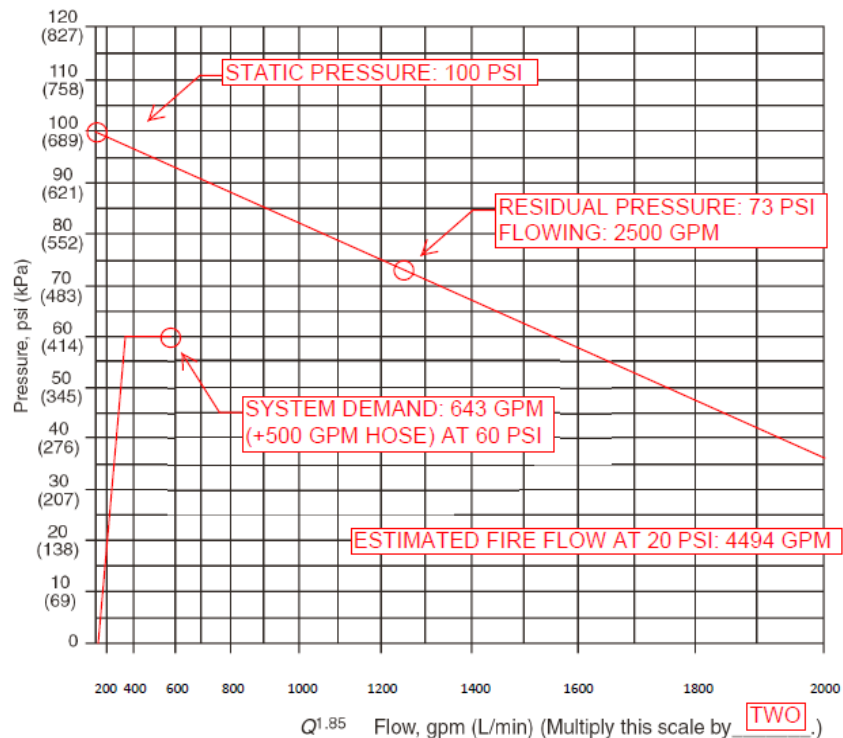


Figure 10 – Available Water Supply vs. System Demand

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Design Criteria

The BEQ automatic sprinkler system shall be provided in accordance with NFPA 13R and the following requirements:

System shall provide at least the following:

- Flow required for the multiple and single sprinkler operating criteria specified by the sprinkler listing. (NFPA 13R Section 7.1.1.1)
- Flow required to produce a minimum discharge density of 0.05 gpm/sq-ft. (NFPA 13R Section 7.1.1.2)
- Four sprinklers in hydraulically most remote living unit. (NFPA 13R Section 7.1.1.3)
- Four sprinklers in hydraulically most remote corridor. (NFPA 13R Section 7.2.1.1)
- 250 GPM hose allowance. (UFC 3-600-01)

Sprinklers shall not be required in the following locations:

- Bathrooms where the bathroom area is less than 55 sq-ft. (NFPA 13R Section 6.6.2)
- Clothes closets within the living units where the closet area is less than 24 sq-ft and the least dimension does not exceed 3 ft. (NFPA 13R Section 6.6.3)
- Balconies, corridors, and stairs that are open and attached. (NFPA 13R Section 6.6.5)
- Noncombustible attics or other concealed spaces. (NFPA 13R Section 6.6.6)

UFC 3-600-01 permits the use of NFPA 13R design criteria. The system shall provide at least the flow required to operate the residential sprinklers in accordance with their listing. (NFPA 13R Section 7.1.1)

Per UFC 3-600-01 Table 4-1, the following design criteria was utilized in the Common Building system design:

Table 5 – Sprinkler System Design Requirements

Occupancy Classification	Design Density (gpm/ft ²)	Design Area (sq-ft)	Hose Stream Allowance (gpm)	Water Supply Duration (minutes)
Light Hazard	0.10	3000	250	60
Ordinary Hazard Group 1	0.15	3000	500	60
Ordinary Hazard Group 2	0.2	3000	500	90

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When listed quick-response sprinklers are used throughout the system, the design area indicated in Table 5 is permitted to be reduced without revising the design density. The percent reduction permitted by NFPA 13 Figure 11.2.3.2.3.1 is illustrated in Figure 11.

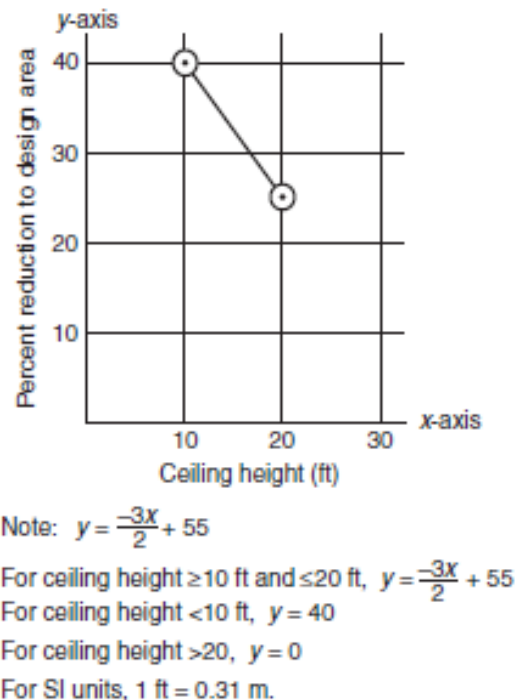


Figure 11 – Design Area Reduction for Quick-Response Sprinklers

Standpipe System

UFC 3-600-01 requires facilities four stories and taller be provided with a combination sprinkler/standpipe riser in at least two stairwells that are interconnected on each floor. The sprinkler system must be hydraulically calculated using the most hydraulically demanding riser. The calculation shall not assume the use of both risers simultaneously.

Per NFPA 14 Section 7.10.1.2, hydraulic calculations and pipe sizes shall be based upon providing 250 gpm at the two most remote hose connections and at the topmost outlet of each of the other standpipes at a minimum residual pressure of 100 psi.

Hydraulic Calculations – Computer-Based

Per UFC 3-600-01 Section 4-2.3.5, new automatic fire sprinkler systems protecting 1500 sq-ft and greater shall be design using hydraulic calculations. The hydraulic calculations must demonstrate that the design will provide an adequate water supply. The following hydraulic calculations were performed by the fire sprinkler contractor. The most hydraulically remote design area (Common Building Laundry Room) and the most hydraulically remote room design (4TH Floor Living Unit) calculation results are as shown on the next page.

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BEQ and Common Building – Combination Wet-Pipe Sprinkler / Manual Wet Standpipe System
(UFC 3-600-01 and UFC 3-600-10N)

Hydraulic System – Ordinary Hazard Group I

Location:	Area #4 – Common Building Laundry Room
No. of Sprinklers:	30 Sprinklers
Density:	0.15 GPM/SQ-FT
Designed Area of Discharge:	3000 – QR 40% Reduction = 1800 SQ-FT
System Demand:	643 GPM @ 38 psi (at BOR CB)
	643 GPM @ 60 psi (at BOR Main Riser)
Hose Allowance:	500 GPM (UFC 3-600-01)

Hydraulic System – Light Hazard (NFPA 13R Design)

Location:	Area #3 – 4 TH Floor Unit
No. of Sprinklers:	4 Sprinklers
Density:	0.05 GPM/SQ-FT
Designed Area of Discharge:	Residential Hall Sprinklers are calculated at 16 FT x 16 FT flowing 14 GPM @ 8.2 psi
System Demand:	47 GPM @ 46 psi (at BOR Main Riser)
Hose Allowance:	250 GPM

Refer to Appendix C for computer-based hydraulic calculations prepared for this project.

During project design, the fire sprinkler shop drawings are reviewed by the Fire Protection Designer of Record (Fire Protection Engineer) to verify conformance with all of the applicable criteria prior to being submitted to the government for final approval. During the approval process, the hydraulic calculations were reviewed line by line, node by node to confirm pipe sizes, lengths, and number of fittings.

Hydraulic Calculations – Hand Calculations

Hydraulic calculations performed by hand are very rarely used these days, since the development of computer-based software programs. Computer-based software programs are much more effective than performing calculations by hand. Hand calculations are used more often for estimating purposes, e.g. estimating requirements for a fire pump, or estimating system demand and pipe sizes.

As an academic exercise, a hand hydraulic calculation of the 4TH Floor Living Unit was performed to compare the hand calculated results with the computer-based results prepared by the fire sprinkler contractor. Based on the hand calculations, the system demand at BOR is 44 gpm at 46 psi, which compares well to the computer-based results. A hand calculation worksheet is included in Appendix C.

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Figure 12 shown below illustrates the most hydraulically remote living unit. The red line represents the compartment and the blue lines represent the piping layout. The flowing sprinklers are at Nodes 472, 471, 470, and 469.

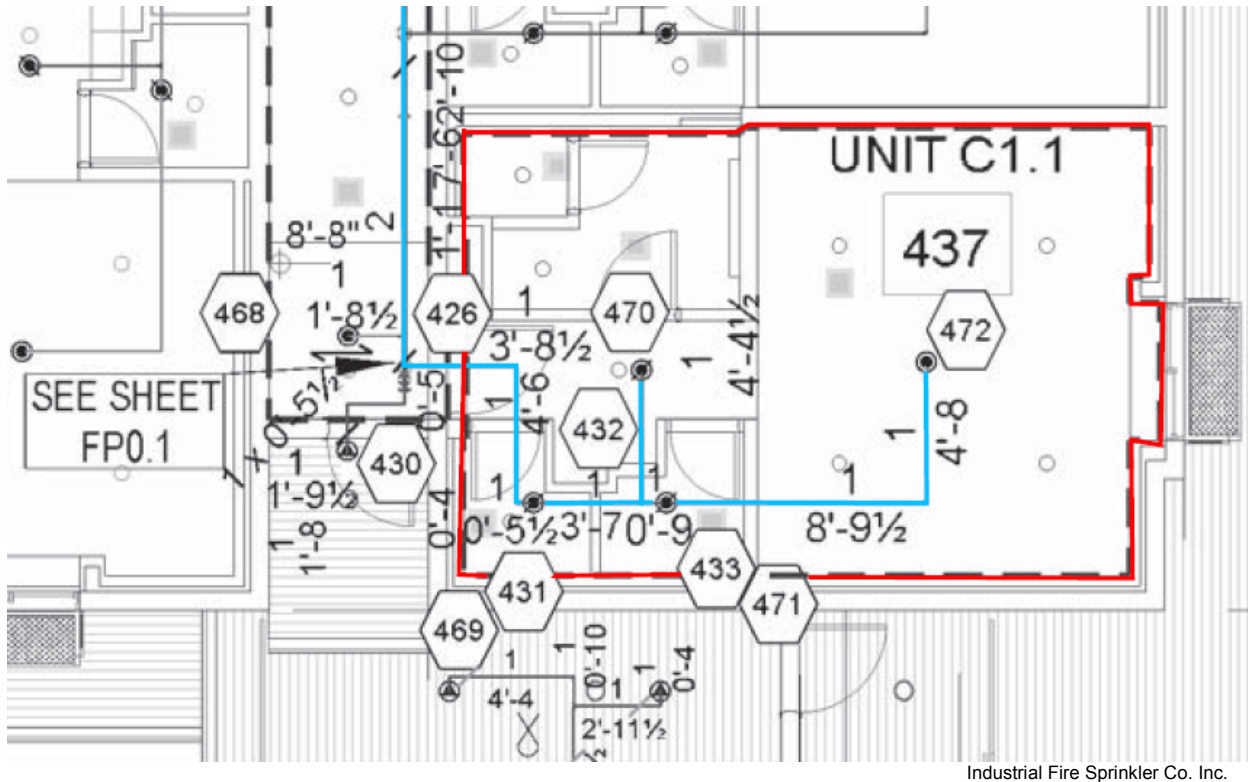


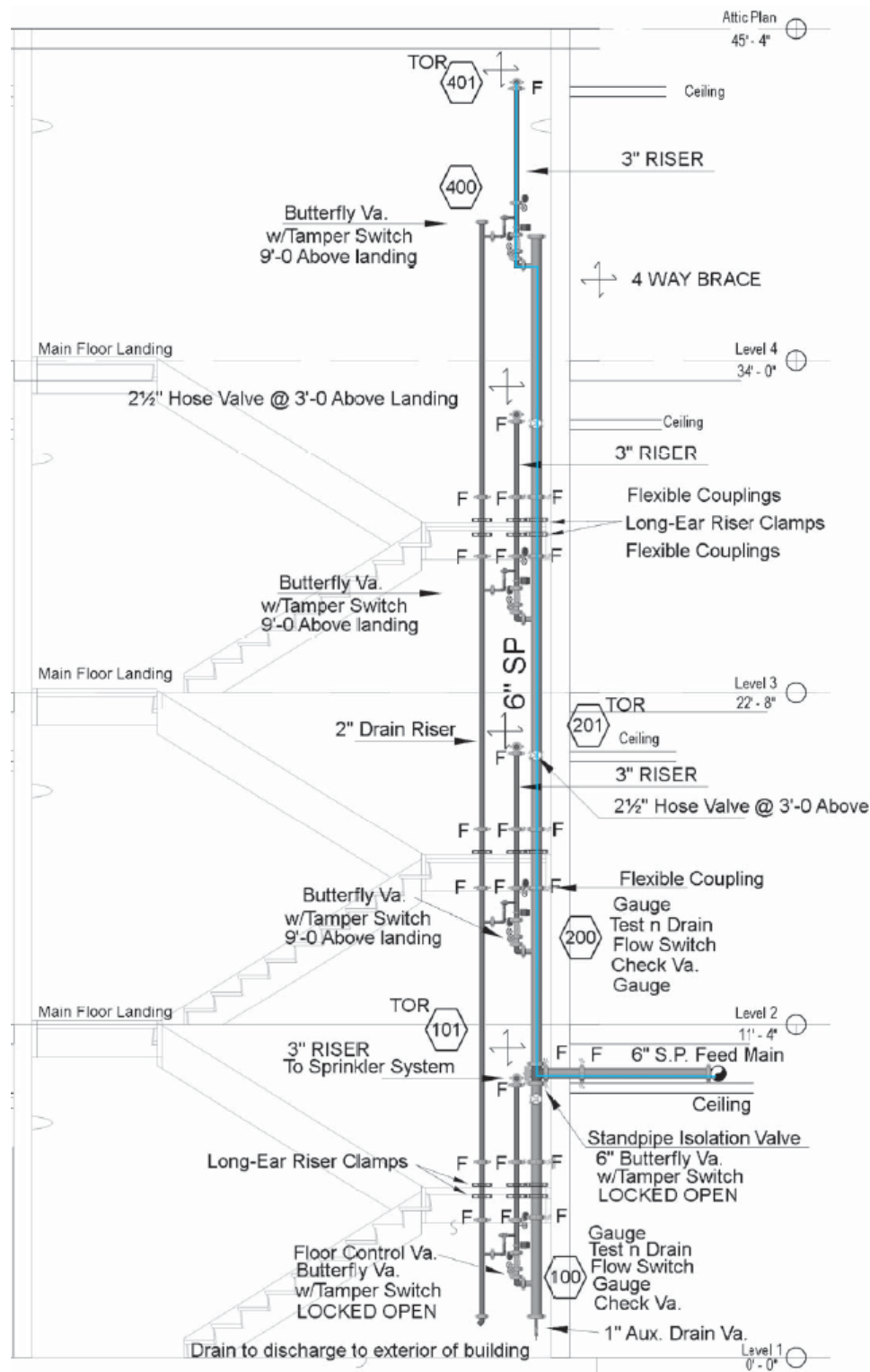
Figure 12 – BEQ 4TH Floor Hydraulically Most Remote Room

Figure 13 on the next page illustrates the change in elevation between the 4TH floor and the ground level. A bulk main is routed from the fire sprinkler point-of-connection (located in Mechanical Room) through the ground level such that all of the risers located in stairwells are interconnect.

Figure 14 on the following page illustrates the backflow preventer, fire department connection, and test header. Regardless of backflow preventer size, UFC 3-600-10N requires hydraulic calculations to include a minimum pressure drop of 12 psi, or the actual pressure drop published by the manufacturer, whichever is greater.

Figure 14 also indicates the pressure boost required at the fire department connection in order to deliver the required demand and pressure at hose connections. This BEQ requires 183 psi at the FDC while flowing 1250 gpm.

Refer to Appendix D for fire sprinkler drawings.



Industrial Fire Sprinkler Co. Inc.

Figure 13 – Fire Sprinkler Section Elevation (BEQ)

Kyle Leadon, EIT

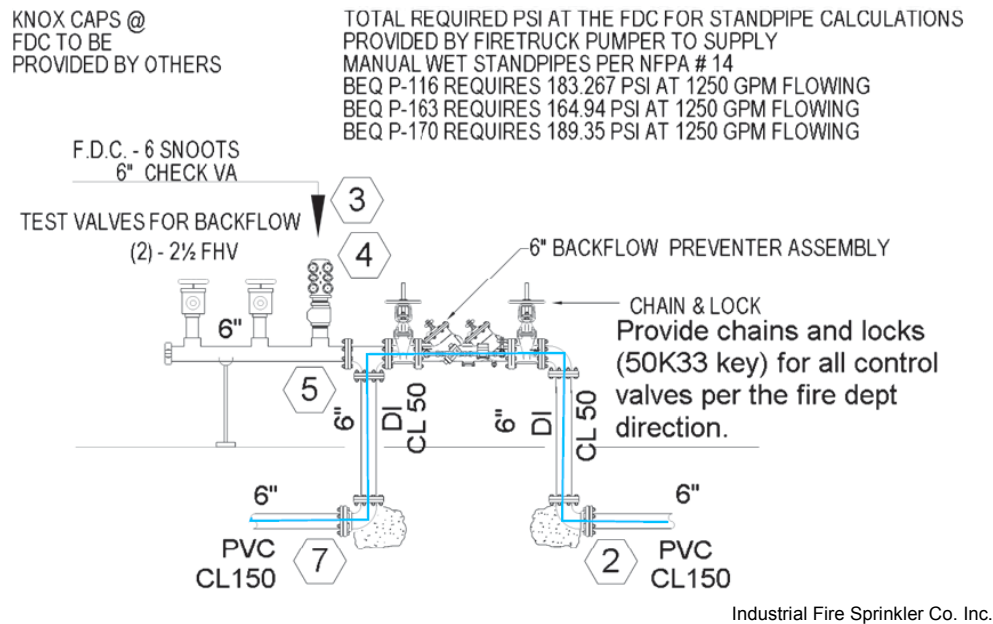


Figure 14 – Backflow Preventer, FDC, and Test Header

Automatic Fire Sprinkler System Components

System components shall be installed in accordance with their listing and all manufacturer installation recommendations. Refer to Appendix E for fire sprinkler product data.

Hangers

Fire sprinkler piping shall be substantially supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb. applied at the hanging point. Unsupported horizontal lengths of pipe between the end sprinkler and the last hanger on the line must not be greater than 36 in. for 1 in. pipe, 48 in. for 1 ¼ in. pipe, and 60 in. for 1 ½ in. or larger pipe. Table 6 below indicates the maximum distance between hangers. (NFPA 13 Section 9.2)

Table 6 – NFPA 13 Table 9.2.2.1(a)

Table 9.2.2.1(b) Maximum Distance Between Hangers (m-mm)

	Nominal Pipe Size (m)											
	20	25	32	40	50	65	80	90	100	125	150	200
Steel pipe except threaded lightwall	N/A	3.66	3.66	4.57	4.57	4.57	4.57	4.57	4.57	4.57	4.57	4.57
Threaded lightwall steel pipe	N/A	3.66	3.66	3.66	3.66	3.66	3.66	N/A	N/A	N/A	N/A	N/A
Copper tube	2.44	2.44	3.05	3.05	3.66	3.66	3.66	4.57	4.57	4.57	4.57	4.57
CPVC	1.68	1.83	1.98	2.13	2.44	2.74	3.05	N/A	N/A	N/A	N/A	N/A
Ductile iron pipe	N/A	N/A	N/A	N/A	N/A	N/A	4.57	N/A	4.57	N/A	4.57	4.57

Figures 15 and 16 shown below illustrates a typical hanger installation on I-Beams and at floor/ceiling assemblies (concrete deck).

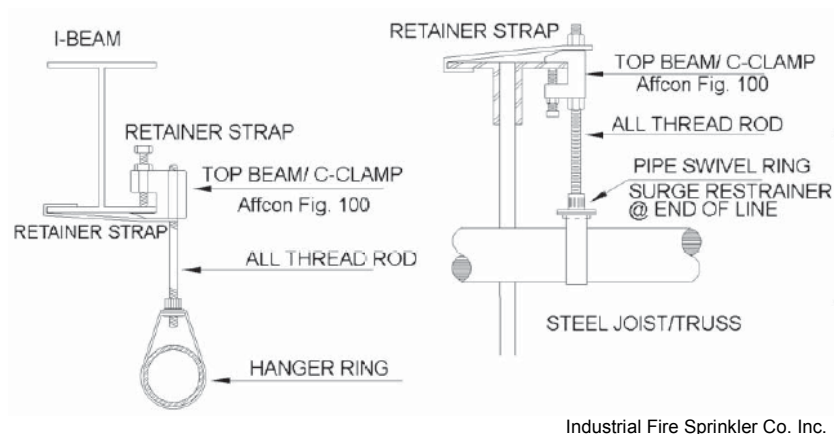
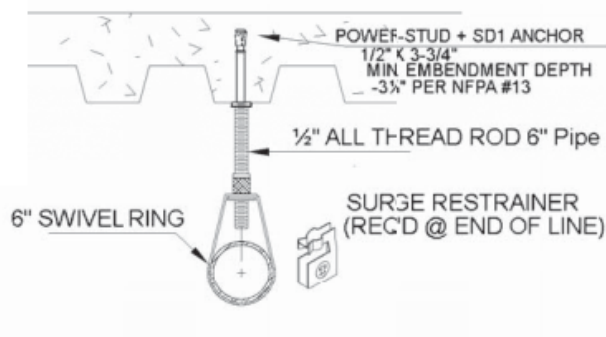


Figure 15 – Hanger Installation on I-Beams



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Figure 16 – Hanger Installation at Floor/Ceiling Assembly

Bracing

Fire sprinkler systems located in seismically influenced areas are required to make appropriate provisions to protect the pipe against damage from earthquakes. The system piping shall be braced to resist both lateral and longitudinal horizontal seismic loads and to prevent vertical motion resulting from seismic loads. The structural components to which bracing is attached shall be determined (evaluated by structural engineer) to be capable of resisting the applied seismic loads. (NFPA 13 Section 9.3)

NFPA 13 Section 9.3.5.3.9 permits lateral bracing to be omitted where pipes individually supported by rods less than 6 in. long measured between the top of the pipe and the point of attachment to the building structure. Figure 17 on the next page illustrates a typical longitudinal brace installation, and Figure 18 a typical lateral brace installation.

Four-way braces are required at the top of risers exceeding 3 ft. in length as shown on the Common Building riser detail in Figure 19 on the next page. (NFPA 13 Section 9.3.5.5.1)



Figure 17 – Longitudinal Brace Installation



Figure 18 – Lateral Brace Installation



Figure 19 – 4-Way Brace at System Risers

The horizontal force acting on a brace is determined based upon the weight of the water-filled pipe being braced, the short period parameter, S_s and the corresponding seismic coefficient, C_p . The S_s value is specific to the region where the system is located. For projects requiring structural engineering services, the S_s values are usually determined by the structural engineer. Where horizontal seismic load data is not made available, NFPA 13 Section 9.3.5.6.3 indicates that a C_p value of 0.5 should be utilized.


For this project, an S_s value of 1.48 was indicated on the structural plans. Table 7 shown below illustrates the short period parameter and the corresponding seismic coefficient.


Table 7 – NFPA 13 Table 9.3.5.6.2

Table 9.3.5.6.2 Seismic Coefficient Table

S_s	C_p
0.33 or less	0.35
0.40	0.38
0.50	0.40
0.60	0.42
0.70	0.42
0.75	0.42
0.80	0.44
0.90	0.48
0.95	0.50
1.00	0.51
1.10	0.54
1.20	0.57
1.25	0.58
1.30	0.61
1.40	0.65
1.50	0.70
1.60	0.75
1.70	0.79
1.75	0.82
1.80	0.84
1.90	0.89
2.00	0.93
2.10	0.98
2.20	1.03
2.30	1.07
2.40	1.12
2.50	1.17
2.60	1.21
2.70	1.26
2.80	1.31
2.90	1.35
3.00	1.40

Figure 20 shown below illustrates an example of a longitudinal and a later brace calculation prepared by the fire sprinkler contractor, see Appendix D.

Tol-Brace Seismic Calculations			
Brace Information		Tolco Brace Components	
Max. Spacing	16'	Tolco Comp. Fig. Number	Adjusted Load
Max. Brace Length	7'-0"	Fig 1000	1745 lbs
Bracing Material	1" Schd. 40 Pipe	Fig 980 Universal Swivel	2395 lbs
Angle from Vertical	60° Min.		
Least Rad. of Gyration	0.421"		
L/R Value	200		
Max Horizontal Load	1604 lbs.		
Force Factor (Cp)	0.69		
Fastener Information		Load Information	
Fastener Orientation	NFPA Type C	Size & Type of Pipe	Total Length Total Load
Type	Power-stud +SD1	2½" Schd. 10 Steel	16'-0" 65 lbs
Diameter	1/2"	2" Schd. 10 Steel	24'-0" 70 lbs
Length	3 1/4"	1½" Schd. 40 Steel	21'-0" 42lbs
Max. Load	826 lbs	1" Schd. 40 Steel	104'-0" 147 lbs
Brace ID			
Orientation of Brace	Lateral	% added for Spk. & fittings	15% 49 lbs
		Total Adjusted Load within Zone of Influence	373 lbs

Tol-Brace Seismic Calculations			
Brace Information		Tolco Brace Components	
Max. Spacing	80'-0"	Tolco Comp. Fig. Number	Adjusted Load
Max. Brace Length	7'-0"	Fig 4L Clamp	1745 lbs
Bracing Material	1" Schd. 40 Pipe	Fig 980 Universal Swivel	2395 lbs
Angle from Vertical	60° Min.		
Least Rad. of Gyration	0.421"		
L/R Value	200		
Max Horizontal Load	1604 lbs.		
Force Factor (Cp)	0.69		
Fastener Information		Load Information	
Fastener Orientation	NFPA Type C	Size & Type of Pipe	Total Length Total Load
Type	Power-stud +SD1	2½" Schd. 10 Steel	80'-0" 325 lbs
Diameter	1/2"		
Length	3-1/4"		
Max. Load	826 lbs		
Brace ID			
Orientation of Brace	Longitudinal	% added for Spk. & fittings	15% 49 lbs
		Total Adjusted Load within Zone of Influence	374 lbs

Industrial Fire Sprinkler Co. Inc.

Figure 20 – Typical Brace Calculation

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Restraint

Restraint is considered a lesser degree of resisting loads than bracing. The method of restraint utilized on this project was No. 12, 440 lb. wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Wire used for restraint shall be located within 2 ft. of a hanger. The hanger closest to a wire restraint shall be of a type that resists upward movement of a branchline. The end sprinkler on a line must be restrained against excessive vertical and lateral movement. (NFPA 13 Section 9.3.6)

Branch lines shall be laterally restrained at intervals not exceeding those specified in Table 8 shown below. Spacing is based upon the branchline diameter and the seismic coefficient. Figure 21 shown below illustrates a typical wire restraint installation.

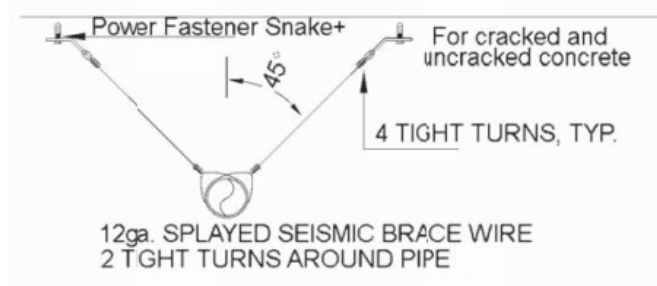
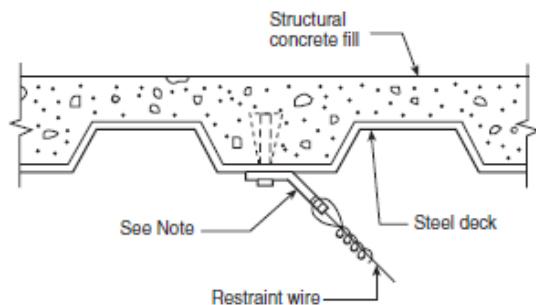
Table 8 – NFPA 13 Table 9.3.6.4(a) and Table 9.3.6.4(b)

Table 9.3.6.4(a) Maximum Spacing (ft) of Steel Branch Line Restraints (ft)

Pipe (in.)	Seismic Coefficient (C_p)		
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$C_p > 0.71$
1	43	36	26
1¼	46	39	27
1½	49	41	29
2	53	45	31

Table 9.3.6.4(b) Maximum Spacing (ft) of CPVC and Copper Branch Line Restraints

Pipe (in.)	Seismic Coefficient (C_p)		
	$C_p \leq 0.50$	$0.5 < C_p \leq 0.71$	$C_p > 0.71$
¾	31	26	18
1	34	28	20
1¼	37	31	22
1½	40	34	24
2	45	38	27



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Figure 21 – Wire Restraint Installation

Kyle Leadon, EIT

Seismic Separation Assemblies

An approved seismic separation assembly shall be installed where sprinkler piping, regardless of size, crosses building seismic separation joints. Seismic separation assemblies consist of flexible fittings or flexible piping which allows movement sufficient to accommodate closing of the separation, opening of the separation to twice its normal size, and movement relative to the separation in the other two dimensions in an amount equal to the separation distance. Figures 22 and 23 shown below illustrate two different approved seismic separation assemblies. Both configurations were utilized in the system design. (NFPA 13 Section 9.3.3)

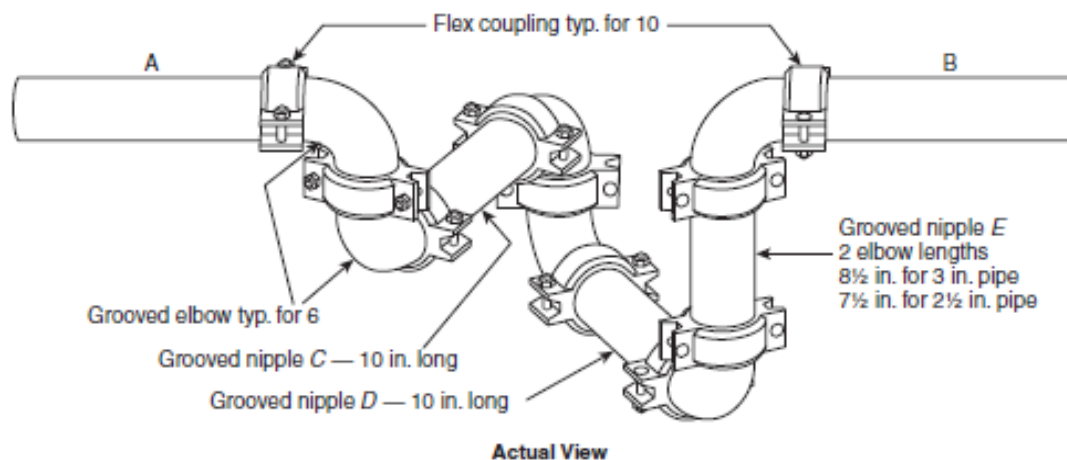


Figure 22 – Typical Seismic Separation Assembly Installation

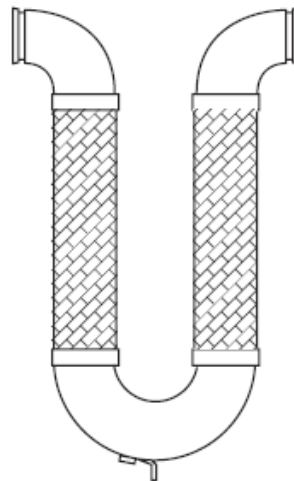


Figure 23 – Metra-Flex Seismic Separation Assembly

Seismic separation assemblies shall be provided with a four-way brace upstream and downstream within 6 ft. of the seismic separation assembly. (NFPA 13 Section 9.3.3.3)

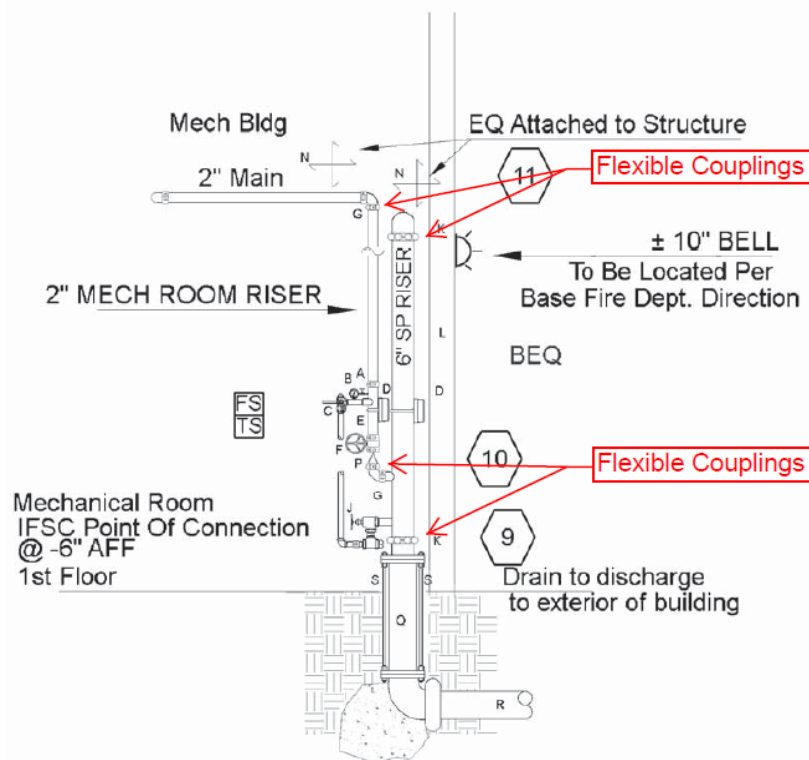
Flexible Couplings

There are many provisions in NFPA 13 for the protection of piping from damage, e.g. providing clearance at penetrations of rigid construction, or the use of flexible couplings. NFPA 13 Section 9.3.2 indicates where flexible couplings are required. Systems having more flexible couplings than required shall provide additional sway bracing to compensate.

Flexible couplings shall be provided in the following locations:

- Within 24 in. of the top and bottom of all risers, unless the following provisions are met:
 1. In risers less than 3 ft. in length, flexible couplings are not required.
 2. In risers 3 to 7 ft. in length, one flexible coupling is adequate.
- Within 12 in. above and within 24 in. below the floor in multistory buildings.
- On both sides of concrete or masonry walls within 1 ft. of the wall surface, unless clearance is provided.
- Within 24 in. of building expansion joints.
- Within 24 in. of the top of drops exceeding 15 ft. in length to portions of systems supplying more than one sprinkler, regardless of pipe size.
- Within 24 in. above and 24 in. below any intermediate points of support for a riser or other vertical pipe.

Figure 24 shown below illustrates an example where flexible couplings are required at system risers.



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Figure 24 – Flexible Couplings at System Risers

Inspection, Test, and Maintenance

A summary of required inspections, testing, and maintenance intervals required by NFPA 25, *Standard for the Inspection, Testing, and Maintenance* is summarized in Appendix F.

Fire Detection and Alarm / Mass Notification System

A combination fire detection and alarm/mass notification system shall be provided for the BEQ and Common Building in accordance with the applicable criteria. The system shall include 24VDC smoke detectors on sounder bases within every living unit. ADA living units shall also be provided with visual notification. Activation of a living unit smoke detector shall cause the detector sounder base to alarm. Activation of any subsequent smoke detector shall activate a building evacuation alarm and transmit signal to the base fire department. Transmission of signals shall be provided via a DACT compatible with the base DACR. (UFC 3-600-01)

Edwards – EST3-Sixty Fire Alarm and Mass Notification control panel was utilized in this project. The EST panel is UL 2572 listed for Mass Notification and UL 864 listed for fire alarm, see Figure 25.

Refer to Appendix G for Fire Alarm Drawings and Appendix H for Fire Alarm Product Data.

Sequence of Operations

A sequence of operations matrix was developed by the fire alarm contractor to organize the system inputs (or devices) and the system outputs (or actions). See Table 8 on the next page for the fire alarm sequence of operations utilized in this project – also see Appendix G for clarity.

The matrix method is a useful tool to describe the following:

Manual pull stations, area smoke detectors, fire sprinkler waterflow switches, second living unit smoke detector, 1ST floor elevator lobby smoke detectors, 2ND – 4TH floor elevator lobby smoke detectors, elevator machine room smoke detector, elevator machine room fire sprinkler waterflow switch, and 2ND floor rollup fire door smoke detectors shall annunciate alarm conditions at the fire alarm control panel and remote annunciator, activate audible/visible notification appliances, transmit alarm signals to government monitoring station, and activate visible notification appliances in ADA living units.

Kyle Leadon, EIT



Figure 25 – Fire Alarm / MNS Control Panel

Valve supervisory switches, living unit smoke detectors, ADA living unit smoke detectors, duct smoke detectors, MNS override of fire alarm system, and elevator shunt trip power loss shall annunciate supervisory conditions at the fire alarm control panel and remote annunciator, and transmit supervisory signals to government monitoring station.

Building power fail, low battery, and system troubles shall annunciate trouble conditions at the fire alarm control panel and remote annunciator, and transmit trouble signals to government monitoring station.

Living unit and ADA living unit smoke detectors shall activate sounder bases upon detection of smoke. The sounder base provides audible notification within the room of origin. ADA living unit smoke detectors also activate visible notification appliances as required by NFPA 72.

2ND – 4TH floor elevator lobby smoke detectors initiate primary elevator recall and firefighter's service visible indicator. 1ST floor elevator lobby smoke detectors initiate elevator recall to an alternate level and the firefighter's service visible indicator (steady). Elevator machine room smoke detectors initiate elevator recall to an alternate level and firefighter's service visible indicator (flashing). Elevator machine room fire sprinkler waterflow switch shall shunt the elevator power.

Building power failure and 2ND floor rollup fire door smoke detectors release the rollup door.

Duct smoke detectors shall shut down their respective air handlers upon detection of smoke.

Table 8 – BEQ and Common Building Sequence of Operations

SEQUENCE OF OPERATIONS																	
	MANUAL PULL STATION	AREA SMOKE DETECTOR	FIRE SPRINKLER WATER FLOW SWITCH	FIRE SPRINKLER SUPERVISORY SWITCH	LIVING UNIT SMOKE DETECTOR	2ND LIVING UNIT SMOKE DETECTOR	ADA UNIT SMOKE DETECTOR	1ST FLOOR ELEVATOR LOBBY SMOKE DETECTOR	2nd-4TH FLOOR ELEVATOR LOBBY SMOKE DETECTOR	ELEVATOR MACHINE ROOM SMOKE DETECTOR	ELEVATOR MACH. ROOM FIRE SPRINKLER WATER FLOW SWITCH	BUILDING POWER FAIL & LOW BATTERY	SYSTEM TROUBLES	DUCT SMOKE DETECTOR	MNS OVERRIDE OF FIRE ALARM SYSTEM	ELEVATOR SHUNT TRIP POWER LOSS	2ND FLOOR ROLL UP DOOR SMOKE DETECTOR
ANNUNCIATE ALARM CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR	●	●	●			●		●	●	●	●						●
ANNUNCIATE TROUBLE CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR												●	●				
ANNUNCIATE SUPERVISORY CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR				●	●		●							●	●	●	
ACTIVATE AUDIBLE/VISUAL ALARM SIGNAL	●	●	●			●		●	●	●	●						●
TRANSMIT ALARM SIGNALS TO GOVERNMENT MONITORING STATION	●	●	●			●		●	●	●	●						●
TRANSMIT TROUBLE SIGNALS TO GOVERNMENT MONITORING STATION												●	●				
TRANSMIT SUPERVISORY SIGNALS TO GOVERNMENT MONITORING STATION				●	●		●							●	●	●	
ACTIVATE SOUNDER BASE IN UNIT OF EVENT					●	●	●										
ACTIVATE VISUAL SIGNAL IN ADA UNITS	●	●	●			●	●	●	●	●	●						●
PRIMARY ELEVATOR RECALL									●								
ALTERNATE ELEVATOR RECALL								●		●							
FIREFIGHTER'S SERVICE VISUAL INDICATOR (FLASHING)										●							
FIREFIGHTER'S SERVICE VISUAL INDICATOR (STEADY)								●	●								
SHUNT ELEVATOR POWER											●					●	
SHUT DOWN ASSOCIATED AIR HANDLER														●			
RELEASE ROLL UP DOOR												●					●

Electronic Control Systems, Inc.

Initiating Devices – Wet-Pipe Sprinkler Systems

Initiating devices contribute to the overall fire protection/life safety system by providing a reliable means to signal off-normal conditions to the fire alarm panel and monitoring station. (NFPA 72 Section 17.2)

The following initiating devices were utilized in the BEQ and Common Building as fire sprinkler and fire alarm system components. Refer to Appendix E for Fire Sprinkler Product Data.

Waterflow Alarm Devices

A waterflow alarm device (flow switch) is an attachment to the sprinkler system that actuates when a flow of water occurs downstream of the device. The flow condition shall be maintained for a period of time necessary to overcome the selected retard period; typically 45 to 60 seconds depending on the jurisdiction.

Potter – Model VSR-F vane-type flow switches were utilized to initiate fire alarm conditions, see Figure 26.

Flow switches were also utilized in the following locations:

- Floor Control Valve Assemblies (BEQ)
- Fire Sprinkler Feed Main (Common Building)
- Elevator Machine Rooms (Zero Retard Shunt Trip Power)



Figure 26 – Potter Vane-Type Waterflow Switch

Valve Supervisory Devices

A valve supervisory device (tamper switch) is an attachment to the fire sprinkler system control valves that actuates when a change of state position or off-normal condition is detected.

Potter – Model OSYSU supervisory switches were utilized to monitor the open position of OS&Y fire sprinkler control valves, see Figure 27.

An example of a butterfly-type control valve equipped with an internal supervisory switch is also shown.



Figure 27 – Typical Valve Supervisory Devices

Initiating Devices – Fire Alarm

The following initiating devices were utilized in the BEQ and Common Building as fire alarm components.

Manual Fire Alarm Stations

Each manual fire alarm station (manual pull station) is required be securely mounted with the operable part not less than 42 in., and not more than 48 in. above floor level. (NFPA 72 Section 17.14)

Manual pull stations are also required to be located within 60 in. of the exit doorway opening at each exit on each floor. Additional pull stations are required to be provided so that the travel distance to the nearest pull station will not be in excess of 200 ft., measured horizontally on the same floor. (NFPA 72 Section 17.14)

EST – SIGA-278 Manual Pull Stations were utilized throughout the BEQ and Common Building, see Figure 28.



Figure 28 – Manual Fire Alarm Station

Smoke Detectors

Spot-type smoke detector are shall be located on the ceiling, or wall mounted between the ceiling and 12 in. down from the ceiling to the top of the detector. (NFPA 72 Section 17.7.3.2)

EST – SIGA-PS Intelligent Photoelectric Smoke Detectors were utilized throughout the BEQ and Common Building in various different locations, see Figure 29.



Figure 29 – Spot-type Smoke Detector

Smoke detectors were provided in the following locations:

- Elevator Lobbies
- Elevator Machine Rooms
- BEQ Living Units (including sounder bases)
- Rollup Fire Door Release
- Protection of Fire Alarm System (NFPA 72 Section 10.15)

The smoke detector spacing for this project was based upon smooth ceilings protection for spot-type smoke detectors in accordance with NFPA 72 Section 17.7.3.2.3. The provisions of this section permit nominal 30 ft. smoke detector spacing where there is an absence of specific performance-based design criteria.

NFPA 72 Annex A explains that the 30 ft. spacing is a guide for prescriptive designs and the “nominal 30 ft.” should be determined to be 30 ft. +/- 5 percent (maximum 31 ft. – 6 in). The typical BEQ living units are relatively small in size (approximately 350 sq-ft), and one smoke detector provides adequate coverage.

Duct Smoke Detectors

Smoke detectors listed for use in air distribution systems are required to be located as follows: (NFPA 90A Section 6.4)

- Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 2000 cfm
- At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air return systems having a capacity greater than 15,000 cfm and serving more than one story.

Return system smoke detectors are not required where the entire space served by the air distribution system is protected by a system of area smoke detectors, or for fan units whose sole function is to remove air from the inside of the building to the outside of the building.

Where provided, duct smoke detectors shall be provided with a remote test station. Duct smoke detectors are required to automatically stop their respective fan(s) upon detecting the presence of smoke.

EST – SIGA-SD Intelligent Duct Smoke Detectors were utilized within the air distribution system in the BEQ and Common Building, see Figure 30.



Figure 30 – Duct Smoke Detector

Notification Devices

Notification appliances shall provide stimuli for initiating emergency action and provide information to users, emergency response personnel, and occupants. (NFPA 72 Section 18.2)

There are many forms on notification appliances, e.g. audible, visible, textual, and tactile. Audible and visible notification appliances were utilized throughout the BEQ and Common Building. See Figure 31 and Figure 32 for examples of ceiling and wall mounted notification appliances respectively (strobe, speaker, and speaker/strobe).

Audible Notification

To ensure that audible public mode signals are clearly heard, they are required to have a sound level at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater, measured 5 feet above the floor. (NFPA 72 Section 18.4.3.1)

If ceiling heights allow, wall-mounted audible appliances are required to have their tops above the finished floors at heights of not less than 90 inches and below the finished ceilings at distances of not less than 6 inches. If combination audible/visible appliances are installed, the location of the installed appliance is determined by the requirements for visible notification appliances. For appliances that are an integral part of a smoke detector (e.g., sounder base), the appliance is required to be located in accordance with the requirements for smoke detectors. (NFPA 72 Section 18.4.8.1)



Figure 31 – Ceiling Mounted Speaker/Strobes

Within the acoustically distinguishable spaces (ADS) where voice intelligibility is required, voice communication systems are required to reproduce prerecorded, synthesized, or live (e.g., microphone, telephone handset, or radio) messages with voice intelligibility. (NFPA 72 Section 18.4.10)

Refer to the Mass Notification System section for additional voice intelligibility requirements.

Speakers

The Genesis Series Speaker offer four sound level outputs; ¼, ½, 1, and 2 Watt tap settings.

The sound pressure levels for the Genesis Series are shown in Table 9.



Figure 32 – Wall Mounted Speaker/Strobes

Table 9 – EST Genesis Series – Sound Level Output

Wattage	25V	25V	70V	70V
	UL Rated*	Typical	UL Rated*	Typical
¼ W	80 dBA	80.7 dBA	80 dBA	81.1 dBA
½ W	84 dBA	83.7 dBA	84 dBA	83.5 dBA
1 W	87 dBA	87.1 dBA	87 dBA	87.2 dBA
2 W	90 dBA	90.1 dBA	91 dBA	90.2 dBA

Audible notification appliance ratings are specified as a decibel rating at a predetermined distance, usually 10 ft. See Figure 33 on the next page for an example of a 2 Watt appliance rated for 90 dBA at 10 ft.

The rule of thumb is that the output of an audible notification appliance is reduced by 6 dB if the distance is doubled. Half watt (½ Watt) appliances were utilized throughout the BEQ providing audible notification within the living units, see Appendix G.

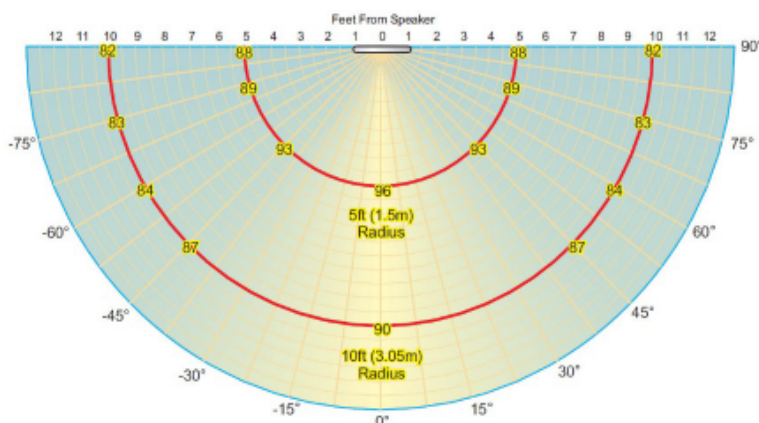


Figure 33 – EST Genesis Series – Typical Sound Output (dBA) at 10 ft.

Based upon Table 9, a ½ Watt appliance is rated for 83.7 dBA at 10 ft. Utilizing the 6 dBA rule of thumb method, the sound pressure level is estimated to be 77.7 dBA at 20 ft., which is in accordance with the minimum requirement for sleeping rooms.

In addition to the audibility requirements of NFPA 72 Section 18.4.3.1, where audible appliances are installed to provide signals for sleeping areas, they are also required to have a sound level of at least 75 dBA, measured at the pillow level. (NFPA 72 Section 18.4.5.1)

Sounder Base

Sounder bases are utilized where localized or group alarm signaling is required. Applications include hotels, dormitories, and other residential occupancies where supplementary audible output is required to meet required sound levels for sleeping areas.

EST – Model SIGA-AB4G Sounder Base were utilized throughout the BEQ providing local audible notification upon smoke detector actuation. See Figure 34 for a typical flush mount installation.

Visible Notification

Wall-mounted visible notification appliances shall be mounted such that the entire lens is not less than 80 in. and not greater than 96 in. above the finished floor. Where low ceiling heights do not permit mounting at the minimum height, visible notification appliances are required to be mounted within 6 in. of the ceiling.

Visible notification appliances are permitted to be either wall

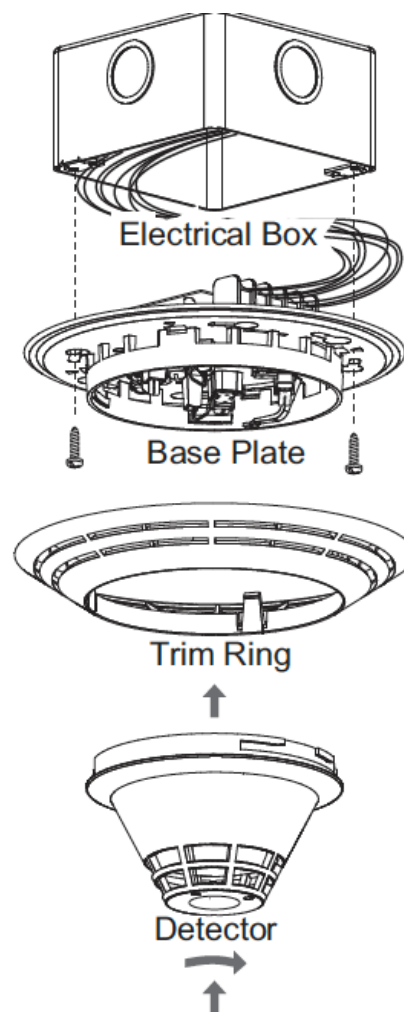


Figure 34 – Smoke Detector on Sounder Base

or ceiling mounted. Per NFPA 72 Section 18.5.4, visible notification appliances shall be spaced in accordance with the following:

Table 10 – NFPA 72 Table 18.5.4.3.1(a)
Room Spacing for Wall-Mounted Visible Appliances

Maximum Room Size		Minimum Required Light Output [Effective Intensity (cd)]		
		One Light per Room	Two Lights per Room (Located on Opposite Walls)	Four Lights per Room (One Light per Wall)
ft	m			
20 × 20	6.10 × 6.10	15	NA	NA
28 × 28	8.53 × 8.53	30	Unknown	NA
30 × 30	9.14 × 9.14	34	15	NA
40 × 40	12.2 × 12.2	60	30	15
45 × 45	13.7 × 13.7	75	Unknown	19
50 × 50	15.2 × 15.2	94	60	30
54 × 54	16.5 × 16.5	110	Unknown	30
55 × 55	16.8 × 16.8	115	Unknown	28
60 × 60	18.3 × 18.3	135	95	30
63 × 63	19.2 × 19.2	150	Unknown	37
68 × 68	20.7 × 20.7	177	Unknown	43
70 × 70	21.3 × 21.3	184	95	60
80 × 80	24.4 × 24.4	240	135	60
90 × 90	27.4 × 27.4	304	185	95
100 × 100	30.5 × 30.5	375	240	95
110 × 110	33.5 × 33.5	455	240	135
120 × 120	36.6 × 36.6	540	305	135
130 × 130	39.6 × 39.6	635	375	185

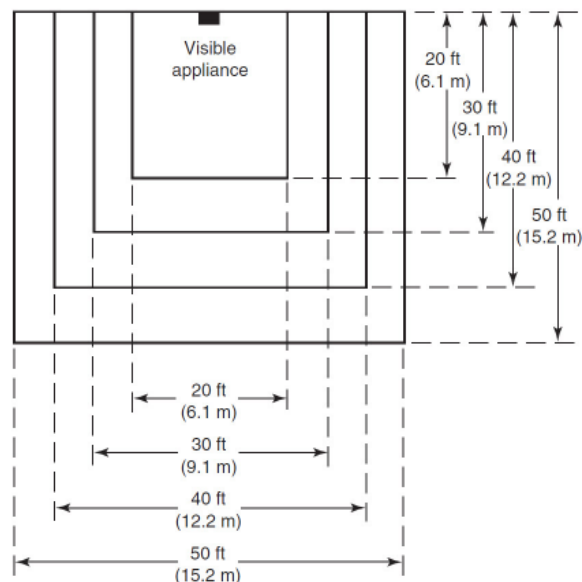


Figure 35 – NFPA 72 Figure 18.5.4.3.1
Room Spacing for Wall-Mounted Visible Appliances

Kyle Leadon, EIT

**Table 11 – NFPA 72 Table 18.5.4.3.1(b)
Room Spacing for Ceiling-Mounted Visible Appliances**

Maximum Room Size		Maximum Lens Height		Minimum Required Light Output (Effective Intensity); One Light (cd)
ft	m	ft	m	
20 × 20	6.1 × 6.1	10	3.0	15
30 × 30	9.1 × 9.1	10	3.0	30
40 × 40	12.2 × 12.2	10	3.0	60
44 × 44	13.4 × 13.4	10	3.0	75
50 × 50	15.2 × 15.2	10	3.0	95
53 × 53	16.2 × 16.2	10	3.0	110
55 × 55	16.8 × 16.8	10	3.0	115
59 × 59	18.0 × 18.0	10	3.0	135
63 × 63	19.2 × 19.2	10	3.0	150
68 × 68	20.7 × 20.7	10	3.0	177
70 × 70	21.3 × 21.3	10	3.0	185
20 × 20	6.1 × 6.1	20	6.1	30
30 × 30	9.1 × 9.1	20	6.1	45
44 × 44	13.4 × 13.4	20	6.1	75
46 × 46	14.0 × 14.0	20	6.1	80
50 × 50	15.2 × 15.2	20	6.1	95
53 × 53	16.2 × 16.2	20	6.1	110
55 × 55	16.8 × 16.8	20	6.1	115
59 × 59	18.0 × 18.0	20	6.1	135
63 × 63	19.2 × 19.2	20	6.1	150
68 × 68	20.7 × 20.7	20	6.1	177
70 × 70	21.3 × 21.3	20	6.1	185
20 × 20	6.1 × 6.1	30	9.1	55
30 × 30	9.1 × 9.1	30	9.1	75
50 × 50	15.2 × 15.2	30	9.1	95
53 × 53	16.2 × 16.2	30	9.1	110
55 × 55	16.8 × 16.8	30	9.1	115
59 × 59	18.0 × 18.0	30	9.1	135
63 × 63	19.2 × 19.2	30	9.1	150
68 × 68	20.7 × 20.7	30	9.1	177
70 × 70	21.3 × 21.3	30	9.1	185

NFPA 72 Table 18.5.4.3.1(b) is used if the ceiling mounted visible notification appliance is at the center of the room. If the ceiling-mounted visible notification appliance is not located at the center of the room, the effective intensity (cd) is determined by doubling the distance from the appliance to the farthest wall to obtain the maximum room size. (NFPA 72 Section 18.5.4.3.7)

The installation of visible notification appliances in corridors shall be located not more than 15 ft. from the end of the corridor with a separation not greater than 100 ft. between appliances. (NFPA 72 Section 18.5.4.4.5)

The spacing of visible notification appliances throughout the BEQ and Common Building was found to be in compliance with NFPA 72.

Kyle Leadon, EIT

Voltage Drop and Battery Calculations

Class A circuits have been provided for all circuits throughout the BEQ and Common Building. Class A circuits provide more reliability than Class B circuits because Class A circuits include a redundant path ensuring the operational capabilities continue past a single open.

Voltage drop calculations for all notification appliance circuits were reviewed. The number of devices and pathway lengths for each circuit were confirmed. The voltage drop calculations were found to be in compliance with the applicable criteria and the manufacturer's instructions. NAC1 and NAC2 voltage drop calculations are shown below in Figure 36.

NAC 2 Voltage Drop Calculation Sheet					
Panel Name		BPS #1			
Area Covered		2nd FLOOR			
Nominal System Voltage		20.4			
Minimum Device Voltage		17.0			
Total Circuit Current		0.671	Wire Gauge	Ohm's Per 1000	
Distance from source to 1st device		66	12	1.98	
Wire Gauge for balance of circuit			12	1.98	
Enter current in amps. .150 = 150 ma		Distance from previous device	Voltage		
Device Number	Device Current		At Device	Drop from Source	Percent Drop
Device 1	0.063	66	20.22	0.175	0.86%
Device 2	0.063	54	20.09	0.305	1.50%
Device 3	0.063	37	20.01	0.385	1.89%
Device 4	0.063	58	19.90	0.496	2.43%
Device 5	0.063	94	19.75	0.652	3.20%
Device 6	0.063	87	19.63	0.775	3.80%
Device 7	0.063	94	19.52	0.884	4.33%
Device 8	0.063	33	19.49	0.914	4.48%
Device 9	0.167	27	19.47	0.932	4.57%
Totals	0.671	550	End of Line Voltage		19.47
Totals		Voltage Drop	Point to Point Method		
Current	Distance		CIRCUIT IS WITHIN LIMITS		
0.671	550	0.93			
End of Line Voltage		19.47			
Percent Drop		4.57%			

NAC 1 Voltage Drop Calculation Sheet					
Panel Name		BPS #1			
Area Covered		1st FLOOR			
Nominal System Voltage		20.4			
Minimum Device Voltage		17.0			
Total Circuit Current		0.504	Wire Gauge	Ohm's Per 1000	
Distance from source to 1st device		82	12	1.98	
Wire Gauge for balance of circuit			12	1.98	
Enter current in amps. .150 = 150 ma		Distance from previous device	Voltage		
Device Number	Device Current		At Device	Drop from Source	Percent Drop
Device 1	0.063	82	20.24	0.164	0.80%
Device 2	0.063	53	20.14	0.256	1.26%
Device 3	0.063	37	20.09	0.312	1.53%
Device 4	0.063	61	20.01	0.388	1.90%
Device 5	0.063	88	19.92	0.476	2.33%
Device 6	0.063	91	19.86	0.544	2.66%
Device 7	0.063	108	19.80	0.598	2.93%
Device 8	0.063	33	19.79	0.606	2.97%
Totals	0.504	553	End of Line Voltage		19.79
Totals		Voltage Drop	Point to Point Method		
Current	Distance		CIRCUIT IS WITHIN LIMITS		
0.504	553	0.61			
End of Line Voltage		19.79			
Percent Drop		2.97%			

Electronic Control Systems, Inc.

Figure 36 – NAC 1 and NAC 2 Voltage Drop Calculations

The fire alarm control panel and auxiliary power supplies are required to have secondary power supply. Most often, this function is provided via standby batteries. The secondary power supply for emergency voice/alarm communications systems are required to be capable of operating the system under quiescent load for a minimum of 60 hours and be capable of operating the system during a fire or other emergency condition for a period of 15 minutes at the maximum connected load. (UFC 4-021-01 Section 4-4.5)

Battery calculations for all control panels and remote power supplies were reviewed. The number of devices on each panel were confirmed. The battery calculations were found to be in compliance with the applicable criteria and the manufacturer's instructions. The battery calculation for BPS #1 is shown in Figure 37 on the next page.

Kyle Leadon, EIT

BPS #1 - BATTERY CALCULATIONS						
Device or Control	Standby Current (mA)			Alarm Current (mA)		
	Qty.	Current	Total	Qty.	Current	Total
BPS6A	1	70	70			
15cd CEILING SPEAKER STROBE				16	63	1008.00
28cd WALL SPEAKER STROBE WP				1	167	167.00
Standby Total			70.00	Alarm Total		1175.00
Standby:		70.00 X	60 hrs. =	4.20 A		
Alarm:		1175.00 X	0.25 hrs. =	0.29 A		
Sub Total:				4.49 A		
Surplus:			20%	0.90 A		
Total Requirement:				5.39 Ah		
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC						

Electronic Control Systems, Inc.

Figure 37 – BPS #1 Battery Calculation

Refer to Appendix G for the Fire Alarm Drawings, which include the additional voltage drop and battery calculations for all NAC circuits and panels.

Transmission of Signals

Transmission of signals is provided via a Digital Alarm Communicator Transmitter (DACT) compatible with the existing WAVES Base Wide Mass Notification System manufactured by Cooper Industries.

EST – Model 3-MODCOM Modem Communicator provides off-premise communications functions for the fire alarm/mass notification system. The module supervises primary and secondary telephone lines. The module first attempts to dial out on either of the two phone lines not in use. In the event that both lines are busy, the module seizes line one.

Mass Notification System (MNS)

The Mass Notification System (MNS) provided for the BEQ and Common Building is intended to provide real-time information to building occupants and personnel in the immediate vicinity of the building. The following section provides information describing the system operating capabilities and characteristics.

Autonomous Control Unit (ACU)

The ACU is used to monitor and control the notification appliance network. Building occupants can initiate pre-recorded voice messages or provide live intelligible voice messages and instructions. (UFC 4-021-01 Section 4-3.2)

The ACU is integrated with the building fire alarm control panel (FACP) to form one combined system that performs both functions. In many cases, the MNS often also serves as the building PA system. Typically a remote general paging microphone is provided for building PA functions. A combined system may include separate ACU and FACP, but many manufacturers have integrated both functions into a single panel. (UFC 4-021-01 Section 4-3.2.2)

EST – Model EST3-Sixty Fire Alarm / Mass Notification Panel is UL2572 Listed for mass notification operations, and UL864 Listing as a fire alarm control system.

Kyle Leadon, EIT

Local Operating Console (LOC)

Similar to a remote annunciator, a LOC provides emergency responders and building occupants the ability to operate the MNS. A LOC is usually contained in a small, wall-mounted enclosure. It should be noted that not all functions that could be performed at the ACU are necessarily available at a LOC. (UFC 4-021-01 Section 4-3.3)

Notification Appliance Network

The MNS notification appliance network consists of audible notification appliances (speakers), visible notification appliances (strobes), and when required, text signs. (UFC 4-021-01 Section 4-3.4)

Speakers are provided throughout the building and at building entrances/exits where building occupants congregate. Exterior speakers are intended to provide notification to personnel less than 16 ft. of the building. (UFC 4-021-01 Section 4-3.4.1)

MNS strobes are provided at the same locations throughout the building that would be required for fire alarm notification appliances. For combined systems, either one clear strobe is provided or two strobes (clear for fire and amber for MNS). Navy installations utilize one clear strobe labeled "ALERT". (UFC 4-021-01 Section 4-3.4.2)

Fire Alarm Override

The MNS is permitted to temporarily override fire alarm audible/visible notification appliances to provide intelligible voice commands during simultaneous fire and terrorist events. All other features of the fire alarm system, including transmission of signals, are required to function properly. MNS messages take priority and continue to override the fire alarm until the MNS message is either manually or automatically ended. If not manually ended, the MNS message will automatically end after 10 minutes. If the MNS is used to override the fire alarm, supervisory signal is required to be annunciated at the ACU and LOC, and transmitted to the government monitoring station. (UFC 4-021-01 Section 4-4.2)

Intelligibility

Intelligibility is defined in NFPA 72 as the quality or condition of being intelligible; capable of being understood or comprehended. Intelligibility of the MNS shall be tested in accordance with UFC 4-021-01.

The following summarizes the intelligibility requirements outlined in UFC 4-021-01 Section 4-6.1.2.

- Verify intelligibility by measurement upon completion of system installation.
- Ensure that a CIS value greater than the required minimum value is provided in each area where building occupants are typically found. The minimum required value for Navy installations is 0.7 CIS.

Kyle Leadon, EIT

- Areas of the building provided with hard wall and ceiling surfaces, e.g. metal or concrete, that are found to cause excessive sound reflections are permitted to have a CIS score less than the minimum required value if approved by the AHJ and if the building occupants in these areas can determine that a voice signal is being broadcast. A building occupant shall walk no more than 33 feet to find a location with at least the minimum required CIS value within the same area.
- Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than the minimum required value if the building occupants can determine that a voice signal is being broadcast. A building occupant shall walk no more than 50 feet to a location with at least the minimum required CIS value within the same area.
- Take measurements near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate).
- The distance a building occupant shall walk to the location meeting the minimum required CIS value is required to be measured on the floor or other walking surface as follows:

- (1) Along the centerline of the natural path of travel, starting from any point subject to occupancy with less than the minimum required CIS value.
- (2) Curving around any corners or obstructions, with a 12 inches clearance there from.
- (3) Terminating directly below the location where the minimum required CIS value has been obtained.

- Use commercially available test instrumentation to measure intelligibility. Use the mean value of at least three readings to compute the intelligibility score at each test location. See Figure 38 for an example an intelligibility meter manufactured by Quest Technologies.



Quest Technologies

Figure 38 – Intelligibility Meter

Inspection, Test, and Maintenance

Prior to acceptance testing, the authority having jurisdiction and the system contractor are required to ensure that all documentation for the system installation has been completed. The required documentation includes specifications, type of system, shop drawings (as-built drawings), input/output matrix, battery calculations, and notification appliance circuit voltage drop calculations.

Kyle Leadon, EIT

Maintenance of a system directly impacts the effectiveness of the system over time. The following is a suggested checklist of documents needed to test and maintain the system.

- Fire Alarm System Record of Completion
- Point-to-Point Wiring Diagrams
- Individual Device Interconnection Drawings
- As-Built (Record) Drawings
- Equipment Submittals
- Operational Manuals
- Manufacturer's Proper Testing and Maintenance Requirements
- Device Address List

All items on the checklist should be provided prior to testing or maintaining the system. The acceptance testing requirements for a Fire Alarm / Mass Notification System can be found in NFPA 72 Table 14.3.1. Refer to Appendix I for a summary of testing requirements for various system components.

Portable Fire Extinguishers and Cabinets

Per base fire department, portable fire extinguishers shall only be provided in locations monitored or attended by staff. The fire department would prefer occupants to initiate a general building fire alarm prior to evacuating in lieu of attempting to perform firefighting services.

Where provided, portable fire extinguishers shall be installed and maintained in accordance with NFPA 10.

The following summarizes NFPA 10 requirements:

Minimum Fire Extinguisher Rating:

4A:80B:C (Base Standard)

Maximum Height to Top of Extinguisher:

5 ft. (NFPA 10 Section 6.1.3.8.1)

Minimum Clearance to Bottom of Extinguisher:

4 in. (NFPA 10 Section 6.1.3.8.3)

Maximum Travel Distance:

75 ft. (NFPA 10 Table 6.2.1.1)

Recessed or semi-recessed cabinets (as shown in Figure 39) shall be provided in finished areas. Surface mounted cabinets are permitted in unfinished or industrial spaces. (UFC 3-600-01)



JL Industries

Figure 39 – Portable Fire Extinguisher and Cabinet

Performance-Based Evaluation

Per UFC 3-600-01, the use of performance-based design in new facilities is permitted only if authorized by the Department of Defense (DoD) component authority having jurisdiction (AHJ), NAVFAC. In new facilities for which established prescriptive criteria exist, performance-based design is prohibited, except for mission critical or unique facilities, where the user mandates requirements and objectives that are not addressed by established prescriptive requirements of national codes or UFC 3-600-01. Performance-based designs are not permitted to eliminate means of egress requirements of NFPA 101, or to eliminate automatic sprinkler systems required by the DoD criteria.

Although a performance-based design was not specifically developed for the actual project, a performance-based evaluation is included in this report and was developed as an academic exercise.

Scope

This performance-based analysis evaluates the performance of the prescriptive-based design summarized in the Building and Life Safety Code summaries. Based upon known mathematical correlations and computer-based software, predictions are compared to modeled results. Conclusions are presented based upon the results.



PGAL Architecture

Figure 40 – Bachelor Enlisted Quarters (BEQ)

Goals and Objectives

The primary goal of the Life Safety Code is to provide an environment for occupants that is reasonably safety from fires. (NFPA Section 4.1.1)

We accomplish this goal by the following means:

- Improve the survivability of occupants located within the living unit.
- Provide protection to occupants located outside the living unit and module.
- Ensure sufficient evacuation time is provided, such that occupants are not exposed to instantaneous or cumulative untenable conditions from smoke, heat, or flames.
- Limit the effects of fire from causing property damage outside the room of origin.
- Prevent structural failure under fire conditions for sufficient time to protect the occupants, and enable firefighters and emergency responders to conduct search and rescue operations.

The priority of these goals and focus of this report are as follow:

- 1) Minimize fire- and smoke-related injuries to occupants not intimate with the initial fire development.
- 2) Improve the survivability of occupants within the living unit.
- 3) Provide sufficient egress time for occupants not intimate with the initial fire development.

Stakeholders

The Department of Defense (DoD) is responsible for national security and the security of U.S. constituents around the world. These responsibilities take on many forms, such as military security and public welfare. As the owner, the DoD is inherently responsible for all aspects of the facility, from financial responsibility; to ensuring the facility is maintained to operate as it was originally designed. DoD is also responsible for the livelihood of the Marines who work and reside in their facilities. The DoD's stake in this project is clear. The facility shall provide the needed level of life safety and property protection from hazards created by fire, explosion, and other hazardous conditions.

The Department of Defense (DoD) component authority having jurisdiction (AHJ) is Naval Facilities Engineering Command (NAVFAC). NAVFAC provides facilities engineering support to the U.S. Navy, Marine Corps, Federal Agencies, and other DoD clients. NAVFAC provides program management of Navy Military Construction (MCON) worldwide, from initial programming and budgeting through construction. NAVFAC is also responsible for the design and oversight of all construction. NAVFAC at times represents themselves as the owner, user, consultant, authority having jurisdiction, and maintenance entity. NAVFAC's stake is to ensure the facility meets the minimum requirements of the applicable criteria and the contract.

Kyle Leadon, EIT

The design team recognizes that their work has a direct and vital impact on the quality of life for Marines who reside in the facility. Accordingly, the services specifically provided by the fire protection engineers require honesty, impartiality, fairness and equity. The design team must be dedicated to the protection and enhancement of the safety, health, and welfare of the Marines. The design team's stake is to provide a facility compliant with the applicable criteria and contract while reducing construction costs.

Occupant Description

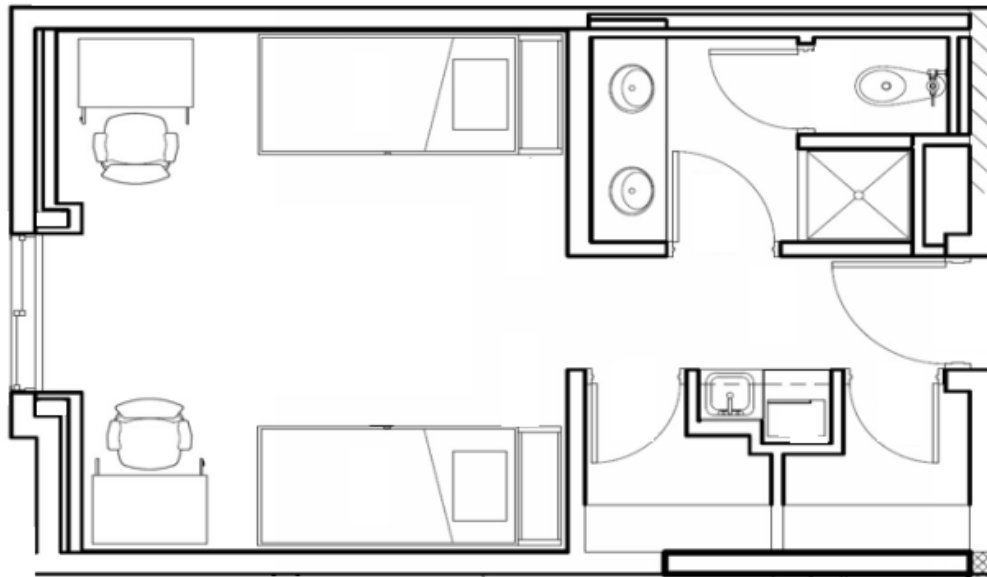
As the user of the facility, the Marines have an interest in the fire protection and life safety features of their facility. Even though their occupancy is often transient at times, the BEQ is home. The following describes the typical occupant of this facility. It is noted that not all BEQs are designed for active-duty military, and the occupant characteristics may vary.

- Able-Bodied Marines
- Men and women within the ages of 18-28.
- Strong healthy bodies and no physical disabilities.
- Highly trained individuals in many aspects of survival, including firefighting.
- High level of confidence and trained to limit hesitation, doubt, confusion, or uncertainty.
- Strong mental conditioning and awareness of surroundings.

Room Description

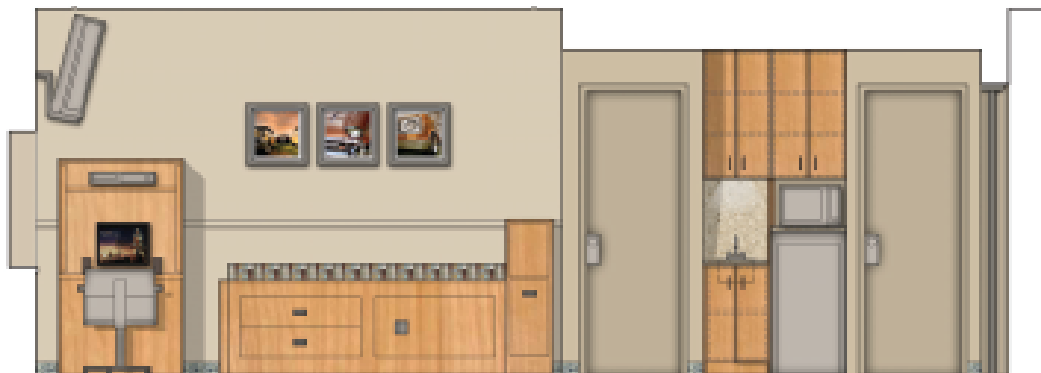
- Typical BEQ Living Unit 15 x 24 x 9 ft.
- 1-hour fire resistive construction (Gypsum/CMU walls)
- 20-minute fire-rated door assembly at corridor 3 x 7 ft.
- Operable Window 4 ft. x 4 ft.
- Four Exhaust Diffusers – One Exhaust Duct with Subduct at 2 hour fire-rated shaft
- One Supply Diffuser – One Supply Duct with Fire Damper at 2 hour fire-rated shaft
- Ambient Temperature: 20°C
- Occupant Load: 2 Marines

The typical BEQ living unit is shown in Figures 41 and 42 on the next page. The room layout includes two twin lift-top beds, each with a mattress, two drawers, and storage headboard. The mattress is made of polyurethane foam and PVC ticking material. The living unit also includes two small computer desks, two closet spaces, and a restroom.



Kathleen Killman Interior Design

Figure 41 – Typical BEQ Living Unit Floor Plan



Kathleen Killman Interior Design

Figure 42 – Typical BEQ Living Unit Elevation View

Design Fire Development

Engineering analysis includes the characteristics of the anticipated fuel and fuel loads. The design fire is permitted to be either a steady fire with a constant heat release rate or an unsteady fire with a heat release rate that varies with time. The design fire heat release rates were based on available test data. The selection of the design fire was determined based upon furniture calorimeter tests conducted at NIST. For the purposes of this report, a mattress made from polyurethane foam and PVC ticking material was determined to have the highest heat release rate of all other fuel sources in the typical BEQ living unit. The ultimate heat release rate, Q utilized in this evaluation was 2,630 kW. (SFPE Table 3-1.15)

Kyle Leadon, EIT

An unsteady design fire is anticipated that has a growth phase based upon a t-squared growth model and a slow growth coefficient of 0.0086 kW/sec. The growth phase is followed by a steady period based upon the assumption, sprinkler activation will control the growth while maintaining a steady or decaying heat release rate.

Estimated smoke detector and sprinkler response times were calculated to determine when the steady period should begin.

Sprinkler Response Time

A combination automatic wet-pipe fire sprinkler and manual Class I wet standpipe system shall be provided throughout the BEQ and Common Building in accordance with the applicable criteria.



Figure 43 – Residential Fire Sprinkler

Fire Sprinklers

Thermal sensitivity defines a sprinkler's ability to control or extinguish a fire. The response time index (RTI) is a measure of the sensitivity of a sprinkler's thermal element. It is usually determined by plunging a sprinkler into heated laminar airflow within a test oven. (NFPA 13 Section 3.6.1)

Globe – Model GL3547 and GL4947 Residential Adjustable Concealed Pendent Sprinklers were utilized (see Figure 43).

See Figure 44 for fire sprinkler operating temperature.

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	155°F	68°C	RED	100°F	38°C

Figure 44 – Fire Sprinkler Operating Temperature

The RTI is calculated using the following:

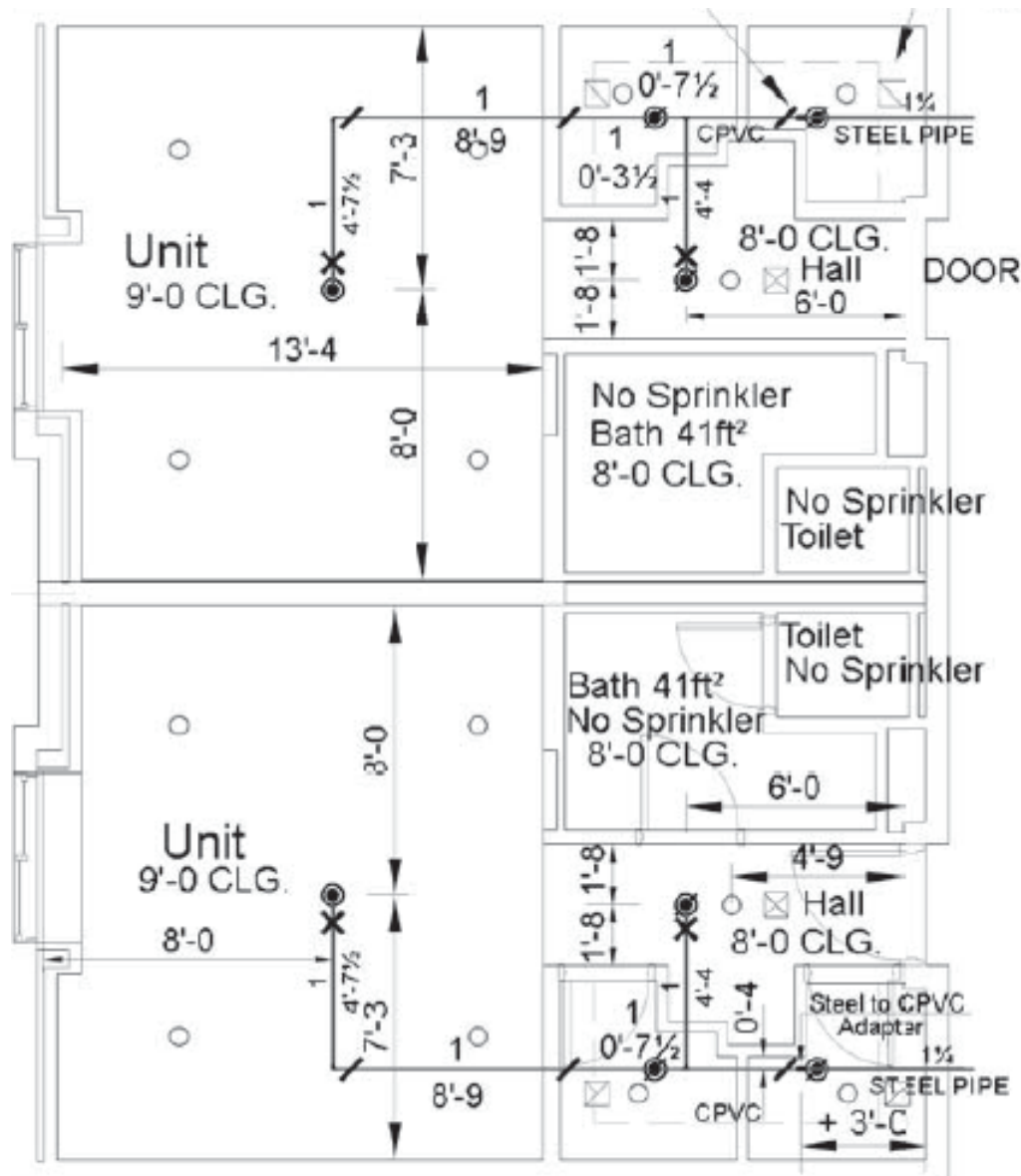
- Sprinkler Operating Time
- Sprinkler Operating Temperature (as determined by test)
- Air Temperature of Test Oven
- Air Velocity of Test Oven
- Conductivity (c) Factor

Other factors affecting response time include the operating temperature, sprinkler position, fire exposure, and radiation.

Sprinklers defined as fast response (e.g., residential sprinklers) have a thermal element with an RTI of 50 (m-s)^{1/2} or less. Sprinklers defined as standard response have a thermal element with an RTI of 80 (m-s)^{1/2} or more. (NFPA 13 Section 3.6.1)

Kyle Leadon, EIT

Consider the typical sprinkler layout for a BEQ living unit shown in see Figure 45.



Industrial Fire Sprinkler Co. Inc.

Figure 45 – Typical BEQ Living Unit – Fire Sprinkler Layout

The response time of a typical sprinkler located in a BEQ living unit was determined by utilizing a DETACT implementation spreadsheet. DETACT is an empirical model, developed based on Alpert correlations used to analyze fire plume and ceiling jet temperatures and velocities.¹¹ Depending on specified design fires and other input parameters, predictions can be made for sprinkler response time.

Kyle Leadon, EIT

DETECT predicts sprinkler response based on the ceiling height, radial distance from fire, ambient and activation temperatures, response time index (RTI), and the fire growth coefficient.

Only convective heat transfer is considered between the ceiling jet and the detector; no conductive loss or radiative heat transfer is considered.

See Figure 46 for DETACT input parameters.

INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	2.8	m	R/H	0.536
Radial distance (R)	1.5	m	$dT(cj)/dT(pl)$	0.455
Ambient temperature (T_o)	20	C	$u(cj)/u(pl)$	0.336
Actuation temperature (T_d)	68	C	Rep. t^2 coeff.	k
Response time index (RTI)	50	$(m-s)^{1/2}$	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.0086	kW/s^n	Fast	0.047
Time step (dt)	4	s	Ultrafast	0.400

Figure 46 – DETACT Input Parameters – Sprinkler Response Time

The ceiling height input parameter represents the height above the fire. For this fire scenario, the ceilings are at 9 feet. Therefore, the height above the fire is the ceiling height minus the height of the twin bed ($9 - 2 = 7$ feet or 2.8 m). The radial distance represents the horizontal distance from the fire to the sprinkler/detector. Assume the fire originates in the middle of the bed. Therefore, the sprinkler's radial distance is approximately 5 feet (1.5 m), see Figure 45.

Assume an ambient temperature of 20°C and a sprinkler actuation temperature of 68°C, see Figure 44. The specific sprinkler RTI was not provided on the manufacturer's product data sheet; therefore, an RTI of 50 $(m-s)^{1/2}$ was utilized. Residential sprinklers are classified as fast response sprinklers. The growth power and growth coefficient represent a t-squared fire. A four second time increment was utilized to evaluate the model.

Figure 47 on the next page represents the DETACT model results graphically. As the fire slowly develops, the gas temperature increases. Notice how the sprinkler temperature closely follows the gas temperature, but is slightly offset. This offset represents a thermal lag between the sprinkler's thermal element and the ceiling jet gas temperature. The thermal lag is more pronounced the higher the RTI value.

Based upon the results shown in Figure 47, typical BEQ living unit sprinklers is expected to operate in approximately 196 seconds (3.3 minutes) with an approximate HRR of 330 kW. It should be noted that this approach does not take into account fire exposure and radiation.

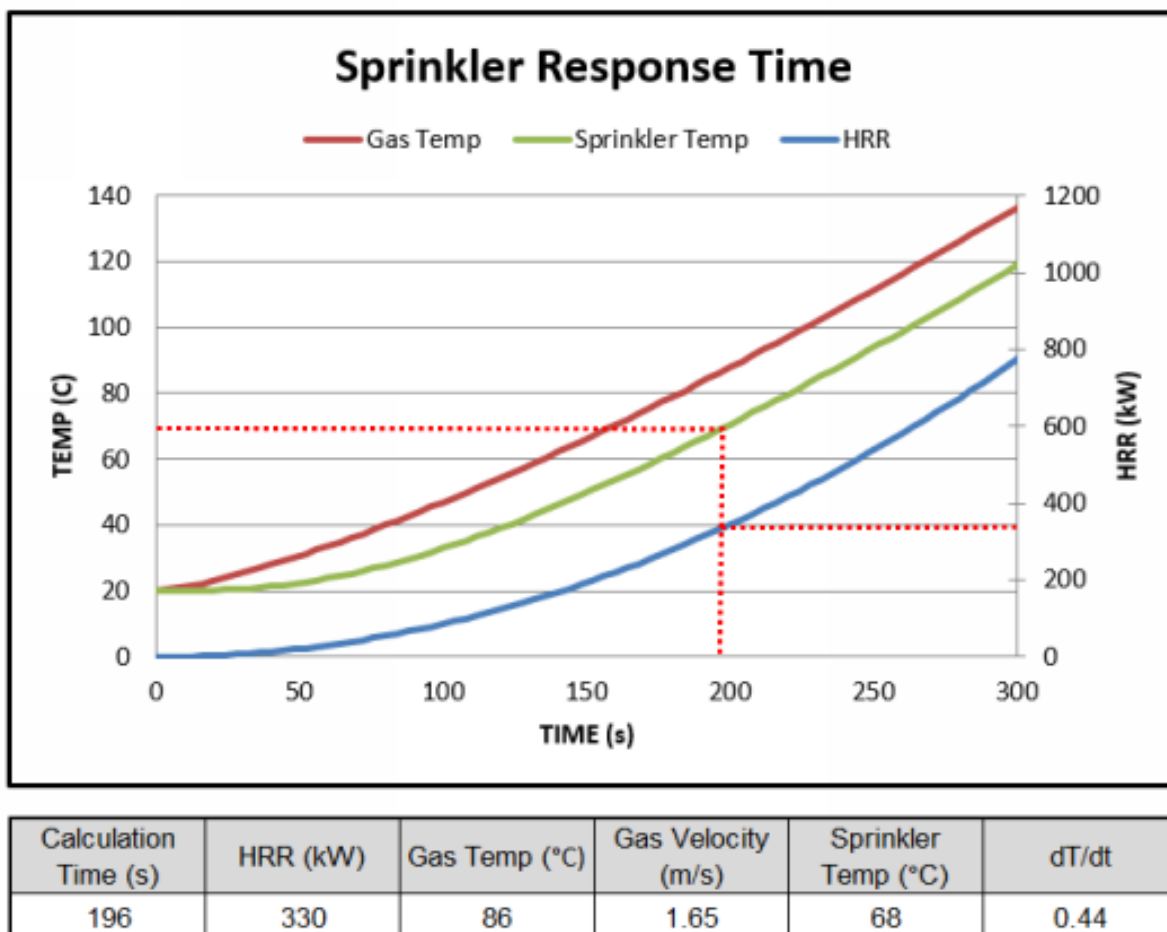


Figure 47 – DETACT Results – Sprinkler Response Time

The typical BEQ living unit is relatively small (approximately 350 sq-ft) and completely enclosed in fire resistive construction. The products of combustion will be contained within the room as the fire develops. The effects of radiation within the living unit will contribute to a faster sprinkler activation time. Slow growing fires produce significant amounts of smoke. In these scenarios, smoke detection will provide improved response time results. See Smoke Detector Response Time section for a detailed evaluation of the response time for a BEQ living unit smoke detector.

Smoke Detector Response Time

A combination fire detection and alarm/mass notification system shall be provided throughout the BEQ and Common Building in accordance with the applicable criteria. The typical BEQ living unit is provided with a photoelectric spot-type smoke detector on a sounder base. The sounder base provides local notification. Upon activation of a second detector, the building evacuation alarm is initiated.

Kyle Leadon, EIT

Spot-Type Photoelectric (light scattering) Smoke Detectors

Photoelectric smoke detectors use the principle of a light source and a photosensitive sensor arranged such that the rays from the light source do not normally fall onto the photosensitive sensor. When smoke particles enter the light path, some of the light is scattered by reflection and refraction onto the sensor. The light signal is processed and used to convey an alarm condition when it meets preset criteria. (NFPA)

NFPA 72 Annex B, *Engineering Guide for Automatic Fire Detector Spacing*, provides guidance for determining detector spacing and provides information related to detector response.

Per NFPA 72 Table B.4.7.5.3, for polyurethane and PVC related fires, scattering-type detectors should activate based upon a 7.2°C temperature rise.



Figure 48 – Spot-type Smoke Detector

Similar to evaluating the fire sprinkler, the response time for a typical photoelectric smoke detector located in a BEQ living unit was determined by utilizing a DETACT implementation spreadsheet. See Figure 49 for DETACT input parameters.

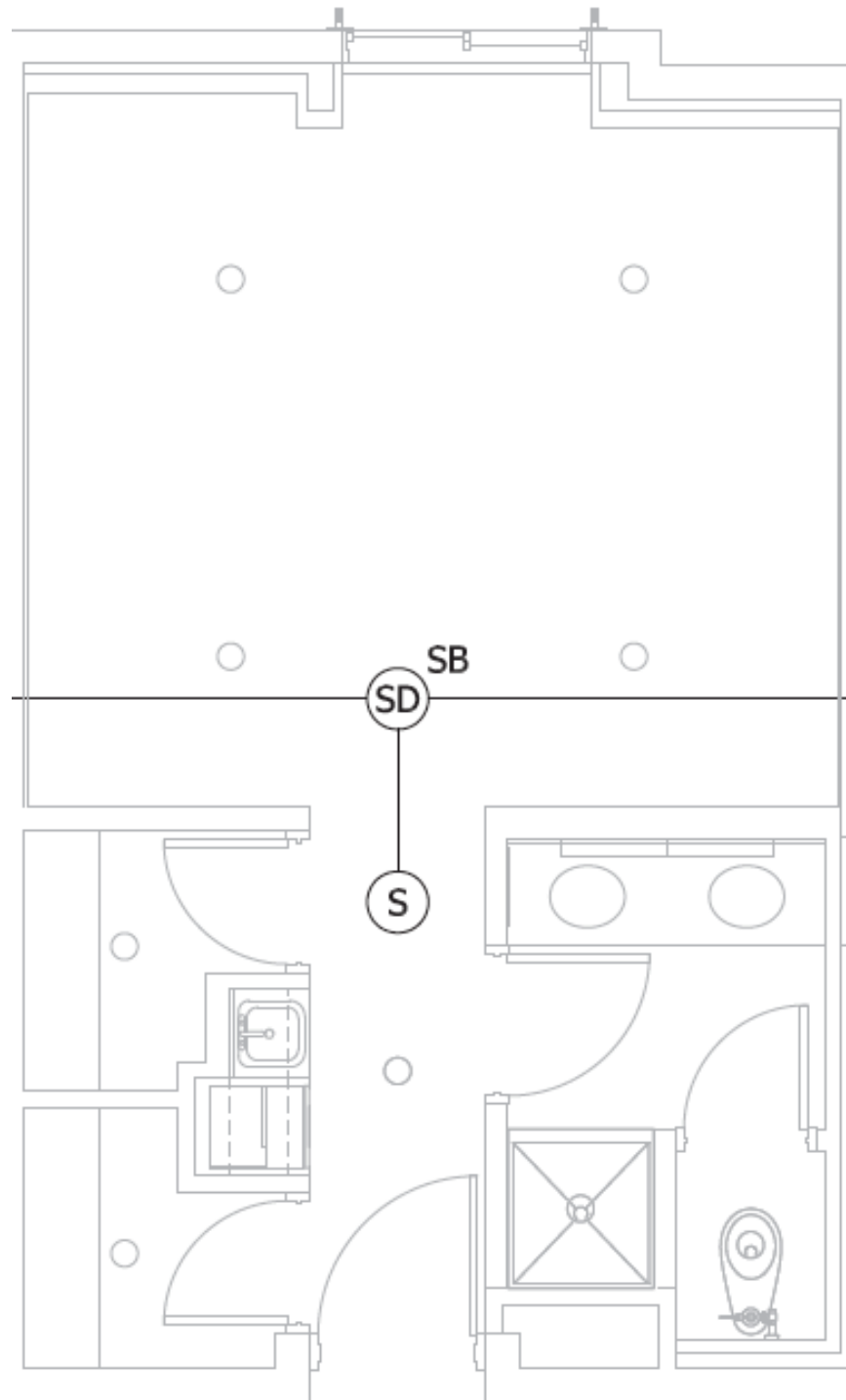
INPUT PARAMETERS			CALC. PARAMETERS	
Ceiling height (H)	2.8	m	R/H	0.536
Radial distance (R)	1.5	m	dT(cj)/dT(pl)	0.455
Ambient temperature (To)	20	C	u(cj)/u(pl)	0.336
Actuation temperature (Td)	28	C	Rep. t ² coeff.	k
Response time index (RTI)	2	(m-s) ^{1/2}	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (k)	0.0086	kW/s ⁿ	Fast	0.047
Time step (dt)	4	s	Ultrafast	0.400

Figure 49 – DETACT Input Parameters – Smoke Detector Response Time

Assume an actuation temperature of 28°C based upon an approximate 8°C temperature rise. (NFPA 72 Table B.4.7.5.3)

Since smoke detectors do not actuate based upon heat, a low RTI value was utilized in the DETACT model to simulate effectively zero thermal lag.

Consider the typical smoke detector layout for a BEQ living unit shown in see Figure 50.



Electronic Control Systems, Inc.

Figure 50 – Typical BEQ Living Unit – Smoke Detector Response

Kyle Leadon, EIT

Figure 51 represents the DETACT model results graphically. Again, notice how the detector temperature closely follows the gas temperature. In this case, there is little to no thermal lag between the detector temperature and the ceiling jet gas temperature because of the low RTI.

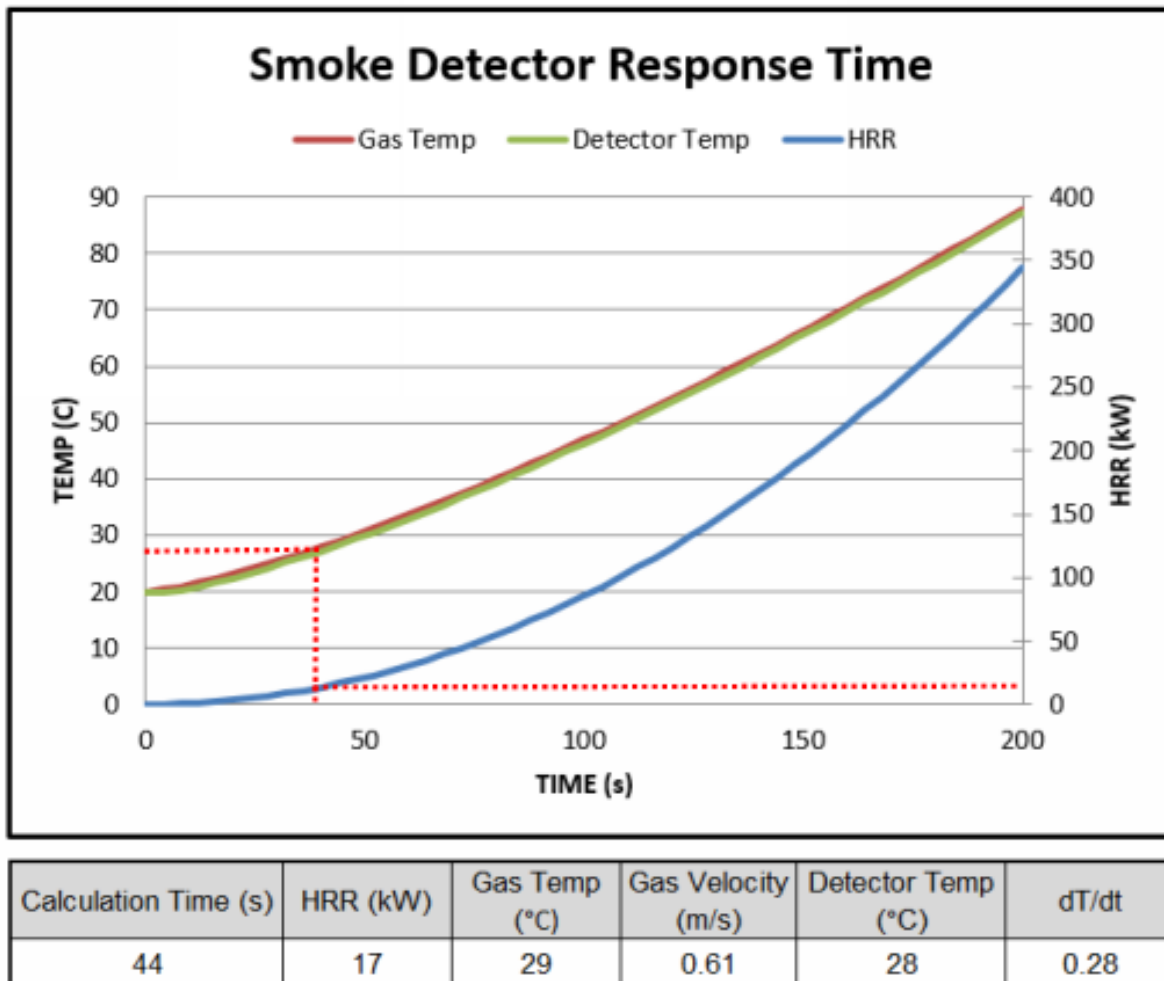


Figure 51 – D3ETACT Results – Smoke Detector Response Time

Based upon the results shown in Figure 51, typical BEQ living unit smoke detector is expected to actuate in approximately 44 seconds with an approximate HRR of 17 kW. As predicted, smoke detectors are more sensitive resulting in a faster response time compared to fire sprinklers. Upon smoke detection, the detector sounder base will activate a local audible alarm which provides notification to occupants within the living unit and those occupants near the room of origin.

Performance Criteria

The facility shall meet the goals and objectives as previously specified for each fire scenario evaluated in this report. Any occupant who is not intimate with ignition shall not be exposed to instantaneous or cumulative untenable conditions. (NFPA 101 Section 5.2)

Tenability Requirements

The primary sources of incapacitation or death during and immediately following fires are exposure to heat and toxic gases.

Exposures to heat result in heat stroke, skin and respiratory tract burns, and is dependent upon relative humidity levels. The tenability limits with respect to heat exposure should be less than 2.5 kW/m² and/or 60°C.⁹

With respect to products of combustion and toxic gases, e.g. carbon monoxide (CO), hydrogen cyanide (HCN), low oxygen (O₂), and carbon dioxide (CO₂), incapacitation and death depends on the concentration levels and exposure times. Lethal concentrations of CO are the most common and can be generated in the immediate vicinity of the fire within 10 minutes, but elsewhere in the room may take hours.⁹ Therefore, long exposure times to CO are not anticipated to occupants who are not already incapacitated. The tenability limit with respect to CO exposure should be less than 6000 ppm.⁹

Obscuration to visibility due to smoke is related to the concentration, which is typically expressed as optical density per meter or as the extinction coefficient. The human response to obscuration, and the subsequent inability to escape, depends on the familiarity the occupants have on their surroundings. Suggested tenability limits for optical density have ranged from 0.5/m (2 m visibility), for occupants of small rooms who are familiar with escape routes, to about 0.065/m (15 m visibility), for large enclosures in which occupants are unfamiliar with their surroundings.¹⁰ Based on this range, the tenability limit with respect to smoke obscuration should be more than 5 m visibility due to the familiarity the occupants have with their surroundings.

Fire Scenarios

The fire scenarios addressed in this performance-based evaluation are limited to the Bachelor Enlisted Quarters (BEQ). The BEQ living unit was determined to be a location where the occupants were most vulnerable; a place of rest and sleep. Alternatively, the Common Building is a standalone structure located approximately 20 ft. from the BEQ, which houses laundry services and a community center. Even though there are many specific fire hazards and risks associated with the Common Building design, the BEQ was the primary focus of this performance-based evaluation. It is noted that Common Building prescriptive requirements of the Life Safety Code were found to meet or exceed the minimum requirements.

Room of Origin

- Typical BEQ Living Unit as described previously.

Location of Design Fire

- Twin Lift-Top Bed with Mattress, Two Drawers, and Storage Headboard
 - 82 in. x 41 in. x 26 in.
- Polyurethane foam spring mattress with PVC ticking material.

Ignition Source

The Fire Analysis and Research Division of NFPA reports that “in 2005-2009, U.S. fire departments responded to an estimated annual average of 3,840 structure fires in dormitories, fraternities, sororities, and barracks (Bachelor Enlisted Quarters) that resulted in 3 civilian deaths, 38 civilian fire injuries, and \$20.9 million in direct property damage, annually.”

The leading causes of fire in this type of facility based on NFPA research is shown in Figure 52.

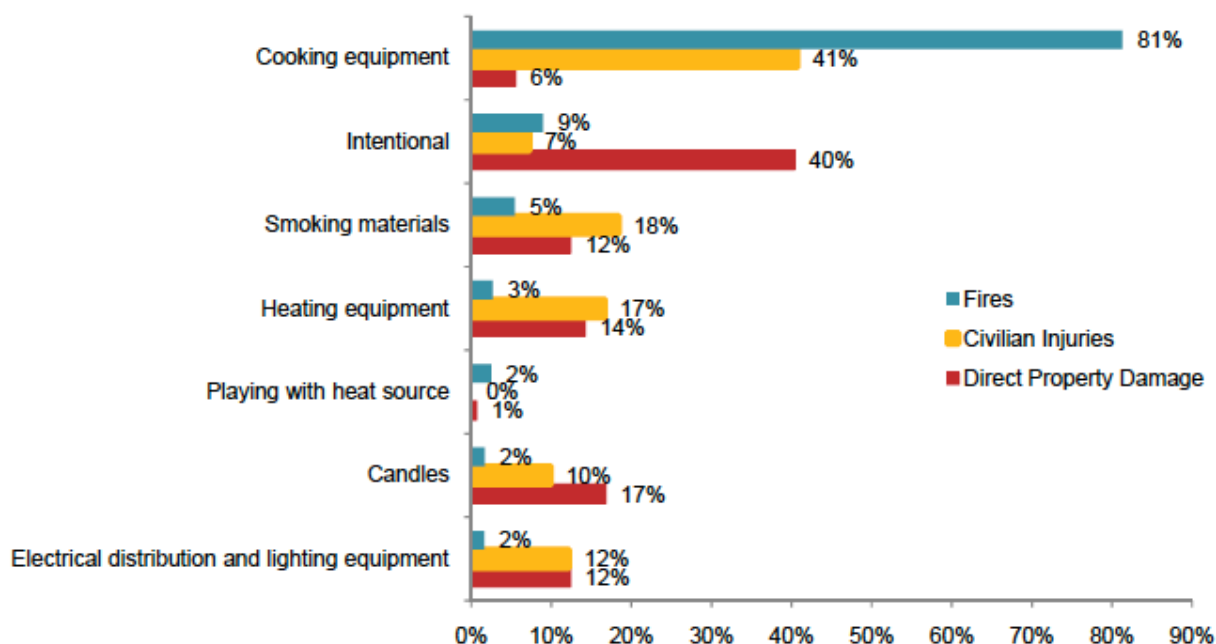


Figure 52 – Leading Causes of Fire4

Since cooking equipment is not provided within the BEQ living units, other potential ignition sources were considered. Cigarettes and other lit tobacco products are the number one cause of fire deaths in the U.S., killing nearly 1,000 people and injuring approximately 1,500 Americans each year.²

Tobacco use is a serious problem in the U.S. military. Active-duty military personnel smoke at much higher rates than the general population. In 2005, 32 percent of active-duty personnel smoked compared to about a 21 percent rate for the general population.¹ With these statistics in mind, the fire scenarios were established based upon the assumption either an accidental or intentional fire was ignited by smoking materials or playing with a heat source (matches or lighter).

An argument could be made that candles could also be a potential ignition source. Either way, a slow to medium developing (smoldering) fire is anticipated based upon the burning characteristics of commercially available polyurethane foam mattresses.

Consider the typical interior furnishings of a BEQ living unit shown in Figure 53.



PGAL Architecture

Figure 53 – Typical BEQ Living Unit

A benchmark was established by modeling the BEQ living unit with all prescriptive requirements in place and functioning properly; i.e. active and passive fire protection systems and features. For all fire scenarios, assume design fire develops as a t-squared fire with a fire growth coefficient, α of 0.0086 kW/s², CO yield of 0.028 g/g, and a soot yield of 0.010 g/g.¹²

Fire Scenario No.1

With all **prescriptive requirements in place and functioning properly**, the design fire as previously described ignites on top of bed (mattress/bedding). Smoke detection and sprinkler activation is anticipated, as well as adequate fire resistance from building materials.

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Fire Scenario No.2

Additional ventilation introduced to the room of origin through an **open window**. With all prescriptive requirements in place and functioning properly, the design fire as previously described ignites on top of bed (mattress/bedding) and develops as previously described. Smoke detection and sprinkler activation is anticipated, as well as adequate fire resistance from building materials.

Fire Scenario No.3

With an **unreliable or malfunctioning fire-rated door (open door)** at corridor, while all other prescriptive requirements in place and functioning properly, the design fire as previously described ignites on top of bed (mattress/bedding) and develops as previously described. Smoke detection and sprinkler activation is anticipated. Based upon the fire growth, a **reduction in the number of available means of egress** is anticipated.

Predicting Flashover

The living unit is a confined space that controls the air supply and thermal environment of the fire scenarios. Ventilation is needed to maintain the fire growth.

The living unit has many sources of ventilation, i.e. door, window, and environmental air ducts. These factors control the fire scenarios growth, burning rates and duration. For purposes of this analysis, two ventilation scenarios were utilized.

- Open Door
- Open Window

It is noted that mechanical ventilation is present within a typical BEQ living unit. For purposes of predicting flashover, mechanical ventilation was not included. However, mechanical ventilation was included in the computer-based simulations.

The McCaffrey, Quintiere, and Harkleroad (MQH) method for predicting the heat release rate (HRR) required for flashover was utilized. Based upon the ventilation scenarios, the estimated HRRs required for flashover were determined to be following:

	Closed Door Open Window	Open Door Closed Window
HRR at Flashover, Q (kW)	1521	2005
Room Temperature at Flashover, T (°C)	435	518
Time to Reach Flashover, t (sec)	421	483
Area of Opening, A _o (m ²)	1.4	1.9
Height of Opening, H _o (m)	1.2	2.1
Total Area of Room, A _T (m ²)	131	131

Figure 54 – MQH Predicted HRR at Flashover

A deterministic time marching approach was utilized to model the estimated HRR. The associated room temperatures were calculated utilizing MQH correlations, and the results were evaluated until the estimated HRRs were reached.

Preventing flashover conditions is imperative to limiting damage to the room of origin. In general, flashover is the transition between the developing fire and the fully developed fire. For purposes of this analysis, assume flashover begins when the gas temperatures within the living unit reach 500°C. Based on Figure 54, fire scenario 3 (open door) is the only scenario where the gas temperatures could exceed 500°C.

Based upon the DETACT analysis, the gas temperature within the living unit when the sprinkler activates is approximately 90°C. Assuming fire sprinkler activation within the living unit controls the fire's growth, flashover is not anticipated.

Fire Dynamics Simulator (FDS) Observations

This performance-based evaluation utilized computational fluid dynamics (CFD) modeling software, Fire Dynamics Simulator (FDS) to support the mathematical correlations and to demonstrate the tenable environment for which occupants evacuate within. FDS solves numerically a form of the Navier-Stokes equations appropriate for low-speed, thermally driven flow with an emphasis on smoke and heat transport from fires. A separate visualization program, Smokeview was utilized to display the results of the FDS simulation.⁸

Refer to Appendix J for FDS input files.

Heat Release Rate (HRR)

The FDS input file specified a t-squared fire growth utilizing a ramp function based upon the design fire heat release rate curve. The HRR curve produced by FDS is illustrated in Figure 55.

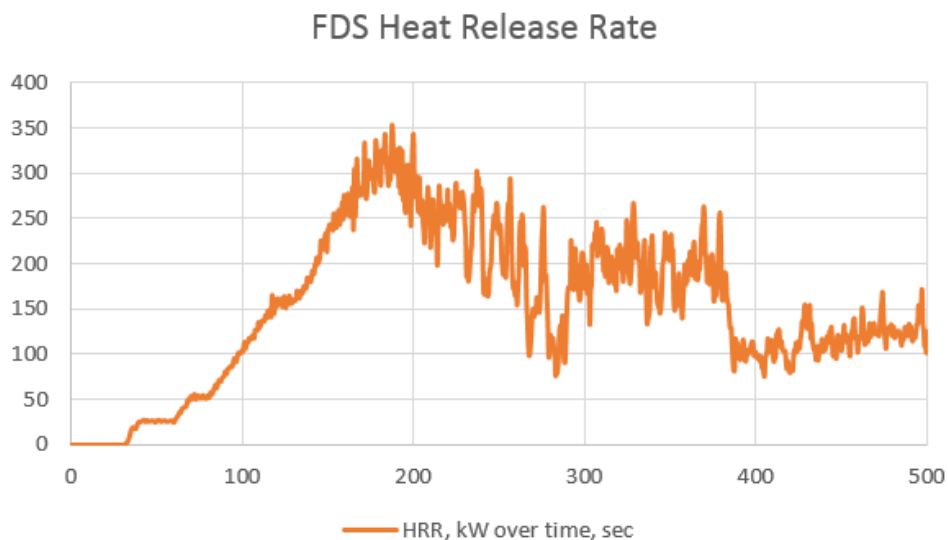


Figure 55 – FDS Heat Release Rate (HRR)

Smoke Detector Response Time

Based on the results shown in Figure 51, the DETACT model predicted smoke detection in approximately 44 seconds (at an approximate HRR of 17 kW). Figure 56 shown below, illustrates an FDS slice for temperatures at an elevation of 2.8 m (elevation of smoke detector). Based on FDS observations shown in Figure 56, smoke detection is anticipated at approximately 50 seconds.

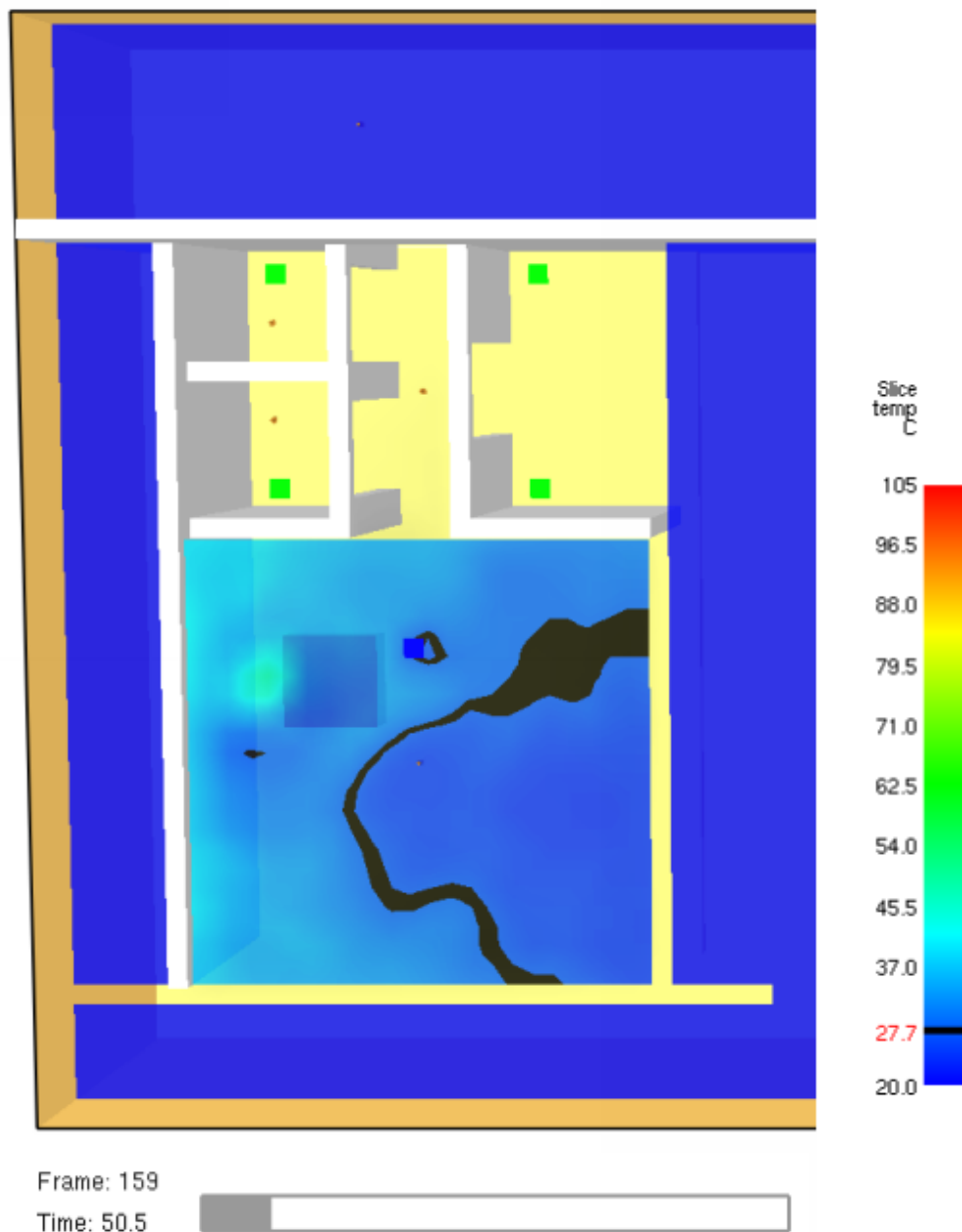


Figure 56 – FDS Smoke Detector Response Time

As shown in Figure 56, the temperatures near the smoke detector at 50 seconds appear to be warm enough to activate the smoke detector assuming an activation temperature of 28°C. Notice the temperature scale located on the right side of Figure 56. A temperature of 27.7°C (~28°C) was selected on the temperature scale. This feature of Smokeview helps illustrate the high and low temperature range at a selected temperature and time frame. In this case, a black line appears within the living unit which will vary its location depending on the time frame being analyzed. As indicated above, at approximately 50 seconds, the temperatures to the left of the black line are above 28°C, and the temperatures to the right are below 28°C. This method of illustrating FDS simulated results is repeated for other analyzed condition, e.g. visibility and CO exposure.

Sprinkler Response Time

Lagrangian particles are used in FDS to represent water droplets discharged from fire sprinklers. The droplets are a visual indication the sprinkler thermal element has reached its activation temperature.⁸

As previously indicated, an RTI value of 50 (m-s)^{1/2} was specified as an FDS input parameter.

As shown in Figure 57 below, the sprinkler located within the living unit activates at approximately 160 seconds, which was 36 seconds sooner than the DETACT model predicted.

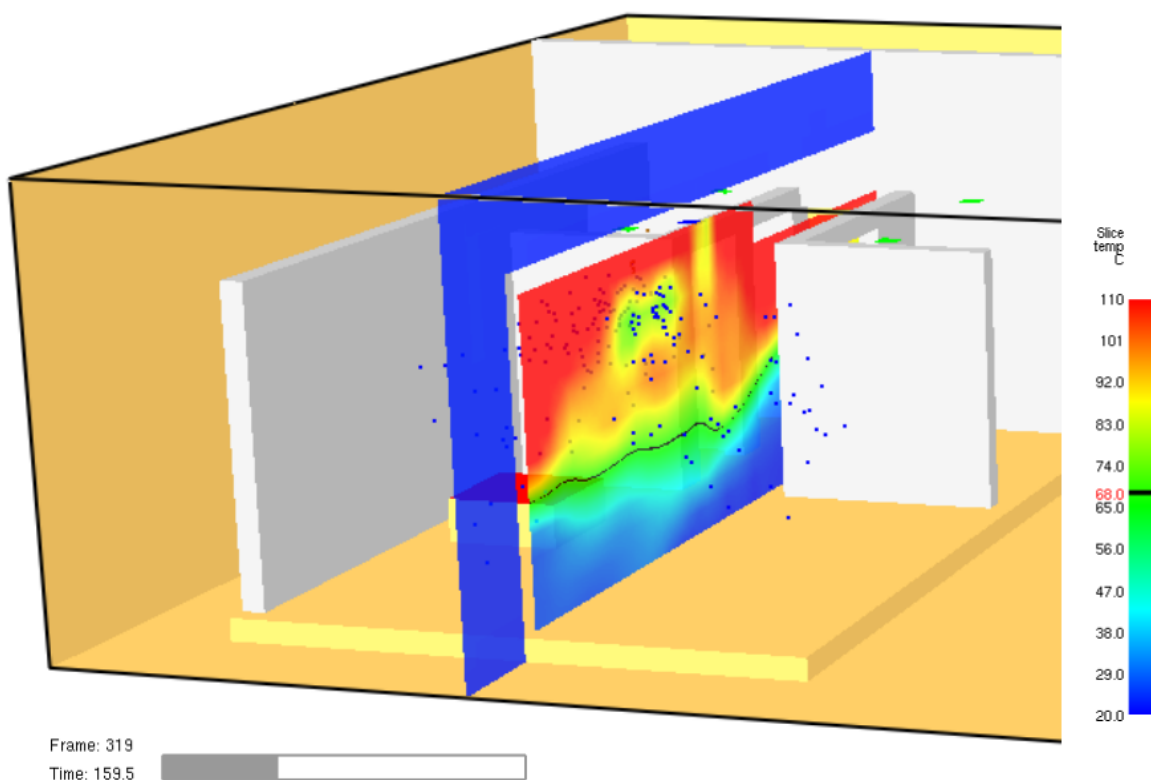


Figure 57 – FDS Sprinkler Response Time

As previously indicated, the DETACT model only considers convective heat transfer between the ceiling jet and the detector; no conductive loss or radiative heat transfer is considered. Also no transport time (or lag time) is considered for the hot gases to travel within the living unit. For each heat release rate time interval, the heat release rate is averaged over the interval and assumed constant.¹¹

FDS on the other hand is simultaneously solving differential equations over a grid of small cells. All forms of heat transfer are considered across each cell; therefore, a faster response time is expected.

Tenability Performance

Similar to sprinkler and detector response time, Smokeview was utilized to display the tenability performance within the FDS model.

Temperature

Figure 58 illustrates the temperature within the BEQ living unit at 120 seconds. Based on smoke detection and local notification provided at 50 seconds, an occupant intimate with the initial fire development has had approximately 70 seconds to evacuate to the room of origin before temperatures begin to exceed 60°C (at an approximate 1 ½ m elevation). The black line shown in Figure 58 represents 60°C.

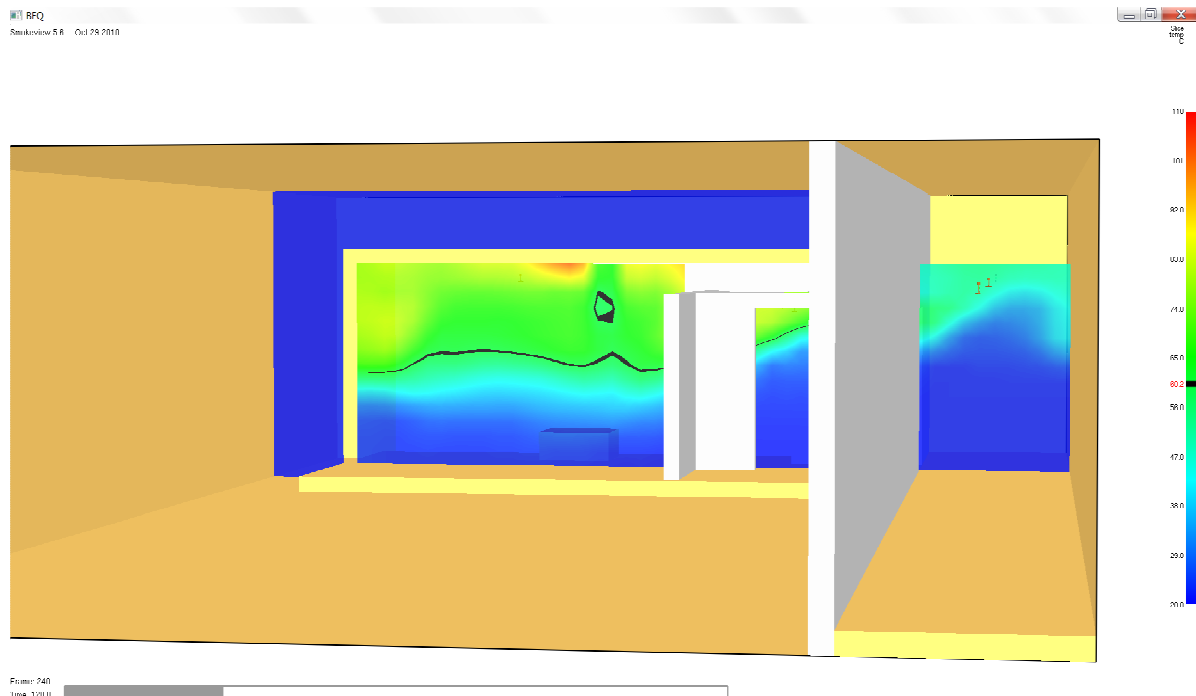


Figure 58 – FDS Temperature within BEQ Living Unit @ 120 Seconds

The temperatures experienced within the corridor are illustrated in Figures 59 and 60. The black lines represent 60°C.

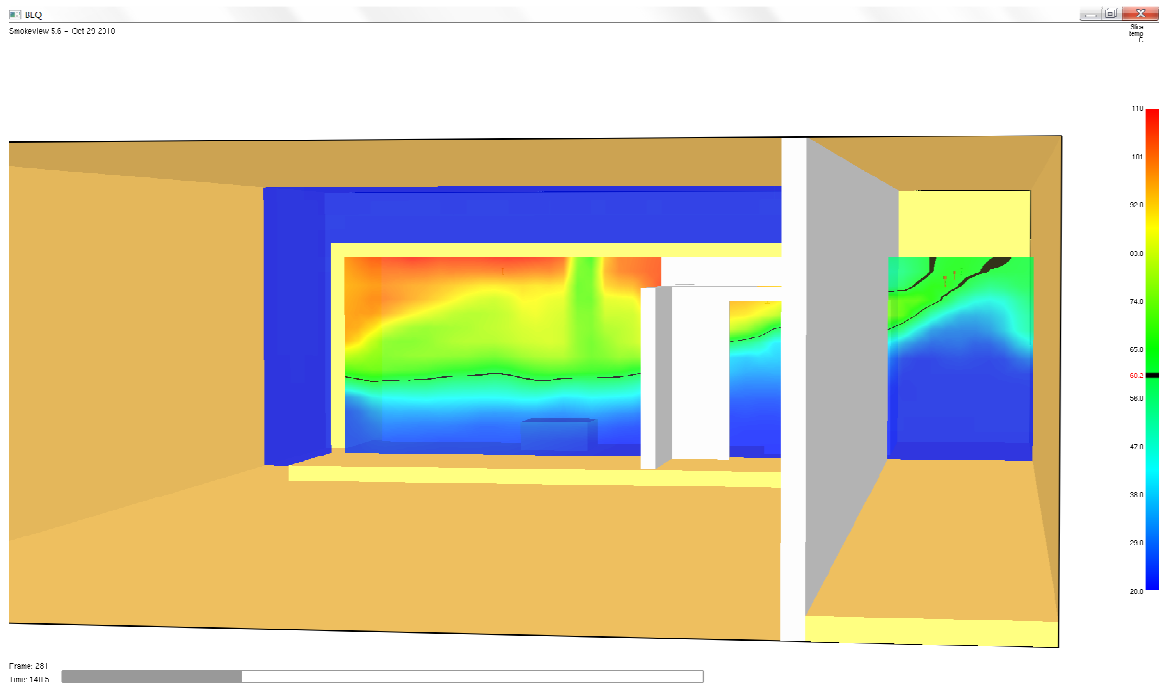


Figure 59 – FDS Temperature at Corridor Door @ 140 Seconds

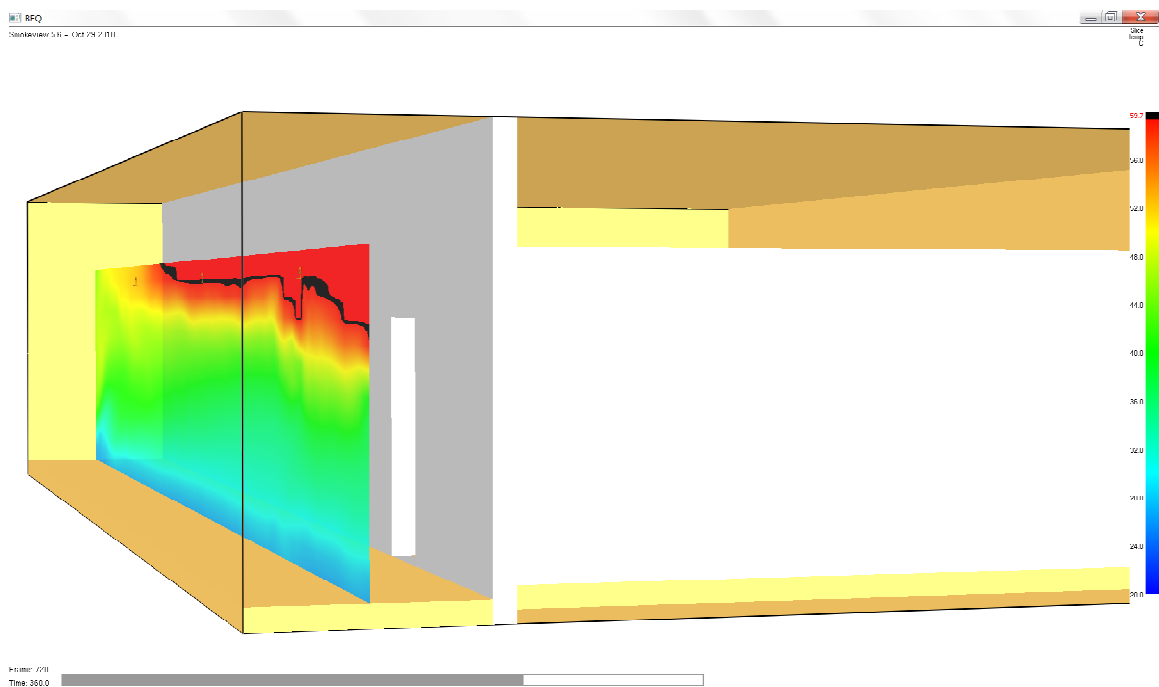


Figure 60 – FDS Temperature within Corridor @ 360 Seconds

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As shown in Figure 59, temperatures above 60°C begin to flow out of the living unit and into the corridor. Depending on the BEQ module configuration, a living unit fire located adjacent to an exit could prevent occupants from egressing in that direction. For purposes of this analysis, a reduction in the number of available means of egress by one occurs at approximately 140 seconds.

Temperatures within the corridor eventually elevate to untenable conditions as shown in Figure 60. At approximately 360 seconds, temperatures within the corridor begin to exceed 60°C at an approximate 2 ½ m elevation.

Based on FDS temperature observations, occupants not intimate with the initial fire development will not be exposed to temperatures exceeding 60°C.

Carbon Monoxide (CO)

As predicted, exposure to carbon monoxide (CO) was negligible. Figures 61 and 62 illustrate the CO exposure within the living unit, and Figure 63 the exposure within the corridor. Based on FDS observations, occupants did not experience untenable CO conditions. As shown in Figure 61, the CO exposure observed within the living unit at 120 seconds was approximately 60 ppm, which is well below the tenable limit for CO exposure.

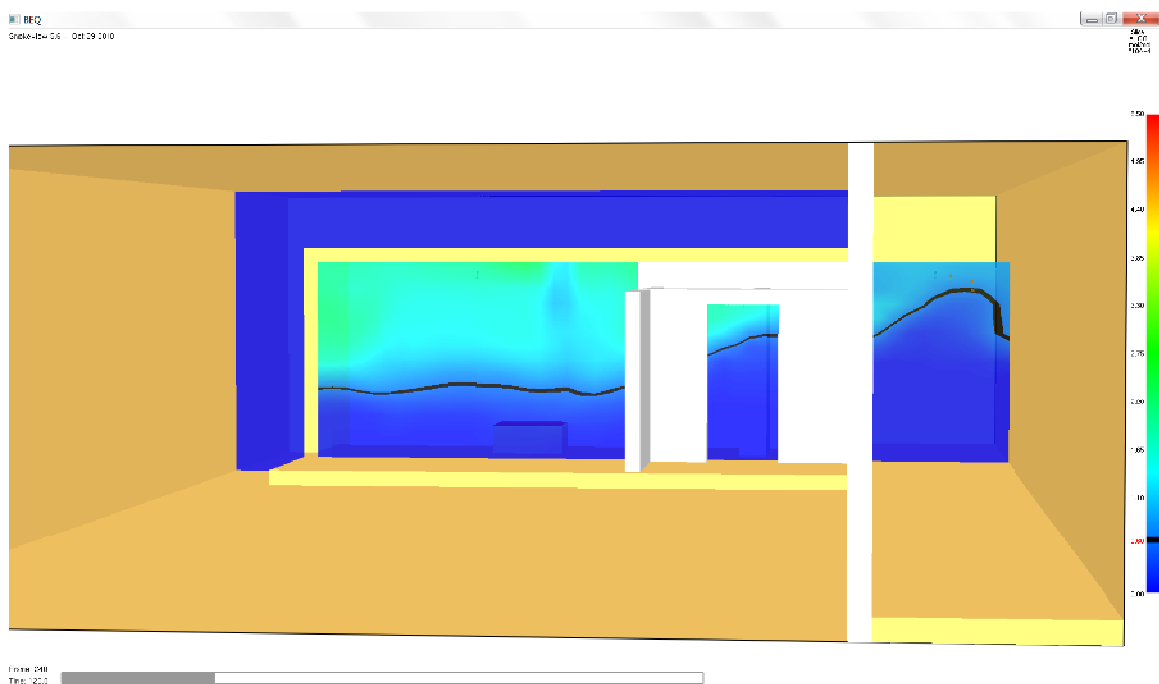


Figure 61 – FDS CO within Living Unit @ 120 Seconds

As shown in Figure 62 on the next page, the CO exposure observed within the living unit at 360 seconds was approximately 400 ppm, which again is well below the tenable limit for CO exposure.

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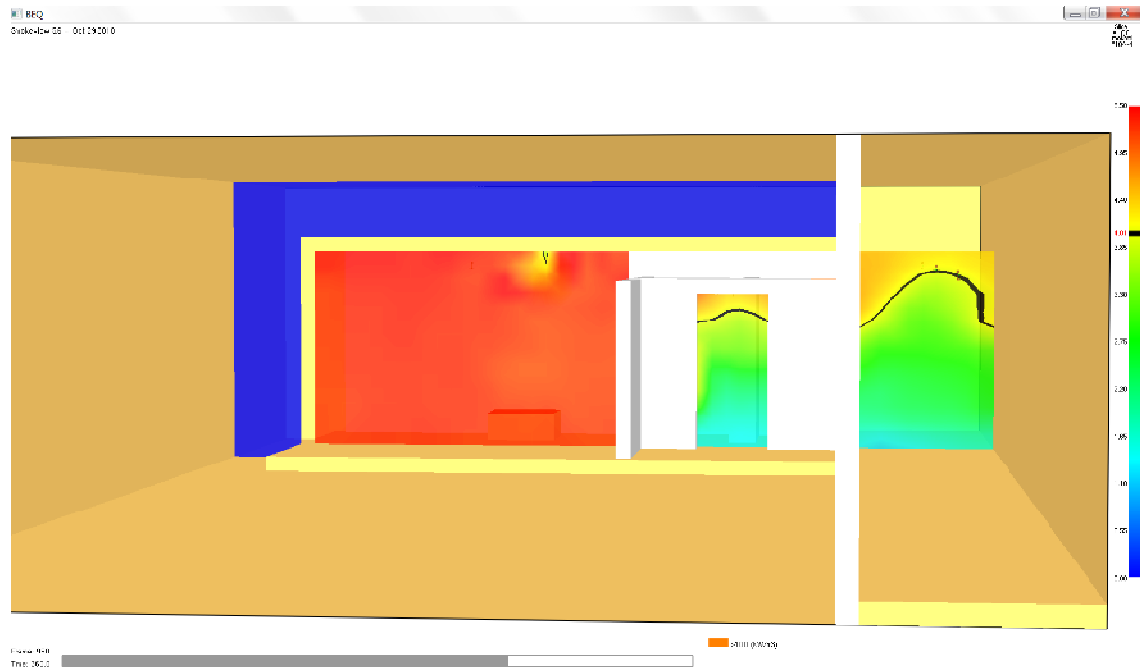


Figure 62 – FDS CO within Living Unit @ 360 Seconds

As shown in Figure 63, the CO exposure observed within the corridor at 360 seconds was approximately 300 ppm, which again is well below the tenable limit for CO exposure.

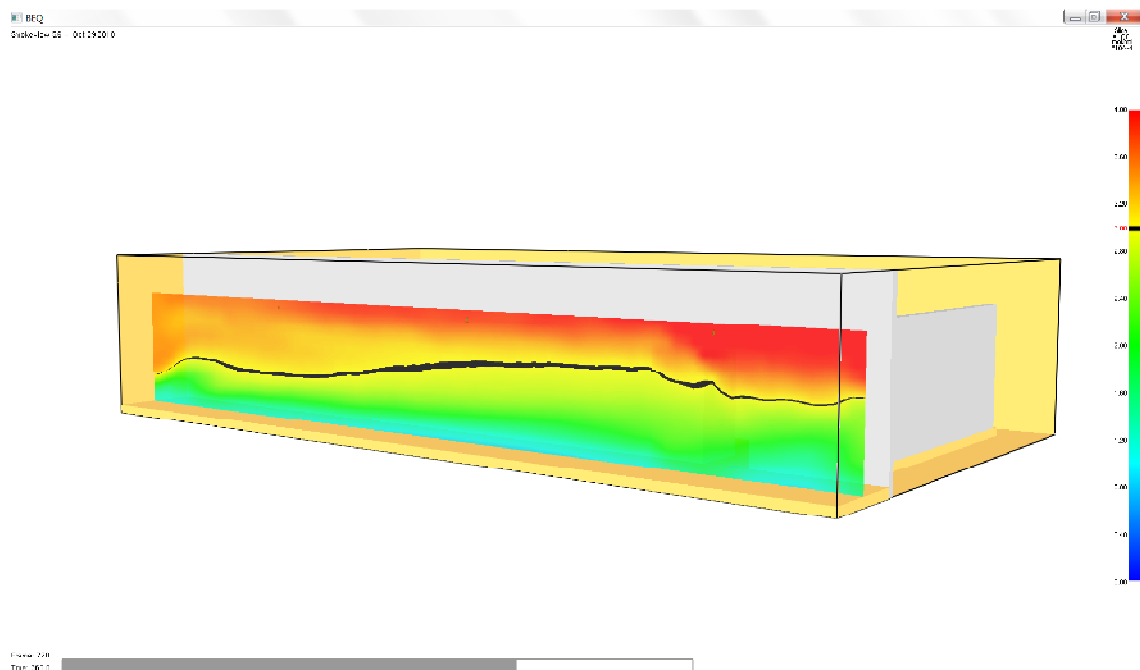


Figure 63 – FDS CO within Corridor @ 360 Seconds

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Visibility

Based on FDS observations shown in Figure 61, the visibility experienced at 1 m within the living unit begin to decrease below 5 m at 160 seconds. This happens to be the same time the sprinkler activates within the BEQ living unit. The black lines represent a visibility of 5 m.

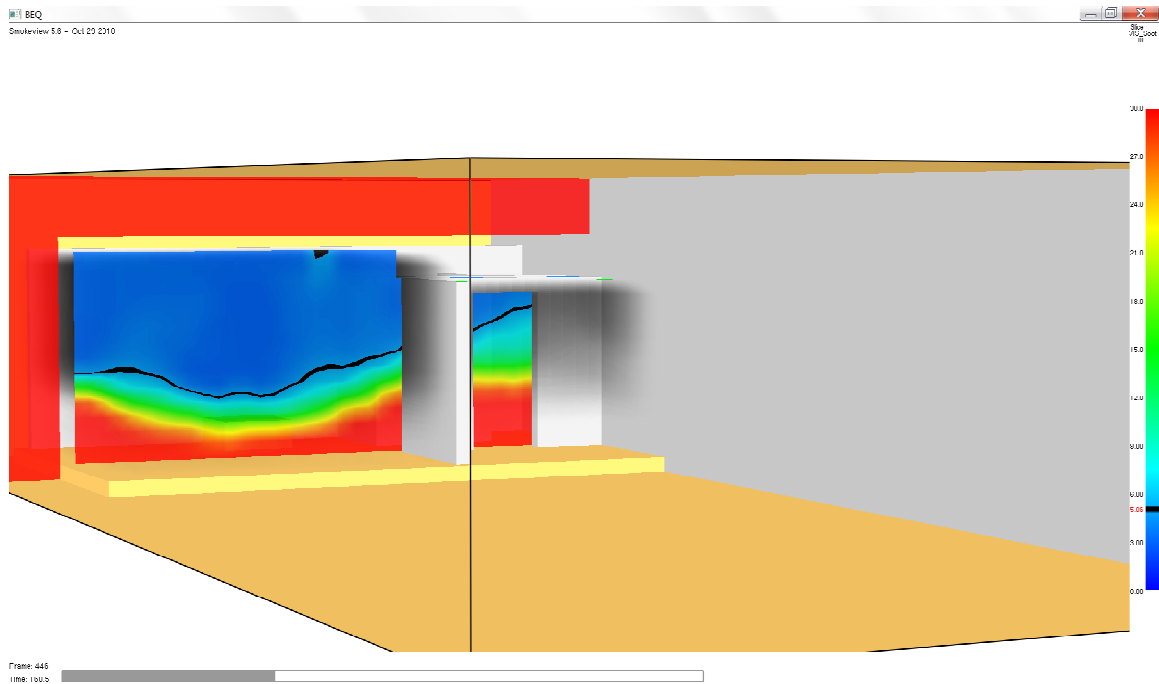


Figure 61 – FDS Visibility within BEQ Living Unit @ 160 Seconds

Shown on the next page, Figures 62 and 63 illustrate the visibility experienced within the corridor. As shown in Figure 62, the visibility at 2 m within the corridor at 240 seconds begins to decrease below 5 m.

Figure 63 illustrates the visibility at 1 m within the corridor at 300 seconds begins to decrease below 5 meters. At this point occupants not intimate with the initial fire development and are still located within the BEQ module affected by the fire, are exposed to limited visibility. The soot particles in the air will cause eye irritation and burning, as well as respiratory ailments. The occupant's walking speed will dramatically decrease, and most likely forcing the occupant to their knees as they attempt to locate the exit door. 300 seconds was determined to be the required safe egress time (RSET).

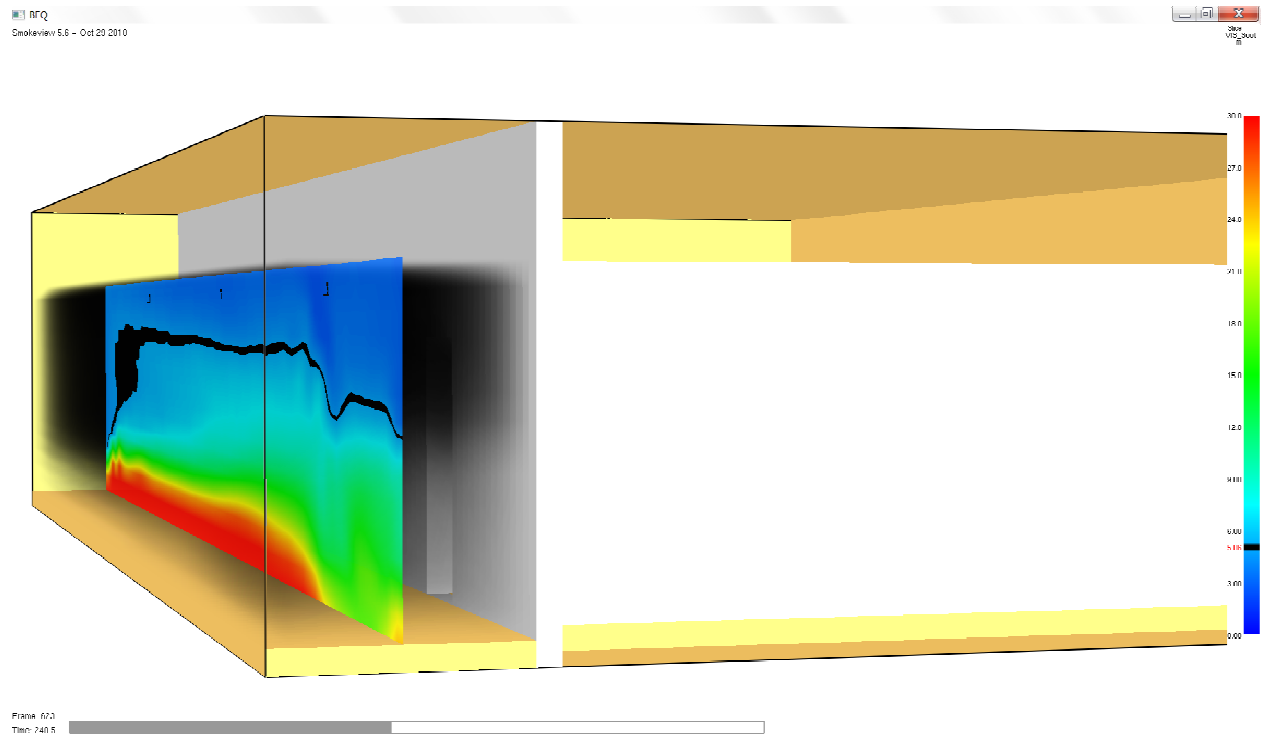


Figure 62 – FDS Visibility at 2 meters within Corridor @ 240 Seconds

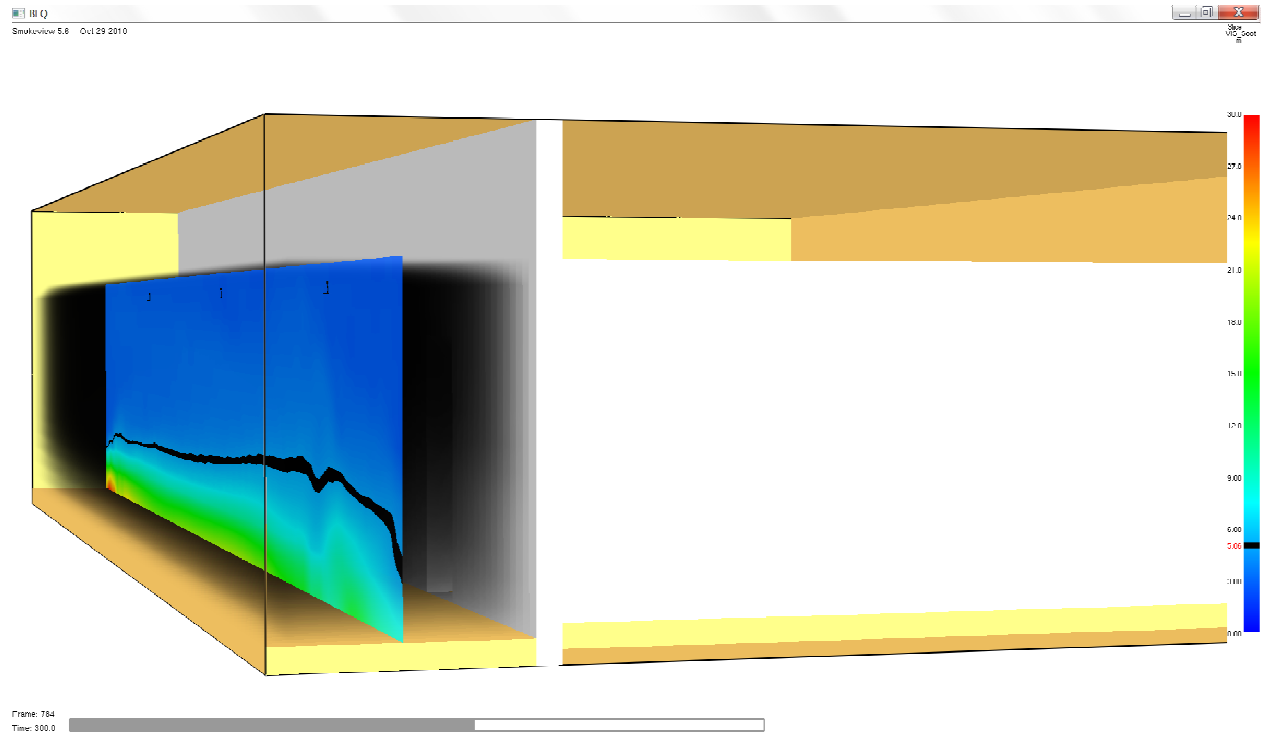


Figure 63 – FDS Visibility at 1 meter within Corridor @ 300 Seconds

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Summary of FDS Observations

- Smoke Detector Response Time ~50 seconds (local alarm active)
- Sprinkler Response Time ~160 seconds (60 second time delay – flow switch)
 - Building Evacuation Alarm ~220 seconds
- Exposure within Living Unit
 - Temperatures at 2 meters begin to exceed 60°C ~120 seconds
 - CO exposure did not exceed 6000 ppm
 - Visibility at 2 meters begins to exceed 5 meters ~160 seconds
- Exposure within Corridor
 - Temperatures at corridor door begin to exceed 60°C ~140 seconds
 - Exit near living unit becomes unavailable
 - Temperatures at 2 meters begin to exceed 60°C ~360 seconds
 - CO exposure did not exceed 6000 ppm
 - Visibility at 2 meters begins to exceed 5 meters ~240 seconds
 - Visibility at 1 meter begins to exceed 5 meters ~300 seconds

Estimated Evacuation Time

The following evacuation time analysis was performed in accordance with NFPA HB Section 4, Chapter 2.

Table 12 – Egress Component Analysis per NFPA HB
Egress Component Analysis – BEQ

Egress Component	Clear Width (in.)	Boundary Layer (in.)	W _E Effective Width (in.)	W _E Effective Width (ft.)
Corridor	67	16	51	4.25
Corridor Doors	34	12	22	1.833
Main Entrance Doors	68	12	56	4.667
Stairs	51	12	39	3.25

Table 12 – Egress Component Analysis per NFPA (continued)
Egress Component Analysis – Common Building

Egress Component	Qty.	Clear Width (in.)	Boundary Layer (in.)	W _E Effective Width (in.)	W _E Effective Width (ft.)
Main Entrance Doors	3	68	12	56	4.667
Side Door	1	34	12	22	1.833
Mezzanine Stair	1	37	12	25	2.083

Table Note:

1. The effective width was determined by subtracting the boundary layer from the clear width in accordance with NFPA HB Table 4.2.4.

Calculated Flow

The calculated flow, F_C is the predicted flow rate of occupants passing a particular egress component. The flow capacity was determined by the following equation:

$$F_C = F_S W_E \text{ (SFPE Equation (4) page 4-60)}$$

The calculated flow for each egress component is summarized in tables on the next page.

Table 13 – Calculated Flow per Egress Component
Calculated Flow – BEQ

Egress Component	F _{SM} Maximum Specific Flow (occ./min/ft of effective width)	F _C Calculated Flow (occ./min)	Most Restrictive Egress Component
Corridor	24	102	
Corridor Doors	24	44	X
Main Entrance Doors	24	112	
Stairs	18.5	60.125	

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Table 13 – Calculated Flow per Egress Component (continued)
Calculated Flow – Common Building

Egress Component	F_{SM} Maximum Specific Flow (occ./min/ft of effective width)	F_C Calculated Flow (occ./min)	Most Restrictive Egress Component
Main Entrance Doors	24	112	
Side Door	24	44	
Mezzanine Stair	18.5	38	X

Table Note:

1. F_S is assumed to be equal to F_{SM} (SFPE Table 4.2.8)

Travel Distance and Speed Between Floors

The evacuation speed of a group is a linear function of population density. The evacuation speed used to determine the travel time between floors was determined by the following equation:

$$S = k - akD \text{ (SFPE Section 4, Chapter 2)}$$

From NFPA HB Table 4.2.5, $a = 2.86$ and $k = 212$ (stairs). The maximum specific flow occurs when the density is 0.175 occ./sq-ft. (SFPE Section 4, Chapter 2)

$$S = 212 - 2.86 \times 212 \times 0.175 = 105.9$$

The travel distance between floors was determined by using the conversion factor from SFPE Table 4.2.6 by converting the vertical rise of a stair to travel distance, and by adding travel distance on landings.

$$\begin{aligned} \text{Travel Distance Between BEQ Floors} &= 12 \times 1.85 + (2 \times 8) = 38.2 \text{ ft} \\ \text{Travel Distance for Mezzanine Stair} &= 12 \times 1.85 = 22.2 \text{ ft} \end{aligned}$$

The travel time per level of stair for BEQ occupants moving with the flow was calculated to be 21.6 seconds per floor. The travel time for the mezzanine stair occupants moving with the flow was calculated to be 12.6 seconds.

Estimated Evacuation Time

The evacuation time was determined by the following equation:

$$T_P = \text{Occupant Load} / F_C \text{ (SFPE Section 4, Chapter 2)}$$

Table 14 – Estimated Evacuation Time per NFPA HB
Estimated Evacuation Time – BEQ

Occupant Load Above 1 ST Floor	Number of Exits	F _C Calculated Flow (occ./min)	Travel Time Between Floors (min)	Estimated Evacuation Time (min)
368 Occupants	11	44 x 11 = 484	0.36	1.12 (67 sec.)

Estimated Evacuation Time – Common Building

Occupant Load Above 1 ST Floor	Number of Exits	F _C Calculated Flow (occ./min)	Travel Time Between Floors (min)	Estimated Evacuation Time (min)
196 Occupants Main Level	4	(112 x 3) + 44 = 380	N/A	0.52 (31 sec.)
41 Occupants Mezzanine	1	38	0.21	1.29 (77 sec)

Based on the calculations above the estimated total building evacuation time is approximately 77 seconds.

Computer-Based Evacuation Model

A simulated evacuation model was developed using Pathfinder to validate the above calculations. The model was used to determine the estimated evacuation time of each floor. As suggested by NFPA HB Table 4.2.1, a delay time of 30 seconds was included in the model. The suggested delay time was derived from actual unannounced drills with poor alarm performance.

In 2008, The Associated Press reported that large numbers of soldiers and Marines are coming home from deployments with permanent hearing loss and ringing in their ears.⁶

A 30 second delay was determined to be appropriate.

Kyle Leadon, EIT

The delay also represents a period of time used by the occupants to gather information about the severity of the event, and the mass notification system has an opportunity to provide evacuation instructions specific to the fire or emergency event.

The results of the simulated evacuation model conclude that approximately 64 seconds to evacuate the Common Building due to the assembly use and occupant load. The residential portion of the simulation was used to determine the time required for the occupants to evacuate to the nearest protected exit. The building egress layout provides occupants at least two means of egress with relative short travel distances to protected exits. Based on the assumption that all exits are available the BEQ occupants evacuated each floor in approximately 45 seconds (including 30 sec. delay). The results are comparable to the hand calculation shown above.

Refer to Appendix K for tabulated simulation results.

Factors Affecting Evacuation Times

The design and operational features of the facility shall provide means to reduce pre-movement times during evacuations. Fire protection systems and life safety features include:

- Automatic Fire Sprinklers
- Portable Fire Extinguishers
- Fire Alarm and Detection System
- Emergency Lighting and Exit Signs

The smoke detection and mass notification systems provide means to reduce pre-movement times in evacuations based upon their ability to notify the occupant of a fire event. Occupant awareness cue research has shown that the effectiveness and of the temporal-three evacuation signal in combination with a pre-recorded or live female voice message. (NFPA HB Section 4, Chapter 1)

Pre-recorded evacuation messages and a remote microphone for live messages provide means for early occupant notification in fire and emergency events. It has been reported by the Department of Veterans Affairs, that hearing loss is the number one disability in the war on terror.⁶ Impaired hearing delays response time by reducing the effectiveness of the mass notification system.

NAVFAC – SW Central IPT, Fire protection Engineers and MCBCP Fire Department have recently conducted live simulated fire drills at several BEQ complexes. Many of the residents failed to evacuate for a number of reasons. Many ignored the fire alarm signals and remained in place because they assumed the fire alarm signal was a false alarm. Others wondered the BEQ investigating the situation.

In studies of real fires, many occupants decide to help fight the fire rather than immediately evacuate. The MCBCP Fire Department prefers occupants to evacuate and initiate general building evacuation in lieu of fighting a fire within this type of occupancy. To help control their desire, portable fire extinguishers will only be provided in locations monitored or attended by staff.

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Conclusion

The Bachelor Enlisted Quarters (BEQ) analyzed in this report was design and constructed in accordance with the applicable criteria. The applicable prescriptive-based design requirements outlined in the building and life safety codes were summarized, as well as a detailed description of the active and passive fire protection systems were provided.

The performance-based analysis presented in this report focused on evaluating the effectiveness of the prescriptive-based requirements. The evaluation determined the required safe egress time (RSET) to be 300 seconds based on untenable visibility conditions within the corridor. Upon smoke detection, a local audible alarm notifies the occupants within the living unit to egress. For occupants not intimate with the initial fire development, the building evacuation alarm is activated upon fire sprinkler water flow. After a 60 second delay (base fire department requirement), the building evacuation alarm is initiated at 220 seconds. Based on estimated evaluation times, the available safe egress time (ASET) was determined to be 285 seconds, which is less than the required safe egress time.

The design goal for the BEQ was to ensure the occupants are provided with an environment that is reasonably safe from fire. We accomplished this goal by improving the survivability of occupants located inside the living unit, and by protecting occupants located outside of the living unit and module. By maintaining the active and passive fire protection systems throughout the BEQ, occupants should remain safe from fire.

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In addition to the applicable criteria identified within this report, the following references were utilized.

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Appendix A – Fire Resistive Construction



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Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the BOCA® *National Building Code*/1990, the 1988 *Standard Building Code*® with 1989/1990 Revisions, the 1988 *Uniform Building Code*™ with 1990 Accumulative Supplement

DIVISION: 09—FINISHES

Section: 09260—Gypsum Board Assemblies

REPORT HOLDER:

USG CORPORATION
550 WEST ADAMS STREET
CHICAGO, ILLINOIS 60661

EVALUATION SUBJECT:

USG Drywall Shaft Partition Systems

1.0 SUBJECT

USG® Drywall Shaft Partition Systems

2.0 PROPERTY FOR WHICH EVALUATION IS SOUGHT

Fire Resistance

3.0 DESCRIPTION

CAVITY SHAFT WALL SYSTEMS

A. One-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs may be used for closure panels at end walls or columns. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with 1⁵/₈-inch Type S screws 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. A single ply 5/₈-inch USG SHEETROCK FIRECODE® Type C gypsum panels installed vertically with 1 inch Type S screws 12 inches on center in field and at edges - 6 inches from top, bottom and ends. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on this ply, when required for decorative purposes.

B. Two-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runner.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H studs. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with 1⁵/₈ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. Gypsum panels attached as follows:
 - a. Base layer: 1/₂-inch SHEETROCK FIRECODE® TYPE C or 5/₈-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically with 1-inch Type S screws 24 inches on center in field and at edges.
 - b. Finish layer: 1/₂-inch SHEETROCK FIRECODE® Type C or 5/₈-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically or horizontally and attached with 1⁵/₈ inch Type S screws at 12 inches on center in field and at edges - 6 inches from top, bottom and ends. When applied vertically, the joints must be staggered with the joints in the base layer.

Joints and screw heads on outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound when required for decorative purposes.
5. Fire Damper (optional) (not shown) - 1¹/₂ hour curtain-type fire damper encased in a No. 22 gauge galvanized sleeve, installed in a 48 inches wide x 36 inches high opening framed with E-Studs and J-Runners. No. 16 gauge galvanized steel, 1¹/₂ inches x 1¹/₂ inches mounting angles are attached to the damper sleeve on the face layer side of the wall only around all 4 sides of the sleeve using 2 inch long No. 10 sheet screws 2 inches from each end and 6 inches o.c. The mounting angles must be installed such that

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an overlap of the wall of not less than 1 inch is maintained. The angles are secured to the framed opening with the same type of screws (2 screws on each side angle 3 inches from each end; 3 screws on each head and sill angle with 1 screw in the center and 1 at each end 3 inches from ends).

C. Two-Hour Cavity shaft Wall - Alternative (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG STEEL C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with 1⁵/₈ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. One-half-inch USG SHEETROCK FIRECODE® Type C or 5/8-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically and attached with 1-inch type S screws at 12 inches on center in field and at edges - 6 inches from top, bottom and ends. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on outer layer only, when required for decorative purposes. Vertical joint must be staggered on opposite sides of the walls.

D. Two-Hour Cavity Shaft Sound Wall (Nonload-Bearing) STC Over 50

1. Two and one-half-inch wide, minimum No. 25 gauge "J" floor and ceiling runners.]
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum is fastened at the ends with 1⁵/₈-inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. One and one-half-inch thick USG THERMAFIBER® Sound Attenuation Blanket.
5. One-half-inch SHEETROCK FIRECODE® Type C or 5/8-inch SHEETROCK FIRECODE® Type X gypsum panels applied vertically and attached with 1-inch Type S screws at 12 inches on center. Joints and screw heads are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound on outer layer only, when required for decorative purposes. Vertical joints in the base layer must be staggered with the vertical joints in the finish layer.
6. USG RC-1 resilient channels at 24 inches on center horizontally and attached with 3/8-inch panhead screws.

E. Three-Hour Cavity Shaft Wall (Nonload-Bearing)

1. Two and one-half-inch-wide, minimum No. 25 gauge "J" floor and ceiling runners.
2. One-inch-thick SHEETROCK brand Gypsum Liner Panels 24 inches wide - no screw attachment.
3. Minimum No. 25 gauge USG Steel C-H stud. Screws not required to attach stud to runner. E-shaped studs are used for closure panels at end walls or columns, or in lieu of C-H stud. (If "J" runners are used at end walls, the gypsum liner is fastened at the ends with 1⁵/₈ inch Type S screws, 12 inches on center.) The H-Section of C-H stud normally faces shaft.
4. Gypsum panels attached as follows:
 - a. Base layer: 5/8 inch SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally with 1 inch Type S screws at 24 inches on center in field and at edges.
 - b. Middle layer: 5/8 inch SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally with 1⁵/₈ inch Type S screws at 24 inches on center in field and at edges. When applied vertically the joints must be staggered with the base and finish layer joints.
 - c. Finish layer: 5/8 inch USG SHEETROCK FIRECODE® Type C gypsum panels applied vertically or horizontally and attached with 2¹/₄ inch Type S screws at 16 inches on center in field and at edges - 6 inches from top, bottom and ends.

Joint and screw heads on outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound systems, when required for decorative purposes.

SOLID AND VENT SHAFT SYSTEMS

F. Two-Hour 2-inch Solid Gypsum Partition (Nonload-Bearing)

1. No. 22 gauge metal angles.
2. One-half-inch USG SHEETROCK FIRECODE Type C gypsum panels laminated to core panels with SHEETROCK Setting Type Joint Compound.
3. One-inch USG V-Edge Gypsum Coreboard 2 feet 0 inch wide (attachment - No. 22 gauge angle: 1 inch Type S screws).
4. No. 22 gauge metal angles.

An alternative assembly sequence for F above: Where construction is limited to application of gypsum panels from one side, "L" runners are anchored to floor and ceiling with suitable attachments at 24 inches on center. If "L" runners frame an opening in concrete, a 2-inch-by-2-inch "L" runner is used to permit fasteners to be driven further from concrete edge. The 1 inch coreboard is fastened to angle runners with two 1¹/₄-inch Type S screws placed 3 inches in from each edge. Two layers of 1/2 inch USG SHEETROCK FIRECODE® Type C gypsum panels are laminated to one side of 1 inch coreboard with all

vertical joints being offset at least 3 inches. Joints need not be taped or finished on inside.

Alternative Construction: As an alternative for all of the above described constructions. Imperial Gypsum Base of the same thickness and core type shall be substituted for the gypsum panels. Joints on the face layer, other than the inside of shaft or duct partitions, may be covered with tape and the entire surface is covered with a minimum of $\frac{1}{16}$ inch of USG Veneer Plaster (Imperial or Diamond Interior Finish) in accordance with manufacturer's directions.

G. USG Cavity Shaft Wall System

To provide a fire-resistive protection to corridor ceilings or the underside of stairs.

USG "J" runners are attached to all existing horizontal and vertical framing intersected at the boundaries of the area to be protected. The "J" runners are attached to the existing framing members using mechanical fasteners spaced at a maximum of 24 inches on center and having an assigned design load of 200 pounds in either shear or pullout. USG C-H studs of the required gauge are attached to the "J" runners at 24 inches on center by means of two Types S-12, $\frac{1}{2}$ -inch panhead screws to frame the walls and/or soffits of the enclosures. Corners of the enclosure which do not intersect existing framing are built up of two "J" runners fastened together with two Type S-12, $\frac{1}{2}$ -inch panhead screws at 24 inches on center. The USG C-H studs are fastened to the "J" runners as previously described. One-inch-thick SHEETROCK brand Gypsum Liner Panels, 24 inches wide, is installed on the interior face of the enclosure within the slots of the C-H studs. No screw attachments are required. Where the Gypsum Liner Panel intersects the "J" runners against the existing horizontal and/or vertical framing, $\frac{5}{8}$ -inch Type S screws are installed at a maximum of 12 inches on center.

Gypsum panels are attached to the exterior surfaces of the framing in the manner required for the fire-resistive rating as follows:

1. One-hour construction consists of one layer of $\frac{5}{8}$ inch SHEETROCK FIRECODE® Type C gypsum panels applied parallel to the C-H studs, with all vertical joint on studs. The panels are fastened to each C-H stud and end "J" runners with 1-inch Type S screws 12 inches on center in the field and at edges. Joints and screw heads on the outer face panels are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound.
2. Two-hour construction consists of a base layer of $\frac{1}{2}$ -inch SHEETROCK FIRECODE® Type C panels applied parallel to the C-H studs and attached with 1-inch Type S screws at 24 inches on center in the field and at edges. The finish layer of $\frac{1}{2}$ -inch SHEETROCK FIRECODE® Type C panels are applied either parallel or normal to the C-H studs, with joints staggered 24 inches from the base layer. One and five-eighths-inch Type S screws at 12 inches on center in the field and at edges fasten the finish layer. Joints and screw heads on the outer layer only are finished with SHEETROCK Joint Tape and SHEETROCK Joint Compound.

H. USG Cavity Shaft Wall for Two-Hour Horizontal Membrane or Horizontal Duct Shaft Protection

Basically the same as described in paragraph "G" above, but uses three layers of $\frac{1}{2}$ inch SHEETROCK FIRECODE® Type C gypsum panels. (See Figure III-H at the end of this report.) The base layer is applied identical to the base layer described in item G.2. above. The second layer is applied the same as the base layer, except that joints are offset 24 inches and $\frac{5}{8}$ -inch type S screws are 4 inches on center. The face layer is installed perpendicular to the C-H studs with $2\frac{1}{8}$ -inch screws 12 inches on center. Butt joints in face layer fall between C-H studs and are secured with $1\frac{1}{2}$ -inch Type G screws 8 inches on center. Treatment of wallboard joints and fasteners is not necessary.

I. Materials

USG Steel C-H studs are roll formed from ASTM A 526 steel having a minimum yield strength of 33,000 psi.

Cement for laminating - SHEETROCK Setting Type Joint Compound.

For taping and sealing joints - SHEETROCK Joint Tape and SHEETROCK Joint Compound.

SHEETROCK FIRECODE® is a USG registered trademark for a Type X core gypsum panel. Type C is a USG trademark for an improved Type X core. USG Type C panels may be substituted for any Type X gypsum panel permitted by the code, provided the panel thickness is the same.

4.0 INSTALLATION

USG Drywall Shaft Partition Systems shall be installed in accordance with the fire rated assembly details and other information contained in this report.

5.0 IDENTIFICATION

Face panels are bundled in two panel groups and bound with a red, white and blue tape with panel designation printed on the tape.

SHEETROCK brand Gypsum Liner Panels are shipped unbundled in units with end banding. The face and back paper is green. The long edges are paper wrapped and have a $\frac{3}{8}$ -inch bevel on top and bottom edge. The back of each liner panel has an Underwriters Laboratories, Inc. Label that denotes UL design U438, lists USG File No. R 1319 and identifies the panel as USG Type SLX (shaft liners fire-rated).

6.0 EVIDENCE SUBMITTED

Results of fire-endurance tests conducted in accordance with ASTM E 119.

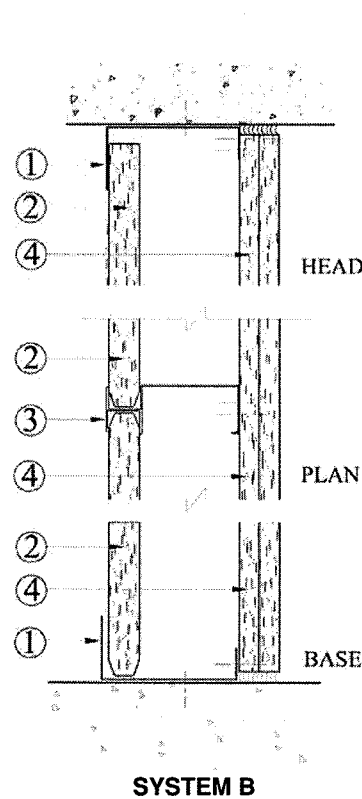
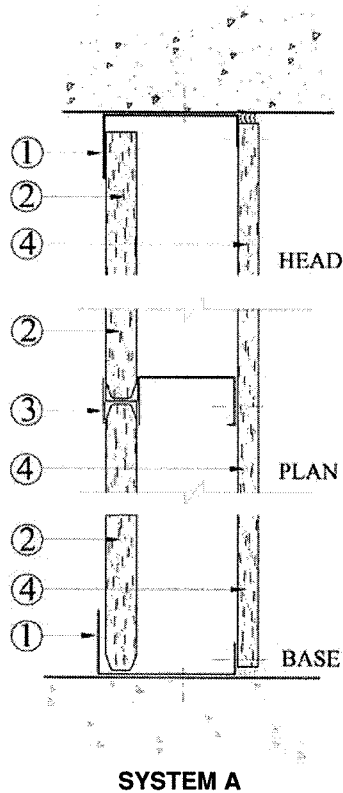
7.0 CONDITIONS OF USE

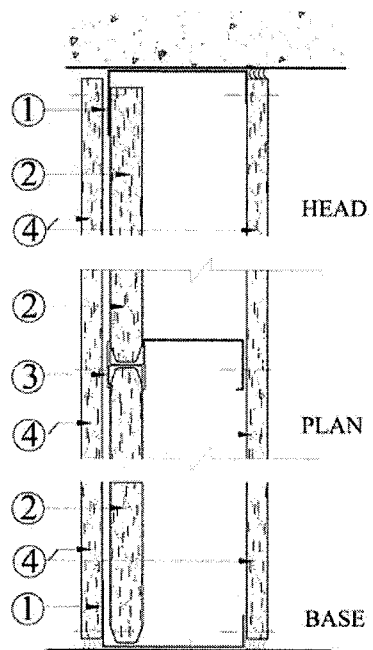
The National Evaluation Service Committee finds that, in their opinion, the USG® Drywall Shaft Partition Systems described in this report are alternates to types of fire-resistive construction specified in the 1990 BOCA National Building Code, the 1988 Standard Building Code with 1989/1990 Revisions, and the 1988 Uniform Building Code with 1990 Accumulative Supplement, subject to the following conditions:

1. The report does not include structural evaluation of the products listed.
2. All cut openings and horizontal joints in metal-framed shaft partitions with coreboard must be cased with system metal framing.

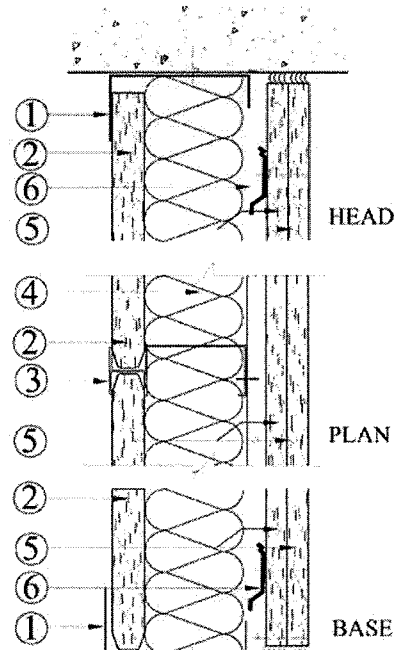
3. System G shaft walls are limited for use as corridor ceilings or as the horizontal enclosure on the underside of stairs (i.e. "Stair Soffits").
4. Assembly described in paragraph H may be used to protect two-hour horizontal ducts (horizontal duct shafts) or where a two-hour horizontal membrane is required and is not part of a floor/ceiling or roof/ceiling assembly. This system is designed to support its own dead weight only and should not be used where there is an attic or loft above, or any probability of storage.

This report is subject to periodic re-examination. For information on the current status of this report, contact the ICC-ES.

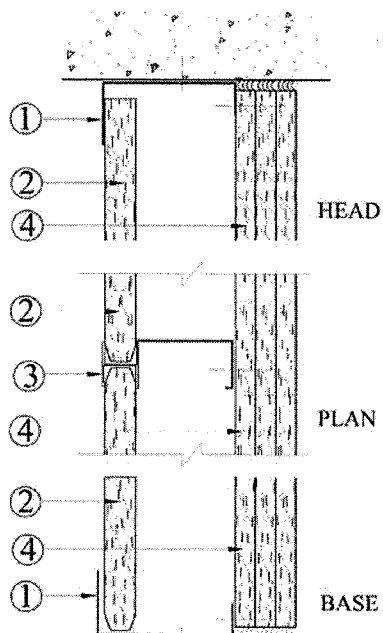




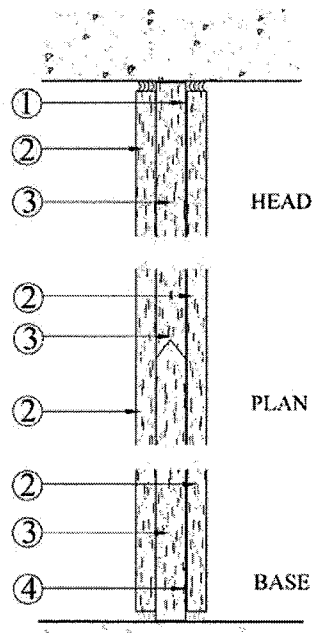
SYSTEM C



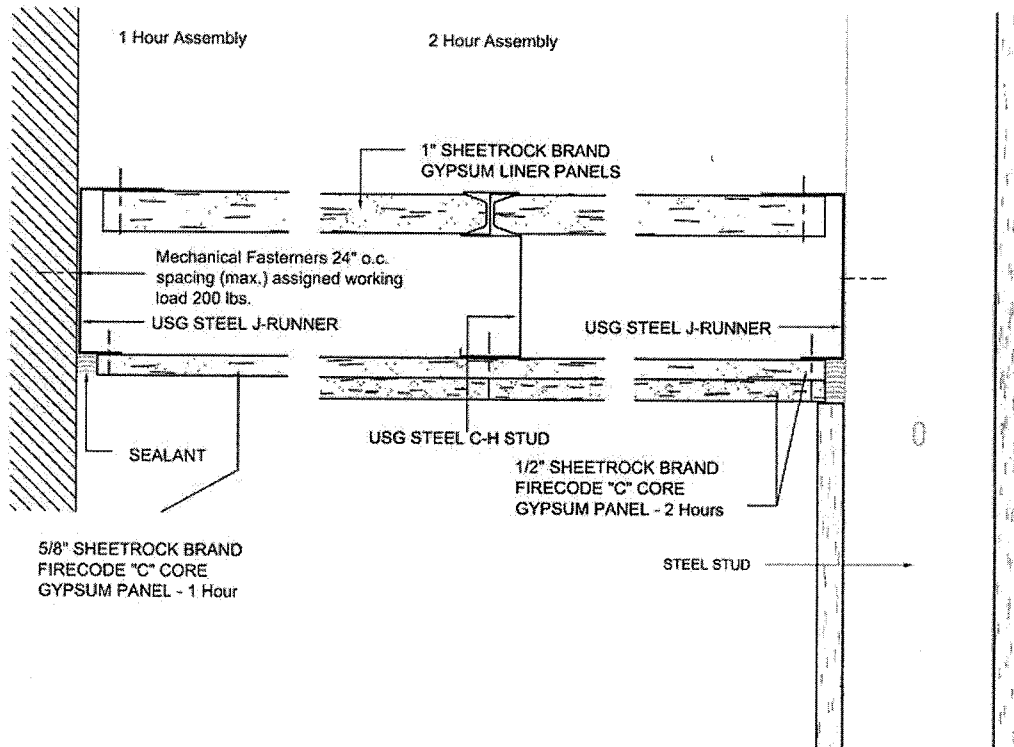
SYSTEM D



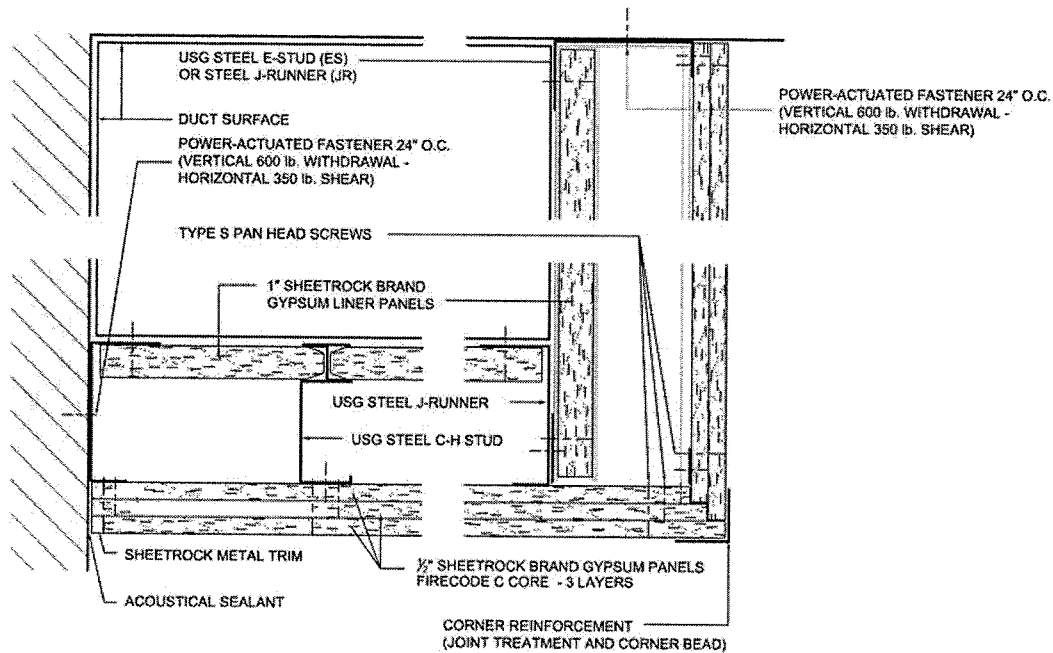
SYSTEM E



SYSTEM F



SYSTEM G



SYSTEM H

MONOKOTE® MK-6®, MK-6/HY® and MK-6s

Product data and application instructions

Product Description

Monokote® MK-6®/HY® and MK-6s are single component, spray applied, mill-mixed fire resistive plasters. MK-6/HY and MK-6s have approval for use on structural steel members and fluted decking to provide up to four hours of fire protection, and on flat plate cellular decking for up to three hours with Spatterkote® SK-3.

Note: Monokote MK-6/HY and MK-6s afford the same level of the fire protection at identical protection thicknesses. By simply specifying “Monokote MK-6,” the fireproofing subcontractor can select the product that will provide the most efficient fire protection for the specific project conditions.

Features & Benefits

Monokote cementitious fireproofing offers many significant advantages to the architect, owner, applicator and building occupant. These include:

- Proven in-place performance
- Low in-place cost
- Fast, efficient application
- UL fire tested and factory inspected
- Building Code compliant (ICBO, SBCCI, BOCA, ICC)

Delivery & Storage

- All material to be used for fireproofing shall be delivered in original unopened packages bearing the name of the manufacturer, the brand and proper UL labels for fire hazard and fire resistance classifications.
- The material shall be kept dry until ready for use. Packages of material shall be kept off the ground, under cover and away from sweating walls and

other damp surfaces. All bags that have been exposed to water before use shall be discarded. Stock of material is to be rotated and used before its expiration date.

Steel & Concrete Surfaces

- Prior to the application of Monokote MK-6, an inspection shall be made to determine that all steel surfaces are acceptable to receive fireproofing. The steel shall be free of oil, grease, rolling compounds or lubricants, loose mill scale, excess rust, noncompatible primer, lock down agent or any other substance that will impair proper adhesion. Where necessary, the cleaning of steel surfaces to receive fireproofing shall be the responsibility of the general contractor.
- The project architect shall determine if the painted/primed structural steel to receive fireproofing has been tested in accordance with ASTM E119, to provide the required fire resistance rating.
- Many Fire Resistance Designs allow the use of painted metal floor or roof-deck in place of galvanized decking. Painted decking must be UL listed in the specific fire resistance designs and must carry the UL classification marking. Consult your local Grace sales representative for details.
- Prior to application of Monokote MK-6, a bonding agent, approved by the fireproofing manufacturer, shall be applied to all concrete substrates to receive MK-6.
- Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete and roof traffic has ceased.
- No fireproofing shall be applied prior to completion of concrete work on steel decking.

Performance Characteristics

Physical Properties	Recommended Specification	Typical Values	Test Method
Dry density, minimum average	15 pcf (240 kg/m ³)	15 pcf (240 kg/m ³)	ASTM E605
Bond strength	200 psf (9.6 KPa)	339 psf (16.2 KPa)	ASTM E736
Compression, 10% deformation	1,200 psf (51 KPa)	1,483 psf (71.0 KPa)	ASTM E761
Air erosion	Max 0.000 g/ft ² (0.00 g/m ²)	0.000 g/ft ² (0.00 g/m ²)	ASTM E859
High velocity air erosion	No continued erosion after 4 hours	No continued erosion after 4 hours	ASTM E859
Corrosion	Does not contribute to corrosion	Does not contribute to corrosion	ASTM E937
Bond impact	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E760
Deflection	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E759
Resistance to mold growth	No growth after 28 days	No growth after 28 days	ASTM G21
Surface burning characteristics	Flame spread = 0 Smoke developed = 0	Flame spread = 0 Smoke developed = 0	ASTM E84
Combustibility	Less than 5 MJ/m ² total, 20 kw/m ² peak heat release	Less than 5 MJ/m ² total, 20 kw/m ² peak heat release	ASTM E1354
Impact penetration	Max 6 cm ³ abraded	3.9 cm ³	City of San Francisco
Abrasion resistance	Max 15 cm ³ abraded	8.3 cm ³	City of San Francisco

- g. Other trades shall not install ducts, piping, equipment, or other suspended items until the fireproofing is completed and inspected.
- h. Other trades shall install clips, hangers, support sleeves, and other attachments that penetrate the fireproofing, prior to application of the fireproofing.

Mixing

- a. Monokote Fireproofing shall be mixed by machine in a conventional, plaster-type mixer or a continuous mixer specifically modified for cementitious fireproofing. The mixer shall be kept clean and free of all previously mixed material. The mixer speed in a conventional mixer shall be adjusted to the lowest speed which gives adequate blending of the material and a mixer density of 40–45 pcf (640–720 kg/m³) of material.
- b. Using a suitable metering device and a conventional mixer, all water shall be first added to the mixer as the blades turn. Mixing shall continue until the mix is lump-free, with a creamy texture. All material is to be thoroughly wet. Target density of 43 ± 1 pcf (688 ± 16 kg/m³) is most desirable. Overmixing Monokote will reduce pumping rate.

Application

- a. Application of Monokote Fireproofing can be made in the following sequence:
 - 1. For thicknesses of approximately ½ in. (13 mm) or less, apply in one pass.
 - 2. For thicknesses of ¾ in. (16 mm) or greater, apply subsequent passes after the first coat has set.
- b. Spatterkote SK-3 shall be applied to all cellular steel floor units with flat plate on the bottom and to roof decking where required prior to application of Monokote. Spatterkote shall be applied in accordance with manufacturer's application instructions.
- c. Monokote Fireproofing material shall not be used if it contains partially set, frozen or caked material.
- d. The minimum average density shall be that required by the manufacturer, listed in the UL Fire Resistance Directory for each rating indicated, ICBO Evaluation Report, as required by the authority having jurisdiction, or minimum average 15 lbs/ft³ (240 kg/m³), whichever is greater.
- e. Monokote shall be mixed with water at the job site.
- f. Monokote Accelerator is to be used with Monokote Fireproofing* to enhance set characteristics and product yield. The Monokote Accelerator is injected into the Monokote Fireproofing at the spray gun. Monokote Accelerator shall be mixed and used according to manufacturers recommendations.

- g. Monokote is applied directly to the steel, at various rates of application which will be job dependent, using standard plastering type equipment or continuous mixer/pump units. A spray gun, with a properly sized orifice and spray shield and air pressure at the nozzle of approximately 20 psi (38 KPa), will provide the correct hangability, density and appearance. NOTE: If freshly sprayed Monokote does not adhere properly, it is probably due to a too wet mix, poor thickness control, or an improperly cleaned substrate.

Temperature & Ventilation

- a. An air and substrate temperature of 40°F (4.4°C) minimum shall be maintained for 24 hours prior to application, during application and for a minimum of 24 hours after application of Monokote.
- b. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided to achieve a minimum total fresh air exchange rate of 4 times per hour until the material is substantially dry.

Field Tests

- a. The architect will select an independent testing laboratory (for which the owner will pay) to sample and verify the thickness and density of the fireproofing in accordance with the provisions of ASTM E605, *Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members* or Uniform Building Code Standard No. 7-6 *Thickness and Density Determination for Spray Applied Fireproofing*.
- b. The architect will select an independent testing laboratory (for which the owner will pay) to randomly sample and verify the bond strength of the fireproofing in accordance with the provisions of ASTM E736.
- c. Results of the above tests will be made available to all parties at the completion of pre-designated areas which shall have been determined at a pre-job conference.

Safety

- a. Monokote is slippery when wet. The general contractor and applicator shall be responsible for posting appropriate cautionary "SLIPPERY WHEN WET" signs. Signs should be posted in all areas in contact with wet fireproofing material. Anti-slip surfaces should be used on all working surfaces.
- b. Material Safety Data Sheets for Monokote MK-6/HY and MK-6s are available on our web site at www.graceconstruction.com or by calling 866-333-3SBM.

* Use of accelerator with MK-6s will provide rapid set but will not result in yield increase.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

Monokote, MK-6, HY and Spatterkote are registered trademarks of W. R. Grace & Co.–Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.–Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This product may be covered by patents or patents pending.
MK-515G Printed in U.S.A. 06/10

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Design No. N782 BXUV.N782 Fire Resistance Ratings - ANSI/UL 263

[Page Bottom](#)

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

Fire Resistance Ratings - ANSI/UL 263

[See General Information for Fire Resistance Ratings - ANSI/UL 263](#)

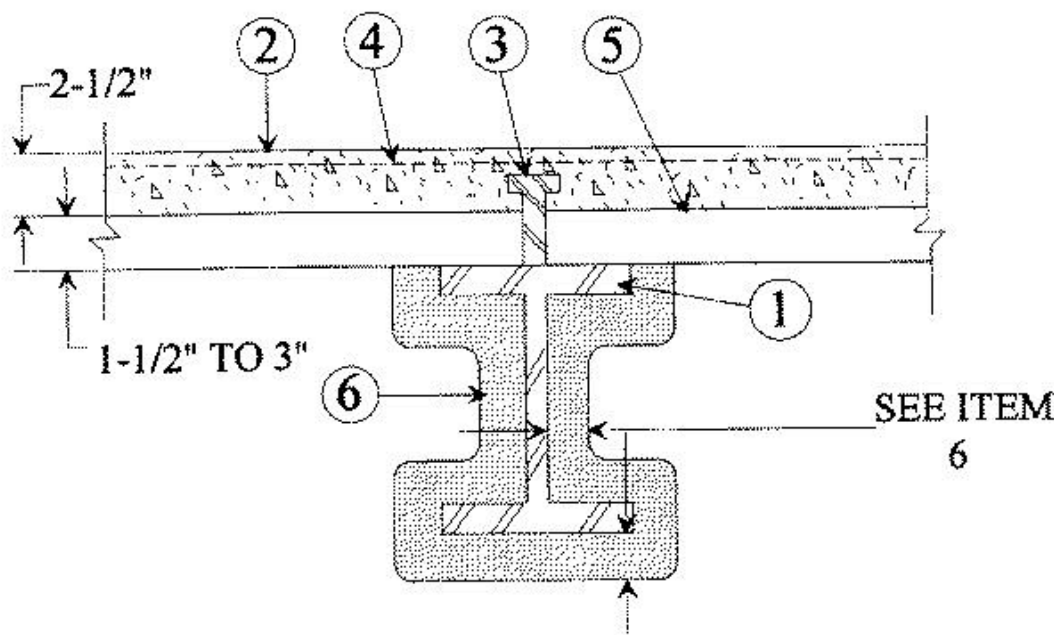
Design No. N782

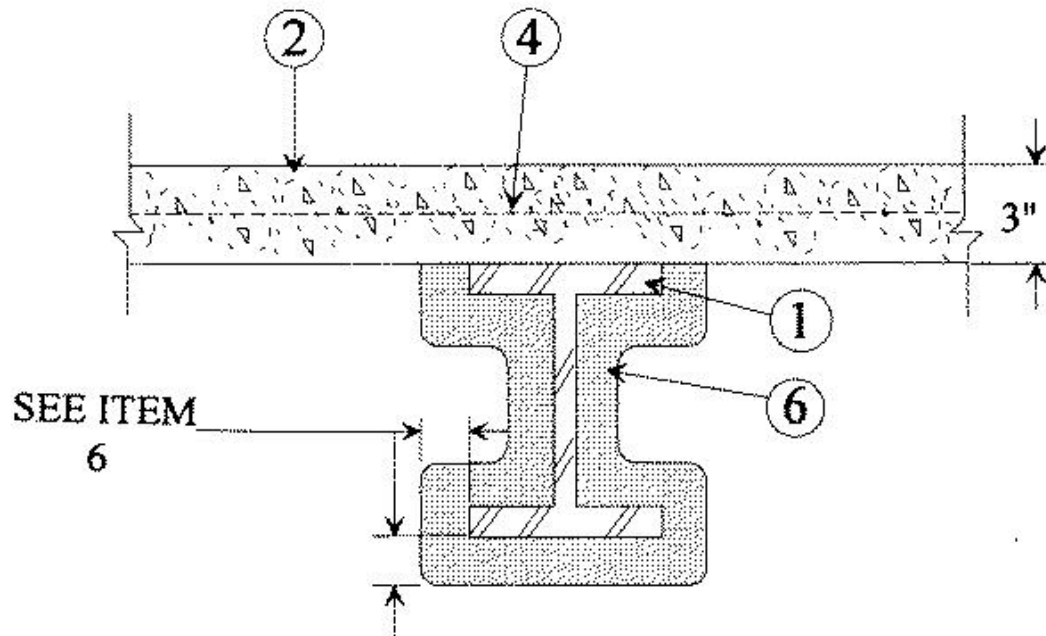
December 14, 2012

Restrained Beam Ratings — 1, 1-1/2, 2, 3 and 4 Hr

Unrestrained Beam Ratings — 1, 1-1/2, 2, 3 and 4 Hr

Load Restricted for Canadian Applications — See Guide [BXUV7](#)





1. **Steel Beam** — W 8x28 in size.
2. **Normal Weight or Lightweight Concrete** — Compressive strength, 3000 psi. For normal weight concrete either carbonate or siliceous aggregate may be used. Unit weight, 148 pcf. For lightweight concrete unit weight 110 pcf.
3. **Shear Connector** — (Optional) \bar{I} Studs, 3/4 in. diam headed type or equivalent per AISC specifications. Welded to the top flange of beam through the steel floor units.
4. **Welded Wire Fabric** — (Optional) \bar{I} 6x6-10/10 SW G.
5. **Steel Floor and Form Units*** — 1-5/16 in. deep corrugated units; or 1-1/2 to 3 in. deep fluted units welded to beam.
6. **Spray-Applied Fire Resistive Materials*** — Applied by mixing with water and spraying in more than one coat to the beam to the final thicknesses shown below. When fluted or corrugated steel floor units are used, crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam. Beam surfaces must be clean and free of dirt, loose scale and oil. Mix in average and minimum density of 15/14 pcf respectively. Mix in average and minimum density of 22/19 pcf respectively for Types Z-106, Z-106/HY, Z-106/G. Mix in average and minimum density of 40/36 pcf respectively for Types AV650, Z-146, Z-146PC and Z-146T cementitious mixture. Mix in average and minimum density of 50/45 pcf respectively for Types AV800, Z-156, Z-156T and Z-156PC. For method of density determination, see Design Information Section.

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with lightweight concrete.

Rating Hr	Min Thkns In.	
	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	7/16	11/16
2	11/16	1
3	1-3/16	1-5/16
4	1-5/8	1-5/8

The thickness of Spray-Applied Fire Resistive Materials shown in the table below are only applicable when the beams are supporting solid, normal weight, concrete slabs or floor assemblies containing only fluted floor or form units, topped with normal weight concrete.

Rating Hr	Min Thkns In.	
	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	3/8	5/8
2	9/16	7/8

3	1	1-7/16
4	1-7/16	2

The thickness of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the thickness applied to the beam's lower flange edges is reduced by one-half and the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with lightweight concrete.

	Min Thkns In.	
Rating Hr	Restrained Beam	Unrestrained Beam
1	7/16+	7/16+
1-1/2	7/16+	3/4
2	11/16	1
3	1-3/16	1-7/16
4	1-11/16	1-15/16

+ $\frac{1}{4}$ Thickness applied to beam's lower flange edges shall be a minimum of $\frac{1}{4}$ in.

The thickness of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the thickness applied to the beam's lower flange edges is reduced by one-half and the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with normal weight concrete.

	Min Thkns In.	
Rating Hr	Restrained Beam	Unrestrained Beam
1	7/16+	7/16+
1-1/2	7/16+	3/4
2	11/16	1-1/16
3	1-3/16	1-11/16
4	1-11/16	2-5/16

+ $\frac{1}{4}$ Thickness applied to beam's lower flange edges shall be a minimum of $\frac{1}{4}$ in.

ARABIAN VERMICULITE INDUSTRIES $\frac{1}{4}$ Types MK-6/HY, MK-6/HY Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6 GF, Z-106, Z-106/G, Z-146 investigated for exterior use. Types AV650 and AV800 investigated for exterior use.

W R GRACE & CO - CONN $\frac{1}{4}$ Types MK-6/HY, MK-6/HY Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6 GF, RG, Z-106, Z-106/G, Z-106/HY, Z-146, Z-146T, Z146PC, Z-156, Z-156T and Z-156PC investigated for exterior use.

GRACE KOREA INC $\frac{1}{4}$ Types MK-6/HY, MK-6/HY Extended Set, MK-10 HB, MK-10 HB Extended Set, MK-6/HB, MK-6s, MK-6 GF, Z-106, Z-106/G, Z-106/HY, Z-146 investigated for exterior use.

6A. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the beam to the final thicknesses shown below. When fluted steel floor units are used, crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam. Beam surfaces must be clean and free of dirt, loose scale and oil. Minimum average and minimum density of 15/14 pcf respectively. For method of density determination, see Design Information Section.

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with lightweight concrete.

	Min Thkns In.	
Rating Hr	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	7/16	5/8
2	11/16	7/8
3	1-3/16	1-5/16

4	1-5/8	1-5/8
---	-------	-------

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with normal weight concrete.

Rating Hr	Min Thkns In.	
	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	3/8	5/8
2	9/16	7/8
3	1	1-5/16
4	1-7/16	1-5/8

ARABIAN VERMICULITE INDUSTRIES $\dot{\bar{\imath}}$ Type MK-6 GF

GRACE KOREA INC $\dot{\bar{\imath}}$ Type MK-6 GF

W R GRACE & CO - CONN $\dot{\bar{\imath}}$ Type MK-6 GF.

6B. Spray-Applied Fire Resistive Materials* — Applied by mixing with water and spraying in more than one coat to the beam to the final thicknesses shown below. When fluted steel floor units are used, crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam. Beam surfaces must be clean and free of dirt, loose scale and oil. Min average and min ind. density of 22/20 pcf respectively. For method of density determination, see Design Information Section.

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with lightweight concrete.

Rating Hr	Min Thkns In.	
	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	7/16	9/16
2	5/8	13/16
3	1-1/16	1-1/4
4	1-5/8	1-5/8

The thicknesses of Spray-Applied Fire Resistive Materials shown in the table below are applicable when the beams are supporting solid concrete slabs or floor assemblies containing only fluted floor or form units with normal weight concrete.

Rating Hr	Min Thkns In.	
	Restrained Beam	Unrestrained Beam
1	5/16	5/16
1-1/2	3/8	9/16
2	9/16	13/16
3	1	1-1/4
4	1-7/16	1-5/8

GRACE KOREA INC $\dot{\bar{\imath}}$ Type Z-106/HY

W R GRACE & CO - CONN $\dot{\bar{\imath}}$ Z-106/HY

*Bearing the UL Classification Mark

Last Updated on 2012-12-14

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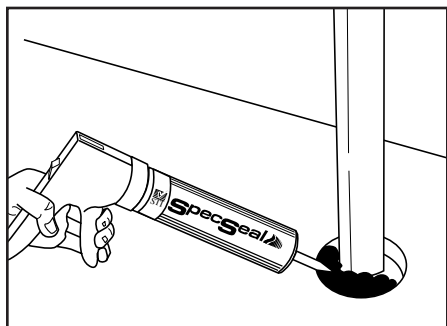
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SERIES LC ENDOTHERMIC SEALANT

APPLICATIONS

SpecSeal® Series LC Sealant is designed primarily for sealing penetrations for noncombustible penetrants. SpecSeal Series LC has been tested and approved for single metallic pipe penetrations up to 24" (610 mm) as well as multiple penetrants through both masonry and gypsum wallboard constructions. Additional systems have been tested for steel sleeved penetrations as well as some common electrical and communications cable penetrations and joint penetrations. See STI's Product & Application Guide as well as the UL Fire Resistance Directory for complete listings.



PRODUCT DESCRIPTION

SpecSeal® Series LC Sealant is a latex-based, high solids firestop compound. This material, when properly installed, will effectively seal penetration openings and joints against the spread of fire, smoke, toxic gasses and water.

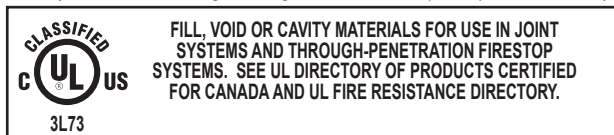
SpecSeal® Series LC Sealant is engineered to adhere well to virtually all construction surfaces and may be applied using a standard caulk gun or by troweling with a standard mason's trowel or with a putty knife.

SpecSeal® Series LC Sealant dries without shrinking to form a flexible shield against the propagation of fire. Its premium latex binder system is totally resistant to water and will not re-emulsify after drying. SpecSeal® Series LC Sealant is non-halogenated, contains no asbestos, inorganic fibers or solvents.

FEATURE	BENEFIT
• Water-Based	Easy installation, cleanup, and disposal.
• Endothermic Fillers	Absorb heat & release water.
• High Solids Formula	No shrinkage!
• Paintable	Paintable (when dry)
• Safe ... No Solvents!	Non-Halogenated! Low VOC's
• Red Color	Easy identification and inspection.
• Installer Friendly	Excellent caulking properties along with high build capabilities.
• Excellent Smoke Seal	
• Flexible	

PERFORMANCE

SpecSeal® Series LC Sealant is the basis for systems that meet the exacting criteria of ASTM E814 (UL1479) as well as the time-temperature requirements of ASTM E119. Tested systems will provide up to a 3 hour rating utilizing as little as 1/4" (6 mm) of sealant depth (1/2" (13 mm) for 4 hours).



PHYSICAL PROPERTIES

Properties	Series LC
Color	Red
Odor	Mild Latex
Density	11.4 lb./gal.
Solids Content	80% ± 2%
pH	7.4-8.4
In Service Temperature	≤120° F (≤49° C)
Flame Spread	0*
Smoke Developed	10*
STC Rating (ASTM E90/ASTM C919)	61
VOC Content (EPA Method 24/ASTM D3960)	0.33 lb/gal.(40 g/L)
Shelf Life	12 Months

*ASTM E84 (UL723) @ 14% Surface coverage. (Modified test for sealants and caulks.)

SPECIFICATIONS

The firestopping sealant shall be a one-part, latex-based compound. The sealant shall dry to form a flexible non-shrinking penetration seal and shall be capable of allowing pipe movement and shall contain no solvents, water soluble fillers, or inorganic fibers. The sealant shall be thixotropic and shall be capable of caulking or troweling on to vertical surfaces or overhead. The sealant shall be UL Classified and tested to the requirements of ASTM E814 (UL1479).

SPECIFIED DIVISIONS

DIV. 7 07840	Through-Penetration Firestopping
DIV. 13 13900	Special Construction Fire Suppression & Supervisory Systems
DIV. 15 15250	Mechanical Insulation – Fire Protection
DIV. 16 16050	Basic Electrical Materials & Methods



INSTALLATION INSTRUCTIONS

GENERAL: Areas to be protected must be clean and free of oil, loose dirt, rust or scale. Installation temperatures must be between 35°F (2°C) and 100°F (38°C). Allow product to dry a minimum of 24 hours before exposure to moisture.

SYSTEM SELECTION: Consult UL® Fire Resistance Directory, STI Product & Application Guide, or drawings provided by the manufacturer for specific details concerning installation design and requirements.

FORMING: Some installations may require forming as either an integral part of the system or as an option to facilitate installation. In systems where forming is required, mineral wool batting (3" (76 mm) nom. thickness, min. 4 lb./cu. ft. 64 kg/m³ density) is recommended. Mineral wool is to be highly compressed and friction fitted into the opening. Position forming or packing material to allow for the proper depth of fill material.

INSTALLATION OF FILL MATERIAL: SpecSeal® Series LC sealant may be installed by caulking using a standard caulking gun or from bulk containers using a bulk loading caulk gun, or by manually troweling using a mason's trowel or putty knife. If the sealant tends to pull back from a surface, clean the surface with a damp rag or sponge and reapply. Install sealant to required depth. Work sealant into all areas exercising care to eliminate voids or seams. The surface of the sealant can be smoothed using a putty knife dipped in water. Adding water to the sealant itself is not recommended. Sealant (when dry) may be sanded and painted using most non-solvent based paints. In gypsum wallboard penetrations, crown sealant a minimum of 1/4" (6 mm) from penetrant to wallboard surface at a point approx. 1/2" (13 mm) or more from opening.

COVER PLATE: In some designs a galvanized steel cover plate (28 gauge) may be used to upgrade the fire resistance rating to 4 hours. Consult STI Product and Application Guide for dimensional and fastening requirements.

LIMITATIONS: SpecSeal® Series LC Sealant is water-based and cures through the evaporation of water. Low temperatures as well as high humidity may retard drying. Non-porous or impermeable backing materials, plates or coatings may retard the drying process. Do not paint or seal in any way that prevents contact with air until sealant has dried through completely.

MAINTENANCE

Inspection: Installations should be inspected periodically for subsequent damage. Any damage should be repaired using SpecSeal® Series LC Sealant as per the original approved design. **Retrofit:** When adding or removing penetrants, care should be taken to minimize damage to the seal. Reseal using SpecSeal® Series LC Sealant as per the approved design. **NOTE:** New penetrants of a different nature than the original design may require a totally new firestop design or extensive modifications to the existing design. Reseal openings as per the requirements of the modified design.

TECHNICAL SERVICE

Specified Technologies Inc. provides toll free technical support to assist in product selection and appropriate installation design. UL Systems, Material Safety Data Sheets and other technical information is available at the Technical Library at www.stifirestop.com.

PRECAUTIONARY INFORMATION

Consult Material Safety Data Sheet for additional information on the safe handling and disposal of this material. Wash areas of skin contact with soap and water. Avoid contact with eyes. The use of an OSHA or NIOSH approved mask for dust and mist environment is recommended. Apply in areas with adequate ventilation.

CAUTION: COATING IS CONDUCTIVE UNTIL DRY. DO NOT APPLY TO OR IN THE PRESENCE OF ENERGIZED ELECTRICAL CONDUCTORS.

AVAILABILITY

SpecSeal® Series LC Sealant is available from authorized distributors worldwide. Consult factory for names and locations of the nearest sales representatives or distributors.

Cat. No.	Description	Packaging	Size
LC150	Endothermic Firestop Sealant	10.1 oz. Tube	18.2 cu in. (300 ml)
LC120	Endothermic Firestop Sealant	20 oz. Sausage	36 cu. in. (592 ml)
LC129	Endothermic Firestop Sealant	29 oz. Tube	52 cu. in. (858 ml)
LC155	Endothermic Firestop Sealant	5 gal. Pail	1,155 cu. in. (19 liters)

CITY OF NEW YORK MEA 129-96-M

IMPORTANT NOTICE: All statements, technical information, and recommendations contained herein are based upon testing believed to be reliable, but the accuracy and completeness thereof is not guaranteed.

WARRANTY

Specified Technologies Inc. manufactures its goods in a manner to be free of defects. Should any defect occur in its goods (within one year), Specified Technologies Inc., upon prompt notification, will at its option, exchange or repair the goods or refund the purchase price.

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SERIES LCI INTUMESCENT SEALANT

APPLICATIONS

SpecSeal® LCI Sealant has a broad application base designed to seal a wide variety of common penetrations in light commercial and grouped residential construction. Penetrant types include insulated and non-insulated metallic pipes and tubes, non-metallic pipes and tubes, and common electrical service and power distribution, telephone, data, and TV cabling. This product is also used in conjunction with other SpecSeal® Products such as SpecSeal® Firestop Collars and Wrap Strips to protect larger plastic pipes.

See Table A for a summary application list.



PRODUCT DESCRIPTION

SpecSeal® LCI Sealant is a versatile and economical intumescent product intended for firestopping a wide array of applications in small commercial or grouped residential construction and other structures with similar applications. SpecSeal® LCI Sealant is available in a single grade that has excellent caulking properties as well as high build properties on vertical or overhead surfaces. This single grade may be caulked (standard cartridge or bulk loaded), knifed or troweled. In addition, SpecSeal® LCI Sealant does not contain PCB's or asbestos.

SpecSeal® LCI Sealant is storage stable (when stored according to the manufacturer's recommendations), and will not separate or shrink when dried. SpecSeal® Series LCI Sealant will adhere to all common construction and penetrant materials and contains no solvents that might adversely effect plastic pipes or cable jackets.

FEATURES

- **Economical:** High performance without the high price!
- **Highly Intumescent:** Expands up to 8 times.
- **Excellent Smoke Seal**
- **Water Resistant :** Will not re-emulsify when dry.
- **Water-Based** for easy installation, cleanup, and disposal.
- **Acoustically Tested:** Reduces noise transmission
- **Safe...**Low VOC's, No Solvents, Non-Halogenated
- **Paintable**

PERFORMANCE

SpecSeal® LCI Sealant is the basis for systems that meet the exacting criteria of ASTM E814 (UL1479) and ASTM E1966 (UL2079) as well as to the time-temperature requirements of ASTM E119 (UL263). LCI provides up to a 2-hour fire rating for typical service penetrations through concrete or wood floors, concrete or masonry walls, as well as gypsum board walls (3-hour for metallic pipe, conduit and tubing). SpecSeal® LCI Sealant meets Class A finish requirements for Flame Spread and Smoke Development when tested in accordance with ASTM E84 (UL723). SpecSeal® LCI Sealant is also acoustically tested, demonstrating excellent sound attenuation properties.



SYSTEM COMPATIBLE

PHYSICAL PROPERTIES

Properties	Series LCI
Color	Red
Odor	Mild Latex
Density	9.0 lb/gal (1.08 kg/L)
pH	9.0
In Service Temperature	≤ 130°F (54°C)
Flame Spread	0*
Smoke Developed	5*
STC Rating (ASTM E90/ASTM C919)	62
VOC Content (EPA Method 24/ASTM D3960)	0.29 lbs/gal (35.0 g/L)
Shelf Life	2 yrs
Volume Expansion	10X Free Expansion
Storage Temp.	≤ 130°F (54°C)

* Tested to ASTM E84 (UL723) at 14% surface coverage (modified test for sealants and caulks)



FILL, VOID OR CAVITY MATERIALS FOR USE IN JOINT SYSTEMS AND THROUGH-PENETRATION FIRESTOP SYSTEMS. SEE UL DIRECTORY OF PRODUCTS CERTIFIED FOR CANADA AND UL FIRE RESISTANCE DIRECTORY.



SPECIFICATIONS

The firestopping sealant shall be a water-resistant, intumescent latex sealant. The sealant when exposed to high heat or flame shall exhibit a free expansion of up to 8 times its original volume. The firestopping sealant shall contain no water soluble nor hygroscopic ingredients and shall be acoustically tested. The sealant shall be UL Classified and/or FM approved and tested to the requirements of ASTM E814 (UL1479) and shall meet Class A finish requirements when tested in accordance with ASTM E84 (UL723).

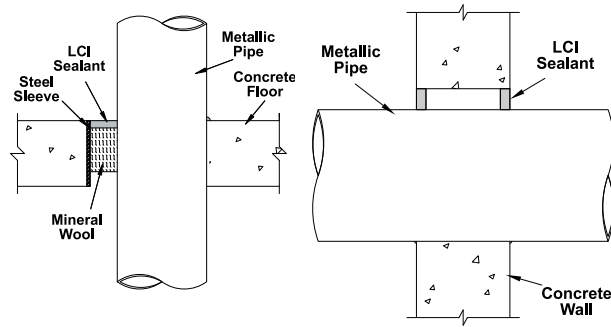
SPECIFIED DIVISIONS

DIV. 7	07840	Through-Penetration Firestopping
DIV. 13	13900	Special Construction Fire Suppression & Supervisory Systems
DIV. 15	15250	Mechanical Insulation – Fire Protection
DIV. 16	16050	Basic Electrical Materials & Methods



Technical Service 1-800-992-1180
www.stifirestop.com

Fig 1: METALLIC PIPES - Concrete/Masonry Floors & Walls



UL System No. C-AJ-1353

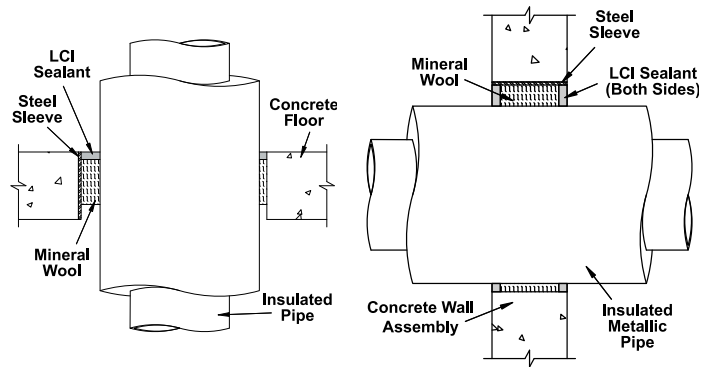
F Rating: 3 Hr • T Rating: 0 Hr
Steel or Iron Pipe: <12", Copper Pipe: <4"
Annulus: 0" to 2"
Sealant Depth: 1/4"

UL System No. W-J-1098

F Rating: 2 Hr • T Rating: 1/4, 3/4 & 1 Hr
Steel or Iron Pipe: <8", Copper Pipe: <4"
Annulus: 0" to 2"
Sealant Depth: 5/8"

Forming Material: Nom 4 pcf mineral wool (2 1/4" Depth)

Fig 2: INSULATED METALLIC PIPES - Concrete/Masonry Floors & Walls



UL System No. C-AJ-5138

F Rating: 2 Hr • T Rating: 3/4 or 1 Hr
Steel or Iron Pipe: 6", Copper Pipe: 4"
Pipe Covering: Max. 2" fiber glass or mineral wool pipe insulation.
Annulus: 1/4" to 1-5/8" • Sealant: 1/2"
Forming: Nom. 4 pcf mineral wool (3" depth)

SEALANT REQUIREMENTS IN CUBIC INCHES PER 1/4 INCH OF INSTALLED DEPTH*

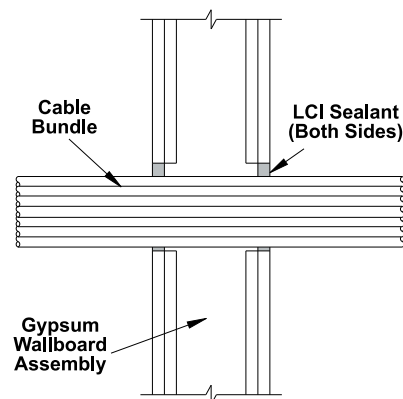
Pipe Size		1.5	2.0	3.0	4.0	5.0	Diameter of Opening (in.)		8.0	10	12	14	26
Trade	Pipe						6.0	7.0					
Size	O.D.												
0.5"	0.840	0.3	0.6	1.6	3.0	4.8	6.9	9.5	12.4	19.5	28.1	38.3	132.6
1"	1.315	0.1	0.4	1.4	2.8	4.6	6.7	9.3	12.2	19.3	27.9	38.1	132.4
1.5"	1.900			1.1	2.4	4.2	6.4	8.9	11.9	18.9	27.6	37.8	132.0
2"	2.375			0.7	2.0	3.8	6.0	8.5	11.5	18.5	27.2	37.4	131.6
2.5"	2.875			0.1	1.5	3.3	5.4	8.0	10.9	18.0	26.7	36.9	131.1
3"	3.500				0.7	2.5	4.7	7.2	10.2	17.2	25.9	36.1	130.3
3.5"	4.000					1.8	3.9	6.5	9.4	16.5	25.1	35.3	129.6
4"	4.500					0.8	3.0	5.6	8.5	15.6	24.2	34.4	128.7
6"	6.625							1.1	4.0	11.1	19.7	29.9	124.2
8"	8.625									4.9	13.6	23.8	118.0
10"	10.750										5.6	15.8	110.0
12"	12.750											6.6	100.8
24"	24.000												19.6

*Different Sealant Depth?

1/2" Multiply by 2
5/8" Multiply by 2.5
1" Multiply by 4
1-1/4" Multiply by 5

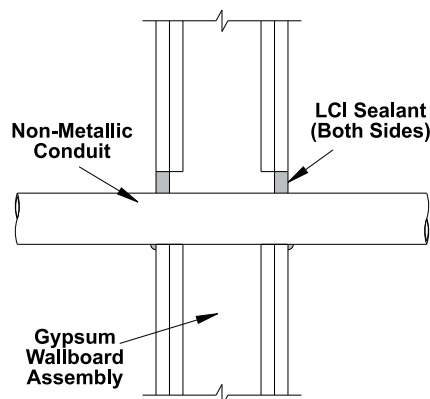
IMPORTANT NOTE: This table is for estimation purposes only. Consult UL Fire Resistance Directory or STI Product & Application Guide for specific installation requirements and limitations
Metric Estimation Table available upon request.

Fig. 3: ELECTRICAL, DATA OR COMMUNICATIONS - Gypsum Walls



UL System No. W-L-3169

F Rating: 1, 2 Hr • T Rating: 1/4 and 3/4
Up to 4-1/2" cable bundle
Annulus: 0" to 1/2" • Sealant: 5/8"



UL System No. W-L-2241

F Rating: 1, 2 Hr • T Rating: 0, 1/4, 1, 1-3/4
<2" Rigid PVC or ENMT, CPVC, ABS
Annulus: 0-1" • Sealant 5/8"

TABLE A: APPLICATIONS

TESTED AND CLASSIFIED FOR FIRE RESISTANCE

- **Metallic Pipes** including steel, iron, or copper pipe and tubing.
- **Nonmetallic Pipes, Conduits & Tubing** including PVC, CPVC, ABS, and PEX.
- **Electrical & Electronic Cabling** including service entrance, power distribution, computer, telephone, and television.
- **Metal Ductwork** including HVAC, bath and dryer vents.
- **Insulated Pipes** including heating, cooling, and condensation applications.
- **Complete Wood Floor firestopping package** for electrical, plumbing, HVAC, telephone, and television.

INSTALLATION INSTRUCTIONS

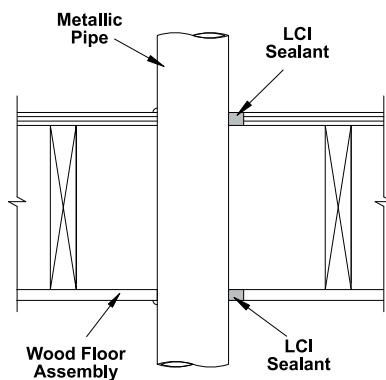
GENERAL: Areas to be protected must be clean and free of oil, loose dirt, rust or scale. Installation temperatures must be between 35°F (2°C) and 100°F (38°C). Allow product to dry a minimum of 24 hours before exposure to moisture.

SYSTEM SELECTION: Selection of an appropriate firestop system design is critical to the fire protection process. Space limitations preclude highly detailed information pertaining to individual application systems. Please consult the Product & Application Guide as well as the UL® Fire Resistance Directory for additional information.

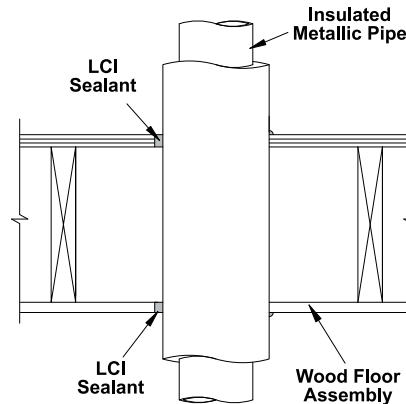
FORMING: Some installations may require forming as either an integral part of the system or as an option to facilitate installation. In systems where forming is required, mineral wool batts with a minimum nominal density of 4 PCF (64 kg/m³) are generally required. Cut forming material oversize to allow for tight packing. Position forming material to allow for the proper depth of fill material.

FILL MATERIAL: SpecSeal® LCI Sealant may be installed by caulking using a standard caulking gun or from bulk containers using a bulk loading caulking gun, or by manually troweling using a mason's trowel or putty knife. If the sealant tends to pull back from a surface, clean the surface with a damp rag or sponge and reapply. Work sealant into all areas exercising care to eliminate voids or seams. The surface of the sealant can be smoothed using a putty knife dipped in water. Adding water to the sealant itself is not recommended. Sealant (when dry) may be painted using most non-solvent based paints.

Fig. 4: BARE & INSULATED METALLIC PIPES - Wood Floor Assemblies



UL System No. F-C-1074
F Rating: 1 & 2 Hr • T Rating: ¼, ½ and 1 Hr
Steel, Iron or Copper: 4" • Chase wall optional.
Annulus: 0" to 1" • Sealant: 5/8" bottom, ¾" top



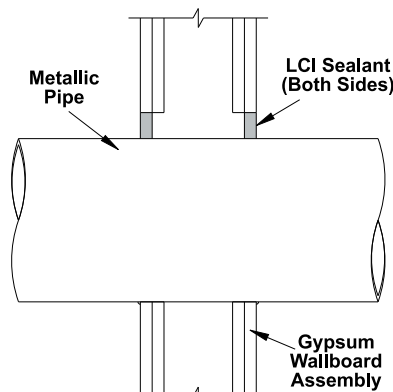
UL System No. F-C-5043
F Rating: 1 & 2 Hr • T Rating: ¾ and 1 Hr
Steel, Iron or Copper: 4"
Pipe covering: 1" Fiber Glass, Mineral fiber or AB/PVC • Chase wall optional.
Annulus: 0" to 1" • Sealant: 5/8" bottom, ¾" top.

In gypsum wallboard penetrations, apply a minimum cove bead of 1/4" (6 mm) at the interface of the penetrant with both exterior wall surfaces.

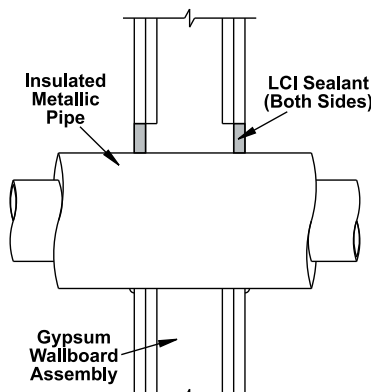
SMOKE SEALING: In some applications including firestop collars, SpecSeal® LCI Sealant is recommended as a smoke seal. It is suggested in these applications that the sealant be applied to both sides of walls. In floor applications, a sealing bead is suggested top and bottom.

LIMITATIONS: SpecSeal® LCI Sealant is water-based and cures through the evaporation of water. Low temperatures as well as high humidity may retard drying. Non-porous or impermeable backing materials, plates, or coatings may retard the drying process. Do not paint or seal in any way that prevents contact with air until sealant has dried through completely. This product has been designed to be safe with plastics and has been used extensively and successfully with a variety of different types of plastic pipes, tubes, and plastic cable insulations. Variations in these materials however, make it impossible to guarantee compatibility. STI strongly recommends that the user consult with the manufacturer of the pipe, tubing, or cable in question regarding any known sensitivities or potential restrictions before applying this product.

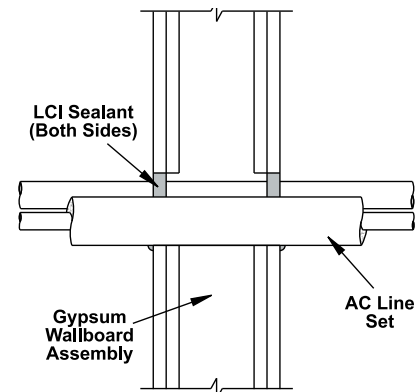
Fig. 5: BARE & INSULATED METALLIC PIPES - Gypsum Walls



UL System No. W-L-1222
F Rating: 1, 2 Hr • T Rating: ¼, ¾, 1 Hr
Steel or Iron pipe: 8", Copper pipe: 4"
Annulus: 0" to 2" • Sealant: 5/8"



UL System Nos. W-L-5121, W-L-5122
F Rating: 1, 2 Hr • T Rating: 1 Hr & 1/4 Hr
Steel or Iron pipe: 6", Copper pipe: 4"
Pipe covering: Max. 2" fiber glass, ¾" AB/PVC or 2" mineral fiber
Annulus: 0" to 1-1/2" • Sealant: 5/8"



UL System No. W-L-8025
F Rating: 1, 2 Hr • T Rating: ¼ Hr
AC Line Set: Two copper tubes, one with ¾" AB/PVC and thermostat wire
Annulus: 0" to 1" • Sealant: 5/8"



MAINTENANCE

No maintenance is normally required, however a periodic inspection of rated barriers is recommended to make sure that any new openings, modifications of previously installed firestops, or areas exhibiting physical damage, have been properly sealed or repaired. Subsequent sealing or repairs should be accomplished using SpecSeal® products per the original approved design.

RETROFIT: When adding or removing penetrants, care should be taken to minimize damage to the seal. Reseal using SpecSeal® products per the approved design. **NOTE:** New penetrants of a different nature than the original design may require a totally new firestop design or extensive modifications to the existing design. Reseal all openings as per the requirements of the modified design.

TECHNICAL SERVICE

Specified Technologies Inc. provides toll free technical support to assist in product selection and appropriate installation design. UL Systems, Material Safety Data Sheets and other technical information is available through the Technical Library at www.stifirestop.com.

PRECAUTIONARY INFORMATION

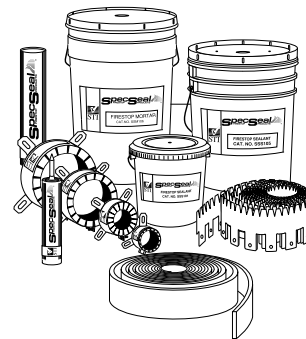
Consult Material Safety Data Sheet for additional information on the safe handling and disposal of this material.

AVAILABILITY

SpecSeal® Series LCI Sealant is available from authorized STI distributors. Consult factory or website for the names and locations of the nearest sales representatives or distributors.

ORDERING INFORMATION

CAT. NO.	DESCRIPTION	
LCI300	Sealant 10.1 oz Tube	18.2 Cu In (300 ml)
LCI305	Sealant 5 Gal Pail	1,155 Cu In (19.0 Liters)
LCI320	Sealant 20 oz Sausage	36 Cu in. (592 ml)
LCI329	Sealant 29 oz Quart Tube	52 Cu in. (858 ml)



Additional SpecSeal Products...

Series SSS Sealant

The industry's most versatile sealant provides the firestopping solutions for a wide range of combustible and noncombustible applications. Water-based intumescent sealant expands up to 8X!

Intumescent Wrap Strips

Three grades of intumescent wrap strips provide an unmatched combination of flexibility, economy, and expansion (up to 30X). Systems for plastic pipes including FR Polypropylene up to 8" trade size!

SSC & LCC Firestop Collars

Easy to install, economical protection for ABS and PVC pipes (both solid and foam core) as well as CPVC, PVDF, and FRPP. LCC Collars are available up to 4" and SSC Collars are available up to 6" trade size.

Firestop Mortar

Lightweight, versatile and economical! The best choice for large or complex installations.

SSP Firestop Putty

Available both in bar form and in pads, putty provides easy retrofit for through-penetrations and economical protection for electrical boxes.

Pensil® Silicones

Sealants and foam for through-penetrations and construction joints. Unexcelled aging characteristics and flexibility.

Elastomeric Joint Seals

New economical products for sealing construction joints. Choose caulk or spray applied products tested to UL2079.

CITY OF NEW YORK MEA 211-01-M

IMPORTANT NOTICE: All statements, technical information, and recommendations contained herein are based upon testing believed to be reliable, but the accuracy and completeness thereof is not guaranteed.

WARRANTY

Specified Technologies Inc. manufactures its goods in a manner to be free of defects. Should any defect occur in its goods (within one year), Specified Technologies Inc., upon prompt notification, will at its option, exchange or repair the goods or refund the purchase price.

LIMITATIONS AND EXCLUSIONS:

THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS EXPRESSED OR IMPLIED (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE) AND UNDER NO CIRCUMSTANCES SHALL SPECIFIED TECHNOLOGIES INC. BE RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL PROPERTY DAMAGE OR LOSSES. PRIOR TO USE, THE USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR ITS INTENDED USE, AND THE USER ASSUMES ALL RISKS AND LIABILITY FOR SUBSEQUENT USE. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

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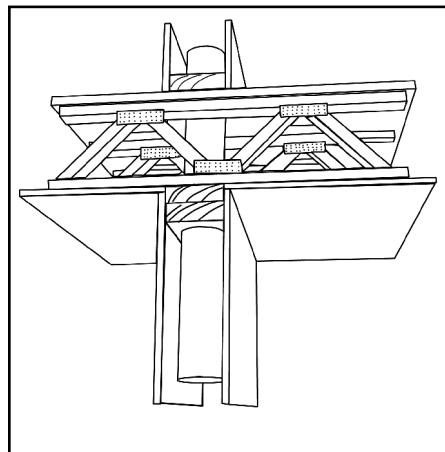




SERIES WF300 INTUMESCENT FIRESTOP CAULK

APPLICATIONS

Type WF300 Caulk is used to seal through penetrations and gaps in fire resistance rated wood frame construction such as floor/ceilings and walls or partitions. Most common penetrating items were successfully tested with WF300.



PRODUCT DESCRIPTION

Type WF300 Caulk is a latex based, high solids firestop caulk. This material, when properly installed, effectively seals penetration openings in wood frame construction against the spread of fire, smoke and combustion byproducts.

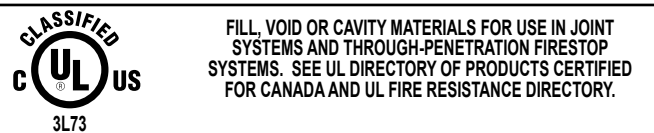
Type WF300 Caulk is a single stage intumescent. When exposed to elevated temperatures, WF300 expands rapidly to seal off voids left by the burning or melting of combustible materials.

Type WF300 Caulk is storage stable (when stored according to manufacturer's recommendations) and will not separate or shrink when dried. WF300 adheres tenaciously to common construction materials such as lumber and gypsum board as well as typical penetrant materials.

FEATURE	BENEFIT
• Water Based	Easy installation, cleanup and disposal
• Intumescent	Expands with heat
• Water-Resistant	Will not re-emulsify
• Paintable	

PERFORMANCE

Type WF300 Caulk is the basis for systems that meet the exacting criteria of ASTM E 814 (ANSI/UL1479) as well as the time/temperature requirements of ASTM E 119 (ANSI/UL263). UL Systems have been tested for wood frame construction and common penetrating items with ratings up to 2 hours. See UL Directory for system information.



PHYSICAL PROPERTIES

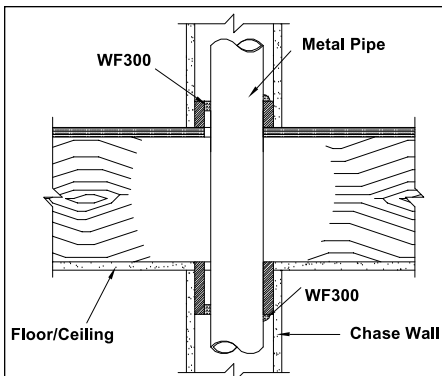
Properties	Series WF300
Color	Red
Odor	Mild Latex
Density	11.4 lbs/gal (1.36 kg/L)
Solids Content	81%
pH	7.4 to 8.4
Max. In Service Temperature	120° F (49° C)
Flame Spread	0*

Properties	Series WF300
Smoke Developed	20*
STC Rating (ASTM E90/ASTM C919)	61
VOC Content (EPA Method 24/ASTM D3960)	33.3 lb/gal. (40.0 g/L)
Expansion Begins	350°F (176°C)
Volume Expansion	>5X Free Expansion
Shelf Life	12 Months

*ASTM E 84 (UL723) @ 14% surface coverage (modified test for caulks and sealants)

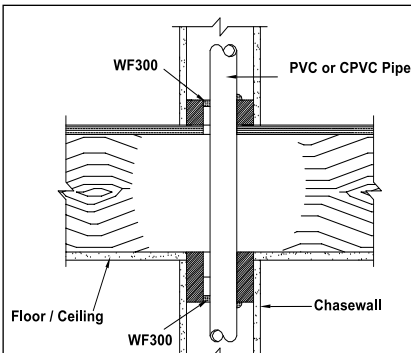


Fig 1: Metal Pipe, Conduit, Tube



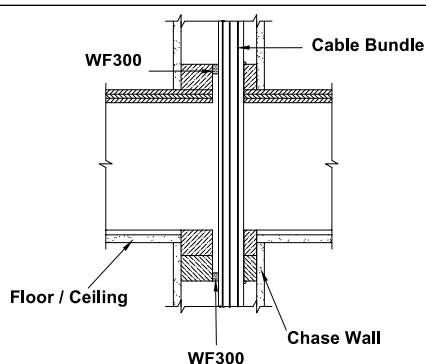
UL System No. F-C-1053
 F Rating: 1 hour • T Rating: 1 hour
 Steel, Iron, Copper, Conduit/EMT: 4"
 Annulus: 0" to 1/2"
 Sealant Depth: 3/4" top, 5/8" bottom

Fig 2: Plastic Pipe



UL System No. F-C-2014
 F Rating: 1 hour • T Rating: 1 hour
 PVS, CPVC (DWV or Closed): 2"
 Annulus: 0" to 1/2"
 Sealant Depth: 1/2" top, 1/2" bottom

Fig 3: Electrical/Telecom/Data Cables



UL System No. F-C-3010
 F Rating: 1 hour • T Rating: 1 hour
 Electrical, Telephone, or Data Cables
 Annulus: 0" to 1/2"
 Sealant Depth: 1/2" top, 1/2" bottom

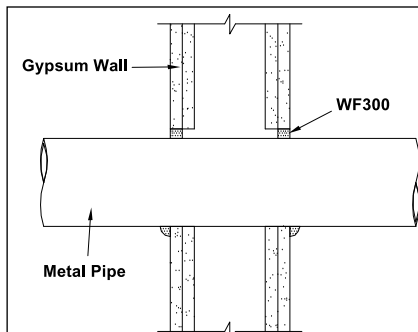
SPECIFICATIONS

The firestopping sealant shall be a water-resistant, intumescent, latex sealant Type WF Firestop Caulk. The sealant when exposed to high heat or flame shall exhibit a free expansion of up to 4 times its original volume. The firestopping sealant shall contain no water soluble nor hygroscopic ingredients. The sealant shall be UL Classified and tested to the requirements of ASTM E814 (UL1479) and shall meet Class A finish requirements when tested in accordance with ASTM E84 (UL723).

SPECIFIED DIVISIONS

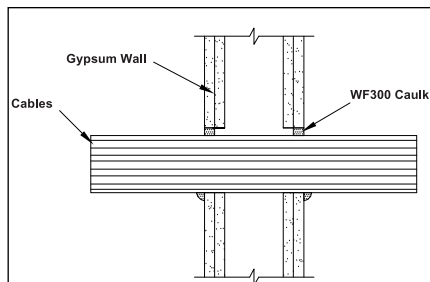
- DIV. 7 07840 Through-Penetration Firestopping
- DIV. 13 13900 Special Construction Fire Suppression & Supervisory Systems
- DIV. 15 15250 Mechanical Insulation – Fire Protection
- DIV. 16 16050 Basic Electrical Materials & Methods

Fig 4: Metal Pipe, Conduit, Tube



UL System No. W-L-1042
 F Rating: 1 or 2 hour • T Rating: 1/4 hour
 Steel, Iron, Copper, Conduit/EMT: 4"
 Annulus: 0" to 1/2"
 Sealant Depth: 5/8" both sides

Fig 5: Electrical/Telecom/Data Cables



UL System No. W-L-3036
 F Rating: 1 or 2 hour • T Rating: 1/2 hour
 Electrical, Telephone, or Data Cables
 Annulus: 0" to 3/4"
 Sealant Depth: 0" both sides

SEALANT REQUIREMENTS IN CUBIC INCHES PER 1/4 INCH OF INSTALLED DEPTH*

Pipe Size		Diameter of Opening (in.)												
		1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	10	12	14	26	
Trade Size	Pipe O.D.													
0.5"	0.840	0.3	0.6	1.6	3.0	4.8	6.9	9.5	12.4	19.5	28.1	38.3	132.6	
1"	1.315	0.1	0.4	1.4	2.8	4.6	6.7	9.3	12.2	19.3	27.9	38.1	132.4	
1.5"	1.900			1.1	2.4	4.2	6.4	8.9	11.9	18.9	27.6	37.8	132.0	
2"	2.375			0.7	2.0	3.8	6.0	8.5	11.5	18.5	27.2	37.4	131.6	
2.5"	2.875			0.1	1.5	3.3	5.4	8.0	10.9	18.0	26.7	36.9	131.1	
3"	3.500				0.7	2.5	4.7	7.2	10.2	17.2	25.9	36.1	130.3	
3.5"	4.000					1.8	3.9	6.5	9.4	16.5	25.1	35.3	129.6	
4"	4.500					0.8	3.0	5.6	8.5	15.6	24.2	34.4	128.7	
6"	6.625	<div>"Different Sealant Depth?"<div><div>1/2" Multiply by 2</div><div>5/8" Multiply by 2.5</div><div>1" Multiply by 4</div><div>1-1/4" Multiply by 5</div></div></div>						1.1	4.0	11.1	19.7	29.9	124.2	
8"	8.625									4.9	13.6	23.8	118.0	
10"	10.750											5.6	15.8	110.0
12"	12.750												6.6	100.8
24"	24.000													19.6

IMPORTANT NOTE: This table is for estimation purposes only. Consult UL Fire Resistance Directory or STI Product & Application Guide for specific installation requirements and limitations
 Metric Estimation Table available upon request.

INSTALLATION INSTRUCTIONS

GENERAL: Areas to be protected must be clean and free of oil, loose dirt, rust or scale. Installation temperatures must be between 35° F to 100° F (2° C to 38° C). Allow product to dry a minimum of 24 hours before prior to exposure to moisture.

SYSTEM SELECTION: Select appropriate UL Classified System. Refer to UL Fire Resistance Directory for more information.

FORMING: Although not generally required, backing materials may be utilized to facilitate the installation of WF300 Caulk. In most wood frame construction applications, open or close cell polyethylene or polyurethane backer rod may be used.

FILL MATERIAL: Type WF300 Caulk may be installed by caulking using a standard caulk gun or from bulk containers using a bulk loading caulk gun, or by manually troweling using a mason's trowel or putty knife. If the sealant pulls back from surface, clean the surface with a damp rag or sponge and reapply. Work caulk into all areas and exercise care to eliminate voids or seams. Surface of caulk can be smoothed using a putty knife dipped in water. Adding water to caulk itself is not recommended. Type WF300 (when dry) may be sanded and painted using most non-solvent based paints. In gypsum board construction, overlapping onto gypsum board paper by a minimum 1/4" (6 mm) is recommended to assure adequate adhesion is maintained.

LIMITATIONS: Type WF300 Caulk is water based and cures through the evaporation of water. Low temperatures, high humidity, the use of non-porous or impermeable backing materials, cover plates or coatings may retard the drying process. Do not paint or seal in any way that prevents contact with air until caulk has dried through completely. Type WF300 Caulk has been designed to be safe for contact with plastics and has been used extensively and successfully with a variety of different types of plastic pipes, tubes, and plastic cable insulations or jackets. Variations in these materials, however, make it impossible to guarantee compatibility. STI strongly recommends that the user consult with the manufacturer of the pipe, tubing, or cable in question regarding any known sensitivities or potential restrictions before applying this product.

MAINTENANCE

Inspection: Installations should be inspected periodically for subsequent damage. Any damage should be repaired using Type WF300 Caulk per the original approved design.

Retrofit: When adding or removing penetrants, care should be taken to minimize damage to the seal. Reseal using Type WF300 Caulk per the original approved design. **NOTE:** New penetrants of a different nature than the original design may require a totally new firestop design or extensive modifications to the existing design. Reseal all openings as per the requirements of the modified design.



TECHNICAL SERVICE

Specified Technologies Inc. provides toll free technical support to assist in product selection and appropriate installation design. UL Systems, Material Safety Data Sheets and other technical information is available through the Technical Library at www.stifireshape.com.

PRECAUTIONARY INFORMATION

Consult Material Safety Data Sheet for additional information on the safe handling and disposal of this material. Wash areas of skin contact with soap and water. Avoid contact with eyes. SEALANT IS CONDUCTIVE UNTIL DRY.

AVAILABILITY

Type WF300 Caulk is available from authorized STI distributors. Visit the company website at www.stifireshape.com for complete list of names and locations of nearest sales representatives or distributors. Available packages and additional STI products for wood frame construction are listed below.

ORDERING INFORMATION

WF300 Intumescent Firestop Caulk is available in caulk tubes, sausages and pails.

Cat. No. Description

WF310	10.1 oz. Tube (300 ml)	18.2 cu.in.
WF329	29 oz. Tube (858 ml)	52 cu.in.
WF320	20 oz. Sausage (592 ml)	36 cu. in.
WF305	5 Gal. Pail (19.0 liters)	1,155 cu. in.

Additional STI Products for Wood Frame Construction...

SmokeBlock™ Sealer

A noncombustible caulk meeting ASTM E 136 for use in sealing penetrants and gaps in non-rated construction.

CITY OF NEW YORK MEA 440-04-M

IMPORTANT NOTICE: All statements, technical information, and recommendations contained herein are based upon testing believed to be reliable, but the accuracy and completeness thereof is not guaranteed.

WARRANTY

Specified Technologies Inc. manufactures its goods in a manner to be free of defects. Should any defect occur in its goods (within one year), Specified Technologies Inc., upon prompt notification, will at its option, exchange or repair the goods or refund the purchase price.

LIMITATIONS AND EXCLUSIONS:

THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS EXPRESSED OR IMPLIED (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE) AND UNDER NO CIRCUMSTANCES SHALL SPECIFIED TECHNOLOGIES INC. BE RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL PROPERTY DAMAGE OR LOSSES. PRIOR TO USE, THE USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR ITS INTENDED USE, AND THE USER ASSUMES ALL RISKS AND LIABILITY FOR SUBSEQUENT USE.

No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

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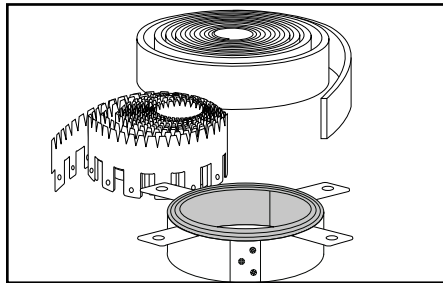


SERIES SSW INTUMESCENT WRAP STRIPS

APPLICATIONS

SpecSeal® Wrap Strips are used for firestop-ping combustible penetrants such as nonmetallic pipes or pipe insulation.

Installations were developed for both "tuck-in" applications (where strips are secured around the penetrant and slid into the opening) and restraining collar assemblies (for surface mounting). For larger openings or complex penetrant configurations, systems were developed utilizing wrap strips in conjunction with other SpecSeal® products. SpecSeal® Wrap Strips are suitable for use in all common forms of construction including concrete floors, concrete over steel deck, concrete walls, concrete block walls, gypsum board/stud walls, and wood floor/ceiling assemblies.



PRODUCT DESCRIPTION

SpecSeal® Wrap Strips are highly flexible, elastomeric strips designed to firestop combustible penetrations in fire-rated floors, floor/ceilings, and walls. Convenient 12' (3.7 m) rolls, or individually sized strips facilitate installation and minimize waste. Four grades are available to suit the product to the application.

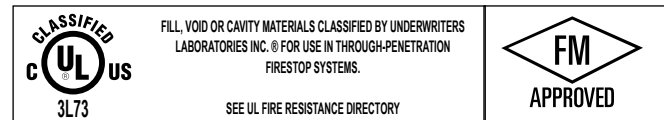
These products utilize STI's fast responding intumescent technology, providing very responsive and highly directionalized expansion. Rapid expansion provides quick closure for burning combustible penetrants.

When exposed to temperatures in excess of 250° F (121° C), the SpecSeal® Wrap Strip begins to expand (intumesce) rapidly to form a dense, highly insulative char. Free expansion varies according to the grade utilized (See Table A). Expansion continues up to temperatures of 1,000° F (538° C).

FEATURE	BENEFIT
• Rapid Expansion:	Closes off burning penetrants faster.
• High Volume Char:	Significant expansion seals off opening!
• Water-Resistant:	No soluble or hygroscopic ingredients.
• Economical:	12' (3.2 m) rolls or precut strips means no piecing... less waste!
• Highly Flexible:	No foil... soft...supple...easier to install!
• Versatile:	Performer for a wide range of complex applications.

PERFORMANCE

SpecSeal® Wrap Strips are the basis for systems that meet the exacting criteria of ASTM E 814 (UL1479). Systems were tested for all common forms of construction and penetrants with ratings up to 3 and 4 hours (dependent upon grade of wrap strip utilized).



PHYSICAL PROPERTIES

See Table A. This material is extremely stable. Long term aging studies indicate no significant loss of physical properties nor significant change in expansion properties after elevated temperature, humidity, and immersion testing. Consult factory for additional information.

TABLE A: PHYSICAL PROPERTIES										
Catalog Number	SSWBLU	SSWBLU2	SSWRED	SSWRED2	SSWBLU220	SSWBLU230	SSWBLU240	SSW125	SSW250	SSW375
Color	Blue	Blue	Red	Red	Blue	Blue	Blue	Gray	Gray	Gray
Thickness	3/16" (4.8 mm)	1/8" (3.2 mm)	1/4" (6 mm)	1/8" (3.2 mm)	1/8" (3.2 mm)	1/8" (3.2 mm)	1/8" (3.2 mm)	1/8" (3.2 mm)	1/4" (6 mm)	3/8" (10 mm)
Width	2" (51 mm)	2" (51 mm)	1-1/2" (38 mm)	1-1/2" (38 mm)	1-1/2" (38 mm)	3" (76 mm)	4" (102 mm)	1-1/2" (38 mm)	1-1/2" (38 mm)	1-1/2" (38 mm)
Length	12' (3.7 m)	12' (3.7 m)	12' (3.7 m)	12' (3.7 m)	8" (204 mm)	11-3/16" (284 mm)	14-5/8" (356 mm)	8" (204 mm)	11-3/4" (298 mm)	15-7/8" (403 mm)
Weight	3.0 lbs (1.4 kg)	0.7 lbs (0.32 kg)	1.10 lbs (0.52 kg)	1.10 lbs (0.52 kg)	0.05 lbs (0.02 kg)	0.15 lbs (0.08 kg)	0.3 lbs (0.12 kg)	0.05 lbs (0.02 kg)	0.2 lbs (0.10 kg)	0.4 lbs (0.18 kg)
Expansion System	Two-Stage	Single Stage	Two-Stage	Single Stage	Single Stage	Single Stage	Single Stage	Single Stage	Single Stage	Single Stage
Expansion Begins	250° F (121° C) 1st Stage 350° F (160° C) 2nd Stage	320° F (160° C)	250° F (121° C) 1st Stage 350° F (160° C) 2nd Stage	320° F (160° C)	320° F (160° C)	320° F (160° C)	320° F (160° C)	320° F (160° C)	320° F (160° C)	320° F (160° C)
Volume Expansion	20 to 30x	30 to 60x	16 to 24x	24 to 48x	30 to 60x	30 to 60x	30 to 60x	30 to 60x	30 to 60x	30 to 60x
In Service Temp	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)	130°F (54°C)
Oven Aging	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)	No Change (60°C)
Humidity Exposure	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)	No Change (60° C; 98% R.H.)
UL Accelerating Aging	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass



SPECIFICATIONS

The wrap strip material shall be highly flexible, intumescent material. The wrap strip shall contain no water soluble expansion ingredients and provide a minimum of 16x free expansion. The intumescent wrap strip shall be faced on each side with plastic. The specified material shall be approved for a wide range of applications including combustible and noncombustible penetrants when used by itself or in combination with other products from the same manufacturer. The wrap strip shall be UL Classified and tested to the requirements of ASTM E 814 (UL1479).

SPECIFIED DIVISIONS

DIV. 7 — 07 84 00 — Firestopping
DIV. 22 — 22 07 00 — Plumbing Insulation
DIV. 22 — 22 00 00 — Plumbing
DIV. 23 — 23 07 00 — HVAC Insulation

INSTALLATION INSTRUCTIONS

GENERAL: Areas to be protected must be free of oil, loose dirt, rust, or scale. In most cases, walls require symmetrical applications and wrap strips must be applied to both sides. Wrap strips may be continuously wrapped or installed individually around the penetrant. When layers are installed individually, butted ends in successive layers may be aligned or offset. When selecting a wrap strip grade, refer to TABLE B below.

TABLE B: WRAP STRIP GRADES				
	SSWRED	SSWRED2	SSWBLU	SSWBLU2
Max. Plastic Pipe Size	6" (152 mm)	6" (152 mm)	12" (305 mm)	12" (305 mm)

SYSTEM SELECTION: A variety of methods have been developed and UL Classified using SpecSeal® Wrap Strips. Visit the Technical Library at www.stifirestop.com to locate precise system installation drawings.

TUCK-IN INSTALLATIONS: Encircle penetrant with wrap strip. Masking tape may be used to temporarily secure wrap strip. Secure wrap strip layers in place using steel tie wire or foil tape as required. Slide wrap strip into opening and position dictated by individual UL System or STI design. Apply SpecSeal® Sealant as required for smoke seal.

RESTRAINING COLLAR INSTALLATIONS: When surface mounted restraining collar systems are used, start by installing SpecSeal® Sealant into annular space as a smoke seal. Although not always required by the UL System, sealing both sides of walls and floors is a recommended practice. Encircle penetrant with wrap strip layers. Temporarily secure layers using masking tape or steel wire. Calculate the length of restraining collar required to completely wrap around the outer diameter of the wrap strip layers plus an additional 1" (25 mm) overlap. Secure restraining collars with stainless steel hose clamp positioned at the mid-point of the collar or symmetrically located steel screws as specified within the UL System. Refer to TABLE C below to select appropriate restraining collar.

TABLE C: APPROPRIATE RESTRAINING COLLAR TYPES				
	SSWRED	SSWRED2	SSWBLU	SSWBLU2
SSWRC			X	X
SSWRC2	X	X		
WSC-8*			X	X
WSC-8RED**	X	X		
WSC-12***			X	X
SSWRC and SSWRC2 sold in 25' (7.6 m) rolls and may be cut to length as required *Single collar for 6" (152 mm) and 8" (204 mm) pipe only **Single collar for 6" (152 mm) pipe only ***Single collar for 10" (254 mm) and 12" (305 mm) pipe only				

For more information, refer to STI's "Product Estimation and Installation Sheet – Wrap Strip Collars" concerning the use of restraining collar.

POURED OR EMBEDDED INSTALLATIONS: Where excessive annular space exists, poured or embedded installations provide an economical method of sealing large openings. Encircle penetrants with appropriate number of wrap strip layers securing wrap strip layers with steel tie wire or foil tape as required. In floors, locate the bottom edge of wrap strip at the position specified in the UL System. In walls, locate the exposed edge of wrap strip at the position specified in the UL System. After wrap strips are secured and positioned, back fill openings with SpecSeal® Firestop Mortar or Sealant as required.

These tables provide the information related to the firestopping of plastic pipes utilizing "tuck-in" or restraining collar assemblies:

1. Number of layers.
2. Length of each layer and total number of required layers.
3. Length of restraining collar metal (with 1" (25 mm) min. added for overlap).

SSWRED WRAP STRIP AND RESTRAINING COLLAR REQUIREMENTS						
Trade Size	Pipe OD	Length of Layers & Restraining Collar (RC) In Inches*				
		1st	2nd	3rd	Total	RC
1.5	1.9	7.5			7.5	8.7
2.0	2.4	9.1			9.1	10.3
2.5	2.9	10.7	12.3		22.9	13.6
3.0	3.5	12.6	14.1		26.7	15.5
3.5	4.0	14.1	15.7	17.3	47.1	18.7
4.0	4.5	15.7	17.3	18.8	51.8	20.3
6.0	6.63	22.4	24.0	25.5	143.7 ¹	27.2 ²

¹Requires double stack of 3 layers of wrap strip

²Requires WSC8RED restraining collar for 6 in. trade size pipe

SSWBLU WRAP STRIP AND RESTRAINING COLLAR REQUIREMENTS								
Trade Size	Pipe OD	Length of Layers & Restraining Collar (RC) In Inches*						
		1st	2nd	3rd	4th	5th	Total	RC
1.5	1.9	7.1					7.1	8.3
2.0	2.4	8.7					8.7	9.9
2.5	2.9	10.3	11.5				21.8	12.8
3.0	3.5	12.2	13.4				25.5	14.7
3.5	4.0	13.7	14.9	16.1			44.8	17.5
4.0	4.5	15.3	16.5	17.7			49.5	19.1
6.0	6.63	22.0	23.2	24.3			139.0 ¹	26.0 ¹
8.0	8.63	28.3	29.5	30.6	31.8		240.3 ²	32.8 ²
10.0	10.75	35.0	36.1	37.3	38.5		367.2 ³	39.6 ³
12.0	12.75	41.2	42.4	43.6	44.8	45.9	544.9 ⁴	47.3 ⁴

¹Requires two stacks of 3 layers of wrap strip and WSC8 restraining collar. ²Requires two stacks of 4 layers of wrap strip and WSC8 restraining collar.

³Requires 2-1/2 stacks of 4 layers of wrap strip and WSC12 restraining collar.

⁴Requires 2-1/2 stacks of 5 layers of wrap strip and WSC12 restraining collar.

SSWRED2 and SSWBLU2 WRAP STRIP AND RESTRAINING COLLAR REQUIREMENTS								
Trade Size	Pipe OD	Length of Layers & Restraining Collar (RC) In Inches*						
		1st	2nd	3rd	4th	5th	Total	RC
1.5	1.9	6.8					6.8	7.9
2.0	2.4	8.3					8.3	9.5
2.5	2.9	9.9	10.7				20.6	11.9
3.0	3.5	11.8	12.6				24.3	13.9
3.5	4.0	13.4	14.1	14.9			42.4	16.3
4.0	4.5	14.9	15.7	16.5			47.1	17.9
6.0	6.63	21.6	22.4	23.2			134.3 ¹	24.7 ¹
8.0	8.63	27.9	28.7	29.5	30.2		232.5 ²	31.1 ²
10.0	10.75	34.6	35.3	36.1	36.9		357.4 ³	38.0 ³
12.0	12.75	40.8	41.6	42.4	43.2	44.0	530.1 ⁴	45.3 ⁴

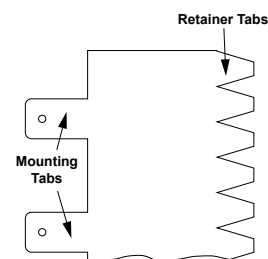
¹Requires two stacks of 3 layers of wrap strip and WSC8 restraining collar. ²Requires two stacks of 4 layers of wrap strip and WSC8 restraining collar.

³Requires 2-1/2 stacks of 4 layers of wrap strip and WSC8RED or WSC12 restraining collar.

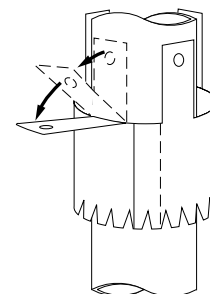
⁴Requires 2-1/2 stacks of 5 layers of wrap strip and WSC12 restraining collar.

* Metric dimensions available online at www.stifirestop.com.

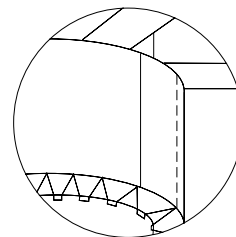
RESTRAINING COLLAR INSTALLATION



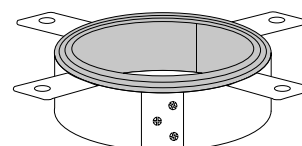
1. Temporarily secure wrap strips to pipe with masking tape. Measure and cut collar to length, providing a 1" (25 mm) overlap.



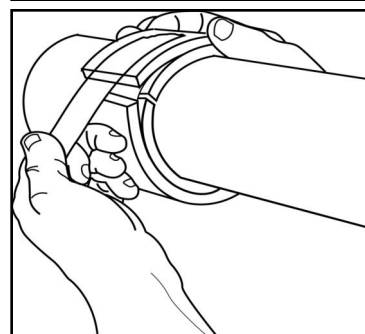
2. Bend mounting tabs 90° away from collar. Tightly secure to pipe or conduit with three #8 sheet metal screws or one stainless steel hose clamp.



3. Bend retainer tabs 90° toward pipe or conduit. Tabs may be bent flush against pipe or trimmed to a length sufficient to contain all wrap strip layers.



4. Slide collar against floor or wall and secure with appropriate steel fasteners and fender washers.



MAINTENANCE

Inspection: Installations should be inspected periodically for subsequent damage. Any damage should be repaired using SpecSeal® products per the original approved design.

TECHNICAL SERVICE

Specified Technologies, Inc. provides toll free technical support to assist in product selection and installation design. Log onto the Technical Library at www.stifirestop.com or call the STI Technical Service Department to obtain UL System drawings, MSDSs, or other technical information.

PRECAUTIONARY INFORMATION

Consult Material Safety Data Sheet for additional information on the safe handling and disposal of this material. Wash areas of skin contact with soap and water. Avoid contact with eyes.

AVAILABILITY

SpecSeal® Wrap Strips are available from authorized distributors. Consult factory for the names and locations of the nearest sales representatives or distributors.

CATALOG NUMBER	DESCRIPTION
RED & RED2 Wrap Strip & Accessories	
SSWRED	12' x 1-1/2" x 1/4" (3.7 m x 38 mm x 6 mm) Intumescent Wrap Strip
SSWRED2	12' x 1-1/2" x 1/8" (3.7 m x 38 mm x 3 mm) Intumescent Wrap Strip
SSWRC2	30 Gauge sheet metal restraining collar for ≤4" (102 mm) pipes (25' (7.6 m) roll)
WSC-8RED	Preformed restraining collar for 6" (152 mm) pipe
BLU & BLU2 Wrap Strip & Accessories	
SSWBLU	12' x 2" x 3/16" (3.7 m x 51 mm x 5 mm) Intumescent Wrap Strip
SSWBLU2	12' x 2" x 1/8" (3.7 m x 51 mm x 3 mm) Intumescent Wrap Strip
SSWRC	30 Gauge sheet metal restraining collar for ≤4" (102 mm) pipes (25' (7.6 m) roll)
WSC-8	Preformed restraining collar for 6" (152 mm) and 8" (204 mm) pipe
WSC-12	Preformed restraining collar for 10" (254 mm) and 12" (305 mm) pipe
Precut Wrap Strips	
SSW125	1-1/2" (38 mm) x 1/8" (3 mm) strip sized for 2" (51 mm) trade size pipe
SSW250	1-1/2" (38 mm) x 1/4" (6 mm) strip sized for 3" (76 mm) trade size pipe
SSW375	1-1/2" (38 mm) x 3/8" (10 mm) strip sized for 4" (102 mm) trade size pipe
SSWBLU220	Precut strip sized for 2" (51 mm) trade size pipe
SSWBLU230	Precut strip sized for 3" (76 mm) trade size pipe
SSWBLU240	Precut strip sized for 4" (102 mm) trade size pipe

CITY OF NEW YORK MEA 130-96 M & MEA 212-01-M

IMPORTANT NOTICE: All statements, technical information, and recommendations contained herein are based upon testing believed to be reliable, but the accuracy and completeness thereof is not guaranteed.

WARRANTY

Specified Technologies Inc. manufactures its goods in a manner to be free of defects. Should any defect occur in its goods (within one year), Specified Technologies Inc., upon prompt notification, will at its option, exchange or repair the goods or refund the purchase price.

LIMITATIONS AND EXCLUSIONS:

THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS EXPRESSED OR IMPLIED (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE) AND UNDER NO CIRCUMSTANCES SHALL SPECIFIED TECHNOLOGIES INC. BE RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL PROPERTY DAMAGE OR LOSSES. PRIOR TO USE, THE USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR ITS INTENDED USE, AND THE USER ASSUMES ALL RISKS AND LIABILITY FOR SUBSEQUENT USE. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

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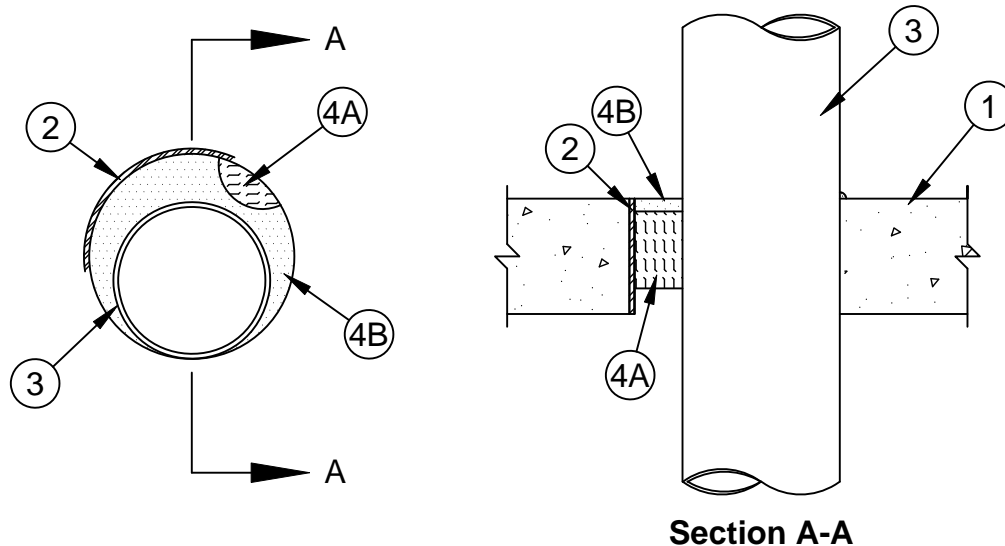
System No. C-AJ-1353

F Rating - 3 Hr

T Rating - 0 Hr

L Rating At Ambient - Less Than 1 CFM/Lin Ft

L Rating At 400°F - Less Than 1 CFM/Lin Ft



1. **Floor or Wall Assembly** - Lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete floor or wall. Min thickness of concrete is shown in table in Item 4B. Floor may also be constructed of any min 6 in. (152 mm) thick hollow-core **Precast Concrete Units***. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 14 in. (356 mm). Max diam of opening in floors constructed of hollow-core is 7 in. (178 mm).

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

2. **Steel Sleeve** - (Optional) - Nom 14 in. (356 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe or No. 26 ga (0.022 in. or 0.56 mm thick) sheet steel sleeve with square anchor flange spot welded to the sleeve at approx mid-height. Sleeve cast or grouted in place flush with floor or wall surfaces. Steel pipe sleeve may project a max of 2 in. (51 mm) beyond the floor or wall surfaces.
3. **Through Penetrant** - One metallic pipe, conduit or tube to be installed eccentrically or concentrically within the firestop system. The annular space between the pipe, conduit or tube and the periphery of the opening shall be min 0 in. (point contact). The max annular space is 1 in. or 2 in. (25 or 51 mm) as shown in the table in Item 4B. Pipe, conduit or tube to be rigidly supported on both sides of the floor or wall assembly. The following types and sizes of metallic pipes, conduits and tubes may be used:
 - A. **Steel Pipe** - Nom 12 in. (305 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 12 in. (305 mm) diam (or smaller) cast or ductile iron pipe.
 - C. **Conduit** - Nom 6 in. (152 mm) diam (or smaller) rigid steel conduit, nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or nom 4 in. (102 mm) diam (or smaller) flexible steel conduit.
 - D. **Copper Pipe** - Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
 - E. **Copper Tube** - Nom 4 in. (102 mm) diam (or smaller) Regular L (or heavier) copper tube.



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PAGE 1 OF 2

- 3A. **Through Penetrating Product* - Flexible Metal Piping** - As an alternate to Item 3, one nom 2 in. (51 mm) diam (or smaller) flexible steel pipe (with or without plastic jacketing) to be installed either concentrically or eccentrically within the firestop system. The annular space between the pipe, conduit or tube and the periphery of the opening shall be min 0 in. (0 mm or point contact). The max annular space is 1 or 2 in. (25 or 51 mm) as shown in the table in Item 4B. Pipe to be rigidly supported on both sides of the floor or wall assembly.

OMEGA FLEX INC

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4. **Firestop System** - The firestop system shall consist of the following:

A. **Packing Material** - When required as shown in the table in Item 4B, min 4 pcf (64 kg/m³) mineral wool batt insulation compressed and tightly packed to min 2-1/4 in. (57 mm) thickness. Packing material recessed from top surface of floor or both surfaces of wall as required to accommodate fill material (Item 4B). When packing material is shown as being optional, mineral wool or glass fiber insulation or polyethylene foam backer rod may be used as a permanent form to facilitate installation of the fill material. In floors constructed of hollow-core precast concrete units, packing material to be recessed from both top and bottom surfaces of floor, as required to accommodate fill material (Item 4B). When steel sleeve projects from top of floor or from both sides of wall, the thickness of mineral wool batt packing material should be increased by an amount equal to the distance that the sleeve extends past the floor or wall surface.

B. **Fill, Void or Cavity Material* - Sealant** - Fill material applied within annulus, flush with top surface of floor assembly or top edge of steel sleeve. In walls and in floors constructed from hollow core precast concrete units, fill material applied symmetrically on both sides of assembly flush with wall/floor surfaces or both ends of steel sleeve. At point contact location, apply min 1/4 in. (6 mm) diam bead of fill material at pipe/concrete interface or pipe/steel sleeve interface on top surface of floor or both surfaces of wall or precast concrete units. The fill material thickness shall be as specified in the following table:

Min Concrete Thickness in. (mm)	Steel Sleeve	Max Annular Space, in. (mm)	Packing Material	Min Fill Material Thickness in. (mm)	F Rating
2-1/2 (64)	Optional	2 (51)	Required	1/4 (6)	3 hr
4-1/2 (114)	Optional	1 (25)	Optional	1/2 (13)	2 hr

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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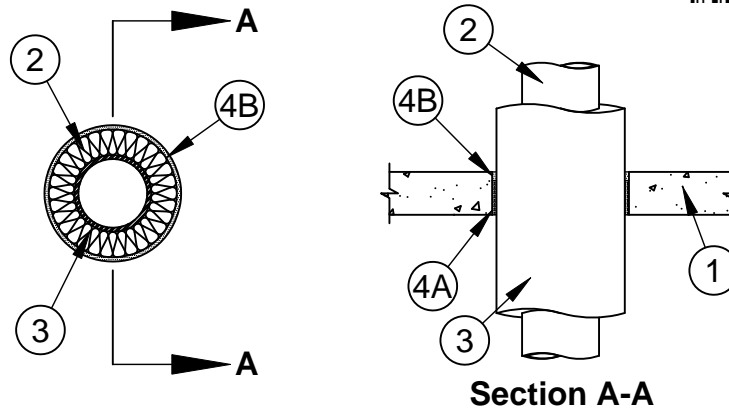
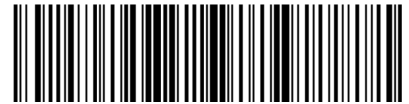


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PAGE 2 OF 2

System No. C-AJ-5102

F Rating - 1-1/2 Hr

T Rating - 1 Hr



Section A-A

1. **Floor or Wall Assembly** - Min 2-1/2 in. (64 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete or 3 in. (76 mm) thick reinforced lightweight or normal weight concrete wall. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 8 in. (203 mm).
See **Concrete Blocks (CAZT)** category in the Fire Resistance Directory for names of manufacturers.
2. **Through Penetrant** - One metallic pipe or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or tubing may be used:
 - A. **Steel Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 4 in. (102 mm) diam (or smaller) cast or ductile iron pipe.
 - C. **Copper Tubing** - Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing.
 - D. **Copper Pipe** - Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
3. **Pipe Coverings*** - One of the following types of pipe coverings shall be used:
 - A. **Pipe and Equipment Covering Materials*** - Nom 1-1/2 in. (38 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. The annular space between the insulated through penetrant and periphery opening shall be a nom 1/2 in. (13 mm).
See **Pipe and Equipment Covering-Materials** - (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a smoke Developed Index of 50 or less may be used.
 - B. **Pipe Covering Materials*** - Nom 1-1/2 in. (38 mm) thick unfaced mineral fiber pipe insulation sized to the outside diam of pipe or tube. Pipe insulation secured with min 8 AWG steel wire spaced max 12 in. (305 mm) OC. The annular space between the insulated through penetrant and periphery opening shall be a nom 1/2 in. (13 mm).
IIG MINWOOL L L C - High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT or High Temperature Pipe Insulation Thermaloc.
 - C. **Sheathing Material*** - Used in conjunction with Item 3B. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe insulation (Item 3B) with the kraft side exposed. Longitudinal joints and transverse joints sealed with metal fasteners or butt tape.
See **Sheathing Materials** (BVDV) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
4. **Firestop System** - The firestop system shall consist of the following:
 - A. **Packing Material** - Min 2 in. (51 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt 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 to accommodate the required thickness of fill material.
 - B. **Fill, Void or Cavity Material* - Sealant** - Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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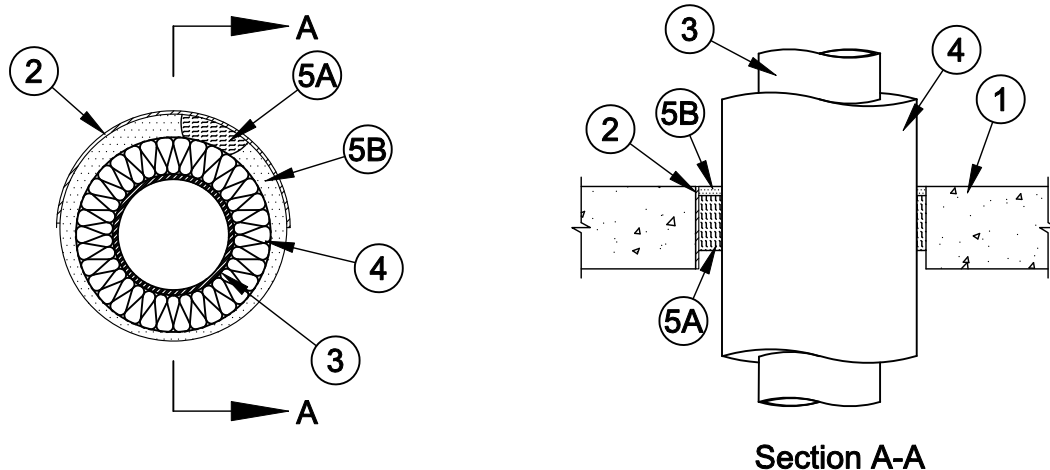


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System No. C-AJ-5138

F Rating - 2 Hr

T Ratings - 3/4 and 1 Hr (See Item 2)



1. **Floor or Wall Assembly** - Min 2-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete floor. Floor may also be constructed of any min 6 in. thick hollow-core **Precast Concrete Units***. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 12 in. Max diam of opening in floors constructed of hollow-core precast concrete units is 7 in.
See **Concrete Blocks** (CAZT) or **Precast Concrete Units** (CFTV) categories in the Fire Resistance Directory for names of manufacturers.
2. **Steel Sleeve** (Optional) - Nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe cast or grouted into floor or wall assembly. Steel sleeve may be installed flush or may project a max 2 in. beyond the floor or wall surfaces. **When steel sleeve is used, the T Rating is 3/4 hr. When steel sleeve is omitted in min 4-1/2 in. thick concrete, the T Rating is 1 hr.**
3. **Through Penetrant** - One metallic pipe or tube to be installed eccentrically or concentrically within the firestop system. Pipe or tube to be rigidly supported on both sides of the floor or wall assembly. The following types and sizes of metallic pipes and tubes may be used:
 - A. **Steel Pipe** - Nom 6 in. diam (or smaller) Schedule 5 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 6 in. diam (or smaller) cast or ductile iron pipe.
 - C. **Copper Pipe** - Nom 4 in. diam (or smaller) Regular (or heavier) copper pipe.
 - D. **Copper Tube** - Nom 4 in. diam (or smaller) Regular L (or heavier) copper tube.
4. **Pipe Coverings** - One of the following types of pipe coverings shall be used:
 - A. **Pipe and Equipment Covering Materials*** - Nom 2 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or butt tape supplied with the product.

See **Pipe and Equipment Covering Materials** (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.



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- B. **Pipe Covering Materials*** - Nom 2 in. thick unfaced mineral fiber pipe insulation having a nom density of 3.5 pcf (or heavier) and sized to the outside diam of pipe or tube. Pipe insulation secured with min No. 8 AWG steel wire spaced max 12 in. OC.

OWENS CORNING HT INC, DIV OF

OWENS CORNING - High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT and High Temperature Pipe Insulation Thermaloc

- C. **Sheathing Material*** - Used in conjunction with Item 4B. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe insulation (Item 4B) with the kraft side exposed. Longitudinal joints and transverse joints sealed with metal fasteners or butt tape.

See **Sheathing Materials** (BVDV) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

5. **Firestop System** - The firestop system shall consist of the following:

- A. **Packing Material** - Min 4 pcf mineral wool batt insulation compressed and tightly packed into opening as a permanent form . Packing material recessed from top surface of floor or both surfaces of wall as required to accommodate fill material (Item 5B). In floors constructed of hollow-core precast concrete units, packing material to be recessed from both top and bottom surfaces of floor, as required to accommodate fill material (Item 5B). When steel sleeve projects from top of floor or from both sides of wall, the thickness of mineral wool batt packing material should be increased by an amount equal to the distance that the sleeve extends past the floor or wall surface. Packing material depth is dependent upon several variables, as shown in the table under Item 5B.
- B. **Fill, Void or Cavity Material* - Sealant** - Fill material applied within annulus, flush with top surface of floor assembly or top edge of steel sleeve. In walls, fill material applied within annulus flush with both surfaces of wall assembly or both ends of steel sleeve. In floors constructed of hollow-core precast concrete units, fill material installed symmetrically on both surfaces of floor. Fill material depth is dependent upon several variables, as shown in the following table:

Min Floor or Wall thickness, in.	Annular Space, in.	Min Packing Material Depth, in.	Min Fill Material Depth, in.
2-1/2	1/4 to 5/8	1-1/2	1
4-1/2	1/4 to 1-5/8	3	1/2

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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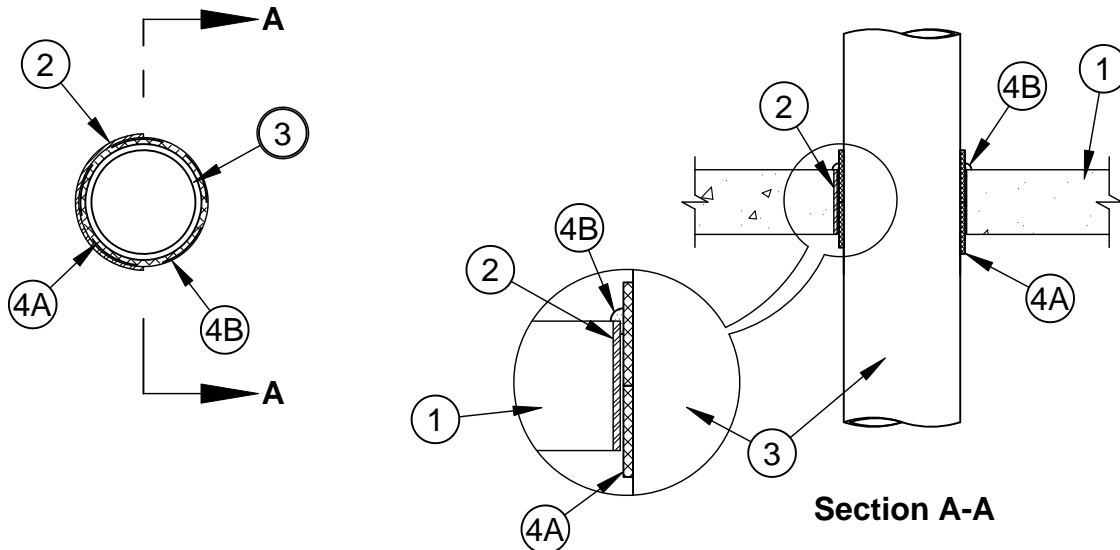
System No. F-A-2077

F Rating - 2 Hr

T Rating - 0 Hr

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



1. **Floor Assembly** - Min 2-1/2 in. (64 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete floor assembly. Diam of floor opening to be 1/2 in. (13 mm) larger than outside diam of penetrant. Max diam of opening is 5 in. (127 mm).
2. **Metallic Sleeve** - (Optional) - Nom 5 in. (127 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe or nom 5 in. (127 mm) diam (or smaller) No. 26 GA (0.022 in. or 0.56 mm thick) sheet metal sleeve with square flange spot welded to the sleeve at approx mid-height and sized to be a min of 2 in. larger than the sleeve diam cast or grouted into floor assembly, flush with floor surfaces. Inside diam of metallic sleeve to be 1/2 in. (13 mm) larger than outside diam of penetrant.
3. **Through Penetrants** - One nonmetallic pipe or conduit to be centered within the opening. Pipe to be rigidly supported on both sides of floor assembly. The following types and sizes of nonmetallic pipes and conduits may be used:
 - A. **Polyvinyl Chloride (PVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 solid or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - B. **Rigid Nonmetallic Conduit+** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with the National Electric Code (NFPA No. 70).
 - C. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) SDR17 SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.
 - D. **Acrylonitrile Butadiene Styrene (ABS) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 solid or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - E. **Flame Retardant Polypropylene (FRPP) Pipe** - Nom 3 in. (76 mm) diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - F. **Electrical Nonmetallic Tubing (ENT)+** - Nom 2 in. (51 mm) diam (or smaller) PVC tubing installed in accordance with the National Electrical Code (NFPA 70).



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4. **Firestop System** - The firestop system shall consist of the following:

- A. **Fill, Void or Cavity Material* - Wrap Strip** - Nom 1/8 in. (3.2 mm) or 3/16 in. (4.8 mm) thick intumescent material faced on both sides with a plastic film, supplied in 2 in. (51 mm) wide strips. A stack of two single layers of wrap strip to be wrapped around the through penetrant with butted seams and joints. Stacked wrap strips secured together with aluminum foil tape around entire circumference with min 1 in. (25 mm) tape overlap. Stacked wrap strips slid into annular space until bottom edge of wrap strip protrudes 1/2 in. (13 mm) below bottom surface of floor. When nom 3 in. (76 mm) diam or smaller penetrants are used, min height of wrap strip stack is 3 in. (76 mm). When nom 3-1/2 or 4 in. (89 or 102 mm) diam penetrants are used, min height of wrap strip stack is 4 in. (102 mm).

SPECIFIED TECHNOLOGIES INC - SpecSeal BLU Wrap Strip or SpecSeal BLU2 Wrap Strip

- A1. **Fill, Void, or Cavity Material* - Wrap Strip** - As an alternate to Item 4A, nom 1/8 in. (3.2 mm) thick intumescent material faced on both sides with a plastic film sized to fit the OD of the pipe. See table for min width of intumescent wrap strip. The wrap strip is continuously wrapped around the outer circumference of the pipe once and slid into the annular space and held in place with one layer of aluminum foil tape. For nom 3 in. (76 mm) and 4 in. (102 mm) diam through penetrants, the wrap strips slid into annular space until bottom edge of wrap strip protrudes 1/2 in. (13 mm) below bottom surface of floor. For nom 2 in. (51 mm) diam through penetrants, the wrap strips are installed such that the bottom edge is recessed a nom 3/4 in. (19 mm) from the bottom surface of the concrete floor.

Nom Pipe Diam, In. (mm)	Wrap Strip	Wrap Strip Width, In (mm)
2 (51)	BLU 220	1-1/2 (38)
3 (78)	BLU 230	3 (76)
4 (102)	BLU 240	4 (102)

SPECIFIED TECHNOLOGIES INC - SpecSeal BLU220, BLU230, or BLU240 Wrap Strip

- B. **Fill Void or Cavity Materials* - Sealant** - Min 1/2 in. (13 mm) thick bead of fill material applied at the wrap strip/steel sleeve or concrete floor interface on the top surface of the floor.

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant or SpecSeal Series SSS Sealant

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System No. F-A-2186

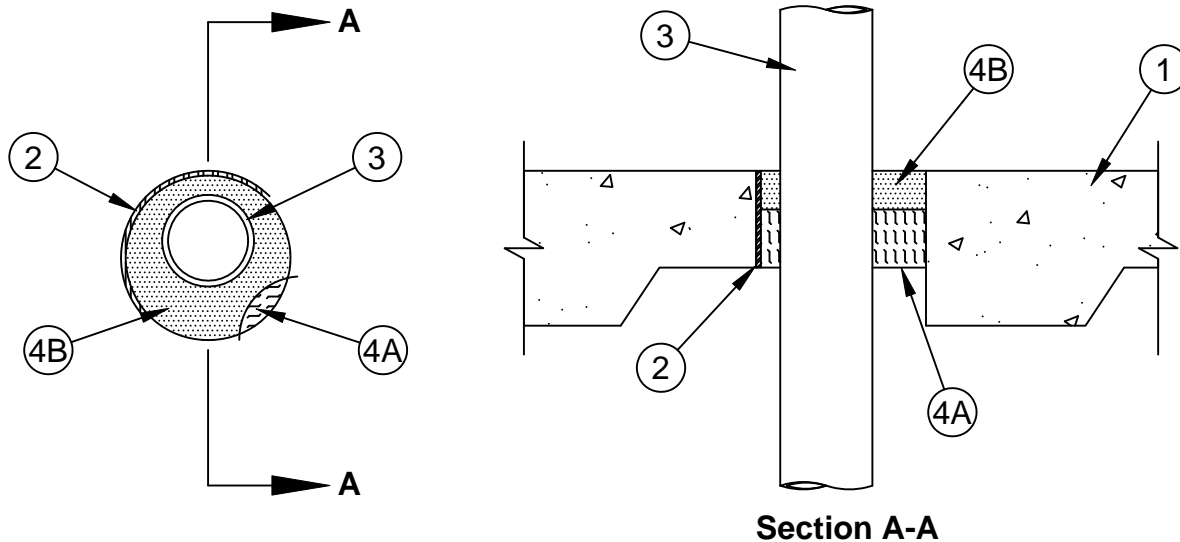
F Rating - 2 Hr

T Rating - 2 Hr

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft

W Rating - Class 1 (See Item 4B)



1. **Floor Assembly** - The fire rated concrete and steel deck floor assembly shall be constructed of the materials and in the manner specified in the individual D900 Series designs in the UL Fire Resistance Directory and as summarized below:
 - A. **Concrete** - Min 2-1/2 in. (64 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete topping.
 - B. **Steel Floor and Form Units*** - Composite or noncomposite min 1-1/2 in. (38 mm) deep fluted galv units as specified in the individual Floor-Ceiling design. Diam of opening through floor to be min 1-1/2 in. (38 mm) larger than outside diam of pipe or conduit. Max diam of opening through floor is 4 in. (102 mm).
- 1A. **Floor Assembly** - As an alternate to Item 1, min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete floor.
2. **Steel Sleeve** - (Optional) - Nom 4 in. (102 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe or nom 4 in. (102 mm) diam (or smaller) No. 26 gauge (0.022 in. or 0.56 mm thick) sheet steel sleeve with square flange spot welded to the sleeve at approx mid-height cast or grouted into floor assembly, flush with floor surfaces.
3. **Through Penetrants** - One nonmetallic pipe to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe and sleeve (Item 2) shall be min 1/4 in. (6 mm) to max 1-3/8 in. (35 mm). When steel sleeve (Item 2) is not provided, the annular space between pipe and periphery of opening shall be min 0 in. (point contact) to max 1-5/8 in. (41 mm). Pipe to be rigidly supported on both sides of floor assembly. The following types and sizes of nonmetallic pipes may be used:
 - A. **Polyvinyl Chloride (PVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid core or cellular core PVC pipe for use in closed (process or supply) piping systems.
 - B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
 - C. **Rigid Nonmetallic Conduit+** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with the National Electrical Code (NFPA 70).
 - D. **Crosslinked Polyethylene (PEX) Tubing** - Nom 1 in. (25 mm) diam (or smaller) SDR 9 PEX tubing for use in closed (process or supply) piping systems.



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4. **Firestop System** - The firestop system shall consist of the following:

- A. **Packing Material** - Min 1-1/2 in. (38 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.
- B. **Fill, Void or Cavity Material* - Sealant** - Min 1 in. (25 mm) thickness of fill material applied within the annulus, flush with top surface of floor. Additionally, nom 1/2 in. (13 mm) diam bead of fill material applied at concrete/penetrant interface at point contact location on top surface of floor.

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant, SpecSeal Series 100, 101, 102, 120, 129, or 105 Sealant, Pensil 300 Sealant, or SpecSeal Series SIL300 Sealant for floors or walls and Pensil 300 SL Sealant or SpecSeal Series SIL300SL Sealant for floors only.

W Rating applies only when Pensil 300 Sealant, SpecSeal Series SIL300, Pensil 300 S/L or SpecSeal Series SIL300SL Sealants are used.

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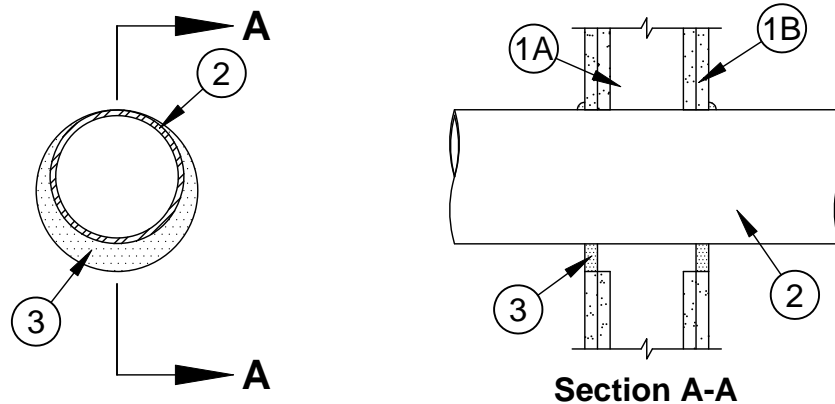
System No. W-L-1049

F Ratings -1 and 2 Hr (See Item 1)

T Rating -0 Hr

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 or 2 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 Design in the UL Fire Resistance Directory and shall include the following construction features:
 - A. **Studs** -Wall framing may consist of either wood studs 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. Steel studs to be min 3-5/8 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.
 - B. **Gypsum Board*** -5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board 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) for steel stud walls. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
- 1A. **Metallic Sleeve** -(Optional, Not Shown) - Cylindrical sleeve fabricated from min 0.016 in. (0.41 mm) to max 0.105 in. (2.7 mm) thick sheet steel. Length of steel sleeve to be equal to the thickness of wall. Longitudinal seam of sleeve welded or overlapped min 1 in. (25 mm). The ends of the steel sleeve shall be flush or recessed max 1/4 in. (6 mm) from wall surfaces.
2. **Through Penetrant** -One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. The annular space between pipe, conduit or tubing and periphery of opening shall be min 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) cast or ductile iron pipe.
 - C. **Conduit** -Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing, nom 6 in. (152 mm) diam (or smaller) steel conduit or nom 1 in. (25 mm) diam (or smaller) flexible steel conduit.
 - 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.
3. **Fill, Void or Cavity Material* -Sealant** -Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrant and gypsum board, a min 3/8 in. (10 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.

SPECIFIED TECHNOLOGIES INC -SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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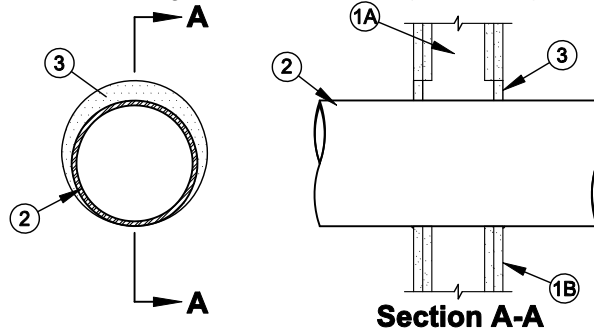


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System No. W-L-1222

F Ratings - 1 and 2 Hr (See Item 1)

T Ratings - 1/4, 3/4 and 1 Hr (See Item 2)



1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
 - A. **Studs** - Wall framing may consist of either wood studs 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. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
 - B. **Gypsum Board*** - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Max diam of opening is 10-5/8 in. (270 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Through Penetrant** - One metallic pipe, conduit or tube to be installed eccentrically or concentrically within the firestop system. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. The annular space between the pipe, conduit or tube and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 2 in. (51 mm). Pipe, conduit or tube to be rigidly supported on both sides of the wall assembly. The following types and sizes of metallic pipes, conduits and tubes may be used:
 - A. **Steel Pipe** - Nom 8 in. (203 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 8 in. (203 mm) diam (or smaller) cast or ductile iron pipe.
 - C. **Conduit** - Nom 6 in. (152 mm) diam (or smaller) rigid steel conduit, nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or nom 4 in. (102 mm) diam (or smaller) flexible steel conduit.
 - D. **Copper Pipe** - Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
 - E. **Copper Tube** - Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tube.

Type of Penetrant	Max Diam	T Rating
Steel or iron pipe, steel conduit or EMT	2 in. (51 mm)	1 hr
Steel or iron pipe, steel conduit or EMT	8 in. (203 mm)	3/4 hr
Copper pipe or tube	4 in. (102 mm)	1/4 hr

- 2A. **Through Penetrating Product* - Flexible Metal Piping** - As an alternate to Item 2, one nom 1-1/4 in. (32 mm) diam (or smaller) steel flexible metal pipe to be installed either concentrically or eccentrically within the firestop system. The annular space between the pipe and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 2 in. (51 mm). Pipe to be rigidly supported on both sides of the wall assembly.

OMEGA FLEX INC

TITEFLEX CORP

A BUNDY CO

WARD MFG INC

3. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly. At point contact location, min 1/4 in. (6 mm) diam bead of fill material applied at metallic pipe/gypsum board interface on both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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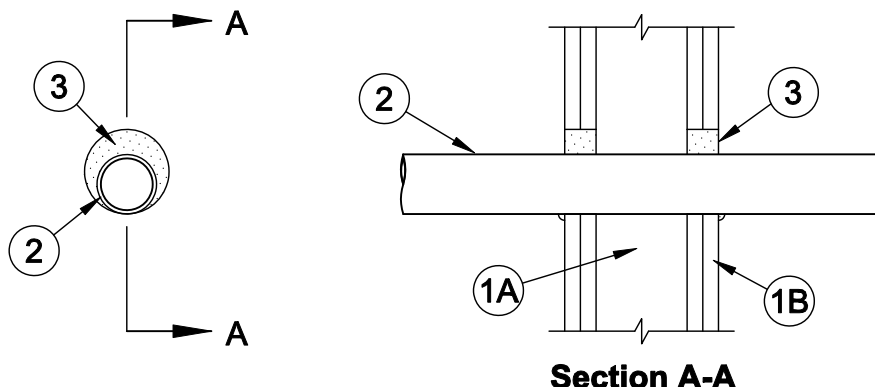
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System No. W-L-2423

F Ratings - 1 and 2 Hr (See Item 1)
T Ratings - 0, 1 and 2 Hr (See Item 2)
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 or 2 h fire rated gypsum board/wood stud wall assembly shall be constructed of the materials and in the manner described in the individual U300 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

- A. **Studs** - Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC.
- B. **Gypsum Board*** - Thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 Series Design in the UL Fire Resistance Directory. Diam of opening to be min 1/2 in. (13 mm) to max 1 in. (25 mm) larger than outside diam of through penetrant.

The hourly F Rating of the firestop system is equal to the hourly assembly rating of the wall assembly in which it is installed.

2. **Through Penetrants** - One nonmetallic pipe to be installed eccentrically or concentrically within the firestop system. The annular space between the pipe and edge of through opening shall be min 0 in. (point contact) to max 1 in. (25 mm). Nonmetallic pipe to be rigidly supported on both sides of the wall assembly. The following types and sizes of nonmetallic pipes may be used:
 - A. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
 - B. **Polyvinyl Chloride (PVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid-core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - C. **Cross-linked Polyethylene (PEX) Tubing** - Nom 2 in. (51 mm) diam (or smaller) SDR9 PEX tube for use in closed (process or supply) piping systems.
 - D. **Rigid Nonmetallic Conduit+** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code (NFPA No. 70).
 - E. **Electrical Nonmetallic Tubing+** - Nom 2 in. (51 mm) diam (or smaller) PVC tubing installed in accordance with Article 331 of the National Electrical Code (NFPA No. 70). See Electrical Nonmetallic Tubing (FKHU) category in the Electrical Construction Materials Directory for names of manufacturers.

For closed piping systems, the hourly T Rating of the firestop system is equal to the hourly assembly rating of the wall assembly in which it is installed. For vented piping systems, the hourly T Rating of the firestop system is 0 Hr.

3. **Fill, Void or Cavity Material* - Caulk** - For 2 h F Rating, min 1-1/4 in. (32 mm) thickness of fill material applied within the annulus, flush with both surfaces of the wall. For 1 h F Rating, min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of the wall. A min 1/4 in. (6 mm) diam bead of caulk shall be applied at the pipe/gypsum board interface at the point contact location on both sides of the wall.

SPECIFIED TECHNOLOGIES INC - Type WF300 Caulk

*Bearing the UL Classification Mark

+Bearing the UL Listing Mark



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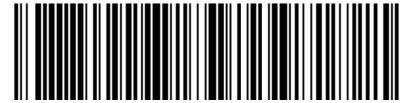
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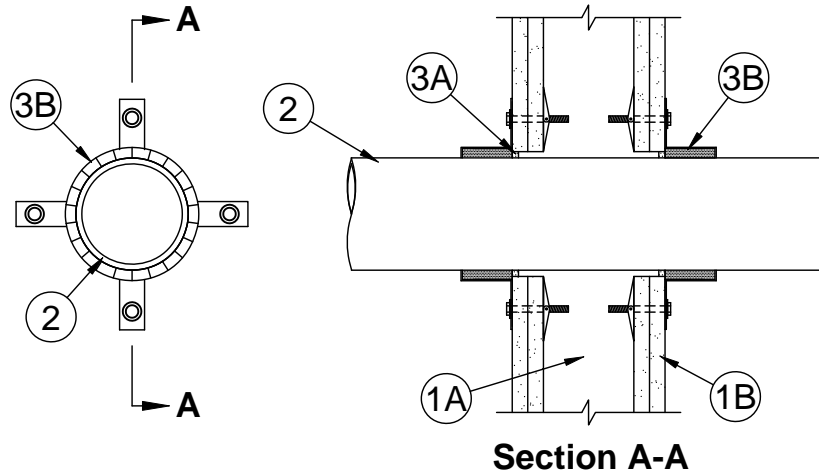
System No. W-L-2439

F Ratings - 1 and 2 Hr (See Item 1)

T Ratings - 1 and 2 Hr (See Item 1)

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 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:

- A. **Studs** - Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC.
- B. **Gypsum Board*** - Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Designs. For nom 2-1/2 in. (64 mm) diam and smaller pipes and conduits, diam of opening shall be max 1/4 in. (6 mm) larger than nom pipe diam. For pipes and conduits greater than nom 2-1/2 in. (64 mm) diam of opening shall be max 1/2 in. (13 mm) larger than nom pipe diam.

The hourly F and T Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Through Penetrants** - One nonmetallic pipe or conduit to be centered within opening with a max annular space between pipe or conduit and periphery of 1/8 in. (3.2 mm) for nom 2-1/2 in. (64 mm) diam and smaller pipes and conduits and 1/4 in. (6 mm) for pipes and conduits greater than 2-1/2 in. (64 mm) diam. Pipe or conduit to be rigidly supported on both sides of the wall assembly. The following types and sizes of nonmetallic pipes and conduits may be used.
 - A. **Polyvinyl Chloride (PVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 solid or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 4 in. (102 mm) diam (or smaller) SDR13.5 or Schedule 80 CPVC pipe for use in closed (process or supply) piping systems.
 - C. **Acrylonitrile Butadiene Styrene (ABS) Pipe** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 solid or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - D. **Rigid Nonmetallic Conduit+** - Nom 4 in. (102 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with Article 347 of the National Electrical Code (NFPA 70).
3. **Firestop System** - The firestop system consists of the following:
 - A. **Fill, Void or Cavity Material* - Sealant** - Min 1/4 in. (6 mm) thickness applied within annulus, flush with both surfaces of wall.

SPECIFIED TECHNOLOGIES INC - Type WF300 Caulk



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- B. Firestop Device*** - Galv steel collar lined with an intumescent material sized to fit the specific diam of the through penetrant. Device shall be installed around through penetrant in accordance with the accompanying installation instructions. Device incorporates anchor tabs for securement to both surfaces of wall assembly by means of 3/16 in. (4.8 mm) diam steel toggle bolts in conjunction with min 1-1/4 in. (32 mm) diam steel fender washers.

SPECIFIED TECHNOLOGIES INC - SpecSeal LCC Collar, SpecSeal Firestop Collar

- C. Fill, Void or Cavity Material - Wrap Strip** - (Optional, Not Shown) - Nom 1/8 or 3/16 in. (3.2 or 4.8 mm) thick intumescent material faced on both sides with a plastic film, supplied in 2 in. (51 mm) wide strips or nom 1/8 or 1/4 in. (3.2 or 6 mm) thick intumescent material faced on both sides with a plastic film, supplied in 1-1/2 in. (38 mm) wide strips. The layers of wrap strips are individually wrapped around the through-penetrant with ends butted and held in place with masking tape. Butted ends in successive layers shall be aligned.

Except as noted in Item 2, the F and T Rating of the firestop system is dependent upon the fire rating of wall, diam of through penetrant and the number of wrap strips as tabulated below:

SPECIFIED TECHNOLOGIES INC - SpecSeal BLU Wrap Strip, SpecSeal BLU2 Wrap Strip, SpecSeal RED Wrap Strip, or SpecSeal RED2 Wrap Strip

Fire Rating of Wall Hr	Max Dia. of Through Penetrant In. (mm)	No. of Wrap Strip Layers	F Rating	T Rating
1	1-1/2 (38)	1	1	1
2	1-1/2 (38)	1	2	1 1/2
1	2 (51)	1	1	1
2	2 (51)	1	2	1 1/2
1	3 (76)	2	1	1
2	3 (76)	2	2	2
1	4 (102)	3	1	1
2	4 (102)	3	2	2

- D. Steel Collar** - (Optional, Not Shown) Used in conjunction with Item 3C, collar fabricated from coils of precut 0.016 in. (0.4 mm) thick galv sheet steel available from wrap strip manufacturer. Collar shall be min 1-1/2 in. (38 mm) deep with 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs for securement to the concrete floor or wall. Retainer tabs, 3/4 in. (19 mm) wide tapering down to 1/4 in. (6 mm) wide and located opposite the anchor tabs, are folded 90 degree toward pipe surface to maintain the annular space around the pipe and to retain the wrap strips. Steel collar wrapped around wrap strips and pipe with a 1 in. (25 mm) wide overlap along its perimeter joint and secured together by means of a min 1/2 in. (13 mm) wide by 0.028 in. (0.7 mm) thick stainless steel hose clamp installed at mid-depth of the steel collar. As an alternate to the steel hose clamp, the steel collar may be secured together by means of three No. 8 by 1/4 in. (6 mm) long steel sheet metal screws when more than one layer of wrap strip is used.

Wrap strip/collar assembly is slid along the through-penetrant until abuts the surface of the wall. Collar secured to wall by 1/8 in. (3.2 mm) diam by 1-3/4 in. (44 mm) long steel molly bolts in conjunction with 1-1/4 in. (32 mm) diam steel fender washers. The number of molly bolts used is dependent upon the nom diam of the through penetrant. Two molly bolts, symmetrically located, are required for nom 1-1/2 in. (38 mm) and 2 in. (51 mm) diam through penetrants. Three molly bolts, symmetrically located, are required for nom 2-1/2 in. (64 mm) and 3 in. (76 mm) diam through penetrants. Four molly bolts, symmetrically located, are required for nom 3-1/2 in. (89 mm) and 4 in. (102 mm) diam through penetrants. Steel collars are installed on each side of wall.

+Bearing the UL Listing Mark

*Bearing the UL Classification Mark



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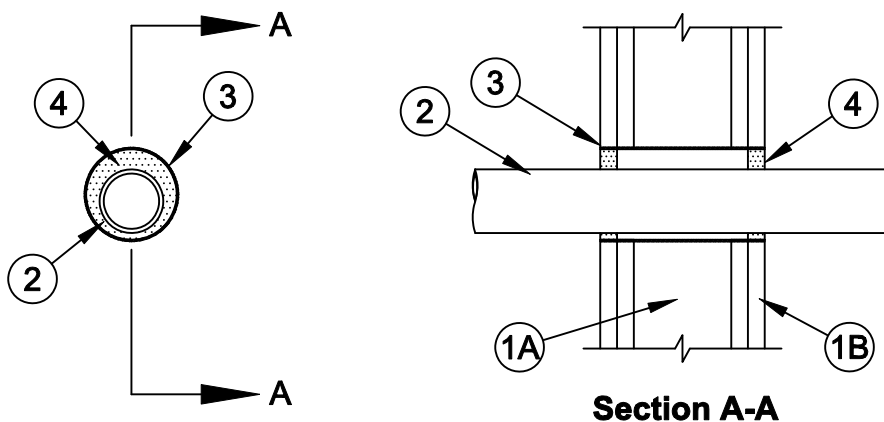


W-L-2439
PAGE 2 OF 2

System No. W-L-2508

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 0 Hr



1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

- A. **Studs** - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
- B. **Gypsum Board*** - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Diam of opening to be 1 in. to 1-1/8 in. (25 to 29 mm) larger than outside diam of pipe.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Steel Sleeve** - Cylindrical sleeve fabricated from 0.0165 in. (0.42 mm) thick galv sheet steel and having a min 2 in. (51 mm) lap along the longitudinal seam. Length of steel sleeve to be equal to or nom 2 in. (51 mm) longer than the thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum board layers. The ends of the steel sleeve shall be flush with or extend max 1 in. (25 mm) beyond each surface of the wall.
3. **Through Penetrant** - One nonmetallic pipe, conduit or tube to be installed eccentrically or concentrically within the firestop system. Annular space to be min 1/4 in. (6 mm) to max 1 in. (25 mm). Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. Pipe, conduit or tube to be rigidly supported on both sides of the wall assembly. The following types and sizes of nonmetallic pipes, conduits and tubes may be used:
 - A. **Polyvinyl Chloride (PVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
 - B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** - Nom 2 in. (51 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
 - C. **Rigid Nonmetallic Conduit+** - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC conduit installed in accordance with the National Electrical Code (NFPA 70).
 - D. **Electrical Nonmetallic Tubing+** - Nom 2 in. (51 mm) diam (or smaller) PVC tubing installed in accordance with the National Electrical Code (NFPA 70).
 - E. **Cross Linked Polyethylene (PEX) Tubing** - Nom 1 in. (25 mm) diam (or smaller) SDR9 PEX tubing for use in closed (process or supply) piping systems.
 - F. **Acrylonitrile Butadiene Styrene (ABS) Pipe** - Nom 1-1/2 in. (38 mm) diam (or smaller) Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
4. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with ends of steel sleeve.

SPECIFIED TECHNOLOGIES INC - SpecSeal LCI Sealant, SpecSeal Series SSS Sealant

*Bearing the UL Classification Mark



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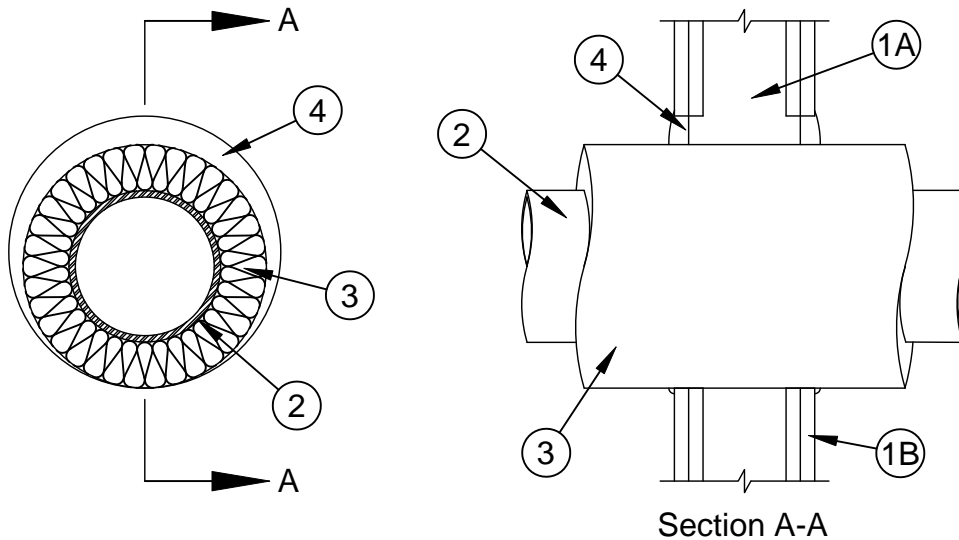
System No. W-L-5014

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 1 Hr

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 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
 - A. **Studs** - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-5/8 in. (92 mm) wide and spaced max 24 in. (610 mm) OC.
 - B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.2 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 18 in. (457 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
- 1A. **Metallic Sleeve** - (Optional, Not Shown) - Cylindrical sleeve fabricated from min 0.016 in. (0.41 mm) to max 0.105 in. (2.7 mm) thick sheet steel. Length of steel sleeve to be equal to the thickness of wall. Longitudinal seam of sleeve welded or overlapped min 1 in. (25 mm). The ends of the steel sleeve shall be flush or recessed max 1/4 in. (6 mm) from wall surfaces.
2. **Through Penetrants** - One metallic pipe or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:
 - A. **Steel Pipe** - Nom 12 in. (305 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 12 in. (305 mm) diam (or smaller) cast or ductile iron pipe.
 - C. **Copper Tubing** - Nom 4 in. (102 mm) diam (or smaller) Type M (or heavier) copper tube.
 - D. **Copper Pipe** - Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
3. **Pipe Coverings*** - One of the following types of pipe coverings shall be used:



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- A. **Pipe and Equipment Covering Materials*** - Max 2 in. (51 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. The annular space between insulated penetrating item and the edge of the through opening shall be min 0 in. (point contact) to max 1-1/4 in. (32 mm).

See **Pipe and Equipment Covering-Materials*** - (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

- B. **Pipe Covering Materials*** - Max 2 in. (51 mm) thick unfaced mineral fiber pipe insulation sized to the outside diam of pipe or tube. Pipe insulation secured with min 18 SWG steel wire spaced max 12 in. (305 mm) OC. The annular space between insulated penetrating item and the edge of the through opening shall be min 0 in. (point contact) to max 1-1/4 in. (32 mm).

IIG MINWOOL L L C - High Temperature Pipe Insulation 1200, High Temperature Pipe Insulation BWT or High Temperature Pipe Insulation Thermaloc.

- C. **Sheathing Material*** - Used in conjunction with Item 3B. Foil-scrim-kraft or all service jacket material shall be wrapped around the outer circumference of the pipe insulation (Item 3B) with the kraft side exposed. Longitudinal joints and transverse joints sealed with metal fasteners or butt tape.

See **Sheathing Materials** (BVDV) category in the Building Materials Directory for names of manufacturers. Any sheathing material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At point contact location between insulated through penetrant and gypsum board, a min 3/8 in. (10 mm) bead of fill material shall be applied to the insulated through penetrant/gypsum board interface on both sides of the wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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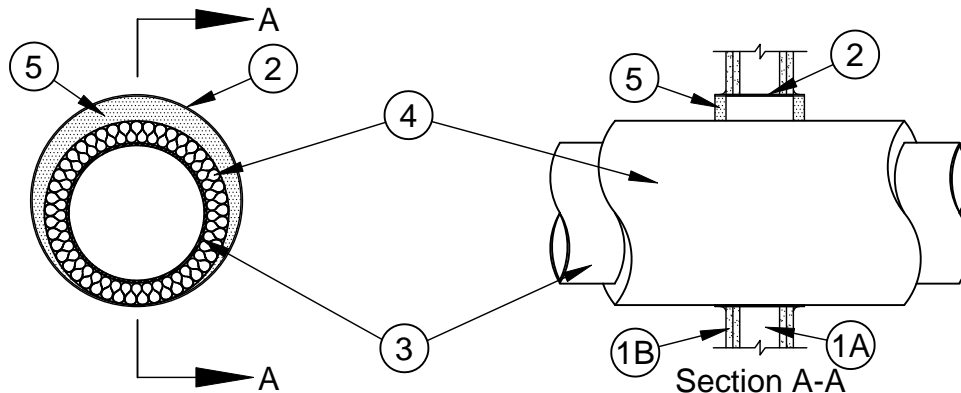
W-L-5014
PAGE 2 OF 2



System No. W-L-5091

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 0 Hr



1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum board/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:

- A. **Studs** - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-5/8 in. (92 mm) wide and spaced 24 in. (610 mm) OC.
- B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.2 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 Series Designs in the UL Fire Resistance Directory. Max diam of opening in wood stud walls is 12 in. (305 mm). Max diam of opening in steel stud walls is 19 in. (483 mm)

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Steel Sleeve** - Cylindrical sleeve fabricated from 0.0165 in. (0.42 mm) thick (28 gauge) galv sheet steel and having a min 2 in. (51 mm) lap along the longitudinal seam. Length of sleeve to be 2 in. (51 mm) greater than the thickness of the wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers. The ends of the steel sleeve shall extend 1 in. (25 mm) beyond each surface of the wall.
3. **Through Penetrants** - One metallic pipe or tube installed concentrically or eccentrically within the firestop system. Pipe or tube to be rigidly supported on both sides of the wall. The following types and sizes of through penetrants may be used:
 - A. Steel Pipe - Nom 12 in. (305 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. Iron Pipe - Nom 12 in. (305 mm) diam (or smaller) cast or ductile iron pipe.
 - C. Copper Tubing - Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
 - D. Copper Pipe - Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
4. **Pipe Covering*** - One of the following types of pipe coverings shall be used:
 - A. **Pipe and Equipment Covering Materials*** - Max 2 in. (51 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 57 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or butt tape supplied with the product. The annular space between the insulated through penetrant and the steel sleeve shall be min 0 in. (point contact) to max 2-1/4 in. (0 to 57 mm).

See Pipe and Equipment Covering Materials* (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.



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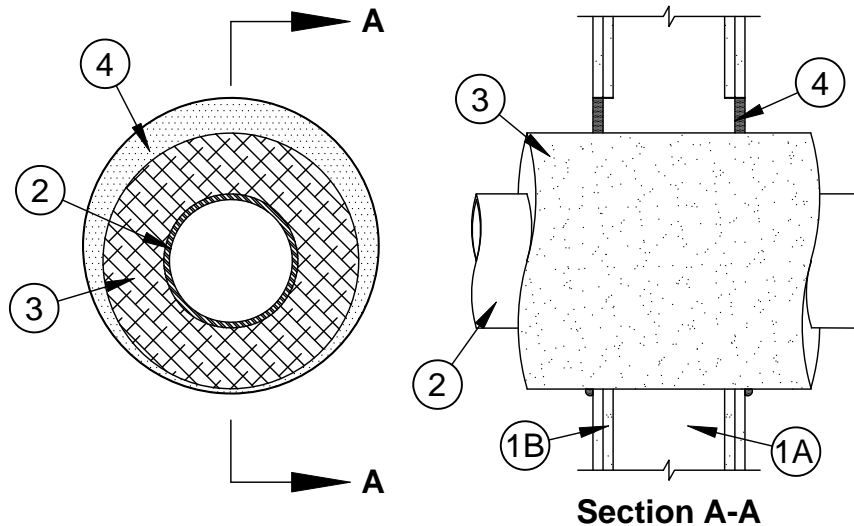
W-L-5091
PAGE 1 OF 2



System No. W-L-5130

F Ratings - 1 and 2 Hr (See Item 1)

T Ratings - 1 and 2 Hr (See Item 4)



1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400 or V400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
 - A. **Studs** - Steel studs to be min 3-1/2 in. wide and spaced max 24 in. OC. When the diam of the opening exceeds the width of the stud cavity, additional framing shall be used to completely frame around the opening such that a nom 1 to 3 in. clearance is present between the insulated pipe and the framing on all sides.
 - B. **Gypsum Board*** - Thickness, type, number of layers and fasteners as specified in the individual Wall and Partition Design. Max diam of opening is 24 in.

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
2. **Through Penetrant** - One metallic pipe or tube to be installed eccentrically or concentrically within the firestop system. Pipe or tube to be rigidly supported on both sides of the wall assembly. The following types and sizes of metallic pipes and tubes may be used:
 - A. **Steel Pipe** - Nom 16 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - B. **Iron Pipe** - Nom 16 in. diam (or smaller) cast or ductile iron pipe.
 - C. **Copper Pipe** - Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe.
 - D. **Copper Tube** - Nom 6 in. diam (or smaller) Type L (or heavier) copper tube.
3. **Pipe Covering** - Max 3 in. thick hollow cylindrical calcium silicate (min 14 pcf) units sized to the outside diam of the through-penetrant. Pipe insulation secured with stainless steel bands or min 8 AWG stainless steel wire spaced max 12 in. OC. The annular space shall be min 0 in. (point contact) to max 1-1/2 in. **When insulation thickness is less than 2 in., T Rating is 1 hr. When insulation thickness is 2 in. or greater, T Rating is 2 hr in walls with a 2 hr assembly rating.**
4. **Fill Void or Cavity Materials* - Sealant** - Min 5/8 in. thickness of fill material applied within the annulus, flush with each surface of the wall assembly. At point contact, min 3/8 in. diam bead of fill material applied at the pipe covering/gypsum board interface.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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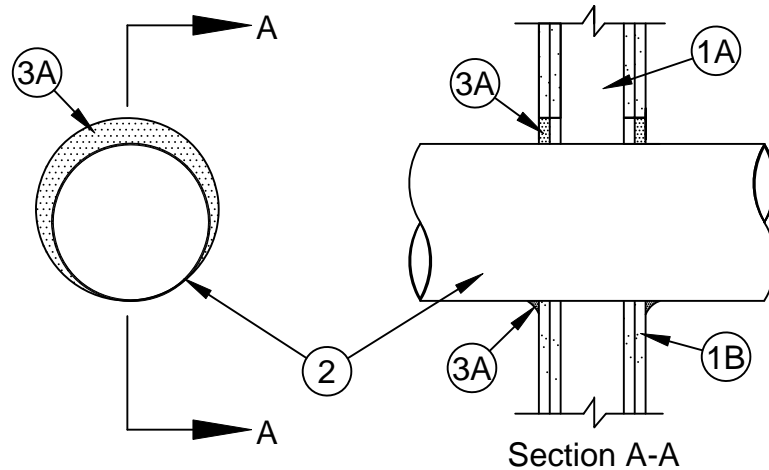
System No. W-L-7026

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 0 Hr

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 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

- A. **Studs** - Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC. When diam of opening exceeds width of stud cavity, additional lengths of steel stud installed to frame out opening around steel duct (Item 2).
- B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or V400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 25-1/2 in. (648 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Steel Duct** - Max 24 in. (610 mm) diam No. 28 gauge (or heavier) galv steel vent duct or No. 26 gauge (or heavier) spiral wound galv steel duct. One steel duct to be installed either concentrically or eccentrically within the firestop system. An annular space of min 0 in. (0 mm, point contact) to max 1-1/2 in. (38 mm) is required within the firestop system. Steel duct to be rigidly supported on both sides of the wall assembly.
3. **Firestop System** - The firestop system shall consist of the following:

- A. **Packing Material** - (Optional, Not Shown) - Polyethylene backer rod, mineral wool batt insulation or fiberglass batt insulation friction fit into annular space for 2 hr rated wall assemblies only. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material (Item 3B).
- B. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. Min 1/4 in. (6 mm) diam bead of fill material shall be applied at the point contact location between the steel duct and the gypsum board. For 2 hr Rated walls when LC150 or LE600 Sealant is used, fill material thickness installed to full depth of gypsum board layers on each side of wall assembly.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant, SpecSeal LCI Sealant, SpecSeal LC150 Sealant, or SpecSeal LE600 Sealant

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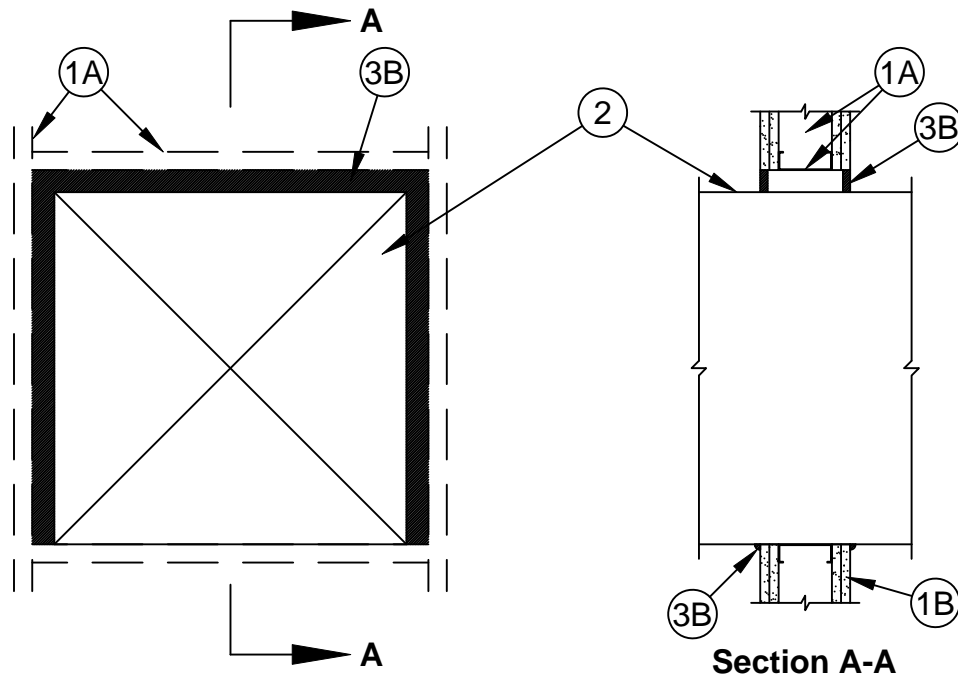
W-L-7026
PAGE 1 OF 1



System No. W-L-7029

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 1/4 Hr



1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - A. **Studs** - Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC.
 - B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or V400 Series Designs in the UL Fire Resistance Directory. Max area of opening is 690 sq in. (0.45 m²) with max dimension of 27 in. (686 mm).
2. **Steel Duct** - Max 24 by 24 in. (610 by 610 mm) No. 26 gauge (or heavier) steel duct to be installed within the opening. The annular space within the firestop system shall be min 0 in. (0 mm, point contact) to max 2 in. (51 mm). Steel duct to be rigidly supported on both sides of the wall assembly.
3. **Firestop System** - The firestop system shall consist of the following:
 - A. **Packing Material** - (Optional, Not Shown) - Mineral wool batt insulation, foam backer rod or glass fiber insulation installed as a permanent form to facilitate installation of fill material (Item 3B).
 - B. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly. Min 1/4 in. (6 mm) diam bead of fill material to be applied at point contact location between the steel duct and the gypsum board.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

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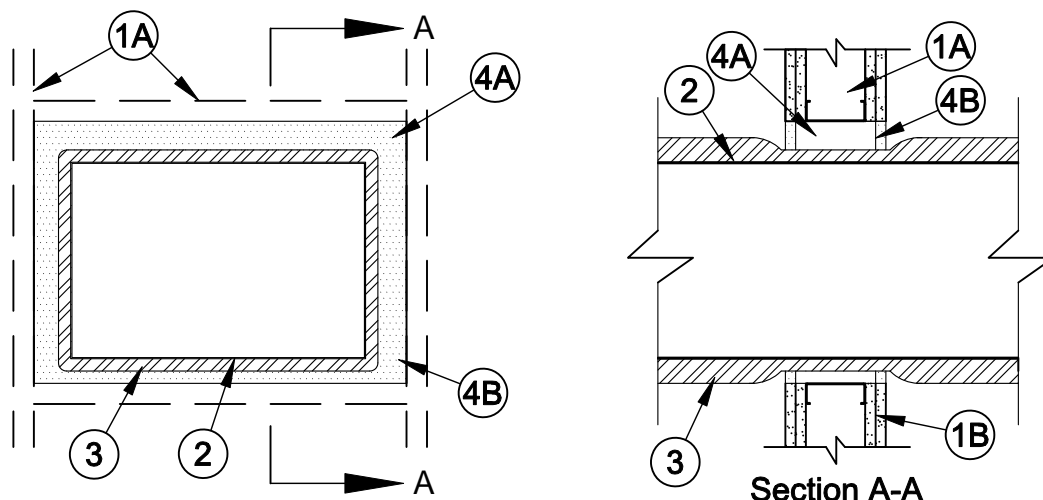
System No. W-L-7178

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 3/4 Hr

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 or 2 hr fire-rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

- A. **Studs** - Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC. Additional steel studs shall be used to completely frame the opening.
- B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or V400 Series Designs in the UL Fire Resistance Directory. Max area of opening is 540 sq in. (0.35 m²) with a max dim of 30 in. (762 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Steel Duct** - Max 24 by 12 in. (610 by 305 mm) No. 26 gauge (or heavier) steel duct to be installed within the framed opening. Min clearance between duct and edge of framed opening in wall is 3 in. (76 mm). Steel duct to be rigidly supported on both sides of the wall assembly.
3. **Batts and Blankets*** - Nom 2 in. (51 mm) thick light density (min 3/4 pcf or 12 kg/m³) glass fiber blanket insulation jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with foil-scrim-kraft tape. Nom annular space between insulated steel duct and periphery of opening to be 1 in. (25 mm).

See **Batts and Blankets** (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.

4. **Firestop System** - The firestop system shall consist of the following:
 - A. **Packing Material** - (Optional, Not Shown) - Polyethylene backer rod, mineral wool batt insulation or fiberglass batt insulation friction fitted into annular space. Packing material to be recessed from both surfaces of wall as required to accommodate the required thickness of fill material.
 - B. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of the wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



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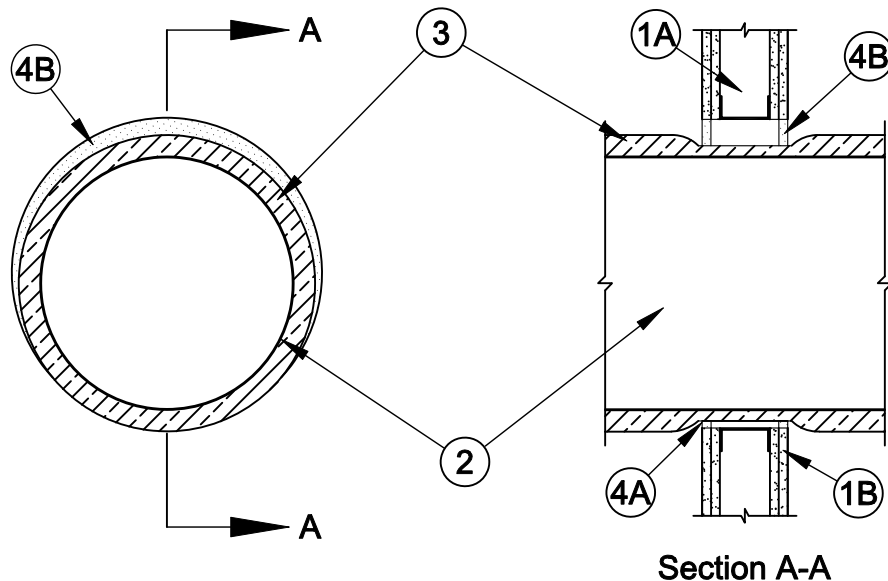
System No. W-L-7179

F Ratings - 1 and 2 Hr (See Item 1)

T Rating - 3/4 Hr

L Rating At Ambient - Less Than 1 CFM/sq ft

L Rating At 400 F - Less Than 1 CFM/sq ft



Section A-A

1. **Wall Assembly** - The 1 or 2 hr fire-rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

- A. **Studs** - Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC.
- B. **Gypsum Board*** - 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or V400 Series Designs in the UL Fire Resistance Directory. Max diam of opening is 26 in. (660 mm).

The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

2. **Steel Duct** - Max 20 in. (508 mm) diam min No. 28 ga (0.016 in. or 0.41 mm thick) spiral-wound or long seam steel duct to be installed eccentrically or concentrically within the opening. Steel duct to be rigidly supported on both sides of the wall assembly.
3. **Batts and Blankets*** - Nom 2 in. (51 mm) thick light density (min 3/4 pcf or 12 kg/m³) glass fiber blanket insulation jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with foil-scrim-kraft tape. Nom annular space to be 1 in. (25 mm).

See **Batts and Blankets** (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.

4. **Fill, Void or Cavity Material* - Sealant** - Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of the wall.

SPECIFIED TECHNOLOGIES INC - SpecSeal Series SSS Sealant or SpecSeal LCI Sealant

*Bearing the UL Classification Mark



Specified Technologies Inc. 210 Evans Way Somerville, NJ 08876

Reproduced courtesy of Underwriters Laboratories, Inc.

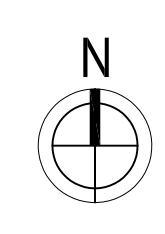
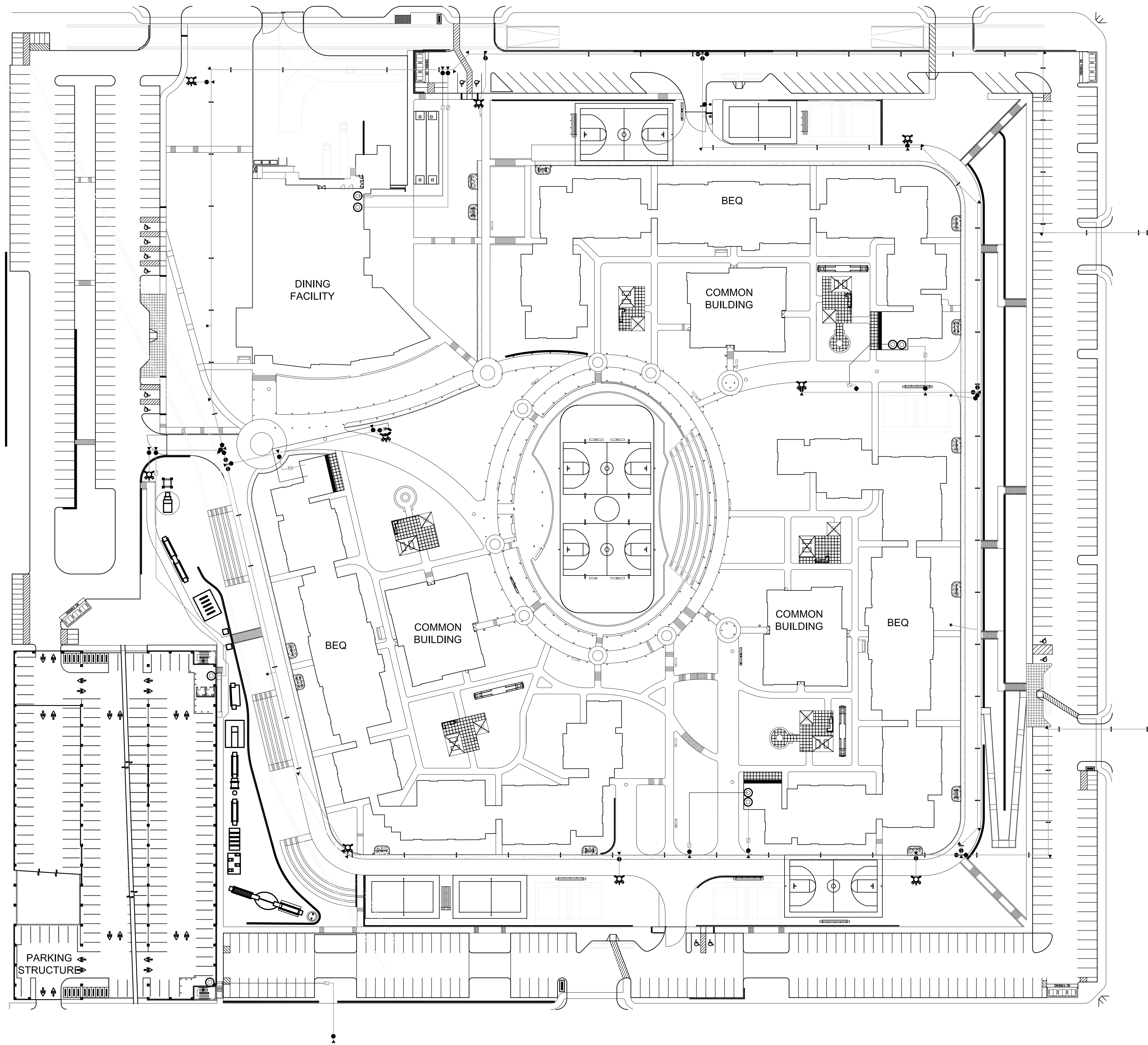
Created or Revised: January 2, 2009

(800)992-1180 • (908)526-8000 • FAX (908)231-8415 • E-Mail:techserv@stifirestop.com • Website:www.stifirestop.com

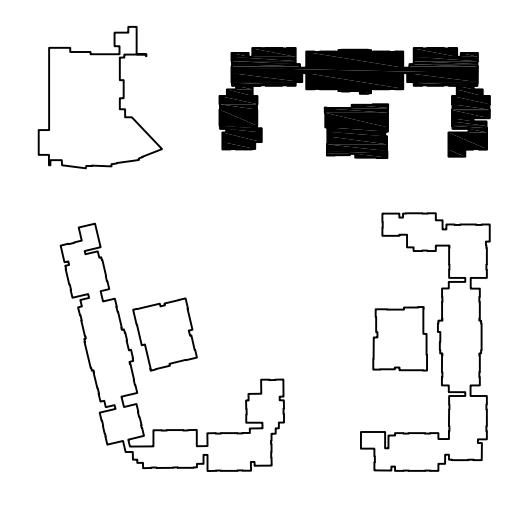
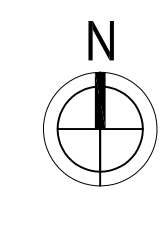


W-L-7179
PAGE 1 OF 1

Appendix B – Fire Protection and Life Safety Egress Plans

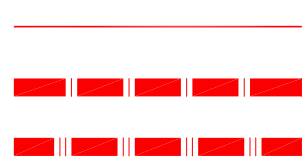


SITE PLAN — REFERENCE ONLY



N.T.S. 1

LEGEND:

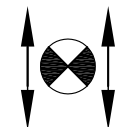


FE

XX OCC.

XX T.D.

XX C.P.T.



TRAVEL PATH
1 HR FIRE BARRIER
2 HR FIRE BARRIER

PANIC HARDWARE ON NON-RATED DOORS
OR FIRE EXIT HARDWARE IN FIRE RATED
ASSEMBLIES.

DOOR ASSEMBLY FIRE-RESISTANCE RATING
(MINUTES) WITH SELF OR AUTOMATIC-CLOSING
HARDWARE

FIRE EXTINGUISHER CABINET LOCATIONS MINIMUM RATING OF
2A:10BC (5 LB. ABC DRY CHEMICAL).

CUMULATIVE OCCUPANT LOAD

TRAVEL DISTANCE

COMMON PATH OF TRAVEL

EXIT SIGN WITH CHEVRON DIRECTION

EGRESS COMPONENT	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD

EGRESS CAPACITY

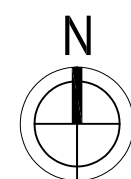
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34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
10 OCC.	170 OCC.	10 OCC.	170 OCC.	12 OCC.	170 OCC.

DOOR	4	DOOR	5	DOOR	6
34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)	68 IN.	0.20 (IN./OCC.)
12 OCC.	170 OCC.	10 OCC.	170 OCC.	10 OCC.	340 OCC.

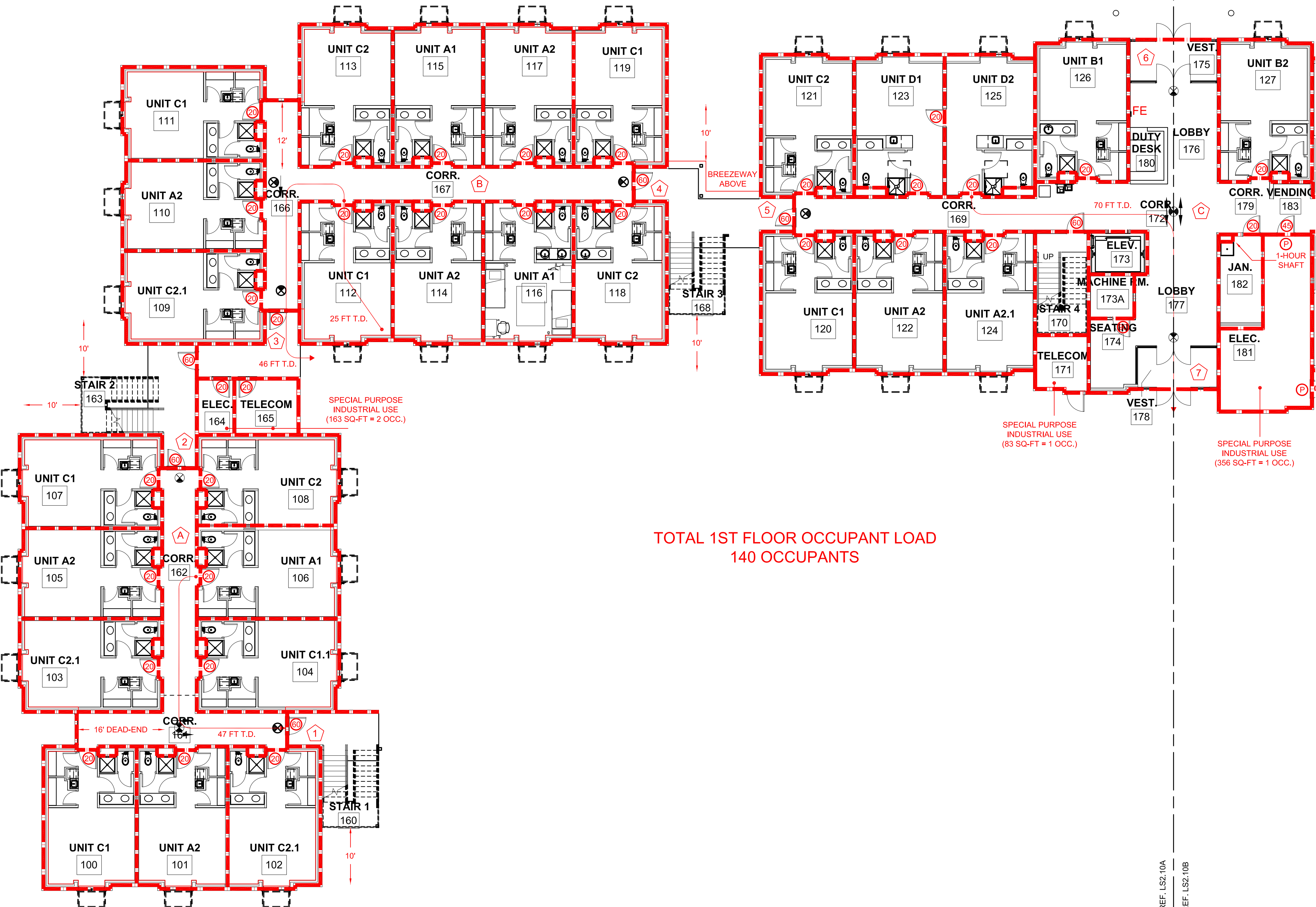
DOOR	7	CORRIDOR	A	CORRIDOR	B
68 IN.	0.20 (IN./OCC.)	67 IN.	0.20 (IN./OCC.)	67 IN.	0.20 (IN./OCC.)
10 OCC.	340 OCC.	20 OCC.	335 OCC.	24 OCC.	335 OCC.

CORRIDOR	C
67 IN.	0.20 (IN./OCC.)
41 OCC.	335 OCC.

0' 8' 16' 24'
SCALE: 3/32" = 1'-0"



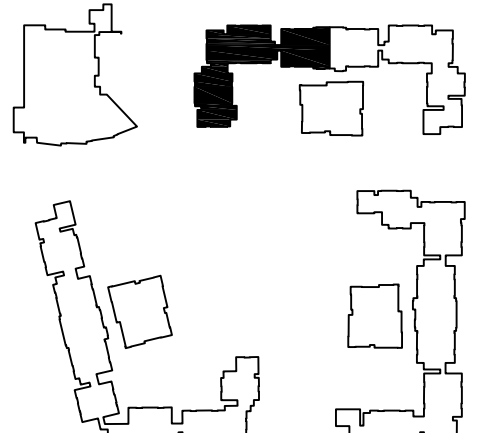
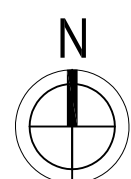
LEVEL 1A EGRESS PLAN (BEQ)

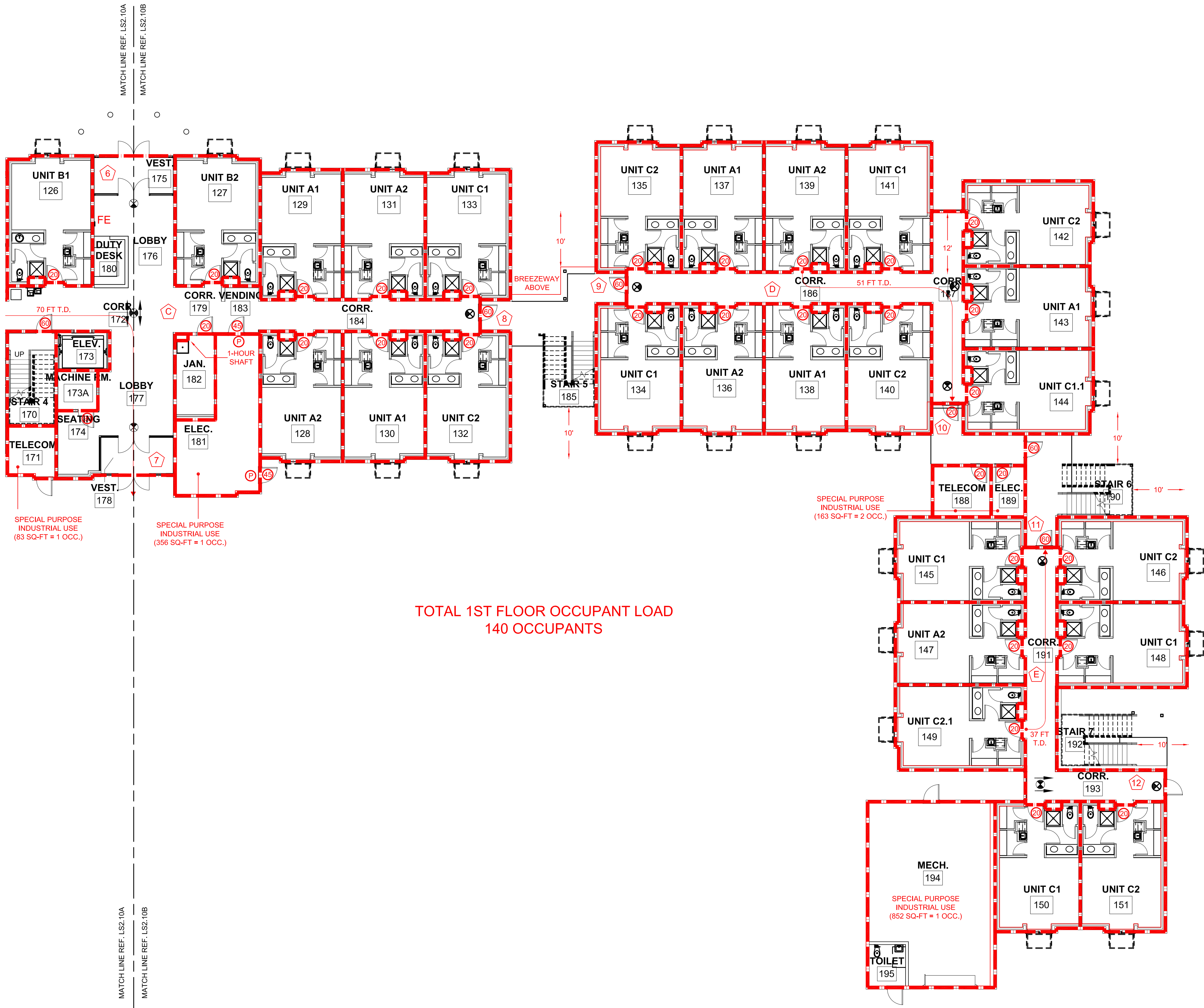


TOTAL 1ST FLOOR OCCUPANT LOAD
140 OCCUPANTS

3/32" = 1'-0"

1





TOTAL 1ST FLOOR OCCUPANT LOAD
140 OCCUPANTS

- LEGEND:
- TRAVEL PATH
 - 1 HR FIRE BARRIER
 - 2 HR FIRE BARRIER
 - PANIC HARDWARE ON NON-RATED DOORS OR FIRE EXIT HARDWARE IN FIRE RATED ASSEMBLIES.
 - DOOR ASSEMBLY FIRE-RESISTANCE RATING (MINUTES) WITH SELF OR AUTOMATIC-CLOSING HARDWARE
 - FIRE EXTINGUISHER CABINET LOCATIONS MINIMUM RATING OF 2A:10BC (5 LB. ABC DRY CHEMICAL).
 - CUMULATIVE OCCUPANT LOAD
 - TRAVEL DISTANCE
 - COMMON PATH OF TRAVEL
 - EXIT SIGN WITH CHEVRON DIRECTION

EGRESS COMPONENT	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD

EGRESS CAPACITY

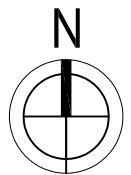
DOOR 6		DOOR 7		DOOR 8	
68 IN.	0.20 (IN./OCC.)	68 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
10 OCC.	340 OCC.	10 OCC.	340 OCC.	10 OCC.	170 OCC.

DOOR 9		DOOR 10		DOOR 11	
34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
12 OCC.	170 OCC.	12 OCC.	170 OCC.	8 OCC.	170 OCC.

DOOR 12		CORRIDOR C		CORRIDOR D	
34 IN.	0.20 (IN./OCC.)	67 IN.	0.20 (IN./OCC.)	67 IN.	0.20 (IN./OCC.)
8 OCC.	170 OCC.	41 OCC.	335 OCC.	24 OCC.	335 OCC.

CORRIDOR E	
67 IN.	0.20 (IN./OCC.)
15 OCC.	335 OCC.

0' 8' 16' 24'
SCALE: 3/32" = 1'-0"



LEVEL 1B EGRESS PLAN (BEQ)

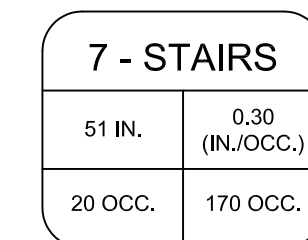
3/32" = 1'-0"

1


$$3/32" = 1'-0"$$

1

LEGEND:



TRAVEL PATH

1 HR FIRE BARRIER

2 HR FIRE BARRIER

PANIC HARDWARE ON NON-RATED DOORS
OR FIRE EXIT HARDWARE IN FIRE RATED
ASSEMBLIES.

DOOR ASSEMBLY FIRE-RESISTANCE RATING
(MINUTES) WITH SELF OR AUTOMATIC-CLOSING
HARDWARE



CUMULATIVE OCCUPANT LOAD



TRAVEL DISTANCE

COMMON PATH OF TRAVEL

EXIT SIGN WITH CHEVRON DIRECTION

EGRESS CAPACITY

DOOR 		DOOR 	
34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
13 OCC.	170 OCC.	12 OCC.	170 OCC.

DOOR 		DOOR 	
34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
8 OCC.	170 OCC.	8 OCC.	170 OCC.

CORRIDOR D		CORRIDOR E	
67 IN.	0.20 (IN./OCC.)	67 IN.	0.20 (IN./OCC.)
24 OCC.	335 OCC.	13 OCC.	335 OCC.

7 - STAIRS	
51 IN.	0.30 (IN./OCC.)
20 OCC.	170 OCC.

0' 8' 16' 24'


SCALE: 3/32" = 1'-0"

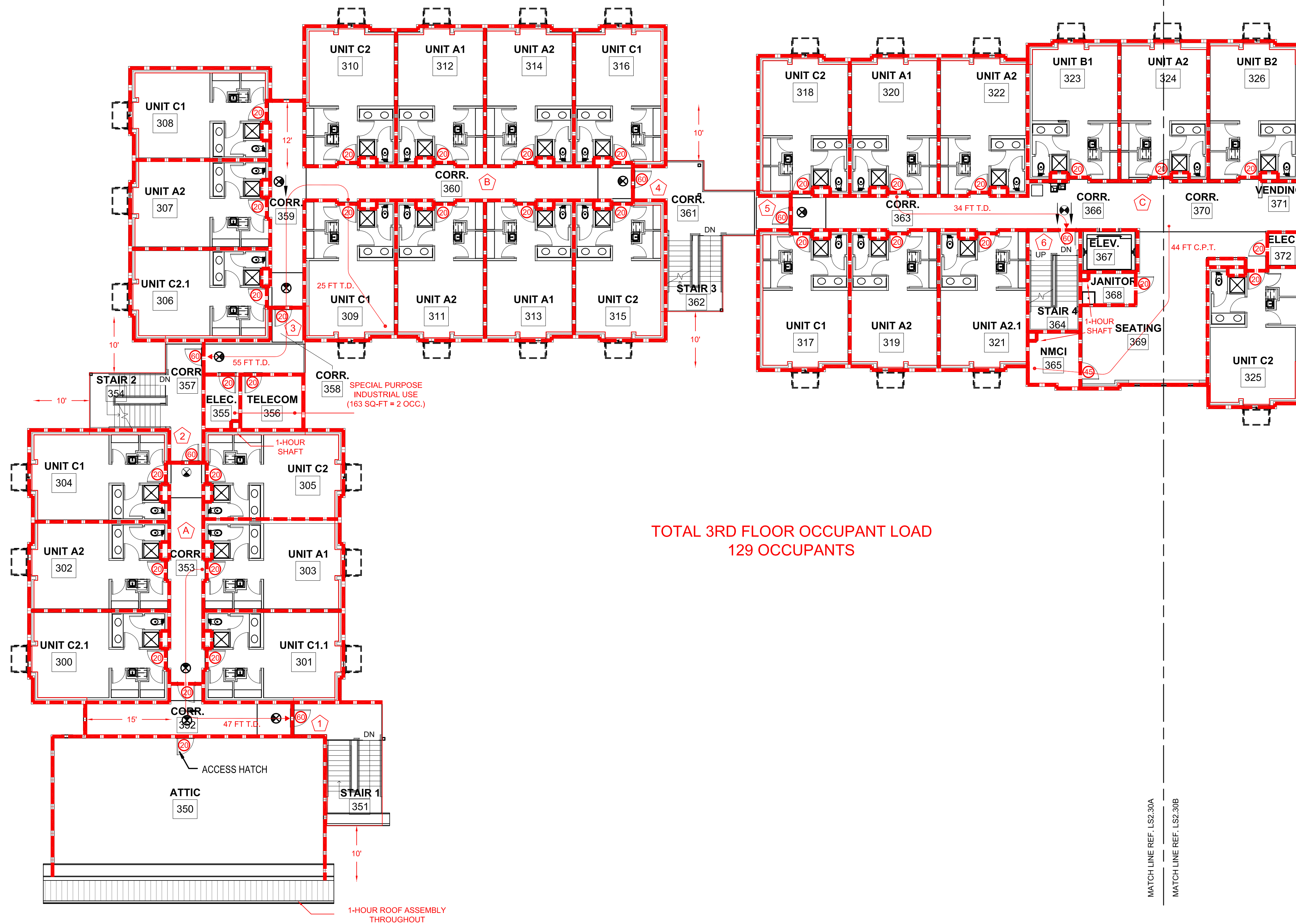
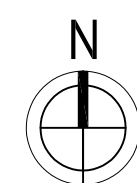
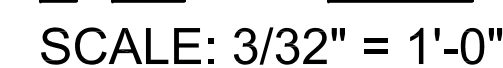


Abstract

EXIT SIGN WITH CHEVRON DIRECTION

EGRESS CAPACITY

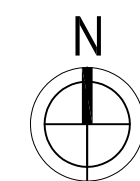
CORRIDOR 	
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41 OCC.	335 OCC.



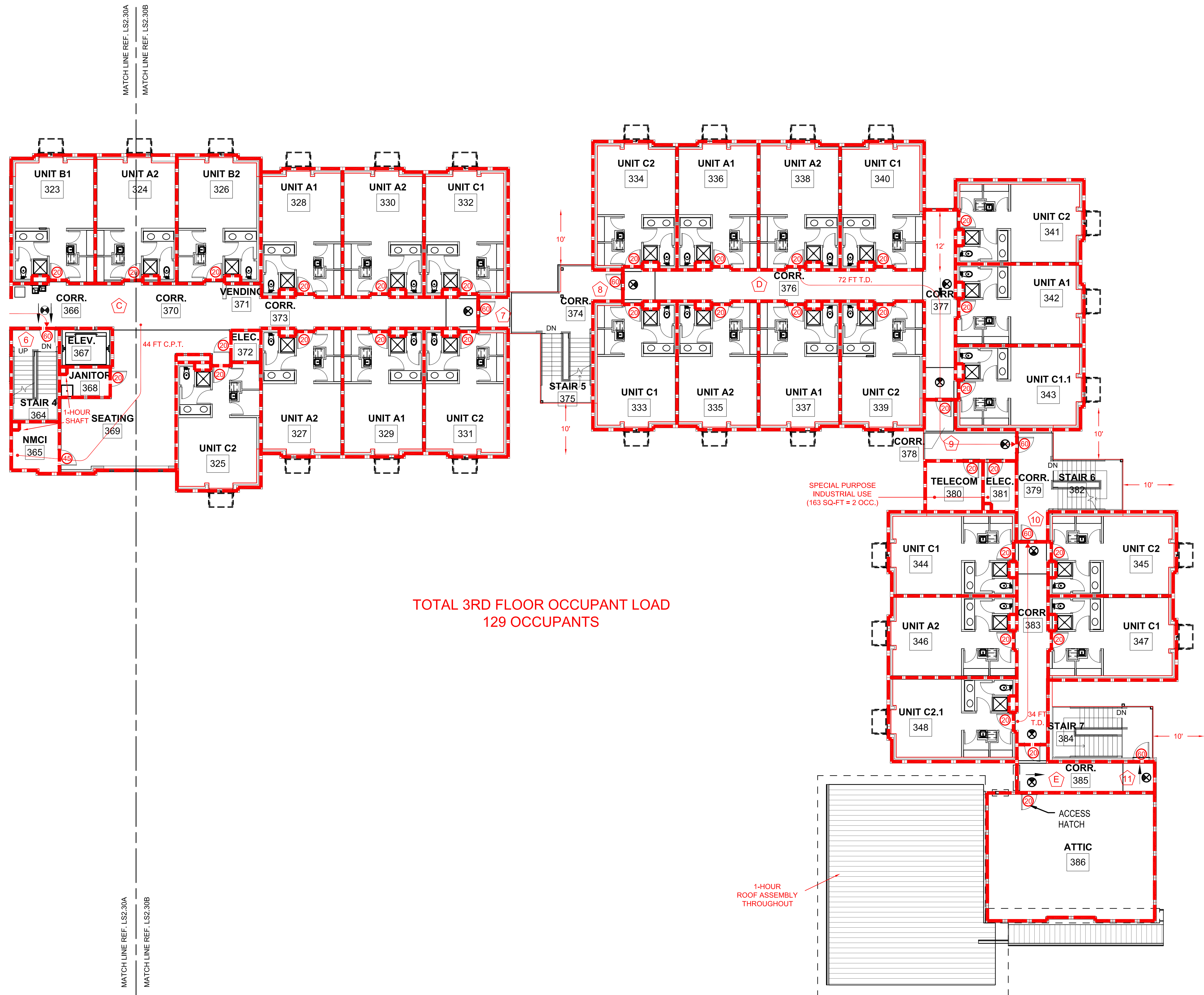
TOTAL 3RD FLOOR OCCUPANT LOAD
129 OCCUPANTS

MATCH LINE REF. LS2.30A

MATCH LINE REF. LS2.30B


$$3/32'' = 1'-0''$$

1



TOTAL 3RD FLOOR OCCUPANT LOAD
129 OCCUPANTS

- LEGEND:
- TRAVEL PATH
 - 1 HR FIRE BARRIER
 - 2 HR FIRE BARRIER
 - PANIC HARDWARE ON NON-RATED DOORS OR FIRE EXIT HARDWARE IN FIRE RATED ASSEMBLIES.
 - DOOR ASSEMBLY FIRE-RESISTANCE RATING (MINUTES) WITH SELF OR AUTOMATIC-CLOSING HARDWARE
 - CUMULATIVE OCCUPANT LOAD
 - TRAVEL DISTANCE
 - COMMON PATH OF TRAVEL
 - EXIT SIGN WITH CHEVRON DIRECTION

EGRESS COMPONENT	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD

EGRESS CAPACITY

DOOR 6	
34 IN.	0.20 (IN./OCC.)
14 OCC.	170 OCC.

DOOR 7	
34 IN.	0.20 (IN./OCC.)
14 OCC.	170 OCC.

DOOR 8	
34 IN.	0.20 (IN./OCC.)
12 OCC.	170 OCC.

DOOR 9	
34 IN.	0.20 (IN./OCC.)
12 OCC.	170 OCC.

DOOR 10	
34 IN.	0.20 (IN./OCC.)
6 OCC.	170 OCC.

DOOR 11	
34 IN.	0.20 (IN./OCC.)
6 OCC.	170 OCC.

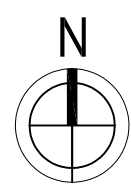
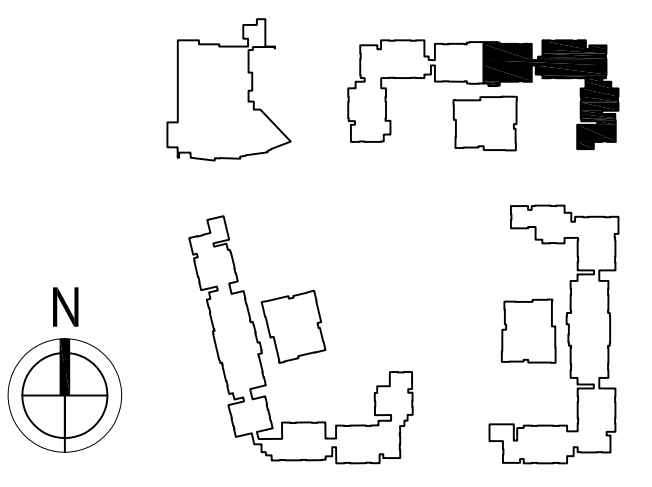
CORRIDOR C	
67 IN.	0.20 (IN./OCC.)
41 OCC.	335 OCC.

CORRIDOR D	
34 IN.	0.20 (IN./OCC.)
24 OCC.	170 OCC.

CORRIDOR E	
34 IN.	0.20 (IN./OCC.)
12 OCC.	170 OCC.

7 - STAIRS	
51 IN.	0.30 (IN./OCC.)
18 OCC.	170 OCC.

0' 8' 16' 24'
SCALE: 3/32" = 1'-0"

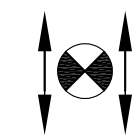



LEVEL 3B EGRESS PLAN (BEQ)

[illegible]

20 45 60

XX C.P.T.




EGRESS COMPONENT 	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD


DOOR		1
34 IN.	0.20 (IN./OCC.)	
12 OCC.	170 OCC.	

DOOR		2
34 IN.	0.20 (IN./OCC.)	
12 OCC.	170 OCC.	

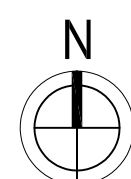
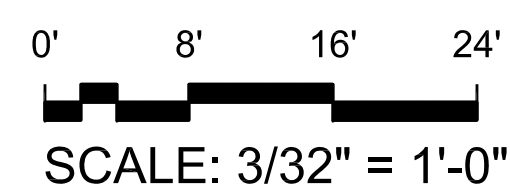
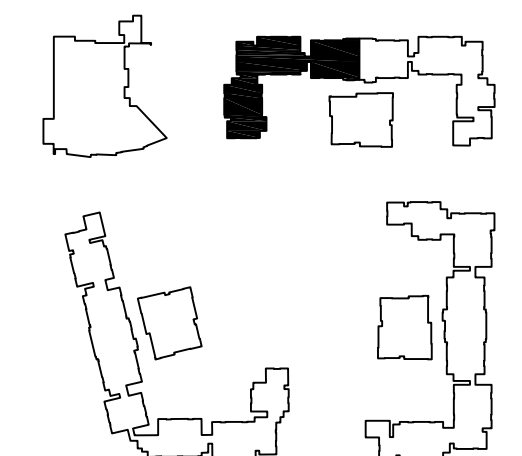
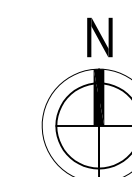
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34 IN.	0.20 (IN./OCC.)	
14 OCC.	170 OCC.	

DOOR		4
34 IN.	0.20 (IN./OCC.)	
14 OCC.	170 OCC.	

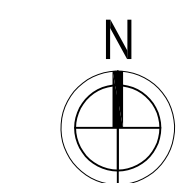
CORRIDOR 	
67 IN.	0.20 (IN./OCC.)
24 OCC.	335 OCC.

CORRIDOR 	
67 IN.	0.20 (IN./OCC.)
41 OCC.	335 OCC.

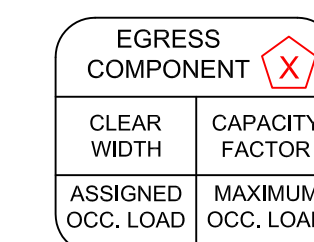
5 - STAIRS	
51 IN.	0.30 (IN./OCC.)
20 OCC.	170 OCC.


$$3/32'' = 1'-0''$$


LEVEL 4A EGRESS PLAN (BEQ)




$$3/32" = 1'-0"$$

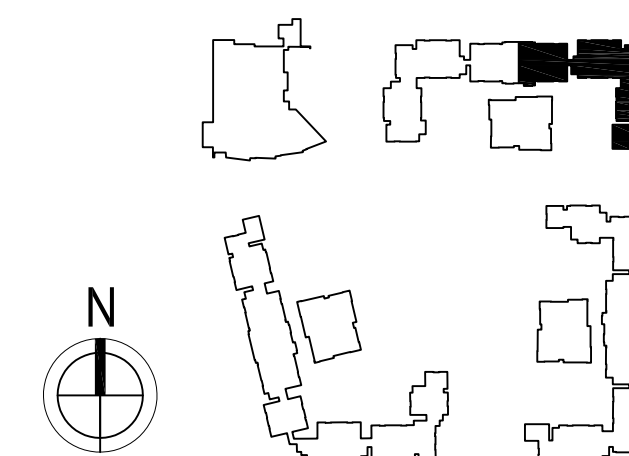
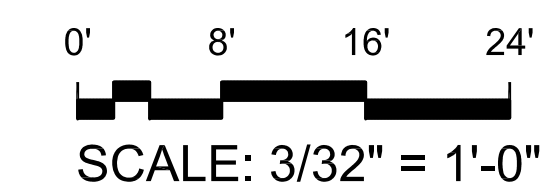
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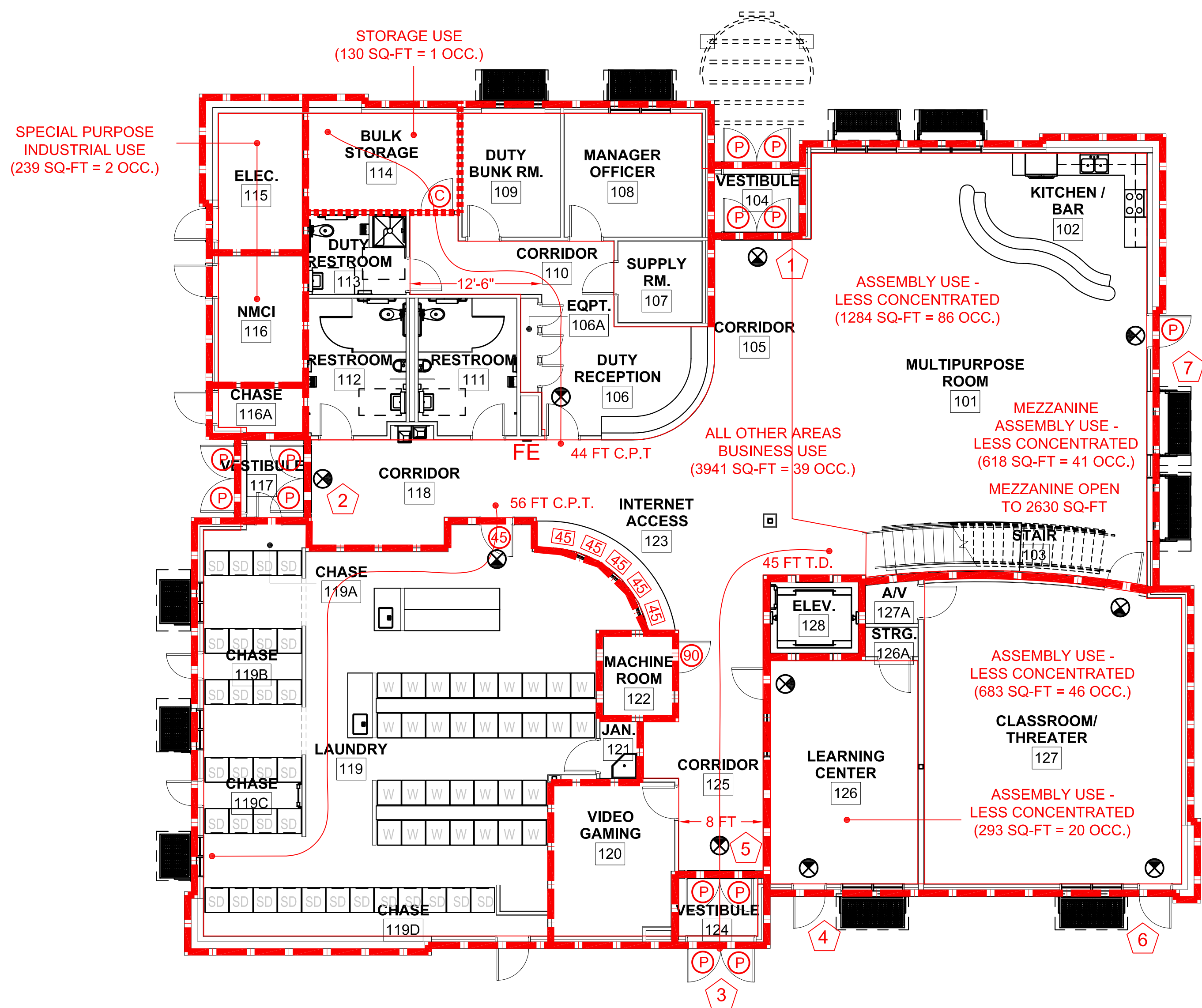


EGRESS CAPACITY

DOOR 5		DOOR 6		DOOR 7	
34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
14 OCC.	170 OCC.	12 OCC.	170 OCC.	12 OCC.	170 OCC.

CORRIDOR 		CORRIDOR 		5 - STAIRS	
67 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)	51 IN.	0.30 (IN./OCC.)
41 OCC.	335 OCC.	24 OCC.	170 OCC.	20 OCC.	170 OCC.





TOTAL 1ST FLOOR COMMON BUILDING OCCUPANT LOAD
194 OCCUPANTS

TOTAL COMMON BUILDING OCCUPANT LOAD
235 OCCUPANTS



COMMON BUILDING LEVEL 1 EGRESS PLAN

1/8" = 1'-0"

1

LEGEND:

- TRAVEL PATH
- SMOKE PARTITION
- 1 HR FIRE BARRIER
- 2 HR FIRE BARRIER
- PANIC HARDWARE ON NON-RATED DOORS OR FIRE EXIT HARDWARE IN FIRE RATED ASSEMBLIES.
- SELF OR AUTOMATIC-CLOSING DOOR WITH MAXIMUM 3/4 IN. UNDERCUT AND NO TRANSFER OPENINGS.
- DOOR ASSEMBLY FIRE-RESISTANCE RATING (MINUTES) WITH SELF OR AUTOMATIC-CLOSING HARDWARE
- WINDOW ASSEMBLY FIRE-RESISTANCE RATING (MINUTES)
- FIRE EXTINGUISHER CABINET LOCATIONS MINIMUM RATING OF 2A:10BC (5 LB. ABC DRY CHEMICAL). DO NOT PROVIDE GLASS. SEMI RECESSED CABINETS ARE TO PROVIDED IN FINISHED AREAS AND ARE PERMITTED TO BE SURFACE MOUNTED IN INDUSTRIAL AREAS.
- CUMULATIVE OCCUPANT LOAD
- TRAVEL DISTANCE
- COMMON PATH OF TRAVEL
- EXIT SIGN WITH CHEVRON DIRECTION

EGRESS COMPONENT	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD

EGRESS ANALYSIS

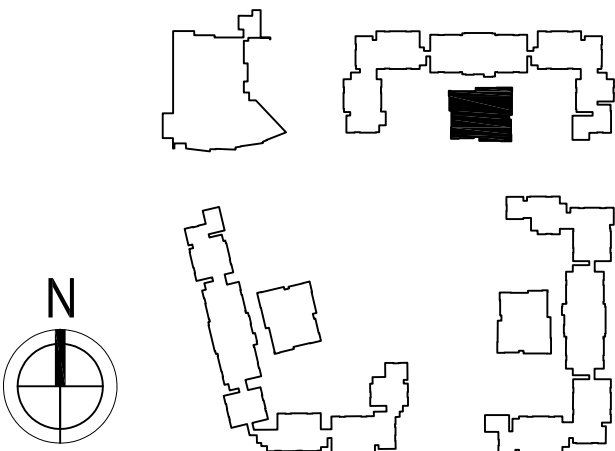
DOOR 1		DOOR 2		DOOR 3	
68 IN.	0.20 (IN./OCC.)	68 IN.	0.20 (IN./OCC.)	68 IN.	0.20 (IN./OCC.)
50 OCC.	340 OCC.	50 OCC.	340 OCC.	50 OCC.	340 OCC.

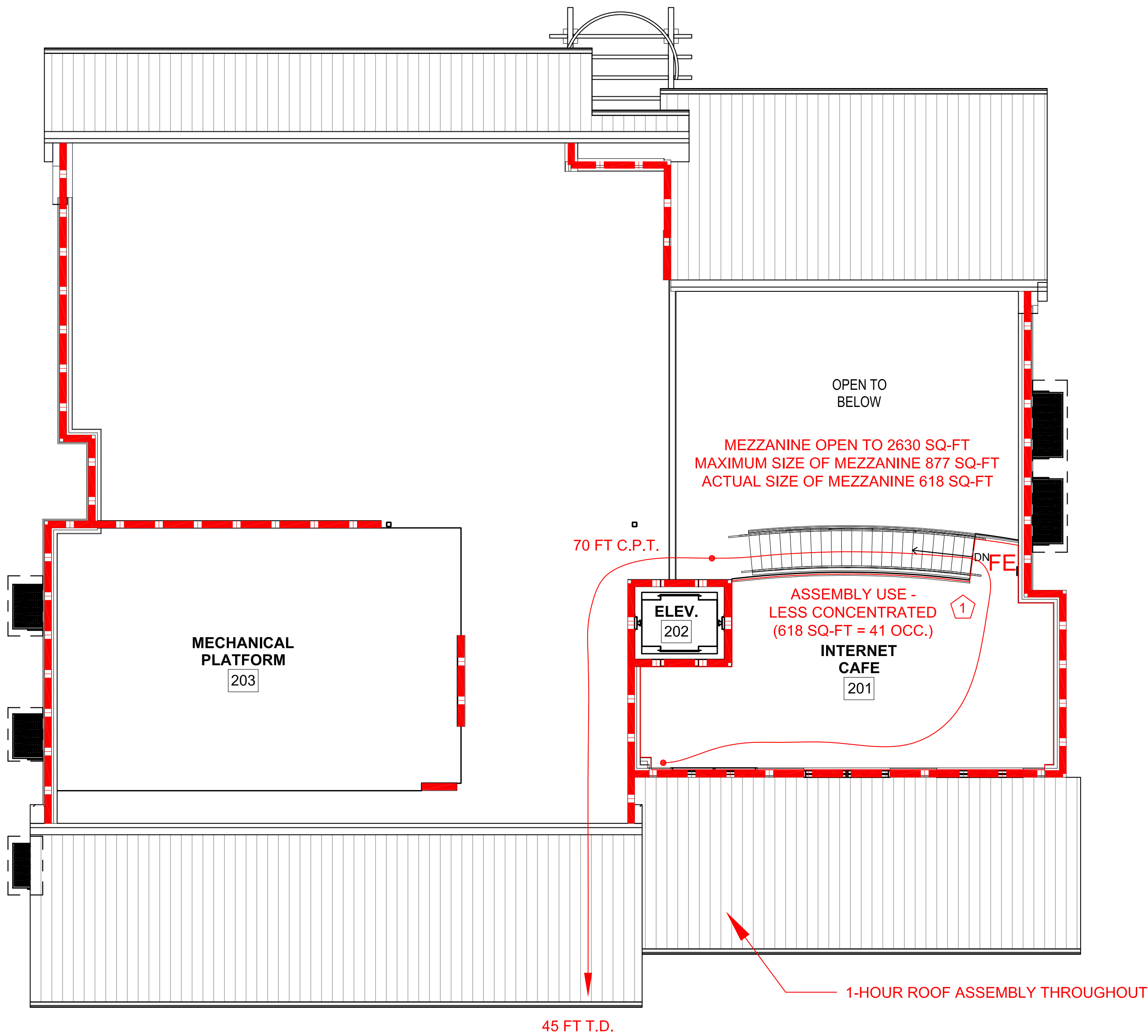
DOOR 4		CORRIDOR 5		DOOR 6	
34 IN.	0.20 (IN./OCC.)	96 IN.	0.20 (IN./OCC.)	34 IN.	0.20 (IN./OCC.)
10 OCC.	170 OCC.	50 OCC.	480 OCC.	23 OCC.	170 OCC.

DOOR 7	
34 IN.	0.20 (IN./OCC.)
50 OCC.	170 OCC.

4' 0' 4' 8'

SCALE: 1/8" = 1'-0"





TOTAL MEZZANINE OCCUPANT LOAD
41 OCCUPANTS

TOTAL COMMON BUILDING OCCUPANT LOAD
237 OCCUPANTS

LEGEND:

- TRAVEL PATH
- 1 HR FIRE BARRIER
- 2 HR FIRE BARRIER

FE

XX OCC.
XX T.D.
XX C.P.T.

- FIRE EXTINGUISHER CABINET LOCATIONS MINIMUM RATING OF 2A:10BC (5 LB. ABC DRY CHEMICAL). DO NOT PROVIDE GLASS. SEMI RECESSED CABINETS ARE TO PROVIDED IN FINISHED AREAS AND ARE PERMITTED TO BE SURFACE MOUNTED IN INDUSTRIAL AREAS.
- CUMULATIVE OCCUPANT LOAD
- TRAVEL DISTANCE
- COMMON PATH OF TRAVEL

EGRESS COMPONENT	
CLEAR WIDTH	CAPACITY FACTOR
ASSIGNED OCC. LOAD	MAXIMUM OCC. LOAD

EGRESS ANALYSIS

STAIRS	
37 IN.	0.30 (IN./OCC.)
41 OCC.	123 OCC.

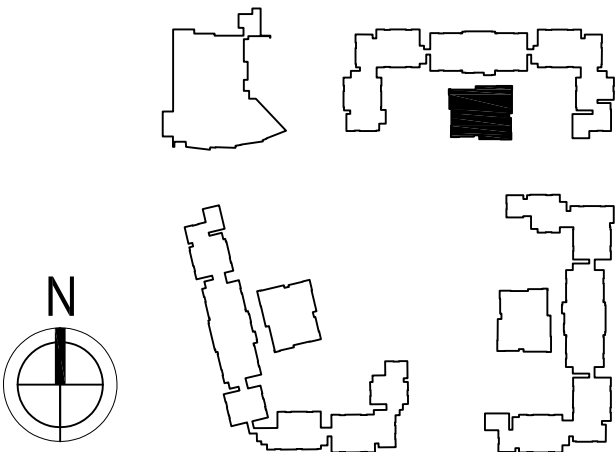
4' 0' 4' 8'
SCALE: 1/8" = 1'-0"



COMMON BUILDING MEZZANINE EGRESS PLAN

1/8" = 1'-0"

1



Appendix C – Fire Sprinkler Hydraulic Calculations



Hydraulic Summary

Job Number: 10-682
Report Description: Ordinary Group I

Job

System

Most Demanding Sprinkler Data 5.6 K-Factor 18.00 at 10.33		Occupancy Ordinary Group I	Job Suffix
Hose Allowance At Source 0.00		Density 0.15gpm/ft²	Area of Application 1845.00ft² (Actual 1980.24ft²)
Additional Hose Supplies <div>Node</div> <div>Hose At Node 1</div> <div>Flow(gpm)</div> <div>500.00</div>		Number Of Sprinklers Calculated 30	Coverage Per Sprinkler 110.00ft²
Total Hose Streams 500.00			
System Flow Demand 1142.62	Total Water Required (Including Hose Allowance) 1142.62		
Maximum Pressure Unbalance In Loops 0.00			
Maximum Velocity Above Ground 17.08 between nodes 22 and 23			
Maximum Velocity Under Ground 12.59 between nodes 1004 and 1			
Volume capacity of Wet Pipes 21218.03gal	Volume capacity of Dry Pipes		

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1000		100.00	73.00		2500.00	93.66		1142.62	82.81	10.85

Contractor

Contractor Number	Contact Name	Contact Title
Name of Contractor: Industrial Fire	Phone	Extension
Address 1 3845 Imperial Ave.	FAX	
Address 2 San Diego CA	E-mail	
Address 3 92113	Web-Site	



Summary Of Outflowing Devices

Job Number: 10-682
Report Description: Ordinary Group I

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hose	1	500.00	500.00	0	76.12		
Sprinkler	101	24.71	21.50	5.6	19.47		
Sprinkler	102	23.95	18.00	5.6	18.28		
Sprinkler	103	22.99	16.50	5.6	16.85		
Sprinkler	104	22.65	18.00	5.6	16.36		
Sprinkler	105	21.90	16.50	5.6	15.29		
Sprinkler	106	21.30	18.00	5.6	14.46		
Sprinkler	107	20.67	16.50	5.6	13.63		
Sprinkler	108	20.48	16.50	5.6	13.38		
Sprinkler	109	25.94	14.82	5.6	21.45		
Sprinkler	110	25.34	16.50	5.6	20.47		
Sprinkler	111	23.96	16.50	5.6	18.31		
Sprinkler	112	20.79	14.82	5.6	13.78		
Sprinkler	113	21.68	17.00	5.6	14.99		
Sprinkler	114	20.39	17.00	5.6	13.26		
Sprinkler	115	19.06	18.00	5.6	11.59		
Sprinkler	116	18.45	16.50	5.6	10.85		
Sprinkler	117	18.49	14.82	5.6	10.90		
Sprinkler	118	25.51	14.82	5.6	20.74		
Sprinkler	119	20.50	18.00	5.6	13.40		
Sprinkler	120	19.86	17.00	5.6	12.57		
⇒ Sprinkler	121	18.00	18.00	5.6	10.33		
Sprinkler	122	17.30	14.82	5.6	9.54		
Sprinkler	123	17.54	16.50	5.6	9.81		
Sprinkler	124	25.20	16.50	5.6	20.24		
Sprinkler	125	25.14	14.82	5.6	20.16		
Sprinkler	126	21.85	16.50	5.6	15.22		
Sprinkler	127	21.60	18.00	5.6	14.88		
Sprinkler	128	19.76	18.00	5.6	12.45		
Sprinkler	129	18.98	18.00	5.6	11.49		
Sprinkler	130	18.65	16.50	5.6	11.10		

⇒ Most Demanding Sprinkler Data



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group I

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
DR	1.05	18.00	6.68	120		0.107085	3'-4"	Pf 1.11
121	8'-10"	18.00	5.6	10.33		Sprinkler,	7'-0"	Pe -1.03
45	11'-2½"			10.40		E(2'-0), T(5'-0)	10'-4"	Pv
BL	1.38	52.84	11.33	120		0.206495	11'-11½"	Pf 2.47
45	11'-2½"	34.84		10.40		Flow (q) from Route 2		Pe 0.00
44	11'-2½"			12.88			11'-11½"	Pv
BL	1.61	72.69	11.46	120		0.175871	9'-0½"	Pf 1.59
44	11'-2½"	19.86		12.88		Flow (q) from Route 10		Pe -0.00
43	11'-2½"			14.47			9'-0½"	Pv
BL	1.61	93.19	14.69	120		0.278454	15'-0½"	Pf 8.64
43	11'-2½"	20.50		14.47		Flow (q) from Route 9	16'-0"	Pe -4.52
42	21'-7½"			18.59		4E(4'-0)	31'-0½"	Pv
BL	2.07	93.19	8.91	120		0.082468	8'-1"	Pf 1.49
42	21'-7½"			18.59			10'-0"	Pe
41	21'-7½"			20.08		PO(10'-0)	18'-1"	Pv
CM	4.26	244.38	5.50	120		0.014499	3'-3½"	Pf 0.05
41	21'-7½"	151.19		20.08		Flow (q) from Route 3		Pe 0.45
40	20'-7"			20.58			3'-3½"	Pv
CM	4.26	269.88	6.08	120		0.017422	9'-10"	Pf 0.17
40	20'-7"	25.51		20.58		Flow (q) from Route 29		Pe 1.35
60	17'-5½"			22.10			9'-10"	Pv
CM	4.26	269.88	6.08	120		0.017422	0'-7"	Pf 0.01
60	17'-5½"			22.10				Pe 0.08
31	17'-3½"			22.19			0'-7"	Pv
CM	4.26	438.04	9.86	120		0.042680	15'-5½"	Pf 1.81
31	17'-3½"	168.15		22.19		Flow (q) from Route 4	26'-10"	Pe 1.55
30	13'-8½"			25.55		3fE(8'-11½)	42'-3½"	Pv
CM	4.26	463.97	10.44	120		0.047472	2'-8½"	Pf 0.13
30	13'-8½"	25.94		25.55		Flow (q) from Route 30		Pe
22	13'-8½"			25.68			2'-8½"	Pv
CM	4.26	642.62	14.47	120		0.086725	13'-7½"	Pf 2.73
22	13'-8½"	178.65		25.68		Flow (q) from Route 13	17'-11"	Pe
21	13'-8½"			28.41		2fE(8'-11½)	31'-6½"	Pv
FR	4.26	642.62	14.47	120		0.086725	8'-0"	Pf 5.35
21	13'-8½"			28.41			53'-8½"	Pe 4.08
20	4'-3½"			37.84		CV(28'-11½), BV(15'-9½), fE(8'-11½)	61'-9"	Pv
ST	4.26	642.62	14.47	120		0.086725	81'-9½"	Pf 13.26
20	4'-3½"			37.84			71'-1"	Pe -2.33
16	9'-8"			48.78		5fE(8'-11½), PO(26'-4)	152'-11"	Pv
ST	6.36	642.62	6.50	120		0.012346	67'-11"	Pf 1.65
16	9'-8"			48.78			25'-2"	Pe -0.10
15	9'-11"			50.32		2fE(12'-7), MF (-0.50)	93'-0½"	Pv
ST	6.36	642.62	6.50	120		0.012346	114'-2"	Pf 2.44
15	9'-11"			50.32			42'-9"	Pe -0.00
13	9'-11"			52.76		2fE(12'-7), E(17'-7), MF (-0.50)	156'-11"	Pv
ST	6.36	642.62	6.50	120		0.012346	132'-7"	Pf 2.72
13	9'-11"			52.76			88'-0"	Pe 0.00
11	9'-11"			55.48		7fE(12'-7)	220'-7"	Pv
FR	6.36	642.62	6.50	120		0.012346	9'-5½"	Pf 0.12
11	9'-11"			55.48				Pe 4.10
9	0'-5½"			59.70			9'-5½"	Pv
UG	6.40	642.62	6.41	140		0.008983	10'-5½"	Pf 0.37
9	0'-5½"			59.70			31'-1½"	Pe 1.50
8	-3'-0"			61.57		2LtE(15'-6½)	41'-7"	Pv
UG	6.09	642.62	7.08	150		0.010069	75'-4½"	Pf 1.12
8	-3'-0"			61.57			35'-5"	Pe 0.00
7	-3'-0"			62.69		2EE(10'-9½), LtE(13'-10½)	110'-9½"	Pv
UG	6.40	642.62	6.41	140		0.008983	11'-0"	Pf 12.84
7	-3'-0"			62.69			82'-11½"	Pe -0.00
2	-3'-0"			75.53		T(51'-10), BFP(-12.00), 2LtE(15'-6½)	93'-11½"	Pv
UG	6.09	642.62	7.08	150		0.010069	7'-6"	Pf 0.59
2	-3'-0"			75.53			50'-10"	Pe 0.00
1	-3'-0"			76.12		GV(4'-7½), T(46'-2½)	58'-4"	Pv
UG	6.09	1142.62	12.59	150		0.029201	113'-11"	Pf 4.81
1	-3'-0"	500.00		76.12		Hose	50'-10"	Pe
1004	-3'-0"			80.93		GV(4'-7½), T(46'-2½)	164'-9"	Pv
UG	7.98	537.23	3.45	150		0.001938	558'-4"	Pf 1.31
1004	-3'-0"			80.93			119'-2½"	Pe
1005	-3'-0"			82.24		2GV(6'-0½), 2EE(13'-7), E(27'-2), T(52'-10)	677'-6½"	Pv



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group I

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	9.79	535.16	2.28	150		0.000711	642'-5"	Pf 0.56
1005	-3'-0"			82.24			140'-3"	Pe -0.01
1001	-3'-0"			82.79		2GV(6'-9"), 2E(29'-8"), T(67'-5")	782'-8"	Pv
UG	11.65	1142.62	3.44	150		0.001240	3'-7"	Pf 0.01
1001	-3'-0"	607.46		82.79		Supply,	8'-0 1/2"	Pe
1000	-3'-0"			82.81		GV(8'-0 1/2"), S	11'-7 1/2"	Pv
		0.00				Hose Allowance At Source		
1000		1142.62						
Route 2								
DR	1.05	17.54	6.51	120		0.102116	5'-2"	Pf 0.94
123	8'-10"	17.54	5.6	9.81		Sprinkler,	4'-0"	Pe -1.02
46	11'-2 1/2"			9.73		2E(2'-0")	9'-2"	Pv
BL	1.38	34.84	7.47	120		0.095558	7'-0 1/2"	Pf 0.67
46	11'-2 1/2"	17.30		9.73		Flow (q) from Route 8		Pe
45	11'-2 1/2"			10.40			7'-0 1/2"	Pv
Route 3								
DR	1.05	18.98	7.05	120		0.118136	3'-9"	Pf 1.27
129	8'-10"	18.98	5.6	11.49		Sprinkler,	7'-0"	Pe -1.03
54	11'-2 1/2"			11.73		E(2'-0"), T(5'-0")	10'-9"	Pv
BL	1.38	37.64	8.07	120		0.110230	12'-0"	Pf 1.33
54	11'-2 1/2"	18.65		11.73		Flow (q) from Route 7		Pe 0.00
53	11'-2 1/2"			13.05			12'-0"	Pv
BL	1.38	57.40	12.31	120		0.240662	10'-0"	Pf 2.41
53	11'-2 1/2"	19.76		13.05		Flow (q) from Route 5		Pe
52	11'-2 1/2"			15.46			10'-0"	Pv
BL	1.61	79.00	12.45	120		0.205133	1'-0 1/2"	Pf 0.21
52	11'-2 1/2"	21.60		15.46		Flow (q) from Route 14		Pe
51	11'-2 1/2"			15.68			1'-0 1/2"	Pv
BL	1.61	100.85	15.89	120		0.322248	14'-4 1/2"	Pf 7.21
51	11'-2 1/2"	21.85		15.68		Flow (q) from Route 20	8'-0"	Pe -5.52
50	23'-11 1/2"			17.36		2E(4'-0")	22'-4 1/2"	Pv
BL	2.07	100.85	9.64	120		0.095439	7'-6"	Pf 1.67
50	23'-11 1/2"			17.36			10'-0"	Pe 0.01
49	23'-11 1/2"			19.04		PO(10'-0")	17'-6"	Pv
CM	4.26	100.85	2.27	120		0.002820	0'-10"	Pf 0.00
49	23'-11 1/2"			19.04				Pe 0.12
48	23'-8"			19.16			0'-10"	Pv
CM	4.26	125.99	2.84	120		0.004257	3'-8 1/2"	Pf 0.02
48	23'-8"	25.14		19.16		Flow (q) from Route 28		Pe 0.51
47	22'-6"			19.68			3'-8 1/2"	Pv
CM	4.26	151.19	3.40	120		0.005964	2'-9"	Pf 0.02
47	22'-6"	25.20		19.68		Flow (q) from Route 26		Pe 0.38
41	21'-7 1/2"			20.08			2'-9"	Pv
Route 4								
DR	1.05	19.06	7.08	120		0.119064	3'-4 1/2"	Pf 1.23
115	8'-10"	19.06	5.6	11.59		Sprinkler,	7'-0"	Pe -1.03
38	11'-2 1/2"			11.79		E(2'-0"), T(5'-0")	10'-4 1/2"	Pv
BL	1.38	56.00	12.01	120		0.229925	8'-0"	Pf 1.84
38	11'-2 1/2"	36.94		11.79		Flow (q) from Route 6		Pe
37	11'-2 1/2"			13.63			8'-0"	Pv
BL	1.61	76.39	12.04	120		0.192759	9'-9 1/2"	Pf 1.89
37	11'-2 1/2"	20.39		13.63		Flow (q) from Route 12		Pe 0.00
36	11'-2 1/2"			15.53			9'-9 1/2"	Pv
BL	1.61	98.07	15.45	120		0.306008	4'-1"	Pf 1.25
36	11'-2 1/2"	21.68		15.53		Flow (q) from Route 18		Pe -0.00
35	11'-2 1/2"			16.77			4'-1"	Pv
BL	2.07	118.85	11.36	120		0.129336	2'-11 1/2"	Pf 1.67
35	11'-2 1/2"	20.79		16.77		Flow (q) from Route 22	10'-0"	Pe -0.06
34	11'-4"			18.39		2E(5'-0")	12'-11 1/2"	Pv
BL	2.07	142.82	13.65	120		0.181669	6'-5"	Pf 2.71
34	11'-4"	23.96		18.39		Flow (q) from Route 25	8'-6"	Pe -2.58
33	17'-3 1/2"			18.52		E(5'-0"), fE(3'-6")	14'-11"	Pv
BL	2.16	142.82	12.54	120		0.147618	5'-5 1/2"	Pf 0.81
33	17'-3 1/2"			18.52				Pe
32	17'-3 1/2"			19.32			5'-5 1/2"	Pv
BL	2.16	168.15	14.76	120		0.199688	2'-0 1/2"	Pf 2.87
32	17'-3 1/2"	25.34		19.32		Flow (q) from Route 27	12'-3 1/2"	Pe
31	17'-3 1/2"			22.19		PO(12'-3 1/2")	14'-4 1/2"	Pv
Route 5								
DR	1.05	19.76	7.34	120		0.127291	3'-9"	Pf 1.62
128	8'-10"	19.76	5.6	12.45		Sprinkler,	9'-0"	Pe -1.03
53	11'-2 1/2"			13.05		2E(2'-0"), T(5'-0")	12'-9"	Pv



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group I

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 6								
DR	1.05	18.45	6.85	120		0.112042	3'-9"	Pf 1.20
116	8'-10"	18.45	5.6	10.85		Sprinkler,	7'-0"	Pe -1.03
39	11'-2½"			11.03		E(2'-0), T(5'-0)	10'-9"	Pv
BL	1.38	36.94	7.92	120		0.106479	7'-2½"	Pf 0.77
39	11'-2½"	18.49		11.03		Flow (q) from Route 11		Pe
38	11'-2½"			11.79			7'-2½"	Pv
Route 7								
DR	1.05	18.65	6.92	120		0.114397	10'-5"	Pf 1.65
130	8'-10½"	18.65	5.6	11.10		Sprinkler,	4'-0"	Pe -1.02
54	11'-2½"			11.73		2E(2'-0)	14'-5"	Pv
Route 8								
DR	1.05	17.30	6.42	120		0.099461	5'-2"	Pf 1.21
122	8'-10"	17.30	5.6	9.54		Sprinkler,	7'-0"	Pe -1.02
46	11'-2½"			9.73		E(2'-0), T(5'-0)	12'-2"	Pv
Route 9								
DR	1.05	20.50	7.61	120		0.136166	4'-4"	Pf 2.09
119	8'-10"	20.50	5.6	13.40		Sprinkler,	11'-0"	Pe -1.02
43	11'-2½"			14.47		3E(2'-0), T(5'-0)	15'-4"	Pv
Route 10								
DR	1.05	19.86	7.37	120		0.128402	3'-3½"	Pf 1.32
120	8'-10"	19.86	5.6	12.57		Sprinkler,	7'-0"	Pe -1.02
44	11'-2½"			12.88		E(2'-0), T(5'-0)	10'-3½"	Pv
Route 11								
DR	1.05	18.49	6.86	120		0.112566	6'-2½"	Pf 1.15
117	8'-10"	18.49	5.6	10.90		Sprinkler,	4'-0"	Pe -1.03
39	11'-2½"			11.03		2E(2'-0)	10'-2½"	Pv
Route 12								
DR	1.05	20.39	7.57	120		0.134852	3'-4"	Pf 1.40
114	8'-10"	20.39	5.6	13.26		Sprinkler,	7'-0"	Pe -1.02
37	11'-2½"			13.63		E(2'-0), T(5'-0)	10'-4"	Pv
Route 13								
DR	1.05	21.30	7.91	120		0.146170	7'-6½"	Pf 2.13
106	8'-10"	21.30	5.6	14.46		Sprinkler,	7'-0"	Pe -3.02
28	15'-10"			13.57		E(2'-0), T(5'-0)	14'-6½"	Pv
BL	1.38	62.45	13.40	120		0.281336	5'-11½"	Pf 1.68
28	15'-10"	41.16		13.57		Flow (q) from Route 15		Pe
27	15'-10"			15.25			5'-11½"	Pv
BL	1.61	84.35	13.29	120		0.231582	2'-0½"	Pf 0.47
27	15'-10"	21.90		15.25		Flow (q) from Route 21		Pe
26	15'-10"			15.72			2'-0½"	Pv
BL	1.61	107.00	16.86	120		0.359573	4'-3½"	Pf 1.55
26	15'-10"	22.65		15.72		Flow (q) from Route 19		Pe -0.00
25	15'-10"			17.27			4'-3½"	Pv
BL	2.07	129.99	12.43	120		0.152638	4'-2"	Pf 0.64
25	15'-10"	22.99		17.27		Flow (q) from Route 24		Pe
24	15'-10"			17.91			4'-2"	Pv
BL	2.07	153.93	14.72	120		0.208694	7'-1"	Pf 1.48
24	15'-10"	23.95		17.91		Flow (q) from Route 23		Pe
23	15'-10"			19.39			7'-1"	Pv
BL	2.07	178.65	17.08	120		0.274874	4'-6½"	Pf 5.37
23	15'-10"	24.71		19.39		Flow (q) from Route 16	15'-0"	Pe 0.92
22	13'-8½"			25.68		E(5'-0), PO(10'-0)	19'-6½"	Pv
Route 14								
DR	1.05	21.60	8.02	120		0.150081	3'-9"	Pf 1.62
127	8'-10"	21.60	5.6	14.88		Sprinkler,	7'-0"	Pe -1.03
52	11'-2½"			15.46		E(2'-0), T(5'-0)	10'-9"	Pv
Route 15								
DR	1.05	20.48	7.60	120		0.136012	10'-10½"	Pf 2.30
108	8'-10"	20.48	5.6	13.38		Sprinkler,	6'-0"	Pe -3.02
29	15'-10"			12.66		3E(2'-0)	16'-10½"	Pv
BL	1.38	41.16	8.83	120		0.130066	7'-0½"	Pf 0.91
29	15'-10"	20.67		12.66		Flow (q) from Route 17		Pe
28	15'-10"			13.57			7'-0½"	Pv
Route 16								
DR	1.05	24.71	9.17	120		0.192481	7'-10½"	Pf 2.86
101	9'-0"	24.71	5.6	19.47		Sprinkler,	7'-0"	Pe -2.95
23	15'-10"			19.39		E(2'-0), T(5'-0)	14'-10½"	Pv
Route 17								
DR	1.05	20.67	7.67	120		0.138354	7'-9½"	Pf 2.05
107	8'-10"	20.67	5.6	13.63		Sprinkler,	7'-0"	Pe -3.02
29	15'-10"			12.66		E(2'-0), T(5'-0)	14'-9½"	Pv



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group I

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 18								
DR	1.05	21.68	8.05	120		0.151059	3'-4 1/2"	Pf 1.57
113	8'-10	21.68	5.6	14.99		Sprinkler,	7'-0	Pe -1.02
36	11'-2 1/2			15.53		E(2'-0), T(5'-0)	10'-4 1/2"	Pv
Route 19								
DR	1.05	22.65	8.41	120		0.163791	7'-6 1/2"	Pf 2.38
104	8'-10	22.65	5.6	16.36		Sprinkler,	7'-0	Pe -3.02
26	15'-10			15.72		E(2'-0), T(5'-0)	14'-6 1/2"	Pv
Route 20								
DR	1.05	21.85	8.11	120		0.153218	3'-7 1/2"	Pf 1.63
126	8'-6	21.85	5.6	15.22		Sprinkler,	7'-0	Pe -1.17
51	11'-2 1/2			15.68		E(2'-0), T(5'-0)	10'-7 1/2"	Pv
Route 21								
DR	1.05	21.90	8.13	120		0.153922	10'-4	Pf 2.98
105	8'-10	21.90	5.6	15.29		Sprinkler,	9'-0	Pe -3.02
27	15'-10			15.25		2E(2'-0), T(5'-0)	19'-4	Pv
Route 22								
DR	1.05	20.79	7.72	120		0.139755	11'-2 1/2"	Pf 3.52
112	10'-0	20.79	5.6	13.78		Sprinkler,	14'-0	Pe -0.53
35	11'-2 1/2			16.77		2E(2'-0), f(-0.00), CV(5'-0), BalV, T(5'-0)	25'-2 1/2"	Pv
Route 23								
DR	1.05	23.95	8.89	120		0.181573	7'-6 1/2"	Pf 2.64
102	8'-10	23.95	5.6	18.28		Sprinkler,	7'-0	Pe -3.02
24	15'-10			17.91		E(2'-0), T(5'-0)	14'-6 1/2"	Pv
Route 24								
DR	1.05	22.99	8.53	120		0.168328	11'-6	Pf 3.45
103	8'-10	22.99	5.6	16.85		Sprinkler,	9'-0	Pe -3.03
25	15'-10			17.27		2E(2'-0), T(5'-0)	20'-6	Pv
Route 25								
DR	1.05	23.96	8.90	120		0.181799	3'-3 3/4"	Pf 1.51
111	8'-0 1/2	23.96	5.6	18.31		Sprinkler,	5'-0	Pe -1.43
34	11'-4			18.39		T(5'-0)	8'-3 3/4"	Pv
Route 26								
DR	1.05	25.20	9.35	120		0.199488	17'-7	Pf 5.50
124	8'-6	25.20	5.6	20.24		Sprinkler,	10'-0	Pe -6.06
47	22'-6			19.68		T(5'-0), PO(5'-0)	27'-7	Pv
Route 27								
DR	1.05	25.34	9.41	120		0.201559	9'-3 1/2"	Pf 2.88
110	8'-0	25.34	5.6	20.47		Sprinkler,	5'-0	Pe -4.03
32	17'-3 1/2			19.32		PO(5'-0)	14'-3 1/2"	Pv
Route 28								
DR	1.05	25.14	9.33	120		0.198750	15'-7 1/2"	Pf 4.50
125	11'-0	25.14	5.6	20.16		Sprinkler,	7'-0	Pe -5.50
48	23'-8			19.16		E(2'-0), PO(5'-0)	22'-7 1/2"	Pv
Route 29								
DR	1.05	25.51	9.47	120		0.204057	12'-6	Pf 3.98
118	11'-0	25.51	5.6	20.74		Sprinkler,	7'-0	Pe -4.15
40	20'-7			20.58		E(2'-0), PO(5'-0)	19'-6	Pv
Route 30								
DR	1.05	25.94	9.63	120		0.210503	14'-0	Pf 5.26
109	11'-0	25.94	5.6	21.45		Sprinkler,	11'-0	Pe -1.17
30	13'-8 1/2			25.55		3E(2'-0), PO(5'-0)	25'-0	Pv
Route 31								
UG	9.79	2.07	0.01	150		0.000000	251'-2	Pf 0.00
1010	-3'-0	2.07		82.24		Flow (q) from Route 32	6'-9	Pe
1003	-3'-0			82.24		GV(6'-9)	257'-10 1/2"	Pv
UG	9.79	607.46	2.59	150		0.000899	290'-5	Pf 0.39
1003	-3'-0	605.39		82.24		Flow (q) from Route 34	140'-3	Pe -0.01
1002	-3'-0			82.62		2GV(6'-9), 2E(29'-8), T(67'-5)	430'-8	Pv
UG	11.65	607.46	1.83	150		0.000385	423'-4 1/2"	Pf 0.17
1002	-3'-0			82.62			16'-1	Pe
1001	-3'-0			82.79		2GV(8'-0 1/2)	439'-5 1/2"	Pv
Route 32								
UG	9.79	2.07	0.01	150		0.000000	74'-3 1/2"	Pf 0.00
1009	-3'-0			82.24				Pe
1010	-3'-0			82.24			74'-3 1/2"	Pv
Route 33								
UG	9.79	2.07	0.01	150		0.000000	625'-11 1/2"	Pf 0.00
1007	-3'-0			82.24			87'-8	Pe 7.15
1008	-19'-6			89.39		2GV(6'-9), 3EE(14'-10), E(29'-8)	712'-9 1/2"	Pv



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group I

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
UG	9.79	2.07	0.01	150		657'-7	Pf 0.00
1008	-19'-6			89.39		36'-5	Pe -7.15
1009	-3'-0			82.24	GV(6'-9), 2EE(14'-10)	694'-0	Pv
Route 34							
UG	7.98	605.39	3.88	150		451'-2½	Pf 1.31
1004	-3'-0			80.93		92'-0½	Pe
1003	-3'-0			82.24	2GV(6'-0½), 2EE(13'-7), T(52'-10)	543'-3	Pv
Route 35							
UG	9.79	2.07	0.01	150		198'-6½	Pf 0.00
1005	-3'-0			82.24		6'-9	Pe
1006	-3'-0			82.24	GV(6'-9)	205'-3	Pv
UG	9.79	2.07	0.01	150		35'-0	Pf 0.00
1006	-3'-0			82.24		6'-9	Pe
1007	-3'-0			82.24	GV(6'-9)	41'-9	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

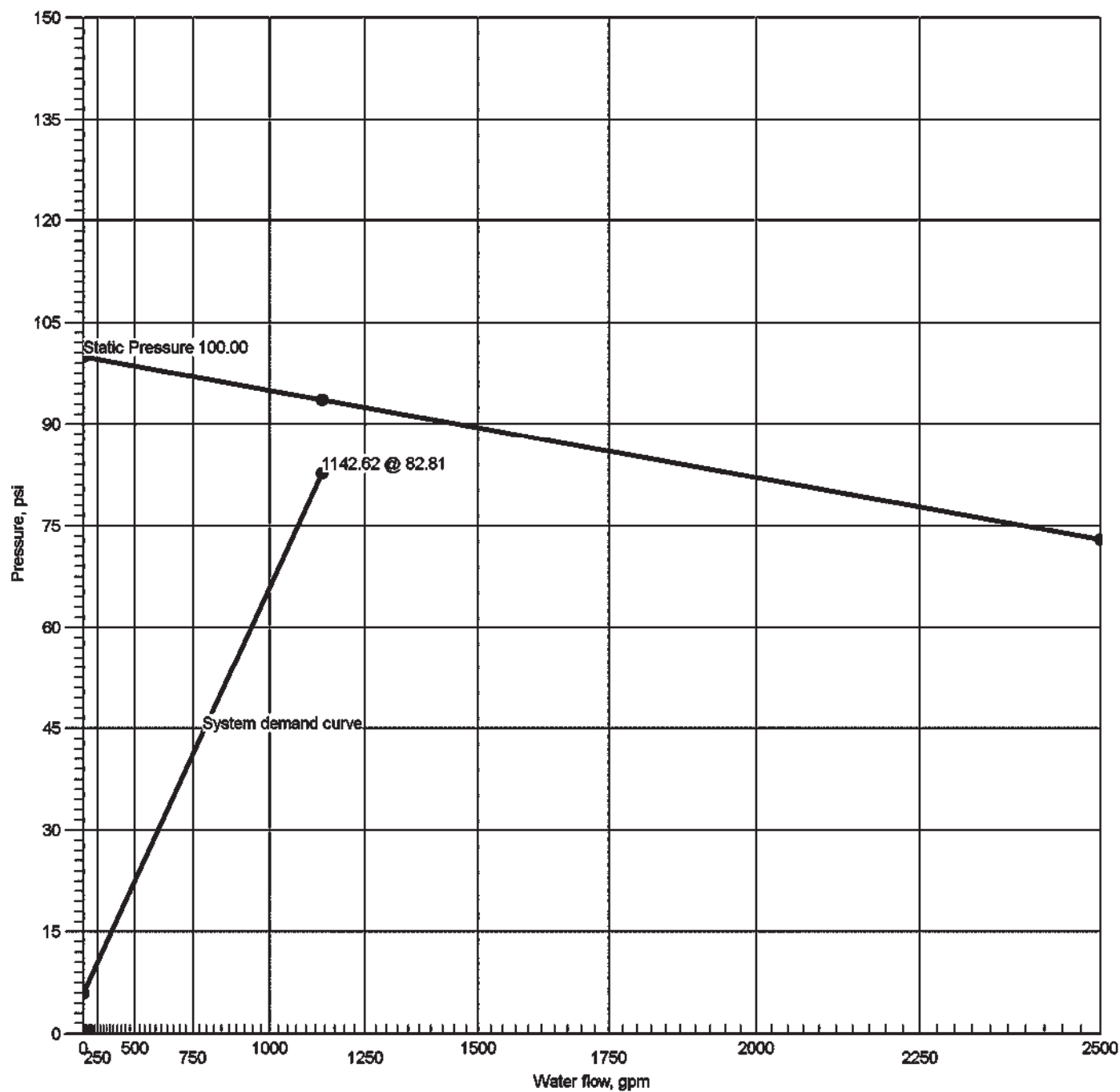
Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

MF Metraflex



Supply at Node 1000



Hydraulic Graph

Supply at Node 1000

Static: Pressure

100.00

Residual: Pressure

73.00 @ 2500.00

Available Pressure at Time of Test

93.66 @ 1142.62

System Demand

82.81 @ 1142.62

System Demand (Including Hose Allowance at Source)

82.81 @ 1142.62



Hydraulic Summary

Job Number: 10-682
Report Description: Residential

Job

System

Most Demanding Sprinkler Data 4.9 K-Factor 14.03 at 8.20		Occupancy Residential		Job Suffix	
Hose Allowance At Source 0.00		Density 0.05gpm/ft²		Area of Application Living Unit	
Additional Hose Supplies <div>Node</div> <div>Hose At Node 1</div> <div>Flow(gpm)</div> <div>250.00</div>		Number Of Sprinklers Calculated 4		Coverage Per Sprinkler	
		AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area			
Total Hose Streams 250.00					
System Flow Demand 296.56		Total Water Required (Including Hose Allowance) 296.56			
Maximum Pressure Unbalance In Loops 0.00					
Maximum Velocity Above Ground 15.69 between nodes 430 and 431					
Maximum Velocity Under Ground 3.27 between nodes 1004 and 1					
Volume capacity of Wet Pipes 21929.01gal		Volume capacity of Dry Pipes			

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1000		100.00	73.00	2500.00	99.48	296.56	60.07	39.41

Contractor

Contractor Number		Contact Name		Contact Title	
Name of Contractor:		Phone		Extension	
Address 1		FAX			
Address 2		E-mail			
Address 3		Web-Site			



Summary Of Outflowing Devices

Job Number: 10-682
Report Description: Residential

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hose	1	250.00	250.00	0	59.53		
Sprinkler	469	11.19	9.00	3.5	10.21		
Sprinkler	470	10.77	9.00	3.5	9.47		
Sprinkler	471	10.57	9.00	3.5	9.13		
➡ Sprinkler	472	14.03	14.03	4.9	8.20		

➡ Most Demanding Sprinkler Data



Hydraulic Analysis

Job Number: 10-682
Report Description: Residential

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.10	14.03	4.73	150		0.035319	15'-0"	Pf 1.06
472	43'-0"	14.03	4.9	8.20		Sprinkler,	15'-0"	Pe -0.58
433	44'-4"			8.68		2E(7'-0"), Tr(1'-0)	30'-0"	Pv
BL	1.10	24.61	8.29	150		0.099835	0'-10"	Pf 0.18
433	44'-4"	10.57		8.68		Flow (q) from Route 2	1'-0"	Pe
432	44'-4"			8.87		Tr(1'-0)	1'-10"	Pv
BL	1.10	35.38	11.92	150		0.195428	3'-8 1/2"	Pf 0.92
432	44'-4"	10.77		8.87		Flow (q) from Route 3	1'-0"	Pe
431	44'-4"			9.78		Tr(1'-0)	4'-8 1/2"	Pv
BL	1.10	46.56	15.69	150		0.324887	8'-10"	Pf 11.64
431	44'-4"	11.19		9.78		Flow (q) from Route 4	27'-0"	Pe 0.33
430	43'-7"			21.74		3E(7'-0"), red(1'-0), PO(5'-0)	35'-10"	Pv
CM	2.16	46.56	4.09	120		0.018564	99'-1 1/2"	Pf 2.11
430	43'-7"			21.74			14'-9"	Pe -0.02
421	43'-7 1/2"			23.83		fT(10'-5 1/2"), fE(4'-3 1/2")	113'-10 1/2"	Pv
CM	2.63	46.56	2.74	120		0.007004	210'-0"	Pf 2.38
421	43'-7 1/2"			23.83			129'-10"	Pe -0.00
402	43'-7 1/2"			26.21		2fT(14'-10"), fE(5'-11"), 16fE(5'-10 1/2")	339'-10"	Pv
CM	3.26	46.56	1.79	120		0.002484	18'-2 1/2"	Pf 0.08
402	43'-7 1/2"			26.21			13'-5 1/2"	Pe -0.05
401	43'-9"			26.25		2fE(6'-8 1/2")	31'-8"	Pv
FR	3.26	46.56	1.79	120		0.002484	6'-3 1/2"	Pf 0.17
401	43'-9"			26.25			61'-10"	Pe 3.12
400	36'-6 1/2"			29.54		CV(21'-6"), BV(13'-5 1/2"), fE(6'-8 1/2"), PO(20'-2)	68'-1 1/2"	Pv
ST	6.36	46.56	0.47	120		0.000096	84'-2 1/2"	Pf 0.27
400	36'-6 1/2"			29.54			125'-9"	Pe 11.54
18	9'-11"			41.35		2fT(31'-5"), BV(12'-7"), 4fE(12'-7"), MF (-0.25)	209'-11"	Pv
CM	6.36	46.56	0.47	120		0.000096	152'-5 1/2"	Pf 0.27
18	9'-11"			41.35			50'-3 1/2"	Pe 0.00
15	9'-11"			41.62		4fE(12'-7"), MF (-0.25)	202'-9"	Pv
CM	6.36	46.56	0.47	120		0.000096	114'-2"	Pf 0.26
15	9'-11"			41.62			37'-8 1/2"	Pe -0.00
13	9'-11"			41.89		3fE(12'-7"), MF (-0.25)	151'-10 1/2"	Pv
CM	6.36	46.56	0.47	120		0.000096	132'-1 1/2"	Pf 0.02
13	9'-11"			41.89			88'-0"	Pe 0.00
11	9'-11"			41.91		7fE(12'-7")	220'-1 1/2"	Pv
FR	6.36	46.56	0.47	120		0.000096	9'-5 1/2"	Pf 0.00
11	9'-11"			41.91			9'-5 1/2"	Pe 4.10
9	0'-5 1/2"			46.01			9'-5 1/2"	Pv
UG	6.40	46.56	0.46	140		0.000070	10'-5 1/2"	Pf 0.00
9	0'-5 1/2"			46.01			31'-1 1/2"	Pe 1.50
8	-3'-0"			47.51		2LtE(15'-6 1/2")	41'-7"	Pv
UG	6.09	46.56	0.51	150		0.000078	75'-4 1/2"	Pf 0.01
8	-3'-0"			47.51			35'-5"	Pe 0.00
7	-3'-0"			47.52		2EE(10'-9 1/2"), LtE(13'-10 1/2")	110'-9 1/2"	Pv
UG	6.40	46.56	0.46	140		0.000070	11'-0"	Pf 12.01
7	-3'-0"			47.52			82'-11 1/2"	Pe -0.00
2	-3'-0"			59.53		T(51'-10"), BFP(-12.00), 2LtE(15'-6 1/2")	93'-11 1/2"	Pv
UG	6.09	46.56	0.51	150		0.000078	7'-6"	Pf 0.00
2	-3'-0"			59.53			50'-10"	Pe 0.00
1	-3'-0"			59.53		GV(4'-7 1/2"), T(46'-2 1/2")	58'-4"	Pv
UG	6.09	296.56	3.27	150		0.002408	113'-11"	Pf 0.40
1	-3'-0"	250.00		59.53		Hose	50'-10"	Pe
1004	-3'-0"			59.93		GV(4'-7 1/2"), T(46'-2 1/2")	164'-9"	Pv
UG	7.98	139.88	0.90	150		0.000161	558'-4"	Pf 0.11
1004	-3'-0"			59.93			111'-8"	Pe
1005	-3'-0"			60.04		2GV(6'-0 1/2"), 2EE(13'-7"), LtE(19'-7 1/2"), T(52'-10)	670'-0"	Pv
UG	9.79	138.69	0.59	150		0.000058	642'-5"	Pf 0.04
1005	-3'-0"			60.04			124'-1"	Pe -0.01
1001	-3'-0"			60.07		2GV(6'-9"), 2LtE(21'-7"), T(67'-5)	766'-6"	Pv
UG	11.65	296.56	0.89	150		0.000102	2'-0"	Pf 0.00
1001	-3'-0"	157.87		60.07		Supply,		Pe
1000	-3'-0"			60.07		Flow (q) from Route 5	2'-0"	Pv
		0.00				Hose Allowance At Source		
1000		296.56						
Route 2								



Hydraulic Analysis

Job Number: 10-682
Report Description: Residential

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	1.10	10.57	3.56	150		0.020928		Pf 0.13
471	43'-0	10.57	3.5	9.13		Sprinkler,		Pe -0.58
433	44'-4			8.68		T(5'-0)		Pv
Route 3								
BL	1.10	10.77	3.63	150		0.021653		Pf 0.41
470	42'-0	10.77	3.5	9.47		Sprinkler,		Pe -1.01
432	44'-4			8.87		E(7'-0), T(5'-0)		Pv
Route 4								
BL	1.10	11.19	3.77	150		0.023223		Pf 0.15
469	43'-0	11.19	3.5	10.21		Sprinkler,		Pe -0.58
431	44'-4			9.78		T(5'-0)		Pv
Route 5								
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1010	-3'-0	1.19		60.04		Flow (q) from Route 6		Pe
1003	-3'-0			60.04		GV(6'-9)		Pv
UG	9.79	157.87	0.67	150		0.000074		Pf 0.03
1003	-3'-0	156.68		60.04		Flow (q) from Route 8		Pe -0.01
1002	-3'-0			60.06		2GV(6'-9), 2LtE(21'-7), T(67'-5)		Pv
UG	11.65	157.87	0.48	150		0.000032		Pf 0.01
1002	-3'-0			60.06				Pe
1001	-3'-0			60.07		2GV(8'-0½)		Pv
Route 6								
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1009	-3'-0			60.04				Pe
1010	-3'-0			60.04				Pv
Route 7								
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1007	-3'-0			60.04				Pe 7.15
1008	-19'-6			67.18		2GV(6'-9), 3EE(14'-10), LtE(21'-7)		Pv
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1008	-19'-6			67.18				Pe -7.15
1009	-3'-0			60.04		GV(6'-9), 2EE(14'-10)		Pv
Route 8								
UG	7.98	156.68	1.01	150		0.000198		Pf 0.11
1004	-3'-0			59.93				Pe
1003	-3'-0			60.04		2GV(6'-0½), 2EE(13'-7), T(52'-10)		Pv
Route 9								
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1005	-3'-0			60.04				Pe
1006	-3'-0			60.04		GV(6'-9)		Pv
UG	9.79	1.19	0.01	150		0.000000		Pf 0.00
1006	-3'-0			60.04				Pe
1007	-3'-0			60.04		GV(6'-9)		Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

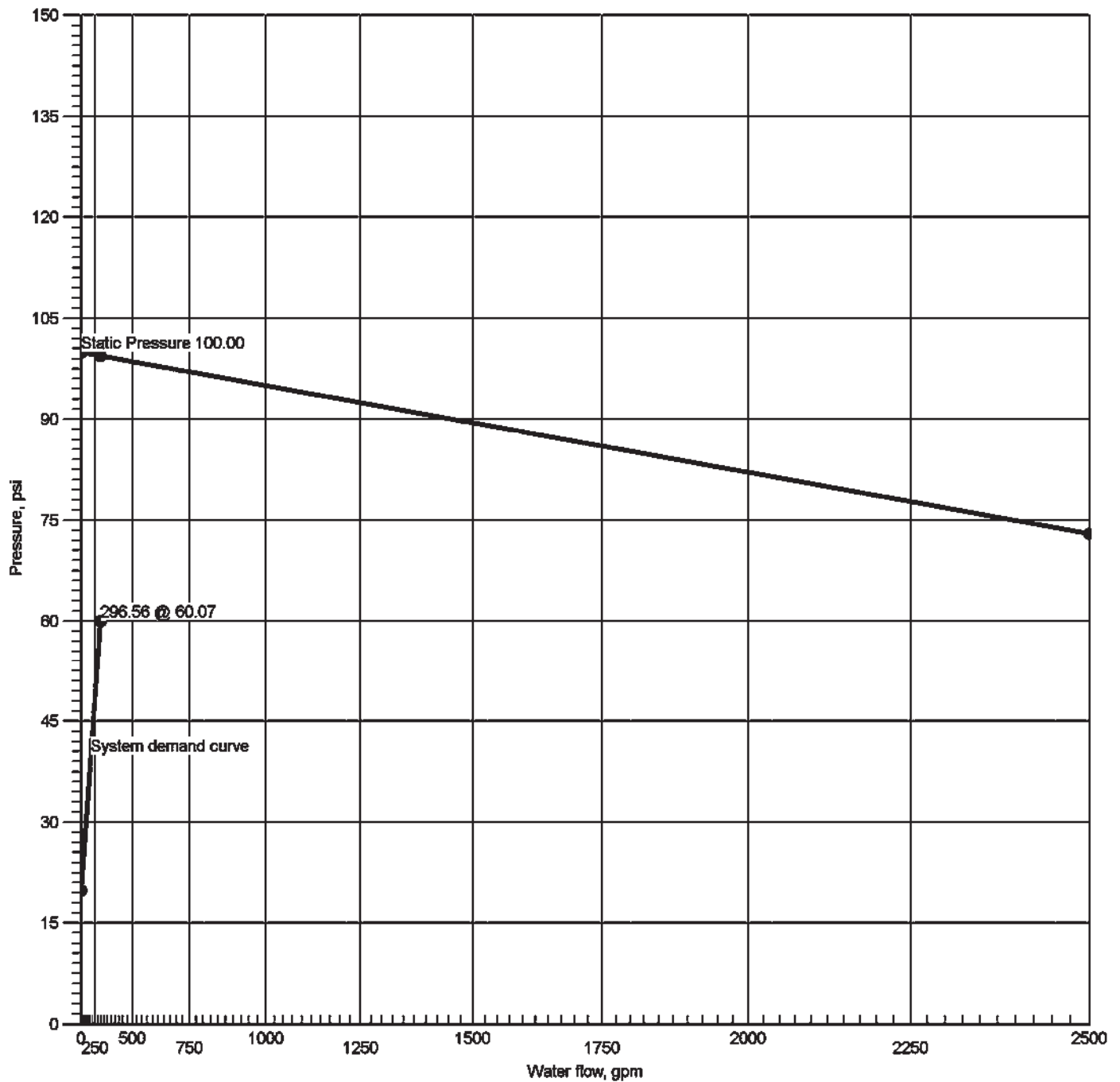
Job Number: 10-682
Report Description: Residential

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	

Pipe Type Legend	Units Legend	Fittings Legend
AO Arm-Over BL Branch Line CM Cross Main DN Drain DR Drop DY Dynamic FM Feed Main FR Feed Riser MS Miscellaneous OR Outrigger RN Riser Nipple SP Sprig ST Stand Pipe UG Underground	Diameter Inch Elevation Foot Flow gpm Discharge gpm Velocity fps Pressure psi Length Foot Friction Loss psi/Foot HWC Hazen-Williams Constant Pt Total pressure at a point in a pipe Pn Normal pressure at a point in a pipe Pf Pressure loss due to friction between points Pe Pressure due to elevation difference between indicated points Pv Velocity pressure at a point in a pipe	ALV Alarm Valve AngV Angle Valve b Bushing BalV Ball Valve BFP Backflow Preventer BV Butterfly Valve C Cross Flow Turn 90° cplg Coupling Cr Cross Run CV Check Valve DelV Deluge Valve DPV Dry Pipe Valve E 90° Elbow EE 45° Elbow Ee1 11¼° Elbow Ee2 22½° Elbow f Flow Device fd Flex Drop FDC Fire Department Connection fE 90° FireLock(TM) Elbow fEE 45° FireLock(TM) Elbow flg Flange FN Floating Node fT FireLock(TM) Tee g Gauge GloV Globe Valve GV Gate Valve Ho Hose Hose Hose HV Hose Valve Hyd Hydrant LtE Long Turn Elbow mecT Mechanical Tee Noz Nozzle P1 Pump In P2 Pump Out PIV Post Indicating Valve PO Pipe Outlet PRV Pressure Reducing Valve PrV Pressure Relief Valve red Reducer/Adapter S Supply sCV Swing Check Valve Spr Sprinkler St Strainer T Tee Flow Turn 90° Tr Tee Run U Union WirF Wirsbo WMV Water Meter Valve Z Cap
		MF MetraFlex



Supply at Node 1000



Hydraulic Graph

Supply at Node 1000

Static: Pressure
100.00

Residual: Pressure
73.00 @ 2500.00

Available Pressure at Time of Test
99.48 @ 296.56

System Demand
60.07 @ 296.56

System Demand (Including Hose Allowance at Source)
60.07 @ 296.56



Hydraulic Summary

Job Number: 10-682
Remote S.P.

Job

System		Remote Area(s)	
Most Demanding Sprinkler Data K-Factor at		Occupancy NA	Job Suffix Manually Flowing
Hose Allowance At Source 0.00		Density NA	Area of Application NA
Additional Hose Supplies		Number Of Sprinklers Calculated 0	Coverage Per Sprinkler NA
<div>NodeFlow(gpm)</div> <div>Hose At Node 707250.00</div> <div>Hose At Node 708250.00</div> <div>Hose At Node 703250.00</div> <div>Hose At Node 702250.00</div> <div>Hose At Node 705250.00</div>			
Total Hose Streams 1250.00			
System Flow Demand 1250.00	Total Water Required (Including Hose Allowance) 1250.00		
Maximum Pressure Unbalance In Loops 0.000			
Maximum Velocity Above Ground 16.88 between nodes 20 and 21			
Maximum Velocity Under Ground 13.88 between nodes 3 and 4			
Volume capacity of Wet Pipes 1790.44gal	Volume capacity of Dry Pipes		

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
3		183.267	183.267		1250.00	183.267		1250.00	183.267	-0.000

Pumper truck to provide
183.267 psi at the F.D.C

Contractor

Contractor Number		Contact Name		Contact Title
Name of Contractor:		Phone		Extension
Address 1		FAX		
Address 2		E-mail		
Address 3		Web-Site		



Summary Of Outflowing Devices

Job Number: 10-682

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hose	702	250.00	250.00	25	100.000		
Hose	703	250.00	250.00	0	97.838		
Hose	705	250.00	250.00	0	106.629		
Hose	707	250.00	250.00	0	127.399		
Hose	708	250.00	250.00	0	130.396		

➡ Most Demanding Sprinkler Data



Hydraulic Analysis

Job Number: 10-682

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
ST	2.47	250.00	16.75	120		0.215409	0'-6"	Pf 0.103
702	32'-7"	250.00		100.000		Hose(-100.000)		Pe 0.208
701	32'-1"			100.311			0'-6"	Pv
CM	4.26	250.00	5.63	120		0.015122	0'-6 1/2"	Pf 0.008
701	32'-1"			100.311				Pe 0.234
700	31'-6 1/2"			100.553			0'-6 1/2"	Pv
CM	4.26	500.00	11.25	120		0.054516	41'-6"	Pf 6.398
700	31'-6 1/2"	250.00		100.553		Flow (q) from Route 4	75'-10"	Pe 9.382
22	9'-11"			116.333		2fT(21'-1), BV(15'-9 1/2), 2fE(8'-11 1/2)	117'-4 1/2"	Pv
ST	4.26	750.00	16.88	120		0.115423	36'-8 1/2"	Pf 12.865
22	9'-11"	250.00		116.333		Flow (q) from Route 2	35'-9"	Pe -0.000
21	9'-11"			129.198		4fE(8'-11 1/2), MF (-4.500)	72'-5 1/2"	Pv
ST	4.26	750.00	16.88	120		0.115423	84'-4 1/2"	Pf 10.772
21	9'-11"			129.198			8'-11 1/2"	Pe 0.000
20	9'-11"			139.970		fE(8'-11 1/2)	93'-4"	Pv
DY	6.36	750.00	7.58	120		0.016432	0'-0"	Pf 0.000
20	9'-11"			139.970				Pe 0.000
19	9'-11"			139.970			0'-0"	Pv
ST	6.36	1000.00	10.11	120		0.027978	25'-8"	Pf 2.922
19	9'-11"	250.00		139.970		Flow (q) from Route 3	25'-2"	Pe -0.000
18	9'-11"			142.891		2fE(12'-7), MF (-1.500)	50'-9 1/2"	Pv
CM	6.36	1000.00	10.11	120		0.027978	52'-2"	Pf 1.459
18	9'-11"			142.891				Pe -0.001
17	9'-11"			144.349			52'-2"	Pv
ST	6.36	1250.00	12.64	120		0.042276	32'-5"	Pf 2.434
17	9'-11"			144.349			25'-2"	Pe 0.066
16	9'-9"			146.849		2fE(12'-7)	57'-7"	Pv
ST	6.36	1250.00	12.64	120		0.042276	67'-11"	Pf 5.934
16	9'-9"			146.849			25'-2"	Pe -0.065
15	9'-11"			152.718		2fE(12'-7), MF (-2.000)	93'-0 1/2"	Pv
CM	6.36	1250.00	12.64	120		0.042276	114'-2"	Pf 8.421
15	9'-11"			152.718			37'-8 1/2"	Pe -0.000
13	9'-11"			161.139		3fE(12'-7), MF (-2.000)	151'-10 1/2"	Pv
CM	6.36	1250.00	12.64	120		0.042276	132'-1 1/2"	Pf 9.307
13	9'-11"			161.139			88'-0"	Pe 0.000
11	9'-11"			170.446		7fE(12'-7)	220'-1 1/2"	Pv
FR	6.36	1250.00	12.64	120		0.042276	9'-5 1/2"	Pf 0.400
11	9'-11"			170.446				Pe 4.100
9	0'-5 1/2"			174.946			9'-5 1/2"	Pv
UG	6.40	1250.00	12.47	140		0.030760	10'-5 1/2"	Pf 1.279
9	0'-5 1/2"			174.946			31'-11 1/2"	Pe 1.499
8	-3'-0"			177.724		2LtE(15'-6 1/2)	41'-7"	Pv
UG	6.09	1250.00	13.77	150		0.034480	75'-4 1/2"	Pf 3.821
8	-3'-0"			177.724			35'-5"	Pe 0.000
7	-3'-0"			181.544		2EE(10'-9 1/2), LtE(13'-10 1/2)	110'-9 1/2"	Pv
UG	6.40	1250.00	12.47	140		0.030760	5'-6"	Pf 1.764
7	-3'-0"			181.544			51'-10"	Pe -2.384
5	2'-6"			180.924		T(51'-10)	57'-4"	Pv
UG	6.36	1250.00	12.64	120		0.042276	1'-6"	Pf 3.359
5	2'-6"			180.924			77'-11 1/2"	Pe -0.497
4	3'-7 1/2"			183.786		PO(37'-8 1/2), CV(40'-3)	79'-5 1/2"	Pv
UG	6.07	1250.00	13.88	120		0.053156	1'-4 1/2"	Pf 0.073
4	3'-7 1/2"			183.786		Supply,		Pe -0.592
3	5'-0"			183.267			1'-4 1/2"	Pv
		0.00				Hose Allowance At Source		
3		1250.00						
Route 2								
ST	2.47	250.00	16.75	120		0.215409	0'-7"	Pf 2.715
705	20'-0"	250.00		106.629		Hose(-100.000)	12'-0"	Pe 0.000
704	20'-0"			109.344		PO(12'-0)	12'-7"	Pv
CM	4.26	250.00	5.63	120		0.015122	100'-5"	Pf 2.617
704	20'-0"			109.344			72'-8"	Pe 4.371
22	9'-11"			116.333		fT(21'-1), BV(15'-9 1/2), 4fE(8'-11 1/2)	173'-1"	Pv
Route 3								
ST	2.47	250.00	16.75	120		0.215409	0'-7"	Pf 2.715
707	31'-10 1/2"	250.00		127.399		Hose(-100.000)	12'-0"	Pe
706	31'-10 1/2"			130.114		PO(12'-0)	12'-7"	Pv
ST	6.36	250.00	2.53	120		0.002153	53'-10 1/2"	Pf 0.333
706	31'-10 1/2"			130.114			100'-7"	Pe 9.523
19	9'-11"			139.970		2fT(31'-5), BV(12'-7), 2fE(12'-7)	154'-5 1/2"	Pv
Route 4								



Hydraulic Analysis

Job Number: 10-682
Report Description: Ordinary Group II

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
ST	2.47	250.00	16.75	120	0.215409	0'-7½"	Pf 2.715
703	31'-6½"	250.00		97.838	Hose	12'-0"	Pe
700	31'-6½"			100.553	PO(12'-0")	12'-7½"	Pv
***** Route 5 *****							
ST	2.47	250.00	16.75	120	0.215409	0'-7½"	Pf 2.715
708	31'-6½"	250.00		130.396	Hose	12'-0"	Pe
709	31'-6½"			133.111	PO(12'-0")	12'-7½"	Pv
CM	4.26	250.00	5.63	120	0.015122	41'-8½"	Pf 1.858
709	31'-6½"			133.111		81'-1½"	Pe 9.381
17	9'-11"			144.349	fT(21'-1), BV(15'-9½"), 2fE(8'-11½"), T(26'-4")	122'-10"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

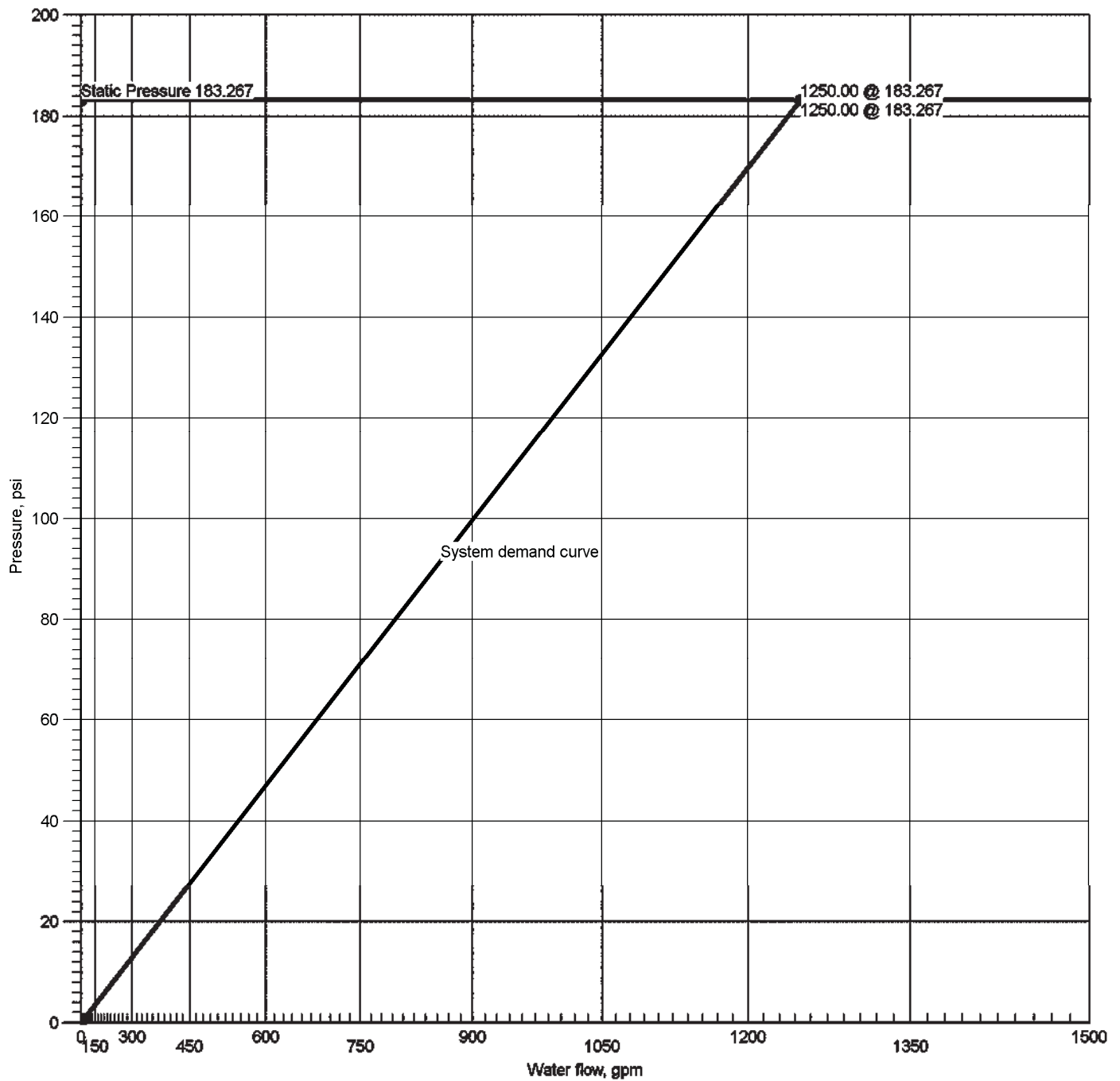
Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaIV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DeIV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

MF Metraflex



Supply at Node 3



Hydraulic Graph

Supply at Node 3

Static: Pressure

183.267

Residual: Pressure

183.267 @ 1250.00

Available Pressure at Time of Test

183.267 @ 1250.00

System Demand

183.267 @ 1250.00

System Demand (Including Hose Allowance at Source)

183.267 @ 1250.00



Summary Of Outflowing Devices

Job Number: 10-682

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hose	702	250.00	250.00	25	100.000		
Hose	703	250.00	250.00	0	97.838		
Hose	705	250.00	250.00	0	106.629		
Hose	707	250.00	250.00	0	127.399		
Hose	708	250.00	250.00	0	130.396		

➡ Most Demanding Sprinkler Data



Hydraulic Analysis

Job Number: 10-682

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
ST	2.47	250.00	16.75	120		0.215409	0'-6"	Pf 0.103
702	32'-7"	250.00		100.000		Hose(-100.000)		Pe 0.208
701	32'-1"			100.311			0'-6"	Pv
CM	4.26	250.00	5.63	120		0.015122	0'-6 1/2"	Pf 0.008
701	32'-1"			100.311				Pe 0.234
700	31'-6 1/2"			100.553			0'-6 1/2"	Pv
CM	4.26	500.00	11.25	120		0.054516	41'-6"	Pf 6.398
700	31'-6 1/2"	250.00		100.553		Flow (q) from Route 4	75'-10"	Pe 9.382
22	9'-11"			116.333		2fT(21'-1), BV(15'-9 1/2), 2fE(8'-11 1/2)	117'-4 1/2"	Pv
ST	4.26	750.00	16.88	120		0.115423	36'-8 1/2"	Pf 12.865
22	9'-11"	250.00		116.333		Flow (q) from Route 2	35'-9"	Pe -0.000
21	9'-11"			129.198		4fE(8'-11 1/2), MF (-4.500)	72'-5 1/2"	Pv
ST	4.26	750.00	16.88	120		0.115423	84'-4 1/2"	Pf 10.772
21	9'-11"			129.198			8'-11 1/2"	Pe 0.000
20	9'-11"			139.970		fE(8'-11 1/2)	93'-4"	Pv
DY	6.36	750.00	7.58	120		0.016432	0'-0"	Pf 0.000
20	9'-11"			139.970				Pe 0.000
19	9'-11"			139.970			0'-0"	Pv
ST	6.36	1000.00	10.11	120		0.027978	25'-8"	Pf 2.922
19	9'-11"	250.00		139.970		Flow (q) from Route 3	25'-2"	Pe -0.000
18	9'-11"			142.891		2fE(12'-7), MF (-1.500)	50'-9 1/2"	Pv
CM	6.36	1000.00	10.11	120		0.027978	52'-2"	Pf 1.459
18	9'-11"			142.891				Pe -0.001
17	9'-11"			144.349			52'-2"	Pv
ST	6.36	1250.00	12.64	120		0.042276	32'-5"	Pf 2.434
17	9'-11"			144.349			25'-2"	Pe 0.066
16	9'-9"			146.849		2fE(12'-7)	57'-7"	Pv
ST	6.36	1250.00	12.64	120		0.042276	67'-11"	Pf 5.934
16	9'-9"			146.849			25'-2"	Pe -0.065
15	9'-11"			152.718		2fE(12'-7), MF (-2.000)	93'-0 1/2"	Pv
CM	6.36	1250.00	12.64	120		0.042276	114'-2"	Pf 8.421
15	9'-11"			152.718			37'-8 1/2"	Pe -0.000
13	9'-11"			161.139		3fE(12'-7), MF (-2.000)	151'-10 1/2"	Pv
CM	6.36	1250.00	12.64	120		0.042276	132'-1 1/2"	Pf 9.307
13	9'-11"			161.139			88'-0"	Pe 0.000
11	9'-11"			170.446		7fE(12'-7)	220'-1 1/2"	Pv
FR	6.36	1250.00	12.64	120		0.042276	9'-5 1/2"	Pf 0.400
11	9'-11"			170.446				Pe 4.100
9	0'-5 1/2"			174.946			9'-5 1/2"	Pv
UG	6.40	1250.00	12.47	140		0.030760	10'-5 1/2"	Pf 1.279
9	0'-5 1/2"			174.946			31'-11 1/2"	Pe 1.499
8	-3'-0"			177.724		2LtE(15'-6 1/2)	41'-7"	Pv
UG	6.09	1250.00	13.77	150		0.034480	75'-4 1/2"	Pf 3.821
8	-3'-0"			177.724			35'-5"	Pe 0.000
7	-3'-0"			181.544		2EE(10'-9 1/2), LtE(13'-10 1/2)	110'-9 1/2"	Pv
UG	6.40	1250.00	12.47	140		0.030760	5'-6"	Pf 1.764
7	-3'-0"			181.544			51'-10"	Pe -2.384
5	2'-6"			180.924		T(51'-10)	57'-4"	Pv
UG	6.36	1250.00	12.64	120		0.042276	1'-6"	Pf 3.359
5	2'-6"			180.924			77'-11 1/2"	Pe -0.497
4	3'-7 1/2"			183.786		PO(37'-8 1/2), CV(40'-3)	79'-5 1/2"	Pv
UG	6.07	1250.00	13.88	120		0.053156	1'-4 1/2"	Pf 0.073
4	3'-7 1/2"			183.786		Supply,		Pe -0.592
3	5'-0"			183.267			1'-4 1/2"	Pv
		0.00				Hose Allowance At Source		
3		1250.00						
Route 2								
ST	2.47	250.00	16.75	120		0.215409	0'-7"	Pf 2.715
705	20'-0"	250.00		106.629		Hose(-100.000)	12'-0"	Pe 0.000
704	20'-0"			109.344		PO(12'-0)	12'-7"	Pv
CM	4.26	250.00	5.63	120		0.015122	100'-5"	Pf 2.617
704	20'-0"			109.344			72'-8"	Pe 4.371
22	9'-11"			116.333		fT(21'-1), BV(15'-9 1/2), 4fE(8'-11 1/2)	173'-1"	Pv
Route 3								
ST	2.47	250.00	16.75	120		0.215409	0'-7"	Pf 2.715
707	31'-10 1/2"	250.00		127.399		Hose(-100.000)	12'-0"	Pe
706	31'-10 1/2"			130.114		PO(12'-0)	12'-7"	Pv
ST	6.36	250.00	2.53	120		0.002153	53'-10 1/2"	Pf 0.333
706	31'-10 1/2"			130.114			100'-7"	Pe 9.523
19	9'-11"			139.970		2fT(31'-5), BV(12'-7), 2fE(12'-7)	154'-5 1/2"	Pv
Route 4								



Hydraulic Analysis

Job Number: 10-682

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
ST	2.47	250.00	16.75	120	0.215409	0'-7½"	Pf 2.715
703	31'-6½"	250.00		97.838	Hose	12'-0"	Pe
700	31'-6½"			100.553	PO(12'-0")	12'-7½"	Pv
***** Route 5 *****							
ST	2.47	250.00	16.75	120	0.215409	0'-7½"	Pf 2.715
708	31'-6½"	250.00		130.396	Hose	12'-0"	Pe
709	31'-6½"			133.111	PO(12'-0")	12'-7½"	Pv
CM	4.26	250.00	5.63	120	0.015122	41'-8½"	Pf 1.858
709	31'-6½"			133.111		81'-1½"	Pe 9.381
17	9'-11"			144.349	fT(21'-1), BV(15'-9½"), 2fE(8'-11½"), T(26'-4)	122'-10"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

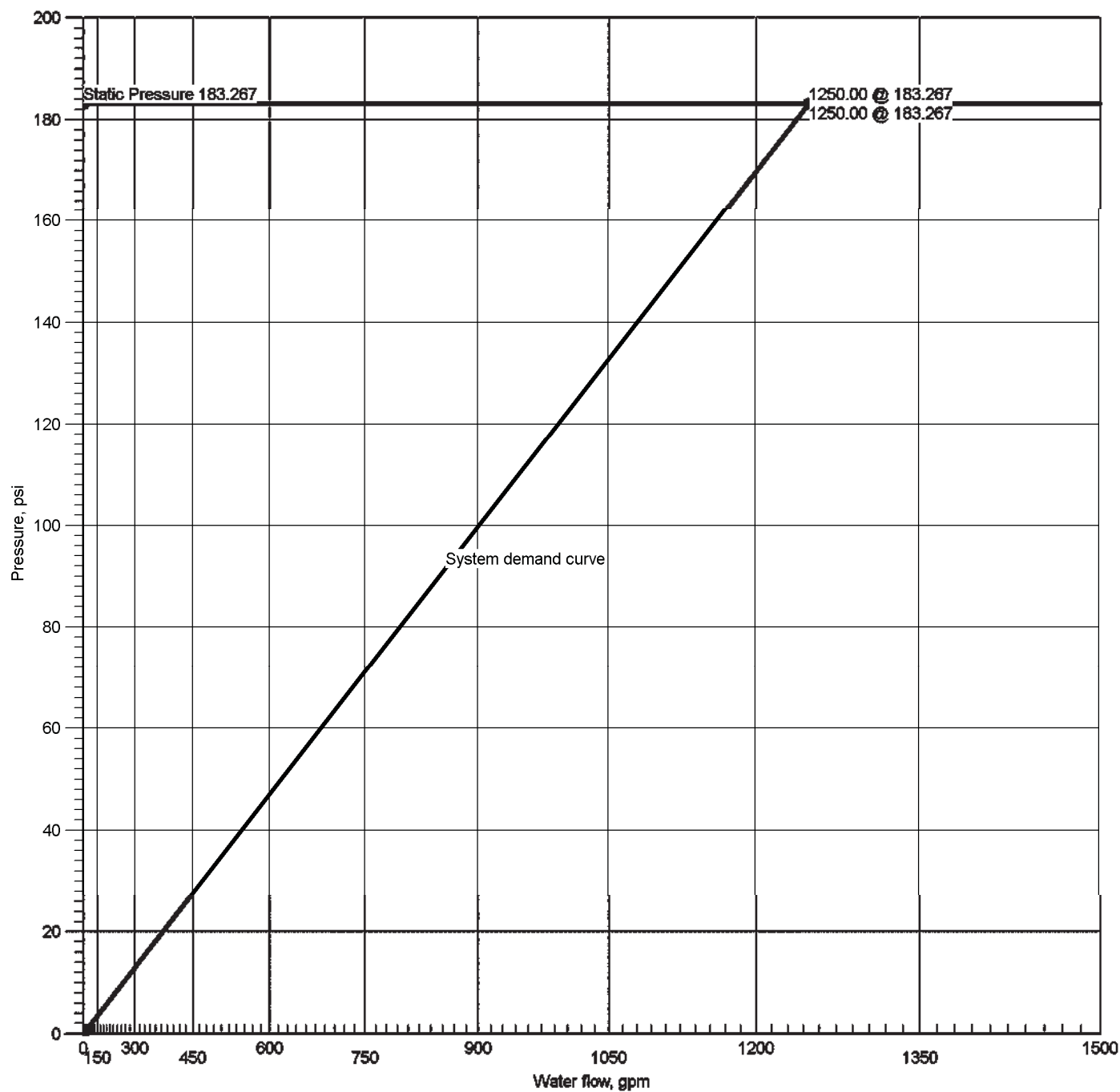
Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaIV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DeIV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

MF Metraflex



Supply at Node 3



Hydraulic Graph

Supply at Node 3

Static: Pressure

183.267

Residual: Pressure

183.267 @ 1250.00

Available Pressure at Time of Test

183.267 @ 1250.00

System Demand

183.267 @ 1250.00

System Demand (Including Hose Allowance at Source)

183.267 @ 1250.00

Hand Calculation Worksheet

Step No.	Nozzle Ident and Location	Flow in gpm	Pipe size	Pipe Fittings and Devices	Equivalent Pipe Length	Friction loss (psi/ft)	Pressure Summary	Notes
1	472 to 433	q	1.10	2E	L 15	C 150	Pt 8.2	k 4.89 Q = 14 gpm (minimum) Pt = 8.2 psi (minimum) k = 14 ÷ √8.2 = 4.89
					F 14	h	Pe 0.0	
		Q 14.0			T 29	pf 0.053	Pf 1.5	
2	471 to 433	q	1.10	T	L 1	C 150	Pt 8.2	k 4.89 Q _{ADJ} = 14 √(9.7 ÷ 8.3) = 15.2 gpm
					F 1	h	Pe 0.0	
		Q 14.0			T 2	pf 0.053	Pf 0.1	
3	470 to 432	Q _{ADJ} 15.2	1.10	E, T			Pt 8.3	k 4.89 Q _{ADJ} = 14 √(10 ÷ 9) = 14.7 gpm
		q			L 7	C 150	Pt 8.2	
					F 8	h	Pe 0.0	
4	469 to 431	Q 14.0	1.10	T	T 15	pf 0.053	Pf 0.8	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
		Q _{ADJ} 14.7					Pt 9.0	
		q			L 1	C 150	Pt 8.2	
5	433 to 432	q	1.10		F 1	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 1	pf 0.208	Pf 0.2	
		Q 29.2			L 4	C 150	Pt 10.0	
6	432 to 431	q	1.10		F	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 4	pf 0.442	Pf 1.8	
		Q 43.9			L 9	C 150	Pt 11.7	
7	431 to 430	q	1.10	2E, T	F 15	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 24	pf 0.442	Pf 10.6	
		Q 43.9			L 100	C 120	Pt 22.3	
8	430 to 421	q	2.16	E, T	F 15	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 115	pf 0.017	Pf 1.9	
		Q 43.9			L 210	C 120	Pt 24.2	
9	421 to 402	q	2.63	2T, 17E	F 132	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 342	pf 0.006	Pf 2.2	
		Q 43.9			L 18	C 120	Pt 26.4	
10	402 to 401	q	3.26	2E	F 14	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 32	pf 0.002	Pf 0.071	
		Q 43.9			L 6	C 120	Pt 26.5	
11	401 to 400	q	3.26	CV, BV, E	F 41	h 7.000	Pe 3.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 47	pf 0.002	Pf 0.105	
		Q 43.9			L 84	C 120	Pt 29.6	
12	400 to 18	q	6.36	2T, BV, 4E, MF	F 127	h	Pe 0.0	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 211	pf 0.000	Pf 0.018	
		Q 43.9			L 152	C 120	Pt 29.6	
13	18 to 15	q	6.36	4E, MF	F 52	h 27.000	Pe 11.7	k 4.89 Q _{ADJ} = 14 √(11.7 ÷ 8.3) = 16.6 gpm
					T 204	pf 0.000	Pf 0.018	
		Q 43.9						

See worksheet continuation on next page.

Hand Calculation Worksheet (Continued)

14	15 to 13	q		6.36	3E, MF	L	114	C	120	Pt	41.3		
		Q	43.9			F	39	h		Pe	0.0		
						T	153	pf	0.000	Pf	0.013		
15	13 to 11	q		6.36	7E	L	132	C	120	Pt	41.3		
		Q	43.9			F	91	h		Pe	0.0		
						T	223	pf	0.000	Pf	0.019		
16	11 to 9	q		6.36		L	10	C	120	Pt	41.4		
		Q	43.9			F		h	10.000	Pe	4.3		
						T	10	pf	0.000	Pf	0.001		
17	9 to 8	q		6.40	2E	L	10	C	140	Pt	45.7		
		Q	43.9			F	30	h	3.000	Pe	1.3		System Demand @ BOR
						T	40	pf	0.000	Pf	0.003		
18	8 to 7	q		6.09	3E	L	75	C	150	Pt	47.0		
		Q	43.9			F	39	h		Pe	0.0		
						T	114	pf	0.000	Pf	0.012		
19	7 to 2	q		6.40	2E, T, BFP	L	11	C	140	Pt	59.0		
		Q	43.9			F	83	h		Pe	0.0		12 psi Friction Loss - Backflow Preventer
						T	94	pf	0.000	Pf	0.008		
20	2 to 1	q		6.09	GV, T	L	7	C	150	Pt	59.0		
		Q	43.9			F	51	h		Pe	0.0		
						T	58	pf	0.000	Pf	0.006		
21	1 to 04	q	250.0	6.09	GV, T	L	114	C	150	Pt	59.0		
		Q	293.9			F	51	h		Pe	0.0		
						T	165	pf	0.004	Pf	0.590		
23	04 to 05	q		7.98	2GV, E, T	L	558	C	150	Pt	59.6		643 ÷ (643 + 543) = 54% of Q
		Q	158.7			F	85	h		Pe	0.0		
						T	643	pf	0.000	Pf	0.197		
24	05 to 01	q		9.79	2GV, 2E, T	L	642	C	150	Pt	59.8		
		Q	158.7			F	124	h		Pe	0.0		
						T	768	pf	0.000	Pf	0.087		
25	01 to 00	q	135.2	11.65		L	1	C	150	Pt	59.9		
		Q	293.9			F		h		Pe	0.0		
						T	1	pf	0.000	Pf	0.000		
										Pt	59.90		
26	04 to 03	q		7.98	2GV, 2EE, T	L	451	C	150	Pt	59.6		543 ÷ (643 + 543) = 46% of Q
		Q	135.2			F	92	h		Pe	0.0		
						T	543	pf	0.000	Pf	0.124		
27	03 to 02	q		9.79	2GV, 2E, T	L	290	C	150	Pt	59.7		
		Q	135.2			F	124	h		Pe	0.0		
						T	414	pf	0.000	Pf	0.035		
28	02 to 01	q		11.65	2GV	L	423	C	150	Pt	59.8		
		Q	135.2			F	51	h		Pe	0.0		
						T	474	pf	0.000	Pf	0.017		
29	01 to 00	q	158.7	11.65	2GV	L	423	C	150	Pt	59.79		
		Q	293.9			F	51	h		Pe	0.0		
						T	474	pf	0.000	Pf	0.072		
										Pt	59.86		
													Q _{@00} = 294 gpm @ 60 psi

Appendix D – Fire Sprinkler Drawings

Steel Pipe at Block Wall or Concrete Floor

System No. C-AJ-1291

F Rating - 2 Hr
T Rating - 8 Hr

SECTION A-A

1. Floor or Wall Assembly-- Min 2-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 30-7/8 in. See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Through-Penetrant -- One metallic pipe or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe or conduit and periphery of opening shall be min 0 in. to max 7/8 in. Pipe or conduit to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or conduits may be used:
A. Steel Pipe -- Nom 30 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.

3. Fill, Void or Cavity Material* -- Sealant -- Min 1/2 in. thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall. At the point contact location between pipe and concrete, a min 1/4 in. diam bead of fill material shall be applied at the concrete/pipe interface on the top surface of floor and on both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC. -- FS -- One Sealant
*Bearing the UL Classification Mark

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CPVC at Block Walls

System No. C-AJ-2167

F Rating -- 2 Hr
T Rating -- 0 Hr

SECTION A-A

1. Floor or Wall Assembly -- Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Floor may also be constructed of any 6 in. thick UL Classified hollow core Precast Concrete Units*, having a min 2 in. concrete thickness below the core. Max diam of opening is 3 in. See Concrete Blocks (CAZT) and Precast Concrete Units (CFTU) categories in the Fire Resistance Directory for names of manufacturers.

2. Through Penetrants -- One nonmetallic pipe to be installed concentrically or eccentrically within the firestop system. Annular space between pipe and edge of opening to be min 0 in. (point contact) and max 5/8 in. Pipe to be rigidly supported on both sides of floor-ceiling assembly. The following types and sizes of nonmetallic pipes may be used:
A. Polyvinyl Chloride (PVC) Pipe -- Nom 2 in. diam (or smaller) Schedule 40 solid or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
B. Chlorinated Polyvinyl Chloride (CPVC) Pipe -- Nom 2 in. diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.

3. Fill, Void or Cavity Material* -- Sealant -- Min 2 in. thickness of fill material applied within the annulus, flush with bottom surface of floor or with both surfaces of wall. At point contact location, min 1/2 in. diam bead of sealant applied at pipe/concrete interface on bottom surface of floor or both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC. -- FS-ONE Sealant
*Bearing the UL Classification Mark

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Bubble Concealed

0'-0"

Dining Facility Seating Area Only

BEQ P-116, P-163, P-170

Pendent Sprinkler - Residential And Commercial

MIN. ALLOWABLE A	B DIMENSION
2'-4"	0'-4"
3'-4"	0'-6"
4'-0"	0'-8"
4'-4"	0'-10"
5'-0"	1'-0"
5'-8"	1'-2"
6'-4"	1'-4"

GL SERIES RESIDENTIAL PENDENT SPRINKLER

DISTANCE FROM OBSTRUCTIONS

*At Exposed Ceilings, coordinate with all light fixtures to avoided obstruction to sprinklers. Per NFPA 13 requirements.

Module Sleeve Locations - Typical

Elevation View

Scale: 1/4" = 1'-0"

Steel Pipe at Gypsum Walls

System No. W-L-1054

F Ratings - 1 and 2 Hr (See Items 1 and 3)
T Rating - 0 Hr
L Rating At Ambient - Less Than 1 CFM/Sq Ft
L Rating At 400 F - 4 CFM/Sq Ft

SECTION A-A

1. Wall Assembly -- The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. Studs -- Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing on all four sides.
B. Gypsum Board -- 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum board 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 32-1/4 in. for steel stud walls. Max diam of opening is 14-1/2 in. for wood stud walls. The F Rating of the firestop system is equal to the fire rating of the wall assembly.

2. Through-Penetrants -- One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. Pipe may be installed with continuous point contact. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. 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 30 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.

3. Fill, Void or Cavity Material* -- Sealant -- Min 5/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and

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Fire Stopping Details

CPVC PIPING IN LIVING UNIT

CPVC PIPING IN LIVING UNIT

Residential Unit Adjacent to Res. Corridors

Typ. Living Unit Piping BEQ's

SCALE: 1/8" = 1'-0"

Residential Unit Adjacent to Light Hazard Corridors

Typ. Living Unit Piping BEQ's

SCALE: 1/8" = 1'-0"

CPVC at Gypsum Walls

System No. W-L-2098

F Ratings - 1 and 2 Hr (See Item 1)
T Ratings - 1 and 2 Hr (See Item 1)
L Rating At Ambient - Less Than 1 CFM/Sq Ft
L Rating At 400 F - 4 CFM/Sq Ft

SECTION A-A

1. Wall Assembly -- The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. Studs -- Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC.
B. Gypsum Board -- 5/8 in. thick, 4 ft 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 Wall and Partition Design. Max diam of opening is 4-3/8 in. The hourly F and T Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Through Penetrants -- One nonmetallic pipe installed within the firestop system. Pipe to be rigidly supported on both sides of floor or wall assembly. The space between pipe and periphery of opening shall be min 3/4 in. to max 1-1/4 in. Pipe to be rigidly supported on both sides of the floor or wall assembly. The following types and sizes of nonmetallic pipes may be used:
A. Polyvinyl Chloride (PVC) Pipe -- Nom 2 in. diam (or smaller) Schedule 40 PVC pipe for use in closed (process or supply) piping system.
B. Chlorinated Polyvinyl Chloride (CPVC) Pipe -- Nom 2 in. diam (or smaller) SDR17 CPVC pipe for use in closed (process or supply) piping systems.

3. Fill, Void or Cavity Materials* -- Sealant -- Installed to completely fill the annular space between the pipes and gypsum wallboard on both sides of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC. -- FS-One Sealant
*Bearing the UL Classification Mark

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Fire Stopping Details

CPVC PIPING IN LIVING UNIT

CPVC PIPING IN LIVING UNIT

Residential Unit Adjacent to Light Hazard Corridors

Typ. Living Unit Piping BEQ's

SCALE: 1/8" = 1'-0"

Residential Unit Adjacent to Light Hazard Corridors

Typ. Living Unit Piping BEQ's

SCALE: 1/8" = 1'-0"

Clearance Notes (NFPA 13 2010)

9.3.4.1 Clearance shall be provided around all piping extending through walls, floors, platforms, and foundations, including drains, fire department connections, and other auxiliary piping.

9.3.4.2 Unless the requirements of 9.3.4.3 through 9.3.4.7 are met, where pipe passes through holes in platforms, foundations, walls, or floors, the holes shall be sized such that the diameter of the holes is nominally 2 in. larger than the pipe for pipe 1 in. nominal to 3 1/2 in. nominal and 4 in. larger than the pipe for pipe 4 in. nominal and larger.

9.3.4.3 Where clearance is provided by a pipe sleeve, a nominal diameter 2 in. larger than the nominal diameter of the pipe shall be acceptable for pipe sizes 1 in. through 3 1/2 in., and the clearance provided by a pipe sleeve of nominal diameter 4 in. larger than the nominal diameter of the pipe shall be acceptable for pipe sizes 4 in. (and larger).

9.3.4.4 No clearance shall be required for piping passing through gypsum board or equally frangible construction that is not required to have a fire resistance rating.

9.3.4.5 No clearance shall be required if flexible couplings are located within 1 ft of each side of a wall, floor, platform, or foundation.

9.3.4.6 No clearance shall be required where horizontal piping passes perpendicularly through successive studs or joists that form a wall or floor/ceiling assembly.

9.3.4.7 No clearance shall be required where nonmetallic pipe has been demonstrated to have inherent flexibility equal to or greater than the minimum provided by flexible couplings located within 1 ft (305 mm) of each side of a wall, floor, platform, or foundation.

9.3.4.8 Where required, the clearance shall be filled with a flexible material that is compatible with the piping material.

9.3.4.9 Clearance from structural members not penetrated or used, collectively or independently, to support the piping shall be at least 2 in.

Fire Sprinkler Symbols & Abbreviations

	Pipe Hanger		
	Hanger with Upward Restraint		
	Lateral Branchline Restraint		
	"Rigid" Grooved Coupling	BOD	Bottom of Deck
	"Flexible" Grooved Coupling	BOJ	Bottom of Joist
	Fire Hydrant	COJ	Cut on Joist
	Fire Department Connection	CPVC	Chlorinated Polyvinyl Chloride
	Fire Sprinkler System Riser	CL	Center Line of Pipe
	RISER UP/DN	DCDA	Detector Check Valve Assembly
	Fire Alarm Bell	FDC	Fire Department Connection
	Flow Switch	FF	Finish Floor
	Tamper Switch	F	Flexible Coupling
	4-Way Seismic Brace	IFOW	Inside Face of Wall
	2-Way Seismic Brace	NFPA	National Fire Protection Association
	Key Valve	NIC	Not in Contract
	Piping Elevation	NTS	Not to Scale
	Hydraulic Ref. Point	OFOV	Outside Face of Wall
	Riser Nipple / Drop Nipple	PIV	Post Indicator Valve
	Ball Valve - Control Valve	POC	Point of Connection
	Backflow Preventor	PSI	Pounds Per Square Inch
	Steel Pipe	RPDA	Reduced Pressure Detector Ass.
	CPVC Pipe	UNO	Unless Noted Otherwise

SHEET INDEX

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FP0.2 NOTES AND DETAILS

FP0.3 STANDPIPE

FP0.4 SECTIONS AND DETAILS

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FP5.0 COMMON BUILDING PIPING PLAN

FP5.1 COMMON BUILDING REFLECTED CEILING PLAN

FP5.2 SECTIONS AND DETAILS

FP6.0 DINING FACILITY PIPING PLAN

FP6.1 DINING FACILITY REFLECTED CEILING PLAN

FP6.2 SECTIONS AND DETAILS

Basis of Design

Dining Facility

The Dining Area to be protected as a Light Hazard Occupancy (.10 gpm/ft²). The Kitchen area to be Ordinary Hazard, Group 1 (.15 gpm/ft²). The Storage areas to be Ordinary Hazard Group 1. Quick-response sprinklers will be provided in areas with finished ceilings. Sprinkler escutcheon plates will be white or chrome to match ceiling color. Corrosion resistant sprinklers (White Polyester) will be provided in all areas exposed to the outside environment. The sprinkler system design area may be reduced as permitted in NFPA 13 when quick-response sprinklers are used without revising the density and must be increased as required in areas with roof slopes exceeding 2:12.

Common Building

Will be protected as a light hazard occupancy (.10 gpm/ft²). Laundry Room will be protected as an Ordinary Group I occupancy (.15 gpm/ft²). Quick-response concealed sprinklers will be provided in areas with finished ceiling Sprinkler escutcheon plates will be white to match ceiling color. The sprinkler system design area may be reduced as permitted in NFPA 13 when quick-response sprinklers are used without revising the density and must be increased as required in areas with roof slopes exceeding 2:12.

BEQs

Basis of Design for BEQ P-116, P-163, and P-170. BEQs will be protected as an NFPA 13R occupancy (.05 gpm/ft²). White "Bubble" Concealed Residential Sprinklers provided at finished ceilings. Lobby Seating Areas will be protected as a Light Hazard Occupancy (.10 gpm/ft²) with Quick Response Sprinklers provided at finish ceilings. The sprinkler system design area may be reduced as permitted in NFPA 13 when quick-response sprinklers are used without revising the density and must be increased as required in areas with roof slopes exceeding 2:12.

Class I Manual Wet Standpipes with 2½" hose valves will be provided in all exit stairways

Material

1. All material shall be new, U.L. listed and or F.M. "approved" for fire sprinkler application.

2. All material shall be American made. "Buy American Act". FAR 52.225-11

3. All material shall be protected from damage while stored on site.

4. All valves shall UL Listed or FM Approved.

5. Control valves shall be U.L. listed.

6. Identification signs shall be provided for each local alarm bell, control valve, test and drain valve, main and auxiliary drains and fire department connection. All signs shall be metal.

7. Hydraulic Placards and general information signs shall be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire chain, or other acceptable means.

Field Testing and Flushing

1. Overhead System = Hydrostatic Test @ 200 PSI For 2 Hours.

2. Underground System = Installed, Flushed And Tested By Installing Contractor

Fire Sprinkler System Description and Design

1. Provide a complete wet pipe automatic fire sprinkler system in accordance with National Fire Protection Association (NFPA) standards 13, 13R (2010 edition). UFC 3-600-10N (AUG 2007), UFC 3-600-01 (SEPT 2009) Sprinklers heads shall be spaced per NFPA # 13, 13R and/or in accordance with the manufacturer's listing. Extended coverage sprinklers shall not be used, except for residential sprinklers in residential occupancy application.

2. Systems are supplied from the site water main.

3. All fire sprinkler systems are hydraulically calculated.

4. Industrial Fire Sprinkler Co., Inc. point of connection is at six inch above finished slab. Underground And Backflow By Others (N.I.C.) (Underground Contractor).

5. Industrial Fire Sprinkler Co., Inc. shall supply an electric bell installation and wiring by electrical contractor.

6. All electrical wiring by others.

7. All painting, labeling or marking of any kind by others. All painting of sprinkler piping must satisfy the specific requirements of UFC 3-600-10N.

8. Insulation as required to be provided and installed by others.

9. Soffiting and furring to conceal pipe by others.

10. Access panels/doors provided by Industrial Fire are to be installed by others.

11. All exposed sprinkler pipe shall be steel.

12. Sprinklers in the center of ceiling tiles IS NOT required.

13. Main (Large) Pipe NOTES:
A. Feed Main, Cross Mains and Risers 2" and larger shall be SCHD. 10. grooved
B. All main outlets shall be welded
C. All main fittings shall be grooved.
D. All main couplings shall be grooved.

14. Branch Line (Small) Pipe Notes:
A. Residential Unit piping 1½" and smaller shall be CPVC
B. All exposed (below ceiling) piping shall be Sched 40 Black Steel.
C. Std weight (125 lb.) cast iron threaded fittings.

15. CPVC piping is acceptable and used only above gyp. board "hard ceilings".

16. All Pipe Hangers shall be in accordance with NFPA 13 and NFPA 13R.

17. Sway bracing size, location, spacing, and connections shall be in accordance with NFPA 13 (9.3.5, 2010 Edition). See Details for spacing, brace type, and attachment method.

18. It is the responsibility of the owner to provide adequate heat to prevent the Fire Protection System from freezing

FP0.1

SWAY BRACING CALCULATIONS

JOB SITE LOCATION
Per Sheet S0.01 Ss = 1.48
PER TABLE 9.3.5.6.2
Fp= .69

Typ. BEQ's Braced Pipe: 6" & 4" Schd. 10 Steel Pipe

Tol-Brace Seismic Calculations			
Brace Information		Tolco Brace Compnents	
Max. Spacing	40'	Tolco Comp. Fig. Number	Adjusted Load
Max. Brace Length	7'-0"	Fig 4L Clamp	1745 lbs
Bracing Material	1" Schd. 40 Pipe	Fig 980 Universal Swival	2395 lbs
Angle from Vertical	60° Min.	Load Information	
Least Rad. of Gyration	0.421"		
L/R Value	200		
Max Horizontal Load	1604 lbs.		
Force Factor (Cp)	0.69		
Fastener Information			
Fastener Orientation	Parallel		
Type	Power-Stud+SD1		
Diameter	1/2"		
Length	3-1/4"		
Max. Load	826 lbs		
Brace ID	11		
Orientation of Brace	Longitudinal	% added for Spk. & fittings	15% 95 lbs
		Total Adjusted Load within Zone of Influence	731 lbs

4-6" Diameter standpipe bulk - 1" Schd. 40 Longitudinal Bracing Spaced at Max. of 40' with angle of brace a min 60° from vertical
See sheet FP 2.1A, 2.1B, 3.1A & 3.1B for additional BEQ Brace Calculations

COMMON BUILDING

Braced Pipe: 3" Schd. 10 Steel Pipe

Tol-Brace Seismic Calculations		Tol-Brace Seismic Calculations	
Brace Information		Brace Information	
Max. Spacing	20'	Max. Spacing	80'-0"
Max. Brace Length	10'-4"	Max. Brace Length	10'-4"
Bracing Material	1½" Schd. 40 Pipe	Bracing Material	1½" Schd. 40 Pipe
Angle from Vertical	60° Min.	Angle from Vertical	60° Min.
Least Rad. of Gyration	0.623"	Least Rad. of Gyration	0.623"
L/R Value	200	L/R Value	200
Max Horizontal Load	2595 lbs.	Max Horizontal Load	2595 lbs.
Force Factor (Cp)	0.69	Force Factor (Cp)	0.69
Load Information		Load Information	
Size & Type of Pipe	4" Schd. 10 Steel	Size & Type of Pipe	3" Schd. 10 Steel
Total Length	20'-0"	Total Length	80'-0"
Total Load	163 lbs	Total Load	438 LBS
Fastener Information		Fastener Information	
Fastener Orientation	Perpendicular	Fastener Orientation	Parallel
Type	Tolco Fig 825A	Type	Tolco Fig 825A
Diameter	n/a	Diameter	n/a
Length	n/a	Length	n/a
Max. Load	1265 lbs	Max. Load	1265 lbs
Brace ID	1	Brace ID	11
Orientation of Brace	Lateral	Orientation of Brace	Longitudinal
		% added for Spk. & fittings	15% 66 lbs
		Total Adjusted Load within Zone of Influence	504 lbs

COMMON BUILDING - 1½" Schd. 40 Lateral Bracing Spaced at Max. of 20' with angle of brace a min 60° from vertical
1½" Schd. 40 Longitudinal Bracing Spaced at Max. of 80' with angle of brace a min 60° from vertical

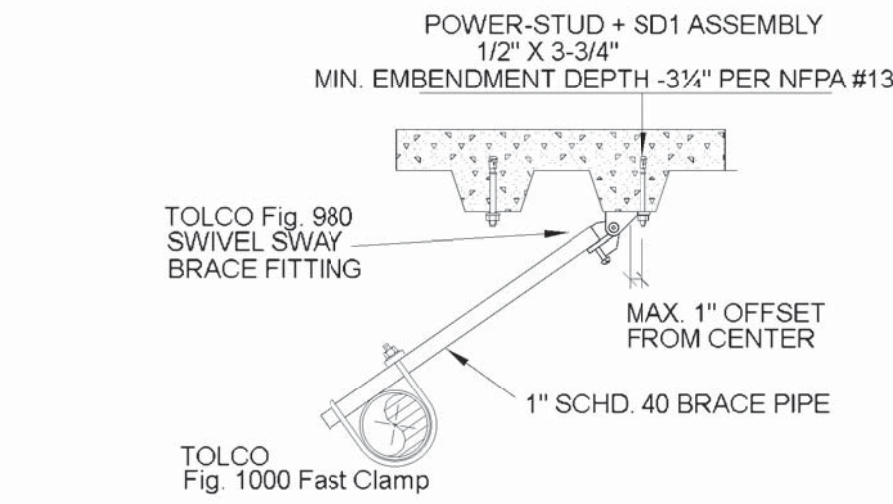
DINING FACILITY

Braced Pipe: 4" Schd. 10 Steel Pipe

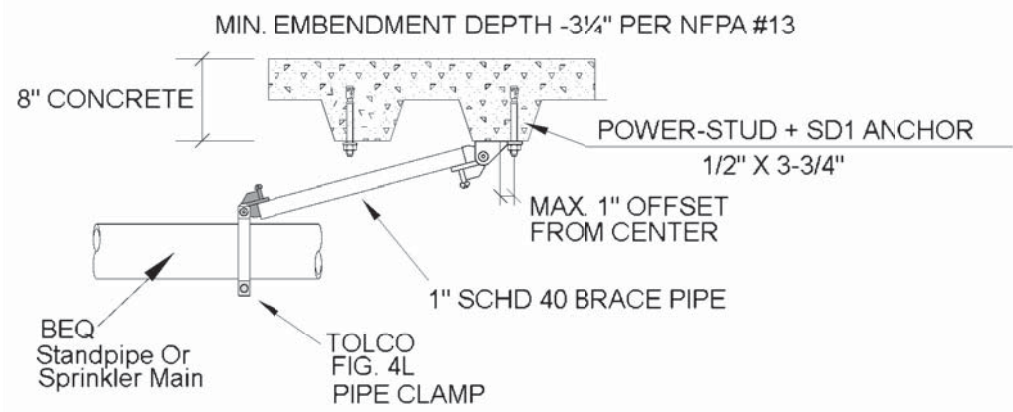
Tol-Brace Seismic Calculations		Tol-Brace Seismic Calculations	
Brace Information		Brace Information	
Max. Spacing	15'	Max. Spacing	80'-0"
Max. Brace Length	9'-0"	Max. Brace Length	9'-0"
Bracing Material	1½" Schd. 40 Pipe	Bracing Material	1½" Schd. 40 Pipe
Angle from Vertical	60° Min.	Angle from Vertical	60° Min.
Least Rad. of Gyration	0.54"	Least Rad. of Gyration	0.54"
L/R Value	200	L/R Value	200
Max Horizontal Load	2173 lbs.	Max Horizontal Load	2173 lbs.
Force Factor (Cp)	0.69	Force Factor (Cp)	0.69
Load Information		Load Information	
Size & Type of Pipe	4" Schd. 10 Steel	Size & Type of Pipe	4" Schd. 10 Steel
Total Length	15'-0"	Total Length	80'-0"
Total Load	122 lbs	Total Load	650 LBS
Fastener Information		Fastener Information	
Fastener Orientation	Perpendicular	Fastener Orientation	Parallel
Type	Tolco Fig 828	Type	Tolco Fig 828
Diameter	n/a	Diameter	n/a
Length	n/a	Length	n/a
Max. Load	2015 lbs	Max. Load	2015 lbs
Brace ID	1	Brace ID	11
Orientation of Brace	Lateral	Orientation of Brace	Longitudinal
		% added for Spk. & fittings	15% 98 lbs
		Total Adjusted Load within Zone of Influence	748 lbs

Dining Fac Bldg. - 4" Dia. Main - 1½" Schd 40. Lateral Bracing Spaced at Max. of 15' with angle of brace a min 60° from vertical
4" dia - 1½" Schd 40 Longitudinal Bracing Spaced at Max. of 80' with angle of brace a min 60° from vertical

BEQ - Bracing Details

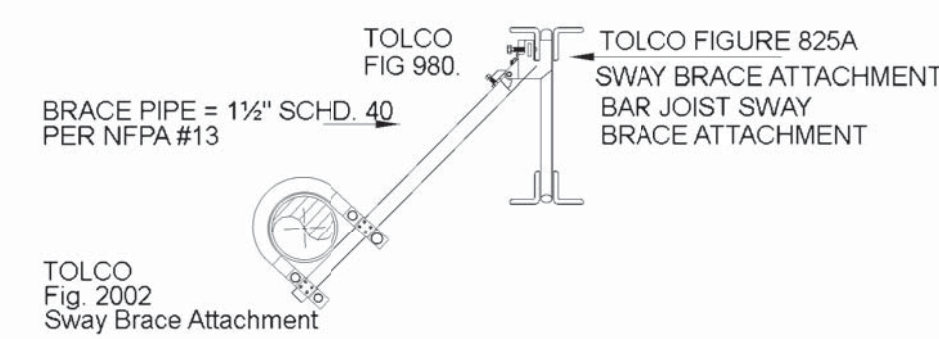


Lateral Brace Application
SWAY BRACING TO CONCRETE DECK
BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.



Longitudinal Earthquake Brace
SWAY BRACING TO CONCRETE DECK
BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.

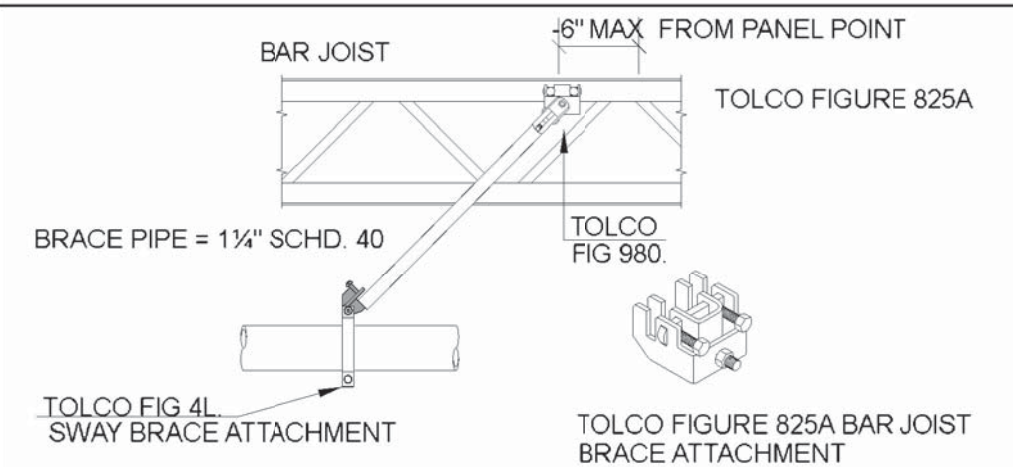
COMMON BUILDING - Bracing Details



BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.

BAR JOIST SWAY BRACE ATTACHMENT

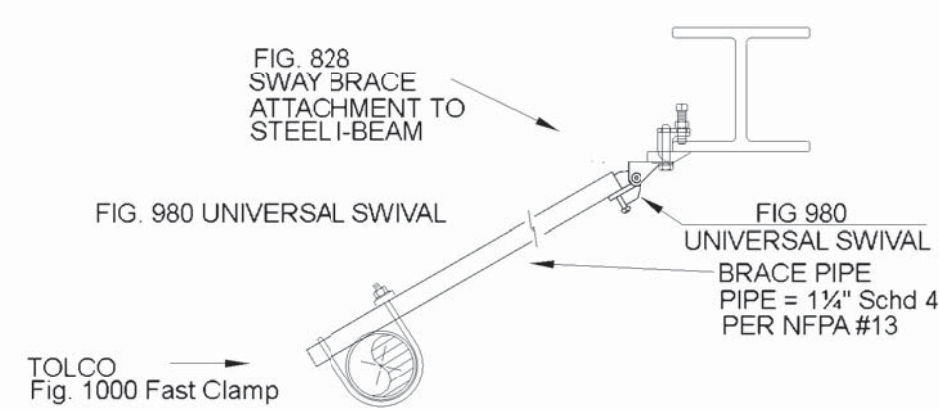
SHOWN IN LATERAL BRACE APPLICATION
BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.



BAR JOIST SWAY BRACE ATTACHMENT

BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.

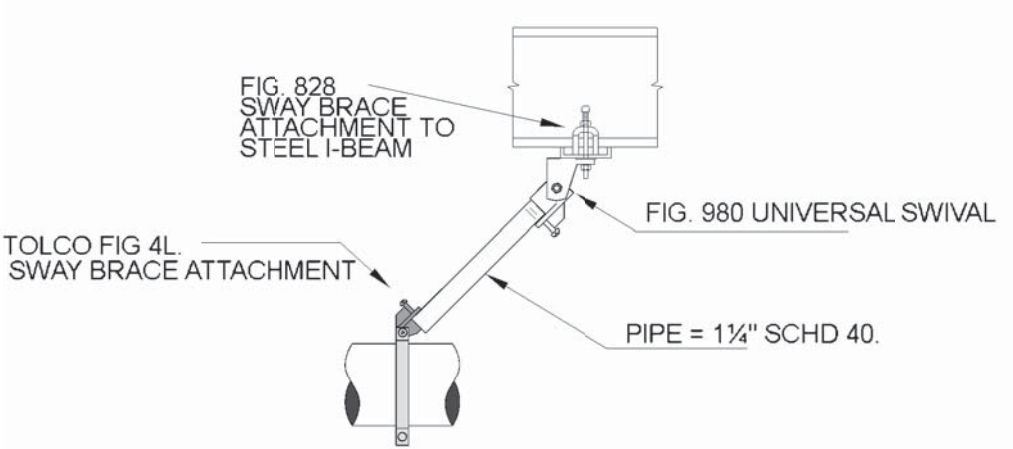
DINING FACILITY - Bracing Details



SHOWN IN LATERAL BRACE APPLICATION

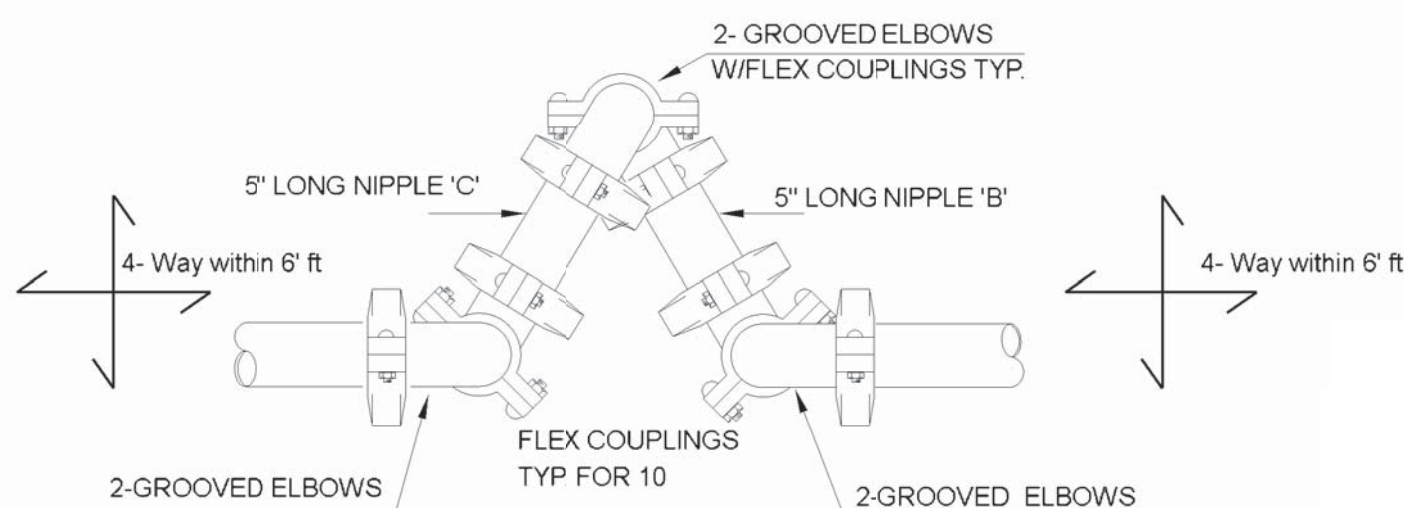
SWAY BRACE ATTACHMENT TO STEEL I-BEAM

BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.

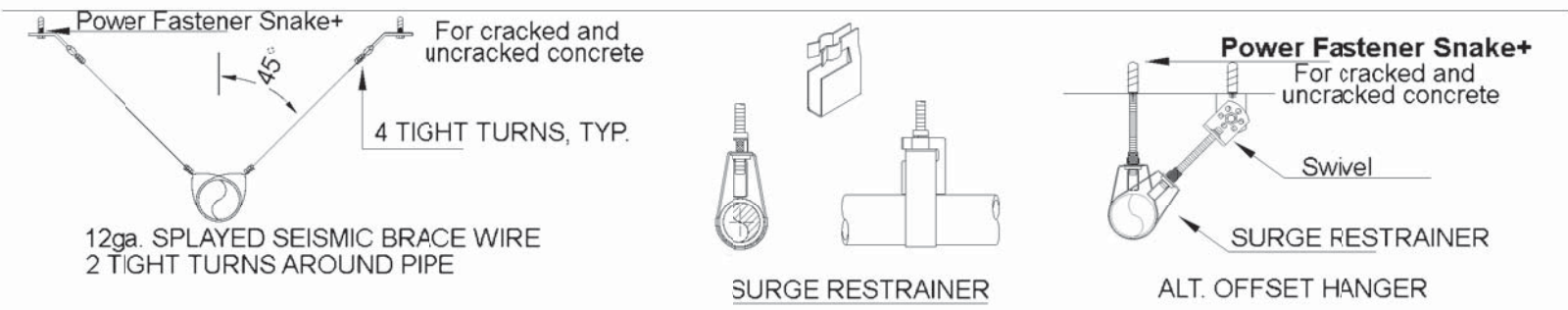


SWAY BRACE ATTACHMENT TO STEEL I-BEAM

BRACE ATTACHMENTS MUST BE USED ONLY WITH OTHER TOLCO PRODUCTS, TO MAINTAIN U.L. LISTING.



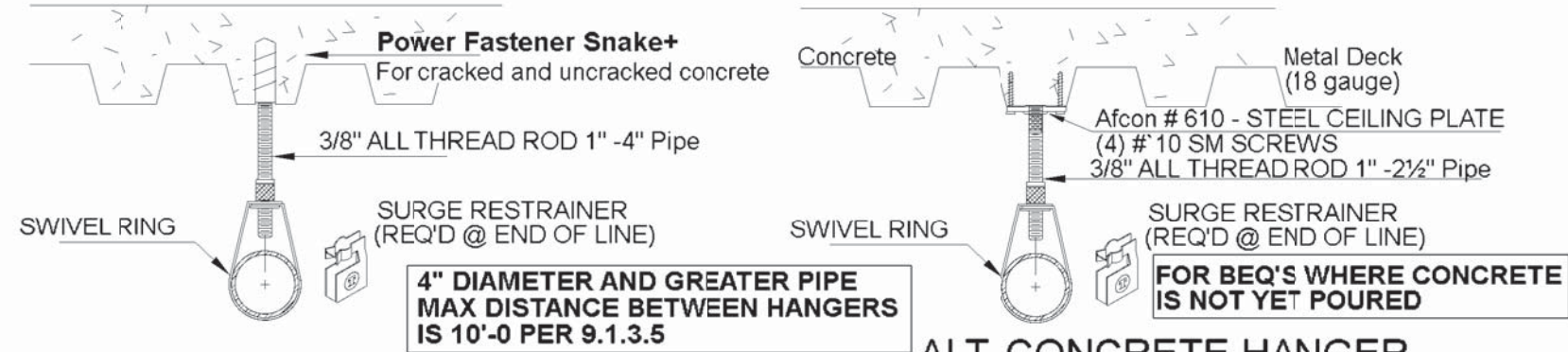
SEISMIC FLEXIBLE JOINT
FOR 4" EXPANSION JOINT



Branchline Restraint

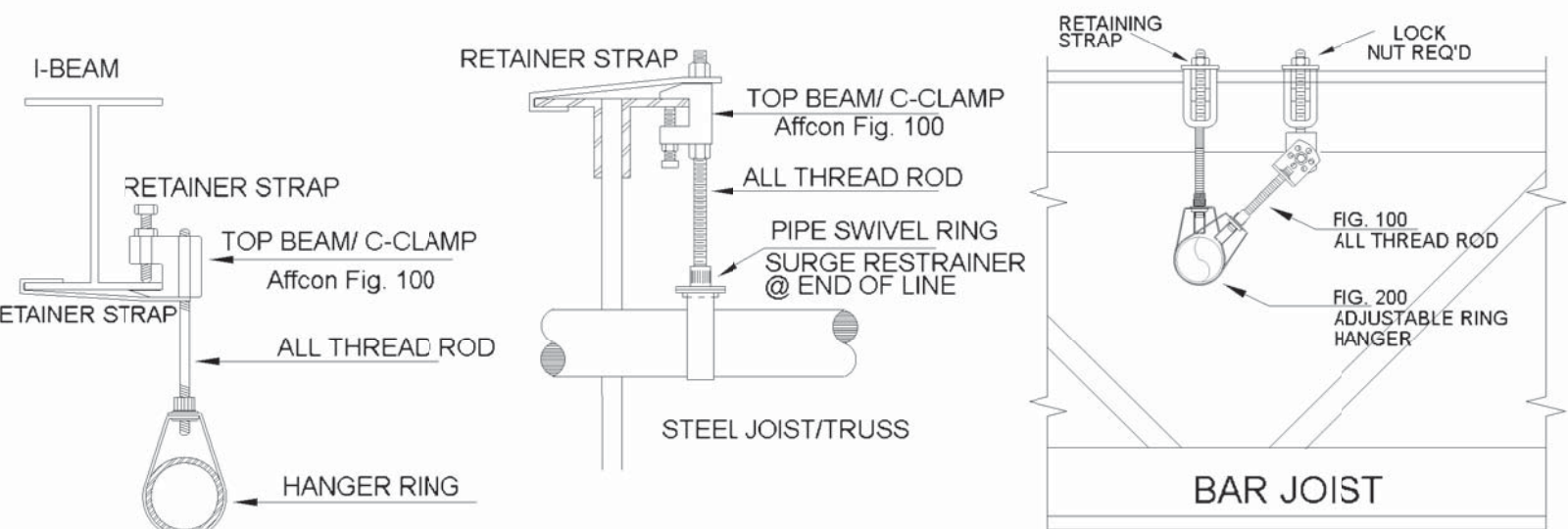
For Steel Pipe & CPVC
Max Spacing of Branchline Restraint
Cp = .69

Steel Pipe	CPVC Pipe
1" = 36"	1" = 28"
1½" = 39"	1½" = 31"
1½" = 41"	1½" = 34"
2" = 45"	2" = 38"



CONCRETE ANCHOR - HANGER DETAIL

CONCRETE ANCHOR-RESTRAINT



TOP BEAM CLAMP - HANGER DETAIL

TOP BEAM CLAMP-RESTRAINT



DINING FACILITY & COMMON BLDG - HANGER DETAIL

6 " MAIN HANGER DETAIL

HANGER NOTES

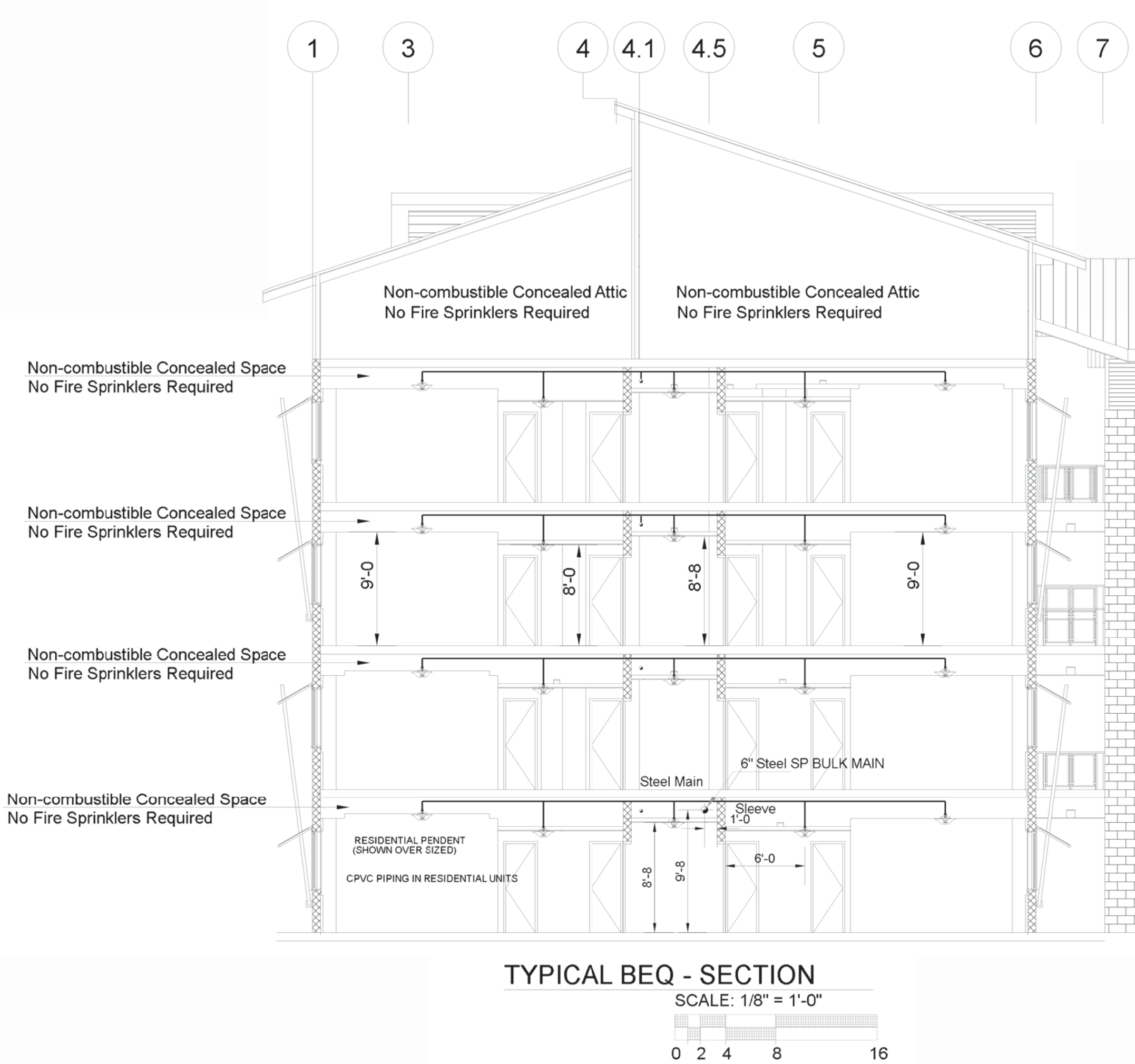
Installation and Location of Hangers shall be per NFPA 13, 9.2
Where Max. Pressure Exceeds 100 psi follow installation guidelines Per NFPA 13, 9.2.3.4.4:

9.2.3.4.4.1 Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi (6.9 bar) and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the hanger assembly supporting the pipe supplying an end sprinkler in a pendent position shall be of a type that prevents upward movement of the pipe.

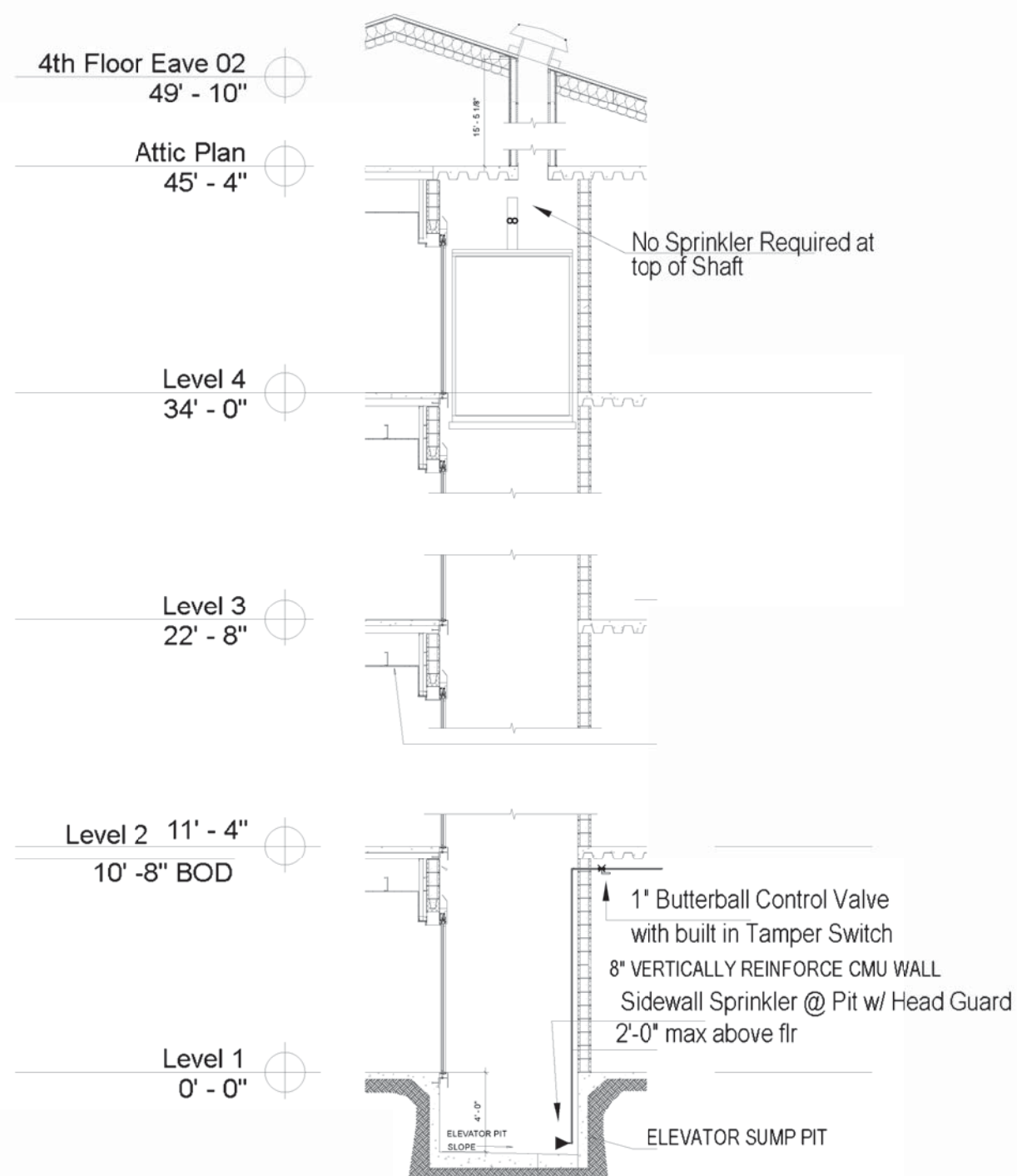
9.2.3.5.2* Maximum Length of Unsupported Armover Where the Maximum Pressure Exceeds 100 psi (6.9 bar) and a Branch Line Above a Ceiling Supplying Sprinklers in a Pendent Position Below the Ceiling.

9.2.3.5.2.1 Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi (6.9 bar) and a branch line above a ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop shall not exceed 12 in. (305 mm) for steel pipe tube.

Building and Floors of Buildings with pressures in excess of 100 psi
Dining Facility P-114 - Maximum Pressure Exceeding 100 psi
1st floor Only BEQ P-163 - Maximum Pressure Exceeding 100 psi
Common Building P-163 - Maximum Pressure Exceeding 100 psi



T.O. Roof - DS File
63' - 6"



TYPICAL ELEVATOR - SECTION

SCALE 1/8" -1'-0"

DIRECT PLUNGER HYDRAULIC ELEVATOR
NO HYDRAULIC FLUID ABOVE THE
FIRST LEVEL

Control Valve w/ Tamper
Check Valve
Flow Switch w/ no retard, zero delay
Inspector's Test Valve

ELEVATOR NOTES

Design and Construction of Elevator to
comply with ITG Elevator Design Guide.
Fire Protection per Chapter 7

UFC 3-600-01
26 September 2006

6-30.4 Hydraulic Elevators.

In buildings protected with an automatic sprinkler system, provide the following (see Tables 6-6 and 6-7, and Figures 6-8, 6-9, and 6-10):

6-30.4.1 Machine Room:

Provide sprinkler(s) with sprinkler guard(s) in the machine room(s). Provide a supervised shut-off valve, check valve, flow switch, and test valve in the sprinkler line supplying the machine room(s). These items must be located outside of and adjacent to the machine room(s). Actuation of the flow switch must remove power to the elevator(s), served by that machine room, by shunt trip breaker operation. The flow switch must have no time delay.

6-30.4.2 Elevator Pit:

Provide a sidewall sprinkler(s) with sprinkler guards in the pit for hydraulic elevators. Locate the sprinkler no more than 610 mm (2 ft) above the pit floor. Provide a supervised shut-off valve in the sprinkler line supplying the pit. Locate the valve outside of and adjacent to the pit. Actuation of the pit sprinkler must not disconnect power to the elevator.

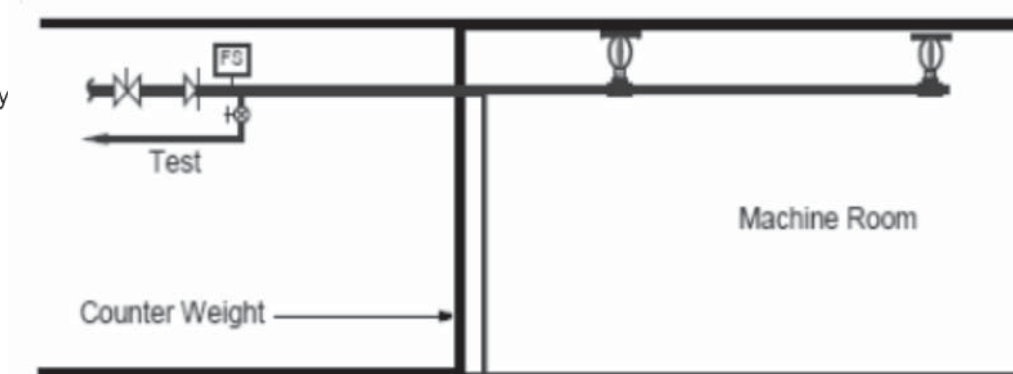
6-30.4.3 Top of Elevator Hoistway:

When a sprinkler is provided at the top of the hoistway, provide a supervised shut-off valve, check valve, flow switch, and test valve in the sprinkler line supplying the hoistway. These items must be located outside of and adjacent to the hoistway. Actuation of the flow switch must disconnect power to the elevator by shunt trip breaker operation. Flow switch must have no time delay.

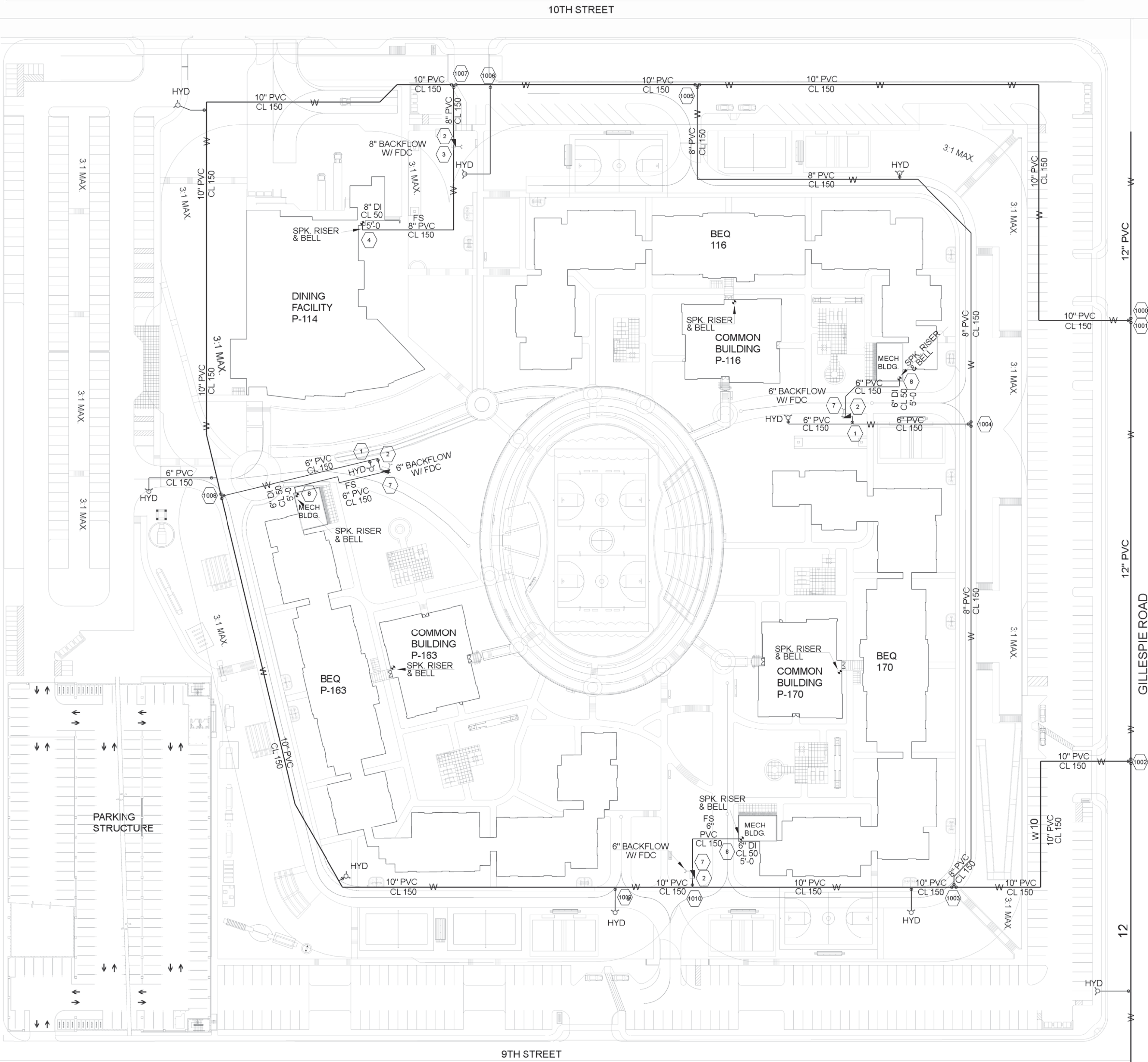
Table 6-6 DIRECT PLUNGER HYDRAULIC ELEVATOR

ROOM / AREA	PROVIDE SPRINKLER (Not Applicable for Buildings Without Sprinkler Protection)	PROVIDE SMOKE DETECTOR to INITIATE ELEVATOR FIREFIGHTERS SERVICE and BUILDING FIRE ALARM SYSTEM
MACHINE ROOM	YES	YES
ELEVATOR LOBBIES	YES	YES
PIT AREA	YES	NO
TOP of HOISTWAY	NO *	NO *

* Provide sprinklers and smoke detector where existing hoistway walls are not 2 hour rated, and existing elevator cab does not meet flame spread or smoke development requirements of ASME A 17.1. These sprinklers must follow the requirements of paragraphs 6-29.4.3 and 6-29.5.

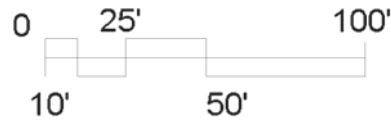


Elevator



SITE PLAN

SCALE 1"=60'-0"

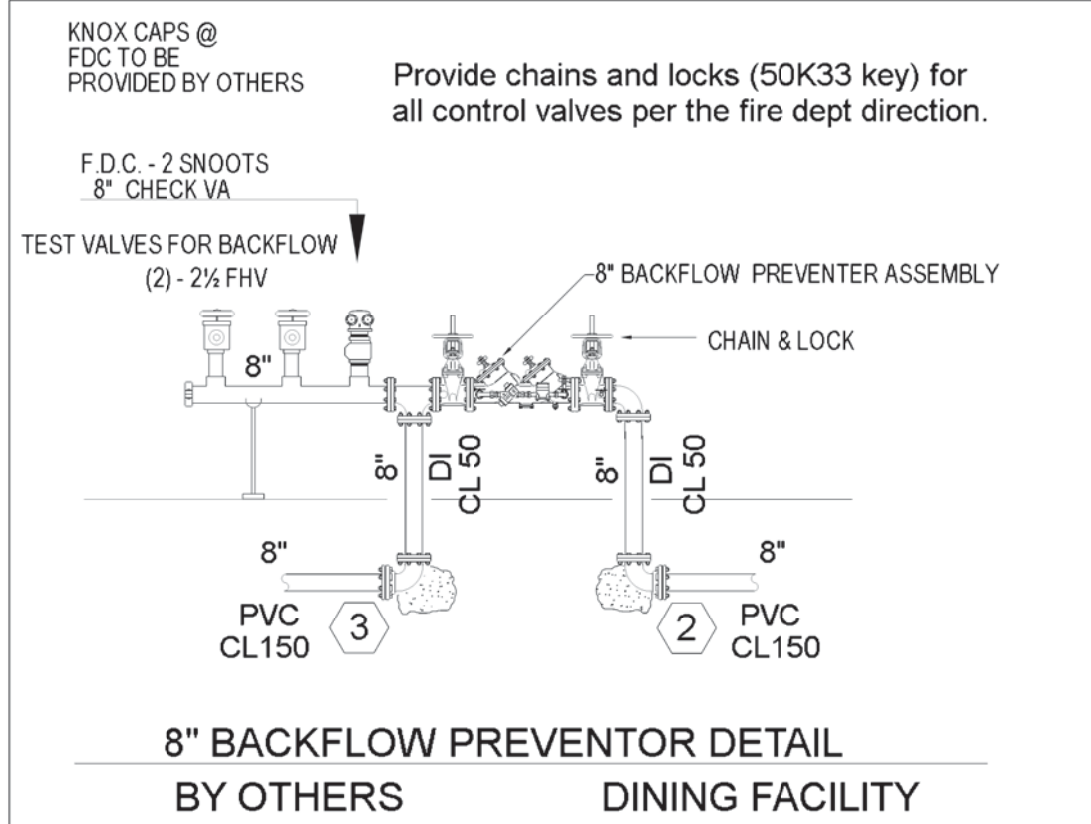
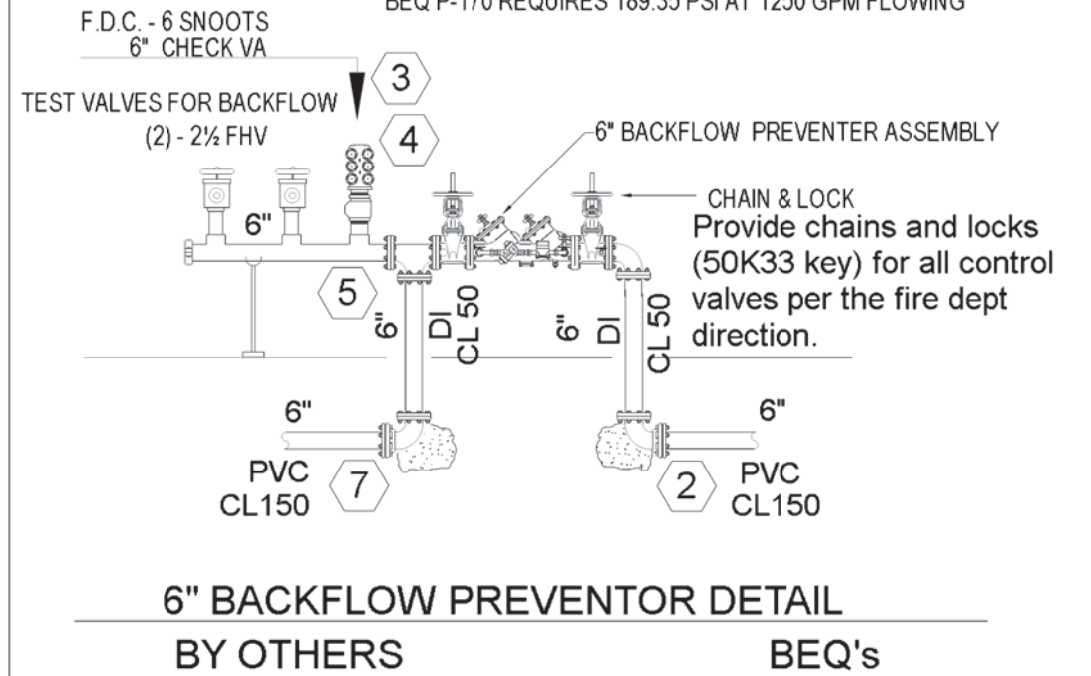


ALL UG WORK IS DONE BY OTHERS
SITE PLAN IS SHOWN FOR
HYDRAULIC PURPOSES ONLY



KNOX CAPS @
FDC TO BE
PROVIDED BY OTHERS

TOTAL REQUIRED PSI AT THE FDC FOR STANDPIPE CALCULATIONS
PROVIDED BY FIRETRUCK PUMPER TO SUPPLY
MANUAL WET STANDPIPES PER NFPA # 14
BEQ P-116 REQUIRES 183.267 PSI AT 1250 GPM FLOWING
BEQ P-163 REQUIRES 164.94 PSI AT 1250 GPM FLOWING
BEQ P-170 REQUIRES 189.35 PSI AT 1250 GPM FLOWING



FLOWTEST

STATIC: 100 PSI
RESIDUAL: 73 PSI
FLOW: 2500 GPM + MAX DAY USE
ELEV: 1936
LOCATION: PAD A / GILLESPIE
PROVIDED BY: KRIS SCHULZE
RBF HYDRAULIC ANALYSIS
SEE RFI - 078D

CPVC PIPE INTO UNIT FROM MAIN
TYP FOR RESIDENTIAL CORRIDOR
CPVC PIPE OVER HARD LID CEILING
SEE DETAIL FP0.1 TYP.

STEEL PIPE INTO UNIT FROM MAIN
TRANSITIONS TO CPVC PIPING
AT 3'-0" FROM INSIDE FACE OF WALL
TYP FOR UNIT FOR COL (J) THRU (T)
SEE DETAIL FP0.1 TYP.

NFPA 13R - NO SPRINKLER REQUIRED
6.6.5* Sprinklers shall not be required in any porches,
balconies, corridors, carports, and stairs that are open and
attached.

A.6.6.5
An example of an open corridor or breezeway is one that is exposed
to the outside atmosphere (temperature) and empties to an
unenclosed stairway and has no doors attached to it.

3rd Flr Int Landing
100 PSI @ 250 GPM
2 1/2" HV

2 1/2" HV 250 GPM

4" S.P.
See Sheet FP 0.3

2" MAIN
@ 9'-8" AFF

4" MAIN
@ 9'-11" AFF

4" MAIN
@ 9'-11" AFF

4" MAIN
@ 9'-11" AFF

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@ 9'-11" AFF

4" MAIN
@ 9'-11" AFF

Tol-Brace Seismic Calculations	
Brace Information	Tolco Brace Components
Max. Spacing Max. Brace Length Bracing Material Angle from Vertical Least Rad. of Gyration L/R Value Max Horizontal Load Force Factor (Cp)	Tolco Comp. Fig. Number Fg 1000 Fg 980 Universal Swivel
16' 7'-0" 1" Schd. 40 Pipe 60° Min. 0.421" 200 1604 lbs. 0.69	Adjusted Load 1745 lbs 2395 lbs
Load Information	
Size & Type of Pipe 2 1/2" Schd. 10 Steel 2" Schd. 10 Steel 1 1/2" Schd. 40 Steel 1" Schd. 40 Steel	Total Length 16'-0" 24'-0" 21'-0" 104'-0"
	Total Load 65 lbs 70 lbs 42 lbs 147 lbs
	% added for Spk. & fittings 15%
	49 lbs
	Total Adjusted Load within Zone of Influence 373 lbs
Fastener Information	
Fastener Orientation Type Diameter Length Max. Load	NFPA Type C Power-stud +SD1 1/2" 3-1/4" 826 lbs
Brace ID	
Orientation of Brace	Lateral

Tol-Brace Seismic Calculations	
Brace Information	Tolco Brace Components
Max. Spacing Max. Brace Length Bracing Material Angle from Vertical Least Rad. of Gyration L/R Value Max Horizontal Load Force Factor (Cp)	Tolco Comp. Fig. Number Fig 4L Clamp Fig 980 Universal Swivel
80'-0" 7'-0" 1" Schd. 40 Pipe 60° Min. 0.421" 200 1604 lbs. 0.69	Adjusted Load 1745 lbs 2395 lbs
Load Information	
Size & Type of Pipe 2 1/2" Schd. 10 Steel	Total Length 80'-0"
	Total Load 325 lbs
	% added for Spk. & fittings 15%
	49 lbs
	Total Adjusted Load within Zone of Influence 374 lbs
Fastener Information	
Fastener Orientation Type Diameter Length Max. Load	NFPA Type C Power-stud +SD1 1/2" 3-1/4" 826 lbs
Brace ID	
Orientation of Brace	Longitudinal

HYDRAULIC-SYSTEM

This Building is Protected
by a Hydraulically Designed
Automatic Sprinkler System.

Location Area # 1 - 1st Flr Lobby

No. of Sprinklers 18

Basis of Design

1. DENSITY .10 GPM/SQ. FT.

2. DESIGNED AREA OF DISCHARGE 1822.70 SQ. FT.

System Demand

1. GPM DISCHARGE 303.17 GPM

2. RESIDUAL PRESSURE AT THE BASE OF THE RISER 69.47 PSI

*Unit Closet Sprinklers are omitted from the Calc Area

22.4.4.6.2* Where the design area is equal to or greater than the

area in Table 22.4.4.6.2 for the hazard being protected by the

sprinkler system, the discharge for sprinklers protecting small

rooms such as closets, washrooms, and similar small

compartments that are in the design area shall be permitted to be

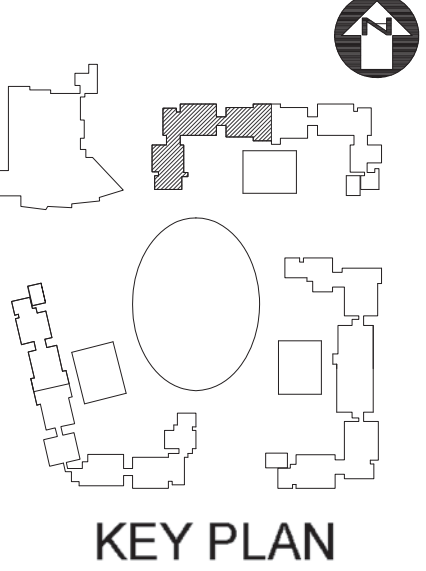
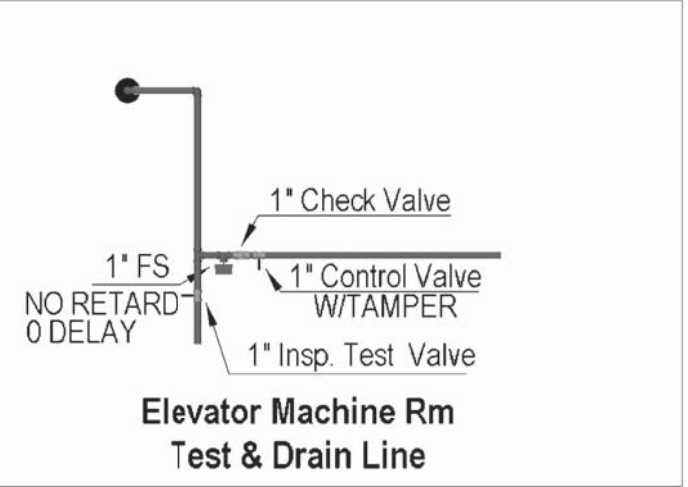
omitted from the hydraulic calculations.

Table 22.4.4.6.2

Occupancy Hazard Classification Min. Design Area to Omit Discharge

Light Hazard wet pipe system 1500 ft²

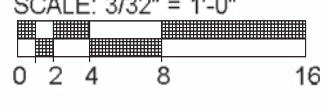
Ordinary Hazard wet pipe system 1500 ft²

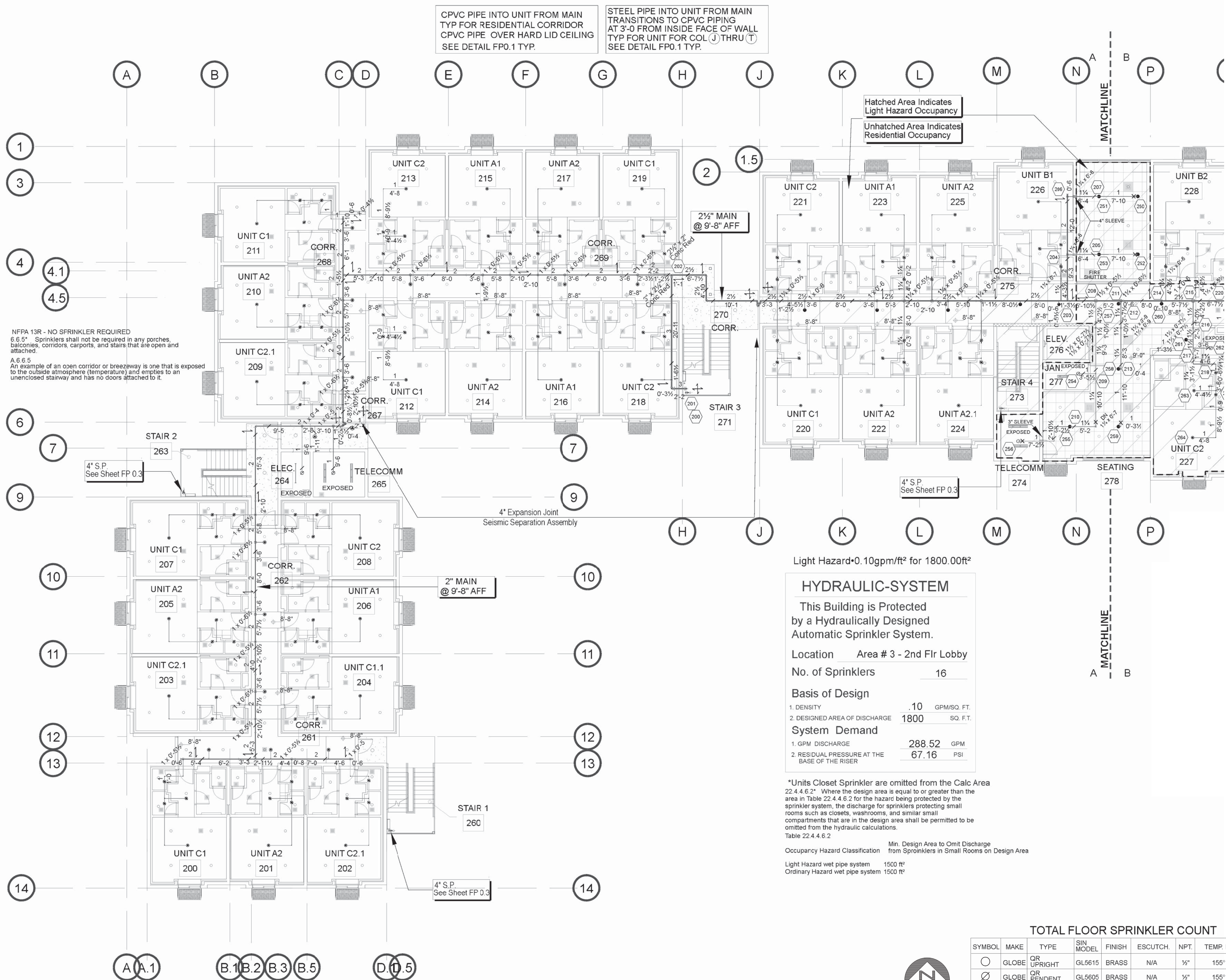


TOTAL FLOOR SPRINKLER COUNT

SYMBOL	MAKE	TYPE	SIN MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
○	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	1/2"	155°	5.6	15
○	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	5
●	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	5.6	20
●	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	4.9	77
●	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	3.5	154
◄	GLOBE	SIDEWALL	GL5626	BRASS	N/A	1/2"	200°	5.6	1
◄	GLOBE	DRY PENDENT	GL5679	WHITE CORRO	RECESSED	1"	155°	5.6	4
FLOOR TOTAL:									276

PIPING PLAN - LEVEL 1A(BEQ P-116)





NFPA 13R - NO SPRINKLER REQUIRED
6.6.5 - Sprinklers shall not be required in any porches, balconies, corridors, carports, and stairs that are open and attached.
A.6.6.5
An example of an open corridor or breezeway is one that is exposed to the outside atmosphere (temperature) and empties to an unenclosed stairway and has no doors attached to it.

CPVC PIPE INTO UNIT FROM MAIN
TYP FOR RESIDENTIAL CORRIDOR
CPVC PIPE OVER HARD LID CEILING
SEE DETAIL FP0.1 TYP.

STEEL PIPE INTO UNIT FROM MAIN
TRANSITIONS TO CPVC PIPING
AT 3'-0" FROM INSIDE FACE OF WALL
TYP FOR UNIT FOR COL (J) THRU (T)
SEE DETAIL FP0.1 TYP.

Light Hazard=0.10gpm/ft² for 1800.00ft²

HYDRAULIC-SYSTEM

This Building is Protected by a Hydraulically Designed Automatic Sprinkler System.

Location Area # 3 - 2nd Flr Lobby

No. of Sprinklers 16

Basis of Design

1. DENSITY .10 GPM/SQ. FT.

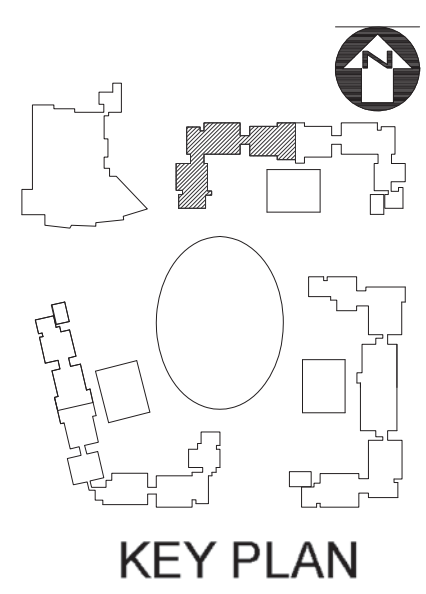
2. DESIGNED AREA OF DISCHARGE 1800 SQ. FT.

System Demand

1. GPM DISCHARGE 288.52 GPM

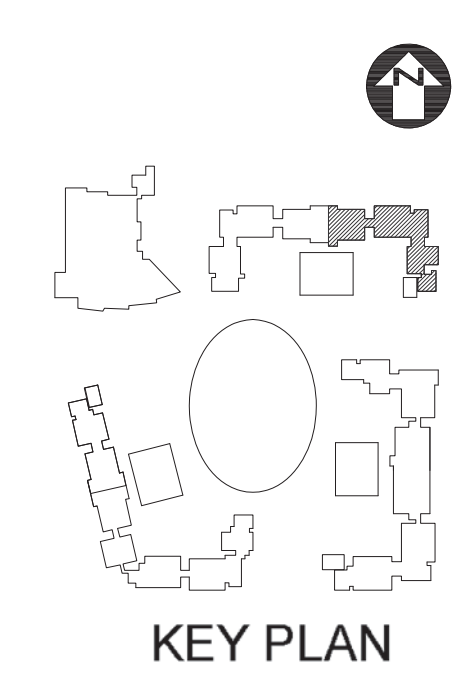
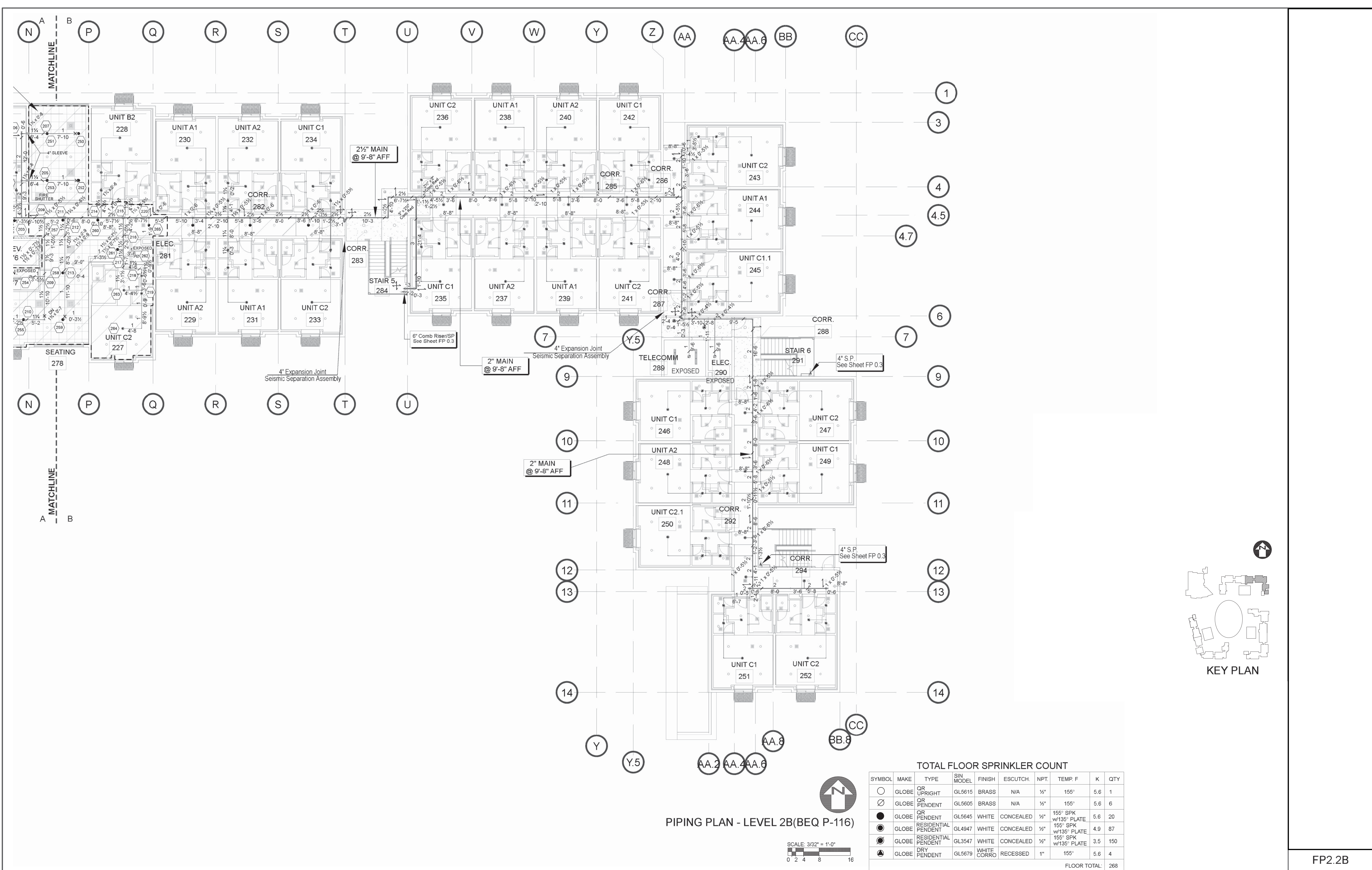
2. RESIDUAL PRESSURE AT THE BASE OF THE RISER 67.16 PSI

*Units Closet Sprinkler are omitted from the Calc Area
22.4.4.6.2 Where the design area is equal to or greater than the area in Table 22.4.4.6.2 for the hazard being protected by the sprinkler system, the discharge for sprinklers protecting small rooms such as closets, washrooms, and similar small compartments that are in the design area shall be permitted to be omitted from the hydraulic calculations.
Table 22.4.4.6.2
Occupancy Hazard Classification Min. Design Area to Omit Discharge from Sprinklers in Small Rooms on Design Area
Light Hazard wet pipe system 1500 ft²
Ordinary Hazard wet pipe system 1500 ft²

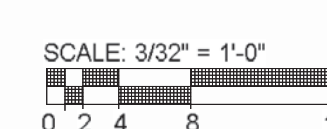


PIPING PLAN - LEVEL 2A(BEQ P-116)
SCALE: 3/32" = 1'-0"
0 2 4 8 16

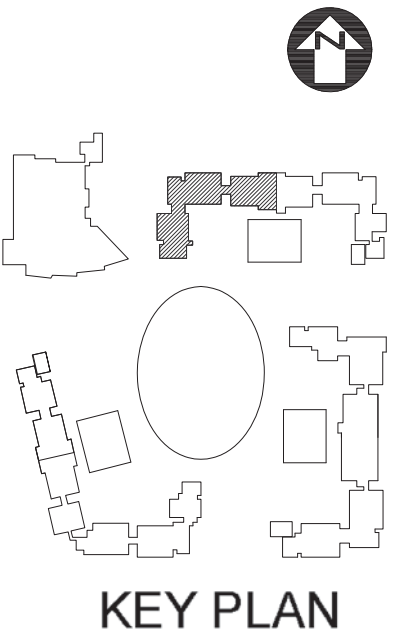
TOTAL FLOOR SPRINKLER COUNT									
SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
○	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	½"	155°	5.6	1
⊙	GLOBE	OR PENDENT	GL5605	BRASS	N/A	½"	155°	5.6	6
●	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	½"	155° SPK w/135° PLATE	5.6	20
⊙	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	½"	155° SPK w/135° PLATE	4.9	87
⊙	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	½"	155° SPK w/135° PLATE	3.5	150
⊙	GLOBE	DRY PENDENT	GL5679	WHITE CORRO	RECESSED	1"	155°	5.6	4
FLOOR TOTAL:									268



PIPING PLAN - LEVEL 2B(BEQ P-116)

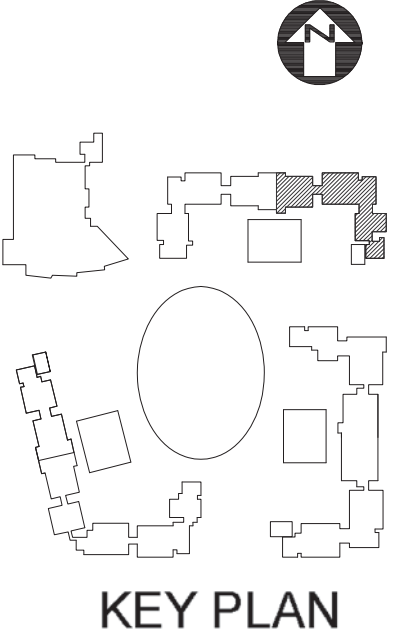
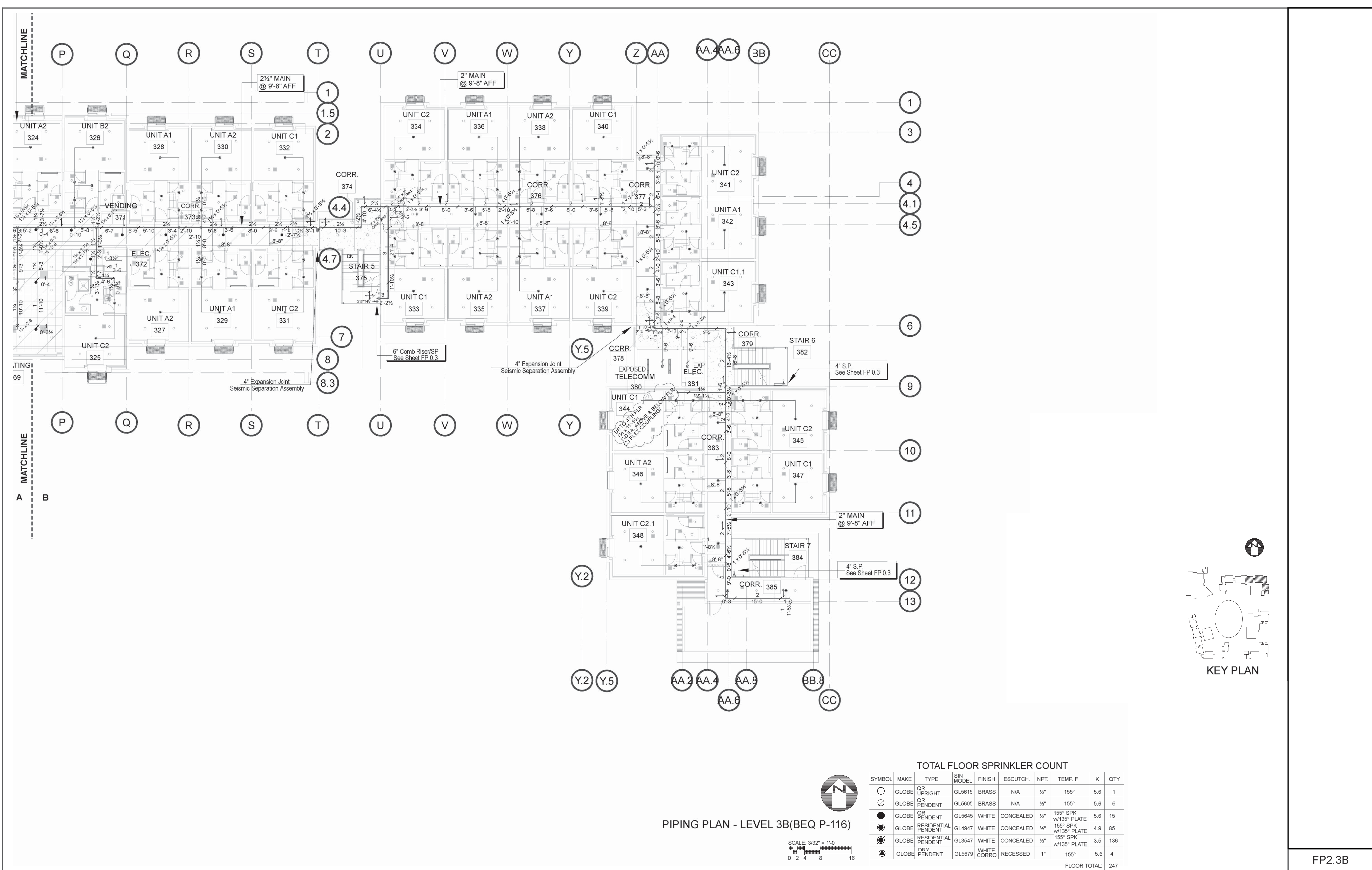


TOTAL FLOOR SPRINKLER COUNT									
SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	1/2"	155°	5.6	1
	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	6
	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	5.6	20
	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	4.9	87
	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	3.5	160
	GLOBE	DRY PENDENT	GL5679	WHITE CORRO	RECESSED	1"	155°	5.6	4
FLOOR TOTAL:									268

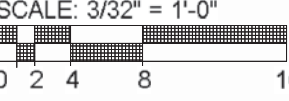


SCALE: $\frac{3}{32}'' = 1'-0''$

FP2.3A



PIPING PLAN - LEVEL 3B(BEQ P-116)



TOTAL FLOOR SPRINKLER COUNT									
SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	1/2"	155°	5.6	1
	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	6
	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	5.6	15
	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	4.9	85
	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	3.5	136
	GLOBE	DRY PENDENT	GL5679	WHITE CORRO	RECESSED	1"	155°	5.6	4
FLOOR TOTAL:									247

CPVC PIPE INTO UNIT FROM MAIN
TYP FOR RESIDENTIAL CORRIDOR
CPVC PIPE OVER HARD LID CEILING
SEE DETAIL FP0.1 TYP.

STEEL PIPE INTO UNIT FROM MAIN
TRANSITIONS TO CPVC PIPING
AT 3'-0" FROM INSIDE FACE OF WALL
TYP FOR UNIT FOR COL (J) THRU (T)
SEE DETAIL FP0.1 TYP.

4" Expansion Joint
Seismic Separation Assembly

Unhatched Area Indicates
Residential Occupancy

MATCHLINE
A B

MATCHLINE
A B

2 1/2" MAIN
@ 9'-8" AFF

4" S.P.
See Sheet FP 0.3

Hatched Area Indicates
Light Hazard Occupancy

HYDRAULIC-SYSTEM

This Building is Protected
by a Hydraulically Designed
Automatic Sprinkler System.

Location Area # 4 - 4th Flr Lobby

No. of Sprinklers 15

Basis of Design

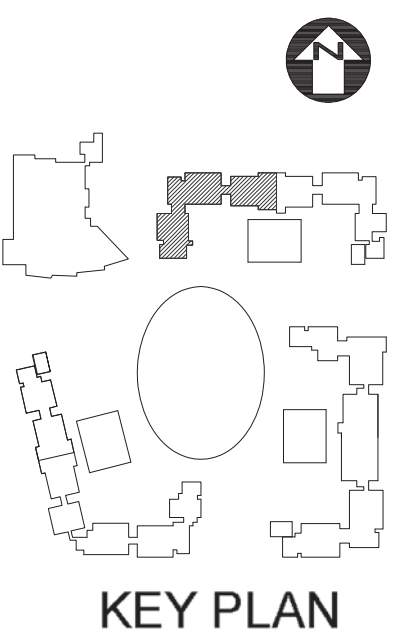
1. DENSITY .10 GPM/SQ. FT.
2. DESIGNED AREA OF DISCHARGE 1807.85 SQ. FT.

System Demand

1. GPM DISCHARGE 253.56 GPM
2. RESIDUAL PRESSURE AT THE
BASE OF THE RISER 67.49 PSI

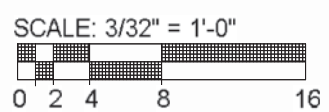
*Units Closet Sprinkler are omitted from the Calc Area
22.4.4.6.2 Where the design area is equal to or greater than the
area in Table 22.4.4.6.2 for the hazard being protected by the
sprinkler system, the discharge for sprinklers protecting small
rooms such as closets, washrooms, and similar small
compartments that are in the design area shall be permitted to be
omitted from the hydraulic calculations.

Table 22.4.4.6.2
Occupancy Hazard Classification Min. Design Area to Omit Discharge
from Sprinklers in Small Rooms on Design Area
Light Hazard wet pipe system 1500 ft²
Ordinary Hazard wet pipe system 1500 ft²



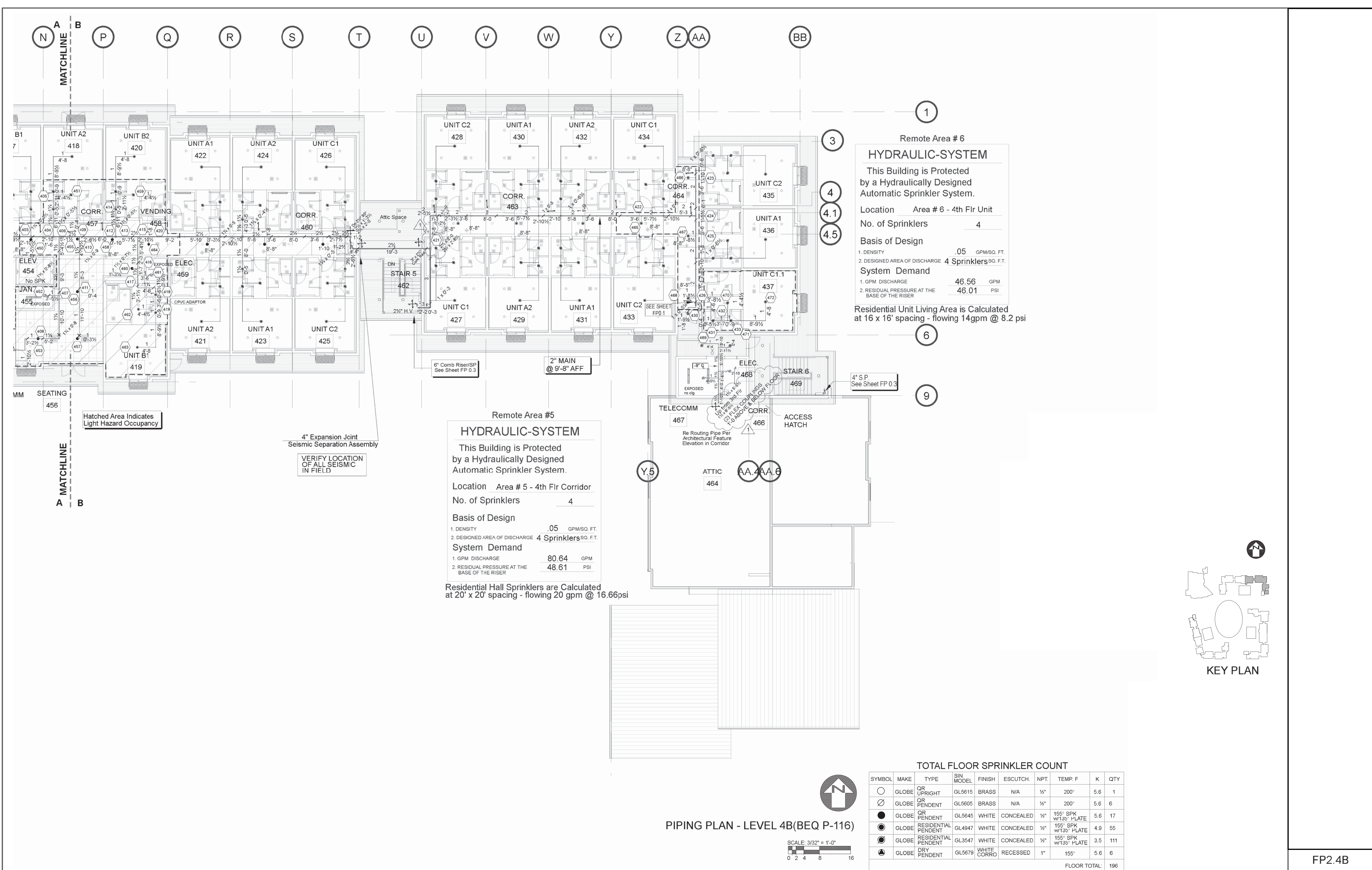
KEY PLAN

PIPING PLAN - LEVEL 4A(BEQ P-116)



TOTAL FLOOR SPRINKLER COUNT

SYMBOL	MAKE	TYPE	SIN MODEL	FINISH	ESCUTCH.	NPT.	TEMP F	K	QTY
○	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	1/2"	155°	5.6	1
◊	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	6
●	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	5.6	17
⦿	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	4.9	55
⦿	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	3.5	111
⦿	GLOBE	DRY PENDENT	GL5679	WHITE CORRO	RECESSED	1"	155°	5.6	6
FLOOR TOTAL:									196



1

Remote Area # 6

HYDRAULIC-SYSTEM

This Building is Protected by a Hydraulically Designed Automatic Sprinkler System.

Location Area # 6 - 4th Flr Unit

No. of Sprinklers4

Basis of Design

1. DENSITY.05 GPM/SQ. FT.

2. DESIGNED AREA OF DISCHARGE4 SprinklersSQ. F.T.

System Demand

1. GPM DISCHARGE46.56 GPM

2. RESIDUAL PRESSURE AT THE BASE OF THE RISER46.01 PSI

Residential Unit Living Area is Calculated at 16 x 16' spacing - flowing 14gpm @ 8.2 psi

Remote Area #5

HYDRAULIC-SYSTEM

This Building is Protected by a Hydraulically Designed Automatic Sprinkler System.

Location Area # 5 - 4th Flr Corridor

No. of Sprinklers4

Basis of Design

1. DENSITY.05 GPM/SQ. FT.

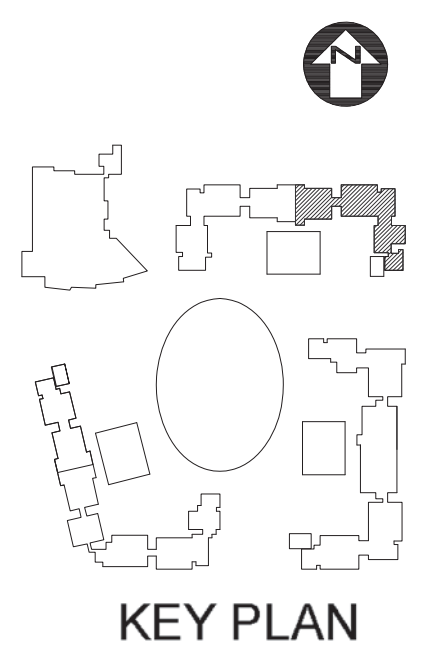
2. DESIGNED AREA OF DISCHARGE4 SprinklersSQ. F.T.

System Demand

1. GPM DISCHARGE80.64 GPM

2. RESIDUAL PRESSURE AT THE BASE OF THE RISER48.61 PSI

Residential Hall Sprinklers are Calculated at 20' x 20' spacing - flowing 20 gpm @ 16.6psi



TOTAL FLOOR SPRINKLER COUNT										
SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY	
○	GLOBE	OR UPRIGHT	GL5615	BRASS	N/A	1/2"	200°	5.6	1	
⊗	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	200°	5.6	6	
●	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	5.6	17	
⦿	GLOBE	RESIDENTIAL PENDENT	GL4947	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	4.9	55	
⦿	GLOBE	RESIDENTIAL PENDENT	GL3547	WHITE	CONCEALED	1/2"	155° SPK w/135° PLATE	3.5	111	
⦿	GLOBE	DRY PENDENT	GL5679	WHITE CORRO.	RECESSED	1"	155°	5.6	6	
FLOOR TOTAL:									196	

PIPING PLAN - LEVEL 4B(BEQ P-116)

SCALE: 3/32" = 1'-0"

0 2 4 8 16

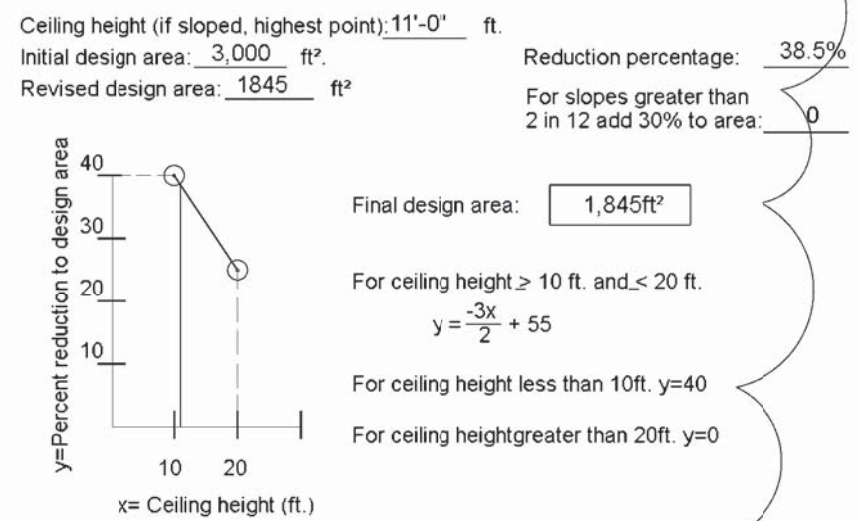
LAUNDRY NOTES

Attic space above ceiling is a noncombustible concealed space not requiring sprinkler protection. Dryer Chases shall be enclosed from the attic/roof structure - by others.

8.15.1.2.2 Concealed spaces of noncombustible and limited-combustible construction with limited access and not permitting occupancy or storage of combustibles shall not require sprinkler protection.

8.15.1.2.2.1 The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

QUICK RESPONSE HYDRAULIC DESIGN AREA



REMOTE AREA #1

REDUCED TO 1845.00sqft
FOR QUICK RESPONSE SPRINKLERS

HYDRAULIC-SYSTEM

This Building is Protected
by a Hydraulically Designed
Automatic Sprinkler System.

Location LAUNDRY
No. of Sprinklers 30

Basis of Design

1. DENSITY .15 GPM/SQ. FT.
2. DESIGNED AREA OF DISCHARGE 1980.24 SQ. FT.

System Demand

642.62 GPM
37.84 PSI

Ordinary Group I-0.15gpm/ft² for 1845.00ft²

500 GPM HOSE
PRESSURE @ BEQ P116 - BASE OF THE RISER NODE 9 = 59.70 PSI
PRESSURE @ BEQ P163 - BASE OF THE RISER NODE 9 = 57.69 PSI
PRESSURE @ BEQ P170 - BASE OF THE RISER NODE 9 = 60.48 PSI

REMOTE AREA #2

Light Hazard-0.10gpm/ft² for 3000.00ft²
250 GPM HOSE

HYDRAULIC-SYSTEM

This Building is Protected
by a Hydraulically Designed
Automatic Sprinkler System.

Location MULTIPURPOSE ROOM

No. of Sprinklers 30

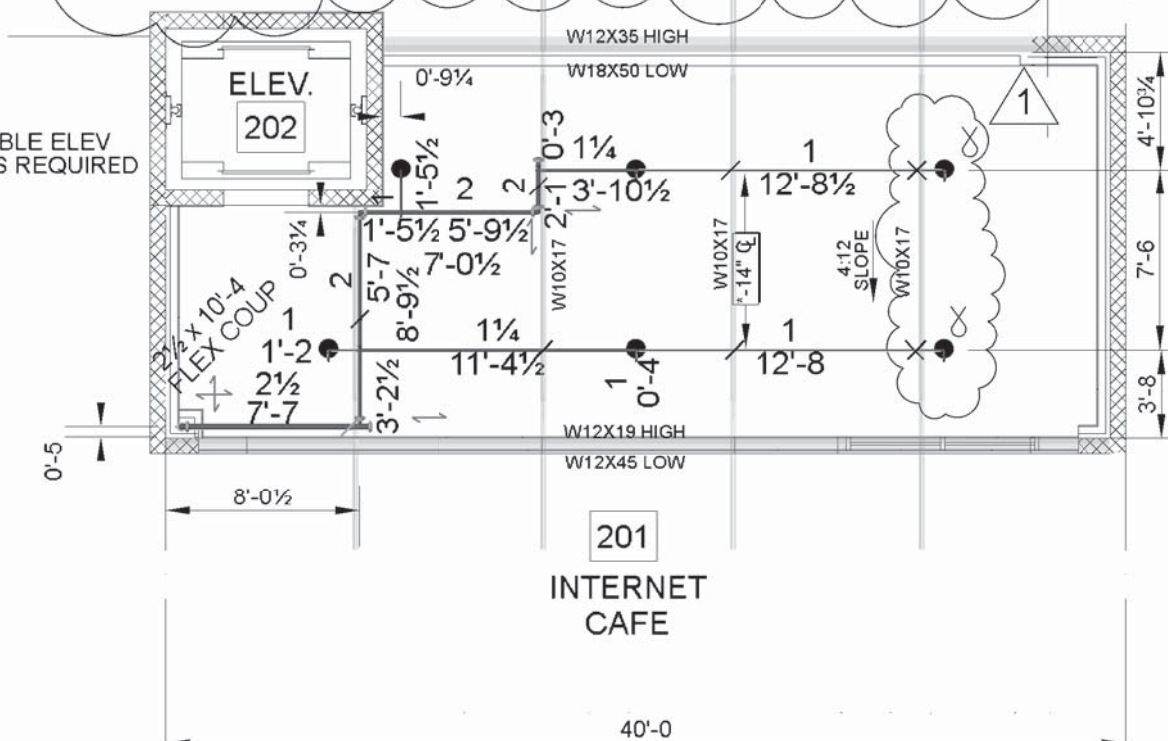
Basis of Design

1. DENSITY .10 GPM/SQ. FT.
2. DESIGNED AREA OF DISCHARGE 3003.83 SQ. FT.

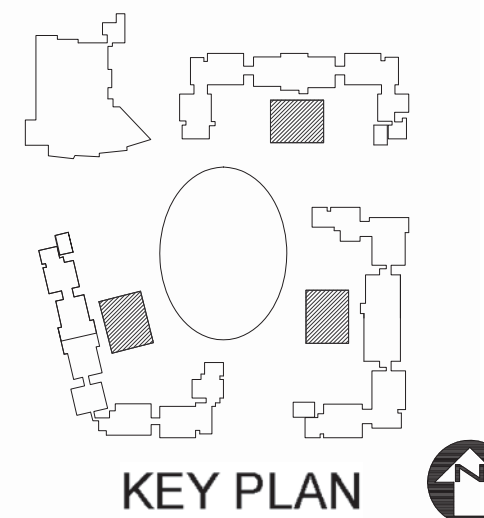
System Demand

609.72 GPM
36.90 PSI

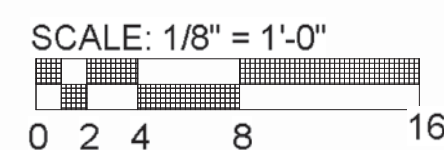
PRESSURE @ BEQ P116 - BASE OF THE RISER NODE 9 = 56.98 PSI
PRESSURE @ BEQ P163 - BASE OF THE RISER NODE 9 = 55.12 PSI
PRESSURE @ BEQ P170 - BASE OF THE RISER NODE 9 = 57.69 PSI
THE TOTAL SLOPED CEILING AT THE MULTIPURPOSE RM IS 1335'. THIS IS INCLUDED IN THE 3,000 REMOTE AREA PER NFPA 13 11.2.3.2.4 COMMENTARY - NO AREA INCREASE REQUIRED
NFPA 13 22.4.4.6.2 Sprinklers protecting small closets are permitted to be omitted from hydraulic calculation for Remote Area < 1500ft²



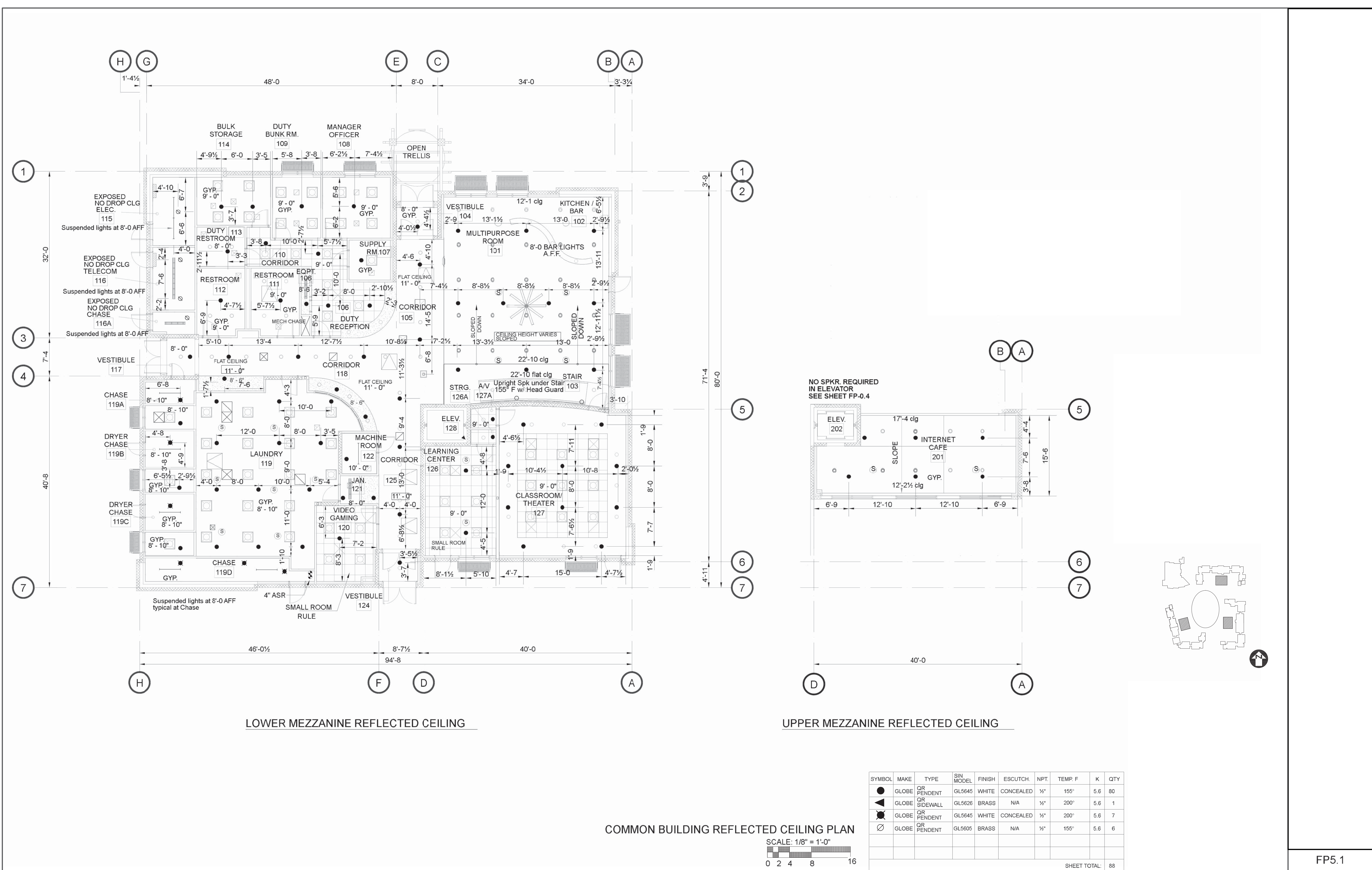
ROOF PIPING OVER MEZZANINE



COMMON BUILDING PIPING PLAN TYPICAL FOR THREE BUILDINGS



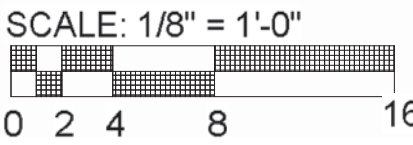
SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
●	GLOBE	QR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155°	5.6	79
◐	GLOBE	QR SIDEWALL	GL5626	BRASS	N/A	1/2"	200°	5.6	1
○	GLOBE	QR UPRIGHT	GL5615	BRASS	N/A	1/2"	155°	5.6	2
⊗	GLOBE	QR PENDENT	GL5645	WHITE	CONCEALED	1/2"	200°	5.6	7
◑	GLOBE	QR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	4
SHEET TOTAL:									94



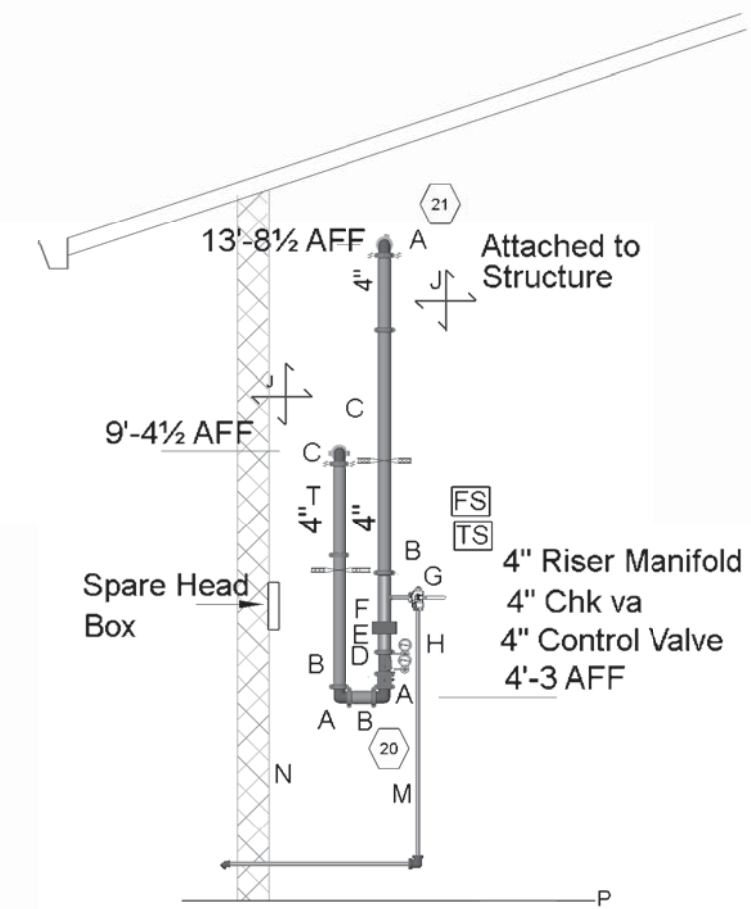
LOWER MEZZANINE REFLECTED CEILING

UPPER MEZZANINE REFLECTED CEILING

COMMON BUILDING REFLECTED CEILING PLAN

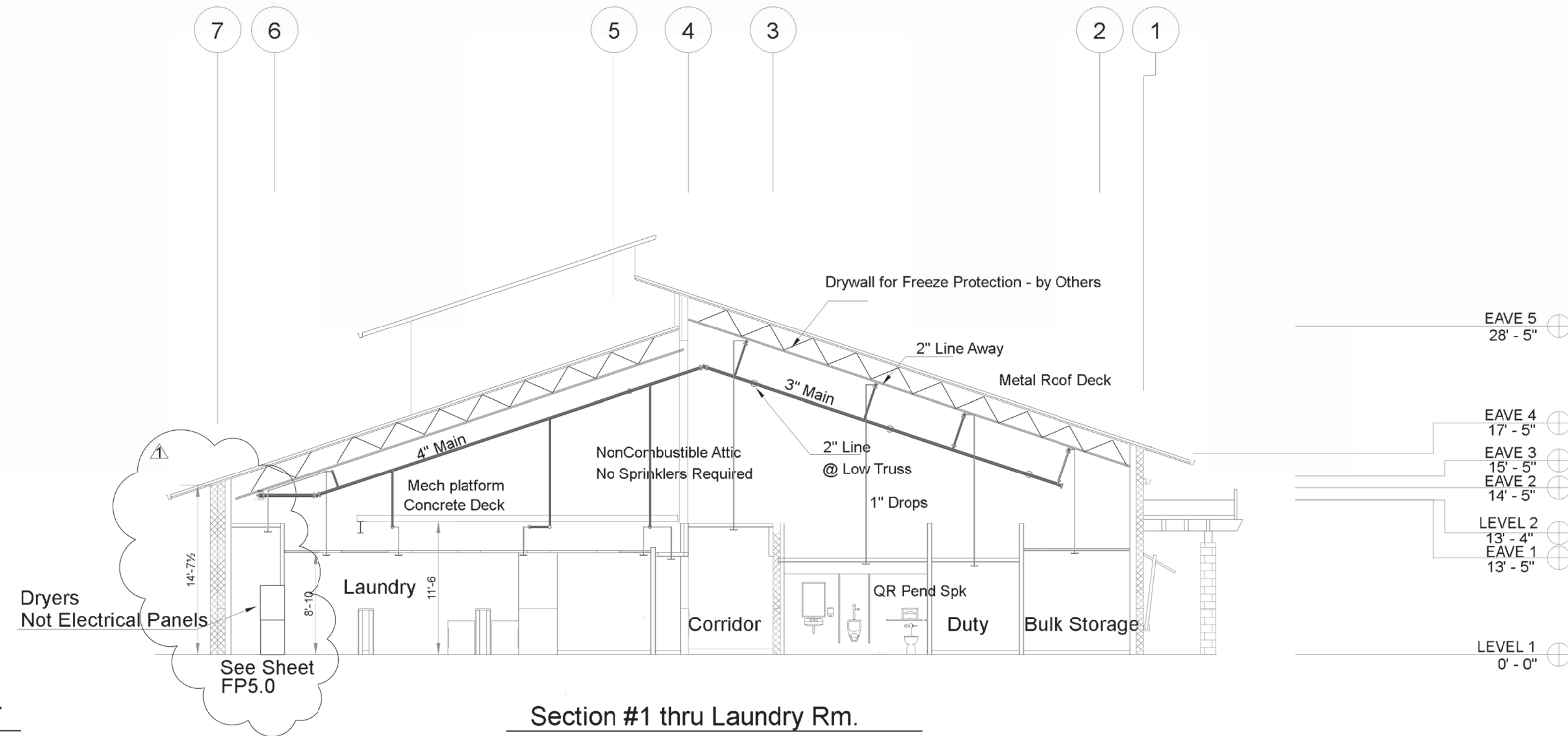


SYMBOL	MAKE	TYPE	SIN. MODEL	FINISH	ESCUTCH.	NPT.	TEMP. F	K	QTY
●	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	155°	5.6	80
▲	GLOBE	OR SIDEWALL	GL5626	BRASS	N/A	1/2"	200°	5.6	1
⊗	GLOBE	OR PENDENT	GL5645	WHITE	CONCEALED	1/2"	200°	5.6	7
○	GLOBE	OR PENDENT	GL5605	BRASS	N/A	1/2"	155°	5.6	6
SHEET TOTAL:									88



Common Building 4" Sprinkler Riser

SCALE: 1/4" = 1'-0"



Section #1 thru Laundry Rm.

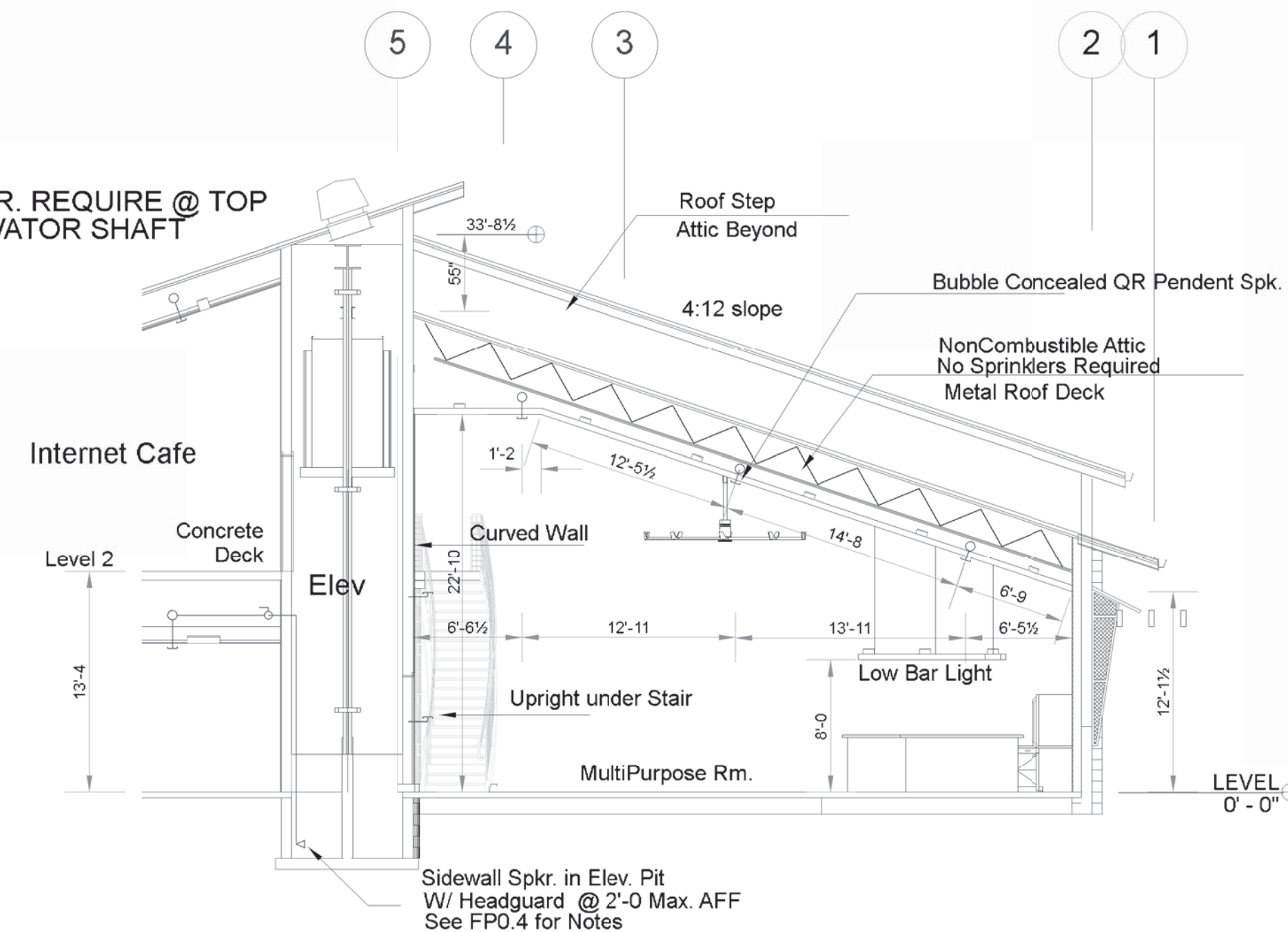
SCALE: 1/8" = 1'-0"

A=4" Grooved Short Radius 90° Elbow
 B=4" Rigid Grooved Coupling
 C=4" Flex Grooved Coupling
 D=4" Grv Butterfly Valve W/ Tamper Switch
 E=4" Grooved Check Valve
 F=Water Flow Indicator (Flow Switch)
 G=2" AGF Test & Drain
 W/ Pressure Relief Valve
 H=Water Pressure Gauge

J=4 Way Seismic Brace
 M=2" Drain Piping
 T=Unistrut Bracing-Support To CMU Wall

N=Common Building Exterior CMU Wall
 P=Building Floor Slab

NO SPKR. REQUIRE @ TOP
 OF ELEVATOR SHAFT



Section #2 thru MultiPurpose Rm.

SCALE: 1/8" = 1'-0"

Appendix E – Fire Sprinkler Product Data



U.S. Pat. No. 3921989
Canadian Pat. No. 1009680
Other Patents Pending
Potter Electric, Rd., 1990

UL, ULC and CSFM Listed, FM and LPCB Approved, NYMEA Accepted, CE Marked

Service Pressure: Up to 450 PSI (31 BAR)

Minimum Flow Rate for Alarm: 10 GPM (38 LPM)

Maximum Surge: 18 FPS (5,5 m/s)

Contact Ratings: Two sets of SPDT (Form C)
15.0 Amps at 125/250VAC
2.0 Amps at 30VDC Resistive

Conduit Entrances: Two knockouts provided for 1/2" conduit

Environmental Specifications:

- Suitable for indoor or outdoor use with factory installed gasket and die-cast housing.
- NEMA 4/IP54 Rated Enclosure - use with appropriate conduit fitting.
- Temperature Range: 40°F/120°F, 4.5°C/49°C
- Non-corrosive sleeve factory installed in saddle.

Caution: This device is not intended for applications in explosive environments.

Sizes Available: Steel Pipe schedules 10 thru 40, sizes 2" thru 8"
BS 1387 pipe 50mm thru 200mm

Note: For copper or plastic pipe use Model VSR-CF.

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

Optional: Cover Tamper Switch Kit, Stock No. 0090018

GENERAL INFORMATION

The Model VSR-F is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50mm thru 200mm).

LPC approved sizes are 2" thru 8" (50mm thru 200mm).

The unit may also be used as a sectional waterflow detector on large systems.

The unit contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 gallons per minute (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

ENCLOSURE: The unit is enclosed in a general purpose, die-cast housing. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin no. 5400775 for installation instructions of this switch.

INSTALLATION: See Fig.2

These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they should be installed on the top side of the pipe where they will be accessible. The units should not be installed within 6" (15cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.

Drain the system and drill a hole in the pipe using a circular saw in a slow speed drill. The 2" (50mm) and 2 1/2" (65mm) devices require a hole with a diameter of 1 1/4" + 1/8" - 1/16" (33mm ±2mm). All other sizes require a hole with a diameter of 2" ±1/8" (50mm ±2mm).

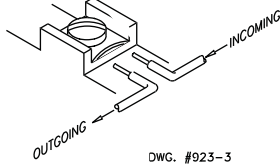
Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole.

Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Install the saddle strap and tighten nuts alternately to an eventual 50 ft-lbs. (68 n-m) of torque (see Fig. 2). The vane must not rub the inside of the pipe or bind in any way.

Specifications subject to change without notice.

FIG. 1

**SWITCH TERMINAL
CONNECTIONS
CLAMPING PLATE
TERMINAL**



CAUTION:

An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal.

FIG. 2

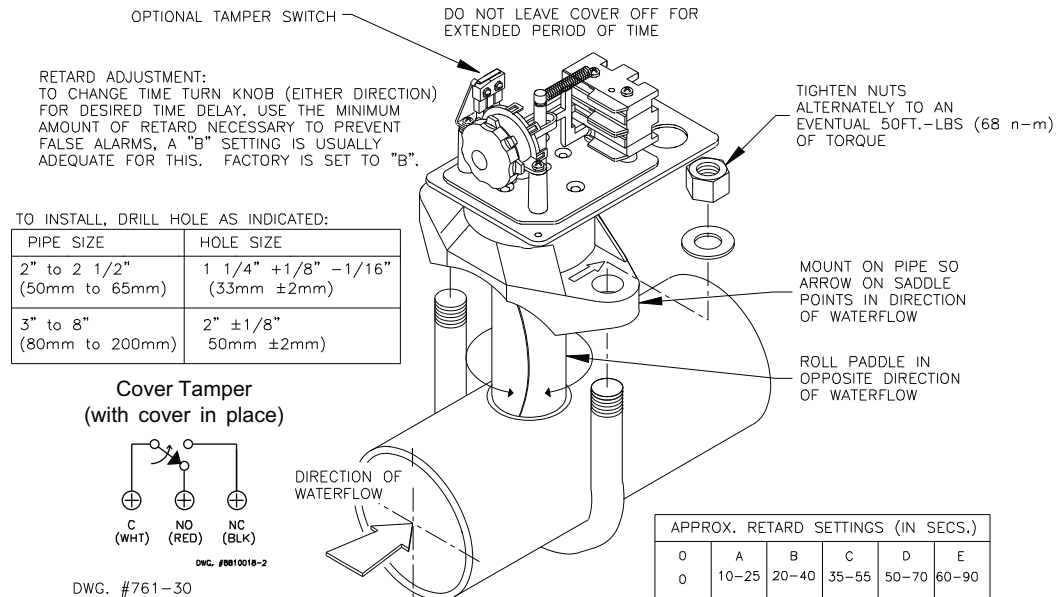
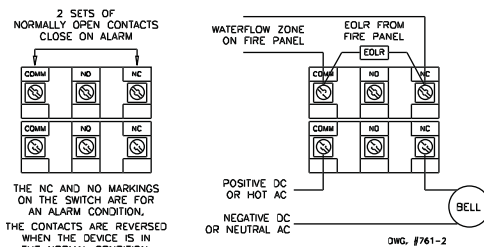


FIG. 3 TYPICAL ELECTRICAL CONNECTIONS

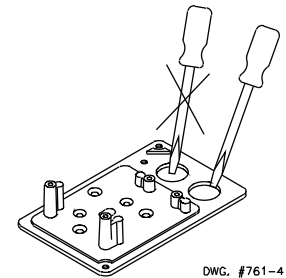


NOTES:

1. The Model VSR-F has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. A condition of LPC Approval of this product is that the electrical entry must be sealed to exclude moisture.
3. For supervised circuits see "Switch Terminal Connections" drawing and caution note (Fig. 1).

FIG. 4

To remove knockouts: Place screwdriver at edge of knockouts, not in the center.



APPLICATION WARNING!

Due to the possibility of unintended discharges caused by pressure surges, trapped air, or short retard times, waterflow switches that are monitoring wet pipe sprinkler systems should not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems.

TESTING

The frequency of inspection and testing for the model VSR-F and its associated protective monitoring system should be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

If provided, the inspector's test valve, that is usually located at the end of the most remote branch line, should always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR-F is not recommended or advisable.

A minimum flow of 10 gpm (38 Lpm) is required to activate this device.

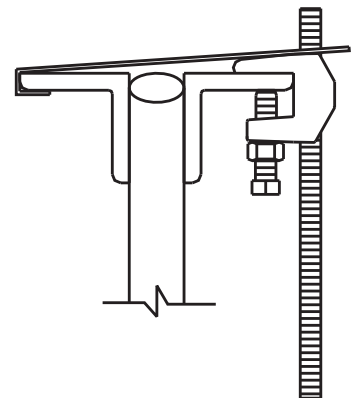
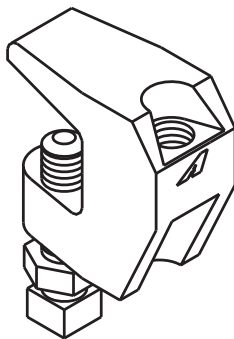
IMPORTANT NOTICE: Please advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.



P.O. Box 3365 South El Monte, CA 91733 626.444.0541 Fax 626.444.3887 www.Afcon.org

100

REVERSIBLE BEAM CLAMP 3/4" MOUTH



SIZE - 3/8" and 1/2" rod.

MATERIAL - Ductile iron.

FINISH - Plain, E.G. and H.D.G.

LISTINGS -



203-EX 2551

Approval guide - Pipe Hangers

FUNCTION - Hanger assembly attachment to steel flange with thickness of less than 3/4".

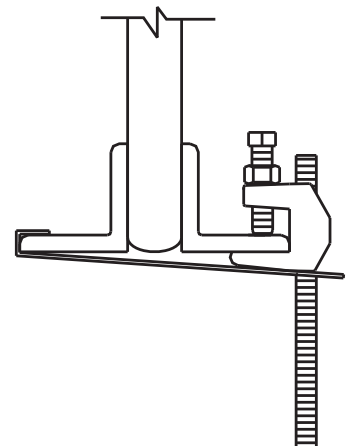
INSTALLATION - Per NFPA 13 with set screw up or down.

Torque - 3/8" = 60 inch lbs. or 1/2" = 125 inch lbs. In the absence of a torque wrench, engage set bolt finger tight then additionally tighten 1/3 turn.

FEATURES

- * Listings allow installation with set screw up or down - see drawings.
- * Maintains **CONSTANT HANGER CENTER-LINE**, with set screw up or down.
- * Flat throat back to prevent twisting on flange during installation.

ORDERING - Part #, rod size and finish.

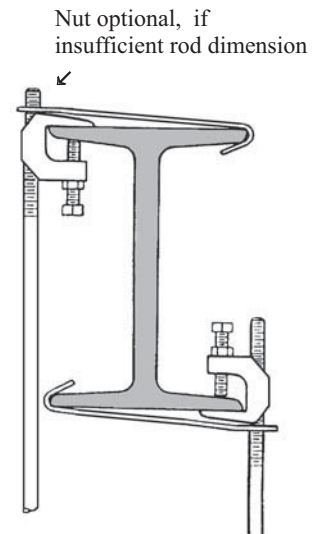
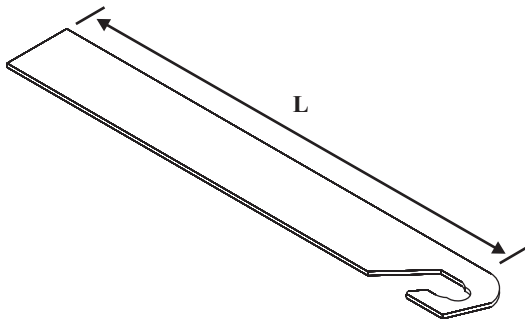




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162

UNIVERSAL RESTRAINING STRAP




SIZE- One size fits both 3/8" and 1/2" rod or set screw.
Available lengths 4" and longer.

MATERIAL - Carbon Steel.

FINISH - Mil. Galvanized.

LISTINGS -

c  US 203-EX 2551

PATENT - No. 5,897,088

FUNCTION - To enhance hanger attachment in areas subject to Earthquakes.

INSTALLATION - Install tight to structure and component parts
Minimum return on strap: 1"
L-dimension is measured from hanger rod center to the strap end.

FEATURES

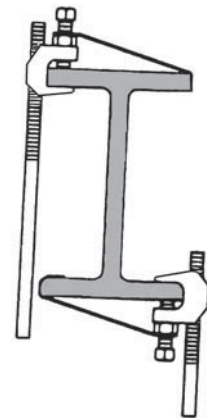
* Fast installation for new construction or retrofit.

* Requires no hanger disassembly to install.

IMPORTANT NOTE: "No Nut Is Required"

When installed tight to structure and component parts. (See drawings provided)

ORDERING - Part # and L-dimension.

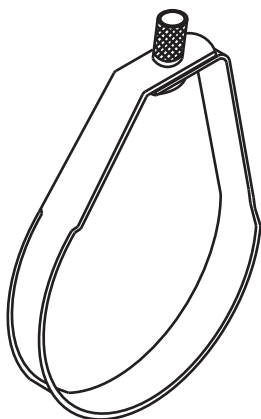




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300

RING HANGER



3/4 thru 4 inch pipe
LISTED FOR STEEL/CPVC



1/2 inch pipe
5 thru 8 inch pipe

SIZE - 1/2 thru 8 inch pipe.

MATERIAL - Carbon Steel, Mil. Galvanized to G-90 spec.

LISTING/APPROVAL -

 **203-EX 2551**

 **Approval guide - Pipe Hangers**

OSHPD OPA-0601 See Website.

CONFORMS WITH: Federal Specification WW-H-171 Type 10,
Manufacturers Standardization Society ANSI/MSS-SP-58 Type 10.

MAXIMUM TEMPERATURE - 650°F.

FUNCTION - Pipe hanger component for use on steel, CPVC or
copper piping.

INSTALLATION - Per NFPA 13, 13R, 13D and
CPVC manufacturers instructions.

SPECIAL NOTE: When installing on CPVC sprinkler system pipe:

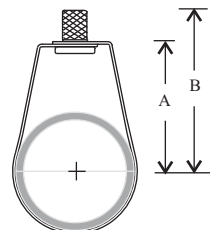
Verify that all assembly components are cleaned of any surface oil.

FEATURES -

- * Sized and listed exclusively for use with #310 Surge Restrainer.
- * Band edge is offset for EASY pipe insertion.
- * Custom fit swivel nut for better retention in ring body.
- * Full length knurl on swivel nut for better grip.

ORDERING - Part #, pipe size.

NFPA 13		MAX REC.	METRIC
PIPE	ROD	LOAD LBS.	REFERENCE
3/4	3/8	400	20
1	3/8	400	25
1 1/4	3/8	400	32
1 1/2	3/8	400	40
2	3/8	400	50
2 1/2	3/8	600	65
3	3/8	600	80
3 1/2	3/8	600	
4	3/8	1000	100
5	1/2	1250	125
6	1/2	1250	150
8	1/2	1250	200



PIPE	A	B
1	1.8793	2.5259
1 1/4	2.1382	2.7850
1 1/2	2.2673	2.9140
2	2.6048	3.2516
2 1/2	3.4920	4.1150
3	3.7845	4.4311
4	4.3582	4.9992
6	6.0668	6.8180
8	7.5768	8.3290



Fig. 800 - Adjustable Sway Brace Attachment to Steel

Size Range — 4" thru 18" beam width

Material — Carbon Steel

Function — Seismic brace attachment to steel.

Features — This product's design incorporates a concentric attachment point which is critical to the performance of structural seismic connections. NFPA 13 indicates the importance of **concentric** loading of connections and fasteners. Permits secure connection to steel where drilling and/or welding of brace connection could present structural issues.

Installation Instructions — The Fig. 800 is the structural attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with a TOLCO transitional attachment, "bracing pipe" and a TOLCO "braced pipe" attachment to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

To Install — Place the Fig. 800 on the steel beam, tighten the cone point set bolts on flange until bolt heads break off. Tighten hex head bolts into clamp body until lock washers are fully flat. Attach other TOLCO transitional attachment fitting, Fig. 909, 910, 980 or 986. Transitional fitting attachment can pivot for adjustment to proper brace angle.

Approvals — Underwriters Laboratories Listed in the USA (**UL**) and Canada (**cUL**). Approved by Factory Mutual Engineering (**FM**). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

Order By — Figure number, type number and size number.

Dimensions • Weights

Size	Fits Beam Range (In.)	Max. Design Loads/Lbs. (cULus)		Max. Design Load Lbs. (FM)*	
		Along Beam	Across Beam	Along Beam	Across Beam
1	4 - 6	1265	2015	2800	2800
2	6 - 8	1265	2015	2800	2800
3	8 - 10	1265	2015	2800	2800
4	10 - 12	1265	2015	2800	2800
5	12 - 14	1265	2015	2800	2800
6	14 - 16	1265	2015	2800	2800
7	16 - 18	1265	2015	2800	2800

Dimensions • Weights

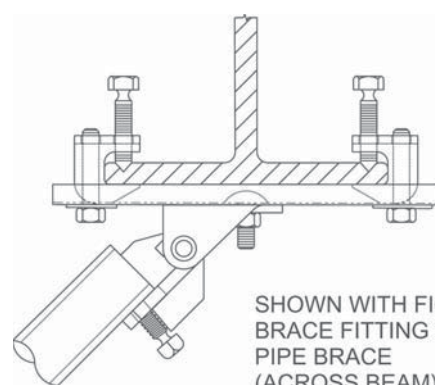
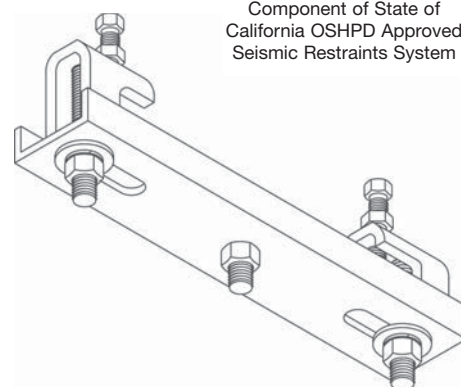
Type	Flange Thickness Max. (In.)	Max. Design Loads/Lbs. (cULus)		Max. Design Load Lbs. (FM)*	
		Along Beam	Across Beam	Along Beam	Across Beam
1	3/4	1265	2015	2800	2800
2	1 1/4	1265	2015	2800	2800

* The loads listed are axial loads on the brace. The horizontal load capacity, H, of the brace is: $H = F \times \sin \theta$, where θ is the installation angle measured from the vertical.

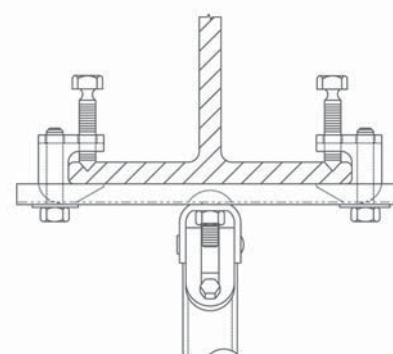
TOLCO® brand bracing components are designed to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.



Component of State of California OSHPD Approved Seismic Restraints System



SHOWN WITH FIG. 980
BRACE FITTING TO
PIPE BRACE
(ACROSS BEAM)



SHOWN WITH FIG. 980
BRACE FITTING TO
PIPE BRACE
(ALONG BEAM)

Fig. 980 - Universal Swivel Sway Brace Attachment



Component of State of California OSHPD Approved Seismic Restraints System

Size Range — One size fits bracing pipe 1" thru 2", TOLCO 12 gauge channel, and all structural steel up to 1/4" thick.

Material — Carbon Steel

Function — Multi-functional attachment to structure or braced pipe fitting.

Features — This product's design incorporates a **concentric** attachment opening which is critical to the performance of structural seismic connections. NFPA 13 (2002) Figure 9.3.5.9.1 indicates clearly that fastener table load values are based only on concentric loading. Mounts to any surface angle. Break off bolt head assures verification of proper installation.

Installation — The Fig.980 is the structural or transitional attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO "braced pipe" attachment, Fig. 1000, 1001, 2002, 4L, 4A or 4B to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

To Install — Place the Fig. 980 onto the "bracing pipe". Tighten the set bolt until set bolt head breaks off. Attachment can pivot for adjustment to proper brace angle.

Approvals — Underwriters Laboratories Listed in the USA (**UL**) and Canada (**cUL**). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

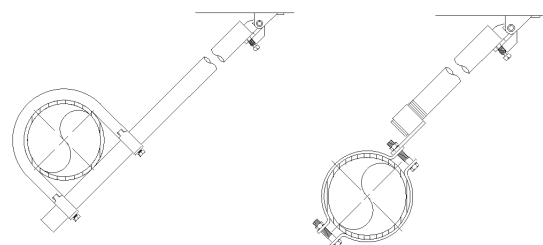
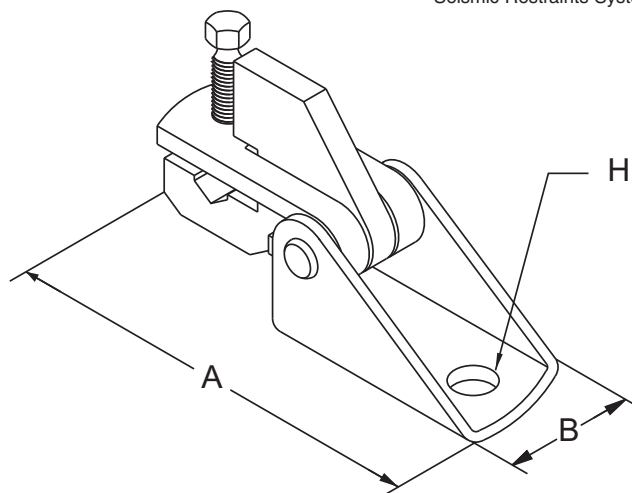
Note — The Fig. 980 Swivel Attachment and the Fig. 1001, Fig. 1000 , Fig. 2001 or Fig. 4A Pipe Clamp make up a sway brace system of **UL** Listed attachments and bracing materials which satisfies the requirements of Underwriters' Laboratories and the National Fire Protection Association (**NFPA**)

Finish — Plain

Note — Available in Electro-Galvanized finish.

Order By — Figure number and finish.

PATENT #6,273,372



Lateral Brace

Dimensions • Weights

A	B	H*	Max. Design Load Lbs.	Approx. Wt./100
5 1/4	1 7/8	17/32	2765	132

* Available with hole sizes to accommodate up to 3/4" fastener. Consult factory.

TOLCO™ brand bracing components are designed to be compatible **ONLY** with other TOLCO™ brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO™ brand bracing components, in the instance that such TOLCO™ brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO™ brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

Fig. 1000 - "Fast Clamp" Sway Brace Attachment



Component of State of
California OSHPD Approved
Seismic Restraints System

Size Range — Pipe size to be braced: 1" thru 6" Schedule 10 thru 40 IPS.* Pipe size used for bracing: 1" and 1¼" Schedule 40 IPS.

* Additionally (UL) approved for use to brace Schedule 7 sprinkler pipe up to 4" (maximum horizontal design load 655 lbs.) Torque requirement 6 — 8 ft. lbs.

Material — Carbon Steel

Function — For bracing pipe against sway and seismic disturbance.

Features — Field adjustable, making critical pre-engineering of bracing pipe unnecessary. Unique design requires no threading of bracing pipe. Can be used as a component of a 4-way riser brace. Can be used as longitudinal brace with Fig. 907. Comes assembled and individually packaged with illustrated installation instructions — sizes are clearly marked. Steel leaf spring insert provided to assure installer and inspector necessary minimum torque has been achieved.

Installation — The Fig. 1000 is the "braced pipe" attachment component of a lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO structural attachment component, Fig. 980, 910 or 909 to form a complete bracing assembly. Follow NFPA 13 and/or OSHPD guidelines.

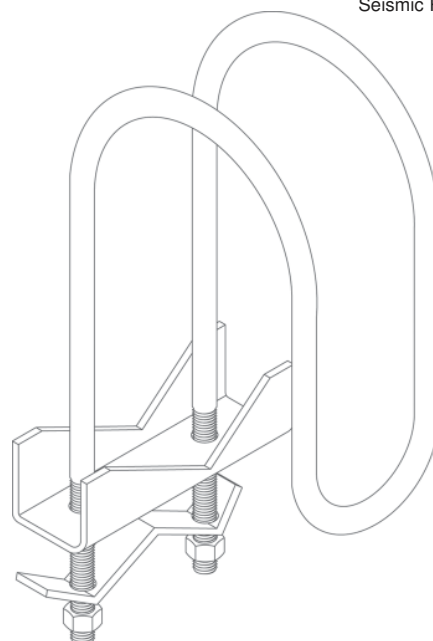
To Install — Place the Fig. 1000 over the pipe to be braced, insert bracing pipe through opening leaving a minimum of 1" extension. Tighten hex nuts until leaf spring is flat. It is recommended that the brace angle be adjusted before hex nuts are fully tightened.

Approvals — Underwriters Laboratories Listed in the USA (UL) and Canada (cUL). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (OSHPD). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

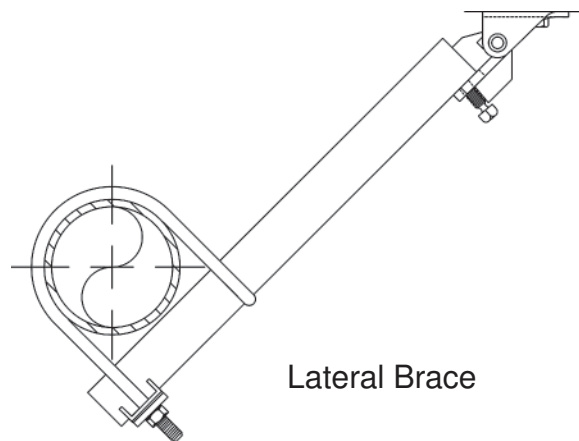
Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Order first by pipe size to be braced, followed by pipe size used for bracing, figure number and finish.



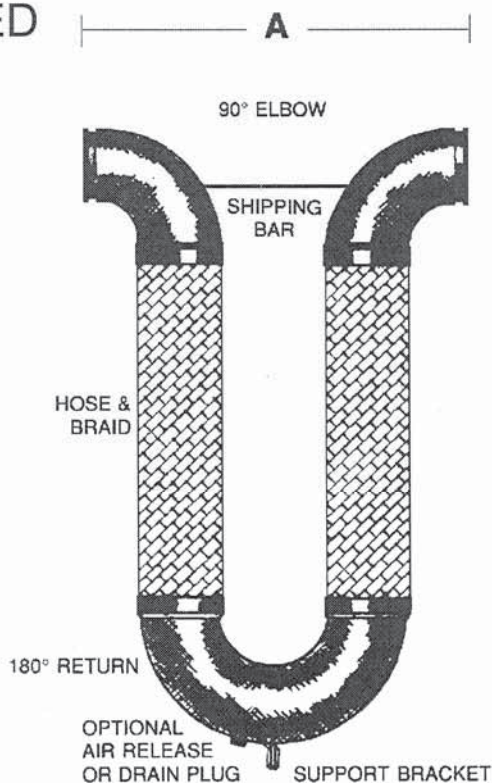
Maximum Design Load
1" thru 4" pipe size — 2015 lbs.
6" size — 1265 lbs.



Lateral Brace

TOLCO® brand bracing components are designed to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

GROOVED
ENDS



**MATERIALS
OF
CONSTRUCTION**

End fittings _____

Hose & Braid _____

90° Elbow _____

180° Return _____



LISTED
For Fire Sprinkler
Systems

NOTE: METRALOOPS 2" AND LARGER INSTALLED IN ANY ORIENTATION OTHER THAN HANGING DOWN MUST HAVE THE 180° RETURN SUPPORTED. (SEE INSTALLATION INSTRUCTIONS.)

QTY	SIZE	MODEL	MOVEMENT	A END TO END	B LENGTH	PSI	SPRING FORCE LBS.*	WEIGHT LBS.
	2"(50mm)	MLUG80200	±4"	20"	25"	300	78	18
	2-1/2"(65mm)	MLUG80250	±4"	21-1/2"	28"	300	83	29
	3"(80mm)	MLUG80300	±4"	24"	30"	300	90	43
	4"(100mm)	MLUG80400	±4"	30"	35"	175	120	60
	5"(125mm)	MLUG80500	±4"	36"	40"	175	186	99
	6"(150mm)	MLUG80600	±4"	42"	46"	175	202	150
	8"(200mm)	MLUG80800	±4"	56"	58"	175	260	286

*Spring force: these values reflect the total force required to move the Metraloop it's full rated movement for 150 p.s.i. @ 70° F.

ALL DIMENSIONS IN INCHES

CUSTOMER _____

PROJECT _____

ENGINEER _____

ARCHITECT _____

PRO OR P.O. NO. _____

the Metraflex[®] company
CHICAGO ILLINOIS

DESCRIPTION:

METRAFLEX FIRELOOP™

US Patent No. 5,195,784

DRAWN BY:

ZB

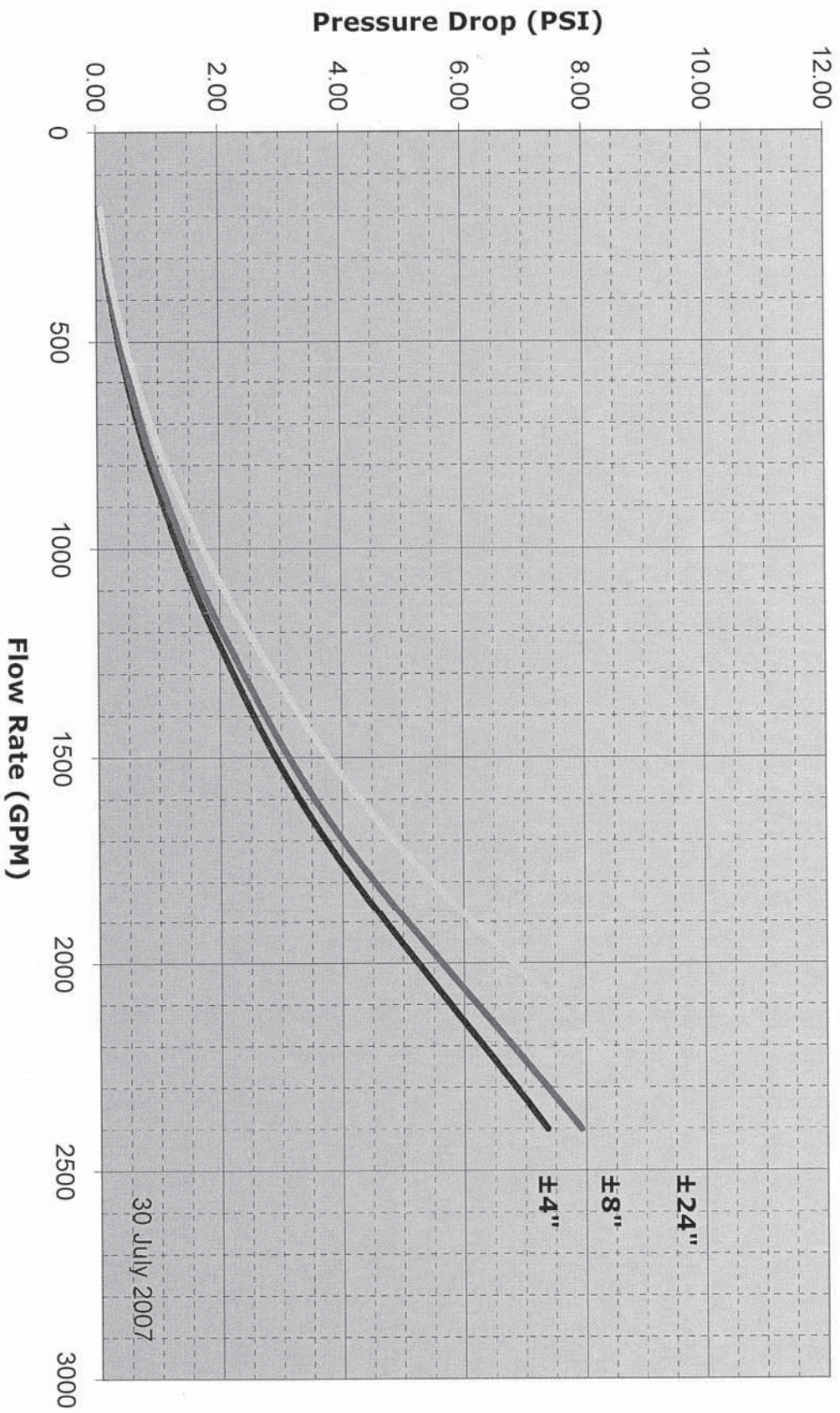
DATE:

11/20/00

DRAWING NO:

FireLoop

6" Metraflex Fireloop Pressure Drop



Metraflex.
for pipes in motion

www.fireloop.info

312-738-3800



RESIDENTIAL
AUTOMATIC SPRINKLERS
MODELS GL4147 & GL4947
ADJUSTABLE CONCEALED PENDENT

DESCRIPTION AND OPERATION

The Globe Models GL4147 and GL4947 Residential Adjustable Concealed Pendent Sprinkler have a low profile yet durable design that utilizes a 3mm frangible glass ampule as the thermosensitive element. They feature economy, aesthetics and low water flow with 1/2" of adjustment. The combination of the 3mm frangible glass ampule and specially designed deflector make the Models GL4147 and GL4947 Residential Adjustable Concealed Pendent Sprinklers the ultimate in life safety and fire control. They have met the strict requirements of Underwriters Laboratories Inc. as described in UL Standard, 1626, for Residential Sprinklers for Fire Protection Service, and should be used accordingly. These sprinklers should also be installed in accordance with the appropriate NFPA Standard 13, 13D or 13R and under the direction of the approving authorities having jurisdiction.

Globe's Residential Adjustable Concealed Pendent Sprinkler consists of our pendent residential type sprinkler concealed from view by a 1" deep dome shaped ceiling plate. All that is seen at the ceiling is the 3 5/16" diameter ceiling plate color finished to match the specifier's exact requirements. The ceiling plate is soldered to the sprinkler's special upper support assembly in three places. Upon the application of sufficient heat, the plate falls to the floor exposing the residential pendent spray sprinkler. At the prescribed temperature the internal pressure within the ampule exceeds the strength of the glass causing the glass to shatter. This results in water discharge which is distributed in an approved pattern.

TECHNICAL DATA

- See reverse side for Approvals and Specifications.
- Temperature Rating - 155°F (68°C).
- Water Working Pressure Rating - 175 psi (12 Bars).
- Factory tested hydrostatically to 500 psi (34 Bars).
- Maximum low temperature glass bulb rating is -67°F (-55°C).
- Frame - bronze • Deflector - brass • Screw - brass
- Bulb seat - copper • Spring - nickel alloy • Seal - teflon
- Bulb - glass with alcohol based solution, 3mm size.
- Cover Plate - brass
- Upper Escutcheon Assembly - steel



RESIDENTIAL
CONCEALED PENDENT

• SPRINKLER TEMPERATURE RATING/CLASSIFICATION and COLOR CODING

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	155°F	68°C	RED	100°F	38°C

RESIDENTIAL

AUTOMATIC SPRINKLERS

MODELS GL4147 & GL4947

ADJUSTABLE CONCEALED PENDENT

SPECIFICATIONS AND APPROVALS

SIN MODEL	K FACTOR	THREAD SIZE	LENGTH	FINISHES	155°F (68°C) SPRINKLER WITH 135°F (57°C) PLATE	cULus	NYC - DOB MEA 101-92-E
GL4147	4.1 (58 metric)	1/2" NPT	3" (7.6 cm)	Bright Chrome	X	X	X
GL4947	4.9 Nominal (68 metric)			White Painted Satin Chrome ¹ Bright Brass ¹ Other Painted Finishes ¹			

NOTE: METRIC CONVERSIONS ARE APPROXIMATE.

¹FINISHES AVAILABLE ON SPECIAL ORDER.

INSTALLATION DATA

CONCEALED PENDENT

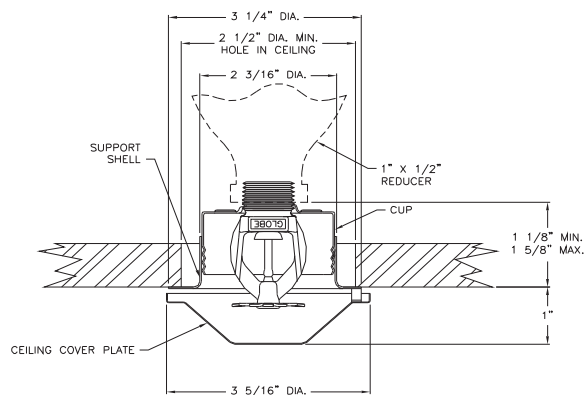
MODEL	MAXIMUM AREA OF COVERAGE	MINIMUM WATER DISCHARGE & PRESSURES NEEDED PER SPRINKLER *
GL4147	12' x 12'	11 G.P.M. - 7.2 P.S.I.
	14' x 14'	15 G.P.M. - 13.4 P.S.I.
	16' x 16'	15 G.P.M. - 13.4 P.S.I.

CONCEALED PENDENT

GL4947	12' x 12'	13 G.P.M. - 7 P.S.I.
	14' x 14'	14 G.P.M. - 8.2 P.S.I.
	16' x 16'	14 G.P.M. - 8.2 P.S.I.
	18' x 18'	17 G.P.M. - 12 P.S.I.
	20' x 20'	20 G.P.M. - 16.7 P.S.I.

*WHEN THESE SPRINKLERS ARE USED IN NFPA 13 SYSTEMS, A 0.1 DESIGN DENSITY MINIMUM SHALL BE UTILIZED.

CROSS SECTION



1/2" ADJUSTMENT

ORDERING INFORMATION

SPECIFY

- Quantity • Model Number • Style
- Orifice • Temperature • Finishes desired
- Quantity - Concealed Wrenches - P/N 325391
- Quantity - Protective Caps - P/N 327119

GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).



JANUARY 2009

PRINTED U.S.A.

4077 AIRPARK DRIVE, STANDISH, MICHIGAN 48658

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www.globesprinkler.com

BULLETIN GL4147/GL4947, REV. #4



**REPLACEMENT RESIDENTIAL
AUTOMATIC SPRINKLERS
MODEL GL3547
LOW FLOW
ADJUSTABLE CONCEALED PENDENT**

DESCRIPTION AND OPERATION

The Globe Model GL3547 Low Flow Residential Adjustable Concealed Pendent Sprinkler is a low profile yet durable design that utilizes a 3mm frangible glass ampule as the thermosensitive element. It features both economy, aesthetics and low water flow. The combination of the 3mm frangible glass ampule and specially designed deflector make the Model GL3547 Low Flow Residential Adjustable Concealed Pendent Sprinkler the ultimate in life safety and fire control. The Model GL3547 is available with 1/2" of adjustment and a deeper profile cover plate assembly. It has met the strict requirements of Underwriters Laboratories Inc. as described in UL Standard, 1626, for Residential Sprinklers for Fire Protection Service, and should be used accordingly. These sprinklers should also be installed in accordance with the appropriate NFPA Standard 13, 13D or 13R and under the direction of the approving authorities having jurisdiction.

Globe's Residential Adjustable Concealed Pendent Sprinkler consists of our pendent residential type sprinkler concealed from view by a dome shaped ceiling plate. All that is seen at the ceiling is the 3 5/16" diameter ceiling plate color finished to match the specifier's exact requirements. The ceiling plate is soldered to the sprinkler's special upper support assembly in three places. Upon the application of sufficient heat, the plate falls to the floor exposing the residential pendent spray sprinkler. At the glass ampule's rated temperature, the sprinkler opens discharging water onto the floor in its required and approved distribution pattern.

TECHNICAL DATA

- See reverse side for Approvals and Specifications.
- Temperature Rating - 155°F (68°C).
- Water Working Pressure Rating - 175 psi (12 Bars).
- Factory tested hydrostatically to 500 psi (34 Bars).
- Maximum low temperature glass bulb rating is -67°F (-55°C).
- Frame - bronze • Deflector - brass • Screw - brass
- Bulb seat - copper • Spring - nickel alloy • Seal - teflon
- Bulb - glass with alcohol based solution, 3mm size.
- Cover Plate - brass
- Upper Escutcheon Assembly - steel



**RESIDENTIAL
CONCEALED PENDENT**

• SPRINKLER TEMPERATURE RATING/CLASSIFICATION and COLOR CODING

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	155°F	68°C	RED	100°F	38°C

REPLACEMENT RESIDENTIAL AUTOMATIC SPRINKLERS MODELS GL3547 LOW FLOW ADJUSTABLE CONCEALED PENDENT SPECIFICATIONS AND APPROVALS

SIN MODEL	K FACTOR	THREAD SIZE	LENGTH	FINISHES	155°F (68°C) SPRINKLER WITH 135°F (57°C) PLATE	cULus
GL3547	3.5 (49 metric)	1/2" NPT	2 1/2" (6.4 cm)	Bright Chrome White Painted *Satin Chrome *Bright Brass *Other Painted Finishes	X	X

NOTE: METRIC CONVERSIONS ARE APPROXIMATE.

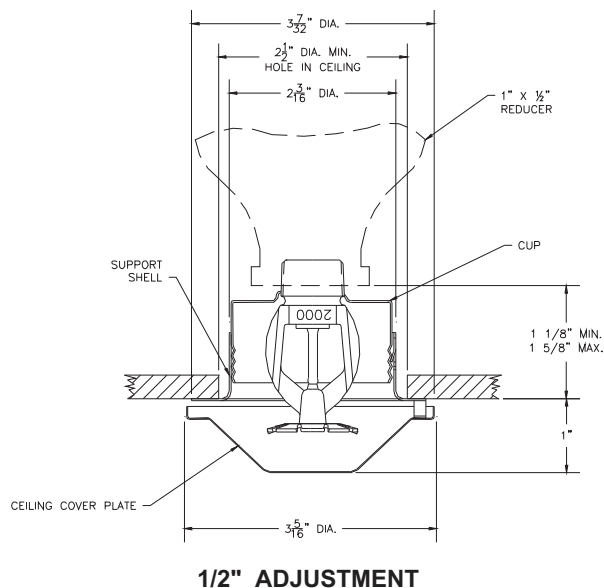
*FINISHES AVAILABLE ON SPECIAL ORDER.

INSTALLATION DATA CONCEALED PENDENT SPRINKLER

MAXIMUM AREA OF COVERAGE	MINIMUM WATER DISCHARGE & PRESSURES NEEDED*	
	SINGLE SPRINKLER	TWO SPRINKLERS
12' x 12'	9 G.P.M. - 7 PSI.	9 G.P.M. - 7 PSI. (EACH)
14' x 14'	12 G.P.M. - 11.7 PSI.	12 G.P.M. - 11.7 PSI. (EACH)
16' x 16'	12 G.P.M. - 11.7 PSI.	12 G.P.M. - 11.7 PSI. (EACH)
18' x 18'	16 G.P.M. - 20.9 PSI.	13 G.P.M. - 13.8 PSI. (EACH)
20' x 20'	16 G.P.M. - 20.9 PSI.	16 G.P.M. - 20.9 PSI. (EACH)

*WHEN THESE SPRINKLERS ARE USED IN NFPA 13 SYSTEMS, A 0.1 DESIGN DENSITY MINIMUM SHALL BE UTILIZED.

CROSS SECTION



ORDERING INFORMATION SPECIFY

- Quantity • Model Number • Style
- Orifice • Temperature • Finishes desired
- Quantity - Wrenches - P/N 325390
- Quantity - Recessed Wrenches - P/N 325391
- Quantity - Protective Caps - P/N 327119

GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).



OCTOBER 2003

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PRINTED U.S.A.

BULLETIN GL3547, REV. #2

DESCRIPTION AND OPERATION

The Globe Quick Response GL Series Adjustable Concealed Pendent Sprinkler is a low profile, aesthetically pleasing design. It provides sprinkler operation approximately six times faster than ordinary sprinklers and can be installed wherever standard concealed spray sprinklers are specified when allowed by the applicable standards. It offers the additional feature of greatly increased safety to life and should be used advisedly and under the direction of approving authorities having jurisdiction. The Sprinkler is available with 1/2" of adjustment and a deeper profile cover plate assembly. All that is seen at the ceiling is a 3 5/16" diameter ceiling plate color finished to match the specifier's exact requirements. The GL Series Adjustable Concealed Sprinkler may be virtually invisible as it does not interrupt the "smooth flow" of the ceiling. Globe's Adjustable Concealed Sprinkler utilizes its 3mm frangible glass ampule type sprinkler which is located above the ceiling and concealed from view by the ceiling plate. The ceiling plate is soldered to the sprinkler's special upper support assembly in three places. Upon the application of sufficient heat, the plate falls to the floor exposing the quick response pendent spray sprinkler. At the ampule's rated temperature, the sprinkler opens discharging water onto the floor in its required and approved distribution pattern.

TECHNICAL DATA

- See reverse side for Approvals and Specifications.
- Temperature Ratings -
 - 135°F (57°C) Sprinkler, 135°F (57°C) Cover Plate;
 - 155°F (68°C) Sprinkler, 135°F (57°C) Cover Plate
 - 175°F (79°C) Sprinkler, 155°F (68°C) Cover Plate;
 - 200°F (93°C) Sprinkler, 155°F (68°C) Cover Plate.
- Water Working Pressure Rating - 175 psi (12 Bars).
- Factory tested hydrostatically to 500 psi (34 Bars).
- Maximum low temperature glass bulb rating is -67°F (-55°C).
- Frame - bronze • Deflector - brass • Screw - brass
- Bulb seat - copper • Spring - nickel alloy • Seal - teflon
- Bulb - glass with alcohol based solution, 3mm size.
- Cover Plate - brass
- Upper Escutcheon Assembly - steel



QUICK RESPONSE
WHITE
CONCEALED PENDENT

• SPRINKLER TEMPERATURE RATING/CLASSIFICATION and COLOR CODING

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	135°F/155°F	57°C/68°C	ORANGE/RED	100°F	38°C
INTERMEDIATE	175°F/200°F	79°C/93°C	YELLOW/GREEN	150°F	66°C

QUICK RESPONSE **AUTOMATIC SPRINKLERS** **GL SERIES** **ADJUSTABLE CONCEALED PENDENT**

SPECIFICATIONS

NOMINAL "K" FACTOR	THREAD SIZE	LENGTH	FINISHES
2.8 (39 metric)	1/2" NPT	2 1/2" (6.4 cm)	Bright Chrome
4.2 (59 metric)	1/2" NPT		White Painted
5.6 (80 metric)	1/2" NPT		Satin Chrome ¹
8.1 (116 metric)	3/4" NPT		Bright Brass ¹ Other Painted Finishes ¹

NOTE: METRIC CONVERSIONS ARE APPROXIMATE.

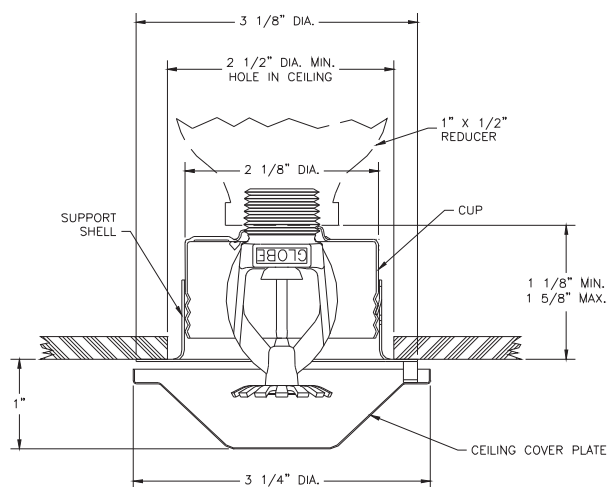
¹ FINISHES AVAILABLE ON SPECIAL ORDER.
PAINTED PLATES OTHER THAN WHITE REQUIRE
CUSTOMER TO FURNISH PAINT.

APPROVALS

STYLE	SIN MODEL	K FACTOR	135°F (57°C) WITH PLATE 135°F (57°C)	155°F (68°C) WITH PLATE 135°F (57°C)	175°F (79°C) WITH PLATE 155°F (68°C)	200°F (93°C) WITH PLATE 155°F (68°C)	cULus
CONCEALED PENDENT	GL2845	2.8	X	X	X	X	X
	GL4245	4.2	X	X	X	X	X
	GL5645	5.6*	X	X	X	X	X
	GL8145	8.1*	X	X	X	X	X

*LISTED FOR ALL HAZARDS.

CROSS SECTION



1/2\" ADJUSTMENT

ORDERING INFORMATION

SPECIFY

- Quantity • Model Number • Style
- Orifice • Thread Sizes • Temperature
- Finishes desired
- Quantity - Concealed Wrenches - P/N 325391
- Quantity - Protective Caps - P/N 327119

GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).



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QUICK RESPONSE
AUTOMATIC SPRINKLERS
GL SERIES
UPRIGHT • PENDENT
VERTICAL SIDEWALL
HORIZONTAL SIDEWALL
CONVENTIONAL (OLD STYLE)

DESCRIPTION AND OPERATION

The Globe Quick Response GL Series Sprinklers are a low profile yet durable design which utilizes a 3mm frangible glass ampule as the thermosensitive element. This provides sprinkler operation approximately six times faster than ordinary sprinklers. While the Quick Response Sprinkler provides an aesthetically pleasing appearance, it can be installed wherever standard spray sprinklers are specified when allowed by the applicable standards. It offers the additional feature of greatly increased safety to life and is available in various styles, orifices, temperature ratings and finishes to meet many varying design requirements. Quick Response Sprinklers should be used advisedly and under the direction of approving authorities having jurisdiction.

The heart of Globe's GL Series sprinkler proven actuating assembly is a hermetically sealed frangible glass ampule that contains a precisely measured amount of fluid. When heat is absorbed, the liquid within the bulb expands increasing the internal pressure. At the prescribed temperature the internal pressure within the ampule exceeds the strength of the glass causing the glass to shatter. This results in water discharge which is distributed in an approved pattern depending upon the deflector style used.

The sprinkler and escutcheon are not factory assembled. Assembly is done in the field.



QUICK RESPONSE
UPRIGHT



QUICK RESPONSE
CONVENTIONAL



QUICK RESPONSE
PENDENT



QUICK RESPONSE
VERTICAL SIDEWALL

TECHNICAL DATA

- See reverse side for Approvals and Specifications.
- Temperature Ratings - 135°F (57°C), 155°F (68°C), 175°F (79°C), 200°F (93°C), 286°F (141°C)
- Water Working Pressure Rating - 175 psi (12 Bars)
- Factory tested hydrostatically to 500 psi (34 Bars)
- Maximum low temperature glass bulb rating is -67°F (-55°C)
- Frame - bronze • Deflector - brass • Screw - brass
- Bulb seat - copper • Spring - nickel alloy • Seal - teflon
- Bulb - glass with alcohol based solution, 3mm size



QUICK RESPONSE
HORIZONTAL SIDEWALL

• SPRINKLER TEMPERATURE RATING/CLASSIFICATION and COLOR CODING

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	135°F/155°F	57°C/68°C	ORANGE/RED	100°F	38°C
INTERMEDIATE	175°F/200°F	79°C/93°C	YELLOW/GREEN	150°F	66°C
HIGH	286°F	141°C	BLUE	225°F	107°C

4077 AIRPARK DRIVE, STANDISH, MICHIGAN 48658

989-846-4583 • FAX 989-846-9231

QUICK RESPONSE

AUTOMATIC SPRINKLERS

GL SERIES

UPRIGHT • PENDENT • VERTICAL SIDEWALL

HORIZONTAL SIDEWALL • CONVENTIONAL (OLD STYLE)

SPECIFICATIONS

NOMINAL "K" FACTOR	THREAD SIZE	LENGTH ¹	FINISHES
2.8 (39 metric)	1/2" NPT	2 1/4" (5.7 cm)	Factory Bronze
4.2 (59 metric)	1/2" NPT	2 1/4" (5.7 cm)	Satin Chrome ²
5.6 (80 metric)	1/2" NPT	2 1/4" (5.7 cm)	Bright Chrome
7.8 (111 metric)	1/2" NPT	2 1/4" (5.7 cm)	White Polyester ³
8.1 (116 metric)	3/4" NPT	2 7/16" (6.2 cm)	Black Polyester ³
			Lead Coated ²

NOTE: METRIC CONVERSIONS ARE APPROXIMATE.

¹ HORIZONTAL SIDEWALL IS 2 9/16".

² FINISHES AVAILABLE ON SPECIAL ORDER.

³ AVAILABLE AS cULus LISTED CORROSION RESISTANT WHEN SPECIFIED ON ORDER.

APPROVALS

STYLE	SIN MODEL	K FACTOR	135°F 57°C	155°F 68°C	175°F 79°C	200°F 93°C	286°F 141°C	cULus	F.M.	LPC	CE	NYC - DOB MEA 101-92-E
UPRIGHT	GL2815	2.8	X	X	X	X	X	X	---	---	---	X
	GL4215	4.2	X	X	X	X	X	X	---	---	---	X
	GL5615	5.6	X	X	X	X	X	X	X	X	X	X
	GL8115	7.8*	X	X	X	X	X	X	X	---	---	X
	GL8118	8.1	X	X	X	X	X	X	X	X	X	X
PENDENT	GL2801	2.8	X	X	X	X	X	X	---	---	---	X
	GL4201	4.2	X	X	X	X	X	X	---	---	---	X
	GL5601	5.6	X	X	X	X	X	X	X	X	X	X
	GL8101	7.8*	X	X	X	X	X	X	X	---	---	X
	GL8106	8.1	X	X	X	X	X	X	X	X	X	X
VERTICAL SIDEWALL†	GL5632	5.6	X	X	X	X	X	X	X	---	---	---
	GL8133	8.1	X	X	X	X	X	X	---	---	---	---
HORIZONTAL SIDEWALL §	GL2826	2.8	X	X	X	X	X	X	---	---	---	X
	GL4226	4.2	X	X	X	X	X	X	---	---	---	X
	GL5626	5.6	X	X	X	X	X	X	X	---	---	X
	GL8127	8.1	X	X	X	X	X	X	---	---	---	---
CONVENTIONAL (OLD STYLE)	GL5624	5.6	X	X	X	X	X	---	---	X	X	---
	GL8125	8.1	X	X	X	X	X	---	---	X	X	---

§ HORIZONTAL SIDEWALL cULus LISTED FOR DEFLECTOR 4" TO 12" BELOW THE CEILING, FM APPROVED 4" TO 6".

† VERTICAL SIDEWALL SPRINKLER cULus LISTED FOR LIGHT HAZARD ONLY.

PENDENT VERTICAL SIDEWALL cULus LISTED FOR 6' MIN. SPACING.

UPRIGHT VERTICAL SIDEWALL cULus LISTED FOR 9' MIN. SPACING.

*1/2" NPT.

ORDERING INFORMATION

SPECIFY

- Quantity • Model Number • Style
- Orifice • Thread Sizes • Temperature
- Finishes desired
- Quantity - Wrenches - P/N 325390 (1/2"); P/N 312366 (L.O.)

GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).



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AUTOMATIC SPRINKLERS

GL SERIES

DRY TYPE

PENDENT

RECESSED PENDENT

DESCRIPTION AND OPERATION

The Globe GL Series Dry Type Pendent Sprinkler is designed for use in special applications such as freezing environments and conditions where sediment or foreign materials might accumulate in ordinary drop nipples.

The Globe GL Series Dry Type Pendent Sprinkler utilizes a frangible glass ampule sprinkler. At the ampule's rated temperature, the sprinkler opens releasing the bulb seat, causing the inner tube assembly to move, allowing spring assembly to pivot alongside the inner tube. At this time, water flows through the sprinkler and is distributed by the deflector, in an approved discharge pattern.

The heart of Globe's GL Series sprinkler proven actuating assembly is a hermetically sealed frangible glass ampule that contains a precisely measured amount of fluid. When heat is absorbed, the liquid within the bulb expands increasing the internal pressure. At the prescribed temperature the internal pressure within the ampule exceeds the strength of the glass causing the glass to shatter. This results in water discharge which is distributed in an approved pattern.



**SURFACE
MOUNT**



**SLEEVE
& SKIRT**

TECHNICAL DATA

- See reverse side for Approvals and Specifications.
- Temperature Ratings: 135°F (57°C), 155°F (68°C), 175°F (79°C), 200°F (93°C), 286°F (141°C)
- Water Working Pressure Rating: 175 psi (12 Bars)
- Factory tested hydrostatically to 500 psi (34 Bars)
- Maximum low temperature glass bulb rating: -67°F (-55°C)
- Frame - bronze • Deflector - brass • Screw - brass
- Bulb seat - brass • Spring - teflon coated nickel alloy
- Retainer - brass • Pin - stainless steel
- Torsion spring - stainless steel
- Bulb - glass with glycerin solution, 5mm
- Orifice insert - brass • 3/4" or 1" NPT
- Outer tube - galvanized steel pipe • Inner tube - stainless steel



EXTENDED



RECESSED

• SPRINKLER TEMPERATURE RATING/CLASSIFICATION and COLOR CODING

CLASSIFICATION	AVAILABLE SPRINKLER TEMPERATURES		BULB COLOR	N.F.P.A. MAXIMUM CEILING TEMPERATURE	
ORDINARY	135°F/155°F	57°C/68°C	ORANGE/RED	100°F	38°C
INTERMEDIATE	175°F/200°F	79°C/93°C	YELLOW/GREEN	150°F	66°C
HIGH	286°F	141°C	BLUE	225°F	107°C

AUTOMATIC SPRINKLERS GL SERIES DRY TYPE PENDENT - RECESSED PENDENT

SPECIFICATIONS

NOMINAL "K" FACTOR	THREAD SIZE	LENGTH	FINISHES
5.6 (80 metric)	3/4" or 1" NPT	cULus Variable to 48"	Factory Bronze Bright Chrome Satin Chrome ¹ White Polyester ² Black Polyester ^{1,2} Lead Coated ^{1,2} Wax Coated ^{1,2,3} Wax Over Lead ^{1,2,3}
8.1 (116 metric)	1" NPT	FM Variable to 36"	

NOTE: METRIC CONVERSIONS ARE APPROXIMATE.

¹FINISHES AVAILABLE ON SPECIAL ORDER.

²AVAILABLE AS cULus LISTED CORROSION RESISTANT - WHEN SPECIFIED ON ORDER.

³WAX COATING cULus LISTED UP TO 200°F ONLY.

APPROVALS

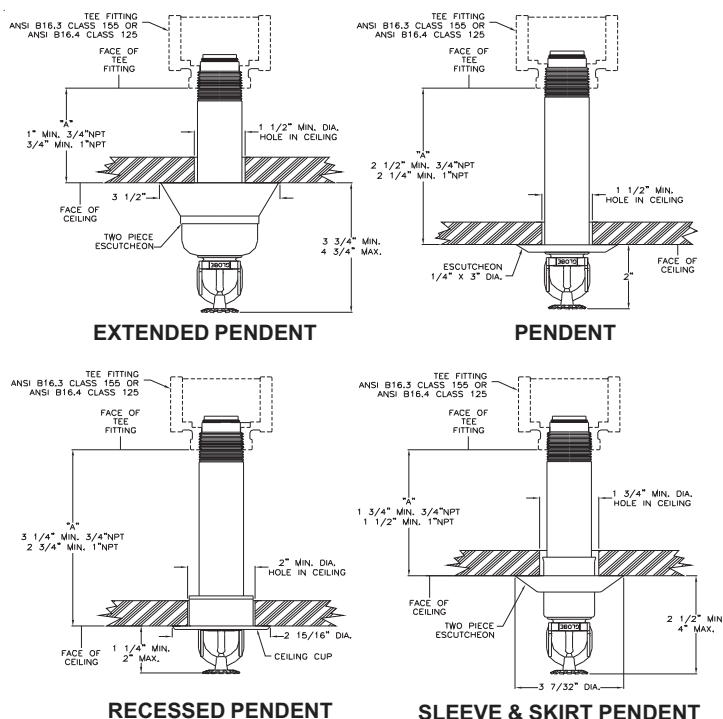
STYLE	SIN MODEL	K FACTOR	THREAD SIZE	135°F 57°C	155°F 68°C	175°F 79°C	200°F 93°C	286°F 141°C	cULus	FM*	NYC - DOB MEA 101-92-E
PENDENT	GL5679	5.6	1" NPT	X	X	X	X	X	X	X	X
	GL5680	5.6	3/4" NPT	X	X	X	X	X	X	-	X
	GL8179	8.1	1" NPT	X	X	X	X	X	X	-	X
RECESSED PENDENT	GL5679	5.6	1" NPT	X	X	X	X	X	X	X	X
	GL5680	5.6	3/4" NPT	X	X	X	X	X	X	-	X
	GL8179	8.1	1" NPT	X	X	X	X	X	X	-	X

NOTE: LISTED FOR ALL HAZARDS

* DRY PENDENT - FM APPROVED 155°F, 200°F, AND 286°F ONLY.

* DRY RECESSED PENDENT - FM APPROVED 155°F AND 200°F ONLY.

CROSS SECTIONS



IMPORTANT INSTALLATION DATA

Globe GL Series Dry Pendent sprinklers should be installed in accordance with the requirements set forth in NFPA 13. These sprinklers are to be installed using a pipe wrench applied to the outer tube. When this is not possible, the proper sprinkler head wrench may be used with extreme care for lengths up to approximately 18". Excessive force may distort the frame thus destroying the unit.

When installed in a wet system extending into a freezing area see chart on Dry Caution sheet for minimum exposed barrel length to prevent ice plugs. Please refer to our Dry Caution sheet for further important installation data.

ORDERING INFORMATION

SPECIFY

- Quantity • Model Number • Style
- Orifice • Temperature • Finishes desired
- Quantity - Wrenches - P/N 333010
- Quantity - Recessed Wrenches - P/N 337014
- Quantity - Protective Caps - P/N 327109-CAP (Friction Fit Recessed) • Escutcheons desired
- "A" Dimension - Distance from face of fitting to the finished ceiling line regardless of escutcheon used.

GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).

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GLOBE RECESSED AND STANDARD ESCUTCHEONS

STANDARD ESCUTCHEONS

1/2" NPT or 3/4" NPT

Universal for all sprinkler models

1 Pc. (1/4" x 3" Diameter)

Finish/Part No. 1/2" NPT

- Chrome: 325398
- Chrome-RP: 325398-RP
- Brass: 325399
- White: 325400



1 Pc. (5/8" x 2 7/8" Diameter)

Finish/Part No. 1/2" NPT

- Chrome: 312086
- Brass: 312088
- White: 312090

Finish/Part No. 3/4" NPT

- Chrome: 312087
- Brass: 312089
- White: 312091



2 Pc. Extended (max. 2 3/4" x 3 1/2" Diameter)

Finish/Part No. 1/2" NPT

- Chrome: 312075
- Chrome-P: 312075-P
- Brass: 312076
- White: 312074
- White-P: 312074-P

Finish/Part No. 3/4" NPT

- Chrome: 312077
- Brass: 312078
- White: 312079



Optional Skirts for 2 Pc. Extended Escutcheon
Short Taper Skirt

(reduces deflector to ceiling distance by 3/4")

Finish/Part No.

- Chrome: 312040
- Brass: 312041
- White: 312042



Flush Skirt

(reduces deflector to ceiling distance by 1 1/4")

Finish/Part No.

- Chrome: 312044
- Brass: 312045
- White: 312046



***NOTE:** Other Escutcheons Available Upon Request. Unless stated "-RP" (rust proof) or "-P" (plastic), all escutcheons are coated/plated for decorative purposes only, thus not recommended for corrosive atmospheres.



GLOBE RECESSED AND STANDARD ESCUTCHEONS

RECESSED ESCUTCHEONS

1/2" NPT or 3/4" NPT

2 Pc. Recessed

(3/4" Adj. x 2 7/8" Diameter)

Finish/Part No. 1/2" NPT:

- Chrome: 325422
- Brass: 325424
- *Poly: 325426

Finish/Part No. 3/4" NPT:

- Chrome: 325423
- Brass: 325420
- *Poly: 325427



2 Pc. Recessed

(1/2" Adj. x 2 7/8" Diameter)

Finish/Part No. 1/2" NPT:

- Chrome: 332071
- Brass: 332072
- *Poly: 332073



2 Pc. Screw Adjustable Recessed

(3/4" Adj. x 2 7/8" Diameter)

Finish/Part No. 1/2" NPT:

- Chrome: 329306
- *Poly: 329308

Finish/Part No. 3/4" NPT:

- Chrome: 325423
- Brass: 325420
- *Poly: 325427



2 Pc. Screw Adjustable Recessed

(1/2" Adj. x 2 7/8" Diameter)

Finish/Part No. 1/2" NPT:

- Chrome: 329301
- *Poly: 329303

Finish/Part No. 3/4" NPT:

- Chrome: 329311
- *Poly: 329313



1/2" Adjustable Recessed Model Numbers

- cULus Approved: 2810, 4110, 4210, 4230, 4231, 4234, 4710, 5628, 5630, 5631, 8101, 8107, 8128, 8129, 8151 & 8174
- cULus & FM Approved: 5601, 8106 & 8156

3/4" Adjustable Recessed Model Numbers

- cULus Approved: 2801, 2826, 2851, 2870, 4201, 4226, 4231, 4251, 4270, 5601, 5602, 5626, 5628, 5635, 5636, 5641, 5642, 5652, 5670, 5679, 5680, 5685, 5686, 8101, 8102, 8151, 8152, 8106, 8107, 8109, 8127, 8128, 8129, 8135, 8141, 8157, 8159, 8171, 8174, 8179, 8185
- cULus & FM Approved: 5651 & 8156

*When ordering specify color after part number: -W= white, -B= black.

4077 AIRPARK DRIVE, STANDISH, MICHIGAN 48658
OCTOBER 2007

989-846-4583 • FAX 989-846-9231
BULLETIN ESCUTCH, REV.#2



UL, ULC, and CSFM Listed, FM Approved, NYMEA Accepted, CE Marked

Dimensions: 6.19" L X 2.25" W X 5.88" H
15,7cm L X 5,7cm W X 14,6cm H

Weight: 2 lbs. (0,9 kg.)

Enclosure: Cover - Die-Cast
Finish - Red Spatter Enamel
Base - Die Cast Zinc

All parts have corrosion resistant finishes.

Cover Tamper: Tamper resistant screws,
Optional cover tamper kit available.

Contact Ratings:
OSYSU-1: One set of SPDT (Form C)
OSYSU-2: Two sets of SPDT (Form C)
15.00 Amps at 125/250VAC
2.50 Amps at 30VDC resistive

Environmental Limitations:

- **NEMA 4 and NEMA 6P Enclosure (IP67) when used with appropriate watertight conduit fittings.**
- Indoor or Outdoor use (Not for use in hazardous locations. See bulletin no. 5400705 OSYS-U-EX for hazardous locations.)
- Temperature Range: -40°F to 140°F (-40°C to 60°C)

Conduit Entrances:
2 knockouts for 1/2" conduit provided

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

General Information

The OSYSU is used to monitor the open position of an OS&Y (outside screw and yoke) type gate valve. This device is available in two models; the OSYSU-1, containing one set of SPDT (Form C) contacts and the OSYSU-2, containing two sets of SPDT (Form C) contacts. These switches mount conveniently to most OS&Y valves ranging in size from 2" to 12" (50mm to 300mm). They will mount on some valves as small as 1/2" (12,5mm).

The cover is held in place by two tamper resistant screws that require a special tool to remove. The tool is furnished with each device and should be left with the building owner or responsible party. Replacement or additional cover screws and hex keys are available. See Ordering Information.

Optional Cover Tamper Switch

A field installable cover tamper switch is available as an option which may be used to indicate removal of the cover. See Ordering Information.

Testing

The OSYSU and its associated protective monitoring system should be inspected and tested in accordance with applicable NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

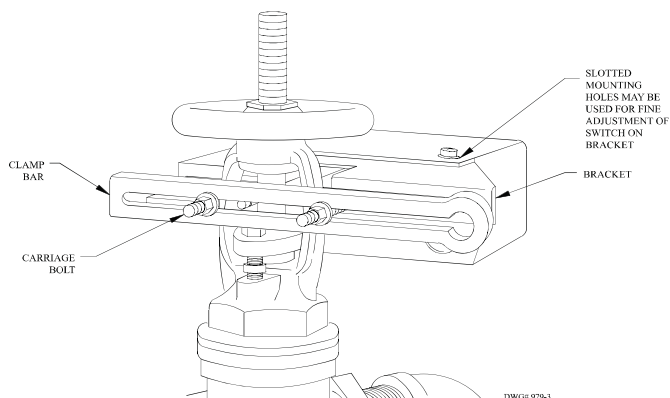
Ordering Information

Model	Description	Stock No.
OSYSU-1	Outside Screw & Yoke-Supervisory Switch (Single switch)	1010106
OSYSU-2	Outside Screw & Yoke-Supervisory Switch (Double switch)	1010206
--	Cover Screw	5490424
--	Hex Key for Cover Screws and Installation Adjustments	5250062
--	Optional Cover Tamper Switch Kit	0090131

For pressure reducer type valve installation kits (if required) contact valve manufacturer.

Fig. 1 Small Valve Installation ½" thru 2½"
(12,5mm thru 63,5mm) Sizes

These switches mount conveniently to most 2" to 12" OS&Y valves. They will mount on some valves as small as ½" (12,5mm). J-hooks may be required on valves with limited clearance.

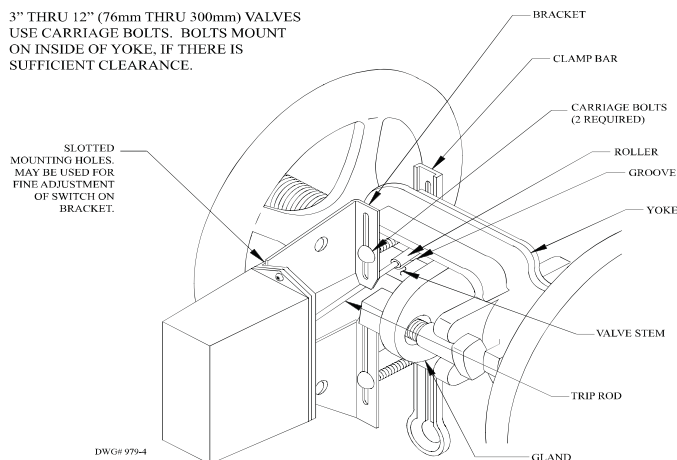


Small Valve Installation

1. Remove and discard "C" washer and roller from the trip rod.
2. With the valve in the FULL OPEN position, locate the OSYSU across the valve yoke as far as possible from the valve gland, so that the trip rod lays against the non-threaded portion of the valve stem.
3. Loosen the locking screw that holds the trip rod in place and adjust the rod length (see Fig. 4). When adjusted properly, the rod should extend past the valve screw, but not so far that it contacts the clamp bar. Tighten the locking screw to hold the trip rod in place.
Note: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the 1" (25mm) long notched section (see Fig. 5). Reinstall trip rod and repeat Step 3 procedure.
4. Mount the OSYSU loosely with the carriage bolts and clamp bar supplied. On valves with limited clearance use J-hooks supplied instead of the carriage bolts and clamp bar to mount the OSYSU.
5. Mark the valve stem at the center of the trip rod.
6. Remove the OSYSU. File a 1/8" (3,2mm) deep groove centered on the mark on the valve stem utilizing a 3/16" (4,8mm) round, non-tapered file. Round and smooth the edges of the groove to prevent damage to the valve packing and to allow the trip rod to move easily in and out of the groove as the valve is operated.
7. Mount the OSYSU with the trip rod centered in groove.
8. Final adjustment is made by loosening 2 screws (see Fig. 1) and sliding the OSYSU on the bracket. Adjustment is correct when switches are not activated with the trip rod seated in the valve stem groove and that the switches activate when the trip rod moves out of the groove.
9. Tighten the adjustment screws and all mounting hardware. Check to insure that the rod moves out of the groove easily and that the switches activate within one turn when the valve is operated from the FULL OPEN towards the CLOSED position.
Note: Close the valve fully to determine that the stem threads do not activate the switch. The switch being activated by the stem threads could result in a *false valve open* indication.

Fig. 2 Large Valve Installation 3" thru 12"
(76mm thru 300mm) Sizes

3" THRU 12" (76mm THRU 300mm) VALVES
USE CARRIAGE BOLTS. BOLTS MOUNT
ON INSIDE OF YOKE, IF THERE IS
SUFFICIENT CLEARANCE.



Large Valve Installation

1. With the valve in the FULL OPEN position, locate the OSYSU across the valve yoke as far as possible from the valve gland, so that the trip rod lays against the non-threaded portion of the valve stem.
2. Mount the OSYSU loosely with the carriage bolts and clamp bar supplied.
3. Loosen the locking screw that holds the trip rod in place and adjust the rod length (see Fig. 4). When adjusted properly, the rod should extend past the valve screw, but not so far that it contacts the clamp bar. Tighten the locking screw to hold the trip rod in place.
Note: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the one 1" (25mm) long notched section (see Fig. 5). Reinstall trip rod and repeat Step 3 procedure.
4. Mark the valve stem at the center of the trip rod.
5. Remove the OSYSU. File a 1/8" (3,2mm) deep groove centered on the mark of the valve stem utilizing a 3/8" (9,5mm) round, non-tapered file. Round and smooth the edges of the groove to prevent damage to the valve packing and to allow the trip rod to move easily in and out of the groove as the valve is operated.
6. Mount the OSYSU loosely with the trip rod centered in groove.
7. Final adjustment is made by loosening 2 screws (see Fig. 2) and sliding the OSYSU on the bracket. Adjustment is correct when switches are not activated with the trip rod seated in the valve stem groove and that the switches activate within one turn when the valve is operated from the FULL OPEN towards the CLOSED position.
8. Tighten the adjustment screws and mounting hardware. Check to insure that the rod moves out of the groove easily and that the switches activate within one turn when the valve is operated from the FULL OPEN towards the CLOSED position.
Note: close the valve fully to determine that the stem threads do not activate the switch. The switch being activated by the stem threads could result in a *false valve open* indication.

Fig. 3 Dimensions

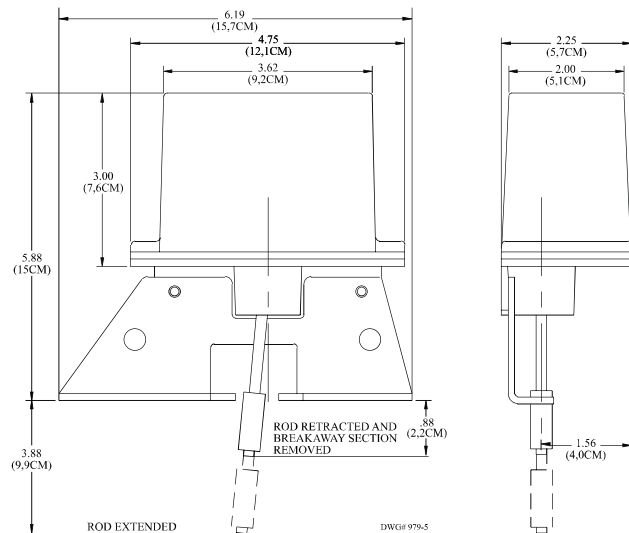


Fig. 4 Parts

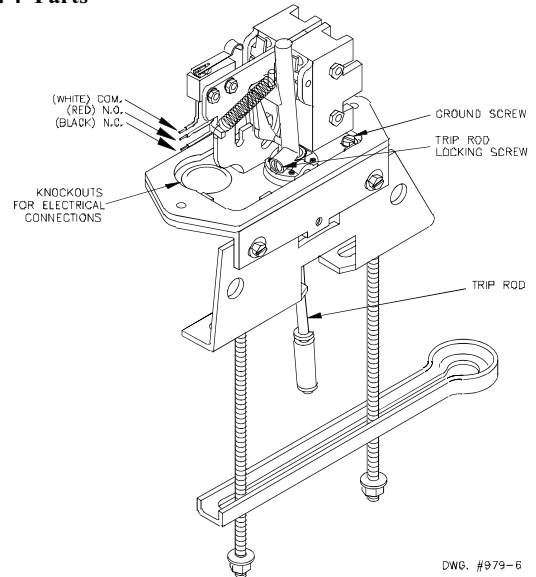
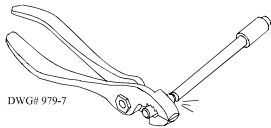
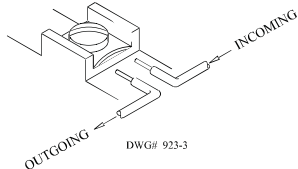


Fig. 5 Breaking Excessive Rod Length



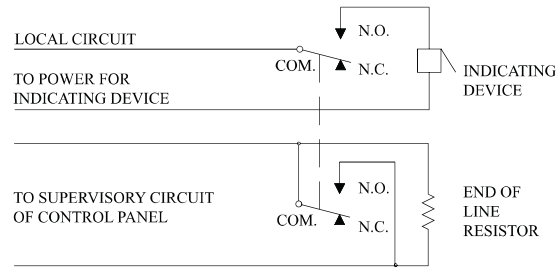
Switch Terminal Connections Clamping Plate Terminal



CAUTION

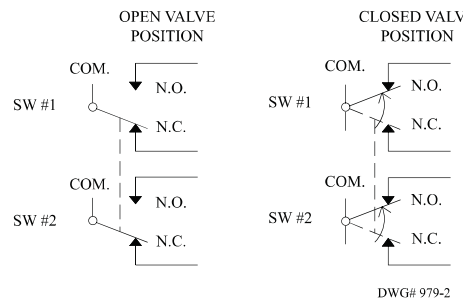
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal.

Typical Electrical Connections



Contacts shown in normal (valve open) condition.

Typical Switch Action





MODEL 1000



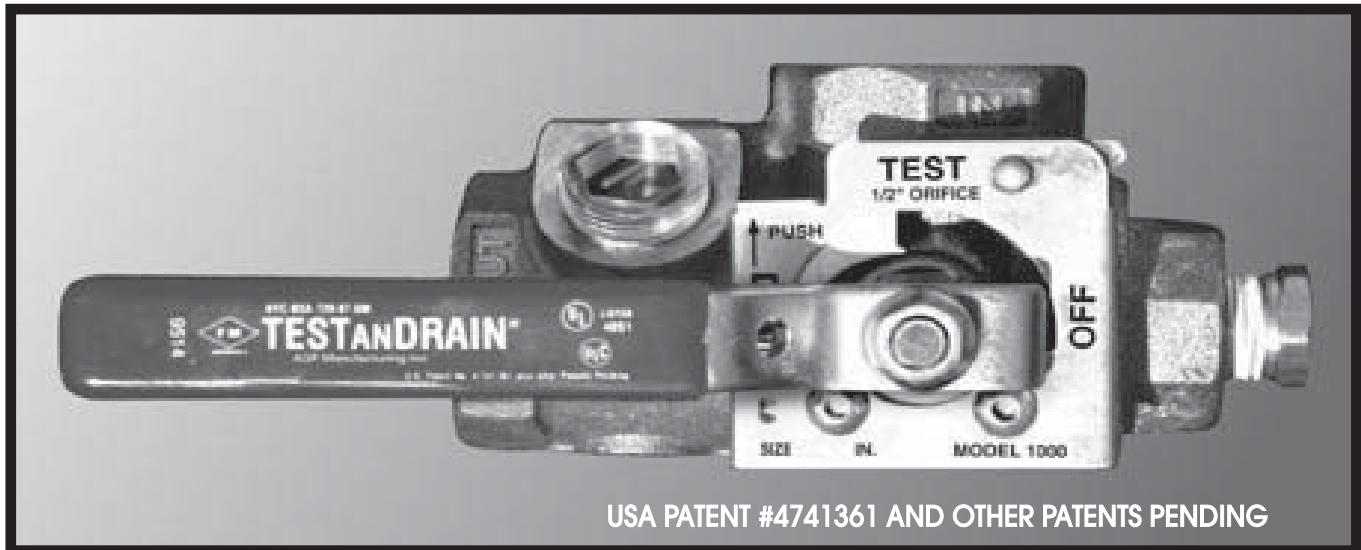
3/4"

1"

1 1/4"

1 1/2"

2"



USA PATENT #4741361 AND OTHER PATENTS PENDING

- ❑ The AGF Manufacturing Inc. **Model 1000 TESTANDRAIN** Provides Both The Test Function And The Express Drain Function For A Wet Fire Sprinkler System.
- ❑ The **Model 1000** Complies With All Requirements Of NFPA-13, NFPA-13R, And NFPA-13D.
- ❑ The **Model 1000 TESTANDRAIN** Is A Single Handle Ball Valve That Is Light Weight And Compact, Includes A Tamper Resistant Test Orifice, Integral Tamper Resistant Sight Glasses, And Is 300 PSI Rated.
- ❑ Available In A Full Range Of Sizes From 3/4" To 2" NPT & BSPT, With All Specifiable Orifice Sizes 3/8", 7/16", 1/2", 17/32", 5/8" (ELO), 3/4" (ESFR) and K.25.
- ❑ The Orifice Size Is Noted On The Indicator Plate And The Valve Is Tapped For A Pressure Gauge.
- ❑ The Standard **Model 1000 TESTANDRAIN** Valve Includes A Pressure Gauge Port Tapping And Can Be Ordered With A Relief Valve As A **Model 1011** Or **1011T**
- ❑ Locking Kit Available Which Provides Superior Vandal Resistance And Prevents Unintentional Alarm Activation.

Check Out Our New AutoCAD Site!
Visit us
on the Internet
at

www.testandrain.com



MODEL 1000

300 PSI



TEST AND DRAIN®

3/4"

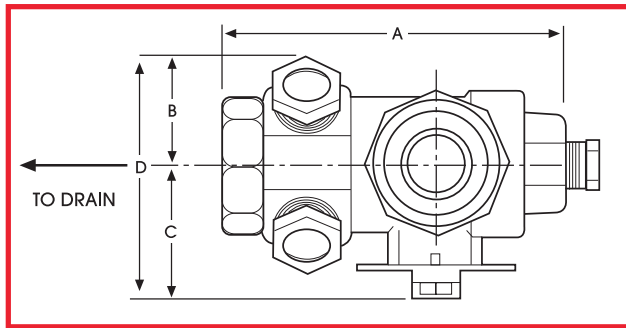
1"

1 1/4"

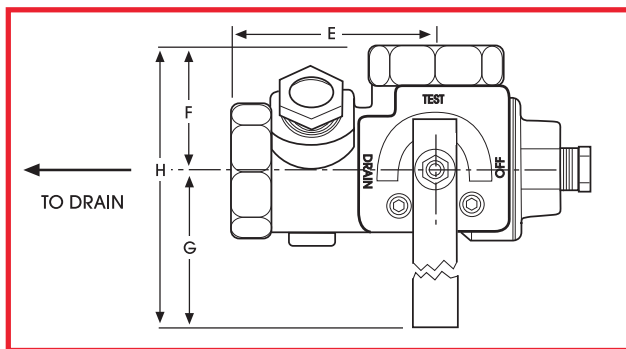
1 1/2"

2"

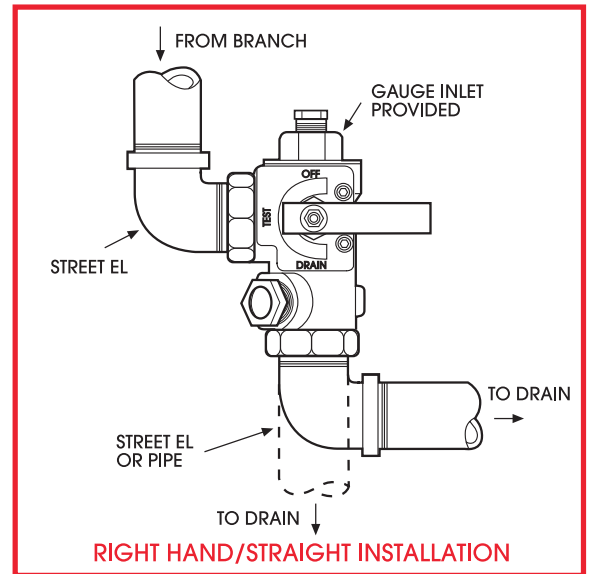
PLAN VIEW



FRONT VIEW/HORIZONTAL INSTALLATION



FRONT VIEW/VERTICAL INSTALLATION



APPROVALS:

- ☐ UL and ULC Listed
- ☐ FM Approved except 3/4"
- ☐ NYC-BSA NO. 720-87-SM
- ☐ CA. State Fire Marshall

ORIFICE SIZE

AVAILABLE – 3/8", 17/16", 1/2", 17/32", ELO(5/8"), ESFR(3/4")* and K.25

*Available on 1 1/2" to 2" size units only.

DIMENSIONS – INCHES

SIZE	A	B	C	D	E	F	G	H
3/4" **	5 1/16" 128mm	1 1/2" 37.58mm	2 3/16" 55.65mm	3 5/8" 93.23mm	3 3/8" 85.88mm	1 13/16" 45.30mm	4 9/16" 117.12mm	6 3/8" 162.42mm
1"	5 1/16" 128mm	1 1/2" 37.58mm	2 3/16" 55.65mm	3 5/8" 93.23mm	3 3/8" 85.88mm	1 13/16" 45.30mm	4 9/16" 117.12mm	6 3/8" 162.42mm
1 1/4"	5 7/16" 137.70mm	1 11/16" 42.70mm	2 9/16" 65.36mm	4 1/4" 108.36mm	3 5/16" 82.84mm	1 15/16" 50.89mm	5 9/16" 141.39mm	5 1/2" 192.28mm
1 1/2"	6 7/16" 163.38mm	1 13/16" 45.50mm	3 1/4" 81.50mm	5 1/16" 127mm	3 7/8" 99.18mm	2 5/8" 66.97mm	8 1/4" 206.63mm	10 7/8" 273.60mm
2"	6 7/16" 163.38mm	1 13/16" 45.50mm	3 1/4" 81.50mm	5 1/16" 127mm	3 7/8" 99.18mm	2 5/8" 66.97mm	8 1/4" 206.63mm	10 7/8" 273.60mm

**3/4" Valve UL listed only.

MATERIAL LIST

PART:

HANDLE
STEM
BALL
BODY
SIGHT GLASS
VALVE SEAT
INDICATOR PLATE
HANDLE LOCK

MATERIAL:

STEEL
ROD BRASS
C.P. BRONZE
BRONZE
LEXAN®
IMPREGNATED TEFLON
STEEL
SPRING STEEL

USA PATENT AND OTHER PATENTS PENDING



AGF Manufacturing Inc.
100 Quaker Lane, Malvern, PA 19355

T: (610) 240-4900 / F: (610) 240-4906
Email: info@testandrain.com
Web: www.testandrain.com

**Reliability, Versatility, Code Compatibility**

JOB NAME: _____

ARCHITECT: _____

ENGINEER: _____

CONTRACTOR: _____

UL LISTING EX4019

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3/02



HOSE VALVES



ANGLE

FEMALE X MALE

REGULARLY FURNISHED: Cast brass valve with red hand wheel. Female N.P.T. inlet X male hose thread outlet. 300 lb. rated

- Fig.**
☐ 4060 1½" Size
☐ 4065 2½" Size

OPTIONAL FINISHES:

- ☐ - B Polished Brass
☐ - C Rough Chrome Plated
☐ - D Polished Chrome Plated

THREADS:

- ☐ N.S.T.
☐ Other _____

VARIATIONS: Extended stem up to 24", SPECIFY length
 ⅛" petcock SPECIFY location

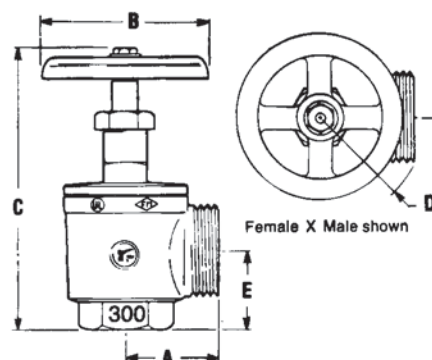
✓	Size	A	B	Closed C	Open C	D	E
	1½	2¼	3½	6½	7½	2½	2
	2½	3½	5	9½	11½	3½	2¾

ALL DIMENSIONS IN INCHES

DOUBLE FEMALE

REGULARLY FURNISHED: Cast brass valve with red hand wheel. Female N.P.T. inlet and outlet. 300 lb. rated

- Fig.**
☐ 4070 1½" Size
☐ 4075 2½" Size



ADJUSTABLE PRESSURE RESTRICTING ANGLE VALVE

FEMALE X MALE

REGULARLY FURNISHED: Cast brass valve with red hand wheel with pressure restricting feature. Female N.P.T. inlet X male hose thread outlet. 175 lb. rated. Furnished with field setting chart.

- Fig.**
☐ 4080 1½" Size
☐ 4085 2½" Size

OPTIONAL FINISHES:

- ☐ - B Polished Brass
☐ - C Rough Chrome Plated
☐ - D Polished Chrome Plated

THREADS:

- ☐ N.S.T.
☐ Other _____

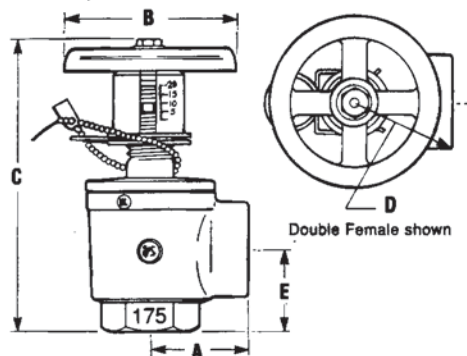
✓	Size	A	B	Closed C	Open C	D	E
	1½	2¼	3½	6½	7½	2½	2
	2½	3½	5	9½	11½	3½	2¾

ALL DIMENSIONS IN INCHES

DOUBLE FEMALE

REGULARLY FURNISHED: Cast brass valve with red hand wheel with pressure restricting feature. Female N.P.T. inlet and outlet. 175 lb. rated. Furnished with field setting chart.

- Fig.**
☐ 4090 1½" Size
☐ 4095 2½" Size



CAST BRASS CAP WITH CHAIN.

- Fig.**
☐ 4615 1½"
☐ 4625 2½"
Threads: ☐ N.S.T. ☐ Other _____

CAP VARIATION:
☐ With Rocker Lugs



CAST BRASS FLANGE WITH SET SCREW.

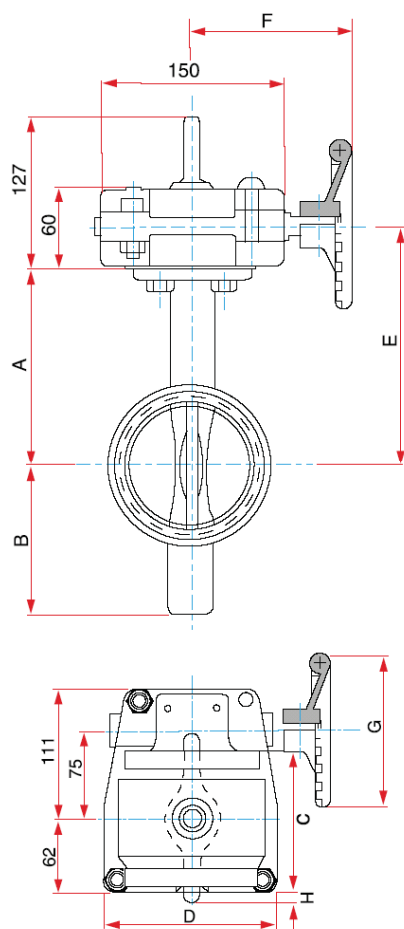
- Fig.**
☐ 4711 1½" 3"
☐ 4712 2½" 6¼"

DATE
 1-25-90

OPTIONAL FINISHES: ☐ - B Polished Brass
☐ - C Rough Chrome Plated ☐ - D Polished Chrome Plated

FIGURE NUMBER

4060-4095



Materials List

COMPONENT	MATERIAL
Body	Ductile ASTM A536 Nylon Coated
Disc	Ductile Iron ASTM A536 EPDM Encapsulated
Stems	Stainless Steel AISI 420
Worm Gear Shaft	Stainless Steel AISI 420
Gear Housing	Ductile Iron ASTM A 536 65-45-12
Handwheel	Ductile Iron ASTM A 536 65-45-12
Flag Indicator	Ductile Iron ASTM A 536 65-45-12
Segment Gear	Bronze ASTM B-148 or ASTM B584
Gaskets and "O" rings	EPDM Grade"E"

General Dimensions

Size	A	B	C	D	E	F	G	H
inch mm	inch mm	inch mm	inch mm	inch mm	inch mm	inch mm	inch mm	inch mm
2½" 65	4.10 105	3.30 85	3.70 94.6	2.90 73.0	5.30 135	5.30 135	4.90 125	
3" 80	4.40 112	3.60 92	3.80 96.4	3.50 88.9	5.60 142	5.30 135	4.90 125	
4" 100	5.70 145	4.30 108	4.50 115.4	4.60 116.2	6.90 175	5.30 135	4.90 125	
6" 150	7.10 180	5.70 145	2.20 133.4	6.60 168.3	8.30 210	7.60 193	8.90 225	0.40 11.2
8" 200	8.00 204	6.70 170	5.80 147.7	8.60 291.1	9.10 232	7.60 193	8.90 225	0.90 24.0

Notes:

Design and materials are subject to change without notice.

Fivalco Firefly™ BT

Bronze Butterfly Valves, UL, ULC Listed / FM Approved
Firefly™ BT Threaded End, Sizes : 1", 1-1/4", 1-1/2", 2" and 2-1/2"

SPECIFICATIONS

Working Pressure : 175 PSI (12.5 Bars)
Max. Test Pressure : 350 PSI (25.0 Bars)
Max. Working Temp. : 250°F (120°C)

Factory Installed UL Listed Double Tamper
Switch For Indoor and Outdoor Use.

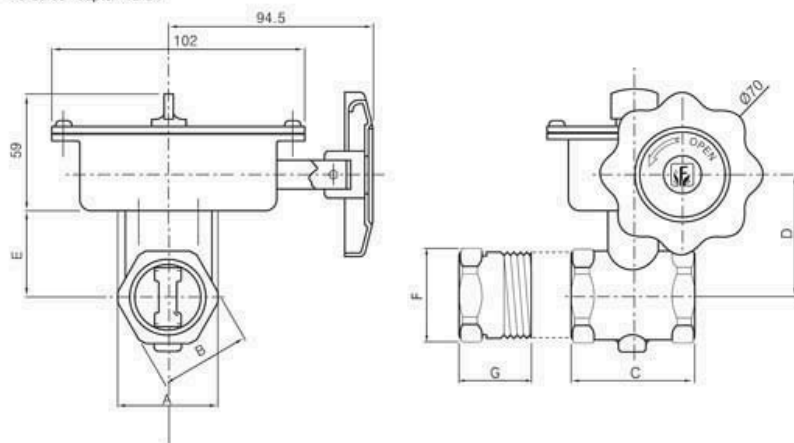
MATERIALS OF PRIMARY COMPONENTS

Body : ASTM B-505
Disc : ASTM B-584 EPDM
Encapsulated
Upper Stem : ASTM A-564 Type XM 12
Lower Stem : ASTM A-564 Type XM 12
Gear Housing, Cover : ASTM A-619
Hand Wheel : ASTM A-619
Flag Indicator : ASTM B-16
York Mechanism : ASTM A-283
Stem Bushing : ASTM B-16
Conduit Connector : ASTM A-307
O-Rings (All) : EPDM Grade "E"
Cover Gasket : NBR



DIMENSION				UNIT: IN (mm)			
SIZE	A	B	C	D	E	F	G
• 1"	1.75(43.7)	1.56(39.7)	2.16(54)	2.08(52)	1.48(52)	43	34
• 1 1/4"	2.16(54)	1.96(49)	2.68(67)	2.24(56)	1.64(41)	47	42.7
• 1 1/2"	2.4(60)	2.24(70)	2.92(73)	2.36(59)	2.45(61.3)	50	48.6
2"	3.04(76)	2.8(70)	3.3(82.4)	2.56(64)	1.96(49)	-	-
2 1/2"	3.6(90)	3.36(84)	4.16(104)	2.78(69.5)	2.18(54.5)	-	-

• Grooved Adapter Available



Firefly™ is the Registered TradeMark of Fivalco Inc.





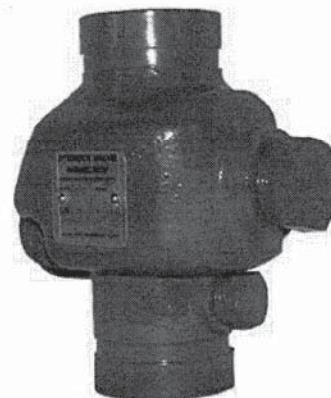
SWING CHECK VALVE MODEL RCV STANDARD & "SHOTGUN" GROOVE/GROOVE 2", 2 1/2", 3" 4" & 6" SIZES

DESCRIPTION AND OPERATION

Globe Model RCV Swing Check Valves feature a swing type clapper designed for use in fire sprinkler or other types of water piping systems that incorporate grooved connecting pipe ends. They are effectively used when it is necessary to permit water flow in one direction only, preventing flow in the reverse direction (non-return). Because the RCV incorporates a spring-loaded clapper assembly, it may be installed in either the vertical or horizontal position. Most commonly, it is used with various configurations of fire department connections for fire sprinkler systems, by-pass connections, gravity pressure tank and, pump discharge in connections from public water supplies to automatic sprinkler systems, etc.

As an alternative to using an alarm check valve with a wet sprinkler system, an RCV Swing Check Valve may be used in a "Shotgun" arrangement whereby the valve is trimmed in a similar manner but utilizes an electric water flow switch and alarm bell instead of a water motor gong for fire notification.

The body of the Globe RCV Swing Check Valve is constructed of high tensile strength cast iron having considerable ductility to reduce damage in field handling. It meets the ASTM A126 Class B rating. The RCV clapper assembly is made of stainless steel and has an E.P.D.M. rubber facing. The RCV incorporates a special stainless steel spring assembly which allows its use in the downward flow direction. It effectively provides a leak tight seal against back pressures greater than one (1) psi.



**MODEL RCV
SWING CHECK VALVE**

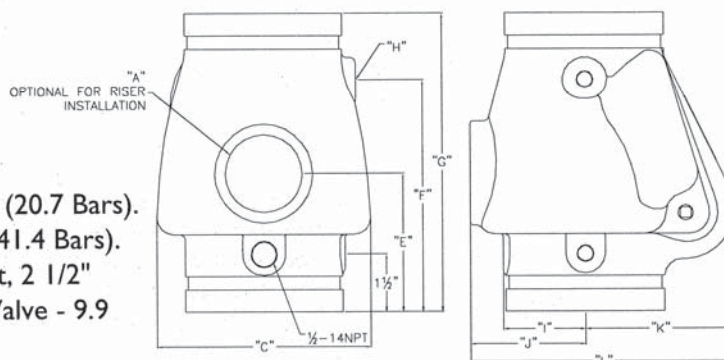
APPROVALS

- cULus Listed
- FM Approved
- NYC - DOB MEA 305-05-E

TECHNICAL DATA

- Water Working Pressure Rating - 300 psi (20.7 Bars).
- Factory tested hydrostatically to 600 psi (41.4 Bars).
- Equivalent feet of pipe: 2" Valve = 7.2 feet, 2 1/2" Valve = 7.2 feet, 3" Valve = 7.2 feet, 4" Valve - 9.9 feet, 6" Valve = 16.1 feet.

PHYSICAL DIMENSIONS



SIZE	A	C	E	F	G	H	I	J	K	L	WEIGHT (lbs.) no trim
2"	1"	4"	3 1/2"	4 1/2"	6 1/2"	1/4"	1 1/2"	2 1/4"	2 1/2"	4 3/4"	4.5
2 1/2"	1 1/4"	4 1/2"	4"	5"	7"	1/4"	1 1/2"	2 1/2"	2 3/4"	5 1/2"	8
3"	1 1/4"	5"	4 1/2"	6"	7 3/4"	1/4"	2"	3"	3 3/4"	6 3/4"	12
4"	2"	6 1/4"	4"	6 1/2"	8 1/2"	1/4"	2 1/2"	3 1/2"	4 1/4"	7 1/2"	17.5
6"	2"	8"	5"	8"	10 1/2"	1/4"	3 1/4"	4 1/4"	5 1/2"	10"	40.5

4077 AIRPARK DRIVE, STANDISH, MICHIGAN 48658

989-846-4583 • FAX 989-846-9231

OCTOBER 2005

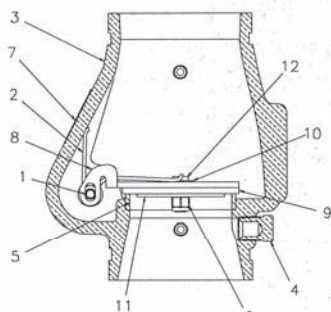
J-10

BULLETIN RCV REV. #1

SWING CHECK VALVE - 2", 2 1/2", 3" 4" & 6"

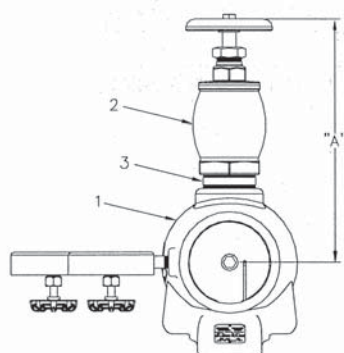
MODEL RCV - STANDARD & "SHOTGUN"

GROOVE/GROOVE



CROSS SECTION

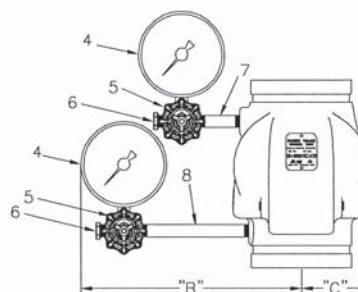
ITEM	DESCRIPTION	MATERIAL	2" P/N	2 1/2" P/N	3" P/N	4" P/N	6" P/N
1	Hinge Pin	Stainless Steel	321521	321528	321535	321541	321549
2	Torsion Spring	Stainless Steel	321523	321531	321531	321545	321554
3	Machined Body	Cast Iron	321501	321503	321505	321507	321509
4	1/2" NPT Plug	Cast Iron	311003	311003	311003	311003	311003
5	Seat Ring	Brass	321516	321530	321537	321543	321551
6	Locknut	Stainless Steel	321556	321556	321556	321556	321556
7	Nameplate	Aluminum	321558	321558	321558	321558	321558
8	Clapper	Stainless Steel	321515	321527	321534	321540	321548
9	Clapper Facing Disc	EPDM	321516	321529	321536	321542	321550
10	Sealing Washer	Hard Fiber	321518	321518	321518	321518	321518
11	Disc Retainer	Stainless Steel	321517	321517	321517	321544	321544
12	Hex Head Bolt	Stainless Steel	321519	321519	321555	321555	321559



TOP VIEW

"SHOTGUN" TRIM ARRANGEMENT

SIZE	A	B	C
2"	10"	8 3/4"	2 1/4"
2 1/2"	11"	9 1/4"	2 1/4"
3"	12"	9 1/2"	2 1/2"
4"	13 1/2"	10"	3 1/4"
6"	14 1/4"	10 3/4"	4"



FRONT VIEW

ITEM	DESCRIPTION	2"	2 1/2"	3"	4"	6"	QTY.
1	RCV	321526	321533	321539	321547	321557	1
2	Angle Valve	311614 (1")	311615 (1 1/4")	311615 (1 1/4")	311617 (2")	311617 (2")	1
3	Close Nipple	310500 (1")	310600 (1 1/4")	310600 (1 1/4")	310800 (2")	310800 (2")	1
4	1/4" Water Gauge	300119	300119	300119	300119	300119	2
5	1/4" 3 Way Valve	311683	311683	311683	311683	311683	2
6	1/4" Plug	311001	311001	311001	311001	311001	2
7	1/4" Nipple	311101 (1 1/2")	311102 (2")	310102 (2")	310103 (2 1/2")	310103 (2 1/2")	1
8	1/4" x 5 1/2" Nipple	310109	310109	310109	310109	310109	1

ORDERING INFORMATION

SPECIFY

- Quantity • Model Number
- Standard or Shotgun style.



GLOBE® PRODUCT WARRANTY

Globe agrees to repair or replace any of its own manufactured products found to be defective in material or workmanship for a period of one year from date of shipment.

For specific details of our warranty please refer to Price List Terms and Conditions of Sale (Our Price List).

4077 AIRPARK DRIVE, STANDISH, MICHIGAN 48658

989-846-4583

FAX 989-846-9231

Appendix F – Fire Sprinkler Inspection, Test, and Maintenance

Summary of Inspection, Testing, and Maintenance Intervals

Inspections:	
Automatic Wet-Pipe Systems	Annually
Manual Wet Standpipe - Class 1	Annually
Control Valves:	
Sealed	Weekly
Locked	Monthly
Tamper Switches	Monthly
Interior	5 Years
System Relief Valves	Annually
Waterflow Switches	Quarterly
Tamper Switches	Quarterly
Elevator Supervisory Switches	Quarterly
Gauges	Monthly
Hydraulic Nameplates	Quarterly
Hangers / Seismic Bracing / Restraint	Annually
Pipe and Fittings	Annually
Sprinklers	Annually
Spare Sprinklers and Wrenches (List)	Annually
Fire Department Connections	Quarterly
Hose Connections	Annually
Hydrants	Annually
Backflow Cross-Connection	Annually
Obstructions	5 Years

Tests:	
Waterflow Switches (Vane-Type)	Semi-Annual
Tamper Switches	Semi-Annual
Elevator Supervisory Switches	Semi-Annual
Main Drain	Annually
Hydrostatic Test (Standpipe)	5 Years
Flow Test (Standpipe)	5 Years
Flow Test (Hydrants)	1 Year
Flow Test (Exposed/Underground Piping)	5 Years
Forward Flow Backflow Test	Annually
Control Valves:	
Position	Annually
Operation	Annually
System Relief Valves	5 Years
Gauges	5 Years
Sprinklers (Quick-Response)	20 Years and Every 10 Years Thereafter

Maintenance:	
Valves (All Types)	Annually or As Needed
Hose Connections	Annually
Hydrants	Annually
Obstruction Investigation	5 Years or As Needed

Appendix G – Fire Alarm Drawings

SCOPE OF WORK

PROVIDE A COMPLETE, ELECTRICALLY SUPERVISED, ADDRESSABLE INTELLIGENT, MANUAL AND AUTOMATIC, ANNUNCIATED FIRE ALARM AND DETECTION SYSTEM THROUGHOUT THE FACILITY. THE SYSTEM SHALL BE A VOICE EVACUATION TYPE SYSTEM AND SHALL ALSO SERVE AS THE BUILDING MASS NOTIFICATION SYSTEM. ALL NOTIFICATION APPLIANCE CIRCUITS SHALL BE CLASS A AND SIGNALING LINE CIRCUITS SHALL BE CLASS A PER RFP.

THE SYSTEM WILL CONSIST OF MANUAL PULL STATION, AUDIO/VISUAL DEVICES, SMOKE DETECTORS AS REQUIRED, ELECTRONIC SUPERVISION OF ALL SPRINKLER SYSTEM ALARM AND SUPERVISORY DEVICES.

EACH BUILDING WILL HAVE ONE LOC INSTALLED AT THE FOLLOW LOCATIONS: THE MAIN ENTRANCE OF THE DINING FACILITY, THE DUTY DESK LOCATED ON THE 1st FLOOR LOBBY OF EACH BEQ AND AT THE DUTY DESK IN EACH COMMON BUILDING.

THE FIRE ALARM WILL BE COMPATIBLE WITH THE EXISTING WAVES BASE-WIDE MNS SYSTEM MANUFACTURED BY MADAHCOM. SUFFICIENT SPACE WILL BE PROVIDED NEXT TO THE FIRE ALARM CONTROL PANEL FOR GOVERNMENT PROVIDED AND INSTALLED MASS NOTIFICATION TRANSCEIVER PANEL.

FIRE MARSHAL REQUIRED NOTES

1. THE INSTALLATION OF THE FIRE ALARM SYSTEM SHALL COMPLY WITH UFC 4-021-01 9-APRIL 2008, UFC 3-600-10N AUG. 2007, UFC 4-730-10 FEB 2009, UFC 3-600-01 14, JULY 2009, AND NFPA 72, 2010 EDITION NFPA 70 2011.
2. THE AUDIBILITY OF FIRE ALARM WARNING DEVICES SHALL BE AUDIBLE THROUGH THE OCCUPANCY WITH A MINIMAL SOUND LEVEL OF 15 dB'S OVER THE AVERAGE AMBIENT NOISE LEVEL AND 5dB OVER THE MAXIMUM NOISE LEVEL EXCEEDING 60 SECONDS. INTELLIGIBILITY OF THE SYSTEM SHALL COMPLY WITH UFC. 4-021-01 SECTION 6-5.3.1. SPEAKERS HAVE A TAB SETTING THAT MAY BE FIELD ADJUSTED TO INCREASE INTELLIGIBILITY.
3. ALL CONDUIT SIZES SHALL BE IN ACCORDANCE WITH NEC 2008 EDITION.
4. UPON COMPLETION OF THE INSTALLATION OF THE FIRE ALARM SYSTEM, A SATISFACTORY TEST OF THE ENTIRE SYSTEM SHALL BE PERFORMED IN THE PRESENCE OF THE ENFORCING AGENCY.
5. ALL CONDUIT PENETRATIONS THROUGH FIRE RATED PARTITIONS SHALL PREVENT THE PASSAGE OF HEAT, SMOKE AND FIRE GASES. ALL PENETRATIONS SHALL COMPLY WITH U.L. ASSEMBLY LISTINGS AS REQUIRED.
6. A "FIRE ALARM CONTROL PANEL INSIDE" SIGN SHALL BE PLACED ON THE DOOR TO THE TELECOM ROOM HOUSING THE FIRE ALARM CONTROL PANEL. SIGN WILL BE PROVIDED AND INSTALLED BY OTHERS.
7. ALL COMPONENTS OF THE FIRE ALARM/MASS NOTIFICATION SYSTEM REQUIRING A KEY SHALL USE THE CAT 15 KEY.
8. BATTERIES WILL BE MARKED WITH DATE OF MANUFACTURE USING MONTH/YEAR FORMAT IN ACCORDANCE WITH NFPA 72 SECTION 10.5.9.1.2.
9. WHEN AN ALARM SIGNAL DEACTIVATION MEANS IS ACTUATED, BOTH AUDIBLE AND VISIBLE NOTIFICATION APPLIANCES SHALL BE SIMULTANEOUSLY DEACTIVATED.

INSTALLATION NOTES

1. ALL TERMINATIONS MUST BE AT A TERMINAL STRIP.
2. ALL CONDUCTOR TERMINATIONS SHALL BE LABELED.
3. ALL DEVICES MUST HAVE SCREW TERMINALS.
4. PULL ALL CONDUCTORS SPLICE FREE. WHERE SPLICES ARE UNAVOIDABLE PROVIDE INSULATED BARRIER TYPE TERMINAL STRIPS AT JUNCTION POINTS. THE USE OF WIRE NUTS, CRIMPED CONNECTORS OR TWISTING OF CONDUCTORS IS PROHIBITED.
5. RUN ALL WIRING TO CONTROL PANELS IN THE VERTICAL OR HORIZONTAL PLANE, MAKE ALL TURNS AT 90 DEGREE ANGLES, AND TIGHTLY BUNDLE AND WRAP ALL WIRE.
6. IDENTIFY ALL CONDUCTORS INDIVIDUALLY WITH PERMANENT MARKINGS.
7. INSTALL ALL WIRING IN METALLIC CONDUIT.
8. ALL CONDUIT SHALL BE A MINIMUM OF 3/4" IN DIAMETER.
9. ALL WIRING MUST BE SOLID COPPER, EXCEPT FOR SPEAKER CIRCUITS OR CIRCUITS REQUIRING SHIELDING.
10. ALL SIGNALING LINE AND INITIATING DEVICE CIRCUITS MUST BE A MINIMUM 16 GAUGE WIRE.
11. PAINT ALL FIRE ALARM JUNCTION BOXES AND COVERS RED IN UNFINISHED AREAS (i.e., ABOVE CEILINGS, MECHANICAL ROOMS, ETC). IN FINISHED AREAS, CONDUIT AND JUNCTION BOXES CAN BE PAINTED TO MATCH ROOM FINISH, THE INSIDE COVER OF THE JUNCTION BOX MUST BE IDENTIFIED AS "FIRE ALARM" AND THE CONDUIT MUST HAVE PAINTED RED BANDS 3/4 INCH (20 MM) WIDE AT 10 FOOT (3.0M) CENTERS AND AT EACH SIDE OF A FLOOR, WALL OR CEILING PENETRATION.

CABLE LEGEND

DESIGN.	DESCRIPTION	CABLE TYPE	CONDUCTOR TYPE	COLOR
B	AUDIO APPLIANCE CIRCUIT	16/2 FPLR	SOLID	BLK/RED IN RED JACKET
BU	UNDERGROUND AUDIO APPLIANCE CIRCUIT	F5240F1 (16AWG FPL)	STRANDED	BLK/RED IN BLK JACKET
C	COMMUNICATION	(2) 16/2 FPLR	SOLID	BLK/RED IN RED JACKET
CU	UNDERGROUND COMMUNICATION	F5240F1 (16AWG FPL)	STRANDED	BLK/RED IN BLK JACKET
D	SIGNALING LINE CIRCUIT	16/2 FPLR	SOLID	BLK/RED IN RED JACKET
DU	UNDERGROUND SIGNALING LINE CIRCUIT	F5240F1 (16AWG FPL)	STRANDED	BLK/RED IN BLK JACKET
P	24VDC POWER CABLE	(2) #14 AWG THHN	SOLID	BLK/RED
PU	UNDERGROUND 24VDC POWER CABLE	(2) #14 AWG THWN	SOLID	BLK/RED
V	VISUAL APPLIANCE CIRCUIT	(2) #12 AWG THHN	SOLID	ORG/BRN
VU	UNDERGROUND VISUAL APPLIANCE CIRCUIT	(2) #12 AWG THWN	SOLID	ORG/BRN

FIRE ALARM SYMBOL LEGEND

P-116 QTY	P-163 QTY	P-170 QTY	P-114 QTY	SYMBOL	DEVICE DESCRIPTION	MODEL NUMBER	MANUFACTURE
1	1	1	1		FIRE ALARM/MASS NOTIFICATION CONTROL PANEL WITH BUILT-IN DACT MODULE	EST3 3-CAB14B 3-MODCOM	EST
1	1	1	-		REMOTE FIRE ALARM CONTROL PANEL	EST3 RCC7	EST
2	2	2	1		LOCAL OPERATING CONSOLE	3-ANNCPU3 3-REMIC	EST
7	7	7	2		REMOTE BOOSTER POWER SUPPLY	BPS6A	EST
6	6	6	1		AUXILIARY POWER SUPPLY WITH REMOTE AUDIO AMPLIFIERS	APS6A SIGA-AA30	EST
44	58	46	8		ADDRESSABLE MANUAL PULL STATION	SIGA-278	EST
6	-	6	-		WEATHERPROOF MANUAL PULL STATION WITH ADDRESSABLE MONITORING MODULE	MPSR1-SHTW-EDWARDS SIGA-CT1	EST
18	16	17	1		ADDRESSABLE PHOTOELECTRIC SMOKE DETECTOR	SIGA-PS	EST
192	192	192	-		ADDRESSABLE PHOTOELECTRIC SMOKE DETECTOR WITH SOUNDER BASE	SIGA-PS SIGA-AB4G	EST
10	8	10	3		ADDRESSABLE DUCT SMOKE DETECTOR WITH REMOTE TEST STATION	SIGA-DH SIGA-PS SIGA-DTS	EST
2	2	2	9		ADDRESSABLE MONITORING MODULE	SIGA-CT1	EST
11	11	11	1		ADDRESSABLE DUAL MONITORING MODULE	SIGA-CT2	EST
10	10	10	1		ADDRESSABLE CONTROL RELAY	SIGA-CR	EST
2	2	2	-		ADDRESSABLE SIGNALING MODULE	SIGA-CC2A	EST
4	4	4	-		MULTI-VOLTAGE RELAY	PAM-1	EST
197	196	198	2		CEILING MOUNTED SPEAKER	GCWA-S7	EST
95	85	91	37		CEILING MOUNTED MULTI-CANDELA SPEAKER STROBE (#cd DENOTES CANDELA RATING)	GCWA-S7VMC	EST
6	6	7	4		WALL MOUNTED MULTI-CANDELA SPEAKER STROBE (#cd DENOTES CANDELA RATING)	G4WA-S7VMC	EST
2	1	2	2		WALL MOUNTED SPEAKER	G4WA-S7	EST
6	-	6	-		WALL MOUNTED WEATHERPROOF 15cd SPEAKER STROBE	757-5A-SS70W 757-WB	EST
30	35	29	10		WALL MOUNTED WEATHERPROOF SPEAKER	757-1A-S70W 757-WB	EST
2	2	2	-		CEILING MOUNTED STROBE	GCWA-VMC	EST
2	2	2	-		CEILING MOUNTED HIGH INTENSITY STROBE	GCWA-VMHC	EST
13	12	13	1		FIRE ALARM TERMINAL CABINET	BY OTHERS	BY OTHERS
1	1	1	1		FUTURE MASS NOTIFICATION TRANSCEIVER	BY OTHERS	BY OTHERS
-	-	-	1		FIRE ALARM PULL BOX	BY OTHERS	BY OTHERS

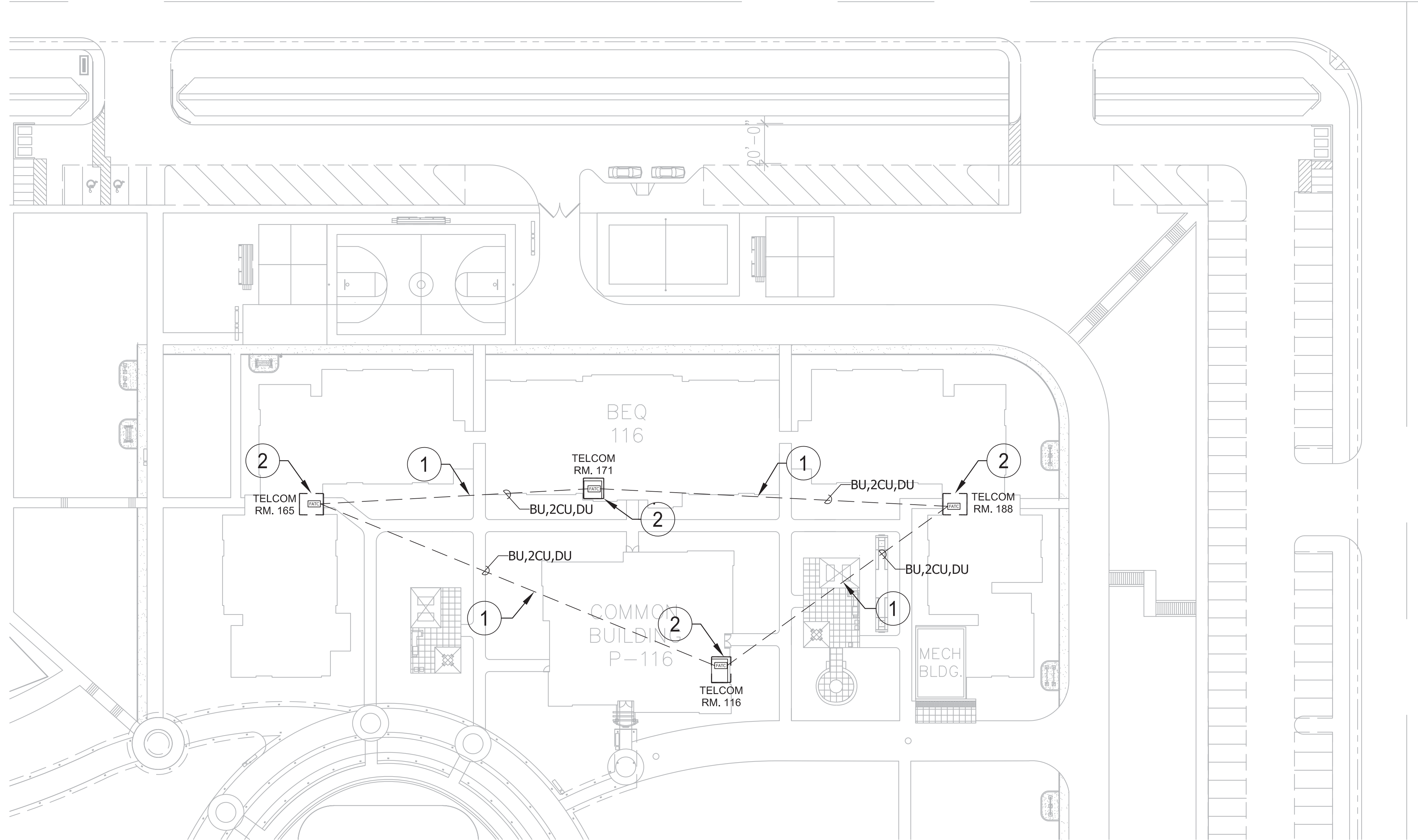
MASS NOTIFICATION SYSTEM NOTES

1. THE FIRE ALARM/MASS NOTIFICATION SYSTEM SHALL BE COMPATIBLE WITH THE EXISTING WAVES BASE-WIDE MNS SYSTEM MANUFACTURED BY MADAHCOM/COOPER INDUSTRIES.
2. A 18"x16"x10" NEMA 4X ENCLOSURE, FOR THE GOVERNMENT PROVIDED AND INSTALLED MNS TRANSCEIVER PANEL (COOPER NOTIFICATION TRX-401), SHALL BE INSTALLED WITHIN 15' OF THE FIRE ALARM/MASS NOTIFICATION CONTROL PANEL.
3. A MINIMUM 1-1/2" CONDUIT WITH LMR 400 CABLE FROM THE TRANCEIVER ENCLOSURE TO 4 FEET ABOVE THE ROOF-LINE WITH A ROOF MOUNTED WEATHER-HEAD MUST BE PROVIDED FOR THE FUTURE ANTENNA INSTALLATION. A MINIMUM OF 6 FEET OF LMR 400 CABLE MUST BE COILED AT EACH END FOR THE FUTURE ANTENNA INSTALLATION. THE MAXIMUM DISTANCE FROM THE TRANSCEIVER ENCLOSURE TO THE WEATHER-HEAD IS 200 FEET.
4. DEDICATED 110 VAC POWER TERMINATED TO A 20 AMP BREAKER MUST BE PROVIDED TO THE LOWER RIGHT AREA OF THE MNS TRANSCEIVER ENCLOSURE BY THE ELECTRICAL CONTRACTOR.
5. CONDUITS MUST ALSO BE PROVIDED FROM THE FIRE ALARM/MASS NOTIFICATION CONTROL PANEL TO THE TRANSCEIVER ENCLOSURE FOR FUTURE PANEL INTERCONNECTIONS.
6. A SEPARATE JUNCTION BOX CONTAINING A TERMINAL STRIP, WITH A MINIMUM OF FOUR CONTACTS, FOR THE FUTURE MNS TRANSCEIVER SHALL BE PROVIDED.
7. THE AUDIO INPUT AND NORMALLY OPEN RELAY CONNECTIONS SHALL BE FULLY PROGRAMMED AS A SECOND MICROPHONE ONE-WAY INPUT.
8. COMPONENTS PROVIDED IN THE FIRE ALARM/MASS NOTIFICATION CONTROL PANEL FOR THE FUTURE TRANSCEIVER CONNECTION SHALL BE CLEARLY LABELED.
9. ACTIVATION OF THE MNS, WHETHER BY PUSH BUTTON OR MICROPHONE, SHALL ACTIVATE THE STROBES THROUGHOUT THE FACILITY.
10. ELECTRICAL CONTRACTOR SHALL PROVIDE TWO 4"x4"x4" EMT BOXES WITH (DECORATIVE) COVERS WITHIN 150' OF THE MNS ENCLOSURE. THESE EMT BOXES SHALL HAVE A DEDICATED 3/4" CONDUIT TO THE MNS ENCLOSURE, ALSO PROVIDED BY THE ELECTRICAL CONTRACTOR. DEDICATED CONDUIT SHALL HAVE A PULL STRING AND SHALL BE ADEQUATELY LABELED FOR FUTURE MNS USE.

SEQUENCE OF OPERATIONS																	
	MANUAL PULL STATION	AREA SMOKE DETECTOR	FIRE SPRINKLER WATER FLOW SWITCH	FIRE SPRINKLER SUPERVISORY SWITCH	LIVING UNIT SMOKE DETECTOR	2nd LIVING UNIT SMOKE DETECTOR	ADA UNIT SMOKE DETECTOR	1st FLOOR ELEVATOR LOBBY SMOKE DETECTOR	2nd-4th FLOOR ELEVATOR LOBBY SMOKE DETECTOR	ELEVATOR MACHINE ROOM SMOKE DETECTOR	ELEVATOR MACH. ROOM FIRE SPRINKLER WATER FLOW SWITCH	BLDG POWER FAIL & LOW BATTERY	SYSTEM TROUBLES	DUCT SMOKE DETECTOR	MNS OVERRIDE OF FIRE ALARM SYSTEM	ELEVATOR SHUNT TRIP POWER LOSS	2ND FLOOR ROLL UP DOOR SMOKE DETECTOR
ANNUNCIATE ALARM CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR	●	●	●			●		●	●	●	●						●
ANNUNCIATE TROUBLE CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR												●	●				
ANNUNCIATE SUPERVISORY CONDITION AT FIRE CONTROL PANEL & REMOTE ANNUNCIATOR				●	●		●							●	●	●	
ACTIVATE AUDIBLE/VISUAL ALARM SIGNAL	●	●	●			●		●	●	●	●						●
TRANSMIT ALARM SIGNALS TO GOVERNMENT MONITORING STATION	●	●	●			●		●	●	●	●						●
TRANSMIT TROUBLE SIGNALS TO GOVERNMENT MONITORING STATION												●	●				
TRANSMIT SUPERVISORY SIGNALS TO GOVERNMENT MONITORING STATION				●	●		●							●	●	●	
ACTIVATE SOUNDER BASE IN UNIT OF EVENT					●	●	●										
ACTIVATE VISUAL SIGNAL IN ADA UNITS	●	●	●			●	●	●	●	●	●						●
PRIMARY ELEVATOR RECALL									●								
ALTERNATE ELEVATOR RECALL								●		●							
FIREFIGHTER'S SERVICE VISUAL INDICATOR (FLASHING)										●							
FIREFIGHTER'S SERVICE VISUAL INDICATOR (STEADY)								●	●								
SHUNT ELEVATOR POWER											●					●	
SHUT DOWN ASSOCIATED AIR HANDLER														●			
RELEASE ROLL UP DOOR												●					●

KEY NOTES:

- ① 1-2" CONDUIT FOR FIRE ALARM.
- ② ALL CABLES ENTERING BUILDING MUST LAND ON SURGE PROTECTOR PRIOR TO BEING CONNECTED TO FIRE ALAR/MASS NOTIFICATION EQUIPMENT.

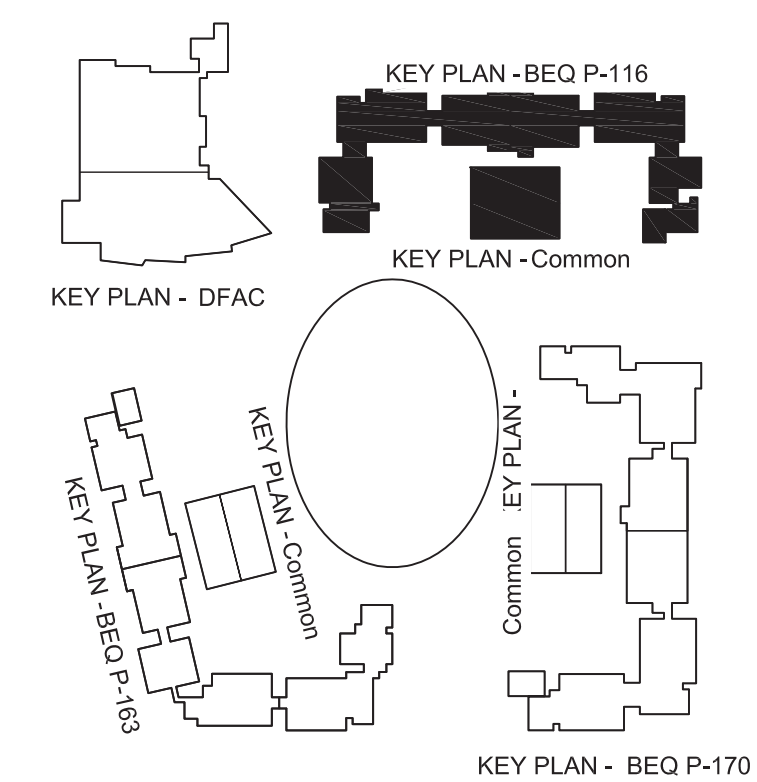


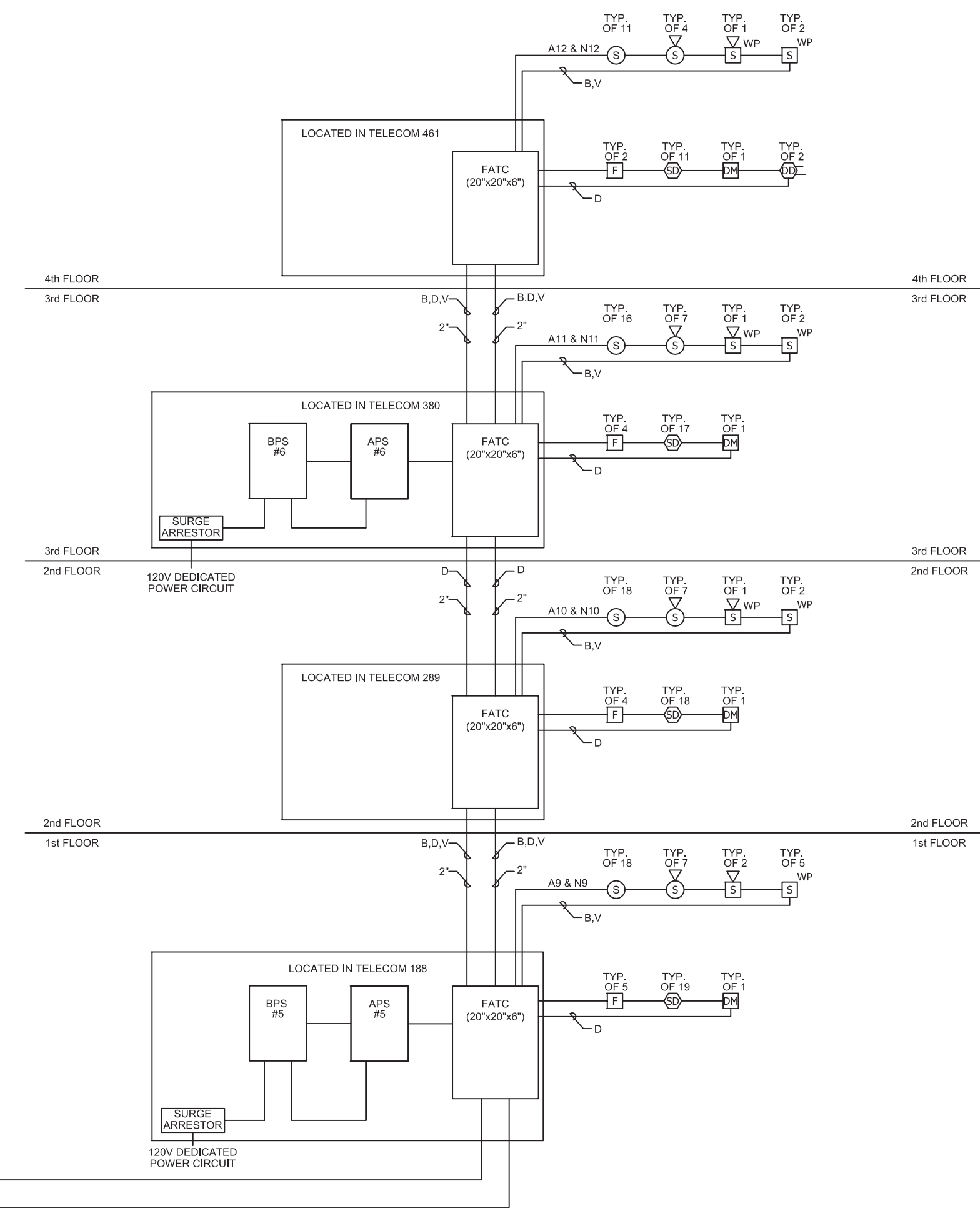
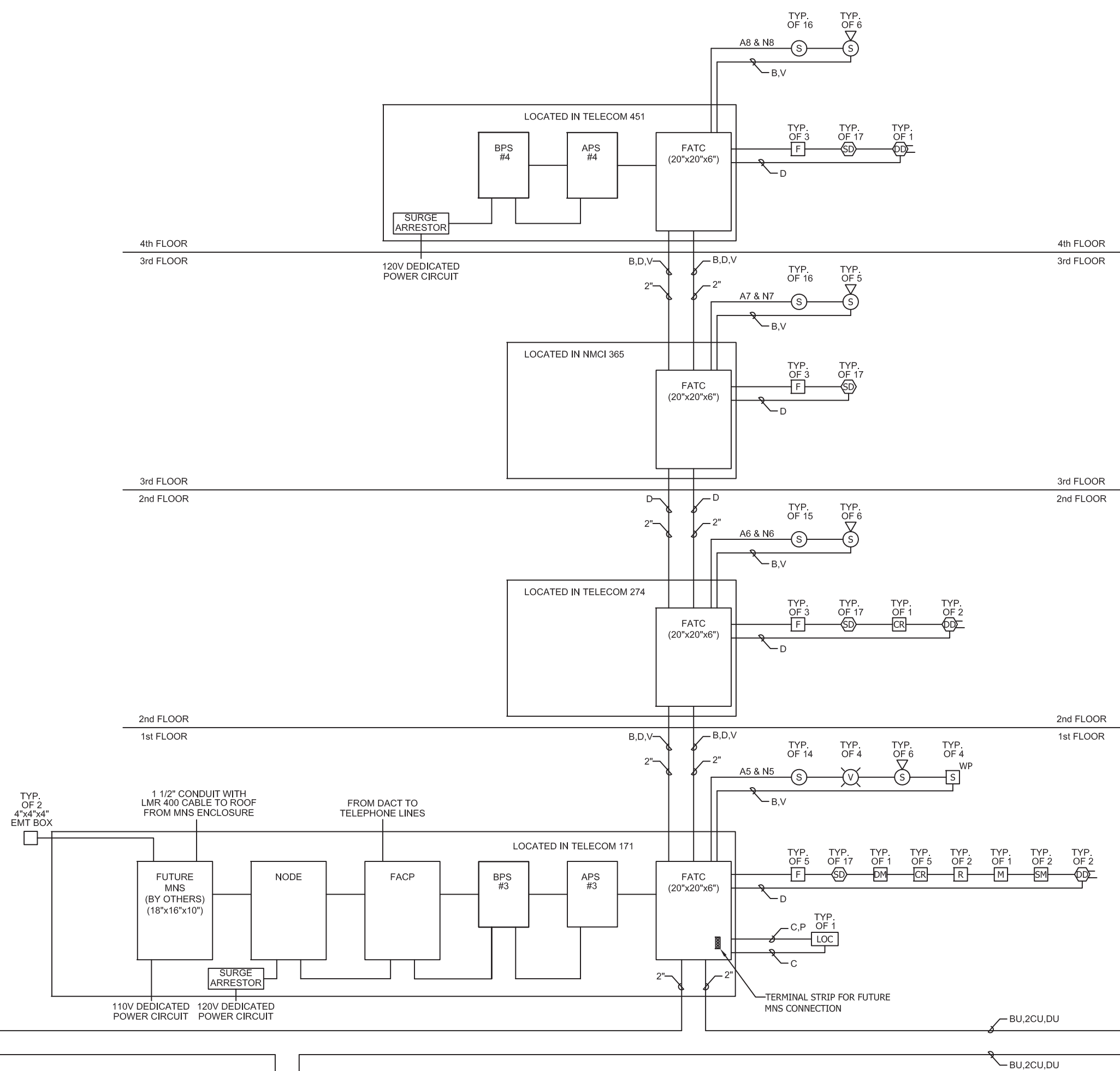
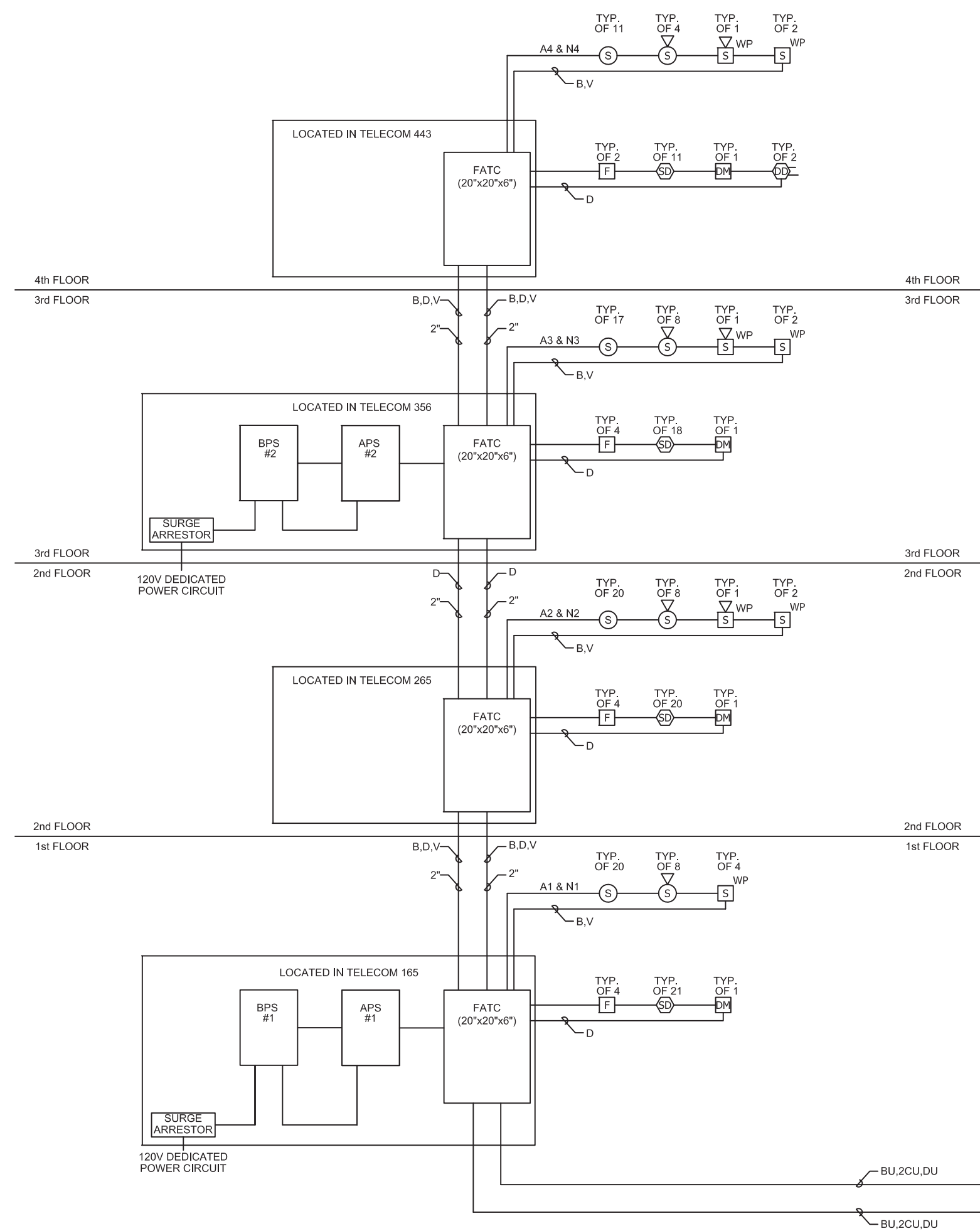
SITE PLAN - ENLARGED (BEQ P-116)

SCALE: 1/32" = 1'-0"

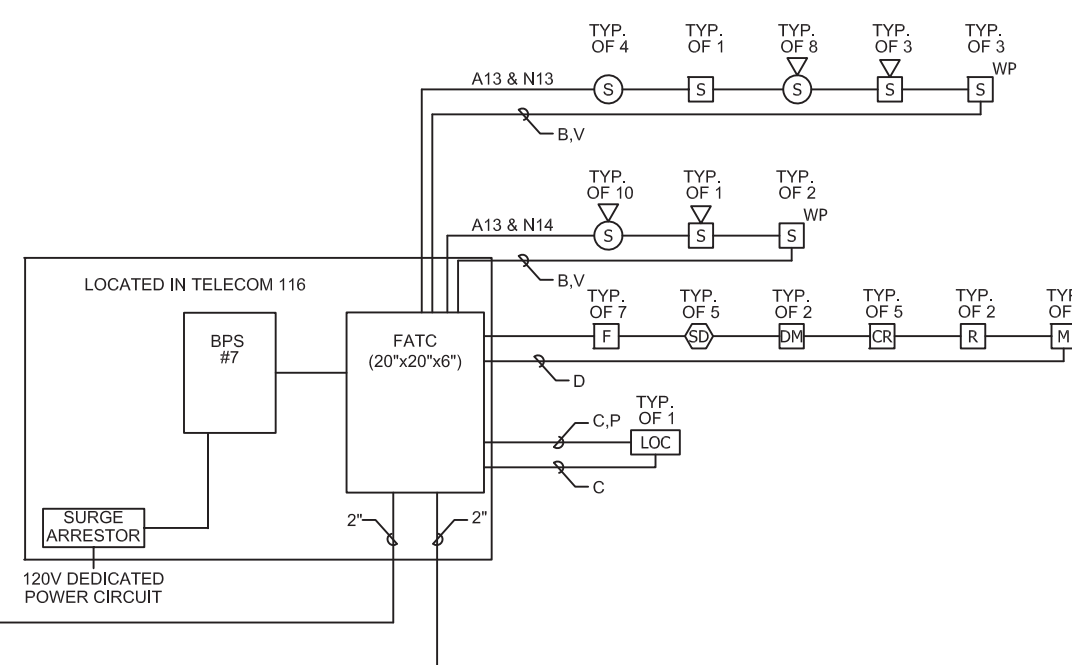
0' 8' 16' 32' 64'

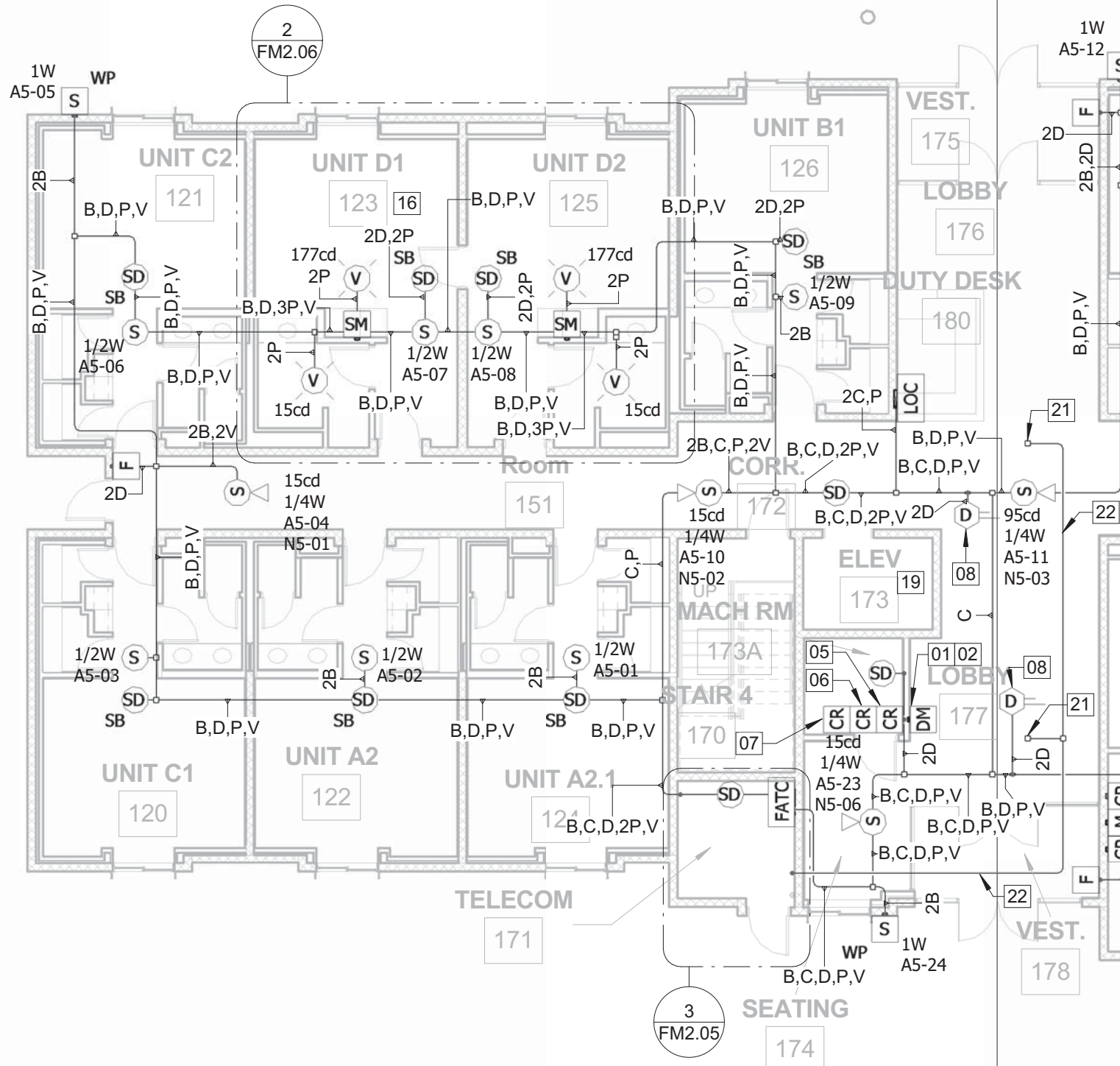
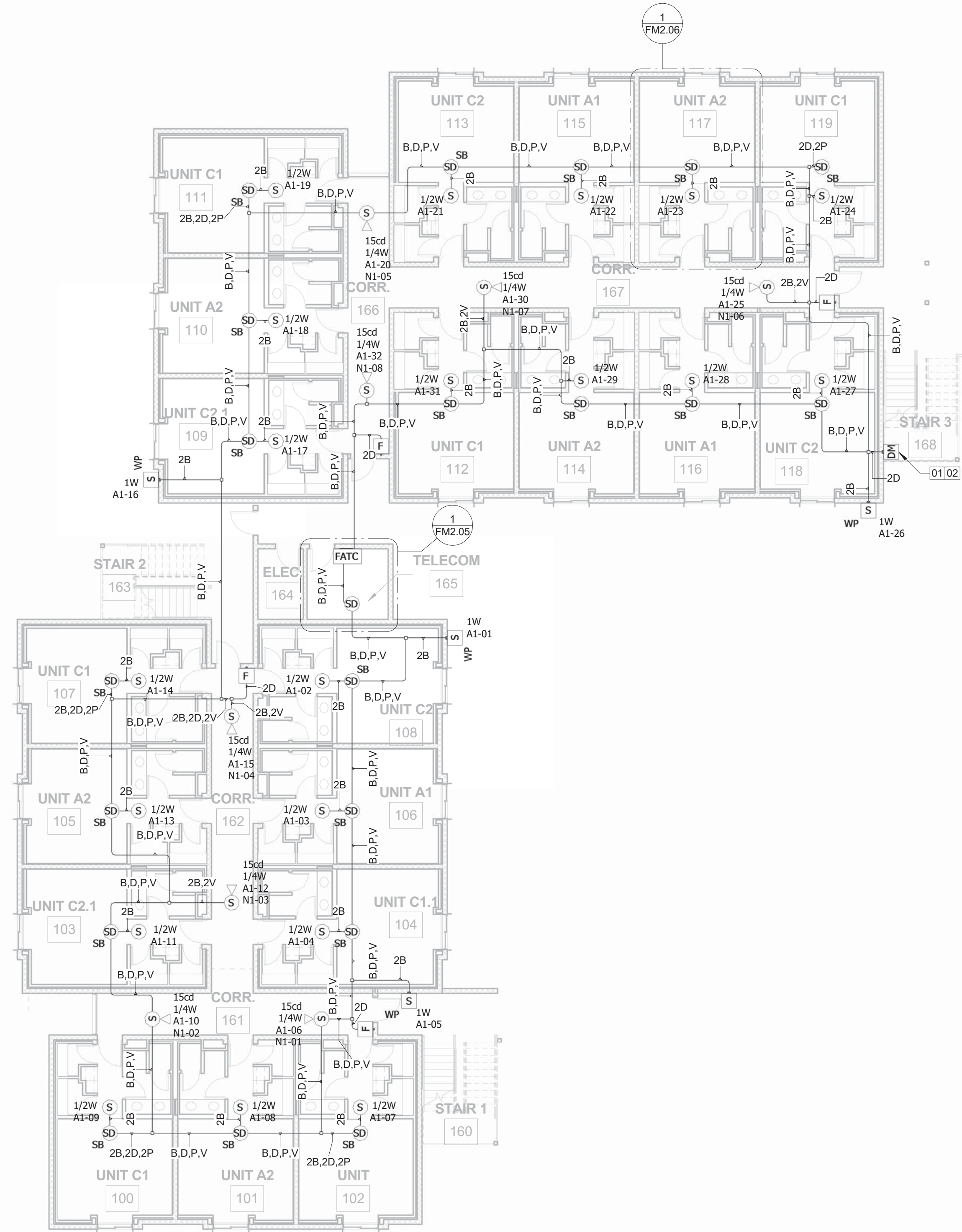
PLAN NORTH





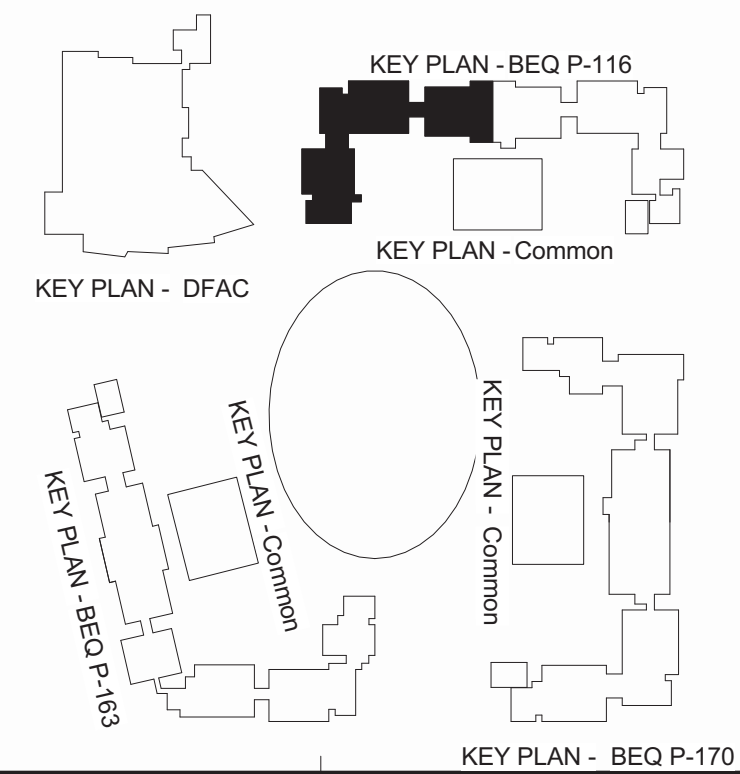
COMMON BUILDING





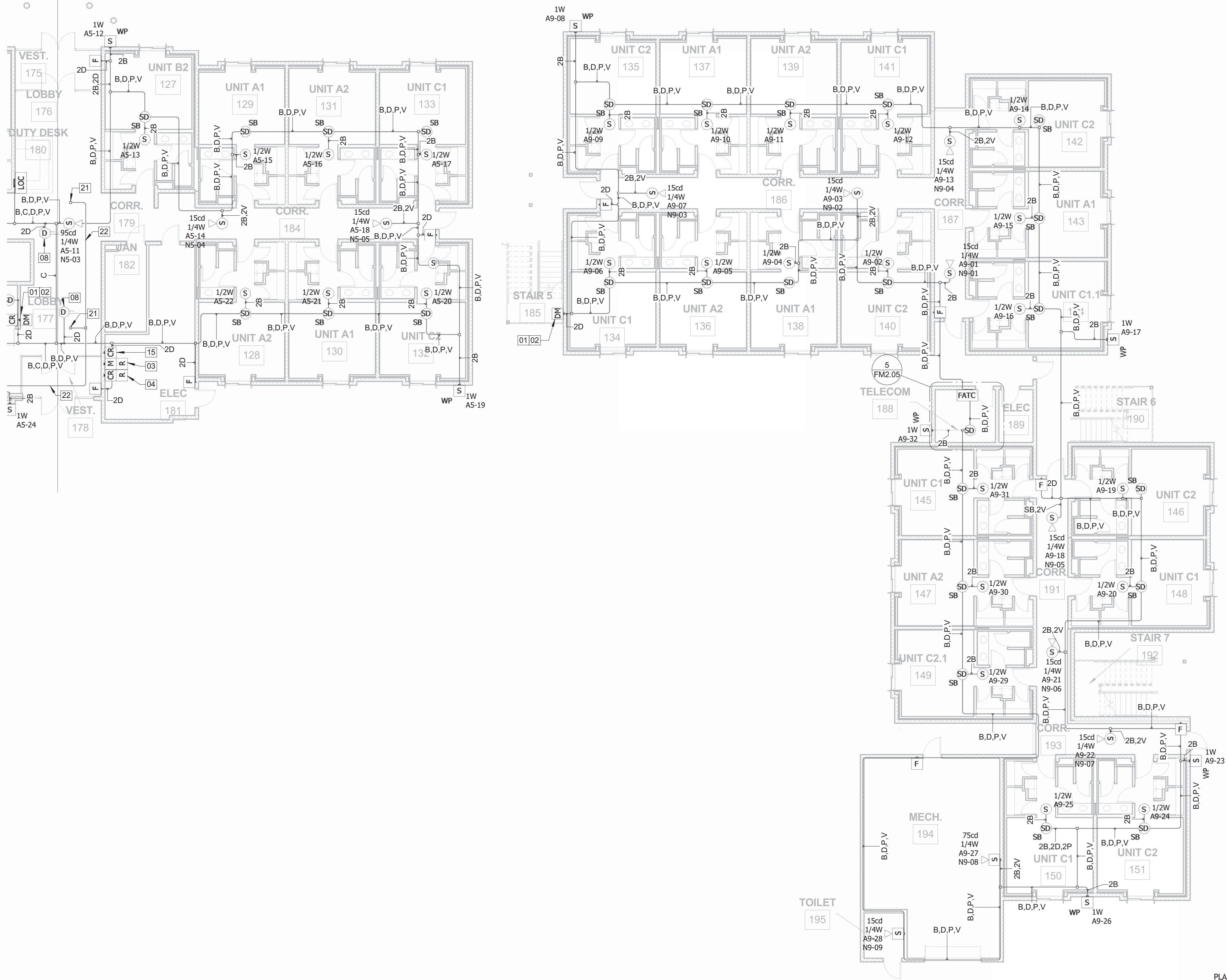
FLOOR PLAN - LEVEL 1A (BEQ P-116)

SCALE: 3/32" = 1'-0"
0' 2' 4' 8' 12' 16'



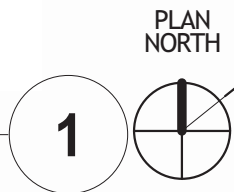
KEYNOTES

01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
02	MONITOR FIRE SPRINKLER TAMPER SWITCH
03	MONITOR ELEVATOR SHUNT TRIP POWER
04	RELAY FOR ELEVATOR SHUNT TRIP CONTROL
05	RELAY FOR PRIMARY ELEVATOR RECALL
06	RELAY FOR SECONDARY ELEVATOR RECALL
07	RELAY FOR FIREFIGHTER'S SERVICE INDICATOR LIGHT
08	DUCT SMOKE DETECTOR LOCATED ABOVE CEILING (REMOTE TEST STATION MOUNTED 60" A.F.F. DIRECTLY BELOW)
09	FIRE ALARM CONTROL PANEL
10	FIRE ALARM REMOTE NODE
11	FIRE ALARM TERMINAL CABINET
12	FUTURE MASS NOTIFICATION TRANSCIVER
13	AUXILIARY POWER SUPPLY
14	REMOTE BOOSTER POWER SUPPLY
15	RELAY FOR FIRE DOOR CLOSURE
16	ADA LIVING UNIT
17	1-1/2" CONDUIT TO ROOF
18	(2) 2" CONDUITS BETWEEN FATC MINIMUM 10" APART
19	HYDRAULIC, DIRECT PLUNGER TYPE ELEVATOR
20	CONTROL RELAY FOR ROLL UP DOOR ACTIVATION
21	4"x4"x4" EMT BOX WITH (DECORATIVE) COVER FOR FUTURE MNS SPEAKERS
22	DEDICATED 3/4" CONDUIT FOR FUTURE MNS USE

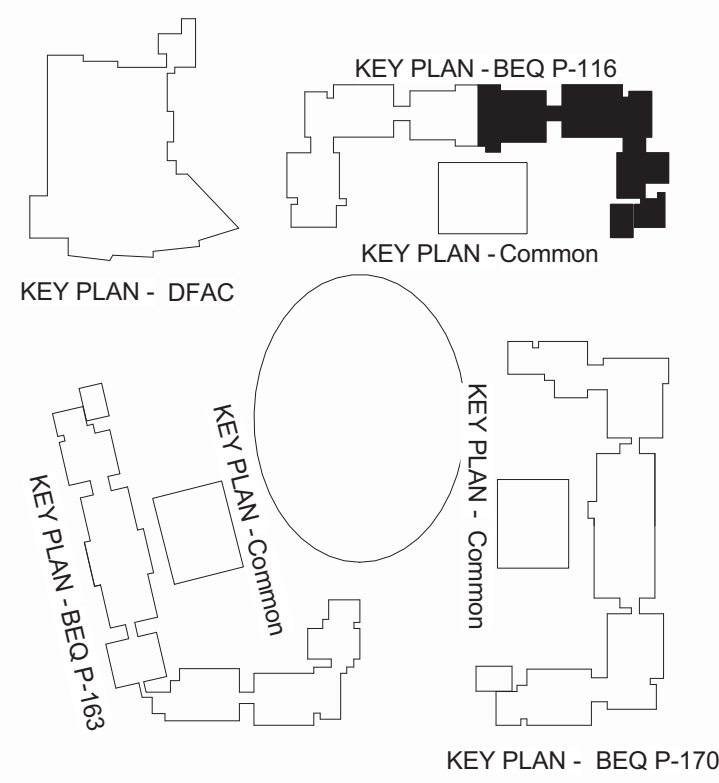


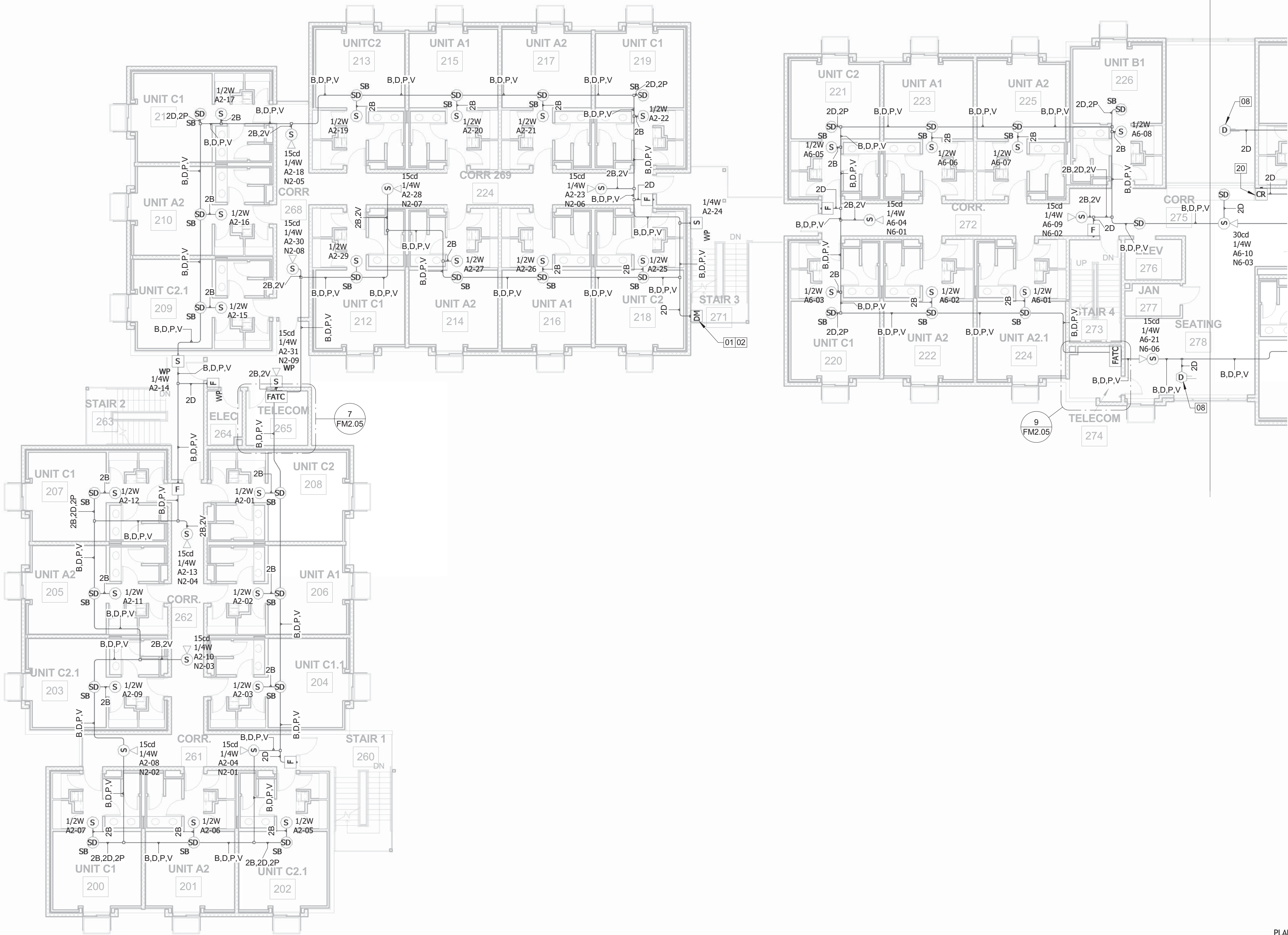
FLOOR PLAN - LEVEL 1B (BEQ P-116)

SCALE: 3/32" = 1'-0"
0' 2' 4' 8' 12' 16'



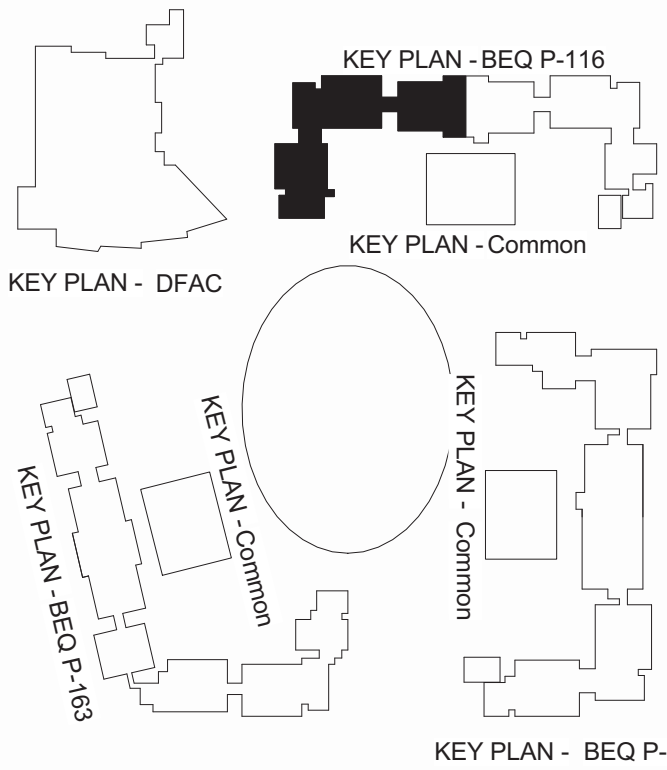
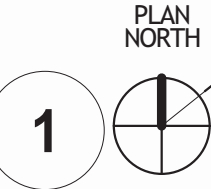
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21	4"x4"x4" EMT BOX WITH (DECORATIVE) COVER FOR FUTURE MNS SPEAKERS
22	DEDICATED 3/4" CONDUIT FOR FUTURE MNS USE



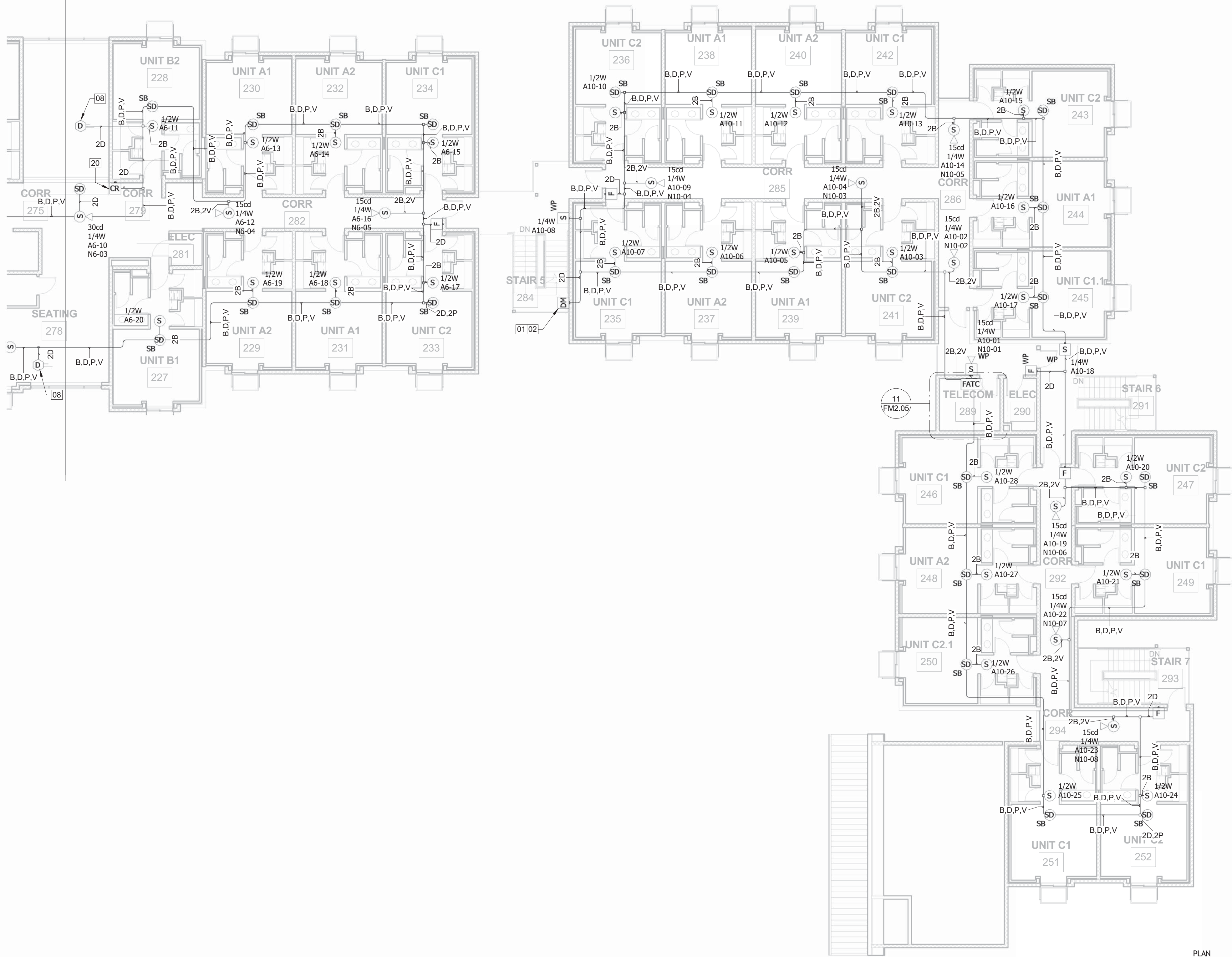


FLOOR PLAN - LEVEL 2A (BEQ P-116)

SCALE: 3/32" = 1'-0"
0' 2' 4' 8' 12' 16'

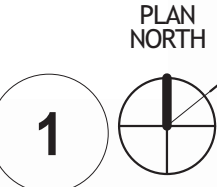


KEYNOTES	
01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
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03	MONITOR ELEVATOR SHUNT TRIP POWER
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21	4"x4"x4" EMT BOX WITH (DECORATIVE) COVER FOR FUTURE MNS SPEAKERS
22	DEDICATED 3/4" CONDUIT FOR FUTURE MNS USE

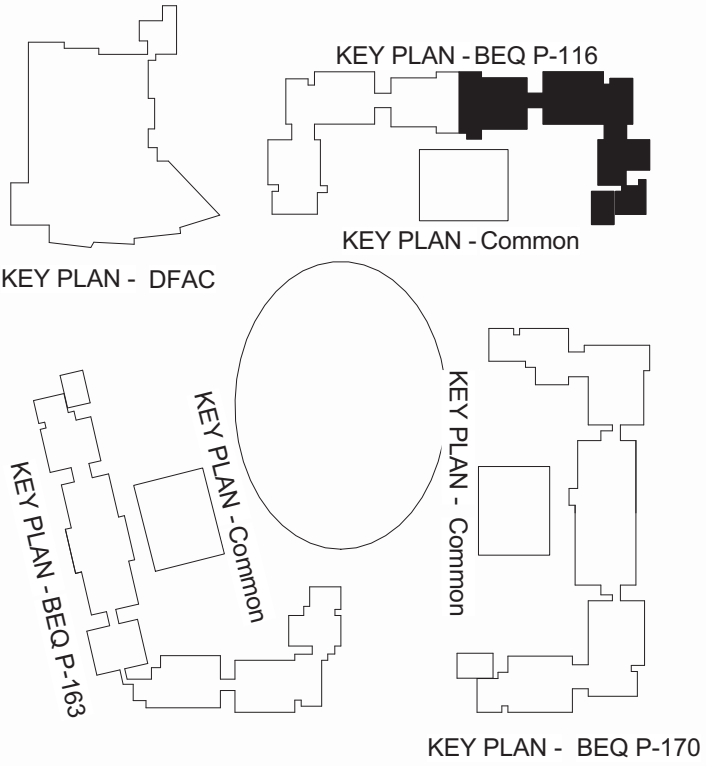


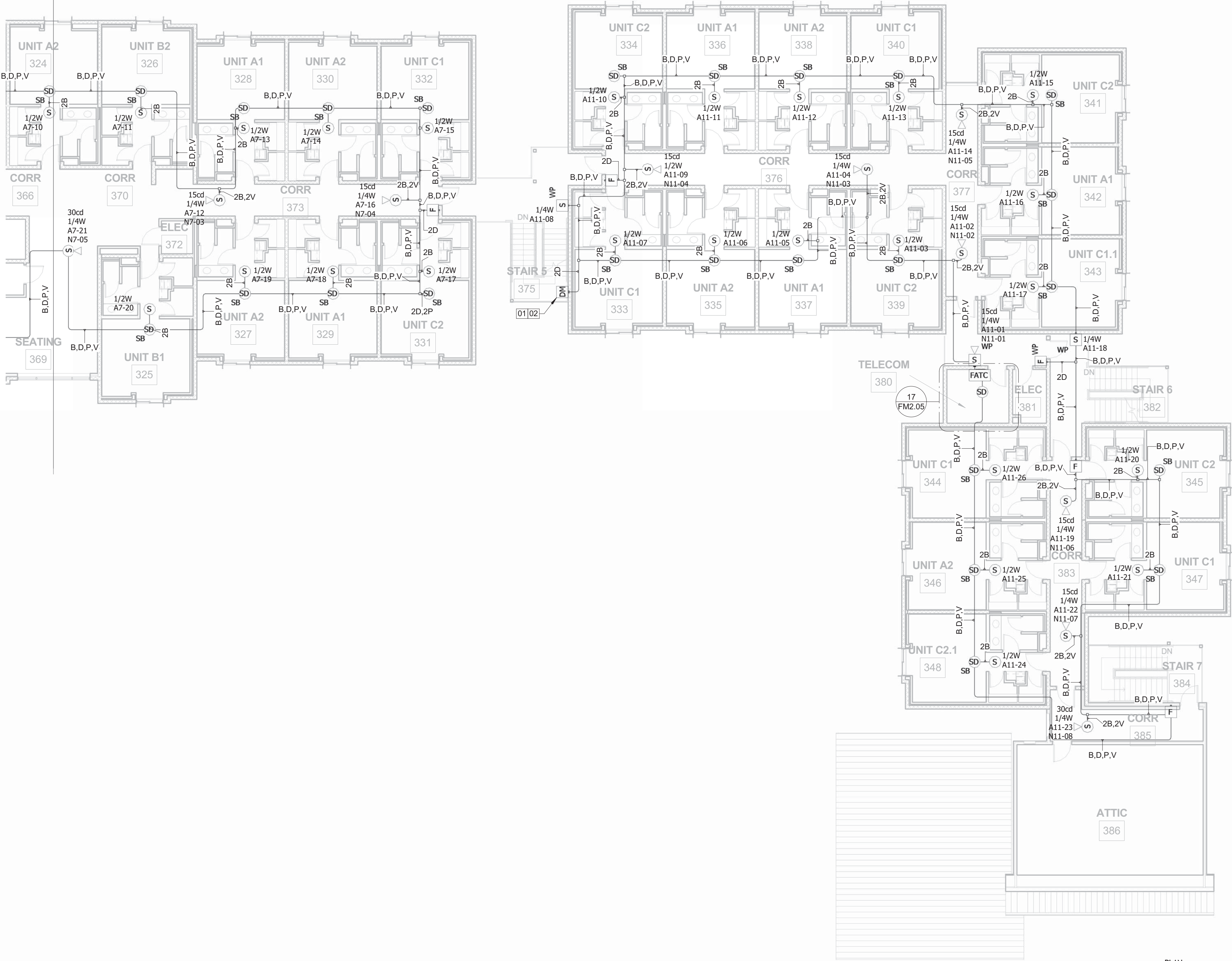
FLOOR PLAN - LEVEL 2B (BEQ P-116)

SCALE: 3/32" = 1'-0"
0' 2' 4' 8' 12' 16'



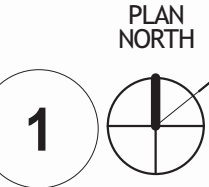
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01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
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22	DEDICATED 3/4" CONDUIT FOR FUTURE MNS USE



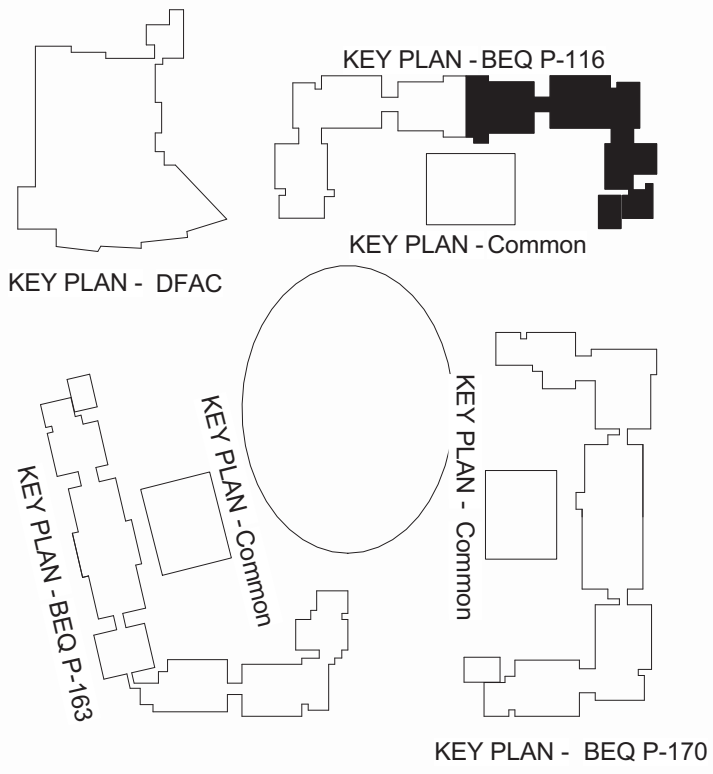


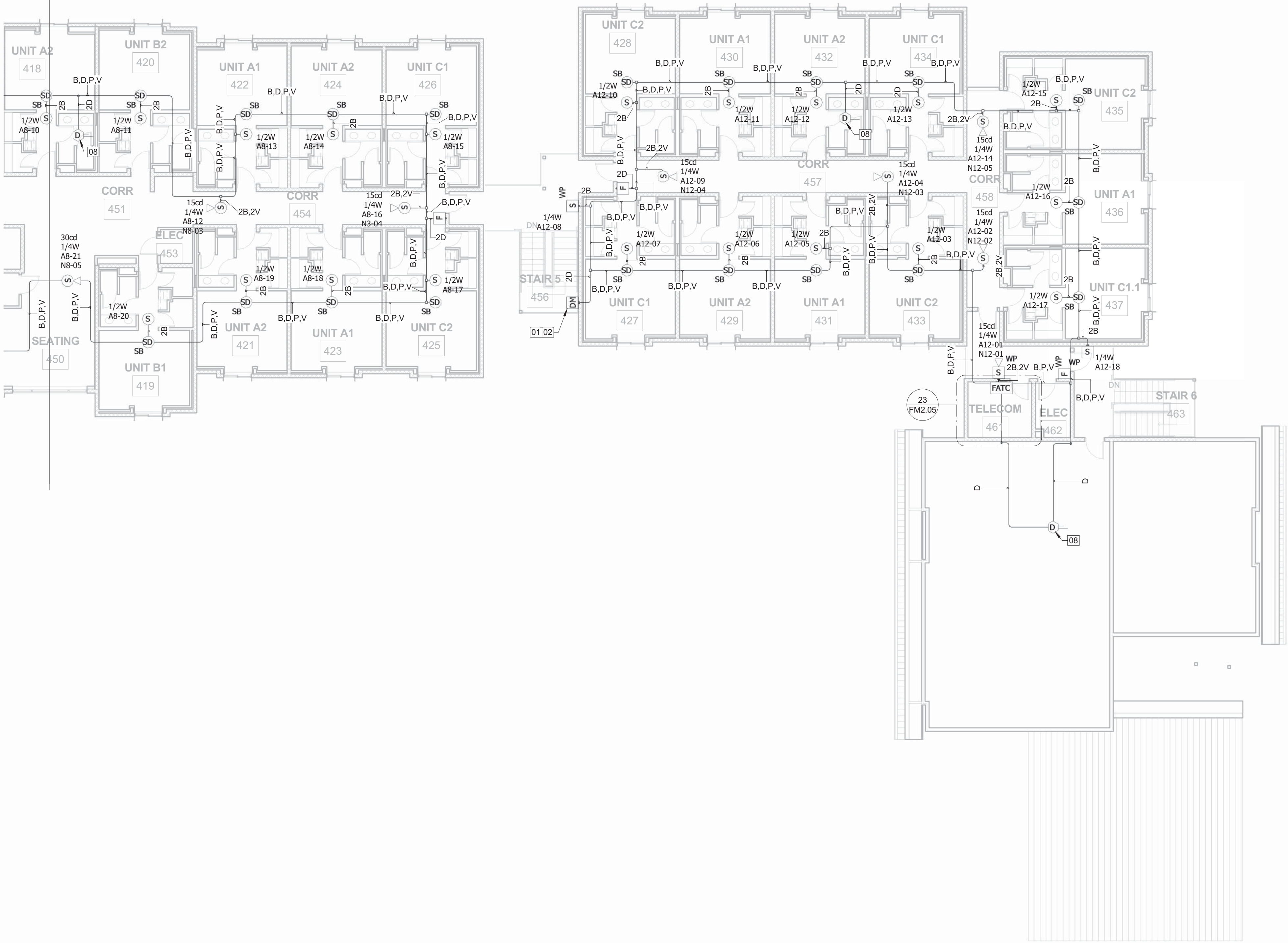
FLOOR PLAN - LEVEL 3B (BEQ P-116)

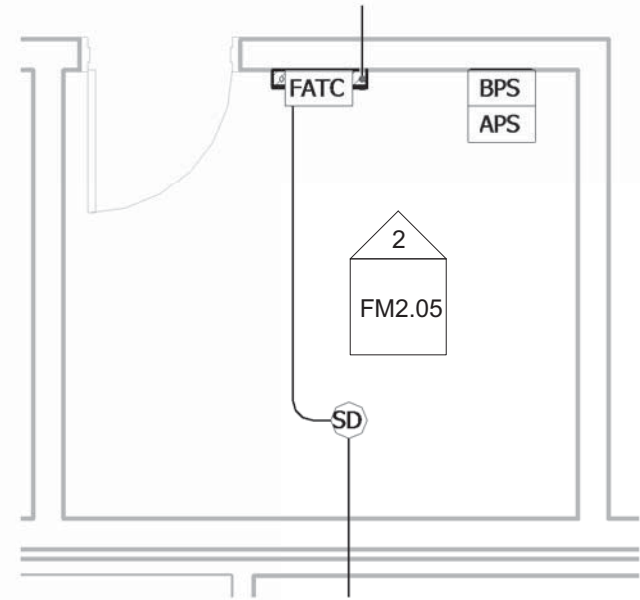
SCALE: 3/32" = 1'-0"
0' 2' 4' 8' 12' 16'



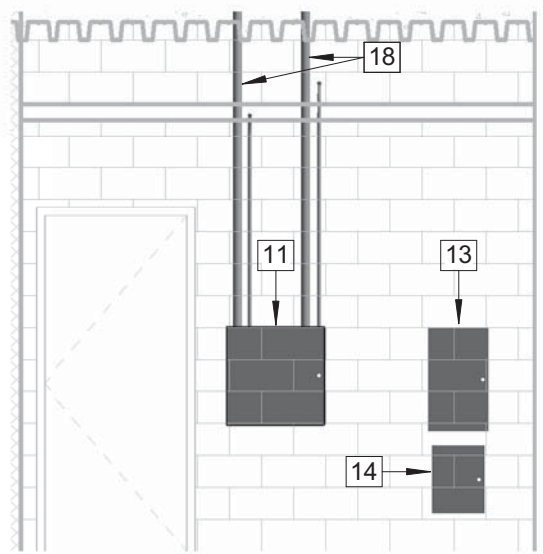
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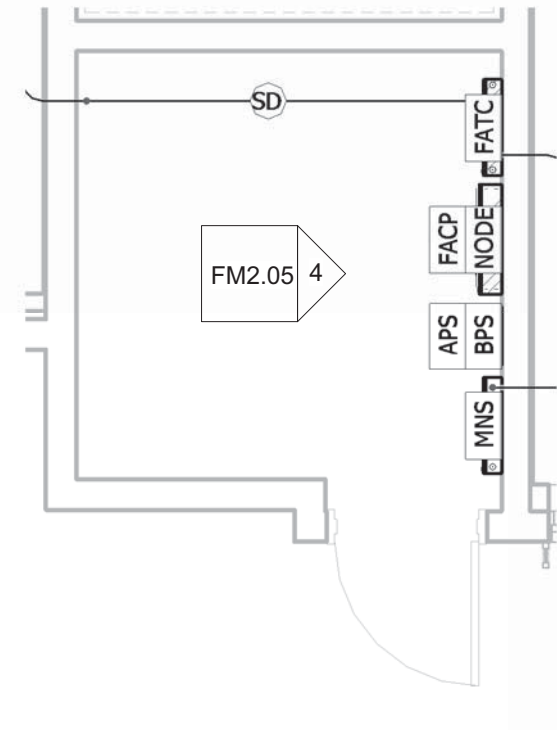




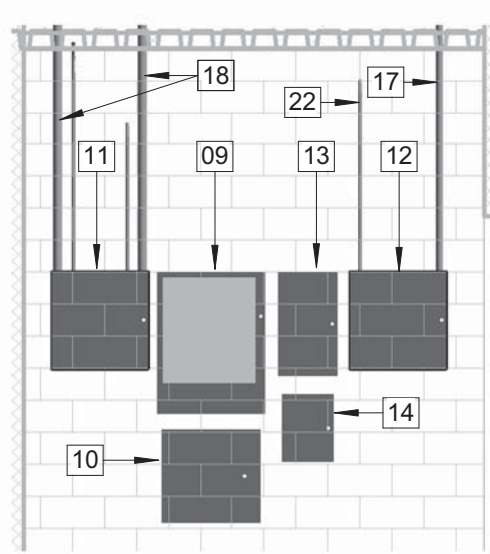
① ENLARGED FLOOR PLAN - ROOM 165
1/4" = 1'-0"



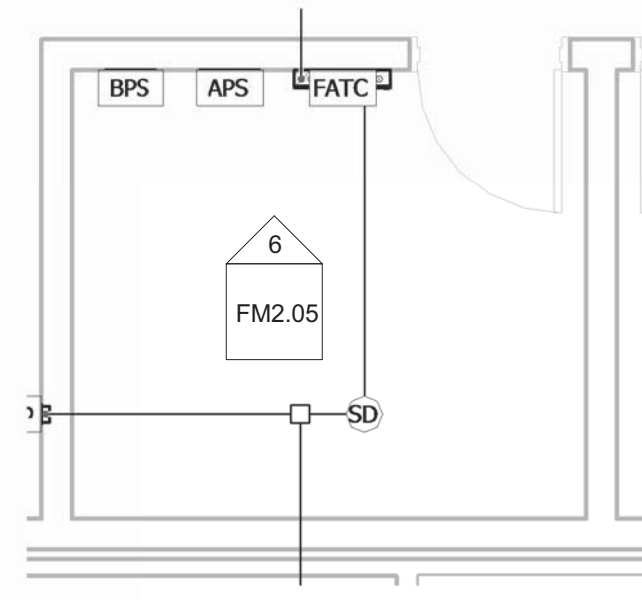
② INTERIOR ELEVATION - ROOM 165
1/4" = 1'-0"



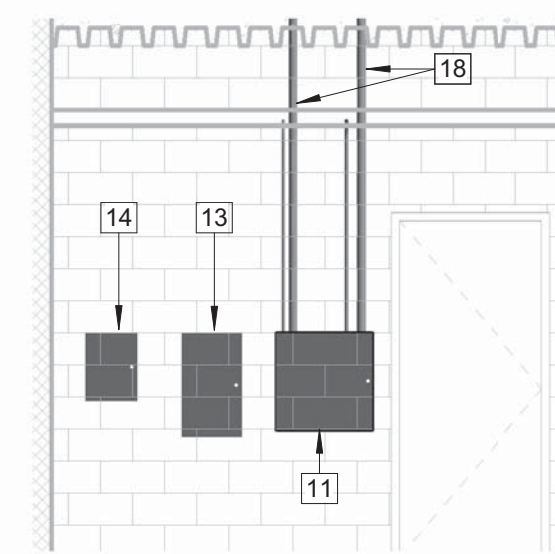
③ ENLARGED FLOOR PLAN - ROOM 171
1/4" = 1'-0"



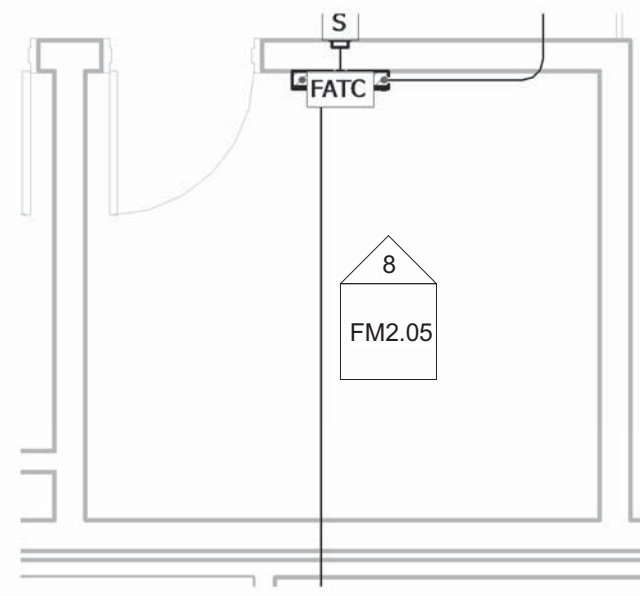
④ INTERIOR ELEVATION - ROOM 171
1/4" = 1'-0"



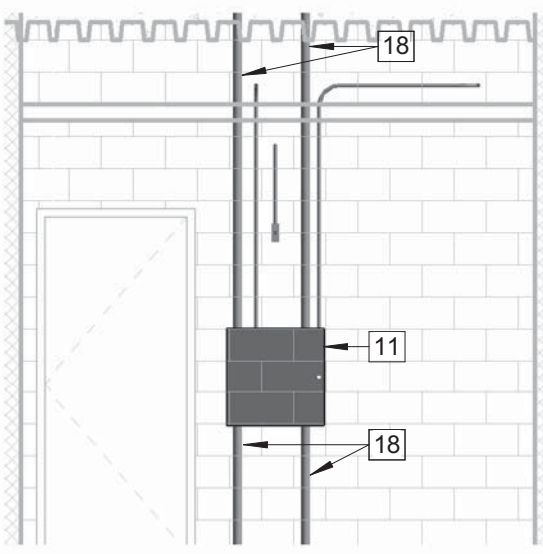
⑤ ENLARGED FLOOR PLAN - ROOM 188
1/4" = 1'-0"



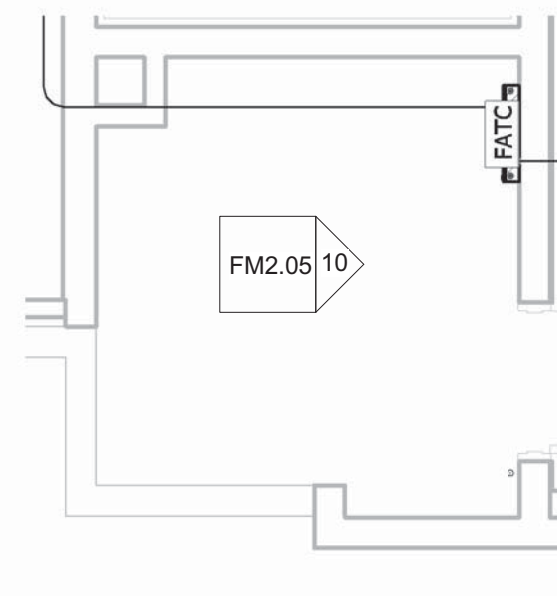
⑥ INTERIOR ELEVATION - ROOM 188
1/4" = 1'-0"



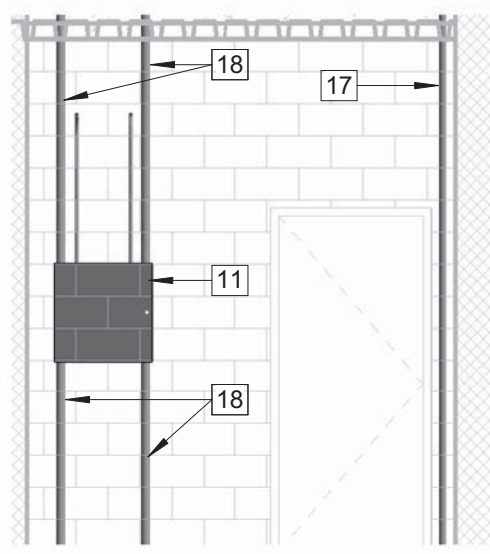
⑦ ENLARGED FLOOR PLAN - ROOM 265
1/4" = 1'-0"



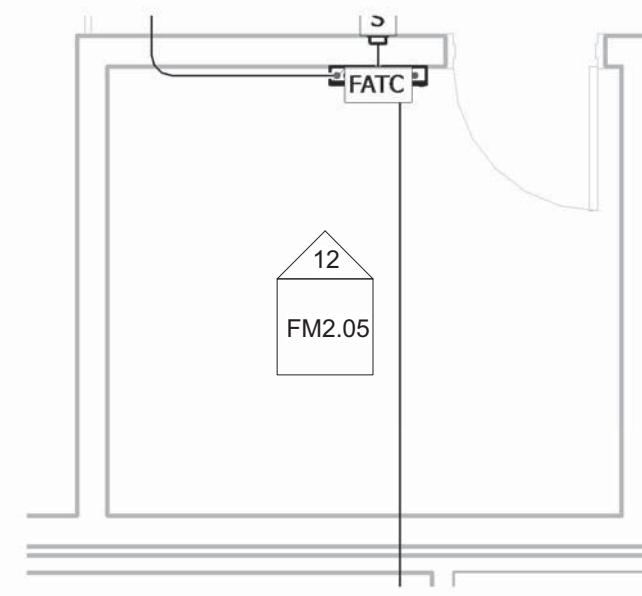
⑧ INTERIOR ELEVATION - ROOM 265
1/4" = 1'-0"



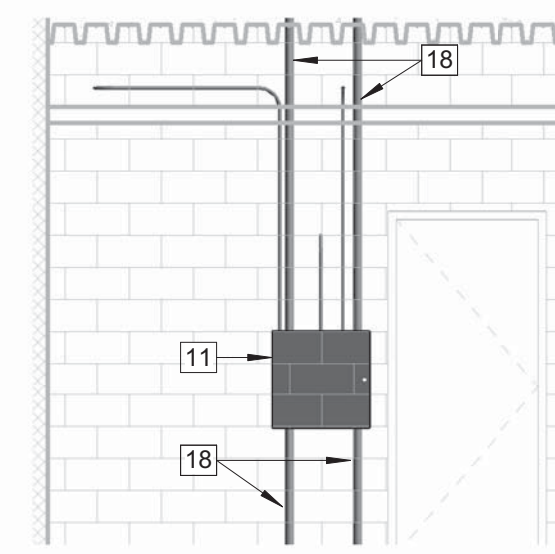
⑨ ENLARGED FLOOR PLAN - ROOM 274
1/4" = 1'-0"



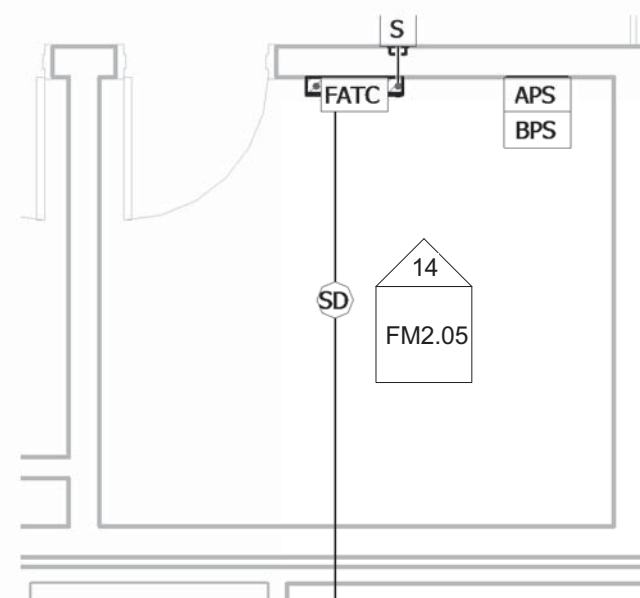
⑩ INTERIOR ELEVATION - ROOM 274
1/4" = 1'-0"



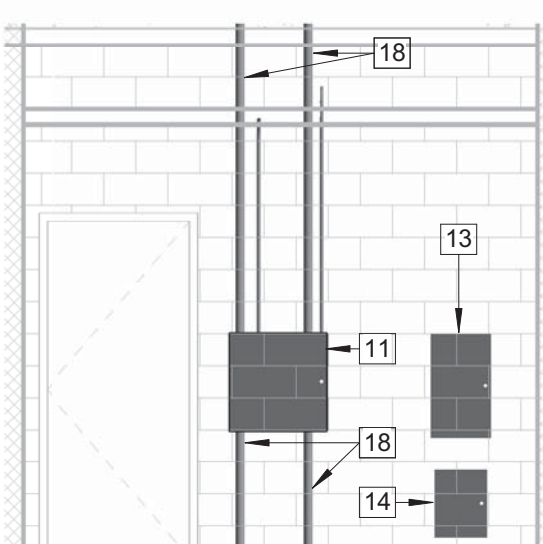
⑪ ENLARGED FLOOR PLAN - ROOM 289
1/4" = 1'-0"



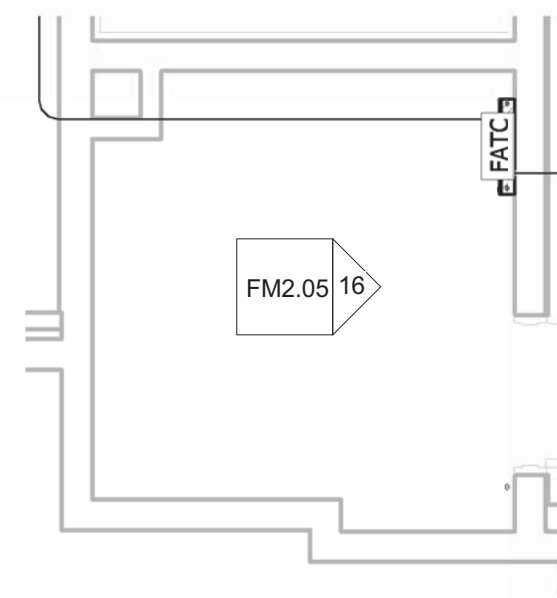
⑫ INTERIOR ELEVATION - ROOM 289
1/4" = 1'-0"



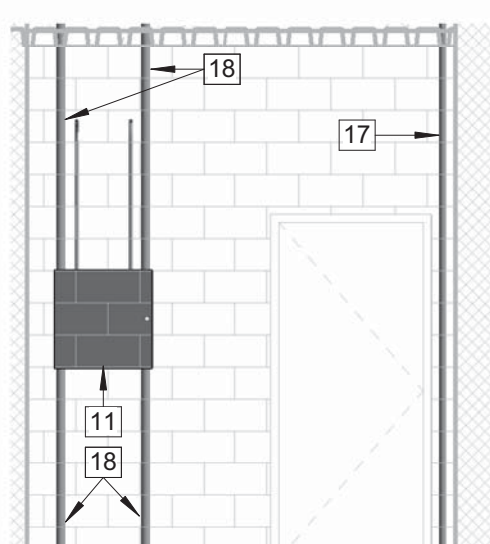
⑬ ENLARGED FLOOR PLAN - ROOM 356
1/4" = 1'-0"



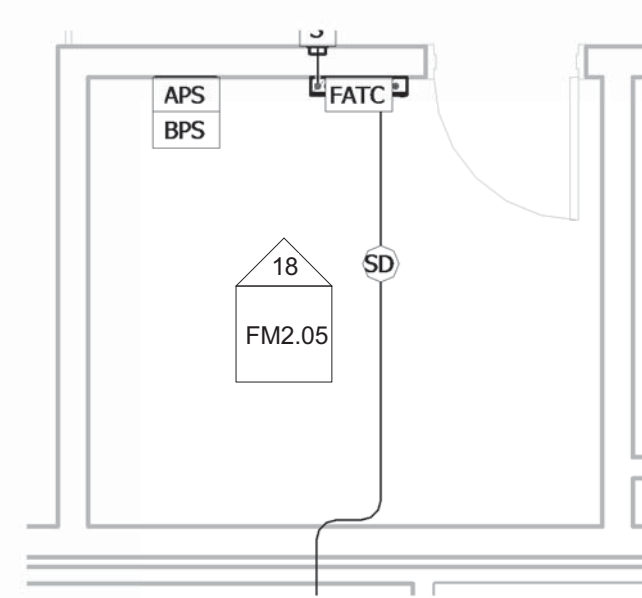
⑭ INTERIOR ELEVATION - ROOM 356
1/4" = 1'-0"



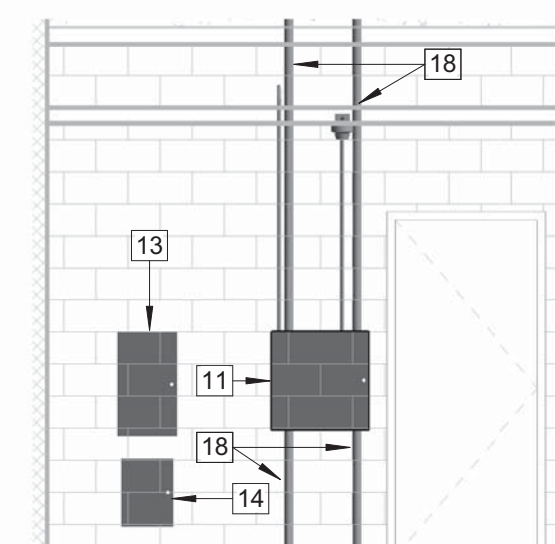
⑮ ENLARGED FLOOR PLAN - ROOM 365
1/4" = 1'-0"



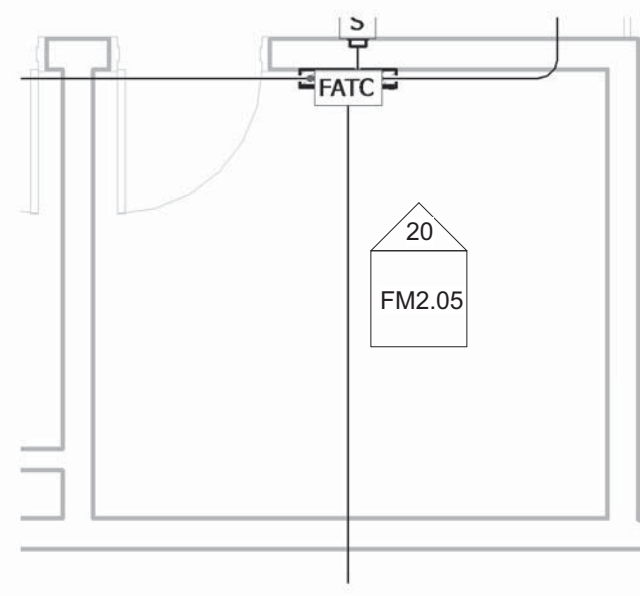
⑯ INTERIOR ELEVATION - ROOM 365
1/4" = 1'-0"



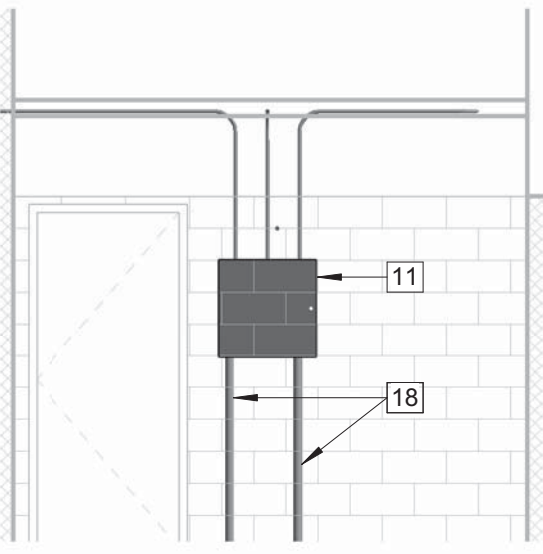
⑰ ENLARGED FLOOR PLAN - ROOM 380
1/4" = 1'-0"



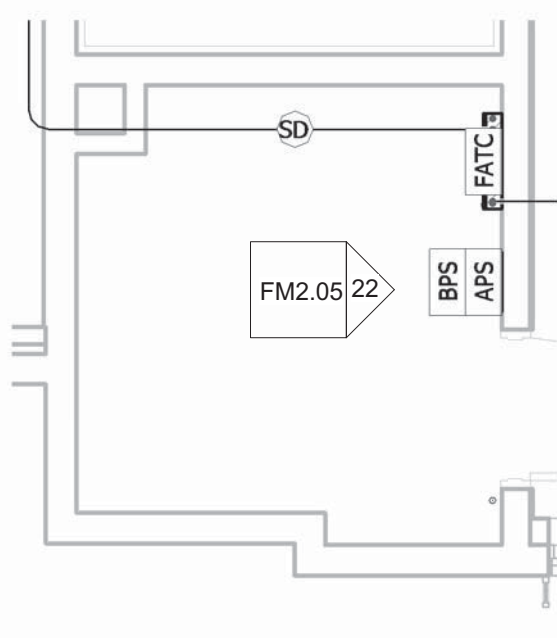
⑱ INTERIOR ELEVATION - ROOM 380
1/4" = 1'-0"



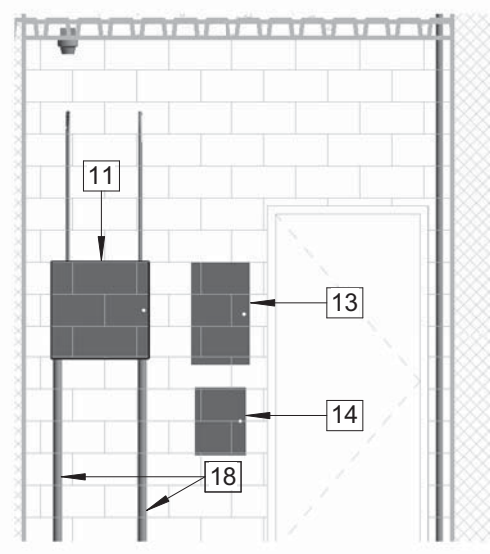
⑲ ENLARGED FLOOR PLAN - ROOM 443
1/4" = 1'-0"



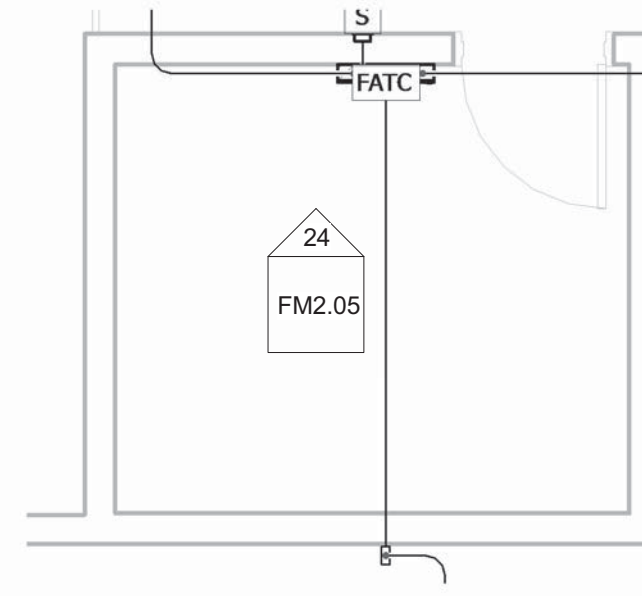
⑳ INTERIOR ELEVATION - ROOM 443
1/4" = 1'-0"



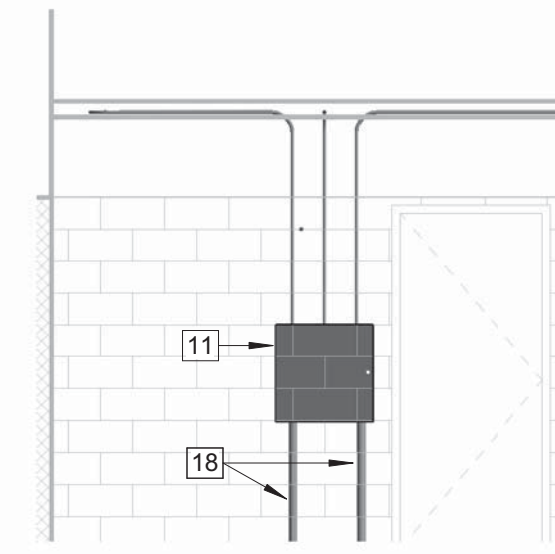
㉑ ENLARGED FLOOR PLAN - ROOM 451
1/4" = 1'-0"



㉒ INTERIOR ELEVATION - ROOM 451
1/4" = 1'-0"



㉓ ENLARGED FLOOR PLAN - ROOM 461
1/4" = 1'-0"

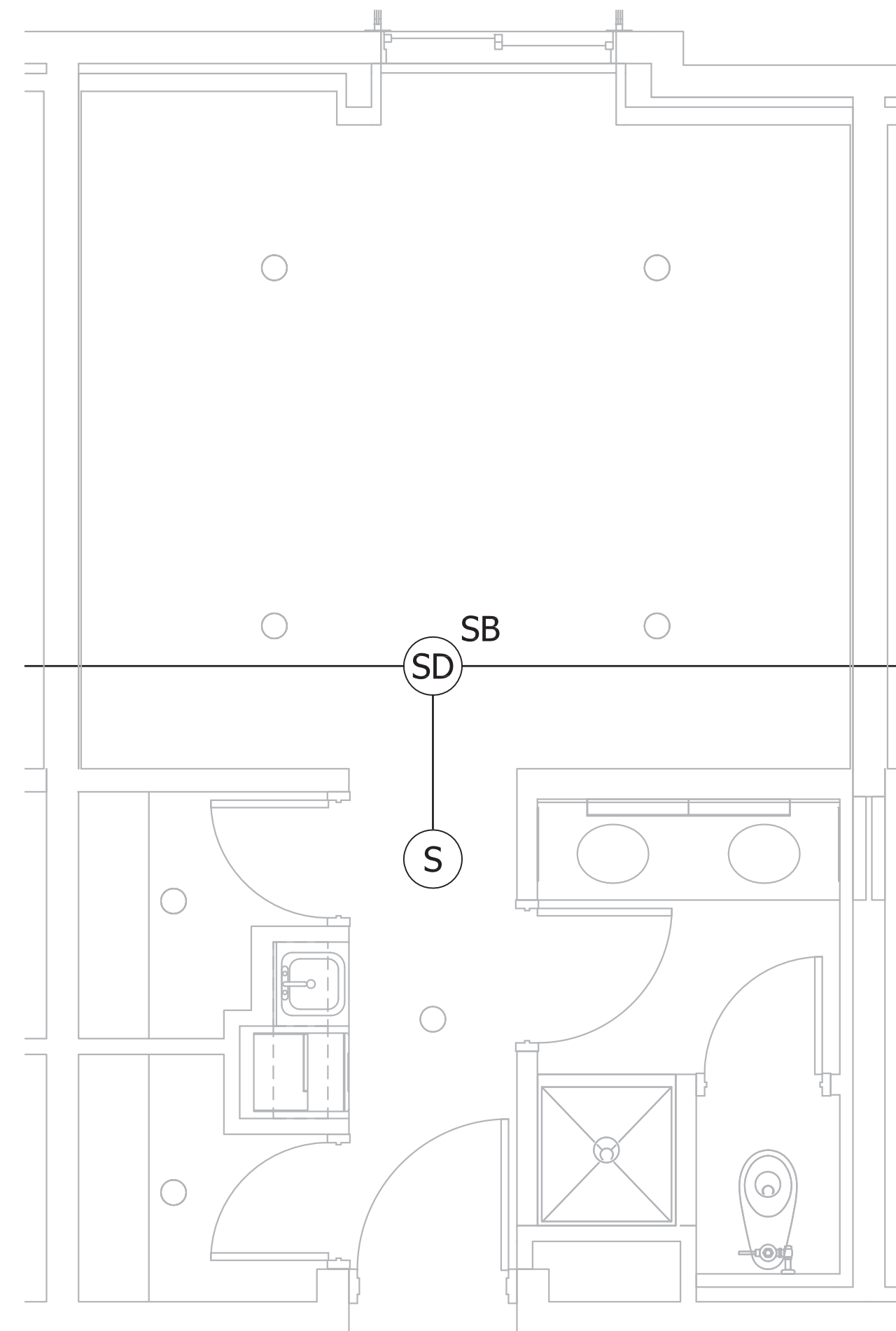


㉔ INTERIOR ELEVATION - ROOM 461
1/4" = 1'-0"

KEYNOTES

01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
02	MONITOR FIRE SPRINKLER TAMPER SWITCH
03	MONITOR ELEVATOR SHUNT TRIP POWER
04	RELAY FOR ELEVATOR SHUNT TRIP CONTROL
05	RELAY FOR PRIMARY ELEVATOR RECALL
06	RELAY FOR SECONDARY ELEVATOR RECALL
07	RELAY FOR FIREFIGHTER'S SERVICE INDICATOR LIGHT
08	DUCT SMOKE DETECTOR LOCATED ABOVE CEILING (REMOTE TEST STATION MOUNTED 60" A.F.F. DIRECTLY BELOW)
09	FIRE ALARM CONTROL PANEL
10	FIRE ALARM REMOTE NODE
11	FIRE ALARM TERMINAL CABINET
12	FUTURE MASS NOTIFICATION TRANSCIEVER
13	AUXILARY POWER SUPPLY
14	REMOTE BOOSTER POWER SUPPLY
15	RELAY FOR FIRE DOOR CLOSURE
16	ADA LIVING UNIT
17	1-1/2" CONDUIT TO ROOF
18	(2) 2" CONDUITS BETWEEN FATC MINIMUM 10" APART
19	HYDRAULIC, DIRECT PLUNGER TYPE ELEVATOR
20	CONTROL RELAY FOR ROLL UP DOOR ACTIVATION
21	4"x4"x4" EMT BOX WITH (DECORITIVE) COVER FOR FUTURE MNS SPEAKERS
22	DEDICATED 3/4" CONDUIT FOR FUTURE MNS USE

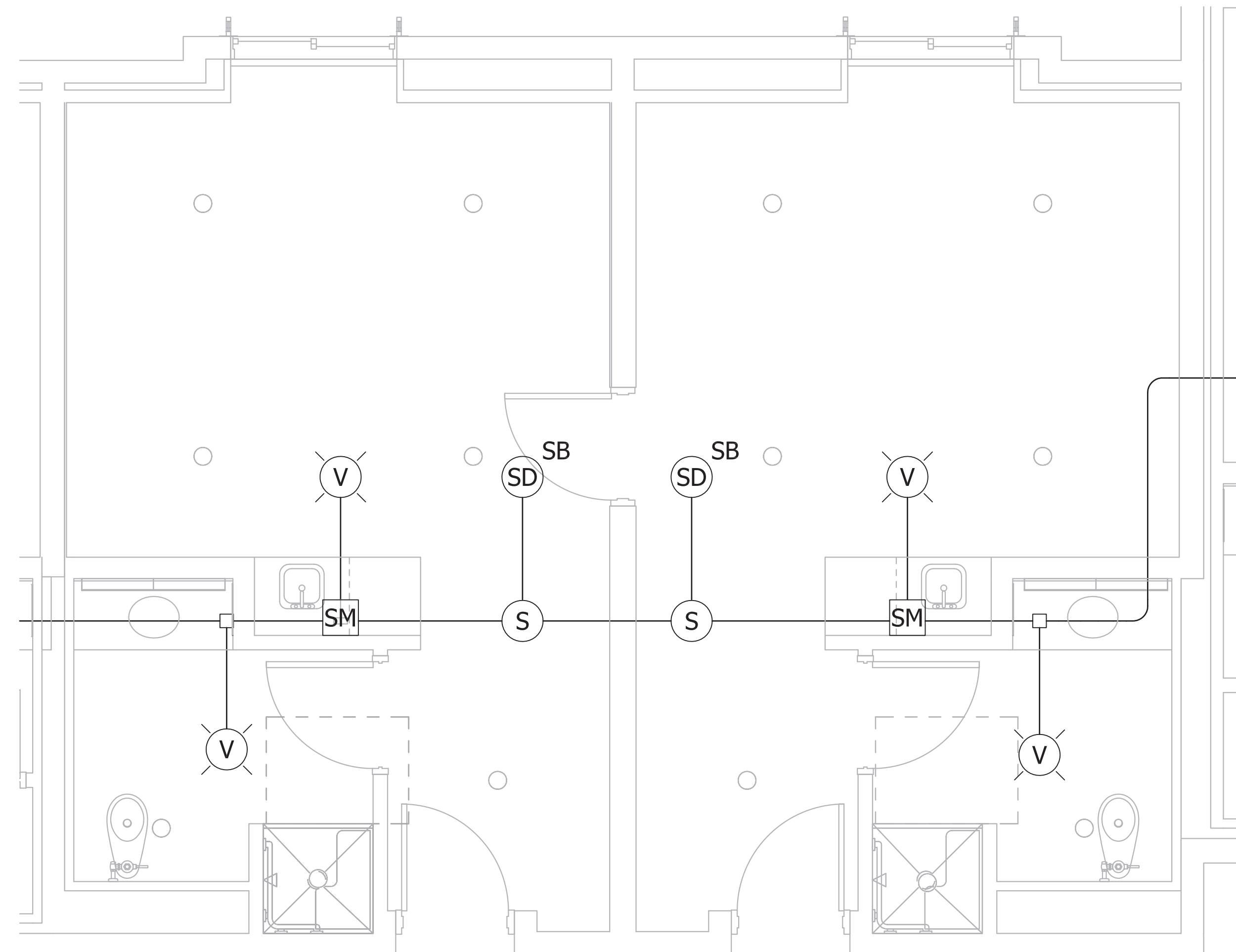
GRAPHIC SCALE
SCALE: 1/4" = 1'-0"
0' 1' 2' 4' 6' 10'



ENLARGED FLOOR PLAN - TYPICAL LIVING UNIT

SCALE: 3/8" = 1'-0"
 0' 6" 1' 2' 3' 4'

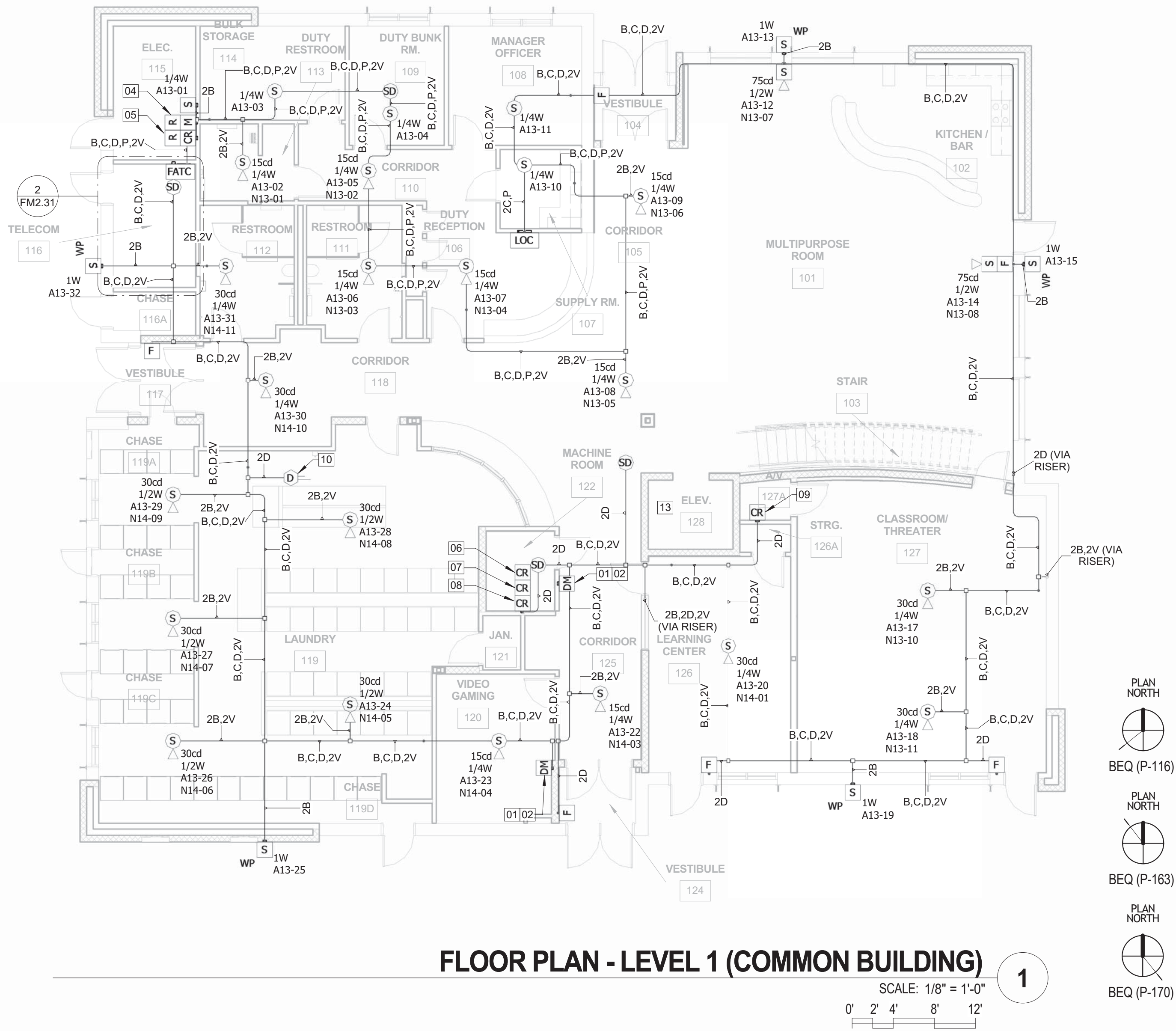
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ENLARGED FLOOR PLAN - TYPICAL ADA LIVING UNIT

SCALE: 3/8" = 1'-0"
 0' 6" 1' 2' 3' 4'

2



PLAN NORTH
BEQ (P-116)

PLAN NORTH
BEQ (P-163)

PLAN NORTH
BEQ (P-170)

KEYNOTES	
NOTE	DESCRIPTION
01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
02	MONITOR FIRE SPRINKLER TAMPER SWITCH
03	NOT USED
04	MONITOR ELEVATOR SHUNT TRIP POWER
05	RELAY FOR ELEVATOR SHUNT TRIP CONTROL
06	RELAY FOR PRIMARY ELEVATOR RECALL
07	RELAY FOR SECONDARY ELEVATOR RECALL
08	RELAY FOR FIREFIGHTER'S SERVICE INDICATOR LIGHT
09	RELAY FOR AUDIO/VISUAL SYSTEM SHUTDOWN
10	DUCT SMOKE DETECTOR LOCATED IN ATTIC (REMOTE TEST STATION MOUNTED 60" A.F.F. DIRECTLY BELOW)
11	FIRE ALARM TERMINAL CABINET
12	REMOTE BOOSTER POWER SUPPLY
13	HYDRAULIC, DIRECT PLUNGER TYPE ELEVATOR

ENLARGED FLOOR PLAN - ROOM 116

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 6' 10'

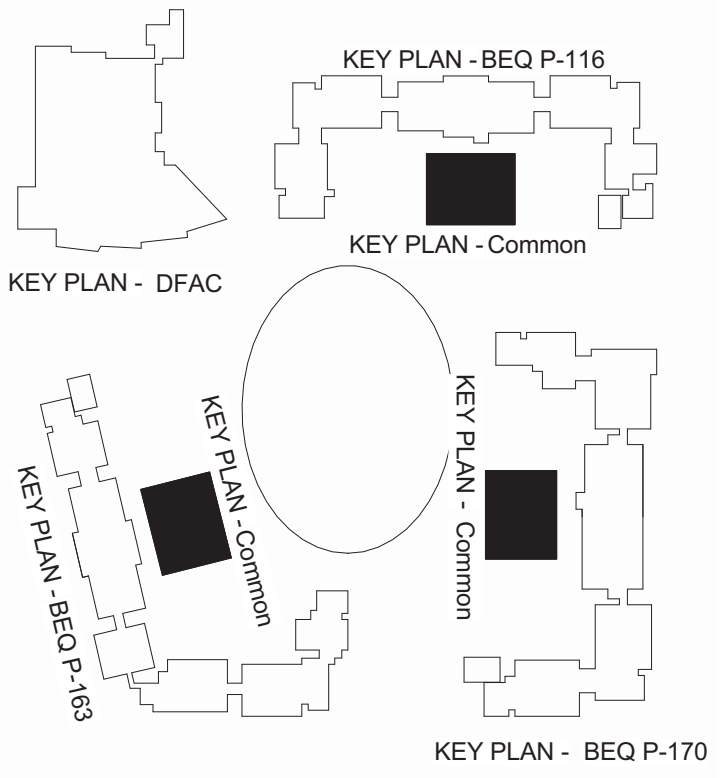
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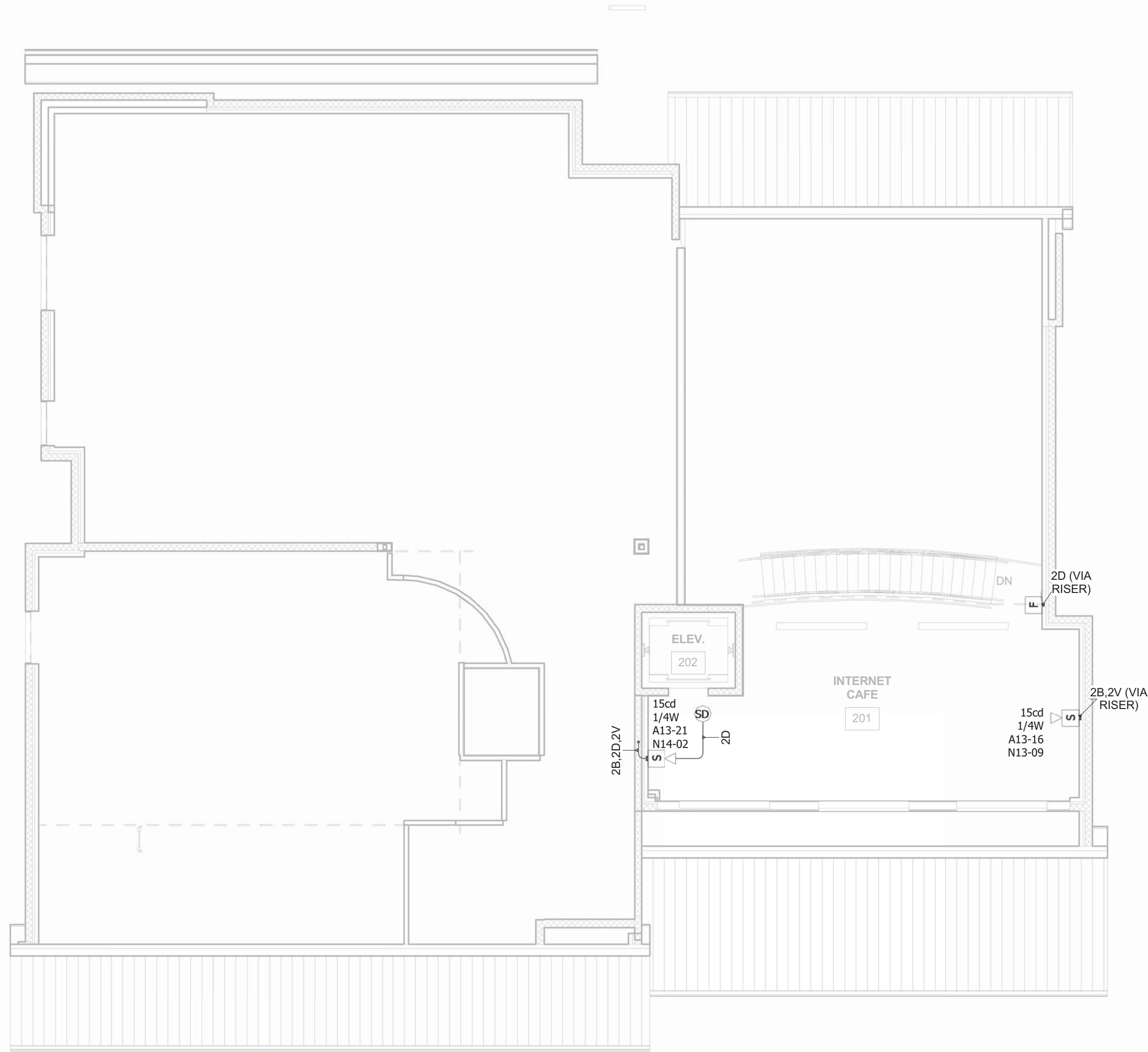
INTERIOR ELEVATION - ROOM 116

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 6' 10'

3





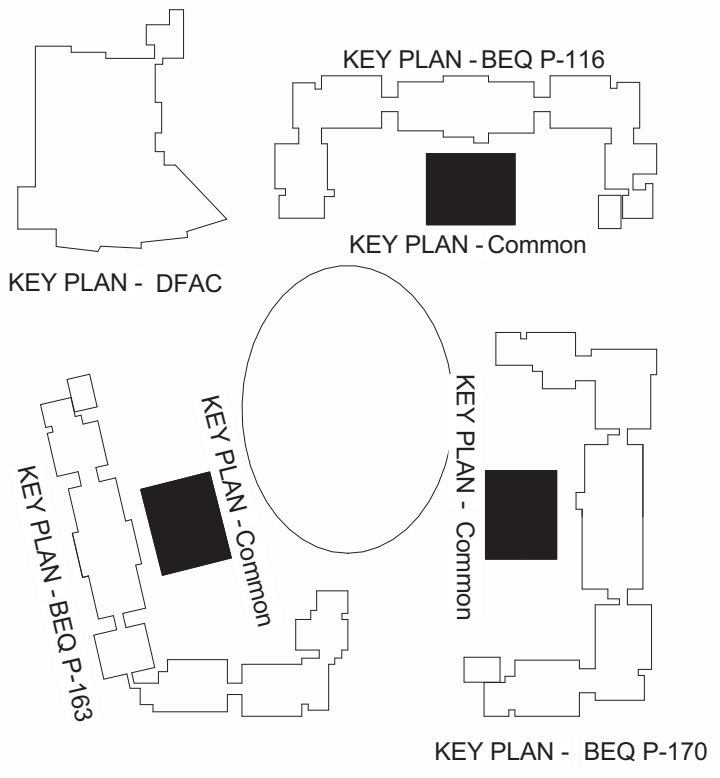
FLOOR PLAN - LEVEL 2 (COMMON BUILDING)

SCALE: 1/8" = 1'-0"
0' 2' 4' 8' 12'

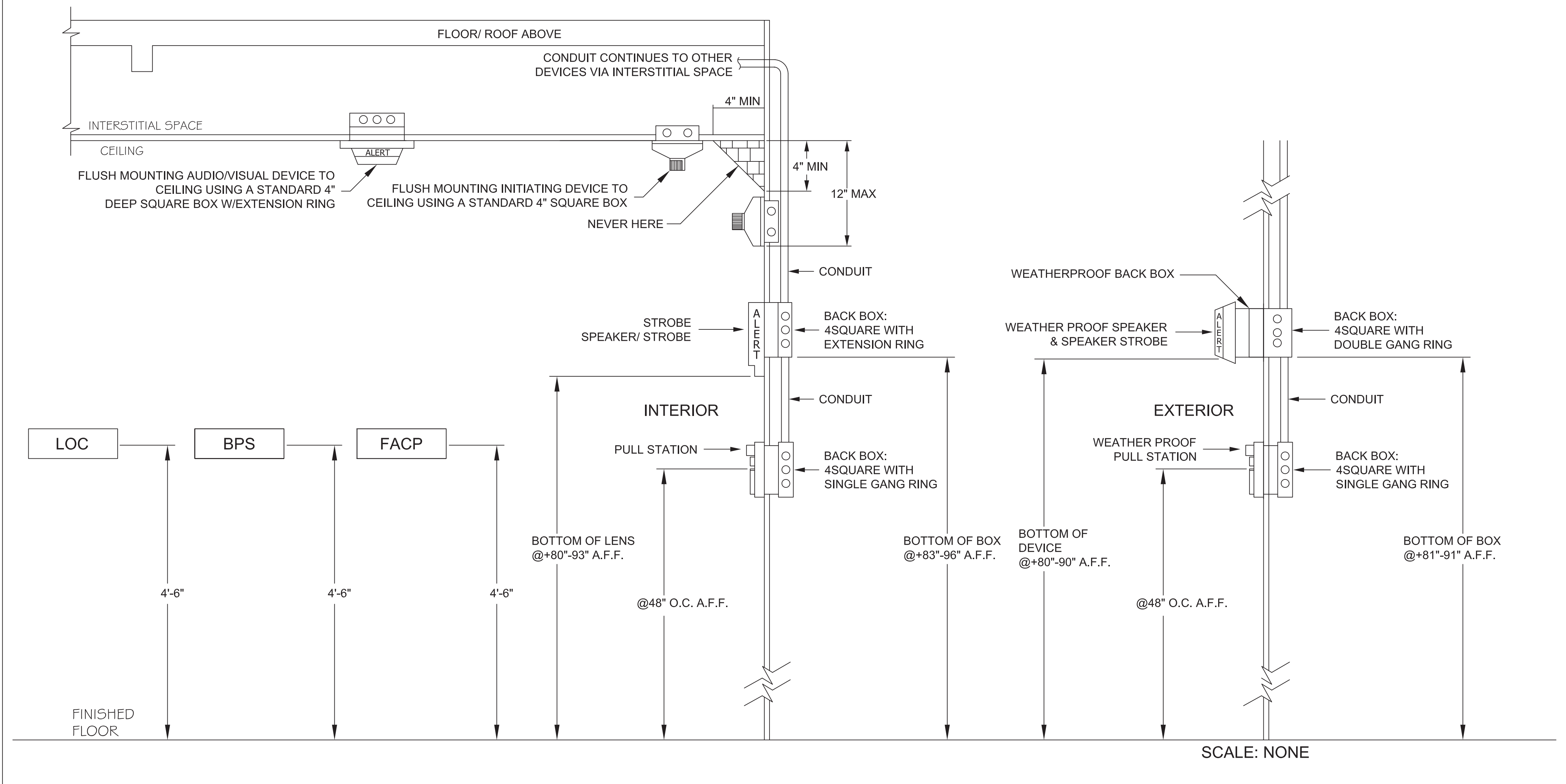
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- PLAN NORTH
BEQ (P-116)
- PLAN NORTH
BEQ (P-163)
- PLAN NORTH
BEQ (P-170)

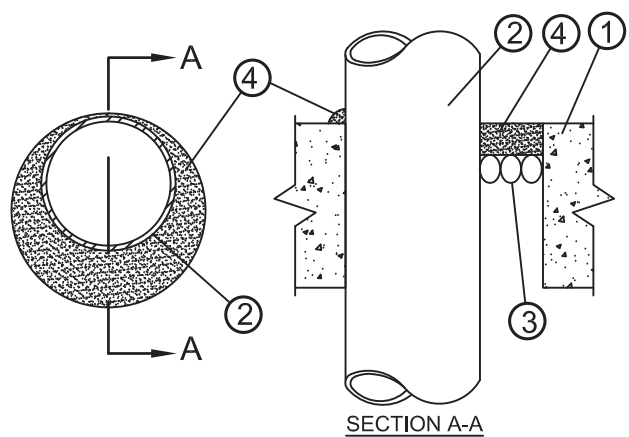
KEYNOTES	
NOTE	DESCRIPTION
01	MONITOR FIRE SPRINKLER WATERFLOW SWITCH
02	MONITOR FIRE SPRINKLER TAMPER SWITCH
03	NOT USED
04	MONITOR ELEVATOR SHUNT TRIP POWER
05	RELAY FOR ELEVATOR SHUNT TRIP CONTROL
06	RELAY FOR PRIMARY ELEVATOR RECALL
07	RELAY FOR SECONDARY ELEVATOR RECALL
08	RELAY FOR FIREFIGHTER'S SERVICE INDICATOR LIGHT
09	RELAY FOR AUDIO/VISUAL SYSTEM SHUTDOWN
10	DUCT SMOKE DETECTOR LOCATED IN ATTIC (REMOTE TEST STATION MOUNTED 60" A.F.F. DIRECTLY BELOW)
11	FIRE ALARM TERMINAL CABINET
12	REMOTE BOOSTER POWER SUPPLY
13	HYDRAULIC, DIRECT PLUNGER TYPE ELEVATOR



FIRE ALARM MOUNTING HEIGHT



SYSTEM NO. 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 I (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 (OPTIONAL, NOT SHOWN) - 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).

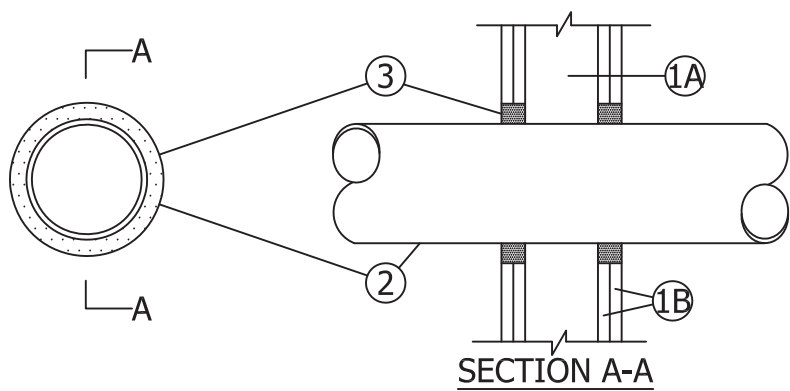
4. FILL,VOID OR CAVITY MATERIAL* - CAULK OR SEALANT - APPLIED TO FILL THE ANNULAR SPACE FLUSH WITH TOP SURFACE OF FLOOR. IN WALL ASSEMBLIES, REQUIRED CAULK THICKNESS TO BE INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL, FLUSH WITH WALL SURFACE. AT POINT CONTACT LOCATION BETWEEN PENETRATE AND SLEEVE OR BETWEEN PENETRATE 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. (MM)	NOM PIPE TUBE OR CONDUIT DIAM IN. (MM)	MAX ANNULAR SPACE IN. (MM)	MIN CAULK THKNS IN. (MM)	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.

*BEARING THE UL CLASSIFICATION MARKING

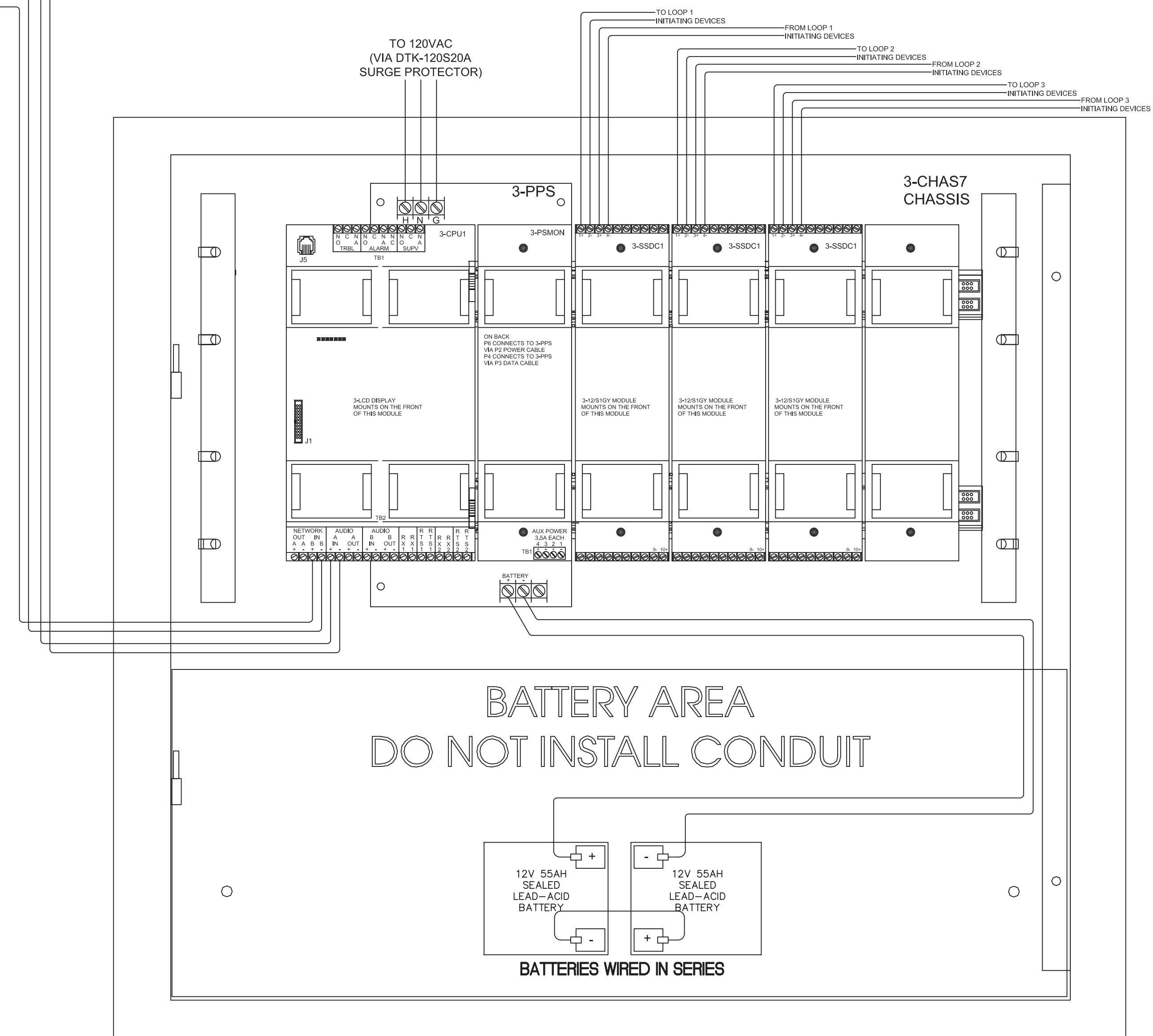
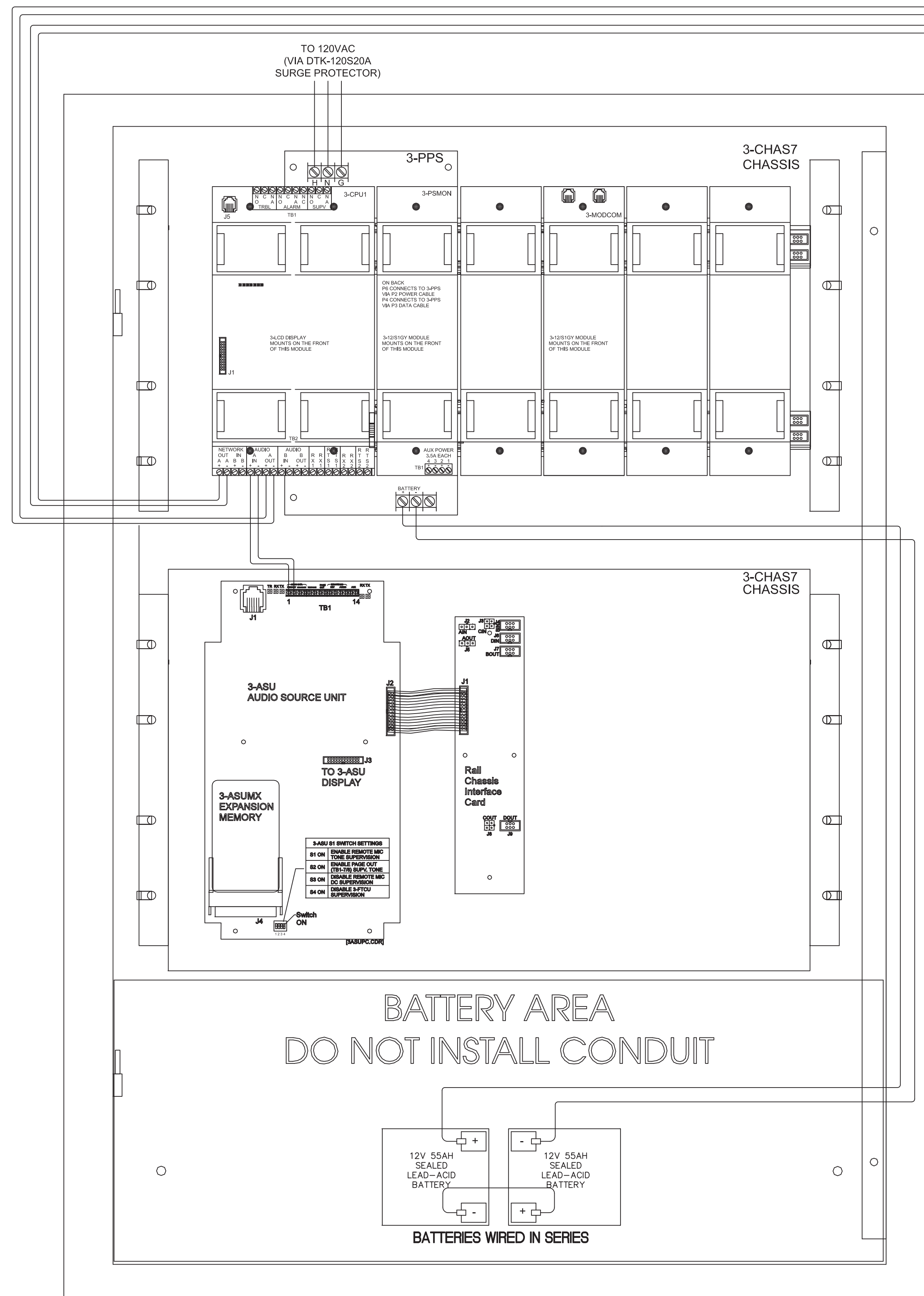
SYSTEM NO. W-L-1001
F RATINGS - 1, 2, 3 AND 4 HR (SEE ITEMS 2 AND 3)
T RATINGS - 0, 1, 2, 3 AND 4 HR (SEE ITEM 3)
L RATING AT AMBIENT - LESS THAN 1 CFM/SQ FT
L RATING AT 400 F - LESS THAN 1 CFM/SQ FT

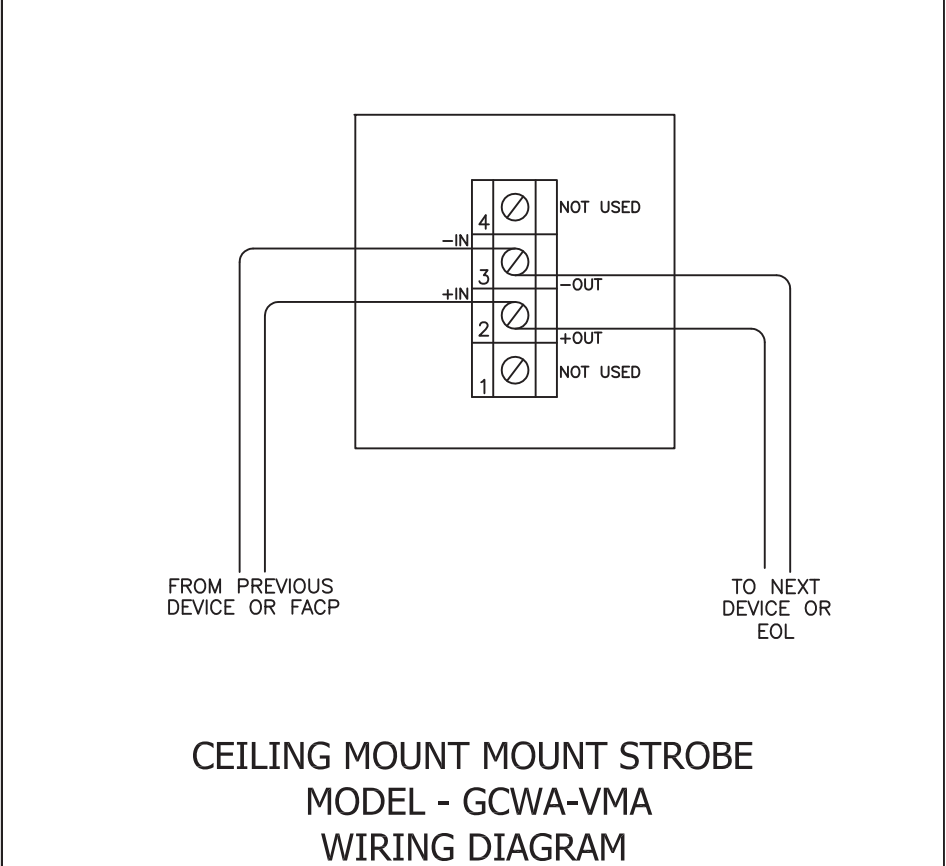
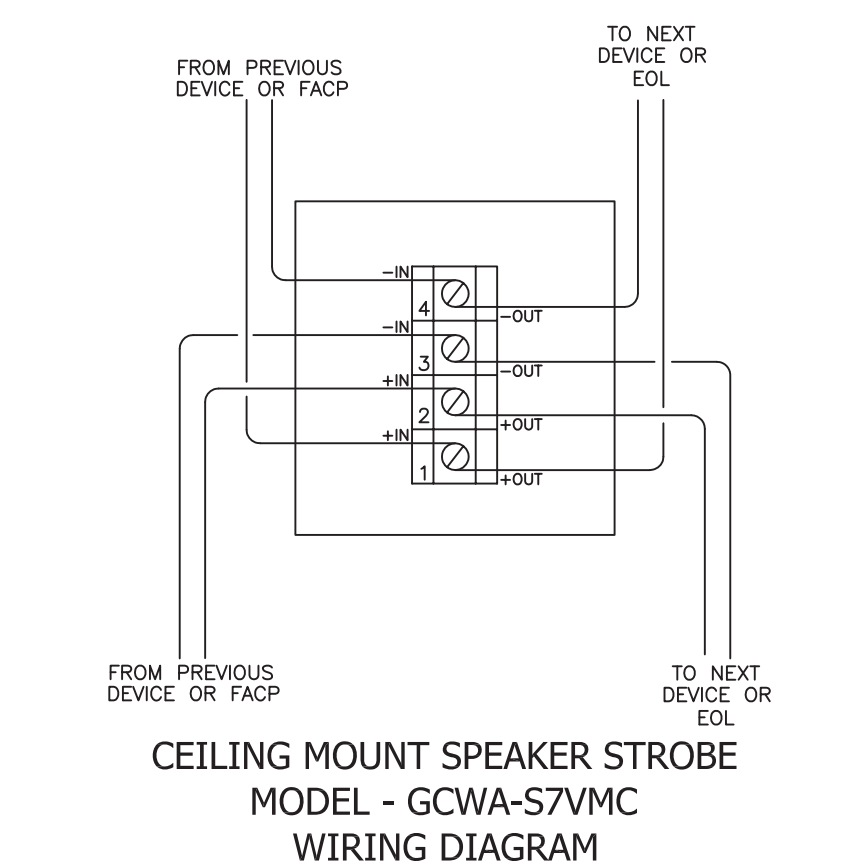
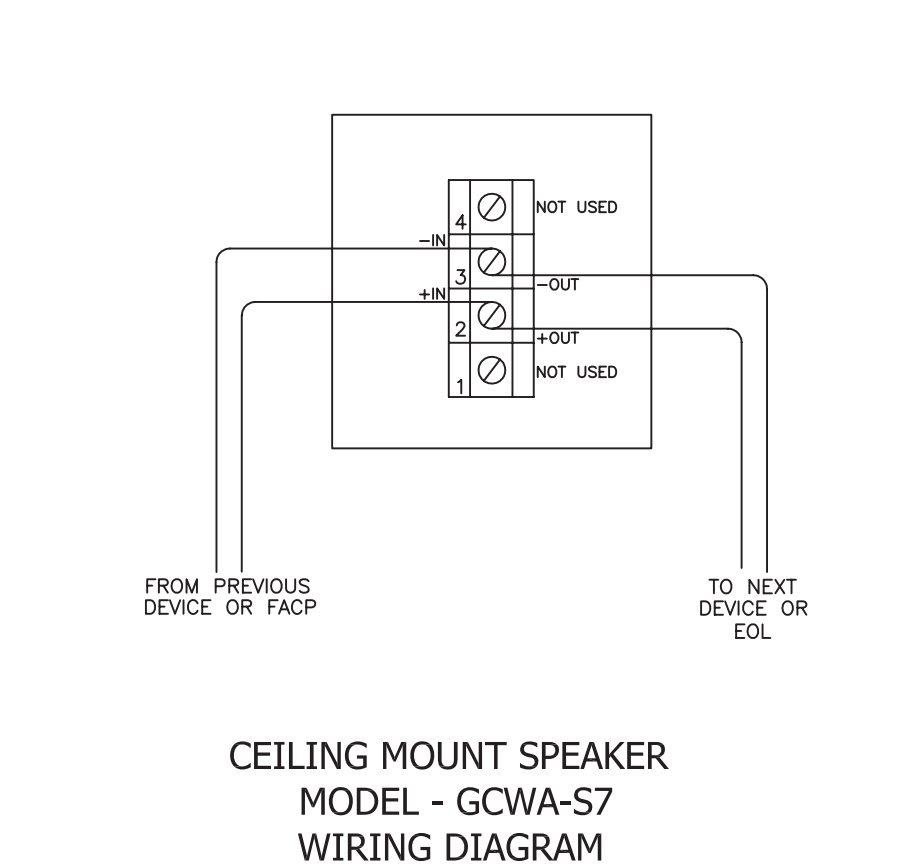
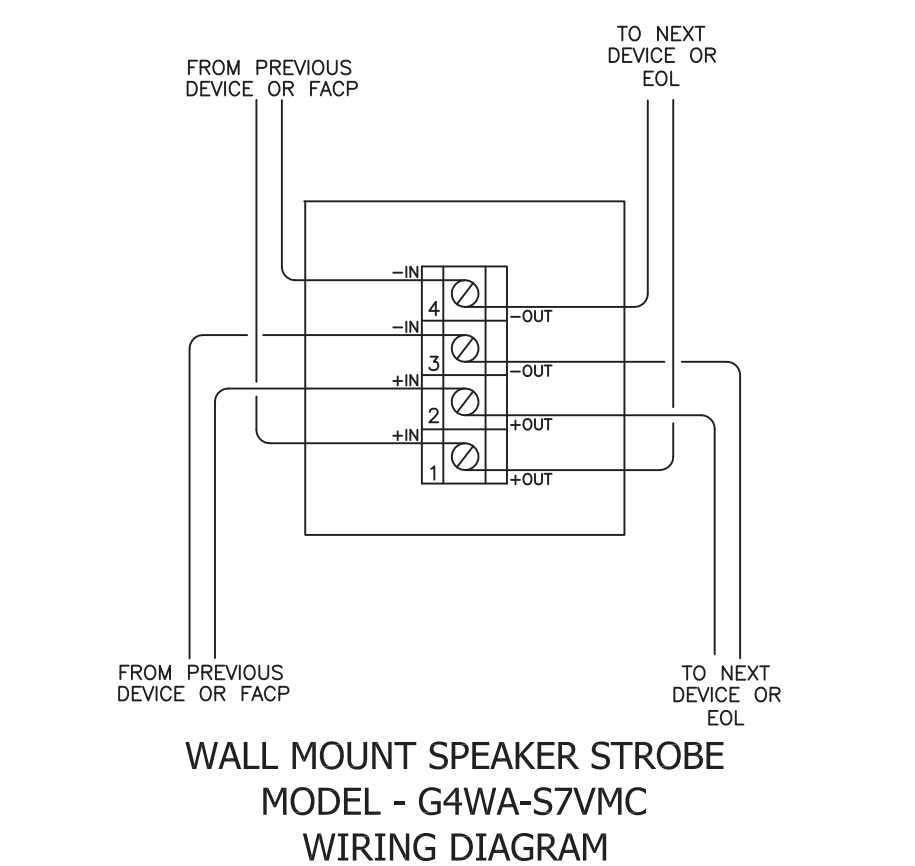
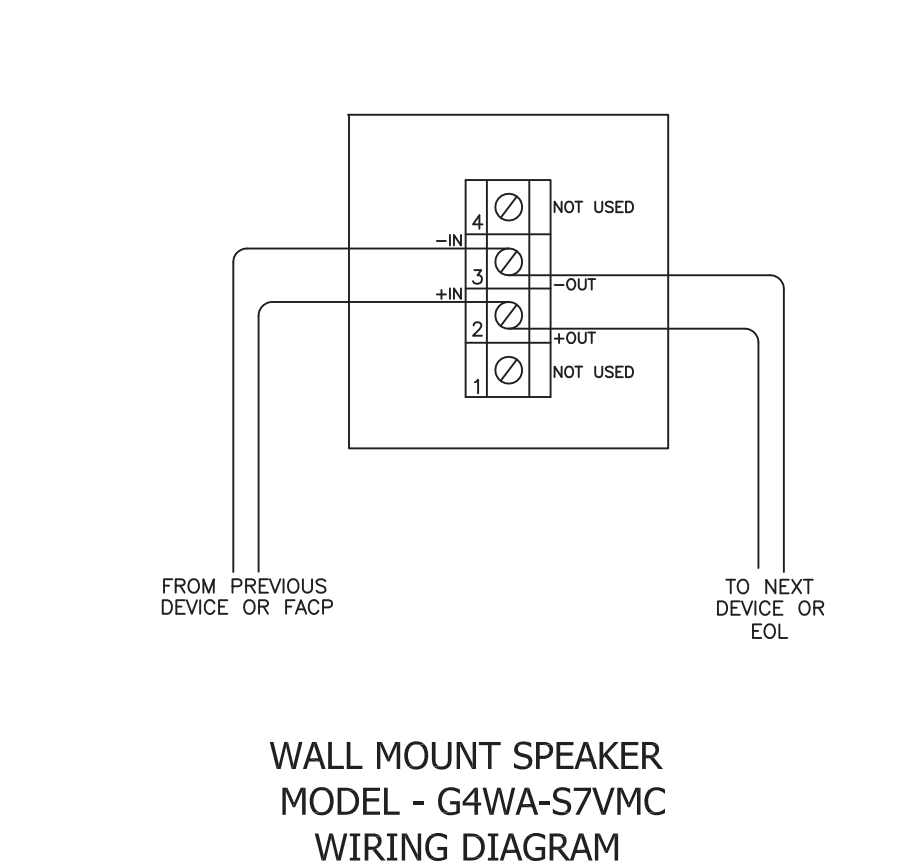
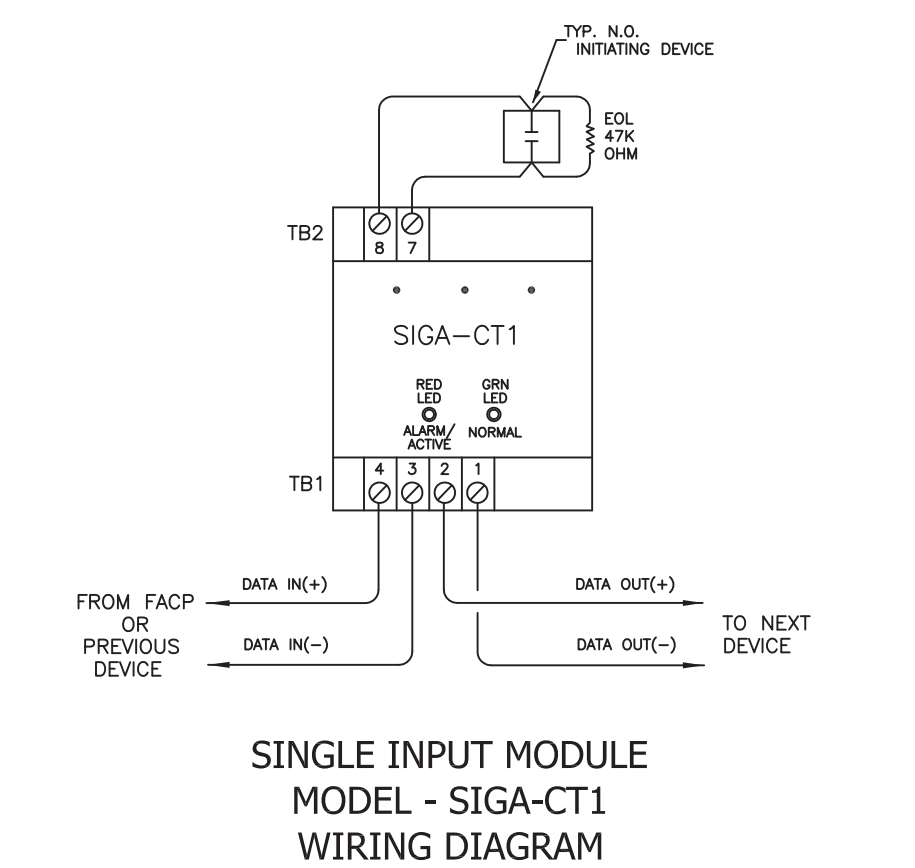
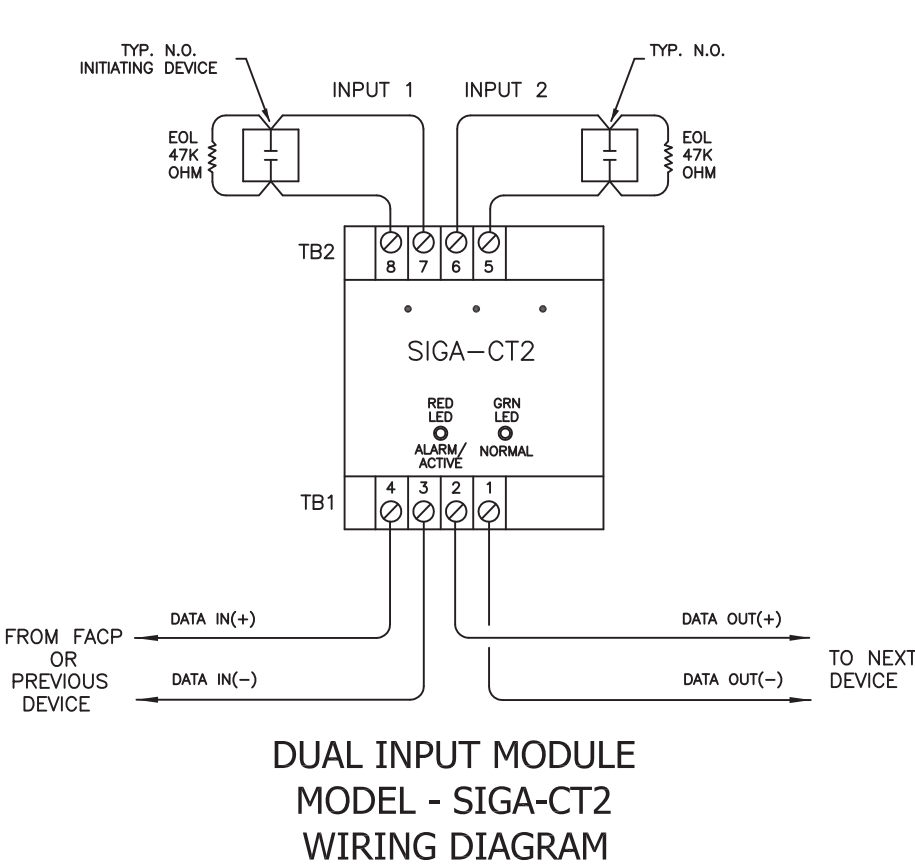
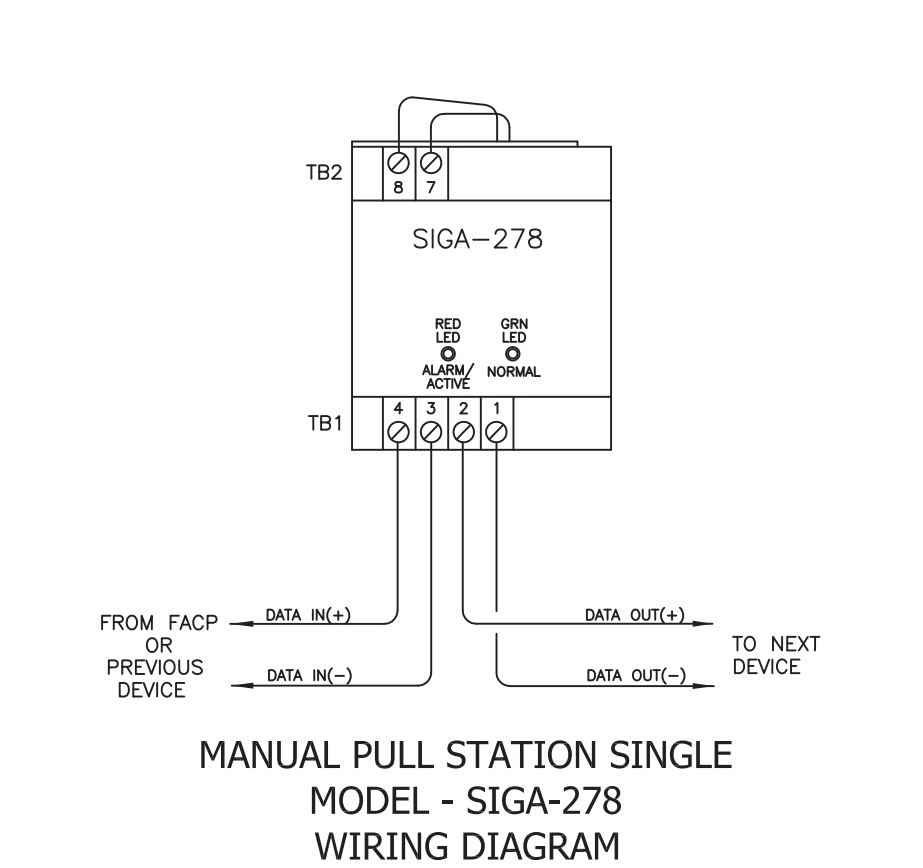
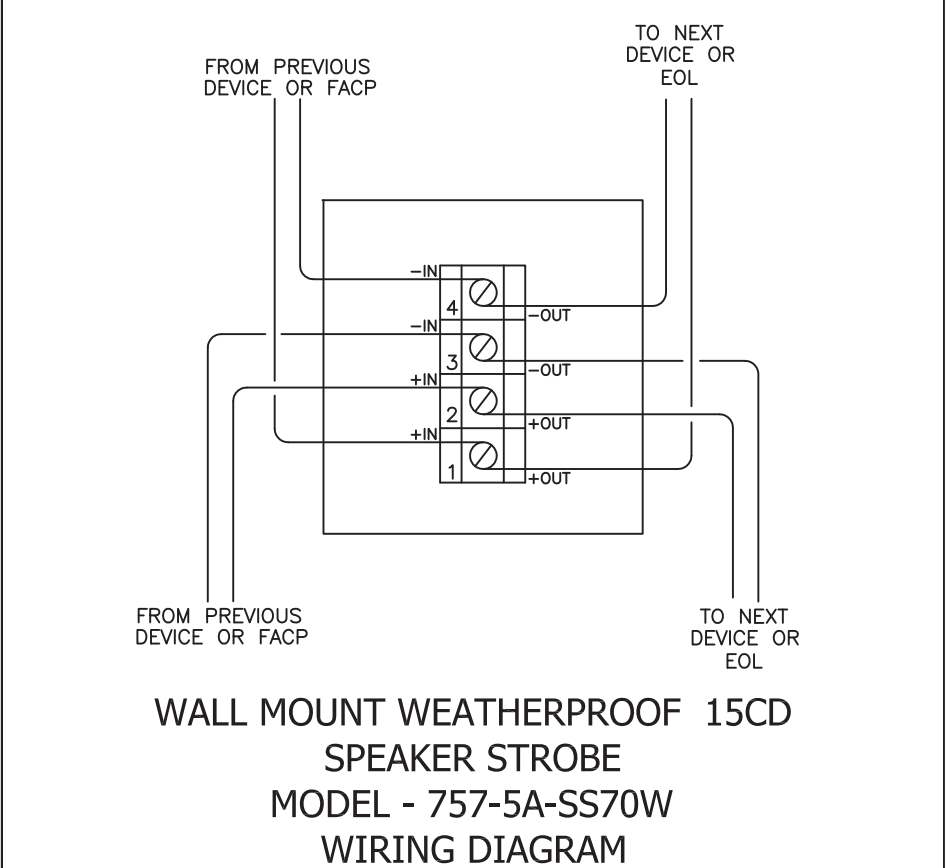
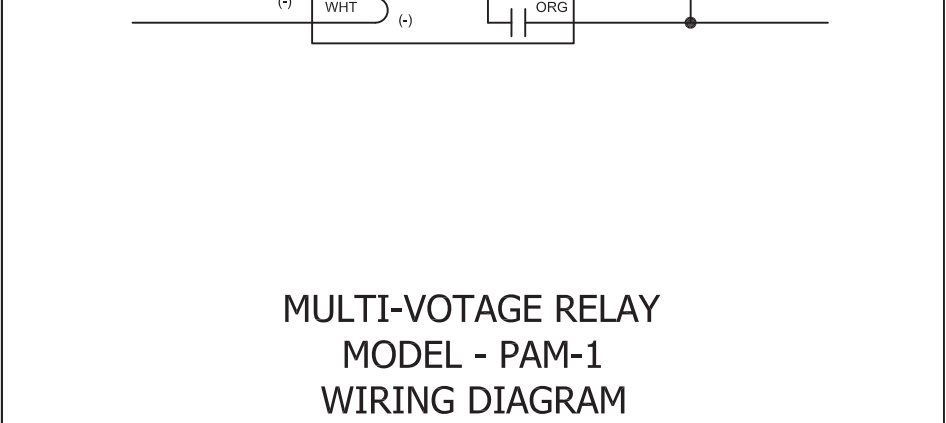
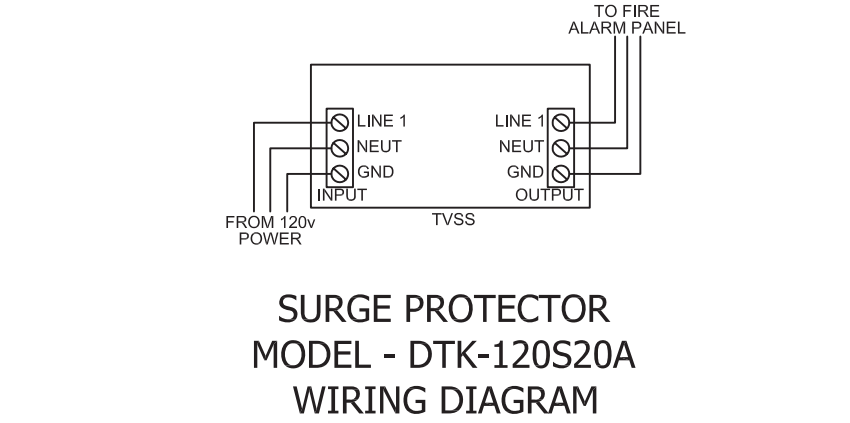
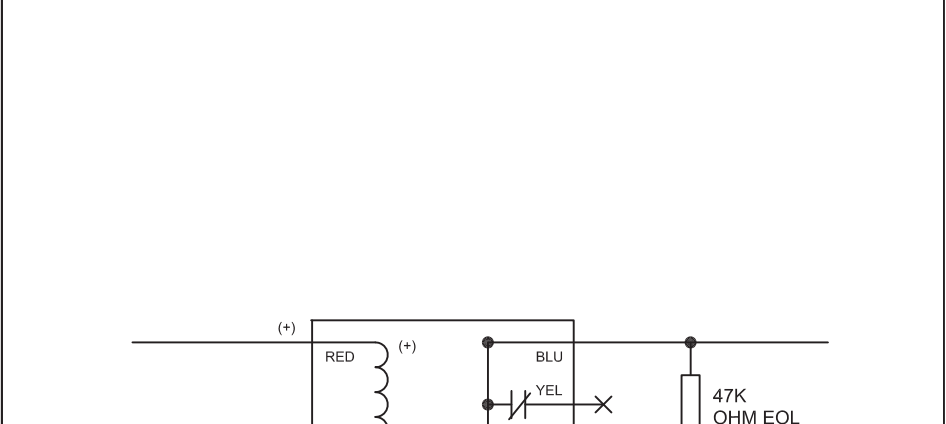
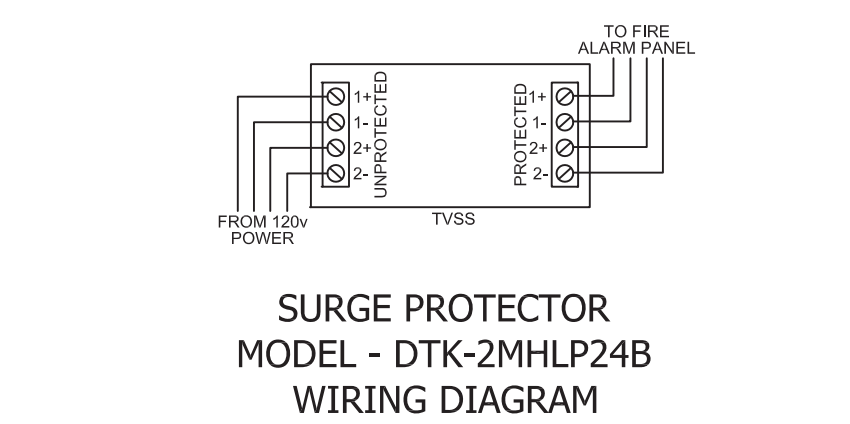
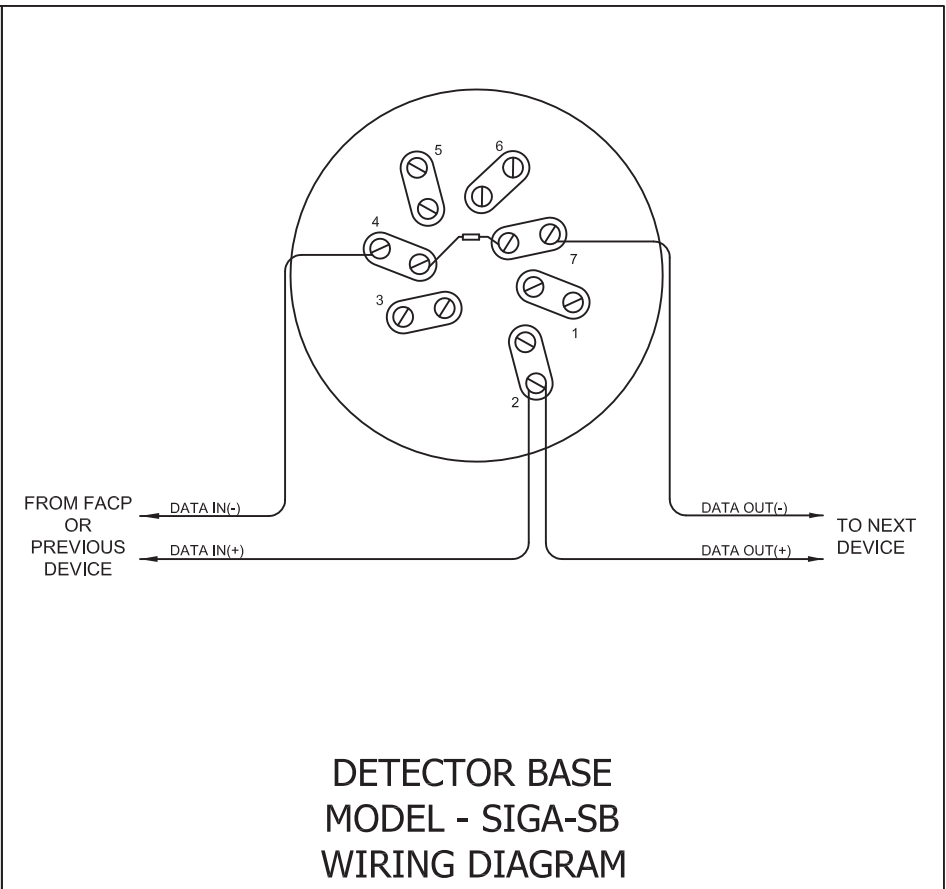
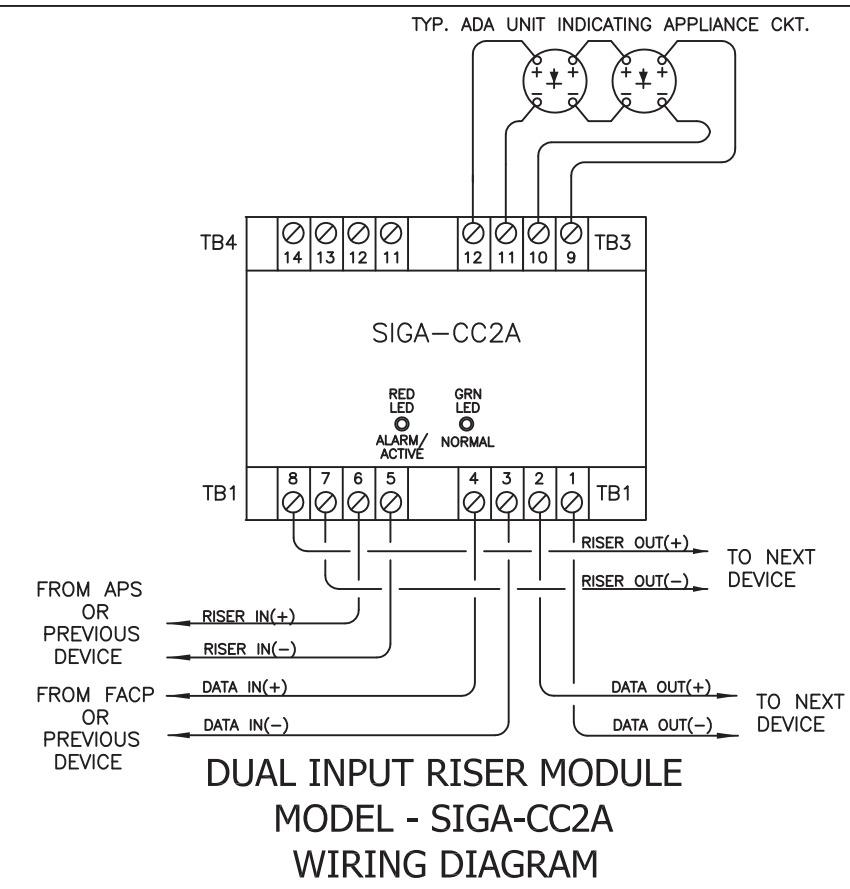
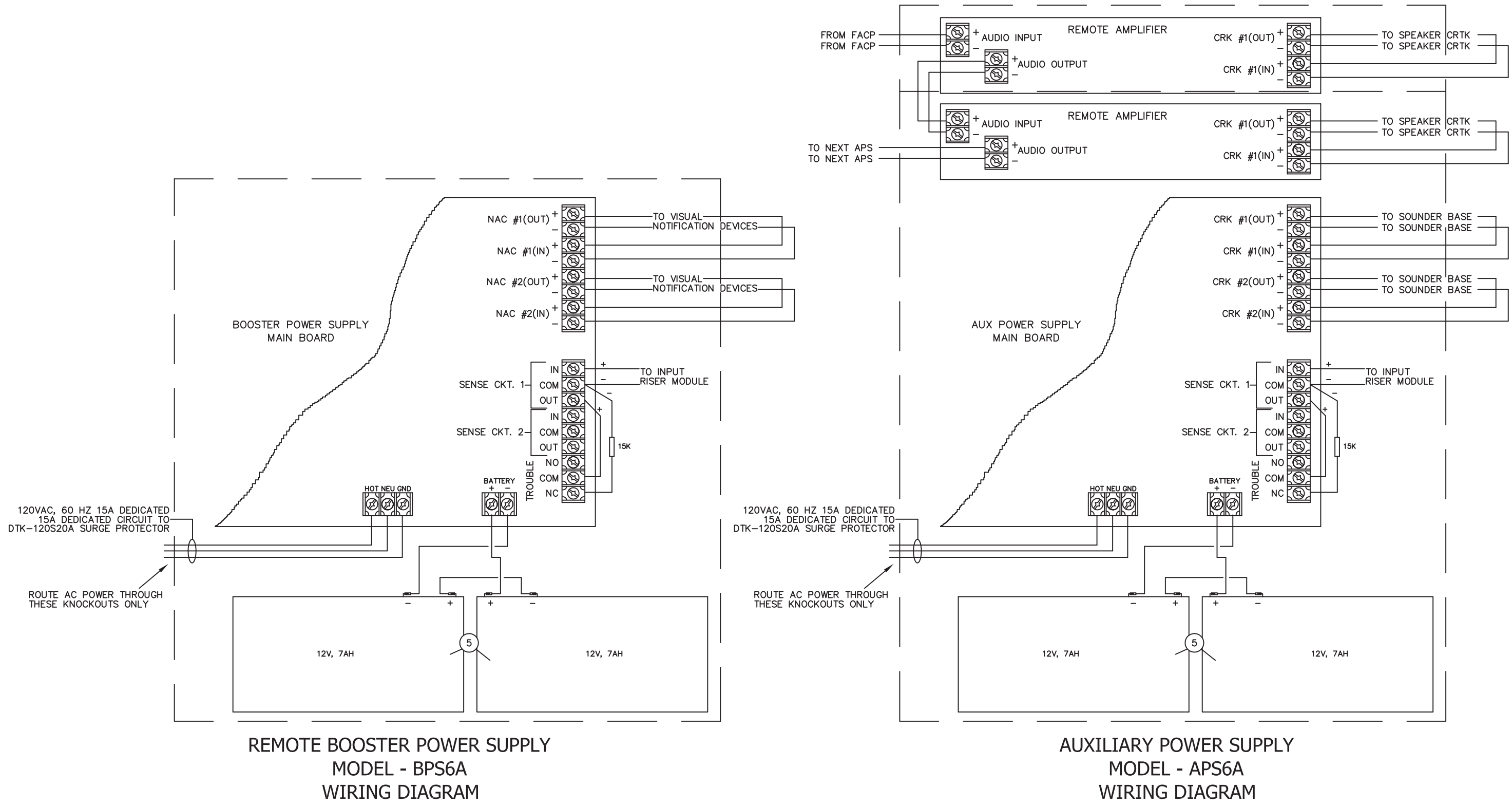


- WALL ASSEMBLY -- THE 1, 2, 3 OR 4 HR FIRE-RATED GYPSUM BOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER SPECIFIED IN THE INDIVIDUAL U300 OR U400 SERIES WALL AND PARTITIONS IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING FEATURES:
 - A. STUDS -- WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS (MAX 2 HR FIRE RATED ASSEMBLIES) OR STEEL CHANNEL STUDS. WOOD STUDS CONSIST OF NOM 2 BY 4 in. (51 BY 102mm) LUMBAR SPACED 16 in. (406mm) O.C. WITH NOM 2 BY 4 in. (51 BY 102mm) LUMBER END PLATES AND CROSS BRACES. STEEL STUDS TO BE MIN 3-5/8 in. (92mm) WIDE BY 1-3/8 in. (35mm) DEEP CHANNELS SPACED MAX OF 24 in. (610mm) O.C.
 - B. GYPSUM BOARD* -- NOM 1/2 OR 5/8 in. (13 OR 16mm) THICK, 4 ft. (122cm) 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. MAS DIAM OF OPENING IS 26 in. (660mm)
- THROUGH-PENETRANT -- ONE METALLIC PIPE, CONDUIT OR TUBING TO BE INSTALLED EITHER CONCENTRICALLY OR ECCENTRICALLY WITHIN THE FIRESTOP SYSTEM. THE ANNULAR SPACE BETWEEN PIPE, CONDUIT OR TUBING AND PERIPHERY OF OPENING SHALL BE MIN 0 in. (0mm) (POINT OF CONTACT) TO MAX 2 in (51mm). 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. (610mm) DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE.
 - B. IRON PIPE -- NOM 24 in. (610mm) DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 in. (305mm) DIAM (OR SMALLER) OR CLASS 50 (OR HEAVIER) IRON PRESSURE PIPE.
 - C. CONDUIT -- NOM 6 in. (152mm) DIAM (OR SMALLER) STEEL STEEL CONDUIT OR NOM 4 in. (102mm) DIAM (OR SMALLER) STEEL ELECTRICAL METALLIC TUBING
 - D. COPPER TUBING -- NOM 6 in. (152mm) DIAM (OR SMALLER) TYPE L (OR HEAVIER) COPPER TUBING.
 - E. COPPER PIPE -- NOM 6 IN DIAM (OR SMALLER) REGULAR (OR HEAVIER) COPPER PIPE.
 - F. THROUGH PENETRATING PRODUCT* - FLEXIBLE METAL PIPING -- THE FOLLOWING TYPES OF STEEL FEXIBLE METAL GAS PIPING MAY BE USED:
 - 1. NOM 2 in. (51mm) 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. (25mm) 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. TITEFLEX CORP, A BUNDY CO
 - 3. NOM 1 in. (25mm) 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
- 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 64mm) THICKNESS OF CAULK FOR 1, 2, 3 AND 4 HR RATED ASSEMBLIES, RESPECTIVELY, APPLIED WITHIN ANNULUS, FLUSH WITH BOTH SURFACES 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 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

*BEARING THE UL CLASSIFICATION MARKING





FACP - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
EST3	3-LCD	1	40		40.00	1	42	42.00
	3CPU3	1	155		155.00	1	165	165.00
	3-24X	3	38		114.00	3	38	114.00
	3-PPS	1	70		70.00	1	70	70.00
	3-ASU	1	80		80.00	1	80	80.00
	3-MODCOM	1	60		60.00	1	95	95.00
LOC	3-ANNCPUI	1	144		144.00	1	144	144.00
	3-REMIC	1	64		64.00	1	64	64.00
Standby Total					727.00			727.00
Alarm Total								774.00
Standby:					727.00 X	60 hrs. =		43.62 A
Alarm:					774.00 X	0.25 hrs. =		0.19 A
Sub Total:								43.81 A
Surplus:						20%		8.76 A
Total Requirement:								52.58 Ah
Battery Supplied: 2 ea. 12V/65Ah BATTERIES FOR TOTAL 65Ah OF BATTERY @ 24VDC								

NODE - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
EST3	3-LCD	1	40		40.00	1	42	42.00
	3CPU3	1	155		155.00	1	165	165.00
	3-SSDC1	1	144		144.00	1	204	204.00
	3-SDDC1	1	264		264.00	1	336	336.00
LOC	3-ANNCPUI	1	120		120.00	1	140	140.00
	3-REMIC	1	64		64.00	1	64	64.00
Standby Total					616.88			616.88
Alarm Total								1112.05
Standby:					616.88 X	60 hrs. =		49.01 A
Alarm:					1112.05 X	0.25 hrs. =		0.28 A
Sub Total:								49.29 A
Surplus:						20%		9.86 A
Total Requirement:								59.15 Ah
Battery Supplied: 2 ea. 12V/65Ah BATTERIES FOR TOTAL 65Ah OF BATTERY @ 24VDC								

APS #1 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1640.00
	SOUNDER BASE SIGA-AB4G	40			40			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			5040.00
Alarm Total								5040.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					5040.00 X	0.25 hrs. =		1.26 A
Sub Total:								3.18 A
Surplus:						20%		0.64 A
Total Requirement:								3.82 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

APS #2 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1148.00
	SOUNDER BASE SIGA-AB4G	28			28			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			4548.00
Alarm Total								4548.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					4548.00 X	0.25 hrs. =		1.14 A
Sub Total:								3.06 A
Surplus:						20%		0.61 A
Total Requirement:								3.67 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

APS #3 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1189.00
	SOUNDER BASE SIGA-AB4G	29			29			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			126.00
Alarm Total								684.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					5399.00 X	0.25 hrs. =		1.35 A
Sub Total:								3.27 A
Surplus:						20%		0.65 A
Total Requirement:								3.92 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

APS #4 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1312.00
	SOUNDER BASE SIGA-AB4G	32			32			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			4712.00
Alarm Total								4712.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					4712.00 X	0.25 hrs. =		1.18 A
Sub Total:								3.10 A
Surplus:						20%		0.62 A
Total Requirement:								3.72 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

APS #5 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1476.00
	SOUNDER BASE SIGA-AB4G	36			36			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			4876.00
Alarm Total								4876.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					4876.00 X	0.25 hrs. =		1.22 A
Sub Total:								3.14 A
Surplus:						20%		0.63 A
Total Requirement:								3.77 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

APS #6 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
APS6A	1	30			30	1	41	1107.00
	SOUNDER BASE SIGA-AB4G	27			27			
	REMOTE AMPLIFIER SIGA-AA30	2	1	2	2	1700	3400.00	
Standby Total					32.00			4507.00
Alarm Total								4507.00
Standby:					32.00 X	60 hrs. =		1.92 A
Alarm:					4507.00 X	0.25 hrs. =		1.13 A
Sub Total:								3.05 A
Surplus:						20%		0.61 A
Total Requirement:								3.66 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

BPS #1 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
BPS6A	1	70			70	1	63	1008.00
	15cd CEILING SPEAKER STROBE					1	167	167.00
	28cd WALL SPEAKER STROBE WP					2		
Standby Total					70.00			1175.00
Alarm Total								1175.00
Standby:					70.00 X	60 hrs. =		4.20 A
Alarm:					1175.00 X	0.25 hrs. =		0.29 A
Sub Total:								4.49 A
Surplus:						20%		0.90 A
Total Requirement:								5.39 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

BPS #2 - BATTERY CALCULATIONS								
Device or Control			Standby Current (mA)			Alarm Current (mA)		
			Qty.	Current	Total	Qty.	Current	Total
BPS6A	1	70			70	1	63	756.00
	15cd CEILING SPEAKER STROBE					12		
	28cd WALL SPEAKER STROBE WP					2	167	334.00
Standby Total					70.00			1090.00
Alarm Total								1090.00
Standby:					70.00 X	60 hrs. =		4.20 A
Alarm:					1090.00 X	0.25 hrs. =		0.27 A
Sub Total:								4.47 A
Surplus:						20%		0.89 A
Total Requirement:								5.37 Ah
Battery Supplied: 2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC								

BPS #3 - BATTERY CALCULATIONS						
Device or Control	Standby Current (mA)			Alarm Current (mA)		
	Qty.	Current	Total	Qty.	Current	Total
BPS6A	1	70	70			
15cd CEILING SPEAKER STROBE				10	63	630.00
30cd CEILING SPEAKER STROBE				1	90	90.00
95cd CEILING SPEAKER STROBE				1	194	194.00
	Standby Total		70.00	Alarm Total		
						914.00
Standby:		70.00 X	60 hrs. =	4.20 A		
Alarm:		914.00 X	0.25 hrs. =	0.23 A		
Sub Total:				4.43 A		
Surplus:			20%	0.89 A		
Total Requirement:				5.31 Ah		
Battery Supplied:	2 ea. 12V/7Ah BATTERIES FOR TOTAL 7Ah OF BATTERY @ 24VDC					

Appendix H – Fire Alarm Product Data

EST3-Sixty

UL 2572 Listed Mass Notification and UL 864 Listed Fire Alarm



Overview

Fire alarm and Mass Notification/Emergency Communication (MNEC): no matter what the configuration, EST3-Sixty provides a total life safety system. With fire alarm providing the communications backbone, EST3-Sixty is UL2572 Listed for Mass Notification operations, while retaining its UL864 Listing as a fire alarm control system. This unique standing ensures that MNEC functions are in perfect harmony with other life safety operations.

Only EST3-Sixty can ensure that MNEC retains priority over fire alarm events and that Mass Notification will not affect the network response speed of fire reporting mandated by codes and standards.

The benefits of this method are many. Mass Notification now benefits from the survivability and reliability mandated by the fire codes and life safety standards. Costs are reduced because system resources are shared. Installation of a single unified system is vastly more efficient than installing multiple interconnected systems. There is no finger pointing, patchwork protocols or gateways that combine one system with another. Just the simple elegance of a single system unencumbered by needless redundancy. EST3 achieves true operational unity with single-system responsibility.

The EST3 is modularly listed under the following standards: UL 864 categories: UOJZ, UOXX, UUKL and SYZV, UL 294 category ALVY, UL 609 category AOTX, UL 636 category ANET, UL 1076 category APOU, UL 365 category APAW, UL 1610 category AMCX, UL 1635 category AMCX, UL2572 Mass Notification.
Also listed to ULC-S527, ULC-S303, and ULC/ORD-C1076.

Standard Features

- Listed for Mass Notification/Emergency Communication, Fire, Security, Access Control, and Emergency Voice Alarm
- Voice Over IP Campus Network Paging
- Campus IP Network UL Listed for MNEC/Fire
- True seamless integration of Fire, Security and MNEC functions
- 168-character LCD
- Exceptional alarm response times
- Network supports copper, multi-mode fiber, single-mode fiber, or a combination of all three
- Total network wiring over 160,000 feet
- Eight channels of multiplexed digital audio on a single pair of wires or fiber filament
- Zoned, distributed and banked audio amplifier options
- Local, Proprietary, and Central Station system operations
- In retrofit applications, existing wiring may be used if code compliant
- Supports Edwards Signature Series detectors and modules
- UL864 Ninth Edition Listed
- UL2572 Mass Notification Listed
- Optional earthquake hardening: OSHPD seismic pre-approval for component Importance Factor 1.5

Mass Notification/ Emergency Communication (MNEC)

During an emergency, building occupants need instructions on when to stay put, when to evacuate, and where to go. They need instructions that reflect the changing conditions of the emergency; instructions that take them to safety one step at a time.

Whether the emergency is a result of a hurricane, tornado, environmental accident, domestic violence, or terrorist threat, response personnel must remain in control of the situation and keep the lines of communication open. EST3-Sixty's MNEC capability accomplishes this by leveraging the power behind the EST3 communications network and offering response personnel the tools they need, not only to warn building occupants of imminent danger, but also guide them to safety.

This requires much more than a simple public address system. Only EST3 benefits from a truly unified communications backbone that can deliver highly survivable MNEC – and simultaneous control of critical building infrastructure functions. Only EST3-Sixty with MNEC unifies emergency communications with threat detection and security control to offer this degree of emergency functionality.

Life Safety Redefined

EST3-Sixty is the name used to describe EST's method of combining fire alarm and Mass Notification into one seamless system. It is not a new system, but rather the logical extension of EST3 architecture into emergency communications.

EST3-Sixty promotes the sharing of resources. It makes a simpler system. One that's easier to service and less trouble to program than several separate systems. EST3 has always been an event-driven system that orchestrates all fire alarm functions with extraordinary efficiency. With added MNEC functions, the possibilities are endless: broadcast to cell phones and other wireless devices; send out email blasts, make use of electronic bulleting boards for emergency communications purposes; or use fire alarm paging functions to offer instructions to building occupants during an emergency – all this through software, with no extra relays or wiring.

Seamless and absolute interplay among functions

From a hardware perspective, the benefits of EST3-Sixty are many. Enclosures, power supplies and backup batteries can be shared by all system functions, as can communication circuits. Now with EST3-Sixty, a simple program rule to unlock the doors replaces additional conduit, wiring and interposing relays. Elevator connections also benefit by using the same supervised control relay package for both elevator recall and elevator access control, and that minimizes wiring.

The *FireWorks* PC-based graphic annunciation and control package is available to coordinate system events on its intuitive segmented display. This event-driven system places all system activity in immediate view and command of the operator. Drivers are available for many major CCTV equipment manufacturers, facilitating the smooth integration of CCTV with fire alarm and MNEC functions. Cameras can automatically be directed to preset locations and easily maneuvered by the operator, all from the same screen.

EST3-Sixty establishes a new benchmark

EST3-Sixty elevates the reliability and survivability of MNEC functions to a level found previously only in dedicated fire alarm systems. EST3 is the first UL 864 and UL 2572-listed fire and MNEC platform ever engineered. The result is a whole that is much greater than the sum of its parts.

Outstanding Features

The EST3 is a modular life safety system uniquely designed to meet the needs of any size facility, be it a single panel system or a multi-panel network.

System components are arranged in layers, starting with the backbox and finishing with inner and outer doors. Cabinets are available with room for up to 20 modules and system batteries up to 65 AH. A single 24-volt battery can act as the secondary power supply for all four internal power supplies. Once the backbox is installed, up to four power supplies can be installed in the chassis assembly. The power supplies use a unique paralleling arrangement that ensures the optimum use of each supply. Each supply

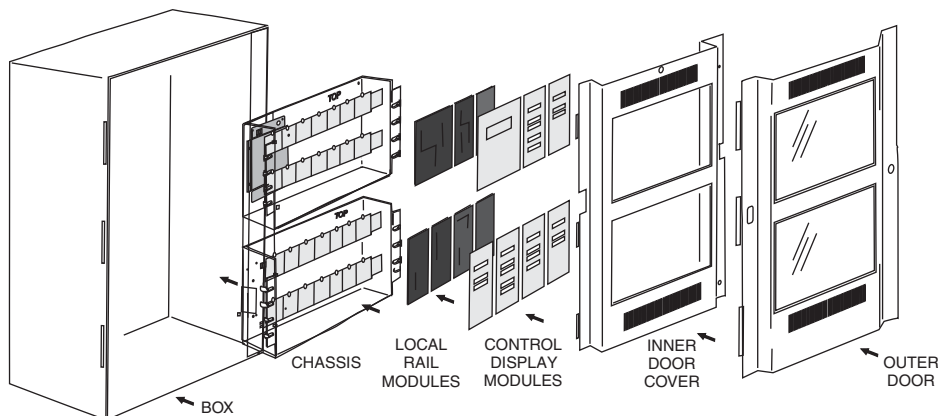
has the capacity to deliver up to 7 amps at 24 Vdc (28 amps total).

The function of each life safety network panel is determined by the Local Rail Modules (LRMs) plugged into the panel's chassis. An extensive variety of modules are available, including central processing units, input/output

circuit modules, communication modules, security/access control modules, and audio amplifier modules. Please refer to the individual LRM module catalog sheets for specific details of module functionality.

The top layer of the LRMs is referred to as the user interface layer. This layer is made up of the Main Display Interface module and a system of generic control/display modules. Any control/display module can mount on any LRM. This maximizes flexibility of design for custom systems. The inner and outer doors finish and secure the enclosure.

A single panel can support up to 2,500 addressable points, provide 28 amps @ 24 Vdc, provide access control for up to 124 doors, and still have room for future expansion. If a single panel is not large enough or you need to distribute functionality throughout the project, then you can network up to 64 panels together!



Networking/Communications

The EST3-Sixty Life Safety/MNEC Network uses a multi-priority peer-to-peer token ring protocol. The protocol gives EST3-Sixty the exceptionally fast alarm response time of less than three seconds across the network, virtually independent of the total number of nodes. The EST3 token ring network configuration also affords long distances between panels. The distance between any three panels on #18 AWG (1.0 mm²) is 5,000 ft (1,523m) for both network control and digital audio signals. Supporting a maximum of 64 panels on a network, the total network length can be 160,000 ft (48,760 m). Network and audio communication are via RS-485 serial ports. Each two-wire circuit supports Class A (Style 7) or Class B (Style 4) wiring configurations. Fiber optic media is also available.

As an indication of the high level of system integration, off-premise communications is handled by the Modcom modem communicator module. This module provides the Digital Alarm Communicator Transmitter (DACT) function, sending system status signals for up to 255 accounts to up to 80 different central monitoring stations and/or commercial paging carriers. The Modcom also acts as a V.32bis 14.4K-baud modem for uploading and downloading of system data remotely via the telephone network.

Digital Audio

EST3-Sixty digitized audio can deliver up to eight audio messages *simultaneously* over a single pair of wires. This is plenty of capacity for both fire alarm voice evacuation as well as MNEC purposes.

All audio messages and live pages originate at the Audio Source Unit (ASU) that can store up to 100 minutes pre-recorded audio messages as .wav files. These messages can be automatically directed to various areas in a facility under program control. On the receiving end, zoned amplifiers installed in remote fire alarm cabinets receive and decode the digital messages. The messages are then amplified and sent out to the speakers.

The availability of eight different channels opens a number of new *simultaneous* notification possibilities:

- 1) Live voice page for MNEC or fire-related instructions;
- 2) Emergency floor evacuation/notification message;
- 3) Alert message on floors above and below the emergency;
- 4) Stairwell evacuation reinforcement message;
- 5) Elevator cab information messages;
- 6) Lobby message instructing occupants to exit the building;
- 7) Concourse instructions to occupants not to enter the lobby;
- 8) Other instructions to areas not directly affected by the emergency.

Any combination of the eight audio channels can be automatically directed to any or all areas of the building, with total manual override as required. Eight channel capability assures that one message is never interrupted in order to process another, a common fault with two-channel systems. This eliminates any chance of confusing the occupants with conflicting messages.

Survivability is also an integral part of EST3's digitized audio system. Default audio messages are continuously transmitted to all network amplifiers by the ASU. These messages provide audio supervision for the digital audio chain, and act as a default signal if the network data circuit fails or should message control information fail to reach the ASU. If the audio data circuit fails, each amplifier generates a 1KHz temporal (3-3-3) tone that is transmit-

ted during an alarm. In the event of an amplifier failure, a backup audio amplifier is automatically substituted for the failed amplifier in the cabinet, restoring audio capability. In the unlikely event of multiple amplifier failures, the backup amp replaces the amplifier actively processing the highest priority message in the cabinet. When messages are no longer directed to a failed amplifier such as when a high priority page message ends, the backup amp is dynamically reassigned to the next highest priority failed amplifier actively processing messages.

The Firefighters Telephone Control unit (FTCU) provides two-way communications between remotely located phones and the fire command center. The alphanumeric display makes operation intuitive, and a single switch permits the phone signals to be used to issue pages in the facility.

Digitized audio increases notification messaging flexibility, reduces wiring and installation costs, provides enhanced supervision and survivability, and is easy to use.

Enhanced Reliability & Survivability

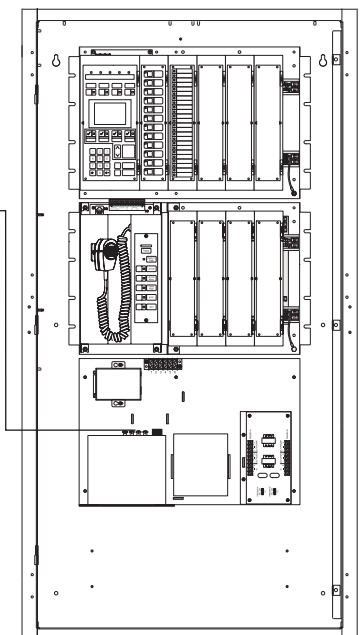
The EST3 uses distributed technology, designed to survive expected and unexpected events including earthquakes. Simple-to-install kits provide internal hardening that meets requirements defined by *Uniform Building Code (UBC 1997)*; *International Building Code (IBC 2006)*; and, *Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems (AC-156)*. Seismic component importance factor of 1.5 can be met by adding appropriate anchorage for local conditions. There is no need for special installation methods for EST3 field devices including signals and detection devices. By following standard mounting methods, along with any local requirements, seismic Importance Factor 1.5 may be gained in order to further enhance system survivability.

On the initiating side, intelligent Signature Series detectors can make alarm decisions on their own, and do not involve other system components in this important decision-making process. Sensor-based technology must communicate data to a remotely located common panel where alarm decisions are made. Failure of this centralized processor can cripple sensor-based systems. With EST3, a panel CPU failure does not disable a panel's ability

Component Layout

EST3-Sixty Control Panel

MN-BRKT1
Mounting Bracket



For earth quake anchorage including detailed mounting weights and center of gravity detail please refer to Seismic Application Guide 3101676. Approval of panel anchorage to site structure may require local AHJ, structural or civil engineer review.

to provide protection. In the event of a CPU failure, the intelligent device controllers can still receive alarms and distribute the alarm information to all other modules in the panel. Modules in the panel are capable of responding with a programmed standalone alarm response.

When a network is wired in a Class B configuration, a single break or short on the wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network, working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted – without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages. Survivability is maximized as responses originating and executed by a single panel are always carried out because a copy of the system database is stored in the panel's memory.

Scheduled maintenance improves system availability, and EST3 is designed to make system maintenance easy. Meanwhile, system components are designed to assist in routine and time-consuming service functions.

System Configuration

The powerful EST3-Sixty System Definition Utility (SDU) helps define flexible system operations in a fraction of the time required by other systems. Based on an object-oriented system of rules, virtually all EST3-Sixty operating features are software-controlled. This gives the designer great flexibility in integrating fire, security, and access control functions into a single seamless design.

A report generator provides a complete library of system reports that are invaluable for troubleshooting, including a printout of Signature device connections as the devices are actually wired.

Use of software-based components permits the SDU to add new features to the system. Even the Signature Series devices are capable of upgrading firmware as new detection algorithms become available.

User Friendly

A comprehensive survey of users and ongoing consultation has resulted in system features and controls that are easy to use.

The main display interface shows the operator the first and most recent system events – without ever touching a single control! All system events are sent to one of four message queues. Alarm messages are never intermixed with trouble or supervisory signals, eliminating confusion. Need more information? The “Details” switch provides additional information about the highlighted device. The operator can easily review supervisory, trouble, and monitor messages by simply selecting the appropriate message queue. After a few minutes of inactivity, the system automatically returns to displaying the first and most recent events.

Optional manual control switches and display modules can be arranged on the system operator layer to suit the application. These modules can be used to provide additional HVAC controls, manual selection of audio circuits, or other required manual control functions.

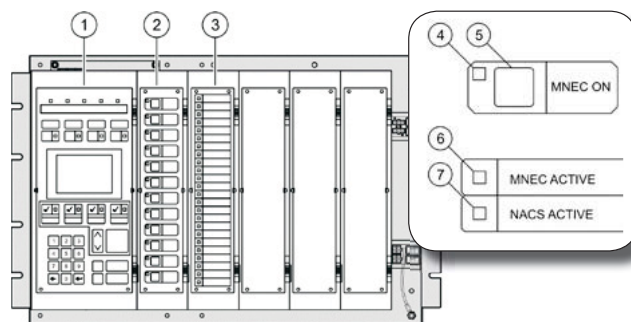
The digital audio system uses only five basic controls to direct all paging messages.

- ALL CALL directs page messages to all zones in the facility.

- Page to EVACUATION automatically directs page messages to the fire area.
- Page to ALERT automatically directs page messages to the areas receiving the alert message.
- All Call Minus automatically directs page messages to the areas NOT receiving the evacuation or alert messages.
- Page by Phone selects the firefighters' telephone system as the source for paging.

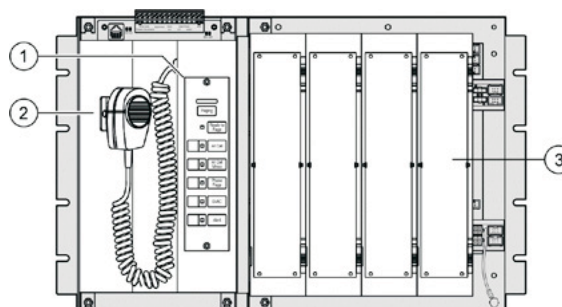
The Firefighters' Telephone Control Unit (FTCU) uses an alphanumeric display to indicate the source of incoming calls. Operators simply scroll through the list and hit the “Connect” button when the desired call is highlighted. There is no need to look through rows of lamps and switches to determine the source of calls. Up to five remote locations can be in simultaneous two-way communications with the FTCU.

CCS Panel Controls and Indicators



1. 3-LCD
2. 3-12SR or equivalent
3. 3-24R or equivalent
4. MNEC ON button status LED. On indicates MNEC ON button was pressed.
5. MNEC ON button. Press to activate MNEC operation.
6. MNEC status LED. On indicates MNEC operation is active.
7. NAC status LED. On indicates all notification appliance circuits are active.

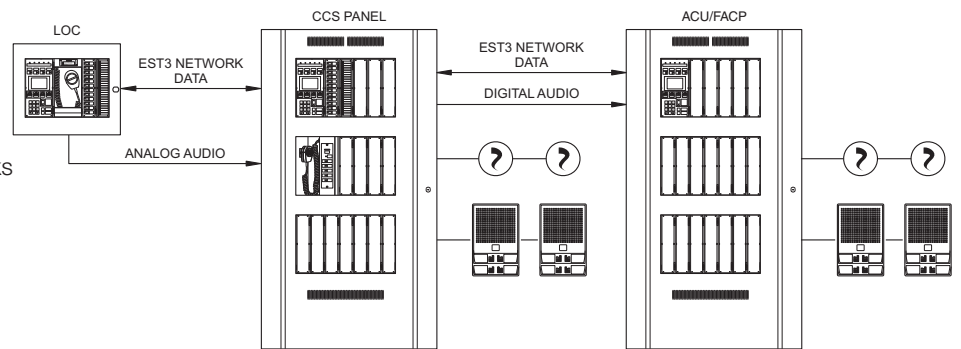
3-ASU Controls and Indicators



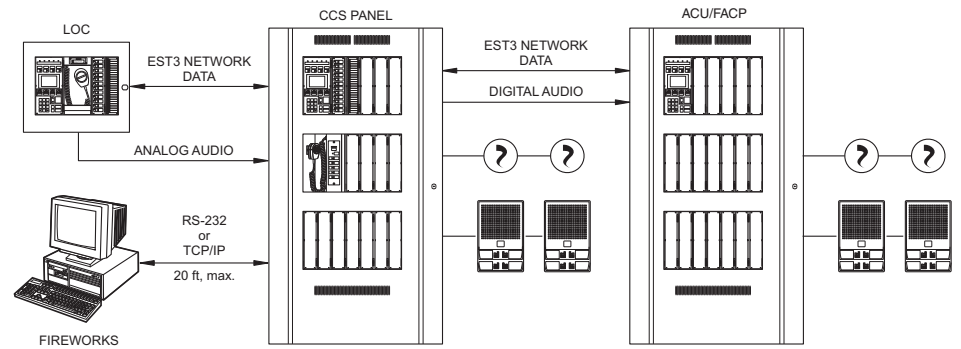
1. Standard paging controls: All Call, All Call Minus (not used), Phone Page (not used), EVAC (not used), Alert (not used)
2. Paging microphone
3. Space for installing optional zone paging controls

Typical Wiring

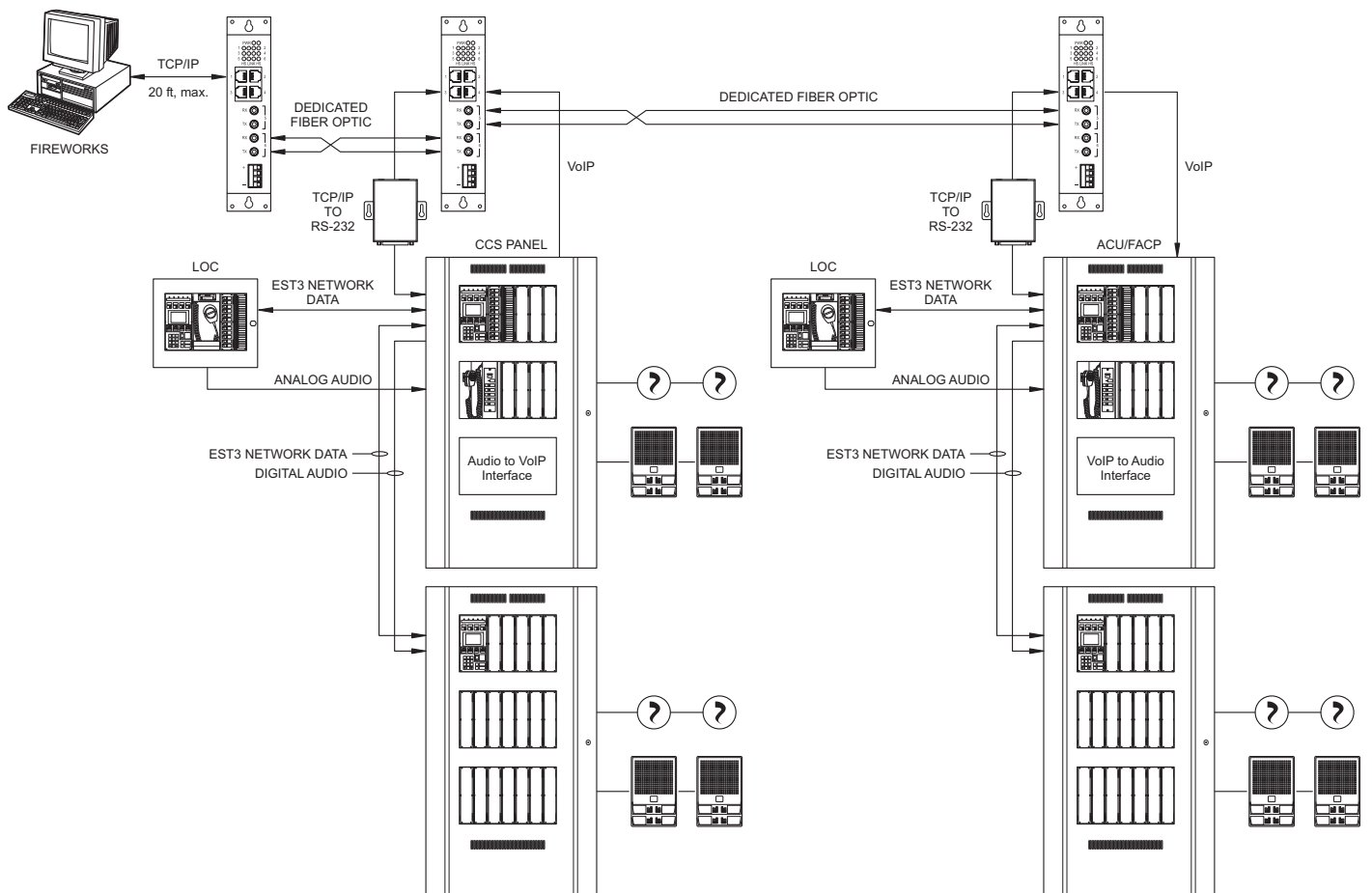
Single EST3-Sixty Network without FireWorks



Single EST3-Sixty Network with FireWorks



Multiple EST3-Sixty Networks with Fireworks on Dedicated UL2572 Listed IP Network using IP & VOIP communications





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Mass Notification Terminology

MNEC - Mass Notification/Emergency Communications

CCS - Central Control System (Main "Head End" for building or Campus)

ACU - Autonomous Unit Control Unit (Individual Building "Main" panel usually combined with FACP).

LOC - Local Operations Center (Annunciator with remote microphone - can be connected to CCS, ASU or used in lieu of ACU)

HPSA - High Power Speaker Array

In-building Mass Notification System - A system used to provide information and instructions to occupants in a building or other space using voice communication, visible signaling and other communication methods

Fire Alarm Control Interface - A product which interfaces the mass notification system with a fire alarm control unit to coordinate signals to and from each other for operational coordination purposes

Local Wide Area Mass Notification System - A system which provides real time information to alert, inform, and instruct people in a building, multiple buildings, outside campus areas, or a combination of these

Wide Area Mass Notification System - A system which provides real time information to areas, including outdoor, in a contiguous or non-contiguous campus, region or global geographical setting

Distributed Recipient Mass Notification System (DRMNS) - A system intended to communicate to targeted individuals that may not be in a contiguous area

Acoustically Defined Space (ADS) - Area or subdivision of an area with specific acoustical conditions

Audio and Telephone Masters

3-ASU series



Overview

The efficient EST3 audio system provides for intuitive local and remote audio control for Mass Notification/Emergency Communications (MNEC), Life Safety and other approved uses. EST3 audio builds from standard modules that fit together easily. Audio components use standard EST3 cabinets and power supplies.

Taking full advantage of digital technology, up to eight channels of audio sources transmit over a single twisted pair of wires or fiber optic cables between nodes. Coupling the inherent reliability and performance of zoned amplifiers with EST3 simplified user interfaces makes audio system design and operation easy and dependable.

The 3-ASU is seamlessly integrated into an EST3 system to provide for a rugged and reliable communications package that can be configured for Mass Notification/Emergency Communication (MNEC), as well as fire alarm and other emergency functions. The 3-ASU audio source unit supports eight channels of clear digital audio that is easily distributed to panels containing 3-ZA rail amplifiers. The 3-ASU supports digital storage and playback of pre-recorded messages as well as live paging. The optional 3-FTCU provides a unique, space-saving and easy-to-operate control point for dedicated emergency/firefighter two-way telephones.

Standard Features

- Eight channels for audio source selection
- Audio data to remote EST3 panels with amplifiers can be transmitted over twisted copper wires or fiber optic cables (see *Data Sheet 85010-0131 for details on EST3 fiber optic communications*)
- Listed for Mass Notification/Emergency Communications
- UL2572 as CCS or ACU or LOC.
- Auxiliary audio input interface for campus paging, telephone interface, etc.
- Single fiber optic filament or one twisted pair of wires between nodes
- VU display shows paging output level
- Ready-to-page LED
- Digital transmission of audio signals
 - greater noise immunity
 - high quality signal transmission
- On board storage of programmed messages and tones
- Optional LCD display of fire phone calls
- Optional earthquake hardening: OSHPD seismic pre-approval for component Importance Factor 1.5

Application

EST3 audio is accomplished by selecting modular components for installation in standard fire alarm cabinet assemblies. At the main control panel location mounting audio control equipment provides an emergency user interface for "Paging" and optionally a "Firefighters Master Telephone". Zoned amplifiers mount in the main control panel and/or in remote nodes. By mounting amplifiers in remote nodes, wire runs and space requirements are reduced at the main control panel.

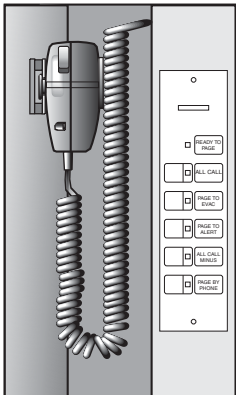
The heart of the EST3 audio package is the Audio Source Unit (ASU). The Audio Source unit converts analog signals to digital signals. On board audio memory stores signal tones and and/or alarm-alert verbal messages.

These digitally-stored messages can be recorded onsite using standard PC audio components or downloaded from a library of pre-recorded messages and tones. Messages can be in any language or combination of languages. The ASU comes standard with two minutes of memory for tone and message storage. Available message memory expands easily to 100 minutes with the optional 3-ASUMX/100 memory expansion card.

Audio Source units support connection of a local microphone, remote microphone, telephone voice line , and Mass Notification/ Emergency Communication (MNEC) audio feed. With eight audio channels to choose from combinations of paging, alert, evacuation signaling and automatic messages are available for simultaneous delivery to different parts of a building or to different buildings.

There are two main audio user interface modules: the paging microphone, and the firefighter's telephone, which supports three-state and four-state firefighter telephones. Available individually or in a set, EST3 audio modules open system design possibilities.

When the Life Safety system requires paging only the 3-ASU or 3-ASU/4 Audio Source Units provides a Master Paging microphone with common controls. Switch labeling makes the operation intuitive. Six LEDs and five switches cover paging operations. Three of the five paging switches, All Call, Page to Evacuation, and Page to Alert, cover most paging operations. A VU display shows the user the output level of the page in process. The 3-ASU series mount in one chassis space of a EST3 Lobby enclosure. In addition to the paging microphone the 3-ASU/4 has mounting space for up to four local rail modules, including 20, 40, and 95 watt zone amplifiers and up to four Control Display modules allowing layout flexibility. The 3-ASU provides the same functionality as the 3-ASU/4 but is supplied with an inner door filler plate and no local rail module spaces.



Paging Microphone

Ready-to-Page LED turns on after the pre-announce tone has finished indicating the system is ready to page.

All Call selects all amplifiers for page delivery.

Page to EVAC selects all amplifiers currently delivering evacuation signaling for page delivery.

Page to ALERT selects all amplifiers currently delivering alert signaling for page delivery.

All Call Minus selects all amplifiers not programmed for alarm signaling for page delivery (typically stairwells).

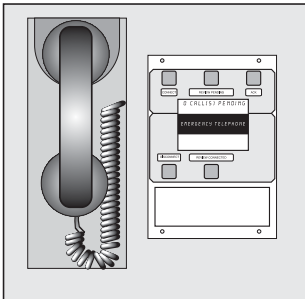
Page by Phone selects the telephone voice line as the paging source.

Operating the Microphone Talk Key stops alarm signaling to selected zones and starts pre-announce tone delivery.

When the pre-announce tone finishes, the Ready to Page LED turns on.

When system design calls for paging with Firefighters telephone the 3-ASU/FT provides all the paging features of the 3-ASU series with the added benefit of a master handset assembly. The 3-ASU/ FT brings to the emergency user easy to understand switches and text messages displaying on a backlit 8 x 20 character LCD display.

Firefighters telephone



CONNECT switch selects phone circuits shown in the Calls Pending Window.

REVIEW PENDING stops automatic display of pending calls and allows the operator to step through each message at his own pace.

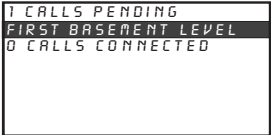
ACK (acknowledge) silences the telephone systems audible signal. The signal resounds for any new call.

DISCONNECT disconnects the highlighted call in the calls connected list.

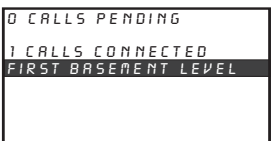
REVIEW CONNECTED scrolls a reverse highlight through the calls connected list.



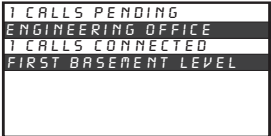
The Firefighters telephone LCD is very similar to the 3-LCD. When there is no active telephone calls the LCD shows a title screen. Active calls display a text message referencing the remote phone location.



When a remote handset is lifted the LCD display updates to show the calls pending and the call-in signal sounds to alert the user of a pending call.



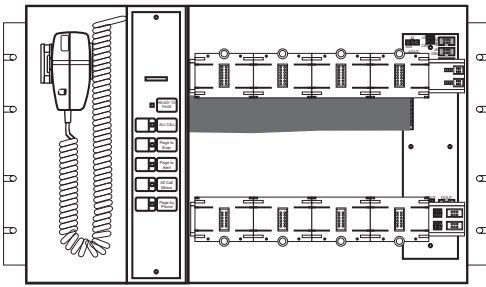
The user answers the call by pressing the Connect switch. The location message moves from the pending line to the connected line. The call in signal silences. The user simply uses the master telephone to talk with the connected telephone.



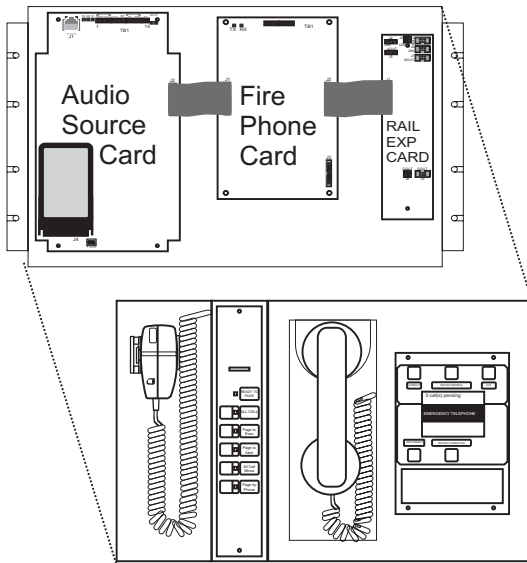
If another call comes in the location message appears in the calls pending line and audible signal resounds. The user can silence the signal by answering the call or by pressing the ACK (acknowledge) switch.

Up to five remote telephone handset assemblies connect to the system simultaneously without any degradation of audio quality.

Installation and Mounting



3-ASU/4 has Chassis, Audio Source Unit, Paging Common Control and rail space for four Local Rail Modules. Mounts in lobby enclosure.



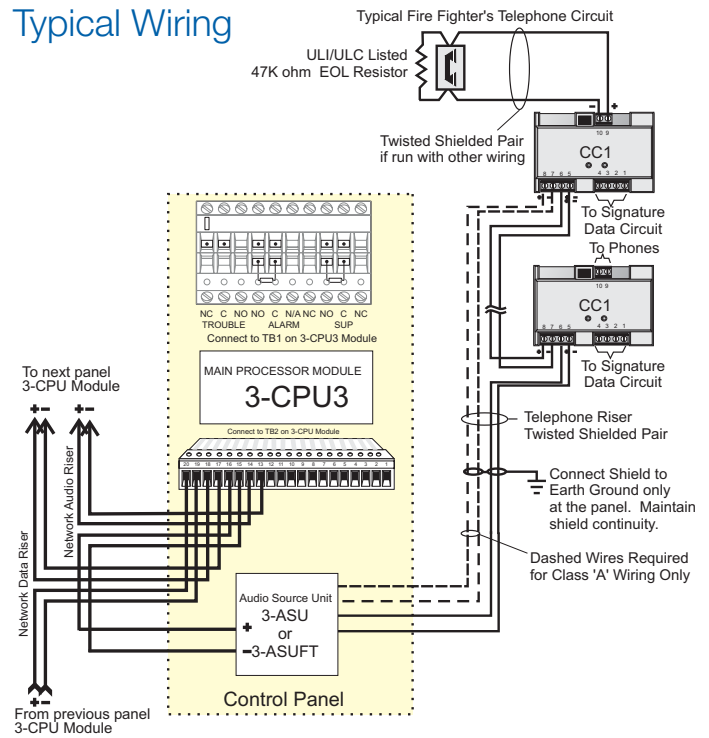
3-ASU/FT has Chassis Assembly /w Audio Source Unit, Paging Common Control and Fire Phone Controls

Engineering Specification

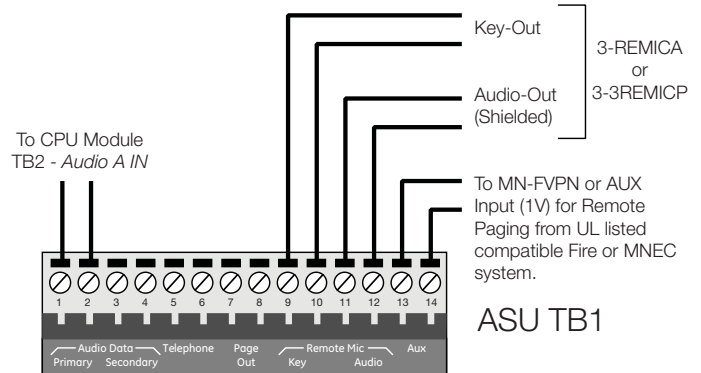
The audio system shall provide eight simultaneous and distinct audio channels. These shall consist of a minimum of: Local Page, Emergency Communication, Multiple Evacuation, Alert, Auxiliary, and General Signaling. Channels shall support hierarchical operation and be controllable from system programming. The audio system also provides Elevator, Stairwell and Auxiliary signaling. Systems that cause signaling devices to go silent while performing any signaling functions will not be accepted.

The system must provide operation to 25Vrms or 70.7Vrms speakers. The system must provide as a minimum the following paging common controls and indicators: Ready to page LED, VU display of paging output level, single switch function for paging to all — Alert zones, Evacuation zones, and areas not programmed for signaling. The system must provide high quality analog to digital conversion of paging sources. Digital transmission of paging must be provided between system nodes. The analog sources must be sampled and converted to digital with a sampling rate no less than 9600 samples per second. It must be possible to transmit signal sources (Alert, Alarm, Page, etc.) together over a single pair of wires between nodes.

Typical Wiring



Mass Notification



System amplifiers must be distributed zoned type. Centrally banked systems are not acceptable. The circuit must carry a minimum rating of 3.5 Amps for operating 24 Vdc signals.

The system shall provide fully integrated fire fighters' telephone system that shall provide 2-way communication between the fire alarm control panel and any fire fighters' telephone station. <<The Audio Source Unit and Firefighters Telephone shall be installed so that a seismic component Importance Factor of 1.5 is achieved.>> The system shall include an alphanumeric user display and controls. When a telephone is activated, a call-in buzzer shall sound, and the location of the phone shall be shown on the alphanumeric display. The display shall be capable of bilingual operation, displaying English, Dutch, Finnish, French, German, Italian, Portuguese or Spanish messages.

The incoming call shall be selected by activating a single button. All subsequent telephone call locations shall be displayed in full text. The system shall display all incoming calls, all connected phone(s) on the alphanumeric display. The system shall be configured so that page messages may be issued from any firefighter's telephone connected to the system, as directed by the emergency operator.



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Specifications

Catalog Number	3-ASU	3-ASU/4	3-ASU/FT	3-FTCU
Agency Listings	UL, ULC, CE			
Ambient Temp.	0°C-49°C (32°F-120°F)			
Ambient Humidity	93% Non-condensing @ 32°C			
Mounting	One Chassis Space			
Wire Size	Network Data Riser - One pair twisted 18-12AWG (1.0mm ² -2.5mm ²) Network Audio Riser - One pair twisted 18-12AWG (1.0mm ² -2.5mm ²)		Network Data Riser- 18-12AWG (1.0-2.5mm ²)(3-ASU/FT only) Network Audio Riser- 18-12AWG (1.0-2.5mm ²)(3-ASU/FT only) Telephone Riser - One pair twisted shielded 18 -14 AWG (1.0mm ² to 1.5mm ²)	
Current Rating	80 mA in Alarm and Supervisory		112 mA Supervisory and Alarm	32 mA Supervisory and Alarm
Audio Inputs	Local Microphone (isolated and supervised); Remote Microphone (isolated and supervised); One MNEC audio input.		Local microphone (isolated and supervised); Remote microphone (isolated and supervised); Firefighters' telephone (isolated and supervised); One MNEC audio input.	
Pre-recorded Message Storage	Two minutes standard expandable to 100 minutes with optional 3-ASUMX/100. Max. message length 40 seconds.			N/A
Supported Message Count	255			N/A
Auxiliary Input impedance	1K Ohm			N/A
Bilingual Support	English, Dutch, Finnish, French, German, Italian, Portuguese, Spanish			

Telephone Riser

Active Telephones	N/A	Five Maximum
Wire size	vN/A	One pair twisted shielded 18 -14 AWG (1.0mm ² to 1.5mm ²)
Line Resistance	N/A	50 Ohm
EOL Resistance	N/A	15K Ohm

Ordering Information

Catalog Number	Description	Ship Wt. lb. (kg)
3-ASU/FT ¹	Audio Source Unit with Local Microphone and Firefighters Telephone.	20 (9.1)
3-ASU/4 ¹	Audio Source Unit w/Local Microphone. Provides four local rail spaces.	15 (6.8)
3-ASU ¹	Audio Source Unit w/Local Microphone. Inner door filler plate	15 (6.8)
3-FTCU ¹	Firefighters Telephone Control Unit inner door filler plate.	15 (6.8)
3-ASUMX/100	Audio Source Unit Memory Expansion. Provides 100 minutes of message time.	0.5 (.23)
3-FTEQ	Seismic hardening kit for 3-ASU/FT or 3-FTCU telephone handset ²	
RFK1	Ferrite Clamp Kit required for EN-54 compliance	.25 (.11)
3-LKE	UK English Label Kit	.25 (.11)
3-LKF	French Label Kit	.25 (.11)
3-LKR	Russian Label Kit	.25 (.11)
3-LKS	Spanish Label Kit	.25 (.11)

1. Add "-CC" for City of Chicago

2. For earthquake anchorage, including detailed mounting weights and center of gravity detail, please refer to *Seismic Application Guide 3101676*. Approval of panel anchorage to site structure may require local AHJ, structural, or civil engineer review.

Modem Communicator

3-MODCOM, 3-MODCOMP

Overview

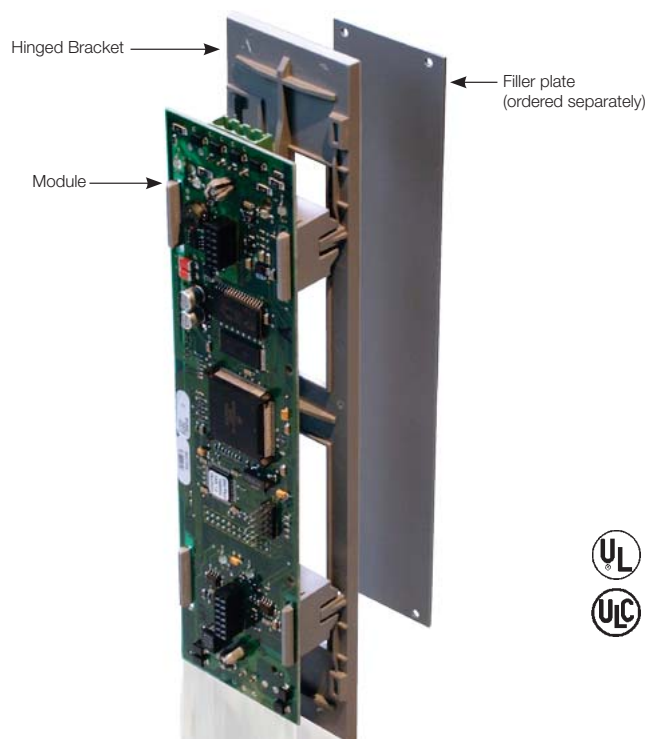
The Modem Communicator is a two-way local rail module that performs a variety of off-premise communications functions for the EST3 system.

Using the latest in digital signal processing (DSP) techniques, the Modcom provides off premise communication features unavailable on any other system.

The module has provisions for supervising two loop-start telephone lines. The module features a modular jack for telephone line connections. The Modcom's configuration and firmware can also be updated from any network node.

Modcom series modules occupy a single local rail space and can be mounted in any node on the network. Any EST3 Control/Display module can be mounted on the face of a Modcom series module. Power for the Modcom is supplied by the EST3 system supply.

The Modcom provides an enhanced level of survivability in the event of a network CPU failure by notifying the Central Monitoring Station of the failure and entering a degraded mode of operation. In degraded mode, the Modcom can transmit a default fire alarm message during a fire alarm condition.



Standard Features

- Listed for fire, security and access control
- V.32bis 14.4K full duplex modem
- Digital alarm communicator transmitter supporting: SIA DCS protocol, Contact ID protocol, 3/1 and 4/2 pulse format protocol
- Supports "tap" alphanumeric pager protocol
- Fully programmable messages
- Alarm override of upload/download
- Two phone line capability
- Field upgradable firmware
- Split and multiple reporting to as many as 80 different receivers
- 255 subscriber accounts
- Supports control/display modules
- Supervised by the network controller

Application

Two versions of the Modcom are available:

3-MODCOM - Has an internal V.32bis 14.4K baud full duplex modem. The modem permits upload and download of system data remotely via a telephone line. In addition, the 3-MODCOM has a Digital Alarm Communications Transmitter (DACT) or dialer function that transmits network status information to Central Monitoring Stations (CMS) via telephone. Four DACT protocols are available:

1. Digital Communicator Standard (DCS) "SIA forma" Dialer – 300 baud format, which transmits alphanumeric system status data to the CMS;
2. Contact ID;
3. SIA 3/1 dialer; and,
4. SIA 4/2 dialer.

Alarm code content is determined by system rules.

3-MODCOMP – In addition to all modem and dialer (DACT) functions of the 3-MODCOM, the 3-MODCOMP can dial directly into paging systems using Telelocator Alphanumeric Protocol (TAP). Alphanumeric system data can be sent to a single pager or group(s) of pagers. Some pager services can forward messages via e-mail and Fax.

Multiple Priority

Each Modcom can buffer up to 500 events in its event queue. It reviews all active events in the queue and identifies the highest priority event and dials the associated receiver. When the receiver is contacted, the MODCOM will transmit the highest priority message for that receiver. If the message is successfully received, the MODCOM identifies the next highest priority message and the process repeats.

Phone Line Friendly

The Modcom series has been designed for installation on the same phone lines with other devices such as phones and faxes. The module makes its first dial out attempt on either of the two phone lines that is not in use. This prevents unnecessary interruption of calls in progress by the line seizure relays. In the event that both lines are busy, the module seizes line one.

A fixed DACT testing time can be set at an off-hour, e.g. 2:00am, again minimizing interruptions and phone line costs. The call time is programmable, and allows testing of the DACT with the central station.

The Modcom series also has the ability to detect Type 1, Type 2 and Type 3 distinctive ringing patterns, permitting it to share its phone lines with other devices and still have a unique phone number for incoming modem calls.

Multiple Modcoms per Network

Multiple Modcoms can be installed in a single cabinet or located in nodes throughout the network to provide added availability and enhanced redundancy of off premise communications.

Multiple Receiver Capability

In large system applications the EST3 system may be partitioned such that it supports a number of different customers, each using different Central Monitoring Stations and/or paging companies. The Modcom can accommodate up to 255 different accounts using up to 80 different receivers.

The Modcom supports split reporting, a process where the system directs the Modcom to send some events or event types to one receiver, and different events to alternate receivers. The module's

multi-dial reporting capability permits an individual event to be transmitted to multiple receivers, including pagers.

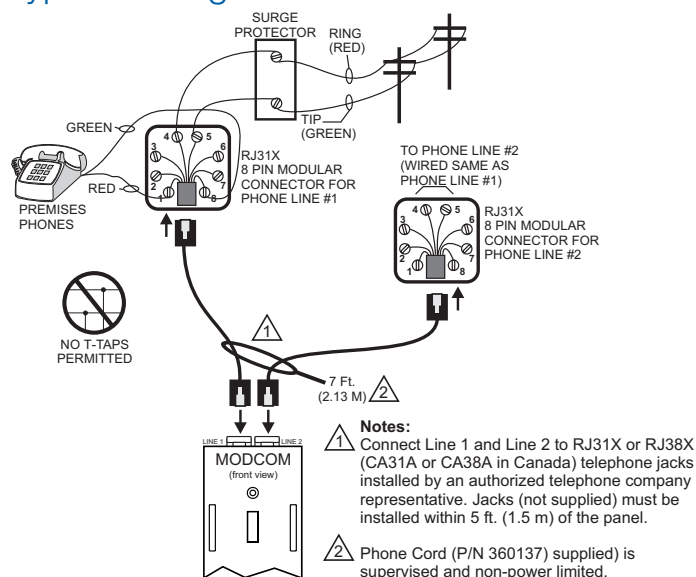
Remote Data Upload/Download

The modem permits data to be downloaded into the memories of the various components making up an EST3 system. Data can be remotely uploaded and downloaded for use with the Edwards Access Control Database Program. In the event that an alarm is received during upload/download activity, the Modcom automatically terminates the call and transmits the alarm events to the appropriate receivers. When completed sending the events, the download will continue where it left off.

Engineering Specification

The system shall provided an off premise communications module capable of transmitting system events to multiple Central Monitoring Station (CMS) receivers. The module shall provide the CMS with point identification of system events via 4/2, Contact ID or SIA DCS protocols. <The module shall also be capable of transmitting alphanumeric system activity by event to a commercial paging system using TAP Pager protocol.> The dialer shall have the capability to support up to 255 individual accounts and to send account information to eighty (80) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system designer. The module shall have a degrade mode capable of transmitting fire alarm signals to the CMS in the event of system CPU failure. The module shall provide a high speed (V.32bis or greater) modem function in order to upload and download system data to/from a remote location.

Typical Wiring



Specifications

Agency Listings	UL, FCC Part 68 / CFR 47, ULC. See Note 1.	
Installation	Takes up one LRM space in 3-CHAS7	
Input Power	24 Vdc @ 60mA standby, 95 mA active	
Modem Protocol	ITU - V.32bis 14.4K baud full duplex using standard PC modem compatible data	
Dialer Protocol	SIA 3/1 (format P2) and 4/2 (format P3): 20 pulses per second, double round Contact ID (DTMF format) Digital Communications Standard (DCS) "SIA format": Level 2 (300 baud, Bell 103)	
Pager Protocol (3-MODCOMP only)	Telocator Alphanumeric Protocol (TAP), Version 1.8, 300 baud, Bell 103	
Telephone	Dialing Connector	Pulse or Tone (DTMF) Two 8-position modular phone jacks
CMS Telephone Numbers	Quantity Available Digits	Two per receiver - 160 max. Up to 24 digits per number
Receivers	Supports up to 80 individual receivers.	
Event Buffer	500 events	
Operating Environment	32°F (0°C) to 120°F (49°C), 93% RH Non-condensing	

Receivers Tested

Format	Manufacturer	Model	Receiver Card
4/2 and 3/1	Ademco	685	685-1 or 685-8
	FBI (Fire Burglary Instruments)	CP220	
	Osborne-Hoffman	OH2000	
	Radionics	D6600	
	Silent Knight	9000	
	Sur-Gard	MLR2, SG-SLR	
Contact ID	MCDI	TLR, TLR+	9032
	Ademco	685	
	Osborne-Hoffman	OH2000	
	Sur-Gard	MLR2, SG-SLR	
	Radionics	D6600	
	Silent Knight	9000	
SIA DCS	MCDI	TLR, TLR+	9032
	Sur-Gard	MLR2, SG-SLR	

Note 1:

The EST3 is modularly listed under the following standards:

UL 864 categories: UQJZ, UOXX, UUKL and SYZV, UL 294 category ALVY, UL 609 category AOTX, UL 636 category ANET, UL 1076 category APOU, UL 365 category APAW, UL 1610 category AMCX, UL 1635 category AMCX
ULC-S527, ULC-S301, ULC-S302, ULC-S303, ULC-S306, ULC/ORD-C1076 and ULC/ORD-C693

Please refer to EST3 Installation and Service Manual for complete system requirements.

Ordering Information

Catalog Number	Description	Ship Wt. lb (kg)
3-MODCOM	Modem/Dialer (DACT) version	0.5 (0.23)
3-MODCOMP	Modem/Dialer (DACT) w/TAP Pager Protocol	0.5 (0.23)
3-FP	Filler Plate, order separately when no LED or LED/Switch module installed.	0.1 (0.05)



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EST3 Remote Annunciators

3-ANNCPU3, 3-LCDANN, 3-6ANN, 3-10ANN, 3-EVxxx, 3-4ANN



EN54-2:1997+A1 and
EN54-4:1997+A1:2002+A2
pending

Overview

EST3 supports a full range of annunciator options for Mass Notification/Emergency Communication (MNEC), Life Safety and other purposes. Annunciator cabinets are constructed from 16 gauge cold rolled steel. The gray textured enamel finish of the annunciators complements any decor. Both surface and semi-flush mounting cabinet configurations maximize mounting flexibility and esthetic appeal. Cabinet arrangements allow both LED and LCD annunciation to easily combine in a single enclosure. Slide in labeling for LEDs and switches provides designation flexibility for labeling in local languages. For graphic annunciation EST3 offers LED driver boards perfectly suited to operate in most graphic annunciators.

EST3 annunciators are perfect for MNEC applications. They can be used in Central Control Stations (CCS), Autonomous Control Units (ACU), Local Operating Console (LOC) and combination units. In these applications, annunciators are configured to operate as Local Operation Consoles, or even Central Command Stations, from which MNEC is initiated and controlled.

Standard Features

- Standard 3-LCD (168 characters) and large-format 3-LCDXL1 (960 character) display options
- LCD uses queues to sort events
- Variety of wallbox configurations
- Programmable LED flash rates
- Slide-in labels
Makes customization for regional language easy
- Full line of driver boards for graphic annunciators

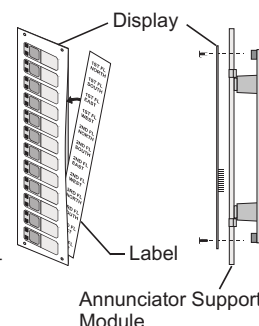
Application

Use EST3 remote annunciators when a compact system status display is needed. Annunciator configurations include: LCD only display, LED only displays or combination LED and LCD display in a single enclosure.

The LCD display uses either the 3-LCD or 3-LCDXL1 Liquid crystal display module. The 3-LCD has a 128 x 64 graphical display typically used to display eight lines of 21 characters on its LCD display while the 3-LCDXL1 has a larger 240 x 320 pixel backlit display that supports 24 lines of 40 characters. Both LCD displays provide the room needed to convey emergency information in a useful format.

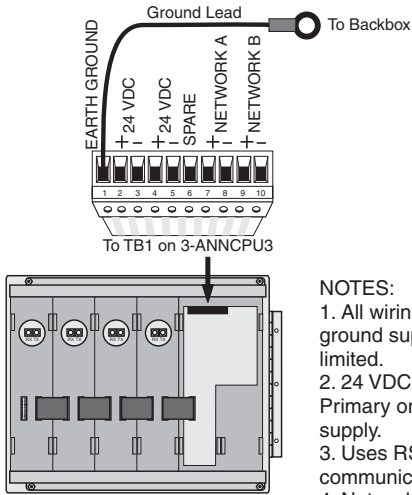
The 3-LCD always displays the last highest priority event even when the user is viewing other message queues. To give the greatest message flexibility EST3 event messages can route to specific annunciators. Routing can be initiated at a specific time/shift change. Messages need only display in areas having to respond to an event.

For LED display, the full line of EST3 Control/Display Modules support event display. Control/Display modules install over any annunciator support module maximizing annunciator design flexibility. A Lamptest feature can program to any spare control switch. If an LCD display is installed in the annunciator, simply operate the Alarm Silence and Trouble Silence switches simultaneously to lamptest all LEDs.



Typical Wiring

Rear view 3-ANNCPU3 Field Wiring 3-6ANN Shown



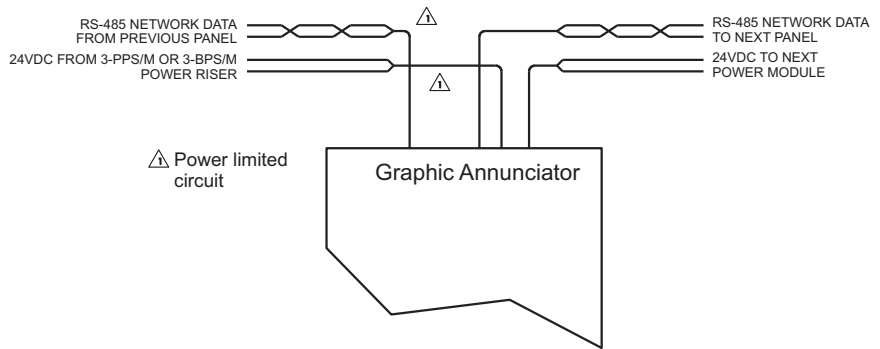
NOTES:

1. All wiring except earth ground supervised and power limited.
2. 24 VDC available from Primary or Booster Power supply.
3. Uses RS-485 Network communication format
4. Network wiring Twisted Pair

Power Riser

Calculate wire size for a maximum 3.4 Vdc total line loss from the 24 Vdc nominal voltage.

Graphic Annunciator Field Wiring



Wire Specifications

Network Data Communications - RS485 Format

Minimum Twisted Pair	18 AWG (0.75 mm ²).
Maximum Circuit Resistance	90 Ohms
Maximum Circuit Capacitance	0.3 µF
Maximum Distance between any 3 panels	5,000 ft. (1,524 m).

Capacitance, entire network

Maximum Accumulative Capacitance

Wire Size	38.4K Baud	19.2K Baud
18 AWG	1.4 µF	2.8 µF
16 AWG	1.8 µF	3.6 µF
14 AWG	2.1 µF	4.2 µF

Distance limits are determined using the maximum allowable circuit resistance and capacitance, and manufacturer's cable specifications.

Specifications

Catalog Number	3-ANNCPU3	3-ANNSM	3-LCD	3-LCDXL1
Agency Listings	UL, ULC, FM, CE, LPCB EN54* pending.			
Mounting Space	Two Spaces	One Space	Mounts over 3-ANNCPU	Mounts over 3-ANNCPU plus two spaces.
Communication Format	RS-485	N/A	N/A	N/A
Current @ 24 Vdc				
Standby	144 mA	10mA	40mA	48mA
Alarm	144 mA	10mA	42mA	50mA
Wiring Termination	Plug in terminal strip	N/A		
Wiring Size	Twisted Pair 18-14 AWG (0.75-1.5 mm²)			
Max. Wire Distance	5000 ft (1524m) between any 3 panels			
Relative Humidity	93% non condensing at 90° F (32° C)			
Temperature Rating	0-49° C (32 - 120° F)			
Wiring Styles	Class A or Class B			

Note: For a complete list of EST3 annunciator display and control modules please refer to Edwards literature sheet part number 85010-0055.

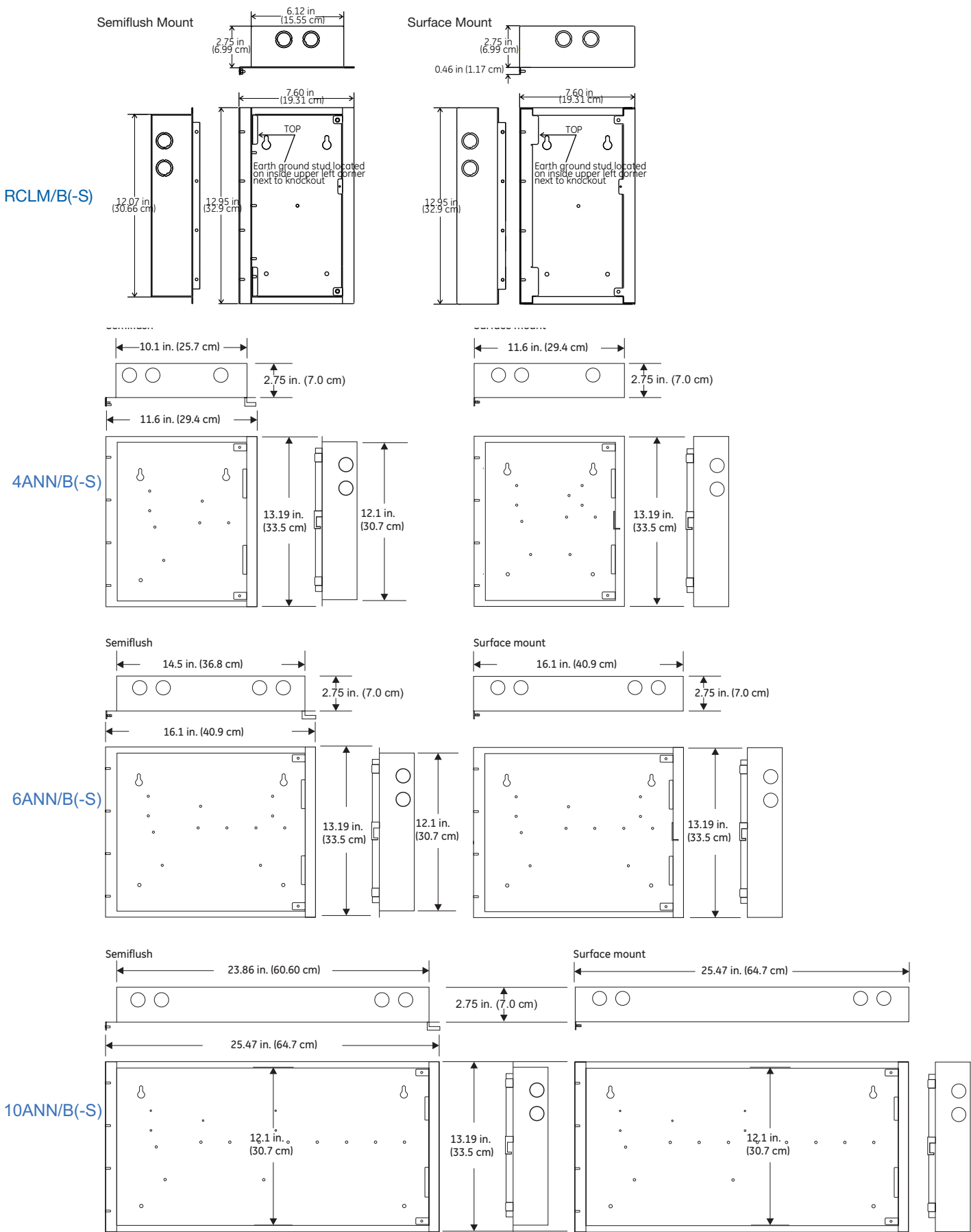
* EN54-2:1997+A1 and EN54-4:1997+A1:2002+A2 pending

Engineering Specification

The Life Safety system shall incorporate annunciation of Alarm, Supervisory, Trouble and Monitor operations. Annunciation must be through the use of both LED display strips complete with a means to custom label each LED as to its function. Where applicable control switches must be provided. Switches with LEDs must provide positive feed back to the operator of remote equipment status. An LCD display with basic common control LEDs and switches shall be provided. The Common Control Switches and LEDs provided as minimum will be: Reset switch and LED, Alarm Silence switch and LED, Panel Silence switch and LED, Drill switch and LED. It must be possible to add additional common controls as required through the use of modular display / control

units. The LCD interface must provide the ability to display custom event messages of a minimum of 40 characters. The LCD must provide the emergency user, hands free viewing of the first and last highest priority event. The last highest priority event must always display and update automatically. System events must automatically be placed in queues. It shall be possible to view specific event types separately. Having to scroll through a mixed list of events types is not acceptable. The total number of active events by type must be displayed. It must be possible to customize the designations of all user interface LEDs and switches for local language requirements. It must be possible to route system event messages to specific annunciator locations.

Dimensions



Ordering Information



Detection & alarm since 1872

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F 866-503-3996

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F 519 376 7258

Southeast Asia
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F : +65 6391 9306

India
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F : +91 80 4344 2050

Australia
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Latin America
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F 305 593 4300

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Catalog Number	Description	Ship Wt. lb (kg)
Command Module Annunciators (Come with CPU, LCD display and doors. Order wallbox separately.)		
3-LCDANN	Remote LCD Command Module Annunciator.	3.8 (1.7)
3-LCDANN-E	Remote LCD Command Module Annunciator. For EN54* market only, CE.	3.8 (1.7)
<i>Base Annunciators (Come with two 3-ANNSM annunciator support modules, a CPU, and doors. Order Display/Control modules, additional support modules & wallbox separately.)</i>		
3-4ANN	Four Position Base Annunciator.	
3-4ANN-E	Four Position Base Annunciator. For EN54* market only, CE.	
3-6ANN	Six Position Base Annunciator.	6.28 (2.85)
3-6ANN-E	Six Position Base Annunciator. For EN54* market only, CE.	6.28 (2.85)
3-10ANN	10 Position Base Annunciator.	10.5 (4.8)
3-10ANN-E	10 Position Base Annunciator. For EN54* market only, CE.	10.5 (4.8)
<i>*EN54-2:1997+A1 and EN54-4:1997+A1:2002+A2 pending</i>		
CPU, Support Module, & LCD Displays		
3-ANNCPU3	Annunciator CPU	1 (.45)
3-CPUDR	CPU doors with filler plates. Order separately, one required per CPU where no LCD display is installed.	0.25 (.11)
3-ANNSM	Annunciator Support Module	.45 (.2)
3-LCD	Liquid Crystal Display Module, eight lines.	.8 (.36)
3-LCDXL1	Liquid Crystal Display Module, 40 lines mounts in 3-4ANN, 3-6ANN or 3-10ANN annunciators. <i>Note one 3-LCDXL1KBL, (ordered separately) is required for each 3-LCDXL1 mounting into 3-6ANN or 3-10ANN annunciator boxes.</i>	
3-LCDXL1KBL	Cable for 3-LCDXL1 (Use to connect from 3-ANNCPU3 to the first annunciator support model. Not required with 3-4ANN and 3-LCDXL1 applications.)	
Control/Display Modules		
3-CPUDR	Two blank filler plates suitable for any annunciator blank space.	.5 (.22)
3-24R	24 Red LED Display Module	.35 (.12)
3-24Y	24 Yellow LED Display Module	.35 (.12)
3-24G	24 Green LED Display Module	.35 (.12)
3-12SR	12 switches with 12 Red LED Display/Control Module	.35 (.12)
3-12SY	12 switches with 12 Yellow LED Display/Control Module	.35 (.12)
3-12SG	12 switches with 12 Green LED Display/Control Module	.35 (.12)
3-12RY	12 Red LED and 12 Yellow LED Display Module	.35 (.12)
3-12/S1GY	12 switches with one Green and one Yellow LED per switch	.35 (.12)
3-12/S1RY	12 switches with one Red and one Yellow LED per switch	.35 (.12)
3-12/S2Y	12 switches with two Yellow LEDs per switch	.35 (.12)
3-6/3S1G2Y	Six groups of three switches. Each switch with one LED: Green, Yellow, Yellow.	.35 (.12)
3-6/3S1GYR	Six groups of three switches. Each switch with one LED: Green, Yellow, Red.	.35 (.12)
3-REMICA	Remote microphone for use in 3-ANN series annunciator cabinets	15 (6.8)
3-FP	Filler Plate, order separately one required per 3-ANNSM when no LED or LED/Switch module installed on operator layer.	0.1 (0.05)
Driver Modules, Power Supplies		
3-EVDVR	LED/SWITCH Driver Module, For Edwards Graphics	.35 (.12)
3-EVDVRA	LED/SWITCH Driver Module Assembly for Third-party Graphics	.35 (.12)
3-EVPWR	Power Supply for Edwards Graphics	.5 (.22)
3-EVPWRA	Power Supply Assembly c/w 19 inch rail mounting chassis assembly space for one 3-ANNCPU3 for Third-party Graphics	2.5 (1.2)
3-EVDVRX	Plastic mounting extrusion 19 inch mounting - Space for up to three 3-EVDVRA modules.	.35 (.12)
Enclosures		
RLCM/B	Remote Command module flush mount LCD wallbox	2.5 (1.2)
RLCM/B-S	Remote Command module surface mount LCD wallbox	2.5 (1.2)
3-RLCM/D	Inner & outer doors for RLCM/B(-S)	2.0 (0.9)
4ANN/B	Four Position LED/LCD flush mount wallbox.	6.0 (2.7)
4ANN/B-S	Four position LED/LCD surface mount wallbox.	6.0 (2.7)
6ANN/B	Six position LED/LCD flush mount wallbox	7.0 (3.2)
6ANN/B-S	Six position LED/LCD surface mount wallbox	7.0 (3.2)
10ANN/B	Ten position LED/LCD flush mount wallbox	9.0 (4.1)
10ANN/B-S	Ten position LED/LCD surface mount wallbox	9.0 (4.1)

Remote Booster Power Supplies

BPS6A, BPS10A



Overview

The Booster Power Supply (BPS) is a UL 864, 9th Edition listed power supply. It is a 24 Vdc filtered-regulated, and supervised unit that can easily be configured to provide additional notification appliance circuits (NACs) or auxiliary power for Mass Notification/Emergency Communication (MNEC), as well as life safety, security, and access control applications.

The BPS contains the circuitry to monitor and charge internal or external batteries. Its steel enclosure has room for up to two 10 ampere-hour batteries. For access control-only applications, the BPS can support batteries totaling up to 65 ampere-hours in an external enclosure. The BPS has four Class B (convertible to two Class A) NACs. These can be activated in one or two groups from the BPS's unique dual input circuits.

The BPS is available in 6.5 or 10 ampere models. Each output circuit has a capacity of three amperes; total current draw cannot exceed the unit's rating.

The BPS meets current UL requirements and is listed under the following standards:

Standard (CCN)	Description
UL864 9th ed.ition (UOXX)Fire Alarm Systems	
UL636 (ANET, UEHX7)	Holdup Alarm Units and Systems
UL609 (AOTX, AOTX7)	Local Burglar Alarm Units and Systems
UL294 (ALVY, UEHX7)	Access Control Systems
UL365 (APAW, APAW7)	Police Station Connected Burglar Alarm Units and Systems
UL1076 (APOU, APOU7)	Proprietary Burglar Alarm System Units
UL1610 (AMCX)	Central Station Alarm Unit
ULC-S527 (UOXXC)	Control Units, Fire Alarm (Canada)
ULC-S303 (AOTX7)	Local Burglar Alarm Units and Systems (Canada)
C22.2 No. 205	Signaling Equipment (Canada)

Standard Features

- Allows for reliable filtered and regulated power to be installed where needed
- Cost effective system expansion
- Provides for Genesis and Enhanced Integrity notification appliance synchronization
- Supports coded output operation
- Self-restoring overcurrent protection
- Multiple signal rates
- Can be cascaded or controlled independently
- Easy field configuration
- On-board diagnostic LEDs identify wiring or internal faults
- Standard Edwards keyed lockable steel cabinet with removable door
- 110 and 230 Vac models available
- Accommodates 18 to 12 AWG wire sizes
- Optional tamper switch
- Dual battery charging rates
- Optional earthquake hardening: OSHPD seismic pre-approval for component Importance Factor 1.5

Application

The BPS provides additional power and circuits for notification appliances and other 24 Vdc loads. It is listed for indoor dry locations and can easily be installed where needed.

Fault conditions are indicated on the on-board diagnostic LEDs, opening the BPS input sense circuit and the trouble relay (if programmed). While this provides indication to the host system, the BPS can still be activated upon command. A separate AC Fail contact is available on the BPS circuit board, which can be programmed for trouble or AC Fail. There are seven on-board diagnostic LEDs: one for each NAC fault, one for battery fault, one for ground fault, and one for AC power.

The unique dual-input activation circuits of the BPS can be activated by any voltage from 6 to 45 VDC (filtered-regulated) or 11 to 33 Vdc (full-wave rectified, unfiltered). The first input circuit can be configured to activate 1-4 of the four possible outputs. The second input circuit can be configured to control circuits 3 and 4. When outputs are configured for auxiliary operation, these circuits can be configured to stay on or automatically deactivate 30 seconds after AC power is lost. This feature makes these circuits ideal for door holder applications. The BPS also has a separate 200 mA 24 Vdc output that can be used to power internal activation modules.

BPS NACs can be configured for a 3-3-3 temporal or continuous output. California temporal rate outputs are also available on certain models. This makes the BPS ideal for applications requiring signaling rates that are not available from the main system.

In addition to the internally generated signal rates, the BPS can also be configured to follow the coded signal rate of the main system NACs. This allows for the seamless expansion of existing NACs.

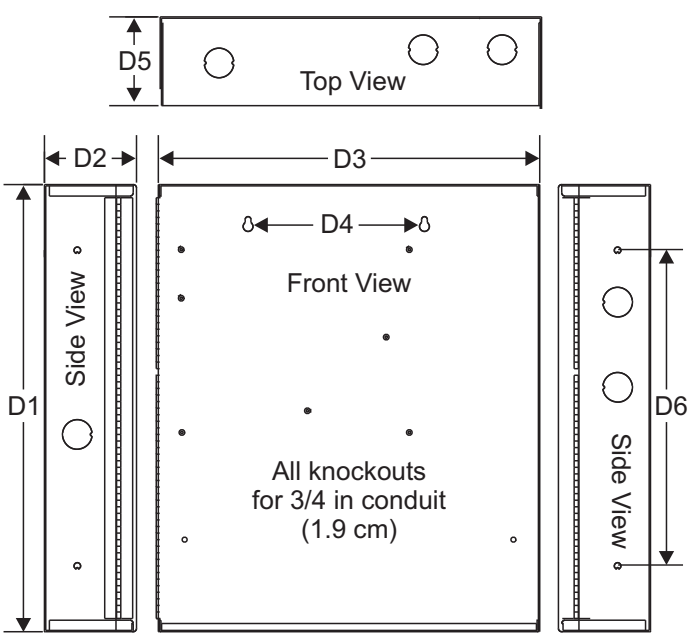
The BPS enclosure has mounting brackets for up to three Signature modules to the right of the circuit board.

Engineering Specification

Supply, where needed, Edwards BPS Series Booster Power Supplies (BPS) that are interconnected to and supervised by the main system. The BPS shall function as a stand-alone auxiliary power supply with its own fully-supervised battery compliment. The BPS battery compliment shall be sized to match the requirements of the main system. The BPS shall be capable of supervising and charging batteries having the capacity of 24 ampere-hours for Mass Notification/Emergency Communication (MNEC), life safety and security applications, and the capacity of 65 ampere-hours for access control applications.

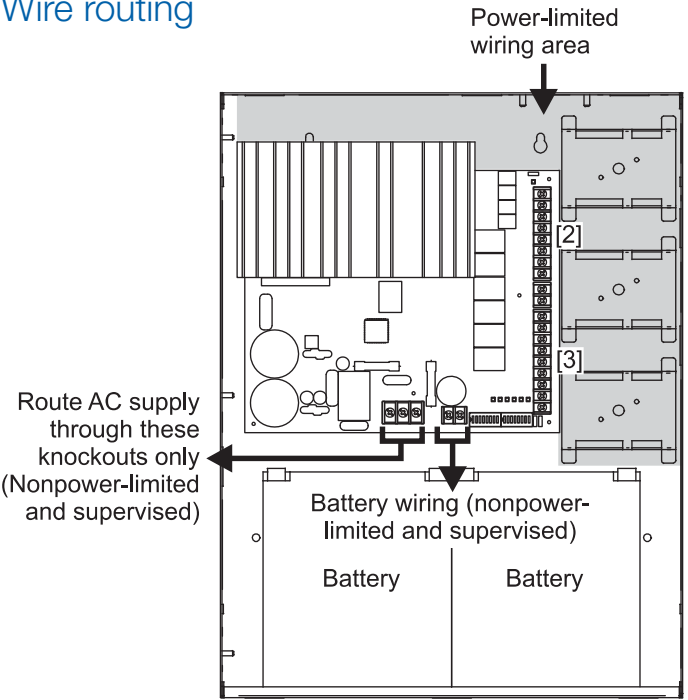
<<The BPS shall be capable of installation for a seismic component Importance Factor of 1.5.>> The BPS shall provide a minimum of four independent, fully supervised Class B circuits that can be field configurable for notification appliance circuits or auxiliary 24 Vdc power circuits. BPS NACs shall be convertible to a minimum of two Class A NACs. Each BPS output circuit shall be rated at 3 amperes at 24 Vdc. Each output circuit shall be provided with automatically restoring overcurrent protection. The BPS shall be operable from the main system NAC and/or Edwards Signature Series control modules. BPS NACs shall be configurable for continuous, 3-3-3 temporal or optionally, California rate. Fault conditions on the BPS shall not impede operation of main system NAC. The BPS shall be provided with ground fault detection circuitry and a separate AC fail relay.

Dimensions



D1	D2	D3	D4	D5	D6
17.0 in (43.2 cm)	3.5 in (8.9 cm)	13.0 in (33.0 cm)	6.5 in (16.5 cm)	3.375 in (8.6 cm)	12.0 in (30.4 cm)

Wire routing

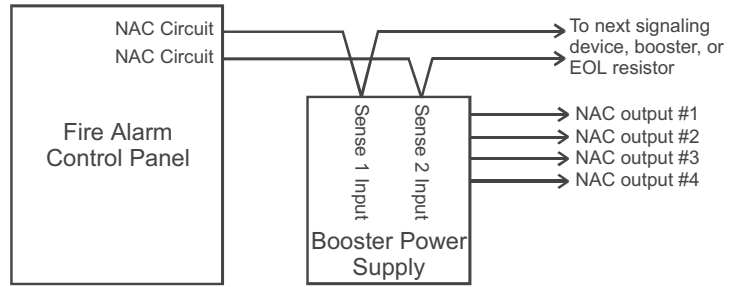


- Notes
- 1. Maintain 1/4-inch (6 mm) spacing between power-limited and nonpower-limited wiring or use type FPL, FPLR, or FPLP cable per NEC.
 - 2. Power-limited and supervised when not configured as auxiliary power. Non-supervised when configured as auxiliary power.
 - 3. Source must be power-limited. Source determines supervision.
 - 4. When using larger batteries, make sure to position the battery terminals towards the door.

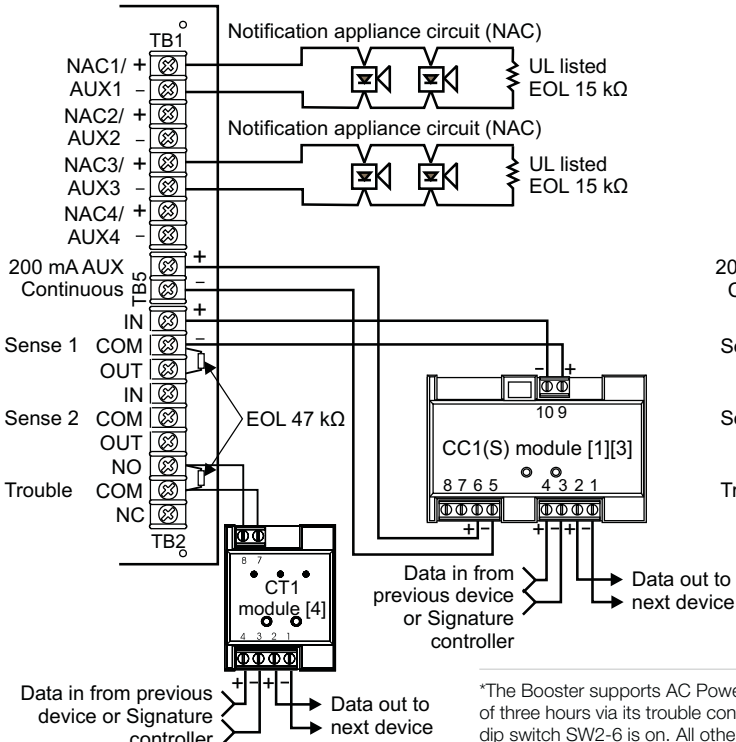
Typical Wiring

Single or cascaded booster
anywhere on a notification appliance circuit

Existing NAC end-of-line resistors are not required to be installed at the booster's terminals. This allows multiple boosters to be driven from a single NAC circuit without the need for special configurations.

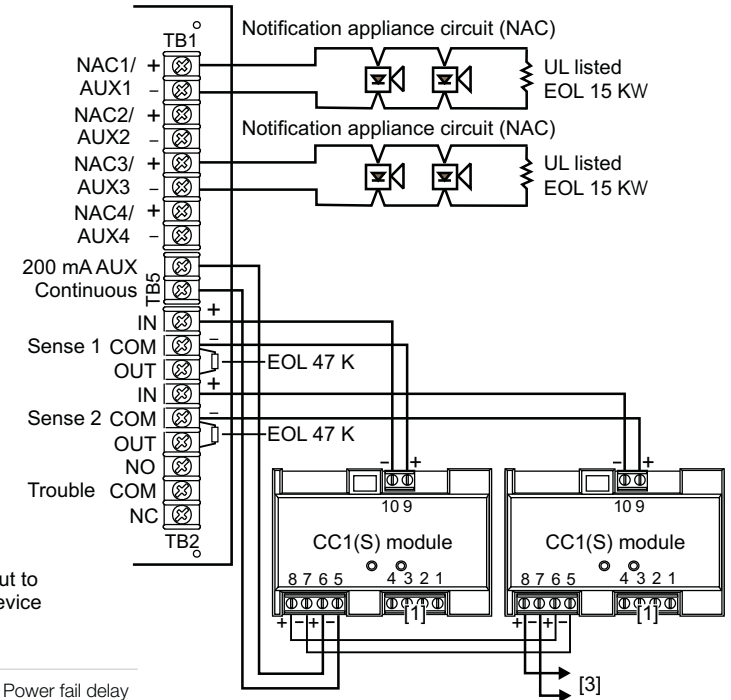


Configuring the Booster for AC Power Fail delay operation*

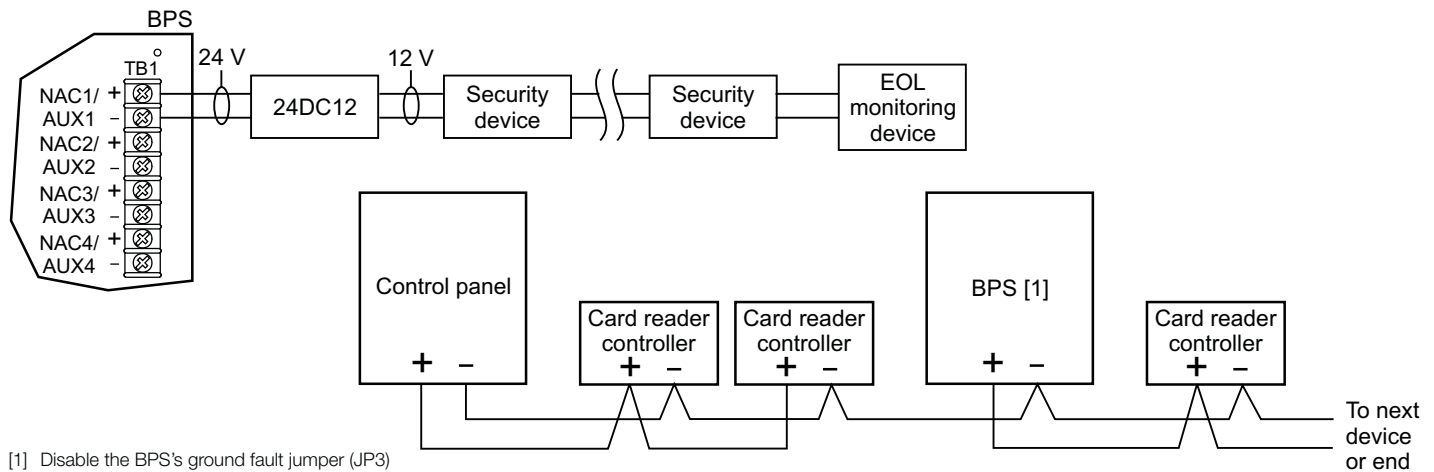


*The Booster supports AC Power fail delay of three hours via its trouble contact when dip switch SW2-6 is on. All other troubles are reported to supervising module or panel without delay via Sense inputs.

Multiple CC1(S) modules using the BPS's sense inputs



Security and access





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Specifications

Model	6.5 amp Booster	10 amp Booster
AC Line Voltage	120VAC or 220-240VAC 50/60Hz 390 watts	120VAC or 220-240VAC 50/60Hz 580 watts
Notification Appliance Circuit Ratings	3.0A max. per circuit @ 24Vdc nominal 6.5A max total all NACs	3.0A max. per circuit @ 24Vdc nominal 10A max total all NACs
Trouble Relay	2 Amps @ 30Vdc	
Auxiliary Outputs	Four configurable outputs replace NACs 1, 2, 3 or 4. as auxiliary outputs and 200 mA dedicated auxiliary. (See note 2.)	
Input Current (from an existing NAC)	3mA @ 12Vdc, 6mA @ 24Vdc	
Booster Internal Supervisory Current	70mA	
Signature Mounting Space	Accommodates three two-gang modules.	
Maximum Battery Size	10 Amp Hours (2 of 12V10A) in cabinet up to 24 Amp hours with ex- ternal battery cabinet for fire and security applications; up to 65 Amp hours for access control applications in external battery box.	
Terminal Wire Gauge	18-12 AWG	
Relative Humidity	0 to 93% non condensing @ 32°C	
Temperature Rating	32° to 120°F (0° to 49°C)	
NAC Wiring Styles	Class A or Class B	
Output Signal Rates	Continuous, California rate, 3-3-3 temporal, or follow installed panel's NAC. (See note 1.)	
Ground Fault Detection	Enable or Disable via jumper	
Agency Listings	UL, ULCL, CSFM	

1. Model BPS*CAA provides selection for California rate, in place of temporal.
2. Maximum of 8 Amps can be used for auxiliary output.

Ordering Information

Catalog Number	Description	Shipping Wt. lb (kg)
BPS6A	6.5 Amp Booster Power Supply	13 (5.9)
BPS6AC	6.5 Amp Booster Power Supply (ULC)	13 (5.9)
BPS6A/230	6.5 Amp Booster Power Supply (220V)	13 (5.9)
BPS6CAA	6.5 Amp Booster Power Supply with California rate	13 (5.9)
BPS10A	10 Amp Booster Power Supply	13 (5.9)
BPS10AC	10 Amp Booster Power Supply (ULC)	13 (5.9)
BPS10A/230	10 Amp Booster Power Supply (220V)	13 (5.9)
BPS10CAA	10 Amp Booster Power Supply with California rate	13 (5.9)

Related Equipment

12V6A5	7.2 Amp Hour Battery, two required	3.4 (1.6)
12V10A	10 Amp Hour Battery, two required	9.5 (4.3)
3-TAMP	Tamper switch	
BC-1EQ	Seismic Kit for BC-1. Order BC-1 separately. See note 3.	
BPSEQ	Seismic kit for BPS6A or BPS10 Booster Power Supplies. See note 3	
BC-1	Battery Cabinet (up to 2 - 40 Amp Hour Batteries)	58 (26.4)
BC-2	Battery Cabinet (up to 2 - 17 Amp Hour Batteries)	19 (8.6)
12V17A	18 Amp Hour Battery, two required (see note 1)	13 (5.9)
12V24A	24 Amp Hour Battery, two required (see note 1)	20 (9.07)
12V40A	40 Amp Hour Battery, two required (see notes 1, 2)	32 (14.5)
12V50A	50 Amp Hour Battery, two required (see notes 1, 2)	40 (18.14)
12V65A	65 Amp Hour Battery, two required (see notes 1, 2)	49 (22.2)

1. Requires installation of separate battery cabinet.
2. BPS supports batteries greater than 24 Amp hours for access control applications only.
3. For earthquake anchorage, including detailed mounting weights and center of gravity detail, refer to Seismic Application Guide 3101676. Approval of panel anchorage to site structure may require local AHJ, structural or civil engineer review.

Auxiliary Power Supplies

APS6A, APS10A

Overview

The Auxiliary Power Supply (APS) is a UL 864, 9th Edition listed power supply. It is a 24 Vdc filtered-regulated, and supervised unit that can easily be configured to provide additional notification appliance circuits (NACs) or auxiliary power for Mass Notification/Emergency Communication (MNEC), as well as life safety, security, and access control applications.

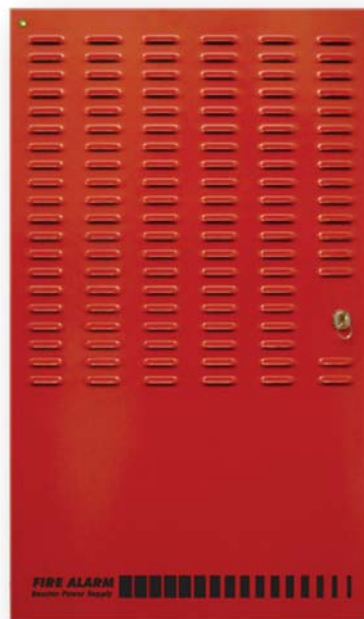
The APS contains the circuitry to monitor and charge internal or external batteries. Its steel enclosure has room for up to two 24 ampere-hour batteries. For access control-only applications, the APS can support batteries totaling up to 65 ampere-hours in an external enclosure. The APS has four Class B (convertible to two Class A) NACs. These can be activated in one or two groups from the APS's unique dual input circuits. The APS has a door-mounted AC power indicator LED.

The APS also has room for and can power a number of different modules. These can be Signature AA-30 or AA-50 dual-channel audio amplifiers, SIGA-UIO modules and/or SIGA-RELS. A MN-BKRT3 can also be installed. This bracket can accommodate an MN-NETSW1 Ethernet network switch, an MN-FVPN VoIP module and a MN-COM1S Communications module

The APS is available in 6.5 or 10 ampere models. Each output circuit has a capacity of three amperes; total current draw cannot exceed the unit's rating.

Features

- Allows for reliable filtered and regulated power to be installed where needed
- Cost effective system expansion



- Provides for Genesis and Enhanced Integrity notification appliance synchronization
- Supports coded output operation
- Self-restoring overcurrent protection
- Multiple signal rates
- Can be cascaded or controlled independently
- Easy field configuration
- On-board diagnostic LEDs identify wiring or internal faults
- Standard Edwards keyed lockable steel cabinet with removable door
- 110 and 230 Vac models available
- Accommodates 18 to 12 AWG wire sizes
- Optional tamper switch
- Dual battery charging rates
- Optional earthquake hardening: OSHPD seismic pre-approval for component Importance Factor 1.5

The APS meets current UL requirements and is listed as under the following standards:

Standard (CCN)	Description
UL864 9th ed.ition (UOXX)	Fire Alarm Systems
UL636 (ANET, UEHX7)	Holdup Alarm Units and Systems
UL609 (AOTX, AOTX7)	Local Burglar Alarm Units and Systems
UL294 (ALVY, UEHX7)	Access Control Systems
UL365 (APAW, APAW7)	Police Station Connected Burglar Alarm Units and Systems
UL1076 (APOU, APOU7)	Proprietary Burglar Alarm System Units
UL1610 (AMCX)	Central Station Alarm Unit
ULC-S527 (UOXXC)	Control Units, Fire Alarm (Canada)
ULC-S303 (AOTX7)	Local Burglar Alarm Units and Systems (Canada)
C22.2 No. 205	Signaling Equipment (Canada)

Application

The APS provides additional power and circuits for notification appliances and other 24 Vdc loads. It is listed for indoor dry locations and can easily be installed where needed.

Fault conditions are indicated on the on-board diagnostic LEDs, opening the BPS input sense circuit and the trouble relay (if programmed). While this provides indication to the host system, the APS can still be activated upon command. A separate AC Fail contact is available on the APS circuit board, which can be programmed for trouble or AC Fail. There are seven on-board diagnostic LEDs: one for each NAC fault, one for battery fault, one for ground fault, and one for AC power.

The unique dual-input activation circuits of the APS can be activated by any voltage from 6 to 45 VDC (filtered-regulated) or 11 to 33 Vdc (full-wave rectified, unfiltered). The first input circuit can be configured to activate 1-4 of the four possible outputs. The second input circuit can be configured to control circuits 3 and 4. When outputs are configured for auxiliary operation, these circuits can be configured to stay on or automatically deactivate 30 seconds after AC power is lost. This feature makes these circuits ideal for door holder applications. The APS also has a separate 200 mA 24 Vdc output that can be used to power internal activation modules.

APS NACs can be configured for a 3-3-3 temporal or continuous output. California temporal rate outputs are also available on certain models. This makes the APS ideal for applications requiring signaling rates that are not available from the main system.

In addition to the internally generated signal rates, the APS can also be configured to follow the coded signal rate of the main system NACs. This allows for the seamless expansion of existing NACs.

At the top of the steel enclosure, the APS has space and mounting bosses for:

- Up to two SIGA-AA30 or SIGA-AA50 dual-channel audio amplifiers

- One MN-BRKT3 with one MN-NETSW1 Ethernet switch, one MN-FVPN VoIP module, and one MN-COM1S communication module
- One SIGA-UIO6 or SIGA-UIO6R module motherboard
- Up to two SIGA-UIO2R module motherboards
- Up to two SIGA-REL releasing modules
- Up to two SIGA MP2L mounting plates modules

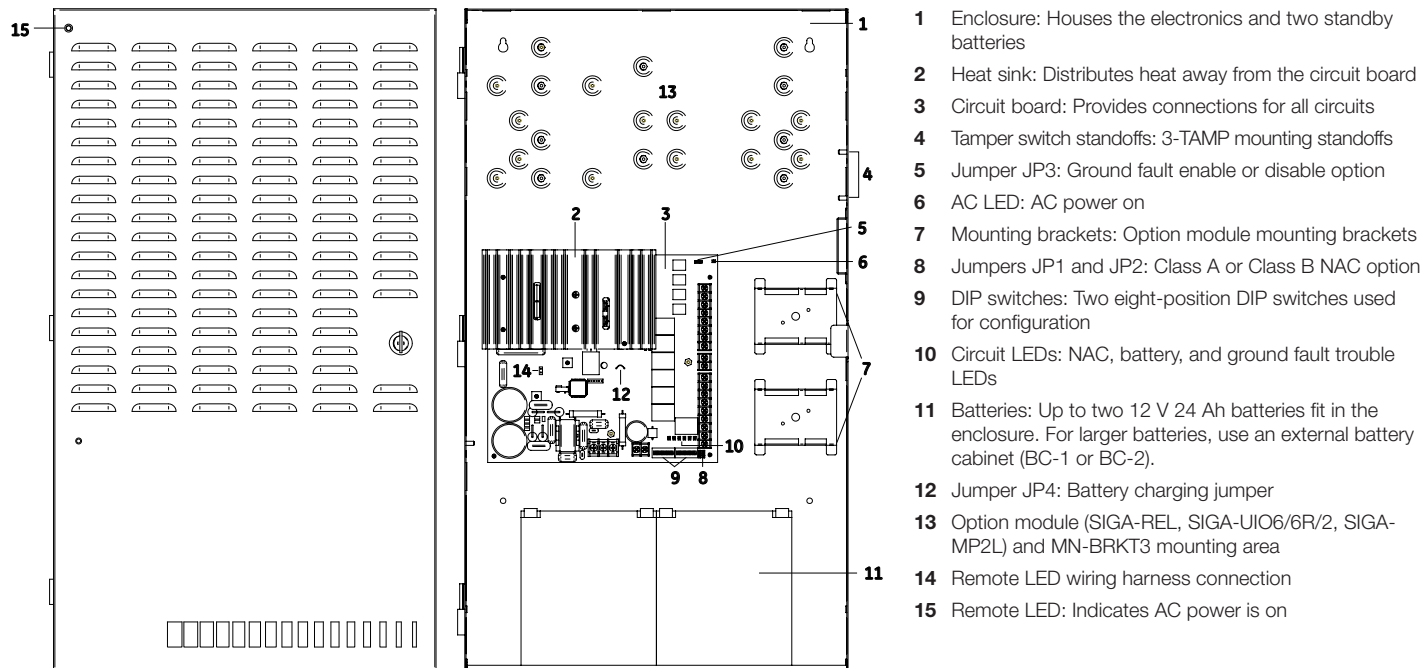
The above devices are in addition to the three factory-installed Signature module mounting brackets to the right of the APS circuit board.

Engineering Specification

Supply, where needed, Edwards APS Series Auxiliary Power Supplies (APS) that are interconnected to and supervised by the main system. The APS shall function as a stand-alone auxiliary power supply with its own fully-supervised battery complement. The APS battery complement shall be sized to match the requirements of the main system. The APS shall be capable of supervising and charging batteries having the capacity of 24 ampere-hours for Mass Notification/Emergency Communication (MNEC), life safety and security applications, and the capacity of 65 ampere-hours for access control applications.

<<The APS shall be capable of installation for a seismic component Importance Factor of 1.5.>>The APS shall provide a minimum of four independent, fully supervised Class B circuits that can be field configurable for notification appliance circuits or auxiliary 24 Vdc power circuits. APS NACs shall be convertible to a minimum of two Class A NACs. Each APS output circuit shall be rated at 3 amperes at 24 VDC. Each output circuit shall be provided with automatically restoring overcurrent protection. The APS shall be operable from the main system NAC and/or Edwards Signature Series control modules. APS NACs shall be configurable for continuous, 3-3-3 temporal or optionally, California rate. Fault conditions on the APS shall not impede operation of main system NAC. The APS shall be provided with ground fault detection circuitry and a separate AC fail relay.

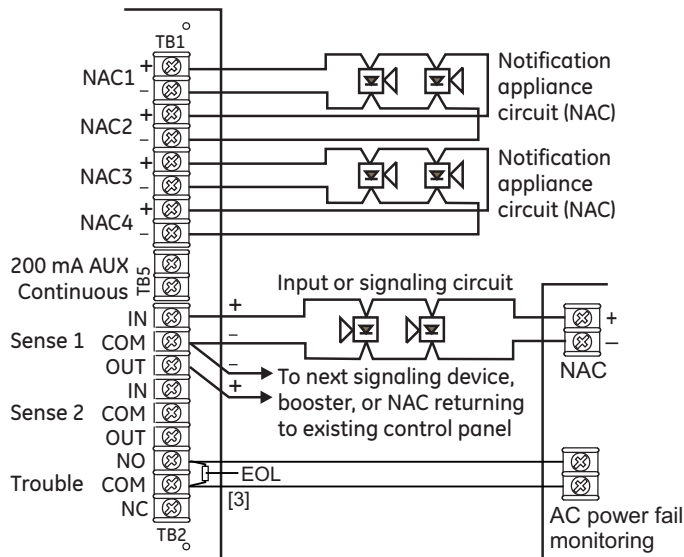
Cabinet Layout



Typical Wiring

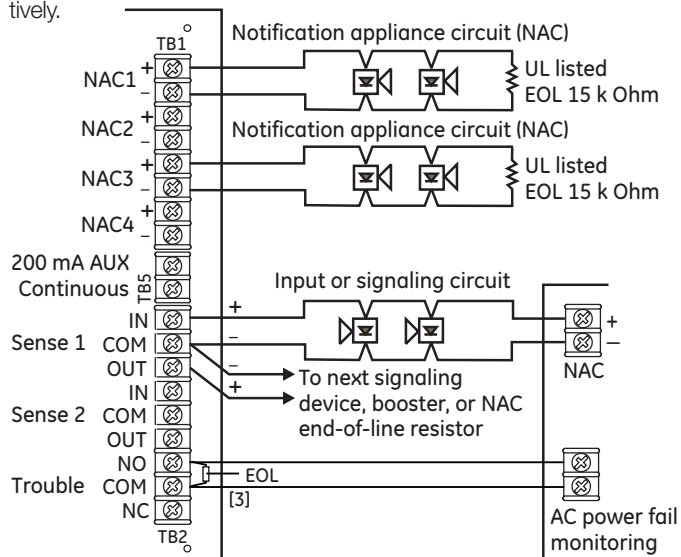
NAC Class A wiring

Connect a single NAC circuit to one NAC output. Terminate the circuit with a 15 k Ohm EOL resistor.



NAC Class B wiring

Connect one NAC circuit to one NAC output, either NAC1 or NAC3. Terminate the circuit at the NAC2 or NAC4 terminal screw, respectively.

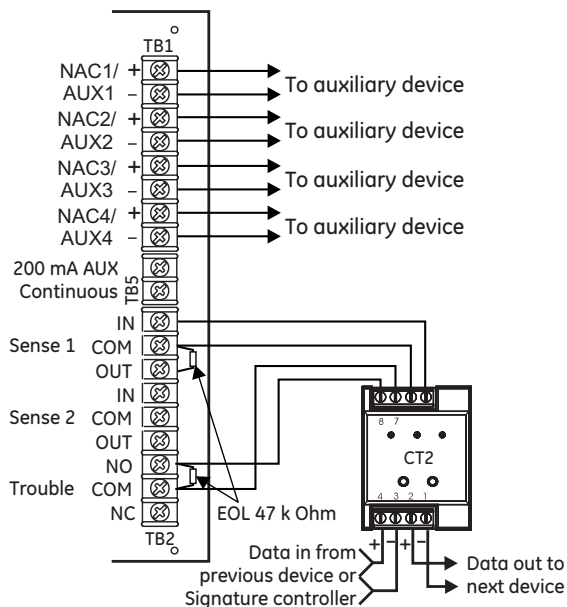


NAC wiring notes:

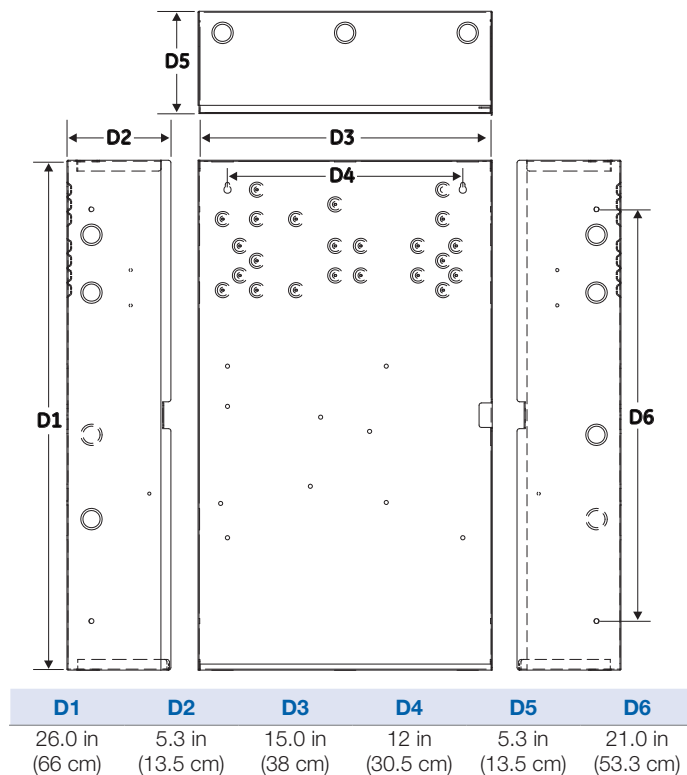
1. A trouble on the APS is sensed on the existing control panel's NAC circuit causing a NAC trouble on that panel. This removes the need to separately monitor the trouble contact except for AC power failure (see [3] below).
In an alarm condition, the APS allows NAC current to move downstream to devices connected to the existing control panel's NAC circuit.
2. Refer to the connected control panel's documentation for more details on NAC wiring.
- [3] The AC power failure panel connection annunciates at the panel but does not report off premises for a predetermined time period in U.S. fire applications.

Trouble relay wiring with four AUX circuits

When all four NAC/AUX circuits are configured as AUX circuits and DIP switch SW2-6 is ON, a SIGA-CT2 module must be used to monitor the sense 1 trouble contacts and the trouble relay.



Dimensions





Detection & alarm since 1872

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Specifications

Model	6.5 amp APS	10 amp APS
AC Line Voltage	120VAC or 220-240VAC 50/60Hz 390 watts	120VAC or 220-240VAC 50/60Hz 580 watts
Sense voltage (input)	6 to 45 Vdc, 11 to 33 Vrms (FWR and unfiltered DC)	
Sense current (input)	6 mA @ 24 Vdc, 3 mA @ 12 Vdc, 12 mA @ 45 Vdc	
NAC/AUX output voltage	19.1 to 26.85 Vdc	
NAC/AUX output current	3.0 A max. per circuit (10 A or 6.5 A max. total for all NACs) (10 A or 6.5 A max. total for all AUXs) [2]	
NAC/AUX class	Class B or Class A	
Wire size	18 to 12 AWG (0.75 to 2.5 sq mm)	
NAC EOL	UL: 15 k Ohm (P/N EOL-15) ULC: Use P/N EOL-P1 and select the 15 k Ohm resistor	
Auxiliary output (continuous)	1 dedicated 200 mA auxiliary output, not supervised by APS, included in total current	
Common trouble relay	Form C, 1 A, 30 Vdc (resistive)	
Battery requirements [1]	6.5 to 24 Ah for fire and up to 65 Ah for security applications Under 10 Ah, cut JP4. 10 Ah or above, do not cut JP4.	
Battery charger current limit	1.2 A when the battery jumper wire is cut 2.1 A when the battery jumper wire is not cut	
Operating environment	Temperature Humidity	
	32 to 120 °F (0 to 49 °C) 0 to 93% RH, noncondensing	
Ground fault impedance	10 k Ohm	
Intended installation environment	Indoor-dry	

[1] The maximum battery size the panel can charge is 24 Ah (12V24A or equivalent) for fire and security applications.

[2] The maximum current is 8 amps for auxiliary circuits that operate when the panel is in standby.

Ordering Information

Catalog Number	Description	Shipping Wt. lb (kg)
APS6A	6.5 Amp Auxiliary Power Supply	26 (11.8)
APS6A/230	6.5 Amp Auxiliary Power Supply (220V)	
APS10A	10 Amp Auxiliary Power Supply	
APS10A/230	10 Amp Auxiliary Power Supply (220V)	

Related Equipment

MN-BRKT3	MN-FVP series mounting bracket for APS-(6)(10)A power supplies	
BC-1EQ	Seismic Kit for BC-1. Order BC-1 separately. See note 3.	
APSEQ	Seismic kit for APS6A or APS10 Auxiliary Power Supplies. See note 3	
12V6A5	12 V, 7.2 Amp Hour Battery, two required	3.4 (1.6)
12V10A	12 V, 10 Amp Hour Battery, two required	9.5 (4.3)
12V17A	12 V, 18 Amp Hour Battery, two required	13 (5.9)
12V24A	12 V, 24 Amp Hour Battery, two required	20 (9.07)
12V40A	12 V, 40 Amp Hour Battery, two required (see notes 1, 2)	32 (14.5)
12V50A	12 V, 50 Amp Hour Battery, two required (see notes 1, 2)	40 (18.14)
12V65A	12 V, 65 Amp Hour Battery, two required (see notes 1, 2)	49 (22.2)
3-TAMP	Tamper switch	1.0 (0.6)
BC-1	Battery Cabinet (up to 2 - 40 Amp Hour Batteries)	58 (26.4)

Notes

- Requires installation of separate battery cabinet.
- APS supports batteries greater than 24 Amp hours for access control applications only.
- For earthquake anchorage, including detailed mounting weights and center of gravity detail, refer to Seismic Application Guide 3101676. Approval of panel anchorage to site structure may require local AHJ, structural or civil engineer review.

Field Configurable Ceiling Speaker-strobes

Genesis Series



Overview

Genesis life safety and mass notification/emergency communications (MNEC) ceiling speaker-strobes are small, compact, and attractive audible-visible emergency signaling devices. Protruding no more than 1.6" (41 mm) from the ceiling, Genesis speaker-strobes blend with any decor.

Life safety appliances feature textured housings in architecturally neutral white or eye-catching life safety red.

Genesis MNEC appliances offer emergency signaling with clear or amber lenses, white housings, and optional ALERT housing labels. They are ideal for applications that require differentiation between life safety and mass notification alerts.

Thanks to patented breakthrough technology, Genesis strobes do not require bulky specular reflectors and lenses. Instead, an exclusive cavity design conditions light to produce a highly controlled distribution pattern. FullLight strobe technology produces a smooth light distribution pattern without the spikes and voids characteristic of specular reflectors. This ensures the entire coverage area receives consistent illumination from the strobe flash.

Depending on the model, Genesis speaker-strobes feature 15 to 95, or 95 to 177 candela output (see ordering information), which is selectable with a conveniently-located switch. The candela output setting remains clearly visible even after final installation, yet it is locked in place to prevent unauthorized movement after installation.

Standard Features

- **Field configurable – no need to remove the device!**
 - Select ¼, ½, 1, or 2 watt operation
 - 15/30/75/95 cd and 95/115/150/177 cd clear strobe lens models available
 - Switch settings remain visible *even after the unit is installed*
- **MNEC models available**
 - 13/26/65/82 and 82/100/130/155 (1971 equivalent) amber lens models available
- **Unique low-profile design**
 - 30 per cent slimmer profile than comparable signals
 - Available with white or red housings
- **Unparalleled performance**
 - loud 90 dBA output ensures clear, crisp audio
 - Precision timing electronics meet tough synchronizing standards for strobes when used with compatible modules
 - 25 V_{RMS} and 70 V_{RMS} models available, all supplied with a DC blocking capacitor for audio circuit supervision
- **Easy to install**
 - Fits all standard 4" square electrical boxes with plenty of room for extra wire – *no extension ring or trim plate needed*
 - #18 - #12 AWG terminals – ideal for long runs, existing wiring
- **Approved for public and private mode applications**
 - UL 1971-listed as signaling devices for the hearing impaired
 - UL 1638-listed as protective visual signaling appliances
 - UL 1480-listed as life safety speaker
 - UL/ULC listed for ceiling or wall use

Strobe Application

Genesis strobes are UL 1971 or 1638 listed for indoor use. Prevailing codes require strobes to be used where ambient noise conditions exceed specified levels, where occupants use hearing protection, and in areas of public accommodation. Consult with your Authority Having Jurisdiction for details.

All Genesis strobes exceed UL synchronization requirements (within 10 milliseconds over a two-hour period) when used with a synchronization source. Synchronization for multiple strobe lights in a single field of view is required.

Speaker Application

The suggested sound pressure level for each signaling zone used with alert or alarm signals is a minimum of 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater. This is measured 5 feet (1.5 m) above the floor.

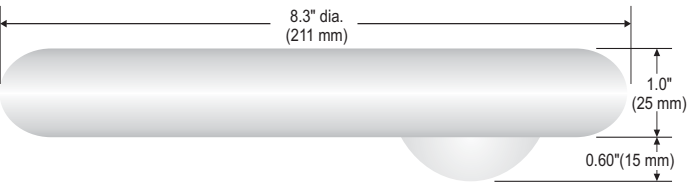
Doubling the distance from the signal to the ear will theoretically cause a 6 dB reduction in the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. Doubling the power output of a device (e.g.: a speaker from 1 W to 2 W) will increase the sound pressure level by 3 dBA. A 3 dBA difference represents a barely noticeable change in volume.

Combination audible/visual signals must be installed in accordance with guidelines established for strobes.

MNEC Applications

Genesis MNEC appliances bring the same high-performance life safety features and unobtrusive design to mass notification applications. Available as standard units with clear or amber lenses with optional ALERT markings, thy are ideal for applications that require differentiation between life safety and MNEC signals. Units are also available (special order) with red, blue or green lenses.

Dimensions



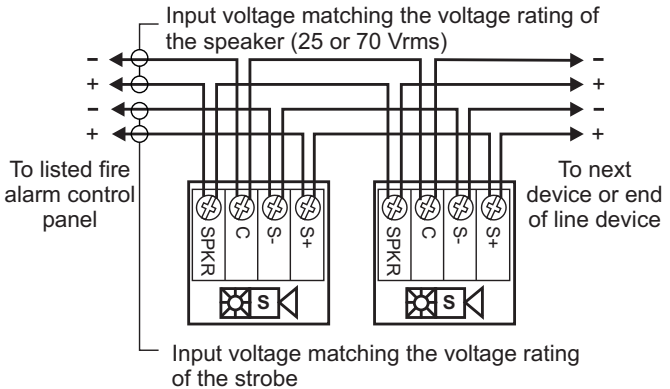
Sound Level Output

Wattage	25V		70V	
	UL Rated*	Typical	UL Rated*	Typical
¼ W	80 dBA	80.7 dBA	80 dBA	81.1 dBA
½ W	84 dBA	83.7 dBA	84 dBA	83.5 dBA
1 W	87 dBA	87.1 dBA	87 dBA	87.2 dBA
2 W	90 dBA	90.1 dBA	91 dBA	90.2 dBA

*Sound level output notes: dBA = Decibels, A-weighted. **UL1480:** Sound level output at 10 ft (3.05 m) measured in a reverberant room using 400 to 4,000 Hz band limited pink noise. **ULC-S541:** Meets or exceeds 85 dBA in an anechoic chamber at 10 ft (3.05 m). **Directional characteristics:** Within 6 dB of on-axis sound level when measured 90° off-axis (horizontal).

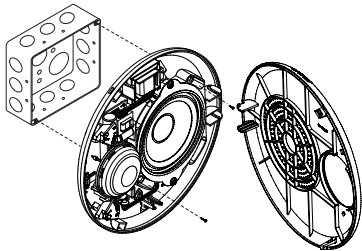
Wiring

Field wiring terminals accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring.

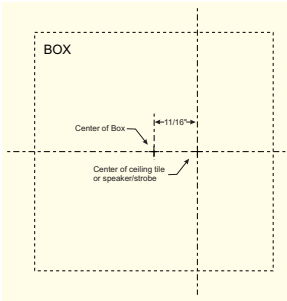


Installation and Mounting

All models are intended for indoor ceiling or wall applications only. Speaker-strobes are mounted to a flush North-American 4" square electrical box, 2 1/8" (54 mm) deep.



Genesis ceiling speaker-strobes simply unclatch and hinge down to open. This gains access to mounting screws and the selectable candela wattage tap switches. The shallow depth of Genesis devices leaves ample room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.

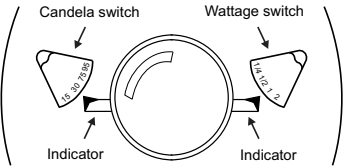


Caution:

When installed, these devices are not centered on the electrical box. Make sure boxes are mounted to compensate for this difference. Use the mounting template provided with installation sheet 3100614.

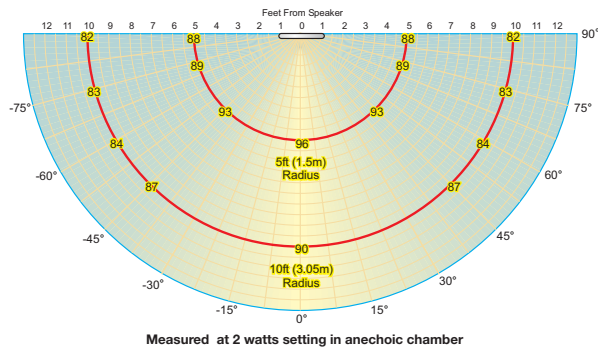
Field Configuration

Genesis ceiling speaker-strobes may be set for ¼, ½, 1, or 2 watt operation. Depending on the model, Genesis ceiling speaker-strobes have multi-candela output (see ordering information).

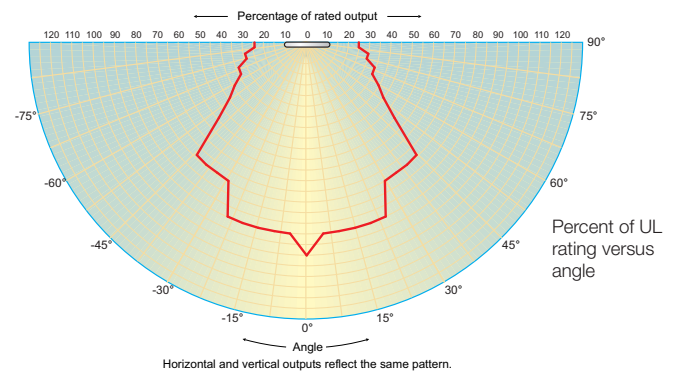


Output settings are changed by simply opening the device and sliding the switches to the desired settings. The speaker-strobe does not have to be removed to change the output settings. The settings remain visible through small windows on the front of the device after the cover is closed.

Typical Sound Output (dBA)



Light output - (effective cd)



Current Draw

UL Nameplate Rating

	15 cd	30 cd	75 cd	95 cd
	RMS	RMS	RMS	RMS
16 Vdc	109	151	281	318
16 Vfwr	131	194	379	437

Typical Current

	15 cd	30 cd	75 cd	95 cd
	RMS	RMS	RMS	RMS
16 Vdc	94	140	273	325
20 Vdc	74	108	205	244
24 Vdc	63	90	168	194
33 Vdc	48	70	124	139
16 Vfwr	126	187	368	403
20 Vfwr	108	156	281	333
24 Vfwr	97	139	240	270
33 Vfwr	89	119	197	214

UL Nameplate Rating (high cd output models)

95 cd	115 cd	150 cd	177 cd
RMS	RMS	RMS	RMS
330	392	502	565
432	518	643	693

Typical Current (high cd output models)

95 cd	115 cd	150 cd	177 cd
RMS	RMS	RMS	RMS
333	392	499	551
259	303	378	429
212	245	306	342
155	180	211	236
484	570	673	724
380	438	537	604
318	361	434	484
245	269	308	338

Notes and Comments

- Current values are shown in mA.
- UL nameplate rating is higher than typical current due to measurement methods and instruments used.
- Edwards recommends using the typical current for system design including NAC and Power Supply loading.
- Use the Vdc RMS current ratings for filtered power supply and battery AH calculations. Use the Vfwr RMS current ratings for unfiltered power supply calculations.
- Fuses, circuit breakers and overcurrent protection devices are typically rated for current in RMS values. Most of these devices operate based upon the heating affect of the current flowing through the device. The RMS current (not the mean current) determines the heating affect and therefore, the trip and hold threshold for those devices.

Specifications

Housing	Textured UV stabilized, color impregnated engineered plastic. Exceeds 94V-0 UL flammability rating. Red and white models available.
Mounting	Flush mount to North American 4-inch square electrical box, 2-1/8 (54 mm) inches deep, or 960A-4RF round flush box. No extension ring required. Suitable for indoor wall or ceiling applications.
Wire connections	Screw terminals: polarized inputs for speaker, #18 to #12 AWG (0.75 mm ² to 2.5 mm ²) wire size
Operating environment	Indoor: 32-120° F (0-49° C) ambient temperature; 0-93% relative humidity.
Agency listings/approvals	Meets ULC-S541, year 2004 UL requirements for standards UL1638 and UL1971, FM, MEA, CSFM, and complies with UL1480 Fifth Edition. All speaker-strobes comply with ADA Code of Federal Regulation Chapter 28 Part 36 Final Rule.
Speaker	
Input/Operating Volts	25 Vrms (Model GC-S2VM) or 70 Vrms (Model GC-S7VM).
Speaker Cone	Speaker frequency response: 250 - 13,000 Hz. Optimized for voice intelligibility. 4-inch (102mm) mylar cone, sealed back construction, rated for 8 watts, 8 ohm voice coil.

Strobe	
Strobe output rating	UL 1971, UL 1638, ULC S526: selectable 15/30/75/95 cd (VM models) and 95/115/150/177 cd (VMH models)
Strobe operating voltage	GC-S2VM/-S7VM series speaker-strobes: non-coded, filtered 16-33 Vdc or unfiltered 16-33 Vdc FWR
Strobe flash rate	GC-S2VM/-S7VM series speaker-strobes: one flash per second synchronized with optional G1M Genesis Signal Master indefinitely within 10 milliseconds (or self-synchronized within 200 milliseconds over thirty minutes on a common circuit without G1M Genesis Signal Master) Temporal setting (private mode only): synchronized to temporal output of Genesis audible signals on same circuit
Synchronization	Meets or exceeds UL 1971 requirements. Maximum allowed resistance between any two devices is 20 Ohms. Refer to specifications for the synchronization control module, this strobe, and the control panel to determine allowed wire resistance.
Synchronization Sources	SIGA-CC1S, SIGA-MCC1S, SIGA-CC2A, SIGA-MCC2A, G1M-RM BPS6A, BPS10A, APS6A, APS10A, iO64, iO500, Fireshield Plus 3, 5 and 10 zone.
Lens	Optical grade polycarbonate



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Ordering Information



Model	Hous- ing	Mark- ing	Lens	Strobe	Speaker	Ship Wt.
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Life safety Appliances (c/w running man icon screen printed on housing)

GC-S2VM	White	None	Clear	Selectable 15, 30, 75, or 110 cd	25 Volt	2.25 lb. (1.0 kg.)
GCF-S2VM	White	FIRE		Selectable 95, 115, 150, or 177 cd		
GC-S2VMH	White	None			Selectable 15, 30, 75, or 110 cd	
GCF-S2VMH	White	FIRE				
GC-S7VM	White	None		Selectable 95, 115, 150, or 177 cd		
GCF-S7VM	White	FIRE				
GCFR-S7VM	Red	FIRE				
GC-S7VMH	White	None				
GCF-S7VMH	White	FIRE				

MNEC Appliances (no running man icon on housing)

GCWA-S2VMA	WHITE	ALERT	Amber	Selectable* A, B, C or D	25 Volt	2.25 lb. (1.0 kg.)
GCWA-S2VMC		ALERT	Clear			
GCWN-S2VMA		NONE	Amber			
GCWN-S2VMC		None	Clear			
GCWA-S2VMHA		ALERT	Amber	Selectable A, B, C or D		
GCWA-S2VM-HC		ALERT	Clear			
GCWN-S2VMHA		None	Amber			
GCWN-S2VM-HC		None	Clear			
GCWA-S7VMA		ALERT	Amber	Selectable A, B, C or D	70 Volt	
GCWA-S7VMC		ALERT	Clear			
GCWN-S7VMA		None	Amber			
GCWN-S7VMC		None	Clear			
GCWA-S7VMHA		ALERT	Amber	Selectable A, B, C or D		
GCWA-S7VM-HC		ALERT	Clear			
GCWN-S7VMHA		None	Amber			
GCWN-S7VM-HC		None	Clear			

* These settings are for clear lenses. Units with red, blue or green lenses are available as a special order.
Contact customer service for details.

Accessories

G1M-RM	Synchronization Output Module (1-gang)	0.2 (0.1)
SIGA-CC1S	Intelligent Synchronization Output Module (2-gang)	0.5 (0.23)
SIGA-MCC1S	Synchronization Output Module (Plug-in UIO)	0.18 (0.08)

All speaker-strobes include field-selectable ¼, ½, 1, or 2 watt taps

NOTE: The flash intensity of some visible signals may not be adequate to alert or waken occupants in the protected area. Research indicates that the intensity of strobe needed to awaken 90% of sleeping persons is approximately 100 cd. Edwards recommends that strobes in sleeping rooms be rated at least 110 cd.

WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, further safeguards such as backup power supplies may be required.

Edwards recommends that these speaker-strobes always be installed in accordance with the latest recognized edition of national and local codes.

Field Configurable Ceiling Speaker

Genesis Series



Overview

Genesis life safety and mass notification/emergency communications (MNEC) ceiling speakers are small, compact, and attractive audible emergency signaling devices. Protruding no more than one inch from the ceiling, Genesis speakers blend with any decor.

Genesis notification appliances feature textured housings in architecturally neutral white or eye-catching fire alarm red.

Genesis MNEC appliances offer emergency signaling with white housings and optional ALERT housing labels. They are ideal for applications that require differentiation between life safety and mass notification alerts.

Genesis ceiling speakers feature ¼ W to 2 W operation, which is selectable with a conveniently-located switch. The wattage tap setting remains clearly visible even after final installation, yet it is locked in place to prevent movement after installation.

All Genesis ceiling speakers include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit. Models for 25 V_{RMS} and 70 V_{RMS} audio circuits are available. The mylar speaker with its sealed back construction is extra durable, is impervious to moisture and provides improved audibility.

Standard Features

- **Unique low-profile design**
 - Attractive appearance
 - No visible mounting screws
 - Available with white or red housings
- **Field configurable – no need to remove the device!**
 - Select ¼, ½, 1, or 2 watt operation
 - Switch setting remains visible even after the unit is installed
- **Unparalleled performance**
 - Loud 90 dBA output ensures clear, crisp audio
 - 25 V_{RMS} and 70 V_{RMS} models available, all supplied with a DC blocking capacitor for audio circuit supervision
- **Easy to install**
 - Fits all standard 4" square electrical boxes with plenty of room behind the signal for extra wire – no extension ring or trim plate needed
 - #18 - #12 AWG terminals – ideal for long runs, existing wiring
- **Approved for public and private mode applications**
 - UL 1480-listed as life safety speaker
 - UL/ULC listed for ceiling or wall use
- **MNEC models available**

Application

Standards generally require that notification systems produce signals a minimum of 15 dBA above the ambient sound pressure level, or 5 dBA above the maximum sound pressure level having a duration of 60 seconds, whichever is greater. This is measured 5 feet (1.5 m) above the floor.

Doubling the distance from the signal to the ear will theoretically cause a 6 dB reduction in the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. Doubling the power output of a device (e.g.: a speaker from 1 W to 2 W) will increase the sound pressure level by 3 dBA. A 3 dBA difference represents a barely noticeable change in volume.

MNEC Applications

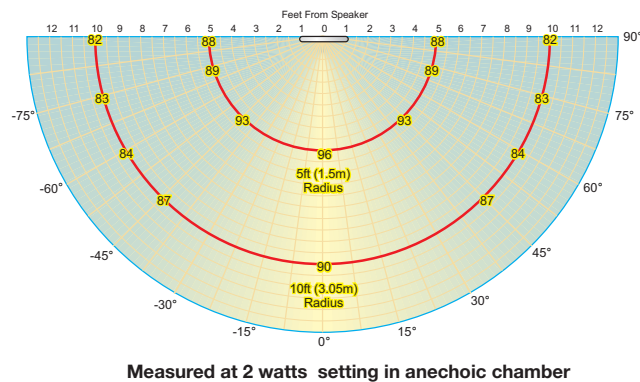
Genesis MNEC appliances bring the same high-performance life safety features and unobtrusive design to mass notification applications. Available with optional ALERT housing labels, they are ideal for applications that require differentiation between life safety and mass notification alerts.

Application Notes - Canada

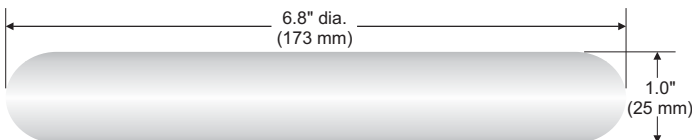
(Based in part on 1995 Canada National Building Code)

The signal sound pressure level shall not exceed 110 dBA in any normally occupied area. The sound pressure level from an audible signal in a floor area used for occupancies other than residential occupancies shall not be less than 10 dBA above ambient levels, and never less than 65 dBA. In sleeping rooms the sound pressure level from an audible signal shall not be less than 75 dBA when any intervening doors between the device and the sleeping room are closed.

Typical Sound Output (dBA)



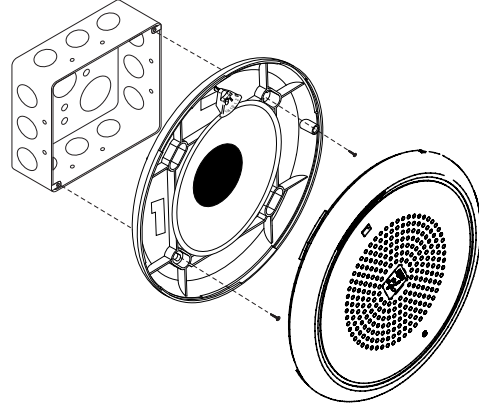
Dimensions



Installation and Mounting

All models are intended for indoor ceiling or wall applications only. Speakers are flush mounted to a North-American 4" square electrical box, 2 1/8" (54 mm) deep or a European 100 mm square box.

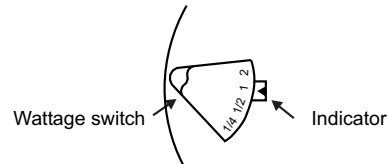
Genesis ceiling speakers simply unlatch and twist to open. This gains access to mounting screws. The shallow depth of Genesis devices leaves ample room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.



Edwards recommends that these speakers always be installed in accordance with the latest recognized edition of national and local codes.

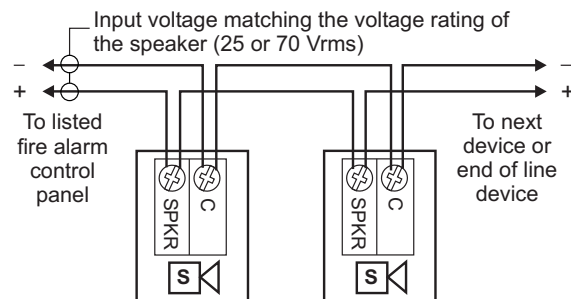
Field Configuration

Genesis ceiling speakers may be set for 1/4, 1/2, 1, or 2 watt operation. Wattage may be changed by simply opening the device and sliding the switch to the desired setting. The speaker does not have to be removed to change the output setting. The setting remains visible through a small window on the front of the device after the cover is closed.



Wiring

Field wiring terminals accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring.



Sound Level Output

Wattage	25V UL Rated*	25V Typical	70V UL Rated*	70V Typical
¼ W	80 dBA	80.7 dBA	80 dBA	81.1 dBA
½ W	84 dBA	83.7 dBA	84 dBA	83.5 dBA
1 W	87 dBA	87.1 dBA	87 dBA	87.2 dBA
2 W	90 dBA	90.1 dBA	91 dBA	90.2 dBA

*Sound level output notes:

dBA = Decibels, A-weighted

UL1480: Sound level output at 10 ft (3.05 m) measured in a reverberant room using 400 to 4,000 Hz band limited pink noise.

ULC-S541: Meets or exceeds 85 dBA in an anechoic chamber at 10 ft (3.05 m).

Directional characteristics: Within 6 dB of on-axis sound level when measured 90° off-axis (horizontal).

Specifications

Housing	Textured UV stabilized, color impregnated engineered plastic. Exceeds 94V-0 UL flammability rating. Red and white models available.
Wire connections	Screw terminals: polarized inputs for speaker, #18 to #12 AWG (0.75 mm ² to 2.5 mm ²) wire size
Mounting	Flush mount to North American 4-inch square electrical box, 2-1/8 (54 mm) inches deep, or 960A-4RF round flush box. No extension ring required. Suitable for indoor wall or ceiling applications.
Operating environment	Indoor: 32-120° F (0-49° C) ambient temperature; 0-93% relative humidity.
Agency listings/approvals	Meets or exceeds UL1480 Fifth Edition, ULC-S541, and CSFM (FM and MEA pending).
Input/Operating Voltage	25 Vrms (Model S2) or 70 Vrms (Model S7).
Speaker Cone	Speaker frequency response: 250-13,000 Hz. Optimized for voice intelligibility. 4-inch (102mm) mylar cone, sealed back construction, rated for 8 watts, 8 ohm voice coil.

Ordering Information

All speakers include field-selectable ¼, ½, 1, or 2 watt taps

Model	Housing	Marking	Speaker	Ship Wt.
Life safety Appliances (c/w running man icon screen printed on housing)				
GC-S2	White	None	25 Volt	1.62 lb. (0.73 kg.)
GCF-S2	White	FIRE		
GCFR-S2	Red	FIRE		
GC-S7	White	None	70 Volt	
GCF-S7	White	FIRE		
GCFR-S7	Red	FIRE		
MNEC Appliances (no running man icon on housing)				
GCWA-S2	White	alert	25 Volt	1.62 lb. (0.73 kg.)
GCWN-S2	white	none		
GCWA-S7	white	alert	70 Volt	
GCWN-S7	white	none		



White Field Configurable Ceiling Speakers may be ordered with or without optional FIRE marking. Red speakers come with FIRE marking. MNEC speakers are available with white housing and optional ALERT marking.



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Re-entrant Speaker and Speaker-Strobe

757 Series



Overview

EST's Integrity Series life safety and mass notification/emergency communications (MNEC) re-entrant speakers and speaker-strobes are high quality appliances for emergency voice communications, as well as alert and alarm tone signals.

Integrity's rugged plastic housing is made from durable and fire retardant, high impact plastic with a slightly textured surface. Housings are rated for outdoor use and are available in red or white. Integrity's ingenious mounting plate firmly holds the device in place with a single screw. This ensures quick and attractive installation. A separate trim plate is not required. Speaker terminals accept up to #12 AWG (2.5mm²) wire for polarized connections. Strobe connections are made to color-coded wire leads.

Integrity MNEC appliances offer emergency signaling with amber lenses. They are ideal for applications that require differentiation between life safety and mass notification alerts.

Life safety strobes are shipped with standard wall mount style FIRE lens markings. Where ceiling orientation, other languages, or different lens markings are required, Edwards offers optional LKW and LKC series Lens Marking Kits. These optional lens markings simply snap on to the strobe. Consult Edwards for availability of special lens markings.

Integrity strobes are designed for 16 to 33 Vdc operation and must be connected to signal circuits that output a constant (not pulsed) voltage. A diode is used to allow full signal circuit supervision.

Standard Features

- **UL 1971-listed synchronizing strobe**
Integrity strobes synchronize to the latest UL 1971 requirements when used with a synchronization source.
- **Genesis-compatible**
All Genesis and Integrity strobes on the same circuit meet UL 1971 synchronization requirements when used with an external control module.
- **MNEC models with amber lenses available**
- **Listed for public and private mode applications**
UL 1971-listed as signaling devices for the hearing impaired and UL 1638-listed as protective visual signaling appliances.
- **98 dBA Output**
High efficiency driver produces a loud 98 dBA at 15 watts.
- **Multiple Output Taps, 25 or 70 Volt Models**
Easy to select for 2, 4, 8, and 15 watt operation. Integrity speakers are supplied with a DC Blocking Capacitor for audio circuit supervision.
- **Outdoor rated**
Durable red or white Noryl front plate is ideal for outdoor, industrial or harsh environments.
- **Field changeable field markings**
Lens language or standard "FIRE" marking is easily changed with optional LKW (wall orientation) and LKC (ceiling orientation) lens kits.

Application

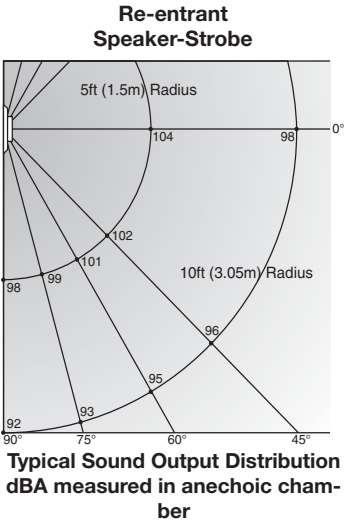
NOTE: The installation of visible and audible signals are subject to national and local standards, codes, and ordinances. Consult your Authority Having Jurisdiction for device installation requirements, application standards, and minimum performance specifications.

Speakers

All Integrity speakers include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit. Models for 25 V_{RMS} and 70 V_{RMS} circuits are available. Wattage taps from 2 W to 15 W provide on-site flexibility.

The suggested sound pressure level for each signaling zone used with alert or alarm signals is a minimum of 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater. This is measured 5 feet (1.5 m) above the floor.

Doubling the distance from the signal to the ear will theoretically cause a 6dB reduction in the received sound pressure level. The actual effect depends on the acoustic properties of materials in the space. Doubling the power output of a device (e.g.: a speaker from 1W to 2W) will increase the sound pressure level by 3dBA.



ceiling- mounted public-mode notification appliances for the hearing impaired. Prevailing codes require strobes to be used where ambient noise conditions exceed specified levels, where occupants use hearing protection, and in areas of public accommodation. Consult with your Authority Having Jurisdiction for details.

As part of the Enhanced Integrity line of products, 757 Series strobes exceed UL synchronization requirements (within 10 milli-seconds over a two-hour period) when used with a synchronization source. Synchronization is important in order to avoid epileptic sensitivity.

Integrity strobes are fully compatible with Edwards Genesis signals.

MNEC Applications

Integrity MNEC appliances are available with amber lenses. They are ideal for applications that require differentiation between life safety and mass notification alerts.

NOTE: The flash intensity of some visible signals may not be adequate to alert or waken occupants in the protected area. Research indicates that the intensity of strobe needed to awaken 90% of sleeping persons is approximately 100 cd. Edwards recommends that wall-mounted appliances in strobes in sleeping rooms be rated at at least 110 cd.

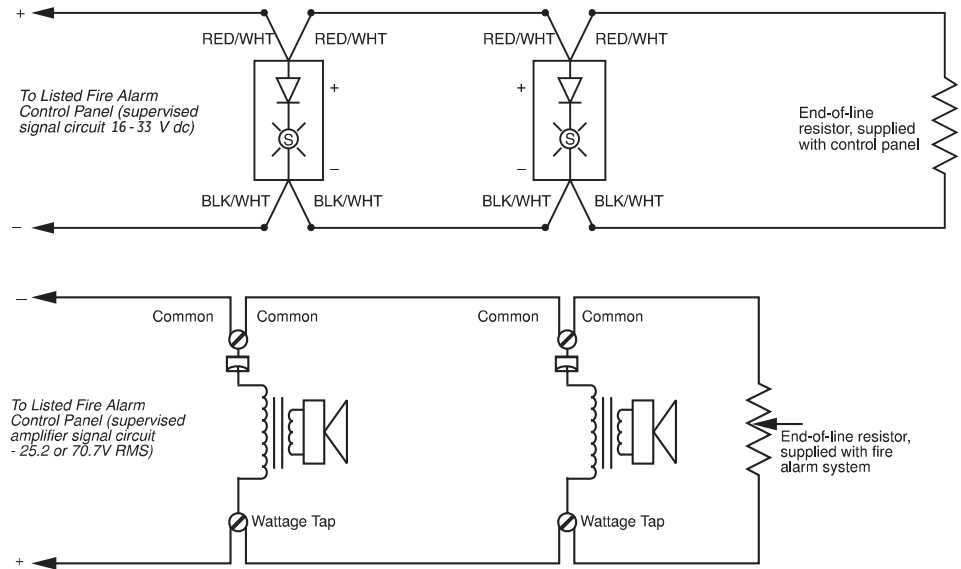
WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, further safeguards such as backup power supplies may be required.

Strobes

Edwards clear strobes are UL 1971-listed for use indoors as wall- or

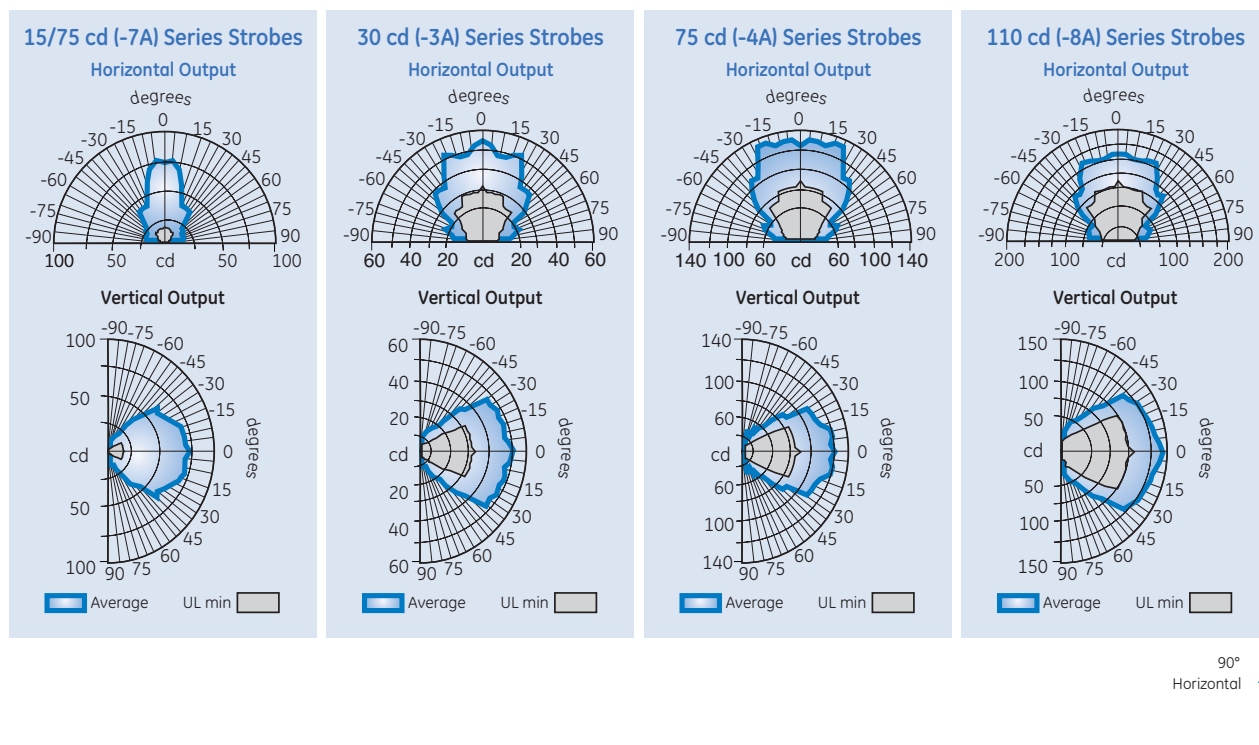
Typical Wiring

The strobe must be connected to signal circuits which output a constant (not pulsed) 24 Vdc voltage. Depending on the model, the speaker must be connected to either 25 or 70 V audio circuits.



Light Distribution Patterns

UL 1971 WALL MOUNTED STROBE LIGHT OUTPUT



Operating Current (RMS)

UL Rating	15/75 cd	30 cd	75 cd	110 cd
16 Vdc	150	130	263	329
16 Vfwr	210	189	333	420

Typical Current	15/75 cd	30 cd	75 cd	110 cd
24 Vdc	90	89	159	180
24 Vfwr	128	134	255	260

Vdc: Volts direct current, regulated and filtered
Vfwr: Volts full wave rectified

Current Draw Notes and Comments

1. Current values are shown in mA.
2. UL Nameplate Rating can vary from Typical Current due to measurement methods and instruments used.
3. Edwards recommends using the Typical Current for system design including NAC and Power Supply loading.
4. Use the Vdc RMS current ratings for filtered power supply and battery AH calculations. Use the Vfwr RMS current ratings for unfiltered power supply calculations.
5. Fuses, circuit breakers and other overcurrent protection devices are typically rated for current in RMS values. Most of these devices operate based upon the heating affect of the current flowing through the device. The RMS current determines the heating affect and therefore, the trip and hold threshold for those devices.

Sound Level Output

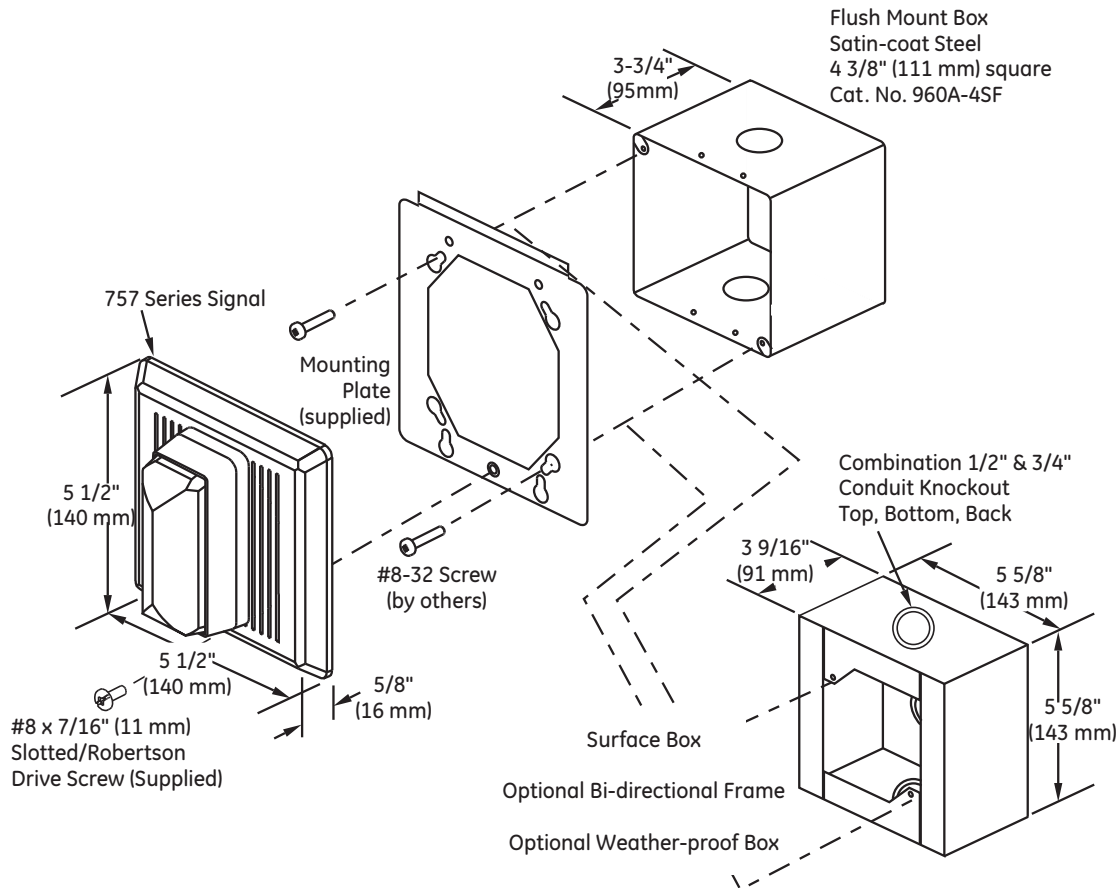
Wattage	Speaker		Speaker-strobe	
	UL 1480	Average	UL 1480	Average
2 W	90.0	90.3	84.0	86.2
4 W	93.0	93.4	87.0	89.4
8 W	96.0	95.7	90.0	91.8
15 W (UL)	96.0	98.2	90.0	94.1

Sound level output notes

- All values shown are dBA measured at 10 feet (3.01m).
- UL1480 values measured in reverberation room.
- Average values are measured in anechoic chamber.

Installation and Mounting

All models fit to flush mounted Edwards box, Catalog Number 960A-4SF. Optional flush trims are not required. For surface mount, use EST's custom indoor and outdoor surface boxes painted in color-matched red or white epoxy. Edwards recommends that these Life safety and MNEC speaker/strobes always be installed in accordance with the latest recognized edition of national and local codes.



Specifications

Model	757-7A-RSxx	757-3A-RSxx	757-8A-RSxx
UL 1638 & ULC S526 Rating (note 2)	75 cd	30 cd	110 cd
UL 1971 Rating (note 2)	15 cd wall, 15 cd ceiling	30 cd wall, 15 cd ceiling	110 cd wall, 60 cd ceiling
Input/Operating Volts	Speaker: 25 VRMS (suffix "-RS25" or 70 VRMS (suffix "-RS70") - see ordering table Strobe: 16-33 Vdc Continuous		
Speaker Taps/Output (note 1)	Measured at 10' (3.05 m): 15W = 98 dBA, 8W = 95 dBA, 4W = 93 dBA, 2W = 90 dBA		
Speaker Driver	Sealed construction, compression driver, 8 ohm voice coil		
Strobe Flash Rate	Synchronized at one flash per second. External control module necessary to meet UL 1971 synchronization requirements of 10 milliseconds over a two-hour period		
Synchronization Sources	SIGA-CC1S, SIGA-MCC1S, SIGA-CC2A, SIGA-MCC2A, G1M-RM BPS6A, BPS10A, APS6A, APS10A, iO64, iO500, Fireshield Plus 3, 5 and 10 zone.		
Flash Tube Enclosure	Clear LEXAN		
Lens Markings	Supplied with LKW-1 "FIRE" red letters, vertical both sides (Wall Mount) - see LKW and LKC series for ceiling style and optional markings		
INDOOR Operating Environment	-31 to 150° F (-35 to 66° C) ambient temperature. 85% relative humidity @ 30° C.		
OUTDOOR Operating Environment (must use weatherproof box)	95% relative humidity @ 60° C; -35-150° F (-31-66° C) ambient temperature (757-7A: rated at 17.7 cd @ -35° C per UL/@ -40° C per ULC) (757-8A: rated at 70.7 cd @ -35° C per UL/@ -40° C per ULC) (757-3A: rated at 9.0 cd @ -35° C per UL/@ -40° C per ULC)		
Wire Connections	Speaker: Terminals for up to #12 AWG (2.5mm ²) Strobe: 6" (150 mm) color-coded polarized wire leads		
Housing (note 3)	Textured, color impregnated engineered plastics - exceeds 94V-0 UL flammability rating		
Mounting - INDOOR	Flush: 960A-4SF Flush Box Surface: 757A-SB Backbox Bi-directional (note 3) 757A-BDF Mounting Frame (note 3)		
Mounting - OUTDOOR	Surface only: 757A-WB Weatherproof Box (note 3)		
Agency Listings	UL 1971, UL 1638, UL 1480, ULC S526, ULC S541, MEA, CSFM, FM, CE (All models comply with ADA Code of Federal Regulation Chapter 28 Pt. 36 Final Rule)		

Note 1: Measured in reverberant room using 400-4000Hz band limited pink noise per UL 1480. Subtract 3dBA for models with strobes.

Note 2: Strobe candela ratings apply to clear strobes. Amber strobes candela rating is available on the installation sheet.

Note 3: RED housing is standard, add Suffix "W" for WHITE



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Lens Marking Kits*

LKW-1	"FIRE", Wall Orientation (supplied)
LKW-2	"FEU", Wall Orientation
LKW-3	"FIRE/FEU", Wall Orientation
LKW-4	"SMOKE", Wall Orientation
LKW-5	"HALON", Wall Orientation
LKW-6	"CO2", Wall Orientation
LKW-7	"EMERGENCY", Wall Orientation
LKW-8	"ALARM", Wall Orientation
LKW-9	"FUEGO", Wall Orientation
LKW-10	"ALERT", Wall Orientation

*Change "W" to "C" for Ceiling Mount (e.g. LKC-1)

Ordering Information

Catalog Number	Description	Ship Wt., lb. (kg)
25 Volt Re-Entrant Speakers		
757-1A-R25	Speaker, Red	2.5 (1.2)
757-1A-R25W	Speaker, White	
25 Volt Re-Entrant Speakers/Strobes		
757-7A-RS25	Speaker-Strobe, 15/75cd, Red	2.5 (1.2)
757-7A-RS25W	Speaker-Strobe, 15/75cd, White	
757-3A-RS25	Speaker-Strobe, 30cd, Red	
757-3A-RS25W	Speaker-Strobe, 30cd, White	
757-8A-RS25	Speaker-Strobe, 110cd, Red	
757-8A-RS25W	Speaker-Strobe, 110cd, White	
70 Volt Re-Entrant Speakers		
757-1A-R70	Speaker, Red	2.5 (1.2)
757-1A-R70W	Speaker, White	
70 Volt Re-Entrant Speakers/Strobes		
757-7A-RS70	Speaker-Strobe, 15/75cd, Red	2.5 (1.2)
757-7A-RS70W	Speaker-Strobe, 15/75cd, White	
757-3A-RS70	Speaker-Strobe, 30cd, Red	
757-3A-RS70W	Speaker-Strobe, 30cd, White	
757-8A-RS70	Speaker-Strobe, 110cd, Red	
757-8A-RS70W	Speaker-Strobe, 110cd, White	
MNEC Re-Entrant Speakers/Strobes		
757-7A-RS70WA	Speaker-Strobe, 70 V, 12/75 cd strobe, white housing, amber lens.	2.5 (1.2)
757-7A-RS25WA	Speaker-Strobe, 25 V, 12/75 cd strobe, white housing, amber lens.	
757-8A-RS70WA	Speaker-Strobe, 70 V, 88 cd strobe, white housing, amber lens.	
757-8A-RS25WA	Speaker-Strobe, 25 V, 88 cd strobe, white housing, amber lens.	
Mounting Accessories		
960A-4SF	Flush Box, Indoor	1.5 (0.7)
757A-SB	Surface Box, Red, Indoor	
757A-SBW	Surface Box, White, Indoor	
757A-WB	Weatherproof Box, Red, Surface	
757A-WBW	Weatherproof Box, White, Surface	
757A-BDF	Bi-directional Mounting Frame, Red	4 (1.8)
757A-BDFW	Bi-directional Mounting Frame, White	

Intelligent Duct Smoke Detector

SIGA-SD



Overview

The Edwards *SuperDuct* Signature Series smoke detector is the most advanced and most reliable device in its class. Designed for easy installation and superb reliability, *SuperDuct* represents the perfect balance of practical design and advanced technology.

SuperDuct detectors feature a unique design that speeds installation and simplifies maintenance. Removable dust filters, conformally coated circuit boards, and optional water-resistant gaskets keep contaminants away from components, ensuring years of trouble-free service. When cleaning is required, the assemblies come apart easily and snap back together in seconds.

A **Signature Series photoelectric sensor** is incorporated into the design of each SIGA-SD duct smoke detector. This sensor inherits the power and benefits of this exceptional line of intelligent devices.

Signature Series sensors gather analog information from their smoke sensing elements and convert it into digital signals. The sensor measures and analyses these signals and compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires, which virtually eliminates unwanted alarms.

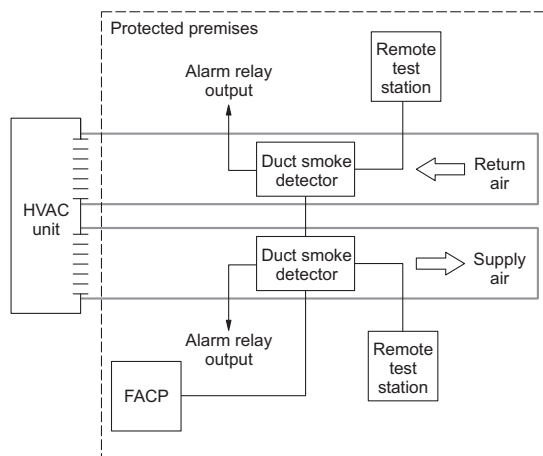
WARNING: Duct detectors have specific limitations. Duct detectors are not a substitute for an open area smoke detector. Duct detectors are not a substitute for early warning detection or a replacement for a building's regular fire detection system. Smoke detectors are not designed to detect toxic gases which can build up to hazardous levels in some fires. These devices will not operate without electrical power. As fires frequently cause power interruptions, Edwards suggests you discuss further safeguards with your local fire protection specialist.

Standard Features

- Less than 2" deep for easy installation and applications where space is tight
- -4°F to 158°F (-20°C to 70°C) operating range with 100 ft/min. to 4,000 ft/min air velocity rating assures reliability under harsh environmental conditions
- Status LEDs remain visible through clear assembly cover
- Cover monitor switch for added security
- Standard sampling tube spacing for easy drop-in migration from other detectors
- Sampling tube can be installed with or without the cover in place and can be rotated in 45-degree increments to ensure proper alignment with duct airflow
- 15.2 to 19.95 Vdc operation
- Magnet-activated test switch
- One Form C auxiliary alarm relay for controlling ancillary equipment (e.g., HVAC controls)
- No special tools required for easy access to field connections
- Signature Series intelligence
- Environmental compensation with differential sensing for reliable, stable, and drift-free sensitivity
- Wide 0.79% to 2.46% obscuration/ft. smoke sensitivity
- Identification of dirty or defective detectors

Application

SuperDuct detectors are ideally suited to duct smoke detection applications where early indication of combustion is required within the confined space of ventilation ductwork. Its primary purpose is to provide early warning of an impending fire and to prevent smoke from circulating throughout the building. It is typically used to detect smoke in the supply side of the HVAC system but can provide supervision of the return side as well.



SuperDuct detectors continually sample air flow in the HVAC duct and initiate an alarm condition whenever smoke is detected. An alarm is activated when the quantity (percent obscuration) of combustion products in that air sample exceeds the detector's sensitivity setting.

Signature Series Intelligence

Like all Signature detectors, the SIGA-SD features electronic addressing and issues a dirty sensor warning when it reaches its preset limit. The dirty sensor warning indicates the sensor is operating within its specified limits but is in need of servicing. When the detector's ability to compensate for environmental changes has reached its limit, the duct smoke detector signals a trouble condition.

The SIGA-SD also uses differential sensing to prevent gradual environmental changes from triggering unwanted alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the detector to signal an alarm state, but dust and debris accumulated over time does not change alarm sensitivity.

Each Signature Series *SuperDuct* detector contains a microprocessor that performs comprehensive self-diagnostics and stores the results in nonvolatile memory. Stored results include details such as hours of operation, last maintenance date, and number of alarms and troubles. This information can be retrieved and reviewed when desired.

Detector Configuration

The detector assembly cover provides easy access to the smoke sensor, its wiring connections, sample and exhaust tubes, and the smoke chamber itself.

Air enters the detector's sensing chamber through a sampling tube (ordered separately) that extends into the duct and is directed back into the ventilation system through an exhaust tube (included). The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the detector initiates an alarm.

The sampling tube may be installed from either the duct side of the assembly or from inside the sensor compartment, as preferred by the installer. (The exhaust tube must be installed from the duct side.) Sampling tubes may be rotated in 45-degree increments so that air-holes can be aligned to allow the unit to be mounted at virtually any angle relative to the air flow.

In installations where the duct smoke detector's controls and indicators are hidden from view, a remote test station or an LED indicator can be connected to the detector to provide these functions.

Remote Test Stations

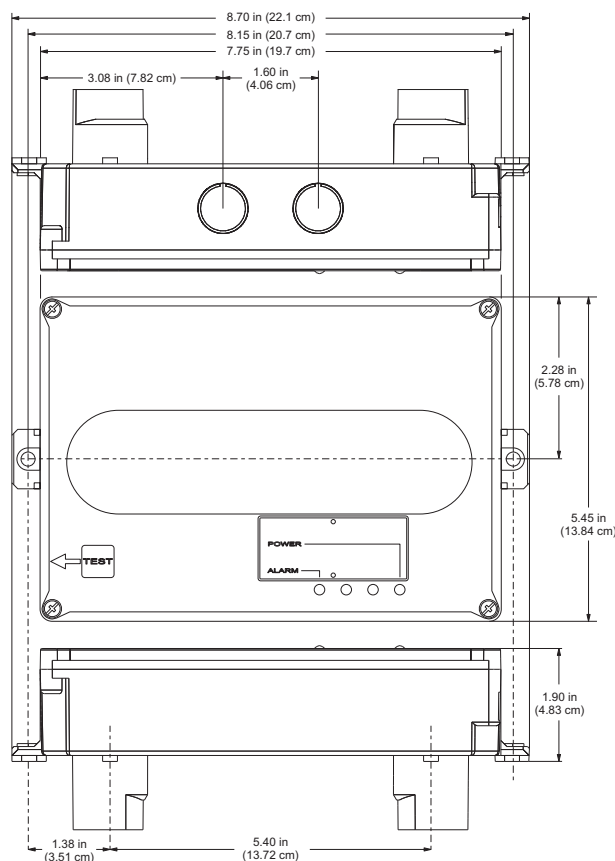


Labor-saving Remote Test/Reset stations provide alarm testing from the convenience of a remote location. Tests can be performed quickly and safely – without having to climb to the roof. Magnetically-operated and key-operated one-gang models are available. Signature *SuperDuct* detectors are also compatible with SIGA-LED remote alarm LED.

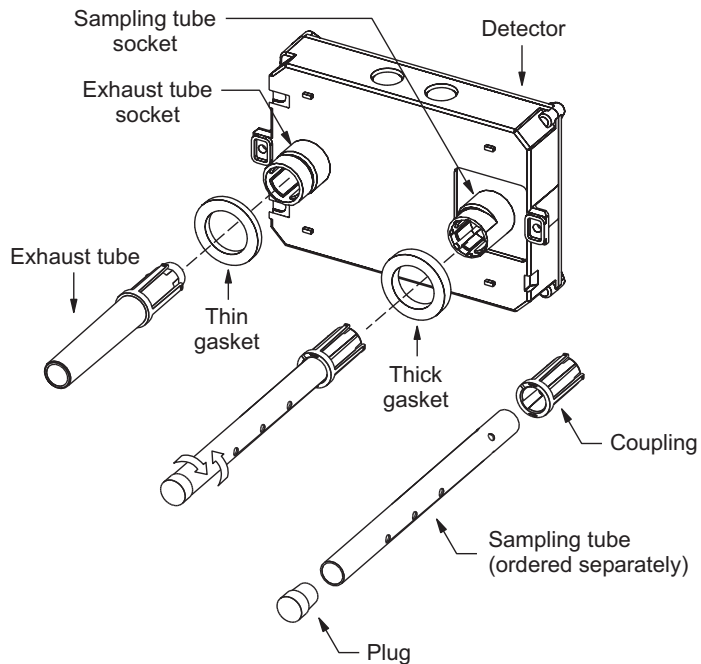
Air velocity in the duct as low as 100 ft/min. maintains adequate air flow into the sensor smoke chamber through air holes in the air sampling tube and discharges through the exhaust tube. *SuperDuct* air sampling tubes must be installed with the inlet holes facing the airstream. Sampling tubes may be rotated in 45-degree increments so that air-holes can be aligned to allow the unit to be mounted in virtually any angle relative to the airflow.

SuperDuct sensors are engineered to operate optimally under the harsh environmental conditions frequently found in HVAC ductwork. Nonetheless, before installing the detector, test the duct air velocity, temperature, and humidity to verify that it is within the operating range of the *SuperDuct* detector. Consult the *SuperDuct* installation sheet for details.

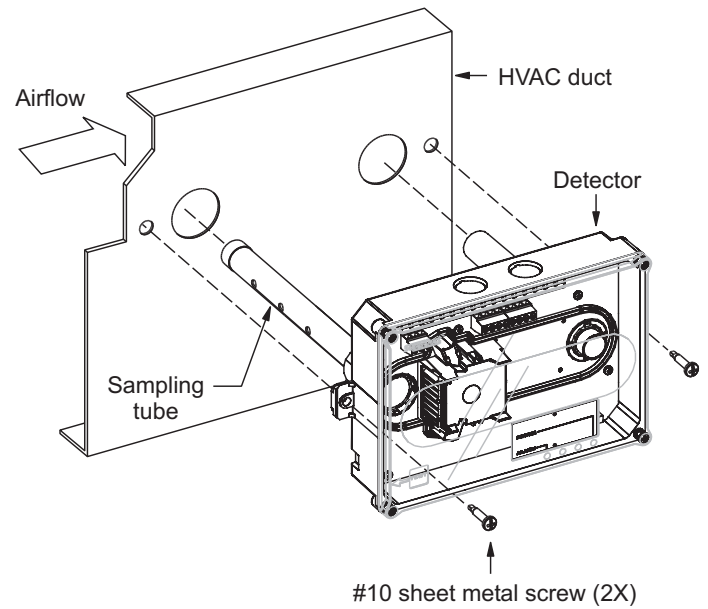
Dimensions



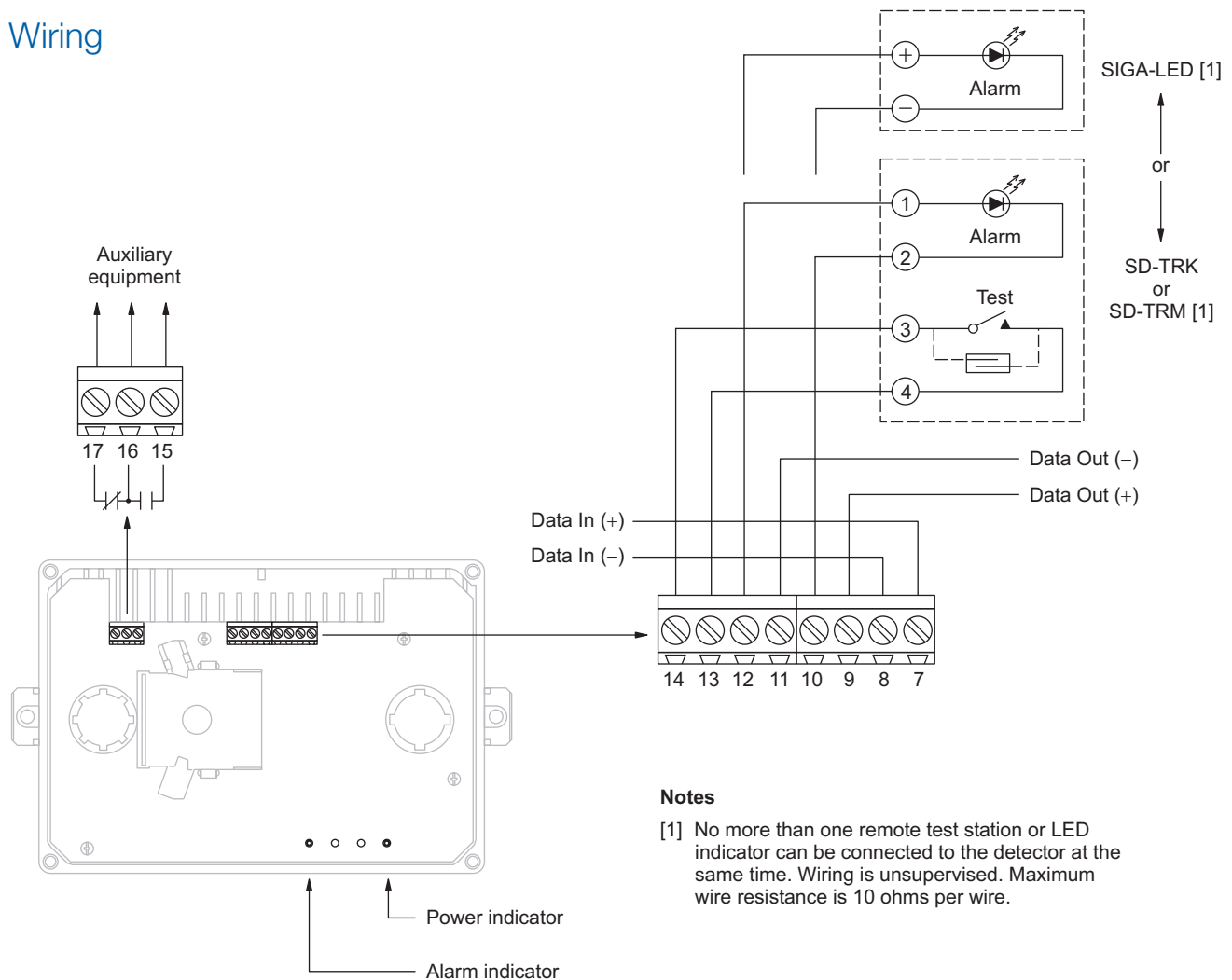
Assembly



Mounting



Wiring



Notes

- [1] No more than one remote test station or LED indicator can be connected to the detector at the same time. Wiring is unsupervised. Maximum wire resistance is 10 ohms per wire.



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Specifications, detector

Dimensions	8.70 x 5.45 x 1.90 inches (221 x 138 x 48 mm)
Wire size	14 to 22 AWG
Detection method	Photoelectric (light scattering principle)
Air velocity rating	100 to 4,000 ft/min and meets the required minimum air pressure differential
Air pressure differential	0.005 to 1.00 inches of water
Sensitivity	0.79 to 2.46 %/ft obscuration
Alarm test response time	5 seconds
LED indicators	Alarm (red), Power (green)
Common alarm relay	Unsupervised and power- limited Quantity: 1 Type: Form C Ratings: 2.0 A at 30 Vdc (resistive)
Operating voltage	15.2 to 19.95 Vdc
Operating current	Standby: 45 µA Alarm: 45 µA Inrush: 1 mA Standalone alarm: 18 mA
Operating environment	Temperature (UL): -4 to 158 °F (-29 to 70 °C). Temperature (ULC): -4 to 120 °F (-29 to 49 °C) Relative humidity: 10 to 93%, noncondensing
Agency listings	UL, ULC, CSFM, FM, MEA

Specifications, test stations

Remote Test/Reset Stations provide alarm test, trouble indication, and reset capability from a remote location. They include a one-gang plate, momentary SPST switch, red alarm LED, and terminal block. Magnetically-operated models (TRM) or key-operated models (TRK) are available.

Compatible electrical boxes	North American 1-gang box Standard 4-in square box, 1-1/2 inches deep, with 1-gang cover
LED indicators	Alarm (red)
LED type	Clear lens
Wire size	14 to 22 AWG
Resistance per wire	10 Ohms, max.
Current requirements	See controller specifications
LED circuit ratings	Voltage: 3 Vdc, max. Current: 30 mA, max.
Switch ratings (SD-TRK)	Voltage: 125 Vdc, max. Current: 4 A, max.
Switch ratings (SD-TRM)	Voltage: 200 Vdc, max. Current: 0.5 A, max.
Compatible detectors	SuperDuct conventional two-wire and Signature duct smoke detectors
Operating environment	-4°F to 158°F (-20°C to 70°C) Humidity: 93% RH, noncondensing
Storage temperature	-4 to 140 °F (-20 to 60 °C)
Agency listings	UL, ULC, CSFM

Ordering Information

Catalog Number	Description	Ship Wt., lb. (kg)
SIGA-SD	Intelligent SuperDuct Detector	2.4 (1.1)
Accessories		
SD-T8	8-inch sampling tube	0.5 (0.2)
SD-T18	18-inch sampling tube	1.5 (0.7)
SD-T24	24-inch sampling tube	2.7 (1.2)
SD-T36	36-inch sampling tube	3.0 (1.4)
SD-T42	42-inch sampling tube	3.5 (1.6)
SD-T60	60-inch sampling tube	5.8 (2.6)
SD-T78	78-inch sampling tube	7.5 (3.4)
SD-T120	120-inch sampling tube	11.5 (5.2)
SIGA-LED	Remote alarm LED	1.0 (0.5)
SD-TRM	Remote test station, magnetic	1.0 (0.5)
SD-TRK	Remote test station, keyed	1.0 (0.5)
SD-VTK	Air velocity test kit (stoppers only, etc)	1.0 (0.5)
SD-GSK	Cover gasket kit	0.5 (0.2)
SD-MAG	Test magnet kit	0.5 (0.2)
SIGA-SDPCB	Replacement PCB/Signature sensor kit	1.0 (0.5)

Sounder Base

Model SIGA-AB4G



Overview

The Signature Series AB4G sounder base adds an audible output function to any Signature Series detector. The base can operate as an independent local alarm, or as part of a zone or system alarm with synchronized audible output.

The sounder base matches the finish of Signature Series detectors and the sound output slots complement the smoke/heat entry openings of the detector. The result is a compact unit with an attractive appearance.

The base generates a loud piercing tone that has excellent wall penetration qualities. It uses the same tone generator found in the award-winning Genesis line of wall and ceiling horns.

The AB4G may be configured in the field for either steady or temporal output and either high or low dB output. Low dB and steady output selections are made by cutting jumpers on the circuit board. The default setting is high dB with temporal output.

AB4G sounder bases on the same circuit may be activated as a group or zone with the use of a SIGA-CRR polarity reversal module, and the group or zone may be synchronized audible output with the use of a G1M-RM signal master.

The AB4G sounder base can simply operate according to the state of its detector, or it can be configured through system programming to operate in conjunction with all sounder bases on the same circuit, or it can be controlled by program rules. Available operating modes are determined by the system that supports the Signature data loop.

Standard Features

- **Temporal or steady tone**
Jumper selects steady or synchronized temporal output.
- **High or low dB output**
Jumper selects low or high dBA output.
- **Single or group operation**
Optional polarity reversing module configures base for group alarm output.
- **UL268 and UL464 listed**
UL listing under smoke detector and audible signal standards allows application as smoke alarm and/or audible signal.
- **Attractive installation**
Flush mount to a wide selection of North American boxes or surface mount to optional custom-matched box.

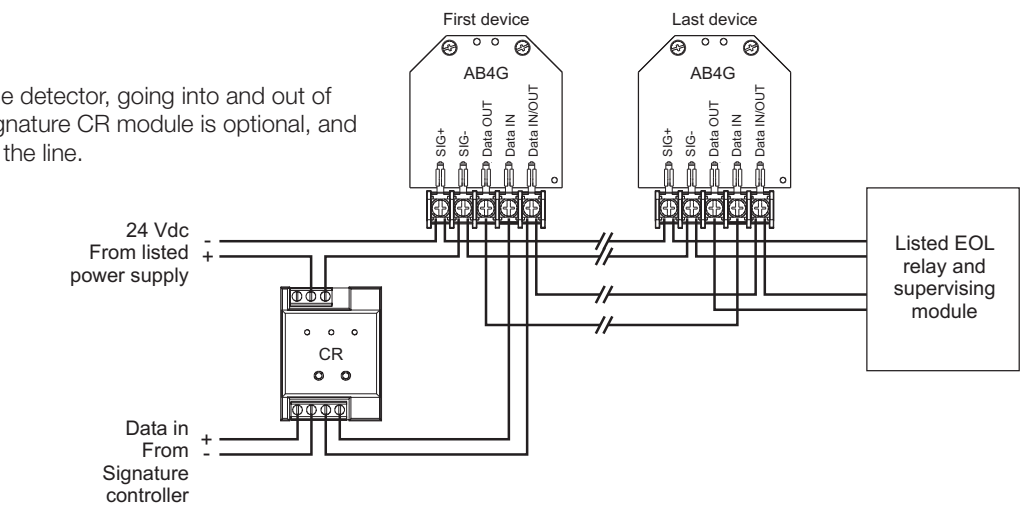
Application

The Signature Series AB4G sounder base is for use with Signature Series detectors in applications where localized or group alarm signaling is required. The base uses the same address and programming label as the detector it supports.

The base is listed by Underwriters Laboratories under the UL268 and UL464 standards, allowing its application where both smoke alarms and/or notification appliances are required. This makes the AB4G ideal for hotels, dormitories, and other residential occupancies where supplementary audible output is required to meet required sound levels for sleeping areas or areas subject to high levels of ambient noise.

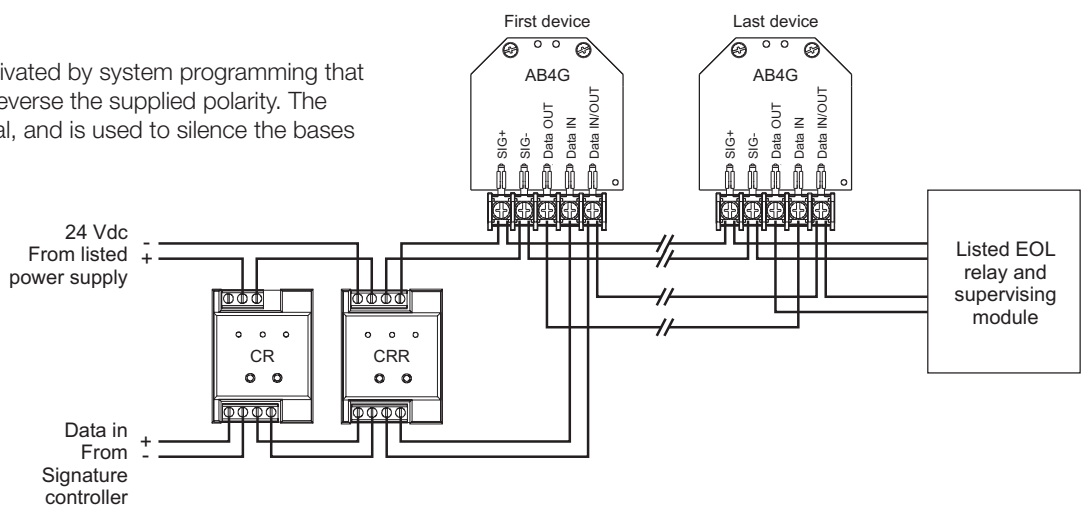
Detector operates the base

The base follows the state of the detector, going into and out of alarm with the detector. The Signature CR module is optional, and is used to silence the bases on the line.



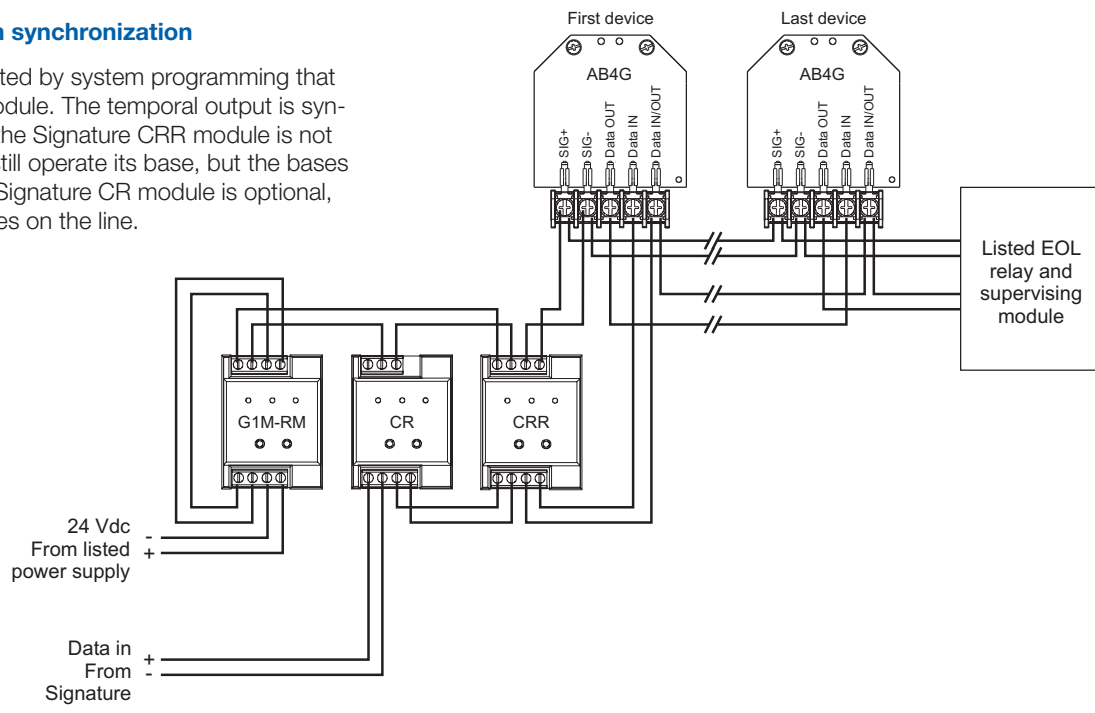
System turns on all bases

All bases on the line can be activated by system programming that triggers the Signature CRR to reverse the supplied polarity. The Signature CR module is optional, and is used to silence the bases on the line.



System turns on bases with synchronization

All bases on the line are activated by system programming that triggers the Signature CRR module. The temporal output is synchronized by the G1M-RM. If the Signature CRR module is not activated, each detector can still operate its base, but the bases will not be synchronized. The Signature CR module is optional, and is used to silence the bases on the line.



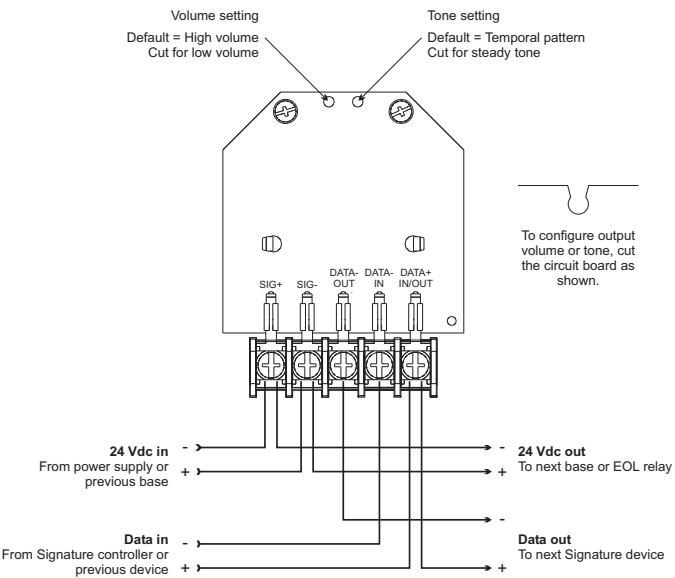
7.4.2 Public Mode Audible Requirements.

7.4.2.1 To ensure that audible public mode signals are clearly heard ... they shall have a sound level at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds, whichever is greater, measured 1.5 m (5 ft) above the floor in the occupiable area, using the A-weighted scale (dBA).

7.4.4 Sleeping Areas.

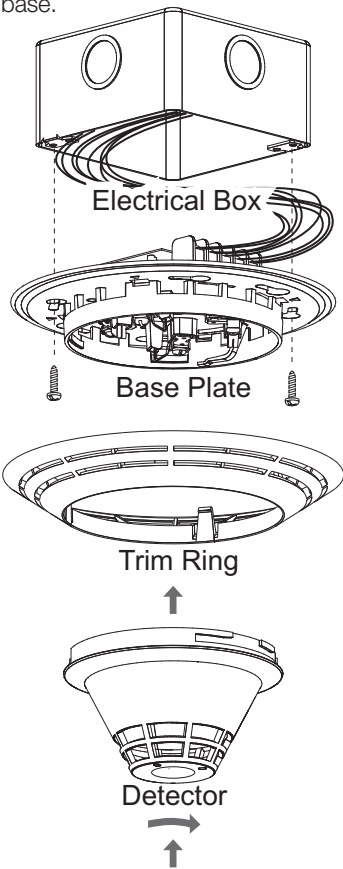
7.4.4.1 Where audible appliances are installed to provide signals for sleeping areas, they shall have a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dBA, whichever is greater, measured at the pillow level in the occupiable area, using the A-weighted scale (dBA).

Configuration and Wiring



Installation and Mounting

Flush Mounting: The sounder base flush mounts into 2-1/8 inch (54 mm) deep standard North American 4 inch square electric box, North American 4 x 4 inch octagonal concrete ring (mud box), and standard European 100 mm square electric boxes. The terminal block makes field wire connections fast and efficient . After wiring, a simple push and twist motion locks the Signature detector into the base.



AB4G-SB
Optional Surface Box
(6.8" diameter x 1.8" deep)

Edwards recommends that fire alarm systems and their devices always be installed in accordance with the latest recognized edition of national and local fire alarm codes.

Sound Level Output

Signal	Voltage	Low dBA	High dBA
Reverberant room per UL 464*			
Temporal	16 Vdc	71.5	78.1
	24 Vdc	75.5	80.7
	33 Vdc	78.5	83.1
Steady	16 Vdc	75.5	81.7
	24 Vdc	79.5	84.5
	33 Vdc	81.8	86.5
Reverberant room per UL 268			
Temporal	16 Vdc	77.5	84.1
	24 Vdc	81.5	86.7
	33 Vdc	84.5	89.1
Steady	16 Vdc	81.5	87.7
	24 Vdc	85.5	90.5
	33 Vdc	87.8	92.5

dBA = Decibels, A-weighted
*For UL 464 applications low dBA settings are for private mode only.



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Specifications

Operating Voltage	16-33 Vdc, 16-33 Vfwr (continuous voltage required for temporal output)						
Supervisory Current	DC=1.46mA; FWR=2.15mA						
Operating Current in mA (RMS)		16 Vdc	24 Vdc	33 Vdc	16 Vfwr	24 Vfwr	33 Vfwr
Low dBA		17	24	31	41	51	60
High dBA		28	41	52	48	60	66
Default Settings	Output volume: high dBA Output tone: temporal pattern (0.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 0.5 s on, 1.5 s off, repeat cycle).						
Environmental	Operating Temperature: 32° to 120° F (0° to 49° C) Operating Humidity: 0 to 93% RH Storage Temperature: -4 to 140 °F (-20 to 60 °C)						
Wire Size	12 to 18 AWG (2.5 to 0.75 mm ²)						
Compatible Detectors	All Signature Series Detectors (SIGA-IPHS, SIGA-PHS, SIGA-IS, SIGA-PS, SIGA-HFS, SIGA-HRS)						
Compatible Electrical Boxes	AB4G-SB Surface Box for Audible Bases, North American 2-1/8 in (54 mm) deep 4-inch square box, North American 4 by 4 inch octagonal ring (mud box), Standard European 100 mm square box						
Dimensions	Base diameter: 6.8 in (173 mm). Base height from box: 0.8 in (21 mm)						
Wall mount applications	Distance from ceiling 12 in (305 mm) maximum						
Agency Listings	Meets or exceeds requirements specified in UL 268, UL 464, and ULC-S525. (MEA, CSFM pending)						

Ordering Information

Catalog Number	Description	Ship Wt., lb. (kg)
SIGA-AB4G	Audible (Sonder) Base	0.3 (0.15)
AB4G-SB	Surface Box for Audible Base	1.0 (0.45)

Related Equipment		
SIGA-MCRR	Polarity Reversal Relay (Plug-in UIO module)	0.18 (0.08)
SIGA-CRR	Polarity Reversal Relay (Standard mount module)	0.2 (0.1)
SIGA-MCR	Control Relay Module (Plug-in UIO module)	0.18 (0.08)
SIGA-CR	Control Relay Module (Standard mount module)	0.2 (0.1)
G1M-RM	Signal Master (1-gang remote mount)	0.2 (0.1)

Intelligent Photoelectric Smoke Detector

SIGA-PS



Overview

The Signature Series Model SIGA-PS Intelligent Photoelectric Smoke Detector gathers analog information from its smoke sensing element and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals. It compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires. Unwanted alarms are virtually eliminated.

The microprocessor in each detector provides four additional benefits - Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

Self-diagnostics and History Log - Each Signature Series detector constantly runs self-checks to provide important maintenance information. The results of the self-check are automatically updated and permanently stored in the detector's non-volatile memory

Automatic Device Mapping - The loop controller learns where each device's serial number address is installed relative to other devices on the circuit. The mapping feature provides supervision of each device's installed location to prevent a detector from being reinstalled (after cleaning etc.) in a different location from where it was originally.

Stand-alone Operation - A decentralized alarm decision by the detector is guaranteed. On-board intelligence permits the detector to operate in stand-alone mode. If loop controller CPU communications fail for more than four seconds, all devices on that circuit go into stand-alone mode. The circuit acts like a conventional alarm

receiving circuit.

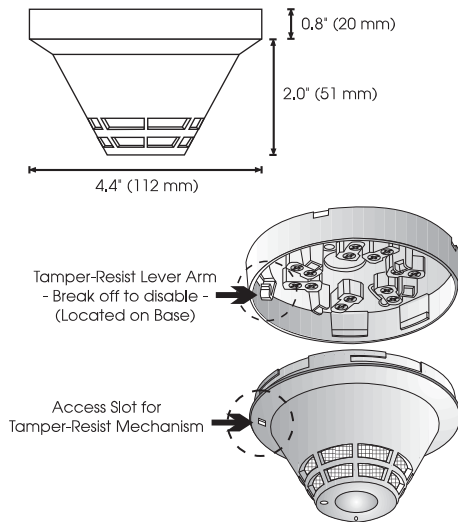
Fast Stable Communication - On-board intelligence means less information needs to be sent between the detector and the loop controller. Other than regular supervisory polling response, the detector only needs to communicate with the loop controller when it has something new to report.

Standard Features

- Integral microprocessor
- Non-volatile memory
- Automatic mapping device
- Electronic addressing
- Environmental compensation
- Intelligent detector
- Wide 0.67% to 3.77%/ft. sensitivity range
- Twenty pre-alarm sensitivity values, set in 5% increments
- Identification of dirty or defective detectors
- Automatic day/night sensitivity adjustment
- Twin RED/GREEN status LEDs
- Standard, relay, fault isolator, and audible mounting bases
- Designed and manufactured to ISO 9001 standards

Installation

Signature Series detectors mount to North American 1-gang boxes, 3-1/2 inch or 4 inch octagon boxes, and to 4 inch square electrical boxes 1-1/2 inches (38 mm) deep. They mount to European BESA and 1-gang boxes with 60.3 mm fixing centers.



Testing & Maintenance

Each detector automatically identifies when it is dirty or defective and causes a "dirty detector" message. The detector's sensitivity measurement can also be transmitted to the loop controller. A sensitivity report can be printed to satisfy NFPA sensitivity measurements which must be conducted at the end of the first year and every two years thereafter.

The user-friendly maintenance program shows the current state of each detector and other pertinent messages. Single detectors may be turned off temporarily from the control panel. Availability of maintenance features is dependent on the fire alarm system used. Scheduled maintenance (Regular or Selected) for proper detector operation should be planned to meet the requirements of the Authority Having Jurisdiction (AHJ). Refer to current NFPA 72 and ULC CAN/ULC 536 standards.

Compatibility

The SIGA-PS detectors are compatible only with the Signature Loop Controller.

Warnings & Cautions

This detector will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your fire protection specialist.

This detector will NOT sense fires that start in areas where smoke cannot reach the detector. Smoke from fires in walls, roofs, or on the opposite side of closed doors may not reach the detector to alarm it.

Accessories

All detector mounting bases have wiring terminals that are accessible from the "room-side" after mounting the base to the electrical box. The bases mount to North American 1-gang boxes and to 3 1/2 inch or 4 inch octagon boxes, 1 1/2 inches (38 mm) deep. They also mount to European BESA and 1-gang boxes with 60.3 mm fixing centers. The SIGA-SB4, SIGA-RB4, and SIGA-IB4 mount to North American 4 inch sq. electrical boxes in addition to the above boxes. They include the SIGA-TS4 Trim Skirt which is used to cover the "mounting ears" on the base. The SIGA-AB4G mounts to a 4" square box only.



Standard Base SIGA-SB, SIGA-SB4 - This is the basic mounting base for Edwards Signature Series detectors. The SIGA-LED Remote LED is supported by the Standard Base.

Relay Base SIGA-RB, SIGA-RB4 - This base includes a relay. Normally open or closed operation is selected during installation. The dry contact is rated for 1 amp (pilot duty) @ 30 Vdc. The relay's position is supervised to avoid accidentally jarring it out of position. The SIGA-RB can be operated as a control relay if programmed to do so at the control panel (EST3 V.2 only). The relay base does not support the SIGA-LED Remote LED.

Audible Base SIGA-AB4G - This base is designed for use where localized or group alarm signaling is required. When the detector senses an alarm condition, the audible base emits a local alarm signal. The optional SIGA-CRR Polarity Reversal Relay can be used for sounding to other audible bases on the same 24 Vdc circuit.

Relay and Audible Bases operate as follows:

- at system power-up or reset, the relay is de-energized
- when a detector is installed in the base with the power on, the relay energizes for four seconds, then de-energizes
- when a detector is removed from a base with the power on, the relay is de-energized
- when the detector enters the alarm state, the relay is energized.

Isolator Base SIGA-IB, SIGA-IB4 - This base includes a built-in line fault isolator for use on Class A circuits. A detector must be installed for it to operate. The isolator base does not support the SIGA-LED Remote LED.

The isolator operates as follows:

- a short on the line causes all isolators to open within 23 msec
- at 10 msec intervals, beginning on one side of the Class A circuit nearest the loop controller, the isolators close to provide the next isolator down the line with power
- when the isolator next to the short closes, reopens within 10 msec.

The process repeats beginning on the other side of the loop controller.

Remote LED SIGA-LED - The remote LED connects to the SIGA-SB or SIGA-SB4 Standard Base only. It features a North American size 1-gang plastic faceplate with a white finish and red alarm LED.

SIGA-TS4 Trim Skirt - Supplied with 4 inch bases, it can also be ordered separately to use with the other bases to help hide surface imperfections not covered by the smaller bases.

Application

Although photoelectric detectors have a wide range of fire sensing capabilities they are best suited for detecting slow, smoldering fires. The table below shows six standard test fires used to rate the sensitivity of smoke and heat detectors. The table indicates that no single sensing element is suited for all test fires.

Edwards recommends that this detector be installed according to latest recognized edition of national and local fire alarm codes.

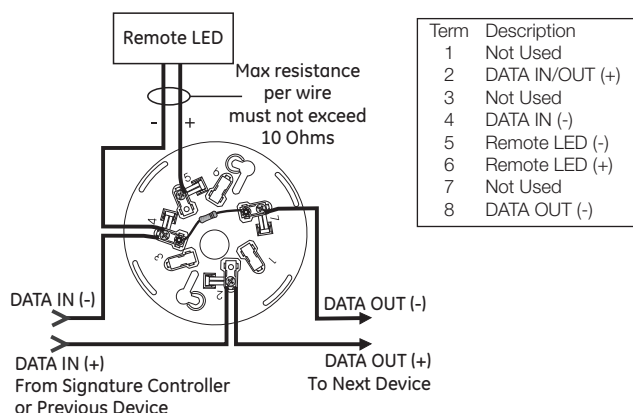
Test Fire	SIGA-IS Ion	SIGA-PS Photo	SIGA-HRS and SIGA-HFS Rate-of- Rise/ Fixed Temp.	SIGA-PHS Photo Heat 3D	SIGA-IPHS Ion/Photo/Heat 4D
Open Wood	optimum	unsuitable	optimum	very suitable	optimum
Wood Pyrolysis	suitable	optimum	unsuitable	optimum	optimum
Smouldering Cotton	very suitable	optimum	unsuitable	optimum	optimum
Poly Urethane Foam	very suitable	very suitable	suitable	very suitable	optimum
n-Heptane	optimum	very suitable	very suitable	optimum	optimum
Liquid Fire without Smoke	unsuitable	unsuitable	optimum	very suitable	very suitable

Typical Wiring

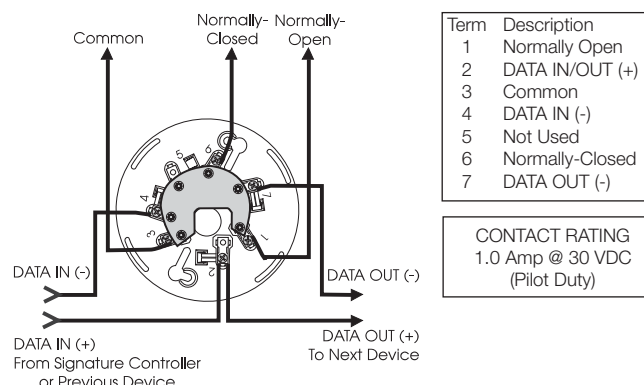
The detector mounting bases accept #18 AWG (0.75mm²), #16 (1.0mm²), #14 AWG (1.5mm²), and #12 AWG (2.5mm²) wire sizes.

Note: Sizes #16 AWG (1.0mm²) and #18 AWG (0.75mm²) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

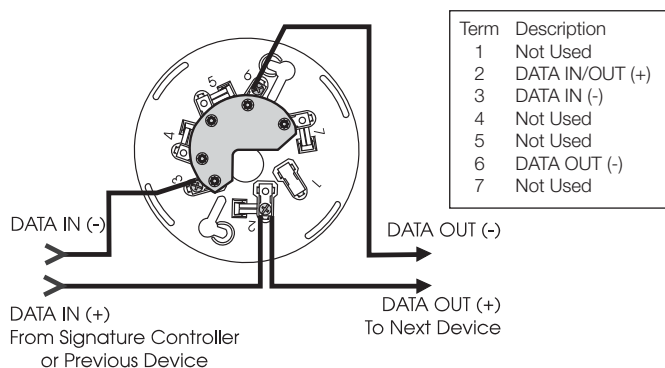
Standard Detector Base, SIGA-SB, SIGA-SB4



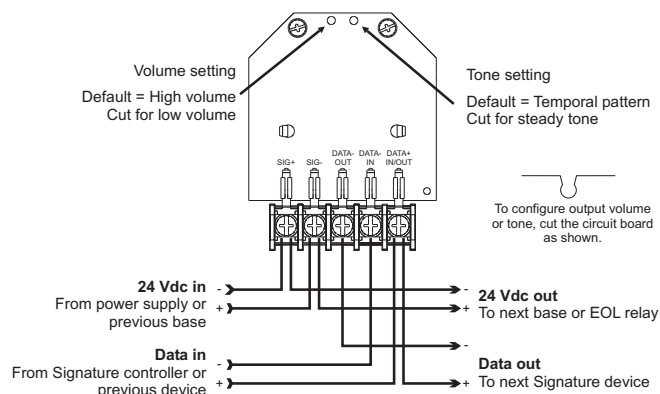
Relay Detector Base, SIGA-RB, SIGA-RB4



Isolator Detector Base, SIGA-IB, SIGA-IB4



Audible Detector Base, SIGA-AB4G





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Specifications

Sensing Element	Photoelectric - Light Scattering Principle
Storage & Operating Environment	Air Velocity Range: 0 to 5,000 ft/min (0 to 25.39 m/s); Humidity: 0 to 93% RH, Non-Condensing Operating Temp: 32°F to 120°F (0°C to 49°C); Storage Temp: -4°F to 140°F (-20°C to 60°C)
Sensitivity Range	ULI/ULC - 0.67% to 3.77% obscuration/foot
User Selected Alarm Sensitivity Settings	Most Sensitive: 1.0%/ft.; More Sensitive: 2.0%/ft.; Normal: 2.5%/ft.; Less Sensitive: 3.0%/ft.; Least Sensitive: 3.5%/ft.
Pre-alarm Sensitivity	5% increments, allowing up to 20 pre-alarm settings
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)
Operating Current	Quiescent: 45µA @ 19 V; Alarm: 45µA @ 19 V Emergency Stand-alone Alarm Mode: 18mA Pulse Current: 100 µA (100 msec); During Communication: 9 mA max.
Construction & Finish	High Impact Engineering Polymer - White
Compatible Mounting Bases	SIGA-SB Standard Base, SIGA-RB Relay Base, SIGA-IB Isolator Base, SIGA-AB4, SIGA-AB4G Audible Bases
LED Operation	On-board Green LED - Flashes when polled; On-board Red LED - Flashes when in alarm Both LEDs - Glow steady when in alarm (stand-alone) Compatible Remote Red LED (model SIGA-LED) Flashes when in alarm
Compatibility	Use With: SIGNATURE Loop Controller
Address Requirements	Uses one Device Address
Agency Listings	UL, ULC, MEA, CSFM
UL Listed Spacing	30 ft

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-PS	Intelligent Photoelectric Detector - UL/ULC Listed	0.5 (.23)
Accessories		
SIGA-SB	Detector Mounting Base - Standard	
SIGA-SB4	4-inch Detector Mounting Base c/w SIGA-TS4 Trim Skirt	
SIGA-RB	Detector Mounting Base w/Relay	
SIGA-RB4	4-inch Detector Mounting Base w/Relay, c/w SIGA-TS4 Trim Skirt	0.2 (.09)
SIGA-IB	Detector Mounting Base w/Fault Isolator	
SIGA-IB4	4-inch Detector Mounting Base w/ Fault Isolator, c/w SIGA-TS4 Trim Skirt	
SIGA-LED	Remote Alarm LED	
SIGA-AB4G	Audible (Sounder) Base	.3 (0.15)
SIGA-TS4	Trim Skirt (supplied with 4-inch bases)	.1 (.04)

Manual Pull Stations

SIGA-270, SIGA-270P,
SIGA-278



Overview

The SIGA-270 and SIGA-278 series Manual Pull Stations are part of EST's Signature Series system. The SIGA-270 Fire Alarm Manual Pull Stations feature our very familiar teardrop shape. They are made from die-cast zinc and finished with red epoxy powder-coat paint complemented by aluminum colored stripes and markings. With positive pull-lever operation, one pull on the station handle breaks the glass rod and turns in a positive alarm, ensuring protection plus fool-proof operation. Presignal models (SIGA-270P) are equipped with a general alarm (GA) keyswitch for applications where two stage operation is required. The up-front highly visible glass rod discourages tampering, but is not required for proper operation.

EST's double action single stage SIGA-278 station is a contemporary style manual station made from durable red colored lexan. To initiate an alarm, first lift the upper door marked "LIFT THEN PULL HANDLE", then pull the alarm handle.

Standard Features

Note: Some features described here may not be supported by all control systems. Check your control panel's Installation and Operation Guide for details.

- **Traditional familiar appearance**
SIGA-270 models feature our familiar teardrop design with simple positive pull action and sturdy die-cast metal body.
- **One stage (GA), two stage (pre-signal), and double action models**
SIGA-270 models are available for one or two stage alarm systems. The single stage double action SIGA-278 features a rugged Lexan housing with keyed reset mechanism.

- **Break glass operation**
An up-front visible glass rod on the SIGA-270 discourages tampering.
- **Intelligent device with integral microprocessor**
All decisions are made at the station allowing lower communication speed while substantially improving control panel response time. Less sensitive to line noise and loop wiring properties; twisted or shielded wire is not required.
- **ADA Compliant**
Meets ADA requirements for manual pull stations.
- **Electronic Addressing with Non-volatile memory**
Permanently stores programmable address, serial number, type of device, and job number. Automatically updates historic information including hours of operation, last maintenance date, number of alarms and troubles, and time and date of last alarm.
- **Automatic device mapping**
Each station transmits wiring information to the loop controller regarding its location with respect to other devices on the circuit.
- **Stand-alone operation**
The station inputs an alarm even if the loop controller's polling interrogation stops.
- **Diagnostic LEDs**
Status LEDs; flashing GREEN shows normal polling; flashing RED shows alarm state.
- **Designed for high ambient temperature operation**
Install in ambient temperatures up to 120 °F (49 °C).

Application

The operating characteristics of the fire alarm stations are determined by their sub-type code or "Personality Code". NORMALLY-OPEN ALARM - LATCHING (Personality Code 1) is assigned by the factory; no user configuration is required. The device is configured for Class B IDC operation. An ALARM signal is sent to the loop controller when the station's pull lever is operated. The alarm condition is latched at the station.

Compatibility

Signature Series manual stations are compatible only with EST's Signature Loop Controller.

Warnings & Cautions

This device will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your local fire protection specialist.

Testing & Maintenance

To test (or reset) the station simply open the station and operate the exposed switch. The SIGA-270 series are opened with a tool; the SIGA-278 requires the key which is supplied with that station.

The station's automatic self-diagnosis identifies when it is defective and causes a trouble message. The user-friendly maintenance program shows the current state of each Signature series device and other pertinent messages. Single devices may be deactivated temporarily, from the control panel. Availability of maintenance features is dependent on the fire alarm system used.

Scheduled maintenance (Regular or Selected) for proper system operation should be planned to meet the requirements of the Authority Having Jurisdiction (AHJ). Refer to current NFPA 72 and ULC CAN/ULC 536 standards.

Typical Wiring

The fire alarm station's terminal block accepts #18 AWG (0.75mm²) to #12 AWG (2.5mm²) wire sizes. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

Wiring Notes

1. Refer to Signature Loop Controller manual for maximum wire distance.
2. All wiring is power limited and supervised.

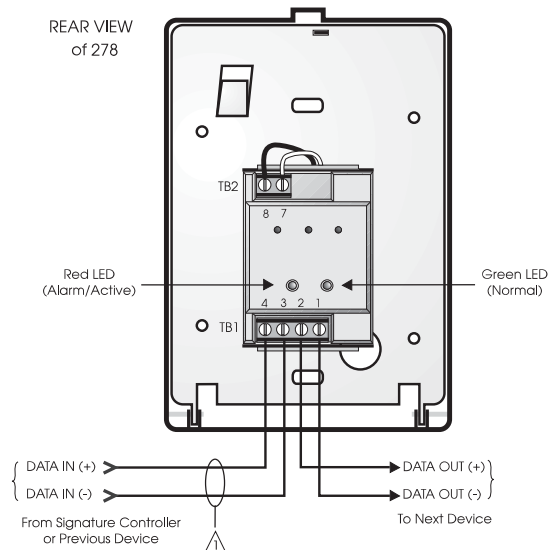


Figure 4. Single Stage Systems

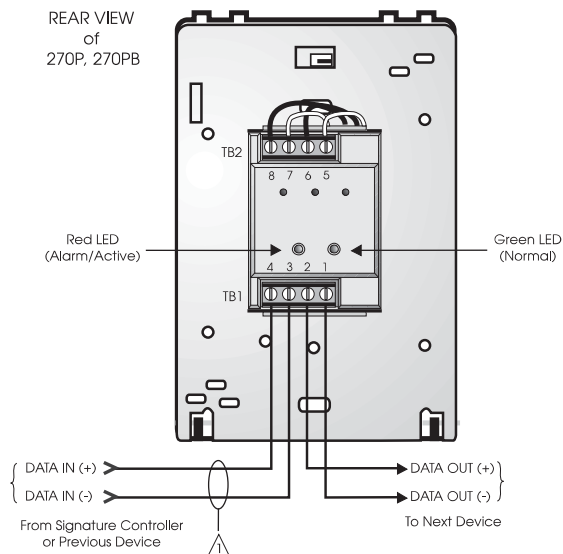


Figure 5. Two Stage Systems

Installation

Single-stage Signature Series fire alarm manual pull stations mount to North American 2½ inch (64 mm) deep 1-gang boxes.

Two stage presignal (270P) models require 1½ inch (38 mm) deep 4-inch square boxes with 1-gang, ½-inch raised covers. Openings must be angular. *Rounded openings are not acceptable.* Recommended box: Steel City Model 52-C-13; in Canada, use Iberville Model CI-52-C-49-1/2.

All models include terminals are suited for #12 to #18 AWG (2.5 mm² to 0.75 mm²) wire size. Edwards recommends that these fire alarm stations be installed according to latest recognized edition of national and local fire alarm codes.

Electronic Addressing: The loop controller electronically addresses each manual station, saving valuable time during system commissioning. Setting complicated switches or dials is not required. Each station has its own unique serial number stored in its on-board memory. The loop controller identifies each device on the loop and assigns a “soft” address to each serial number. If desired, the stations can be addressed using the SIGA-PRO Signature Program/Service Tool.

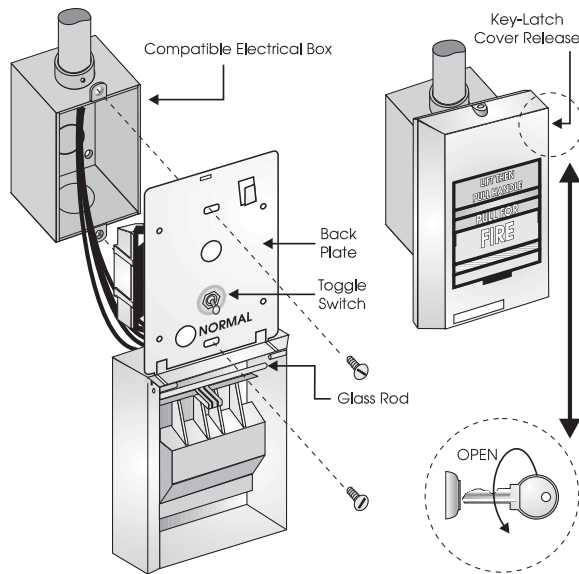


Figure 1. SIGA-278 installation

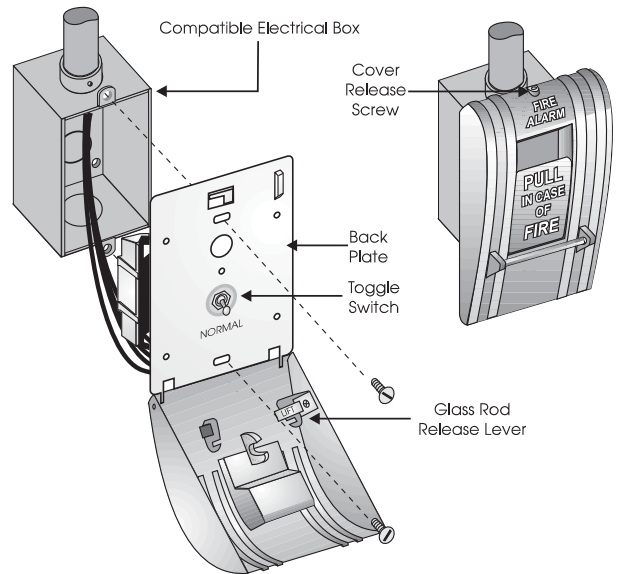


Figure 2. SIGA-270, SIGC-270F, SIGC-270B installation

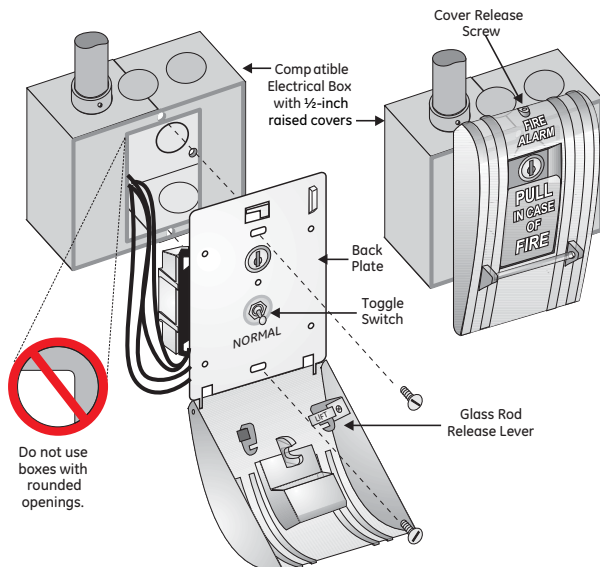


Figure 3. SIGA-270P, SIGC-270PB installation



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Specifications

Catalog Number	SIGA-270, SIGC-270F, SIGC-270B	SIGA-270P, SIGC-270PB	SIGA-278
Description	Single Action - One Stage	Single Action - Two Stage (Presignal)	Double Action - One Stage
Addressing Requirements	Uses 1 Module Address	Uses 2 Module Addresses	Uses 1 Module Address
Operating Current	Standby = 250µA Activated = 400µA	Standby = 396µA Activated = 680µA	Standby = 250µA Activated = 400µA
Construction & Finish	Diecast Zinc - Red Epoxy with aluminum markings		Lexan - Red with white markings
Type Code	Factory Set		
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)		
Storage and Operating Environment	Operating Temperature: 32°F to 120°F (0°C to 49°C) Storage Temperature: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH		
LED Operation	On-board Green LED - Flashes when polled On-board Red LED - Flashes when in alarm Both LEDs - Glow steady when in alarm (stand-alone)		
Compatibility	Use With: Signature Loop Controller		
Agency Listings	UL, ULC (note 1), MEA, CSFM		

Note: SIGC-270F, SIGC-270B and SIGC-270PB are ULC listed only. Suffix "F" indicates French markings. Suffix "B" indicates English/French bilingual markings.

Ordering Information

Catalog Number	Description	Ship Wt. lbs (kg)
SIGA-270	One Stage Fire Alarm Station, English Markings - UL/ULC Listed	1 (0.5)
SIGC-270F	One Stage Fire Alarm Station, French Markings - ULC Listed	
SIGC-270B	One Stage Fire Alarm Station, French/English Markings - ULC Listed	
SIGA-270P	Two Stage (Presignal) Fire Alarm Station, English Markings - UL/ULC Listed	
SIGC-270PB	Two Stage (Presignal) Fire Alarm Station, French/English Markings - ULC Listed	
SIGA-278	Double Action (One Stage) Fire Alarm Station, English Markings - UL/ULC Listed	

Accessories

32997	GA Key w/Tag - for pre-signal station (CANADA ONLY)	0.1 (.05)
276-K2	GA Key - for pre-signal station (USA ONLY)	
276-K1	Station Reset Key, Supplied with all Key Reset Stations	
27165	12 Glass Rods - for SIGA-270 series (CANADA ONLY)	
270-GLR	20 Glass Rods - for SIGA-270 series (USA ONLY)	
276-GLR	20 Glass Rods - for SIGA-278 series	1 (0.6)
276B-RSB	Surface Mount Box, Red - for SIGA pull stations	

5240F1 Multi-Conductor - Water Resistant



For more Information
please call

1-800-Belden1

**Description:**

16 AWG stranded (7x24) tinned copper conductors, PVC insulation, Beldfoil® shield (100% coverage), drain wire, water-blocking tape, PVC jacket.

Usage (Overall)

Suitable Applications:

Low Voltage, Direct Burial, PLTC, FPL, Intercom, Sound, Audio

Physical Characteristics (Overall)**Conductor**

AWG:

# Pairs	AWG	Stranding	Conductor Material
1	16	7x24	TC - Tinned Copper

Insulation

Insulation Material:

Insulation Material	Wall Thickness (in.)
PVC - Polyvinyl Chloride	.010

Outer Shield

Outer Shield Material:

Outer Shield Trade Name	Type	Outer Shield Material	Coverage (%)
Beldfoil®	Tape	Aluminum Foil-Polyester Tape	100

Outer Shield Drain Wire AWG:

AWG	Stranding	Drain Wire Conductor Material
18	7x26	TC - Tinned Copper

Outer Shield Waterblocking Tape:

Yes

Outer Jacket

Outer Jacket Material:

Outer Jacket Material	Nom. Wall Thickness (in.)
PVC - Polyvinyl Chloride	.037

Overall Cabling

Overall Nominal Diameter:

0.254 in.

Pair

Pair Color Code Chart:

Number	Color
1	Black & Red

Mechanical Characteristics (Overall)

Operating Temperature Range: -30°C To +105°C

UL Temperature Rating: 105°C

Bulk Cable Weight: 38 lbs/1000 ft.

Max. Recommended Pulling Tension: 93 lbs.

Min. Bend Radius (Install)/Minor Axis: 2.750 in.

5240F1 Multi-Conductor - Water Resistant

Applicable Specifications and Agency Compliance (Overall)

Applicable Standards & Environmental Programs

NEC/(UL) Specification:	CMG, FPL, PLTC
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CEC/C(UL) Specification:	CMG
--------------------------	-----

EU CE Mark:	Yes
-------------	-----

EU Directive 2000/53/EC (ELV):	Yes
--------------------------------	-----

EU Directive 2002/95/EC (RoHS):	Yes
---------------------------------	-----

EU RoHS Compliance Date (mm/dd/yyyy):	11/08/2006
---------------------------------------	------------

EU Directive 2002/96/EC (WEEE):	Yes
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EU Directive 2003/11/EC (BFR):	Yes
--------------------------------	-----

CA Prop 65 (CJ for Wire & Cable):	Yes
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MII Order #39 (China RoHS):	Yes
-----------------------------	-----

Other Specification:	PLTC-ER
----------------------	---------

Flame Test

UL Flame Test:	UL1685 FT4/IEEE 1202 Vertical Tray Flame Test
----------------	-----------------------------------------------

C(UL) Flame Test:	FT4
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Other Flame Test:	IEEE 1202
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Suitability

Suitability - Indoor:	Yes
-----------------------	-----

Suitability - Outdoor:	Yes
------------------------	-----

Sunlight Resistance:	Yes
----------------------	-----

Plenum/Non-Plenum

Plenum (Y/N):	No
---------------	----

Electrical Characteristics (Overall)

Nom. Capacitance Conductor to Conductor:

Capacitance (pF/ft)

76.000

Nom. Conductor DC Resistance:

DCR @ 20°C (Ohm/1000 ft)

4.4

Nominal Outer Shield DC Resistance:

DCR @ 20°C (Ohm/1000 ft)

5.4

Max. Operating Voltage - UL:

Voltage

300 V RMS

Put Ups and Colors:

Item #	Putup	Ship Weight	Color	Notes	Item Desc
5240F1 0021000	1,000 FT	42.000 LB	RED	C	1 FS PR #16 PVC PVC
5240F1 0101000	1,000 FT	42.000 LB	BLACK	C	1 FS PR #16 PVC PVC

Notes:

C = CRATE REEL PUT-UP.

Revision Number: 1 Revision Date: 05-19-2008

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Belden declares this product to be in compliance with EU LVD (Low Voltage Directive 73/23/EEC), as amended by directive 93/68/EEC.

Appendix I – Fire Alarm Inspection, Test, & Maintenance

Fire Alarm Inspection, Test, & Maintenance

The test methods for the following can be found in NFPA 72 – 2010 Table 14.4.2.2.

- Control Equipment
 - Fuses
 - Interfaced Equipment
 - Lamps and LEDs
 - Primary (main) Power Supply
- Batteries
 - Lead-acid
 - Sealed lead-acid
- Transient Suppressors
- Fire Alarm Control Unit Trouble Signals
 - Open, Ground, and Shorts
- Fiber-optic cable connections
- In-Building Fire Emergency Voice/Alarm Communications Equipment
- Remote Annunciators / Local Operating Console
- Initiating Devices
 - Duct Detectors
 - Manual Fire Alarm Boxes
 - Smoke Detectors
 - Supervisory Signal Devices
 - Waterflow Devices
- Interface Equipment
- Alarm Notification Appliances
 - Sound Pressure Levels
 - Voice Intelligibility
- Supervising Station Alarm System – Transmitters
 - DACT
 - Report of Signals
- Mass Notification System Antenna
- Mass Notification System Transceivers

Appendix J – FDS Input Files

BEQ_FDS5

BEQ.fds

FPE596 Capstone Project - BEQ CLOSED WITH VENTS, SPRINKLER RESPONSE, STEADY FIRE

&HEAD CHID='BEQ' /

&TIME T_END=500.00 /

&DUMP RENDER_FILE='BEQ.ge1' /

&MESH ID='1', IJK=100,55,20, XB=0.00,20.00,0.00,11.00,0.00,4.00 /

&REAC ID='TEST FIRE 1',

C=1.00,

H=4.00,

O=0.00,

N=0.00,

HEAT_OF_COMBUSTION=1.76000000E004,

CO_YIELD=0.0280,

SOOT_YIELD=0.0100,

MASS_EXTINCTION_COEFFICIENT=8.7000000E003,

VISIBILITY_FACTOR=3.00 /

&MATL ID='GYP8',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&MATL ID='GYP4',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&SURF ID='Burner',

RAMP_Q='tsquared',

COLOR='RED',

HRRPUA=2.6300000E003 /

&RAMP ID='tsquared', T=0.0, F=0.00 /

&RAMP ID='tsquared', T=10.0, F=0.00 /

&RAMP ID='tsquared', T=20.0, F=0.00 /

&RAMP ID='tsquared', T=30.0, F=0.00 /

&RAMP ID='tsquared', T=40.0, F=0.01 /

&RAMP ID='tsquared', T=50.0, F=0.01 /

&RAMP ID='tsquared', T=60.0, F=0.01 /

&RAMP ID='tsquared', T=70.0, F=0.02 /

&RAMP ID='tsquared', T=80.0, F=0.02 /

&RAMP ID='tsquared', T=90.0, F=0.03 /

&RAMP ID='tsquared', T=100.0, F=0.04 /

&RAMP ID='tsquared', T=110.0, F=0.05 /

&RAMP ID='tsquared', T=120.0, F=0.06 /

&RAMP ID='tsquared', T=130.0, F=0.06 /

&RAMP ID='tsquared', T=140.0, F=0.07 /

&RAMP ID='tsquared', T=150.0, F=0.09 /

&RAMP ID='tsquared', T=160.0, F=0.10 /

&RAMP ID='tsquared', T=170.0, F=0.11 /

&RAMP ID='tsquared', T=180.0, F=0.12 /

```

&RAMP ID='tsquared', T=190.0, F=0.12 /
&RAMP ID='tsquared', T=200.0, F=0.12 /
&RAMP ID='tsquared', T=210.0, F=0.12 /
&RAMP ID='tsquared', T=220.0, F=0.12 /
&RAMP ID='tsquared', T=230.0, F=0.12 /
&RAMP ID='tsquared', T=240.0, F=0.12 /
&RAMP ID='tsquared', T=250.0, F=0.12 /
&RAMP ID='tsquared', T=260.0, F=0.12 /
&RAMP ID='tsquared', T=270.0, F=0.12 /
&RAMP ID='tsquared', T=280.0, F=0.12 /
&RAMP ID='tsquared', T=290.0, F=0.12 /
&RAMP ID='tsquared', T=300.0, F=0.12 /
&RAMP ID='tsquared', T=310.0, F=0.12 /
&RAMP ID='tsquared', T=320.0, F=0.12 /
&RAMP ID='tsquared', T=330.0, F=0.12 /
&RAMP ID='tsquared', T=340.0, F=0.12 /
&RAMP ID='tsquared', T=350.0, F=0.12 /
&RAMP ID='tsquared', T=360.0, F=0.12 /
&RAMP ID='tsquared', T=370.0, F=0.12 /
&RAMP ID='tsquared', T=380.0, F=0.12 /
&RAMP ID='tsquared', T=390.0, F=0.12 /
&RAMP ID='tsquared', T=400.0, F=0.12 /
&RAMP ID='tsquared', T=410.0, F=0.12 /
&RAMP ID='tsquared', T=420.0, F=0.12 /
&RAMP ID='tsquared', T=430.0, F=0.12 /
&RAMP ID='tsquared', T=440.0, F=0.12 /
&RAMP ID='tsquared', T=450.0, F=0.12 /
&RAMP ID='tsquared', T=460.0, F=0.12 /
&RAMP ID='tsquared', T=470.0, F=0.12 /
&RAMP ID='tsquared', T=480.0, F=0.12 /
&RAMP ID='tsquared', T=490.0, F=0.12 /
&RAMP ID='tsquared', T=500.0, F=0.12 /

```

```

&SURF ID='GYP8',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP8',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.2000/

```

```

&SURF ID='GYP4',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP4',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.1000/

```

```

&PART ID='water drops',
      WATER=.TRUE.,
      AGE=4.00/

```

```

&OBST XB=1.50,2.50,3.50,4.500,0.2000,0.60,
      SURF_IDS='Burner','INERT','INERT'/ Design Fire

```

```

&OBST XB=1.00,6.00,1.00,9.00,0.00,0.20, SURF_ID='INERT'/ Floor
&OBST XB=1.00,6.00,1.00,9.00,3.00,3.20, COLOR='INVISIBLE', SURF_ID='INERT'/
Top wall
&OBST XB=0.00,7.00,1.00,1.20,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/

```

BEQ_FDS5

```

Front wall
&OBST XB=5.80,6.00,1.20,8.80,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/
Right wall
&OBST XB=0.00,20.00,8.80,9.00,0.00,4.00, SURF_ID='GYP8'/ Back wall
&OBST XB=1.00,1.20,1.20,8.80,0.20,3.00, SURF_ID='GYP8'/ Left wall

&OBST XB=1.20,2.70,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Closet Bottom wall
&OBST XB=2.60,2.70,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Closet Right wall
&OBST XB=1.20,2.60,7.30,7.50,0.20,2.60, SURF_ID='GYP4'/ Closet Middle wall
&OBST XB=3.70,5.80,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Bathroom Bottom wall

&OBST XB=3.70,3.90,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Bathroom Left wall
&OBST XB=1.20,5.80,5.80,8.80,2.60,3.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Soffit
&OBST XB=0.00,20.00,9.00,11.00,3.00,4.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Corridor
&OBST XB=0.00,20.00,9.00,11.00,0.00,0.20, SURF_ID='INERT'/ Corridor Floor

&HOLE XB=2.50,2.80,7.20,6.20,0.20,2.40/ Closet Door1
&HOLE XB=2.50,2.80,7.50,8.50,0.20,2.40/ Closet Door2
&HOLE XB=3.60,3.90,6.80,7.80,0.20,2.40/ Bathroom Door
&HOLE XB=2.70,3.70,8.70,9.10,0.20,0.25/ Corridor Door Undercut

&PROP ID='RESIDENTIAL', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=53.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /
&PROP ID='RESIDENTIAL2', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=76.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /

&DEVC ID='SPR_1',XYZ=2.00,7.00,2.40,PROP_ID='RESIDENTIAL' / Closet1
&DEVC ID='SPR_2',XYZ=2.00,8.00,2.40,PROP_ID='RESIDENTIAL' / Closet2
&DEVC ID='SPR_3',XYZ=3.50,7.30,2.40,PROP_ID='RESIDENTIAL' / Hall
&DEVC ID='SPR_4',XYZ=3.50,3.50,2.80,PROP_ID='RESIDENTIAL' / Room

&DEVC ID='SPR_5',XYZ=3.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor1
&DEVC ID='SPR_6',XYZ=9.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor2
&DEVC ID='SPR_7',XYZ=15.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor3

&SURF ID='SUPPLY',VOLUME_FLUX=-0.075,COLOR='BLUE'/ ~155CFM
&SURF ID='EXHAUST1',VOLUME_FLUX=0.025,COLOR='GREEN'/ ~50CFM
&SURF ID='EXHAUST2',VOLUME_FLUX=0.010,COLOR='GREEN'/ ~20CFM

&VENT XB=3.40,3.60,4.60,4.80,3.00,3.00, SURF_ID='SUPPLY'/
&VENT XB=4.60,4.80,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=4.60,4.80,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=2.00,2.20,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST2'/
&VENT XB=2.00,2.20,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST2'/

&SLCF QUANTITY='TEMPERATURE', PBX=2.00/
&SLCF QUANTITY='TEMPERATURE', PBX=3.60/
&SLCF QUANTITY='TEMPERATURE', PBX=4.00/
&SLCF QUANTITY='TEMPERATURE', PBX=10.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=1.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.40/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.80/

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BEQ_FDS5

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&SLCF QUANTITY='visibility', PBX=3.60/
&SLCF QUANTITY='visibility', PBX=4.00/
&SLCF QUANTITY='visibility', PBX=10.00/
&SLCF QUANTITY='visibility', PBZ=1.00/
&SLCF QUANTITY='visibility', PBZ=2.00/

&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=2.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=3.50/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=4.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=10.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=1.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=2.00/

&SLCF QUANTITY='carbon monoxide', PBX=2.00/
&SLCF QUANTITY='carbon monoxide', PBX=3.50/
&SLCF QUANTITY='carbon monoxide', PBX=4.00/
&SLCF QUANTITY='carbon monoxide', PBX=10.00/
&SLCF QUANTITY='carbon monoxide', PBZ=1.00/
&SLCF QUANTITY='carbon monoxide', PBZ=2.00/

&SLCF QUANTITY='extinction coefficient', PBX=2.00/
&SLCF QUANTITY='extinction coefficient', PBX=3.50/
&SLCF QUANTITY='extinction coefficient', PBX=4.00/
&SLCF QUANTITY='extinction coefficient', PBX=10.00/
&SLCF QUANTITY='extinction coefficient', PBZ=1.00/
&SLCF QUANTITY='extinction coefficient', PBZ=2.00/

&SLCF QUANTITY='soot', PBX=2.00/
&SLCF QUANTITY='soot', PBX=3.50/
&SLCF QUANTITY='soot', PBX=4.00/
&SLCF QUANTITY='soot', PBX=10.00/
&SLCF QUANTITY='soot', PBZ=1.00/
&SLCF QUANTITY='soot', PBZ=2.00/

&SLCF QUANTITY='soot density', PBX=2.00/
&SLCF QUANTITY='soot density', PBX=3.50/
&SLCF QUANTITY='soot density', PBX=4.00/
&SLCF QUANTITY='soot density', PBZ=1.00/
&SLCF QUANTITY='soot density', PBZ=2.00/

&SLCF QUANTITY='soot volume fraction', PBX=2.00/
&SLCF QUANTITY='soot volume fraction', PBX=3.50/
&SLCF QUANTITY='soot volume fraction', PBX=4.00/
&SLCF QUANTITY='soot volume fraction', PBZ=1.00/
&SLCF QUANTITY='soot volume fraction', PBZ=2.00/

&TAIL /

```


BEQ_FDS5

BEQ.fds

FPE596 Capstone Project - BEQ OPEN DOOR WITH VENTS, SPRINKLER RESPONSE,
STEADY FIRE

&HEAD CHID='BEQ' /

&TIME T_END=500.00 /

&DUMP RENDER_FILE='BEQ.ge1' /

&MESH ID='1', IJK=100,55,20, XB=0.00,20.00,0.00,11.00,0.00,4.00 /

&REAC ID='TEST FIRE 1',

C=1.00,

H=4.00,

O=0.00,

N=0.00,

HEAT_OF_COMBUSTION=1.76000000E004,

CO_YIELD=0.0280,

SOOT_YIELD=0.0100,

MASS_EXTINCTION_COEFFICIENT=8.7000000E003,

VISIBILITY_FACTOR=3.00 /

&MATL ID='GYP8',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&MATL ID='GYP4',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&SURF ID='Burner',

RAMP_Q='tsquared',

COLOR='RED',

HRRPUA=2.6300000E003 /

&RAMP ID='tsquared', T=0.0, F=0.00 /

&RAMP ID='tsquared', T=10.0, F=0.00 /

&RAMP ID='tsquared', T=20.0, F=0.00 /

&RAMP ID='tsquared', T=30.0, F=0.00 /

&RAMP ID='tsquared', T=40.0, F=0.01 /

&RAMP ID='tsquared', T=50.0, F=0.01 /

&RAMP ID='tsquared', T=60.0, F=0.01 /

&RAMP ID='tsquared', T=70.0, F=0.02 /

&RAMP ID='tsquared', T=80.0, F=0.02 /

&RAMP ID='tsquared', T=90.0, F=0.03 /

&RAMP ID='tsquared', T=100.0, F=0.04 /

&RAMP ID='tsquared', T=110.0, F=0.05 /

&RAMP ID='tsquared', T=120.0, F=0.06 /

&RAMP ID='tsquared', T=130.0, F=0.06 /

&RAMP ID='tsquared', T=140.0, F=0.07 /

&RAMP ID='tsquared', T=150.0, F=0.09 /

&RAMP ID='tsquared', T=160.0, F=0.10 /

&RAMP ID='tsquared', T=170.0, F=0.11 /

&RAMP ID='tsquared', T=180.0, F=0.12 /

```

&RAMP ID='tsquared', T=190.0, F=0.12 /
&RAMP ID='tsquared', T=200.0, F=0.12 /
&RAMP ID='tsquared', T=210.0, F=0.12 /
&RAMP ID='tsquared', T=220.0, F=0.12 /
&RAMP ID='tsquared', T=230.0, F=0.12 /
&RAMP ID='tsquared', T=240.0, F=0.12 /
&RAMP ID='tsquared', T=250.0, F=0.12 /
&RAMP ID='tsquared', T=260.0, F=0.12 /
&RAMP ID='tsquared', T=270.0, F=0.12 /
&RAMP ID='tsquared', T=280.0, F=0.12 /
&RAMP ID='tsquared', T=290.0, F=0.12 /
&RAMP ID='tsquared', T=300.0, F=0.12 /
&RAMP ID='tsquared', T=310.0, F=0.12 /
&RAMP ID='tsquared', T=320.0, F=0.12 /
&RAMP ID='tsquared', T=330.0, F=0.12 /
&RAMP ID='tsquared', T=340.0, F=0.12 /
&RAMP ID='tsquared', T=350.0, F=0.12 /
&RAMP ID='tsquared', T=360.0, F=0.12 /
&RAMP ID='tsquared', T=370.0, F=0.12 /
&RAMP ID='tsquared', T=380.0, F=0.12 /
&RAMP ID='tsquared', T=390.0, F=0.12 /
&RAMP ID='tsquared', T=400.0, F=0.12 /
&RAMP ID='tsquared', T=410.0, F=0.12 /
&RAMP ID='tsquared', T=420.0, F=0.12 /
&RAMP ID='tsquared', T=430.0, F=0.12 /
&RAMP ID='tsquared', T=440.0, F=0.12 /
&RAMP ID='tsquared', T=450.0, F=0.12 /
&RAMP ID='tsquared', T=460.0, F=0.12 /
&RAMP ID='tsquared', T=470.0, F=0.12 /
&RAMP ID='tsquared', T=480.0, F=0.12 /
&RAMP ID='tsquared', T=490.0, F=0.12 /
&RAMP ID='tsquared', T=500.0, F=0.12 /

```

```

&SURF ID='GYP8',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP8',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.2000/

```

```

&SURF ID='GYP4',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP4',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.1000/

```

```

&PART ID='water drops',
      WATER=.TRUE.,
      AGE=4.00/

```

```

&OBST XB=1.50,2.50,3.50,4.500,0.2000,0.60,
      SURF_IDS='Burner','INERT','INERT'/ Design Fire

```

```

&OBST XB=1.00,6.00,1.00,9.00,0.00,0.20, SURF_ID='INERT'/ Floor

```

```

&OBST XB=1.00,6.00,1.00,9.00,3.00,3.20, COLOR='INVISIBLE', SURF_ID='INERT'/
Top wall

```

```

&OBST XB=0.00,7.00,1.00,1.20,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/

```

BEQ_FDS5

```

Front wall
&OBST XB=5.80,6.00,1.20,8.80,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/
Right wall
&OBST XB=0.00,20.00,8.80,9.00,0.00,4.00, SURF_ID='GYP8'/ Back wall
&OBST XB=1.00,1.20,1.20,8.80,0.20,3.00, SURF_ID='GYP8'/ Left wall

&OBST XB=1.20,2.70,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Closet Bottom wall
&OBST XB=2.60,2.70,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Closet Right wall
&OBST XB=1.20,2.60,7.30,7.50,0.20,2.60, SURF_ID='GYP4'/ Closet Middle wall
&OBST XB=3.70,5.80,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Bathroom Bottom wall

&OBST XB=3.70,3.90,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Bathroom Left wall
&OBST XB=1.20,5.80,5.80,8.80,2.60,3.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Soffit
&OBST XB=0.00,20.00,9.00,11.00,3.00,4.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Corridor
&OBST XB=0.00,20.00,9.00,11.00,0.00,0.20, SURF_ID='INERT'/ Corridor Floor

&HOLE XB=2.50,2.80,7.20,6.20,0.20,2.40/ Closet Door1
&HOLE XB=2.50,2.80,7.50,8.50,0.20,2.40/ Closet Door2
&HOLE XB=3.60,3.90,6.80,7.80,0.20,2.40/ Bathroom Door
&HOLE XB=2.70,3.70,8.70,9.10,0.20,2.40/ Corridor Door

&PROP ID='RESIDENTIAL', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=53.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /
&PROP ID='RESIDENTIAL2', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=76.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /

&DEVC ID='SPR_1',XYZ=2.00,7.00,2.40,PROP_ID='RESIDENTIAL' / Closet1
&DEVC ID='SPR_2',XYZ=2.00,8.00,2.40,PROP_ID='RESIDENTIAL' / Closet2
&DEVC ID='SPR_3',XYZ=3.50,7.30,2.40,PROP_ID='RESIDENTIAL' / Hall
&DEVC ID='SPR_4',XYZ=3.50,3.50,2.80,PROP_ID='RESIDENTIAL' / Room

&DEVC ID='SPR_5',XYZ=3.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor1
&DEVC ID='SPR_6',XYZ=9.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor2
&DEVC ID='SPR_7',XYZ=15.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor3

&SURF ID='SUPPLY',VOLUME_FLUX=-0.075,COLOR='BLUE'/ ~155CFM
&SURF ID='EXHAUST1',VOLUME_FLUX=0.025,COLOR='GREEN'/ ~50CFM
&SURF ID='EXHAUST2',VOLUME_FLUX=0.010,COLOR='GREEN'/ ~20CFM

&VENT XB=3.40,3.60,4.60,4.80,3.00,3.00, SURF_ID='SUPPLY'/
&VENT XB=4.60,4.80,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=4.60,4.80,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=2.00,2.20,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST2'/
&VENT XB=2.00,2.20,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST2'/

&SLCF QUANTITY='TEMPERATURE', PBX=2.00/
&SLCF QUANTITY='TEMPERATURE', PBX=3.60/
&SLCF QUANTITY='TEMPERATURE', PBY=4.00/
&SLCF QUANTITY='TEMPERATURE', PBY=10.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=1.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.40/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.80/

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BEQ_FDS5

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&SLCF QUANTITY='visibility', PBX=3.60/
&SLCF QUANTITY='visibility', PBX=4.00/
&SLCF QUANTITY='visibility', PBX=10.00/
&SLCF QUANTITY='visibility', PBZ=1.00/
&SLCF QUANTITY='visibility', PBZ=2.00/

&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=2.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=3.50/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=4.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=10.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=1.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=2.00/

&SLCF QUANTITY='carbon monoxide', PBX=2.00/
&SLCF QUANTITY='carbon monoxide', PBX=3.50/
&SLCF QUANTITY='carbon monoxide', PBX=4.00/
&SLCF QUANTITY='carbon monoxide', PBX=10.00/
&SLCF QUANTITY='carbon monoxide', PBZ=1.00/
&SLCF QUANTITY='carbon monoxide', PBZ=2.00/

&SLCF QUANTITY='extinction coefficient', PBX=2.00/
&SLCF QUANTITY='extinction coefficient', PBX=3.50/
&SLCF QUANTITY='extinction coefficient', PBX=4.00/
&SLCF QUANTITY='extinction coefficient', PBX=10.00/
&SLCF QUANTITY='extinction coefficient', PBZ=1.00/
&SLCF QUANTITY='extinction coefficient', PBZ=2.00/

&SLCF QUANTITY='soot', PBX=2.00/
&SLCF QUANTITY='soot', PBX=3.50/
&SLCF QUANTITY='soot', PBX=4.00/
&SLCF QUANTITY='soot', PBX=10.00/
&SLCF QUANTITY='soot', PBZ=1.00/
&SLCF QUANTITY='soot', PBZ=2.00/

&SLCF QUANTITY='soot density', PBX=2.00/
&SLCF QUANTITY='soot density', PBX=3.50/
&SLCF QUANTITY='soot density', PBX=4.00/
&SLCF QUANTITY='soot density', PBZ=1.00/
&SLCF QUANTITY='soot density', PBZ=2.00/

&SLCF QUANTITY='soot volume fraction', PBX=2.00/
&SLCF QUANTITY='soot volume fraction', PBX=3.50/
&SLCF QUANTITY='soot volume fraction', PBX=4.00/
&SLCF QUANTITY='soot volume fraction', PBZ=1.00/
&SLCF QUANTITY='soot volume fraction', PBZ=2.00/

&TAIL /

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BEQ_FDS5

BEQ.fds

FPE596 Capstone Project - BEQ OPEN WINDOW WITH VENTS, SPRINKLER RESPONSE,
STEADY FIRE

&HEAD CHID='BEQ' /

&TIME T_END=500.00 /

&DUMP RENDER_FILE='BEQ.ge1' /

&MESH ID='1', IJK=100,55,20, XB=0.00,20.00,0.00,11.00,0.00,4.00 /

&REAC ID='TEST FIRE 1',

C=1.00,

H=4.00,

O=0.00,

N=0.00,

HEAT_OF_COMBUSTION=1.76000000E004,

CO_YIELD=0.0280,

SOOT_YIELD=0.0100,

MASS_EXTINCTION_COEFFICIENT=8.7000000E003,

VISIBILITY_FACTOR=3.00 /

&MATL ID='GYP8',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&MATL ID='GYP4',

FYI='Quintiere, Fire Behavior',

SPECIFIC_HEAT=0.84,

CONDUCTIVITY=0.48,

DENSITY=1440.00 /

&SURF ID='Burner',

RAMP_Q='tsquared',

COLOR='RED',

HRRPUA=2.6300000E003 /

&RAMP ID='tsquared', T=0.0, F=0.00 /

&RAMP ID='tsquared', T=10.0, F=0.00 /

&RAMP ID='tsquared', T=20.0, F=0.00 /

&RAMP ID='tsquared', T=30.0, F=0.00 /

&RAMP ID='tsquared', T=40.0, F=0.01 /

&RAMP ID='tsquared', T=50.0, F=0.01 /

&RAMP ID='tsquared', T=60.0, F=0.01 /

&RAMP ID='tsquared', T=70.0, F=0.02 /

&RAMP ID='tsquared', T=80.0, F=0.02 /

&RAMP ID='tsquared', T=90.0, F=0.03 /

&RAMP ID='tsquared', T=100.0, F=0.04 /

&RAMP ID='tsquared', T=110.0, F=0.05 /

&RAMP ID='tsquared', T=120.0, F=0.06 /

&RAMP ID='tsquared', T=130.0, F=0.06 /

&RAMP ID='tsquared', T=140.0, F=0.07 /

&RAMP ID='tsquared', T=150.0, F=0.09 /

&RAMP ID='tsquared', T=160.0, F=0.10 /

&RAMP ID='tsquared', T=170.0, F=0.11 /

&RAMP ID='tsquared', T=180.0, F=0.12 /

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&RAMP ID='tsquared', T=190.0, F=0.12 /
&RAMP ID='tsquared', T=200.0, F=0.12 /
&RAMP ID='tsquared', T=210.0, F=0.12 /
&RAMP ID='tsquared', T=220.0, F=0.12 /
&RAMP ID='tsquared', T=230.0, F=0.12 /
&RAMP ID='tsquared', T=240.0, F=0.12 /
&RAMP ID='tsquared', T=250.0, F=0.12 /
&RAMP ID='tsquared', T=260.0, F=0.12 /
&RAMP ID='tsquared', T=270.0, F=0.12 /
&RAMP ID='tsquared', T=280.0, F=0.12 /
&RAMP ID='tsquared', T=290.0, F=0.12 /
&RAMP ID='tsquared', T=300.0, F=0.12 /
&RAMP ID='tsquared', T=310.0, F=0.12 /
&RAMP ID='tsquared', T=320.0, F=0.12 /
&RAMP ID='tsquared', T=330.0, F=0.12 /
&RAMP ID='tsquared', T=340.0, F=0.12 /
&RAMP ID='tsquared', T=350.0, F=0.12 /
&RAMP ID='tsquared', T=360.0, F=0.12 /
&RAMP ID='tsquared', T=370.0, F=0.12 /
&RAMP ID='tsquared', T=380.0, F=0.12 /
&RAMP ID='tsquared', T=390.0, F=0.12 /
&RAMP ID='tsquared', T=400.0, F=0.12 /
&RAMP ID='tsquared', T=410.0, F=0.12 /
&RAMP ID='tsquared', T=420.0, F=0.12 /
&RAMP ID='tsquared', T=430.0, F=0.12 /
&RAMP ID='tsquared', T=440.0, F=0.12 /
&RAMP ID='tsquared', T=450.0, F=0.12 /
&RAMP ID='tsquared', T=460.0, F=0.12 /
&RAMP ID='tsquared', T=470.0, F=0.12 /
&RAMP ID='tsquared', T=480.0, F=0.12 /
&RAMP ID='tsquared', T=490.0, F=0.12 /
&RAMP ID='tsquared', T=500.0, F=0.12 /

```

```

&SURF ID='GYP8',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP8',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.2000/

```

```

&SURF ID='GYP4',
      RGB=200,200,200,
      MATL_ID(1,1)='GYP4',
      MATL_MASS_FRACTION(1,1)=1.00,
      THICKNESS(1)=0.1000/

```

```

&PART ID='water drops',
      WATER=.TRUE.,
      AGE=4.00/

```

```

&OBST XB=1.50,2.50,3.50,4.500,0.2000,0.60,
      SURF_IDS='Burner','INERT','INERT'/ Design Fire

```

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&OBST XB=1.00,6.00,1.00,9.00,0.00,0.20, SURF_ID='INERT'/ Floor

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```

&OBST XB=1.00,6.00,1.00,9.00,3.00,3.20, COLOR='INVISIBLE', SURF_ID='INERT'/
Top wall

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&OBST XB=0.00,20.00,1.00,1.20,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/

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Front wall
&OBST XB=5.80,6.00,1.20,8.80,0.20,3.00, COLOR='INVISIBLE', SURF_ID='GYP8'/
Right wall
&OBST XB=0.00,20.00,8.80,9.00,0.00,4.00, SURF_ID='GYP8'/ Back wall
&OBST XB=1.00,1.20,1.20,8.80,0.20,3.00, SURF_ID='GYP8'/ Left wall

&OBST XB=1.20,2.70,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Closet Bottom wall
&OBST XB=2.60,2.70,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Closet Right wall
&OBST XB=1.20,2.60,7.30,7.50,0.20,2.60, SURF_ID='GYP4'/ Closet Middle wall
&OBST XB=3.70,5.80,5.80,5.90,0.20,2.60, SURF_ID='GYP4'/ Bathroom Bottom wall

&OBST XB=3.70,3.90,5.90,8.80,0.20,2.60, SURF_ID='GYP4'/ Bathroom Left wall
&OBST XB=1.20,5.80,5.80,8.80,2.60,3.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Soffit
&OBST XB=0.00,20.00,9.00,11.00,3.00,4.00, COLOR='INVISIBLE', SURF_ID='GYP4'/
Corridor
&OBST XB=0.00,20.00,9.00,11.00,0.00,0.20, SURF_ID='INERT'/ Corridor Floor

&HOLE XB=2.50,2.80,7.20,6.20,0.20,2.40/ Closet Door1
&HOLE XB=2.50,2.80,7.50,8.50,0.20,2.40/ Closet Door2
&HOLE XB=3.60,3.90,6.80,7.80,0.20,2.40/ Bathroom Door
&HOLE XB=3.00,4.20,0.80,1.40,0.80,2.00, COLOR='BLUE'/ WINDOW
&HOLE XB=2.70,3.70,8.70,9.10,0.20,0.25/ Corridor Door Undercut

&PROP ID='RESIDENTIAL', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=53.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /
&PROP ID='RESIDENTIAL2', QUANTITY='SPRINKLER LINK TEMPERATURE', RTI=50.00,
C_FACTOR=0.7, ACTIVATION_TEMPERATURE=68.00, OFFSET=0.10,PART_ID='water
drops', FLOW_RATE=76.00, DROPLET_VELOCITY=10., SPRAY_ANGLE=30.,80. /

&DEVC ID='SPR_1',XYZ=2.00,7.00,2.40,PROP_ID='RESIDENTIAL' / Closet1
&DEVC ID='SPR_2',XYZ=2.00,8.00,2.40,PROP_ID='RESIDENTIAL' / Closet2
&DEVC ID='SPR_3',XYZ=3.50,7.30,2.40,PROP_ID='RESIDENTIAL' / Hall
&DEVC ID='SPR_4',XYZ=3.50,3.50,2.80,PROP_ID='RESIDENTIAL' / Room

&DEVC ID='SPR_5',XYZ=3.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor1
&DEVC ID='SPR_6',XYZ=9.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor2
&DEVC ID='SPR_7',XYZ=15.00,10.00,2.80,PROP_ID='RESIDENTIAL2' / Corridor3

&SURF ID='SUPPLY',VOLUME_FLUX=-0.075,COLOR='BLUE'/ ~155CFM
&SURF ID='EXHAUST1',VOLUME_FLUX=0.025,COLOR='GREEN'/ ~50CFM
&SURF ID='EXHAUST2',VOLUME_FLUX=0.010,COLOR='GREEN'/ ~20CFM

&VENT XB=3.40,3.60,4.60,4.80,3.00,3.00, SURF_ID='SUPPLY'/
&VENT XB=4.60,4.80,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=4.60,4.80,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST1'/
&VENT XB=2.00,2.20,6.20,6.40,2.60,2.60, SURF_ID='EXHAUST2'/
&VENT XB=2.00,2.20,8.40,8.60,2.60,2.60, SURF_ID='EXHAUST2'/

&SLCF QUANTITY='TEMPERATURE', PBX=2.00/
&SLCF QUANTITY='TEMPERATURE', PBX=3.60/
&SLCF QUANTITY='TEMPERATURE', PBY=4.00/
&SLCF QUANTITY='TEMPERATURE', PBY=10.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=1.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.00/
&SLCF QUANTITY='TEMPERATURE', PBZ=2.40/

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                                BEQ_FDS5
&SLCF QUANTITY='TEMPERATURE', PBZ=2.80/

&SLCF QUANTITY='visibility', PBX=3.60/
&SLCF QUANTITY='visibility', PBX=4.00/
&SLCF QUANTITY='visibility', PBX=10.00/
&SLCF QUANTITY='visibility', PBZ=1.00/
&SLCF QUANTITY='visibility', PBZ=2.00/

&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=2.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=3.50/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=4.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBX=10.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=1.00/
&SLCF QUANTITY='VELOCITY', VECTOR=.TRUE., PBZ=2.00/

&SLCF QUANTITY='carbon monoxide', PBX=2.00/
&SLCF QUANTITY='carbon monoxide', PBX=3.50/
&SLCF QUANTITY='carbon monoxide', PBX=4.00/
&SLCF QUANTITY='carbon monoxide', PBX=10.00/
&SLCF QUANTITY='carbon monoxide', PBZ=1.00/
&SLCF QUANTITY='carbon monoxide', PBZ=2.00/

&SLCF QUANTITY='extinction coefficient', PBX=2.00/
&SLCF QUANTITY='extinction coefficient', PBX=3.50/
&SLCF QUANTITY='extinction coefficient', PBX=4.00/
&SLCF QUANTITY='extinction coefficient', PBX=10.00/
&SLCF QUANTITY='extinction coefficient', PBZ=1.00/
&SLCF QUANTITY='extinction coefficient', PBZ=2.00/

&SLCF QUANTITY='soot', PBX=2.00/
&SLCF QUANTITY='soot', PBX=3.50/
&SLCF QUANTITY='soot', PBX=4.00/
&SLCF QUANTITY='soot', PBX=10.00/
&SLCF QUANTITY='soot', PBZ=1.00/
&SLCF QUANTITY='soot', PBZ=2.00/

&SLCF QUANTITY='soot density', PBX=2.00/
&SLCF QUANTITY='soot density', PBX=3.50/
&SLCF QUANTITY='soot density', PBX=4.00/
&SLCF QUANTITY='soot density', PBZ=1.00/
&SLCF QUANTITY='soot density', PBZ=2.00/

&SLCF QUANTITY='soot volume fraction', PBX=2.00/
&SLCF QUANTITY='soot volume fraction', PBX=3.50/
&SLCF QUANTITY='soot volume fraction', PBX=4.00/
&SLCF QUANTITY='soot volume fraction', PBZ=1.00/
&SLCF QUANTITY='soot volume fraction', PBZ=2.00/

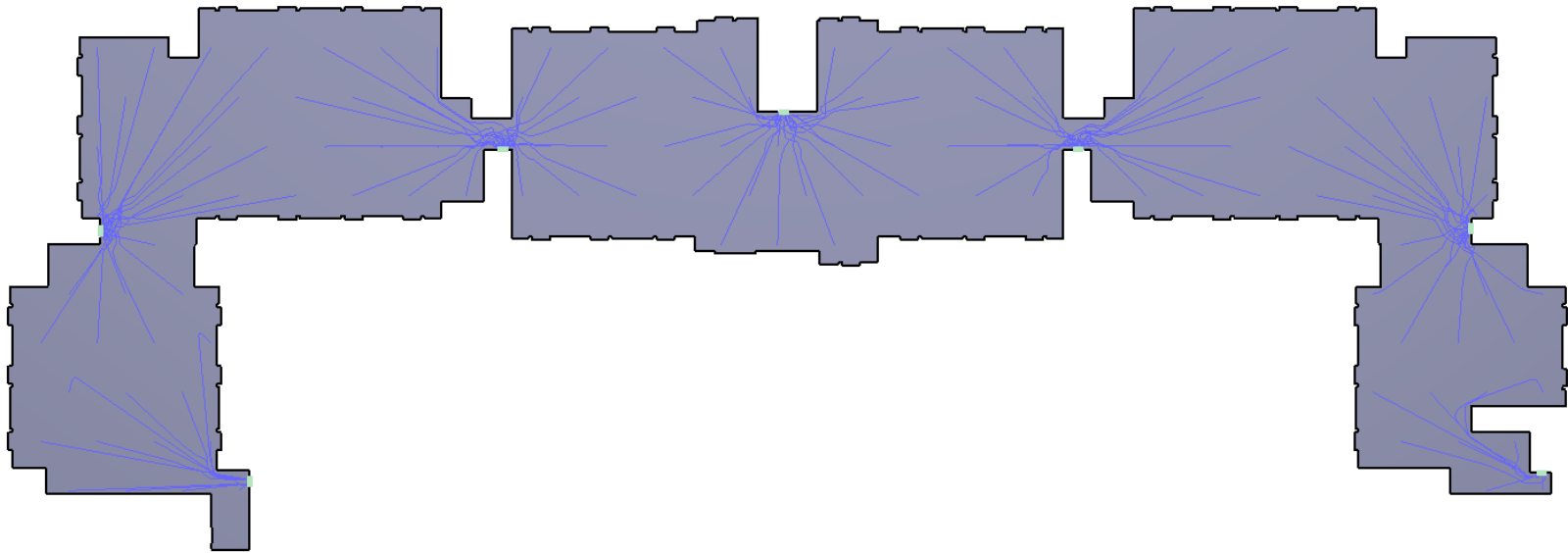
&TAIL /

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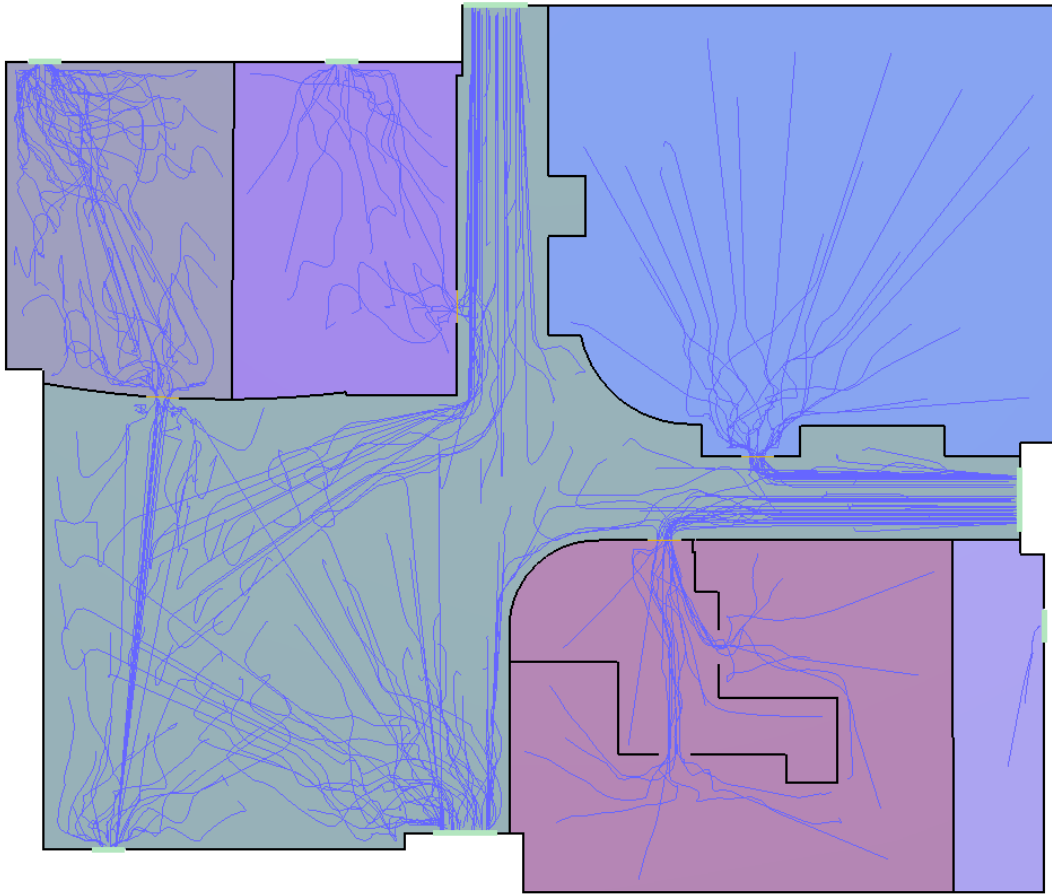

Appendix K – Pathfinder Tabulated Results



Pathfinder Evacuation Model



Pathfinder Egress Paths - BEQ



Pathfinder Egress Paths - Common Building

SUMMARYSUMMARY***SUMMARY***SUMMARY***SUMMARY***

Simulation: PATH 1
 Mode: Steering
 [Components] All: 51
 [Components] Doors: 41
 Triangles: 1780
 Occupants: 726
 Startup Time: 0.2s
 CPU Time: 14.1s

ROOM/DOOR	FIRST IN (s)	LAST OUT (s)	TOTAL USE (pers)	FLOW AVG. (pers/s)	
Floors->1ST FLOOR->1ST FLOOR	0.00	53.20	124		
Floors->1ST FLOOR->Assembly	0.00	63.25	180		
Floors->1ST FLOOR->Laundry	0.00	51.48	20		
Floors->1ST FLOOR->Learning Center	0.00	44.08	22		
Floors->1ST FLOOR->Threater	0.00	59.83	50		
Floors->1ST FLOOR->Business	0.00	45.33	19		
Floors->1ST FLOOR->Industrial	0.00	33.83	2		
Floors->2ND FLOOR->2ND FLOOR	0.00	51.55	138		
Floors->3RD FLOOR->3RD FLOOR	0.00	49.15	129		
Floors->4TH FLOOR->4TH FLOOR	0.00	51.38	101		
Floors->1ST FLOOR->1ST FLOOR	33.08	53.20	19	0.94	
Floors->1ST FLOOR->1ST FLOOR	31.85	53.15	20	0.94	
Floors->1ST FLOOR->1ST FLOOR	33.65	43.43	11	1.13	
Floors->1ST FLOOR->1ST FLOOR	31.35	45.83	10	0.69	
Floors->1ST FLOOR->1ST FLOOR	32.80	40.45	11	1.44	
Floors->1ST FLOOR->1ST FLOOR	31.43	39.25	10	1.28	
Floors->1ST FLOOR->1ST FLOOR	32.43	43.08	9	0.85	
Floors->1ST FLOOR->1ST FLOOR	32.18	43.25	12	1.08	
Floors->1ST FLOOR->1ST FLOOR	32.38	42.28	5	0.51	
Floors->1ST FLOOR->1ST FLOOR	32.53	36.05	3	0.85	
Floors->1ST FLOOR->Door13	32.35	45.40	14	1.07	
Floors->1ST FLOOR->Door33	31.33	51.10	41	2.07	
Floors->1ST FLOOR->Door34	30.83	38.90	8	0.99	
Floors->1ST FLOOR->Door35	31.90	44.08	16	1.31	
Floors->1ST FLOOR->Door36	30.55	59.83	42	1.43	
Floors->1ST FLOOR->Door39	30.65	57.83	57	2.10	
Floors->1ST FLOOR->Door40	32.35	33.83	2	1.36	
Floors->1ST FLOOR->Door41	33.65	45.33	19	1.63	
Floors->1ST FLOOR->Door43	34.60	51.48	20	1.19	
Floors->1ST FLOOR->Door44	30.50	52.60	48	2.17	
Floors->1ST FLOOR->Door45	30.98	63.25	28	0.87	
Floors->1ST FLOOR->Door47	31.30	53.05	12	0.55	
Floors->2ND FLOOR->Door14	32.45	48.65	21	1.30	
Floors->2ND FLOOR->Door15	33.20	46.00	14	1.09	
Floors->2ND FLOOR->Door16	32.40	49.73	24	1.39	
Floors->2ND FLOOR->Door17	32.58	47.90	21	1.37	
Floors->2ND FLOOR->Door18	32.33	51.55	26	1.35	
Floors->2ND FLOOR->Door19	32.58	47.83	20	1.31	
Floors->2ND FLOOR->Door20	31.38	45.00	12	0.88	
Floors->3RD FLOOR->Door21	31.58	44.58	9	0.69	
Floors->3RD FLOOR->Door22	31.73	47.40	21	1.34	
Floors->3RD FLOOR->Door23	31.78	46.30	21	1.45	
Floors->3RD FLOOR->Door24	32.65	48.63	21	1.31	
Floors->3RD FLOOR->Door25	31.15	48.53	23	1.32	
Floors->3RD FLOOR->Door26	33.20	49.15	22	1.38	
Floors->3RD FLOOR->Door27	31.18	45.40	12	0.84	
Floors->4TH FLOOR->Door28	33.45	51.38	20	1.12	
Floors->4TH FLOOR->Door29	31.55	47.08	22	1.42	
Floors->4TH FLOOR->Door30	32.00	50.00	23	1.28	
Floors->4TH FLOOR->Door31	32.03	47.65	20	1.28	
Floors->4TH FLOOR->Door32	31.35	49.58	16	0.88	
SUMMARY	0.00	63.25	180		