Fire Protection & Life Safety Analysis

Eric W. Rood Administration Center

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Keywords

RSET – Required Safe Egress Time
ASET – Available Safe Egress Time
California Building Code
Life Safety Code
Prescriptive Based Analysis
Performance Based Analysis
FDS – Fire Dynamics Simulator

Executive Summary

A Fire Protection & Life Safety Analysis was conducted in order to fulfill the requirements for the degree of Master of Science in Fire Protection Engineering. The Fire Protection & Life Safety Analysis consisted of a prescriptive and performance-based analysis of the Eric W. Rood Administration Center (Rood Center).

The prescriptive based analysis was conducted to determine if the Rood Center adhered to the applicable codes and standards. It utilized the 2013 California Building and Fire Codes and the 2012 Life Safety Code (NFPA 101). Other NFPA codes that were referenced included the 2013 edition of NFPA 13, Standard for the Installation of Sprinkler Systems, the 2013 edition of NFPA 72, National Fire Alarm Signaling Code, and the 2015 edition of NFPA 2001, Standard on Clean Agent Fire Extinguishing systems.

The prescriptive based analysis examined four portions of the building's fire protection system:

- Egress Analysis & Design
- Fire Detection & Alarm Notification
- Water-based Fire Suppression
- Structural Fire Protection

Deficiencies were found in the building's fire detection and notification systems, as well as the inspection, testing, and maintenance of said systems. The building's primary fire alarm

system has photoelectric smoke detectors installed in only portions of the building. The bulk of the detectors are installed in the exit corridors with typically only one detector per department. While the number of smoke detectors in most departments is lacking, some departments don't have any at all. The first floor has only 23 smoke detectors, while the second floor has only 16. Based on coverage-area-per-detector calculations alone, the first floor should have a minimum of 56 detectors and the second floor should have a minimum of 58. One of the departments in the building that does have smoke detectors, has only local detectors (they are not connected to the building's fire alarm control panel (FACP)). Two of the fire scenarios in the performance based analysis indicated the fires were detected within 10 seconds of ignition. In the other two fire scenarios, the fires were not detected until 73 seconds and 107 seconds into the simulations respectively. Examining the building's notification systems revealed several issues as well. Three of the notification devices types currently in use in the building are listed in the FACP's manual as not compatible. Similar to the detection system, there are not enough notification appliances (audio or visual) throughout the building to ensure proper coverage. Inspections and tests are not done to confirm proper audible and/or visual levels in the building during an active alarm.

The performance based analysis examined how the building's fire protection system would react to a fire, and whether occupants would have enough time to escape to safety. A computational fluid dynamics modeling program, Fire Dynamics Simulator (FDS), was used to estimate the available safe egress times (ASET) for four different fire scenarios throughout the building. Those values were then compared with the required safe egress times (RSET) calculated in the prescriptive based analysis for each fire scenario.

The original RSET values were calculated for the departments affected by the fire scenarios. The fire models were analyzed and the ASET values were determined when conditions either first became untenable, or when all the occupants had exited the building; whichever came first. The conditions in the building became untenable before people could evacuate the building in all four fire scenarios (RSET > ASET). In some situations, conditions became untenable seconds after the fire alarm was activated, and several minutes before evacuations were complete.

The performance based analysis determine that the arrangement of the dead end hallway off the second floor lobby was especially problematic as it could cause the occupants to be trapped in the event of a fire. Two fire scenarios were examined, one with the fire in the dead end hallway, and another with the fire in the main lobby. In both cases, the conditions in the building became untenable long before the occupants would have been able to escape the hallway, let alone the building.

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Codes & Standards Referenced in Prescriptive Analysis

2013 California Building Code
2013 California Fire Code
2012 NFPA 101 – Life Safety Code
2013 NFPA 72 – National Fire Alarm and Signaling Code
2013 NFPA 13 – Standard for the Installation of Sprinkler Systems
2015 NFPA 2001– Standard on Clean Agent Fire Extinguishing Systems

Original Applicable Codes & Standards

1979 Uniform Building Code
1979 Uniform Fire Code
1985 NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures
2002 NFPA 72 – National Fire Alarm and Signaling Code
1983 NFPA 13 – Standard for the Installation of Sprinkler Systems
2000 NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems

Building Information

The Eric W. Rood Administration Center (Rood Center) has been operated and maintained by the government of Nevada County since it was built in 1985-86. It is a two story building with both stories above grade. The building faces south-by-southeast and is rectangular in shape, 360 feet wide by 144 feet long. Due to the presence of chamfered corners on the first story (as seen in *Figure 1*), the perimeter of the second story is slightly larger than that of the first. However, the square footage of the second story is smaller due to a two-story lobby and a one-and-a-half story Board of Supervisors chambers. The first floor is 52,138 square feet while the second story is 51,262 square feet for a total of 103,400 square feet.

Figure 1: Chamfered corner at the southwest corner of the building

The exterior walls are filled-concrete while the interior walls consist primarily of gypsum wall board over metal studs. The building has a flat roof and a parapet wall encircling the top of the second story. Each floor has 9-foot-tall T-bar drop ceilings. Most of the main hallways and corridors vary in width along their lengths, from 8 feet to 16 feet wide.

There are three exit stairwells from the second floor; one open-air stairwell in the lobby, and two enclosed cement-lined stairwells at the west and east ends of the building. The tops of the stairwells at either end of the building were designed as areas of refuge. Building staff enter the building through the west and east stairwells. Electronic locks on the doors provide a log of entry. Near the stairwell in the lobby is the only elevator in the building providing handicap access to the second floor. At the front of the building is a two-story wall constructed of tempered glass inside of a metal framework with an atrium-style lobby directly behind it. Located on either side of the glass wall are glass double-doors which are the main public entry points into the building.

The building is classified as mixed occupancy per the 2012 Life Safety Code (6.1.14.3), and a light-hazard occupancy by the Authority Having Jurisdiction (AHJ). The AHJ is the Nevada City Fire Department. The Rood Center is primarily a Group-B Business occupancy with some areas classified as a Group-A Assembly occupancy (with both A-2 and A-3 subclasses). It contains many of the county government's offices, as well as a number of conference rooms, a computer data center, a Board of Supervisors meeting chamber (with fixed seating), and a small cafeteria. The building's hours of operation are Monday through Friday, 8:00am – 5:00pm for both general staff and public access.

The building is protected by two types of sprinkler systems. The lobby and the exterior parapet walls are protected by a dry-pipe system. The internal occupied space of the building and the attic are protected by a wet-pipe system.

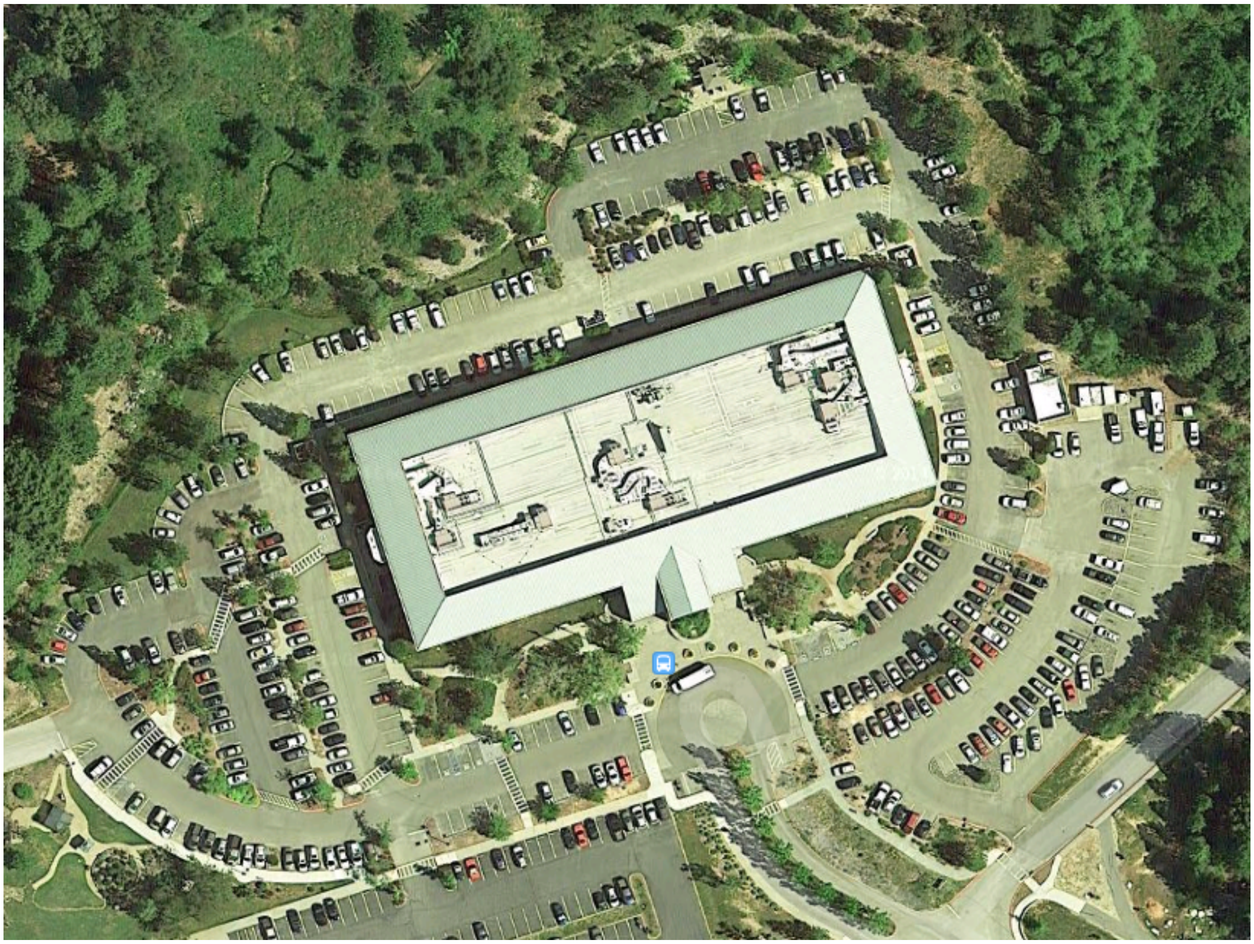

Figure 2: Google Maps view of Eric W. Rood Administration Center (Top of the page is north)

Prescriptive Based Analysis

Structural

Type of Construction

When the building was built, all design requirements were based upon the 1979 Uniform Building Code (UBC). The building was originally classified as type V-N construction, which is the equivalent of type V-B construction today; however, the building today would actually be classified as type III-B construction (non-combustible walls with an unprotected wooden roof structure). The building has two stories above grade, and is approximately 35-40 feet tall.

Building Heights & Allowable Areas

Table 503 lists the allowable building heights and areas per floor (see *Table 1*). According to the table, under type III-B construction, Group B occupancies are allowed to be a maximum of 55 feet tall. According to this table, the building can have a maximum of three-stories with an area per floor of 19,000 ft^2.

Table 1: Allowable Building Height and Areas

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

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

Exceptions

Several sections in Chapter 5 of the 2013 CBC provide general exceptions for the data in *Table 1*. The first is section 504.2 which states that if a building is equipped throughout with an approved automatic sprinkler system, then the values for maximum building height can be increased by 20 feet, and the maximum number of stories can be increased by one, to new values of 75 feet tall and 4 stories.

Section 506.3 includes an exception for the allowable area per floor if the building is equipped throughout with an approved automatic sprinkler system. The maximum area per floor is permitted to be increased by an additional 200% for buildings with more than one story above grade plane. This increase brings the maximum area per floor of the building to 57,000 ft^2, which is above the actual square footage of either floor.

Section 507.4 states that the area of a Group B building no more than two stories above grade plane shall not be limited where the building is equipped throughout with an approved automatic sprinkler system and is surrounded by public ways not less than 60 feet in width. As the building is surrounded on all four sides by parking lots over 60 feet in length, is only two stories tall, and is fully sprinklered, the maximum area per floor would be unlimited. However, the AHJ would have to agree to classify the building throughout as Group B and not Mixed Occupancy.

Table 2: Actual vs. Allowed Values for Building Height and Floor Areas

	Maximum Allowed	Actual
Stories Above Grade Plane	3	2
Building Height	75	35-40
Area Per Floor	57,000 ft^2	52,138 ft^2

There are additional allowances for area per floor based on frontage (CBC – Section 506.2), but as the allowances have already exceeded the actual size, those increases were not needed and therefore won't be discussed further in this report.

Fire Resistance Ratings

Table 601 of the 2013 CBC lists the minimum fire resistance rating requirements for building elements (see *Table 3*). As shown in *Table 3* below, for type III-B construction, the only minimum fire resistance rating requirements for the building is exterior load bearing walls.

Table 3: Fire-Resistance Rating Requirements for Building Elements

SECTION 601 GENERAL

TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls									
Exterior[f, g]	3	2	1	0	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary member (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 1/2[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	HT	1[b,c]	0

Table 4 below lists a comparison of the interior finish requirements of exit corridors and stairways between the Life Safety Code and the California Building Code.

Table 4: Fire-Resistance Rating Requirements for Interior Finishes

Occupancies	LSC (Table A.10.2.2)		CBC (Table 803.9 – Sprinklered)	
	Exits	Corridors	Exits	Corridors
Assembly (>300 existing)	A	A or B	B	B
Business (existing)	A or B	A or B	B	C

Class **A** interior wall and ceiling finish — flame spread index, **0–25**
Class **B** interior wall and ceiling finish — flame spread index, **26–75**
Class **C** interior wall and ceiling finish — flame spread index, **76–200**

As the LSC doesn't list values for a sprinklered building, a note is included at the bottom of the table and it reads:

> *"Automatic sprinklers — where a complete standard system of automatic sprinklers is installed, interior wall and ceiling finish with a flame spread rating not exceeding Class C is permitted to be used in any location where Class B is required, and Class B interior wall and ceiling finish is permitted to be used in any location where Class A is required."*

The second floor main corridors of the building have a small, dense pile carpet with acoustic ceiling tiles in the drop ceiling above (see *Figure 3* below). The walls are metal stud with gypsum wall board. The wall coverings consist of two types of decorative wall paper. At the time of this report, the flammability of these types of wall paper is unknown. With a sprinklered building, finish rating requirement of Class C or below, the wall paper would most likely be approved under the code.

Figure 3: Second Floor East Corridor looking west

The main lobby and CDA waiting areas have tile floors. The ceiling in the main lobby is composed of gypsum wall board, acoustic ceiling tiles, and T-111 tongue-and-groove siding. The wall materials in the main lobby are primarily gypsum wall board, with T-111 tongue-and-groove siding in the front seating area near the windows. The CDA waiting areas has acoustic ceiling tiles and the same type of wall paper as the previously mentioned corridors.

Figure 4: Main lobby looking east

The two stairwells at either end of the building are cement-lined with cement floors and steps. The ceiling and walls of the stairwell are cement with gypsum wall board coverings.

Exterior Walls:

The exterior walls of the building have concrete columns stretching from ground level to the underside of the mansard roof. The columns are spaced approximately 18 feet apart. The beams and bracing for the floors attach to the interior side of the columns.

The sections of the first floor exterior walls in between the concrete columns are 9 feet tall and made of 3’x3’ glass sections in metal frames. The second floor walls have a solid section at the base, with two rows of 3’x3’ glass sections in metal frames at the top. The wall between the first and second floors is concrete. The fascia around the front of the building, the exterior of the stairwells, and the mansard is T-111 tongue-and-groove wood siding.

The only portion of the exterior walls that could potentially fail the 2-hour require fire resistance rating would be the windows. The windows are not protected by glazing or by an automatic sprinkler water curtain. However, Table 705.8 of the CBC states that if the building’s fire separation distance is greater than 30 feet, and the building is protected by an automatic sprinkler system, then there is no requirement for opening protection.

Figure 5: South exterior wall, west side of the building

Interior Walls:

The interior walls are constructed with steel studs spaced 16” on center, with the cavities filled with batts of fiberglass insulation. The walls are covered on both sides with 5/8” gypsum wallboard. While the building’s primary interior wall furnishings appeared to meet the code requirements, some of the decorations that are displayed in the exit corridors do not. That would include paper art projects by local students, and large 8’x8’ quilts hung on the walls.

Floors:

The floors are constructed with 2-1/2” of poured hardrock concrete over ASC Pacific Type “B” hi-form composite 20 gage galvanized steel decking over engineered metal trusses. The concrete is reinforced with welded wire fabric (WWF). The second story floor used the same construction but used 1-1/2” of lightweight concrete, reinforced in the same manner.

Roof:

The building has a roof that is flat in the center with a mansard encircling the top of the second story. The roof material at the front of the building is 26 gage galvanized steel metal which slopes up from the exterior of the mansard towards the center of the building creating a parapet wall around the flat roof (see *Figure 6* below). The roof structure is supported by wooden glulam beams (~36 inches tall) which attach to metal columns. Wooden trusses attach to the glulam beams and occupy the upper 1/3 of the attic. The bottom 2/3 of this attic space is occupied HVAC lines, sprinkler lines, power, phone and cable lines (see *Figure 7* below). Metal cross bars are mounted between the T-bar ceilings and the wooden trusses above. The wooden trusses vary in both size and width. They're built with either 2"x6" or 2"x8" boards, and have two to three wood members sistered together. There are fire walls in place in the attic that separate the open spaces above the offices from the spaces above the fire rated corridors. The fire walls are built with 5/8" gypsum wallboard and metal stud framing. These fire walls are supposed to have their openings sealed but several large openings around pass-throughs were noted. Draft stops are per the 1982 Uniform Building Code (UBC), Section 3205, and are spaced 100 feet on center.

The construction, layout of the building (including the surrounding public ways and the automatic sprinkler system) exceed the structural fire protection requirements set forth in the 2013 CBC.

Figure 6: South portion of the roof at the front of the building

Figure 7: Second floor attic, north side of the building, looking west

An inspection of the second floor's attic revealed fiberglass insulation batts installed on the underside of the roof with the Kraft paper side exposed (see *Figure 7* above). Section 720.3 of the 2013 CBC states that exposed insulating materials shall have a flame spread index of not more than 25. The Kraft paper's flame spread index is greater than 25. This material is easily ignited and could allow very rapid fire spread across the underside of the roof above the sprinklers.

Summary:

The Rood Center's structural fire protection analysis determined that the building's height and allowable areas per floor are acceptable under the code with the use of a couple exceptions granted because of the presence of an automatic sprinkler system. Because the building is type III-B construction, the only requirements for fire resistance ratings concern load-bearing exterior walls. As mentioned above, the building's separation distance is greater than 30 feet so there is no opening protection required for the glass windows. The primary coverings on the interior walls appears to meet the code's requirements, but the decorations that are hung in the corridors do not. Issues in the attic consist of penetrations in the fire wall, and the Kraft paper side of the insulation batts exposed. The structural fire protection system is designed to help contain the spread of fire and provide the occupants more time to escape. An analysis of the egress systems in the next section shows how much the issues with the structural fire protection system would impact evacuation times.

Egress

Building Occupant Load

As the Rood Center is a mixed occupancy building, the occupant load was calculated based on the individual departments/spaces within the building. To complete these calculations, the 2012 version of the LSC and the 2013 version of the CBC were used. Color-coded diagrams (*Figure 2 & Figure 3*) are included at the end of this section which illustrate the occupancy classification of each department/space. A spreadsheet was used to track and calculate the occupant loads of each space within the building. It is included in APPENDIX B.

Table 5: Occupant Load Totals

	Based on the 2013 CBC	Based on the 2012 LSC
First Floor Second Floor	706 651	707 656
Total Occupancy	**1,357**	**1,363**

While these occupancy values represent maximum occupancy, the actual occupancy during normal day-to-day operations is approximately 500 people (35-40% of maximum values). If a meeting is occurring in the BOS chambers, the occupancy would increase to approximately 550-600 people.

First Floor:

The first floor was divided into its various departments and common areas. The departments are Social Services, Child Support Services, Public Works, Planning, EH, CDA, Building, I&G, Sheriff's, and the Mail Room. All of these departments have Group B – Business (Office) occupancies. Within each of these areas are various conference rooms and storage areas.

Some conference rooms are simply labeled "Conference Room", and are not accessible by the general public, while other conference rooms have official names like "Reward Room", "Coyote Room", or "Omega Room"; all of which are accessible to the public.

Under both the CBC (303.1.2) and the LSC (6.1.2.1), if a space has an occupancy of less than 50 people (or is smaller than 750 ft^2 per the CBC), then the space is not an Assembly occupancy, but instead changes to a Business occupancy or the occupancy classification of the space around it (which in this case, is still Business).

The AHJ classified the generic conference rooms not available to the public as Business occupancies, but classified the occupancies of the named conference rooms as Assembly (A-

3). Therefore, the named conference rooms have an OLF of 15 ft^2/person, while the generic ones have with an OLF of 100 ft^2/person.

Each department also had storage areas within, both as closed rooms (with a door) and as open areas. According to the AHJ, the only areas that could be classified as storage areas were those in closed rooms. If the storage areas were open, it would fall under the occupancy of the space around it. Many of these closed rooms had paper and files stored in them, so they were classified as S-1 Storage occupancies which had an OLF of 300 ft^2/person. As most of these storage spaces were quite small (less than 300 ft^2), it was assumed that each space could have 1 person occupying it.

The cafeteria (903 ft^2) is more of a lunchroom or eating area, as it doesn't have cooking equipment. It has a salad bar, a sandwich prep area, racks of small food items, several vending machines, and tables and chairs. As the room was above the "small assembly" rule, it was classified as an Assembly (A-2) occupancy with an OLF of 15 ft^2/person.
The Board of Supervisors (BOS) Chambers is a large room with fixed theater-like seating in the center, and standing space at the rear. The floor slopes gradually downwards towards the front of the room. The grade drops 15 inches in a span of 22 feet. At the front of the fixed seats are two desks which face the supervisors. The supervisors sit on a raised area in an arc around the northwest corner (front) of the room. There are 121 fixed seats, and then an area of ~70 ft^2 at the rear of the room for standing room. According to the CBC, this standing area has an OLF of 5 ft^2/person while the LSC lists an OLF of 7 ft^2/person.

The CDA waiting area in front of the Public Works, Planning, Building, CDA & EH departments, has several chairs, and a small 4'x4' kids play area. This area as well as the Main Lobby at the front of the building are classified as a Business (Group B) with an OLF of 100 ft^2/person.

The first floor contained four sets of public restrooms scattered throughout the building. One pair is located off the main lobby, another off the exit corridor on the east end of the building, another off the exit corridor on the west end of the building, and the last set inside the department of Social Services. As these spaces were not listed in either code, they were classified as "Utility" (CBC) with an OLF of 300 ft^2/person, or "Industrial" (LSC), which has an OLF of 100 ft^2/person. The largest pair of restrooms was only 409 ft^2. With an OLF of 300 ft^2/person, that would only allow for 1 occupant total to be present in the men *and* women's rooms at any given time. As that was not realistic, the occupancy values were increased to 1 person in each restroom, giving a total of 2 per pair of restrooms. With an OLF of 100 ft^2/person (LSC) some of the restrooms had an occupancy value of 4 people.

Throughout the first floor, there were four mechanical rooms that were classified at Utility (CBC) or Industrial (LSC). Again the Utility classification has an OLF of 300 ft^2/person and the Industrial classification has an OLF of 100 ft^2/person. However, due to the fact that the two closets labeled “Fire Alarm” and “Intergen Fire System for IS” were of such a small area and contained large amounts of equipment, there wasn’t any space viable for occupancy. Therefore, neither of these closets were given an occupancy value.

The corridors and exit stairwells were treated as areas where people would only occupy them for the amount of time that it would take to travel through them. Therefore, they weren’t given an occupancy value.

Second Floor:

As with the first floor, the second floor was divided up into various departments with storage and conference rooms inside. These departments are Assessor, Auditor-Controller, Board of Supervisors, Clerk Recorder, CEO, County Counsel, HR, LAFCo, Sheriff’s, Tax Collector-Treasurer, OES, and Elections. These departments all had a Group B – Business occupancy classification with an OLF of 100 ft^2/person. Each department had conference rooms that were for office staff only, and others that were named and were accessible for the public. The “small assembly” rule applies to most of these named conference rooms, but after checking with the AHJ, they were all classified as Assembly (A-3) occupancy with an OLF of 15 ft^2/person. The storage rooms are classified as S-1 Storage with an OLF of 300 ft^2/person (CBC) or 500 ft^2/person (LSC). Each room was assumed to have at least 1 person occupying it.

The Grand Jury room is small enough where it could fall under the “Small assembly spaces” section of the code (CBC - 303.1.2 and LSC - 6.1.2.1) but was classified as Assembly (A-3) by the AHJ with an OLF of 15 ft^2/person.

The Sheriff’s office has its own locker room with men and women’s restrooms attached. These restrooms were not open to the public so they were treated as part of the locker room. In the 2013 CBC and the 2012 LSC there was no mention of Locker Room spaces. However, in the 2010 CBC and the 2009 LSC, there was a section devoted to Locker Rooms which had an OLF of 50 ft^2/person.

The two sets of restrooms available to the public were located in the main corridors at the west and east ends of the building. Like mentioned above, as the CBC has an OLF of 300 ft^2/person, each restroom was assumed to have 1 person occupying it. With an OLF of 100 ft^2/person from the LSC, more people were able to occupy the spaces.

Two rooms used for Utility/Industrial purposes could potentially have 1 person occupying each space so they were given an occupancy value of 1 person each.

The space above the BOS Chambers (indicated on *Figure 3*) was unusable as it was interstitial attic space and therefore didn't receive an occupancy value.

Like the first floor, the corridors and exit stairwells were treated as areas where people would only occupy them for the amount of time that it would take to travel through them. Therefore, they weren't assigned occupancy values.

Table 6: Building Use Color Chart

	Business (Office Space)
	Assembly (A-3) (Tables/Chairs)
	Assembly (A-3) (Standing) - BOS
	Assembly (A-2) (Cafeteria Seating)
	Storage (S-1)
	Restrooms
	Utility
	Exits
	Exit Corridors
	Exit Stairs
	Stairwell space
	Interstitial space

Regarding the building floorplans seen below in *Figure 8* and *Figure* 9, large departments that were connected to each other and of the same occupancy classification had the walls that separated departments colored **red**. If the department separation crossed an area where there were no walls, a wall was drawn in and colored **yellow** to indicate the separation.

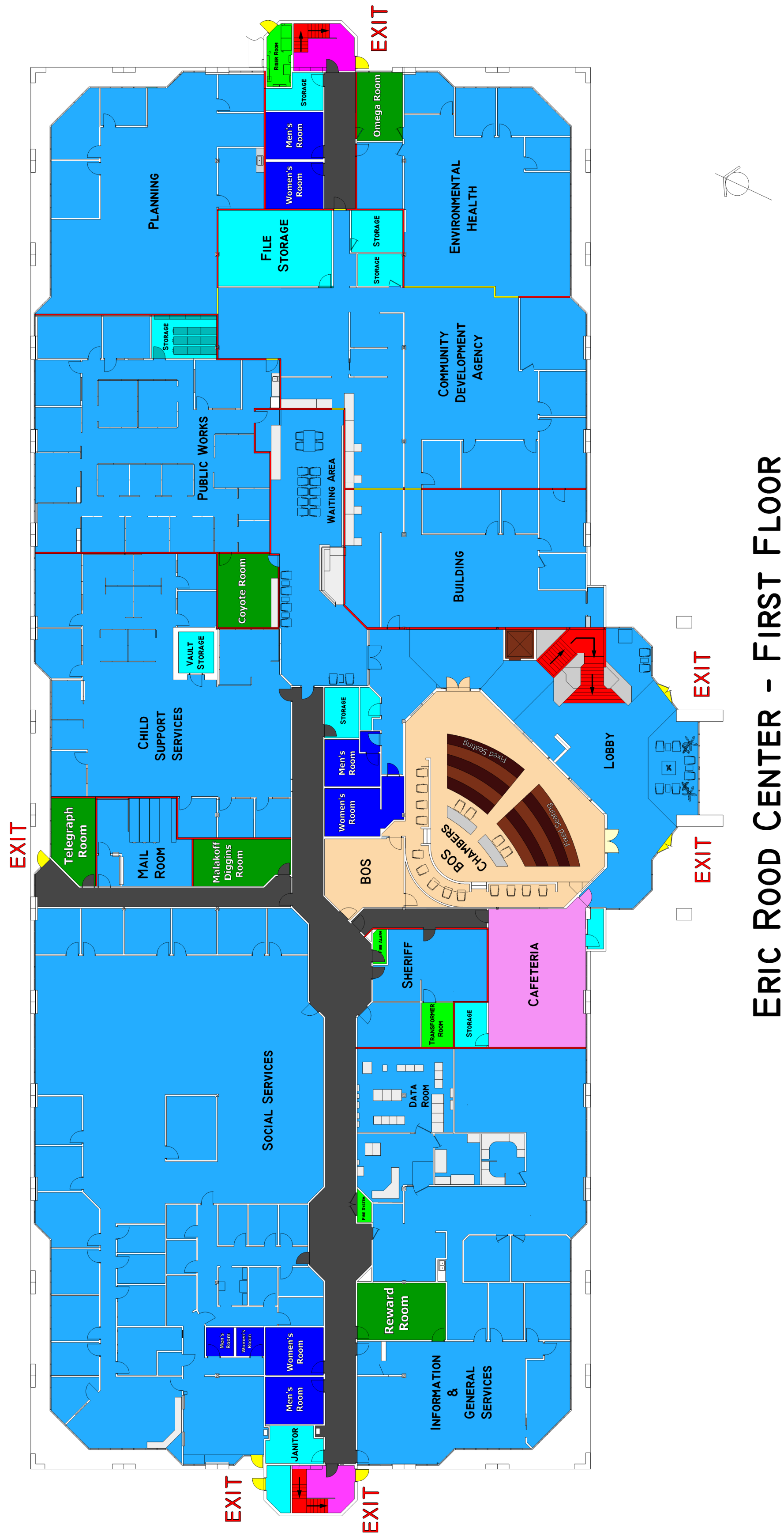

Figure 8: First Floor diagram with building use colors

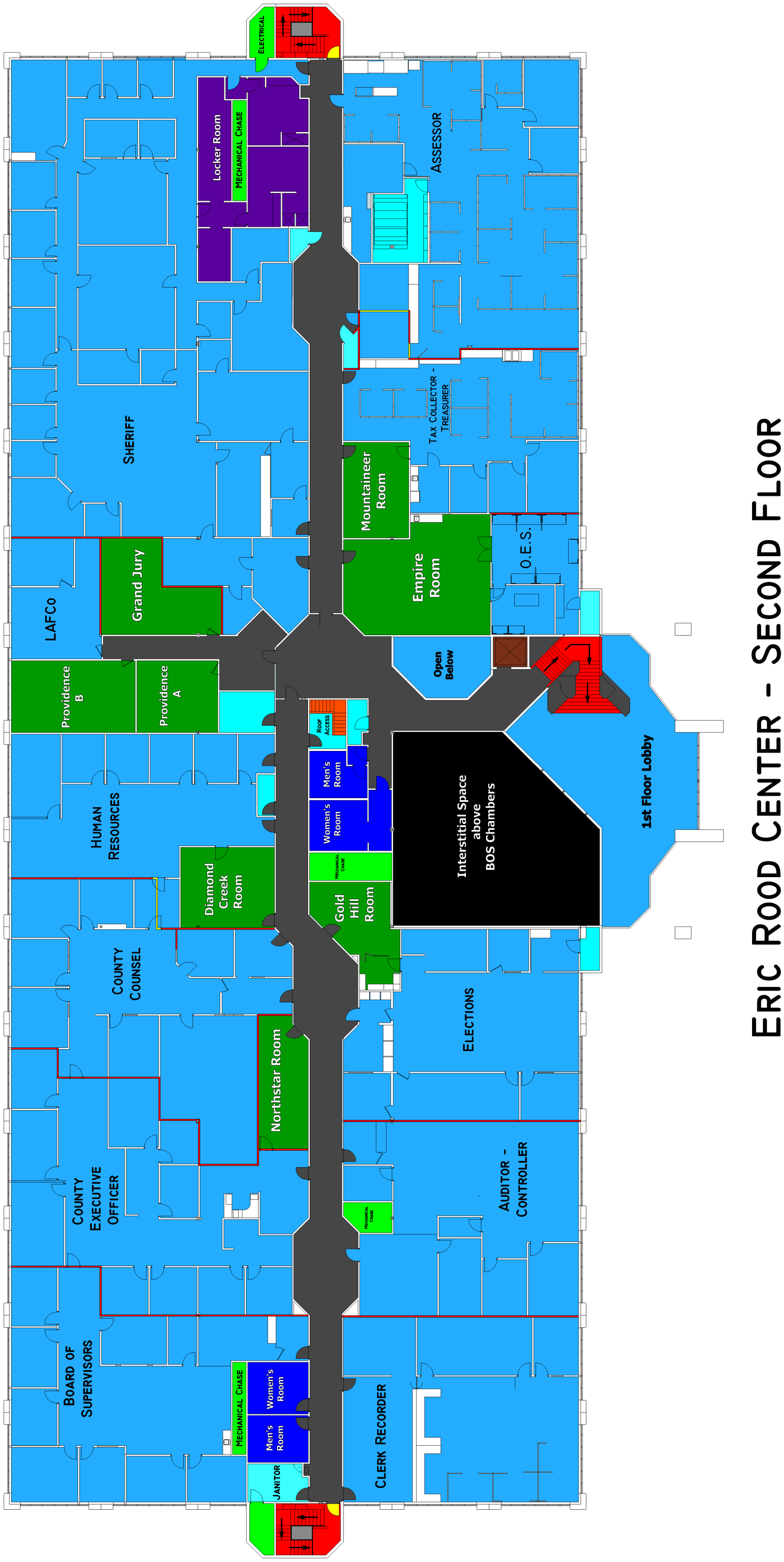

Figure 9: Second Floor diagram with building use colors

<u>Required Number of Exits</u>:

The building has a total occupancy of 1,363 (assuming the higher value). According to both the CBC (Section 1021, Table 1021.3(1)) and the LSC (Section 7.4.1.2), the building has a requirement of 4 exits. The first floor has 6 exits and the second story had access to 3 of those exits. Therefore, there are an adequate number of exits in the building.

<u>Arrangement of Exits & Exit Access</u>:

Section 7.5.1.2 of the LSC states, "***7.5.1.2*** *Corridors shall provide exit access without passing through any intervening rooms other than corridors, lobbies, and other spaces permitted to be open to the corridor…*". Section 1014 of the CBC states a similar concept.

One location where this might be an issue is on the first floor in the cafeteria. A small, hallway that is not marked as an exit, leads from the west corridor, south into the northeast corner of the cafeteria. Both ends of the hallway are serviced via a single-doorway. Once in the cafeteria, the path of egress would then lead south through the east end of the cafeteria and out into the lobby, again, through a single-doorway. This hallway is frequented by staff during day-to-day operations, but it isn't marked as an exit, therefore it is not clear if this arrangement is against the code.

Located on the second floor of each exit stairwell at either end of the building are areas of "rescue assistance" for handicap people. The areas are approximately 40-50 ft^2 and have an evacuation stair-chair mounted in a holder on the wall, along with an intercom/paging system with instructions for use (in English and Brail). The instructions say to press a large red button which notifies a dispatch center of the occupant's location (who in turn notifies the fire department), and continuously pages an intercom located in the west end of the main lobby near the cafeteria until someone answers.

<u>Remoteness of Exits</u>:

By taking into account the occupancy values of each space and the floors as a whole; then taking into account the required number of exits of each space, it appears as if the requirements in Sections 7.5.1.3.1 and 7.5.1.3.3 of the LSC are met throughout the building.

> ***7.5.1.3.1*** *Where more than one exit…is required from a building or portion thereof, such exits…shall be remotely located from each other and be arranged to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition.*
>
> ***7.5.1.3.3*** *In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 9.7, the minimum separation distance between two exits, exit accesses, or exit discharges, measured in accordance with 7.5.1.3.2, shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.*

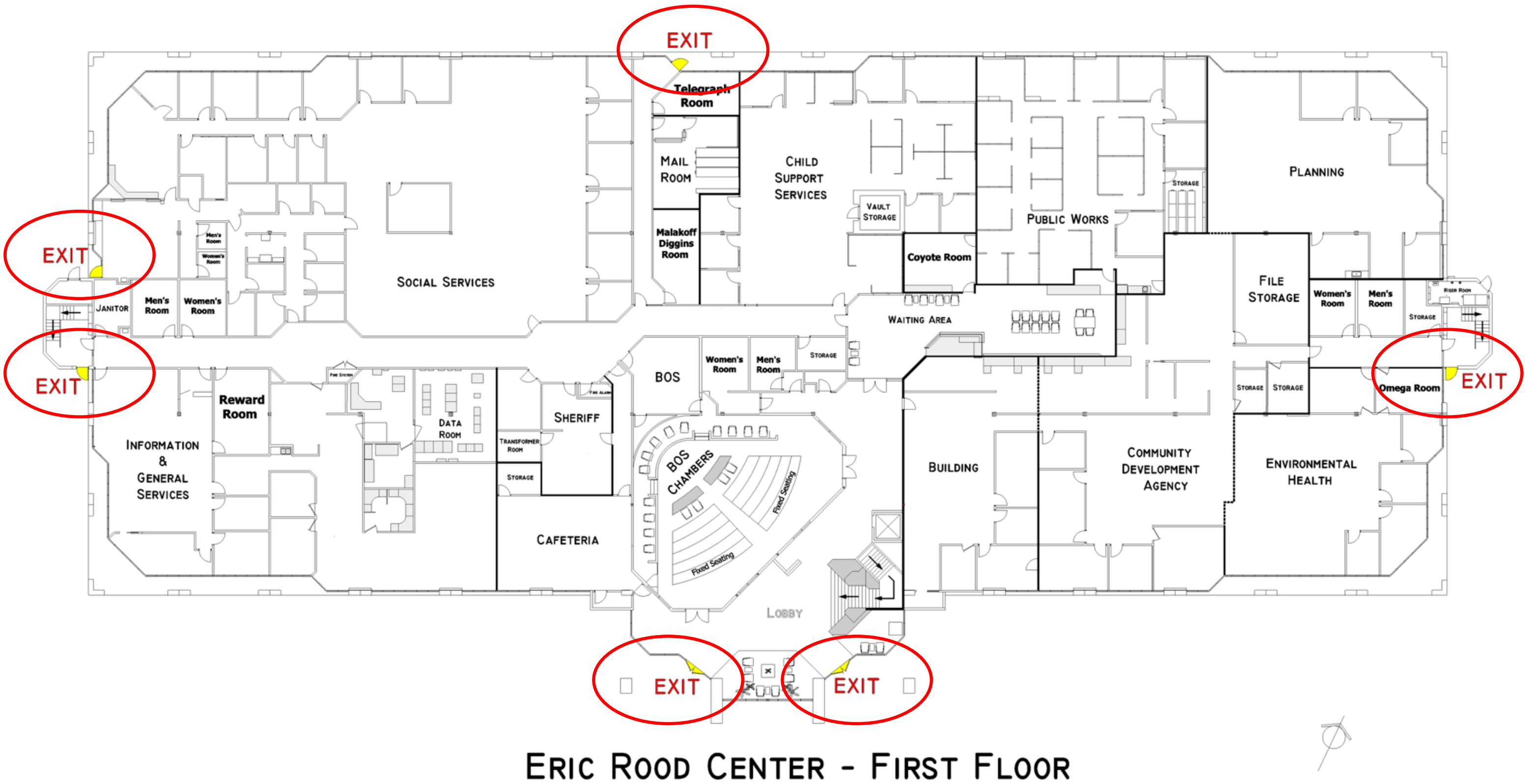

Figure 10: First floor diagram showing locations and remoteness of the exits

<u>Dead Ends</u>:

Section 1018.4 (2) of the CBC and Table A.7.6 of the LSC state that in a building that is sprinklered with a Business occupancy, the length of dead end hallways/corridors has to be less than 50 feet in length. As this building is classified as Mixed Occupancy, to obtain that exception would require the AHJ to again classify the building as Group B – Business. If not, the maximum length of the dead end corridor shall not exceed more than 20 feet.

There is only one "dead end" in the building. It is a corridor located on the second story leading north out of the open-air walkway towards the Grand Jury, two named conference rooms and the LAFCo offices. This corridor was measured and found to be 48 feet in length which is compliant with the code assuming a Group B occupancy.

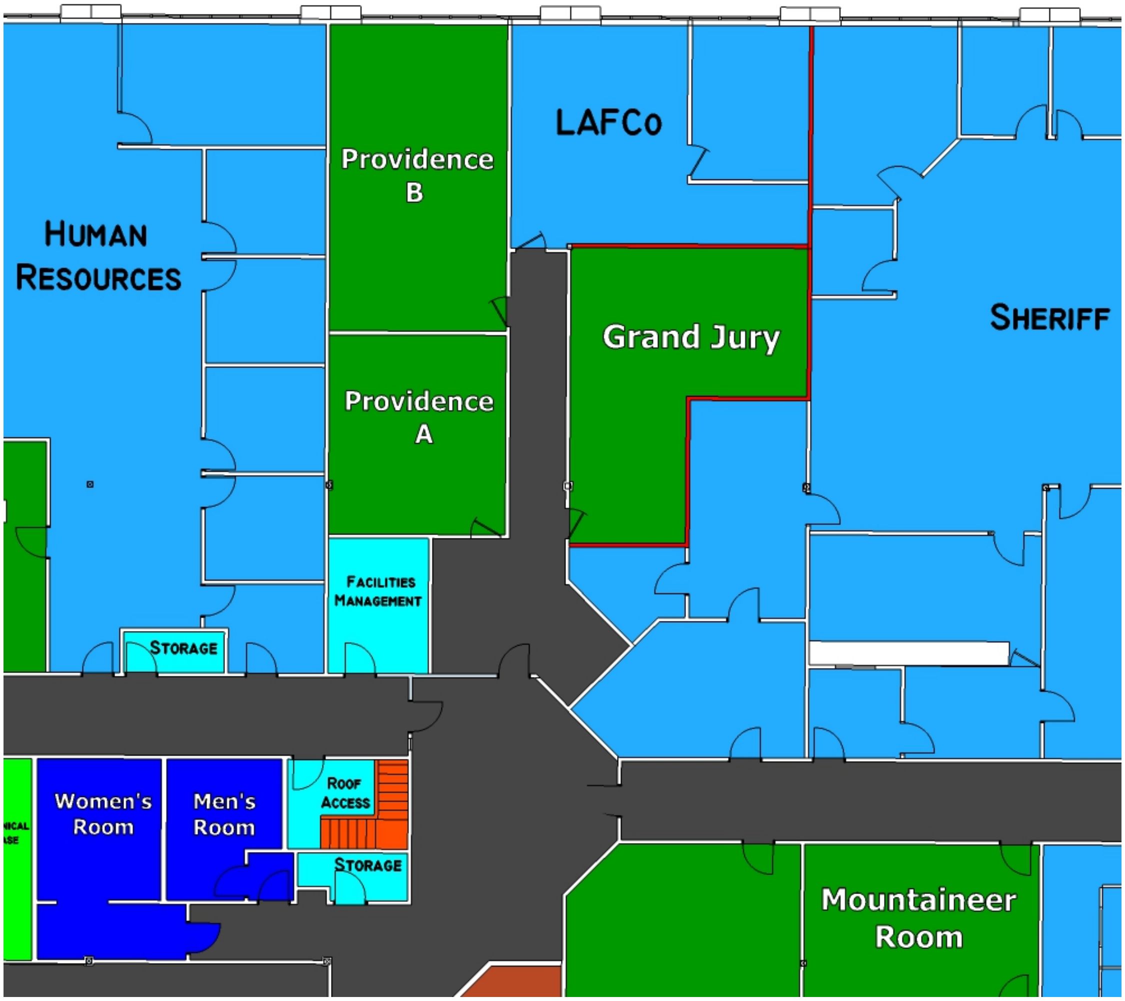

Figure 11: Close-up view of the dead end hallway on the second floor

<u>Travel Distances</u>:

Table 1016.2 in the CBC and Table A.7.6 in the LSC give values for exit travel distance limits. Both tables state that for Assembly occupancies, the maximum travel distance in a sprinklered building is 250 feet, and for Business occupancies, the maximum travel distance in a sprinklered building is 300 feet.

The longest distance anyone would have to travel in a single corridor (assuming other exits were blocked) is only 198 feet, which is well below the two limits.

<u>Exit Discharge</u>:

All exits on the first floor discharge directly out of the building into public areas. These public areas are all handicap accessible and provide people with means to move away from the building safely. The building is surrounded by parking lots on all sides allowing for ample space for people to fill as they exit the building.

<u>Exit Signs</u>:

Every exit within the building has an illuminated exit sign posted above the doorway with the exception of the two front exits in the lobby (which are exceptions according to Section 1011.1 of the CBC and section 7.10.2.1 of the LSC). The signs are white with the letters "EXIT" illuminated in neon green color. The signs have a battery backup installed within. Throughout the corridors, exit signs are posted so that no sign is further than 100 feet from another, complying with Section 1011.1 of the CBC and section 7.10.1.5.2 of the LSC.

In some instances, the exit signs would have a directional indicator on them that would also be illuminated. The directional indicator looked like ">" or "<". In one location, the directional arrow did in fact point to an exit, but did *not* point to the nearest exit. This could potentially be a problem for those not familiar with the building and would rely on the signs for direction. The sign is posted on the first floor just outside of the "File Storage" room in the Community Development Agency (CDA); just west of the eastern exit corridor. The sign's directional indicator pointed to the waiting area of the CDA (west) where someone could then exit via the west corridor (then through the north corridor) or through the main lobby. The shortest path of travel to an exit in that direction was ~200 feet. However, the nearest exit (80 feet away) was in the opposite direction via the eastern stairwell. An image of the sign can be seen in *Figure 12* below.

Figure 12: The exit sign's directional arrow in the CDA pointing away from the nearest exit

Occupants and Pre-Movement Times

Types of Occupants:

This building is a government building with public access during normal business hours (M-F, 8am – 5pm). The building can only be accessed by the public via the two double-doorways at the front of the building. The staff of the building carry identification cards on them at all times which act as their electronic key cards (with exceptions of the Sheriff's department, who know the electronic lock codes for the exterior stairwell doors). The staff are asked to enter the building via the two exit stairwell doors, or the exit on the north side of the building so the electronic lock system can track who is in the building. This also leaves the main entrance more available for the public.

The temporary occupants or guests in the building could range in age from young kids (with their parents) to senior citizens. Most of the people visiting the building are there with a purpose. They head directly to the department they need to visit, conduct their business and then leave the building. Not many people hang out in the building for extended periods of time.

The staff of the building range in age from mid-to-late twenties, to seventies/eighties. The types of mobility could range from complete mobility to handicapped. In case of the latter, handicap access to each exit on the first floor is provided. On the second floor (accessed by an elevator which shuts down in an emergency and returns to ground), areas of rescue assistance (mentioned above) are present in the two exit stairwells.

Figure 13: Staff's cubicle workspaces

Pre-Movement Times/Activities:

The building has its own risk management department which creates emergency evacuation plans. An incident commander (IC) and an alternate are chosen to represent the entire building. Each department has a safety officer and an alternate to represent the staff in the department. Each department has a checklist to follow regarding their procedures in an emergency.

For example, the following is from a checklist in Child Support Services that the safety officer for that department will use to train the other staff in the department:

Emergency Evacuation Checklist

1. Grab cell, glasses, wallet/purse and clip board. *(which this checklist is posted on)*
2. Grab bullhorn and briefcase on cabinet behind Ryan.

3. Knock and notify investigators across the hall *(who may have head phones on for interviews)* during the evacuation process.
4. Evacuate to the Demonstration Garden and take roll call.
5. Report team roll call to safety officer.
6. Stay and wait with team (do not leave the campus or return to the building unless notified to do so). You may be directed to do other duties.

**Remember the safety officer (or other designated individual) is reporting to the Emergency Facilitator. DO NOT take action until the safety officer returns with further instructions.

Each department is trained to grab their personal belongings (cell/purse/glasses, etc.) off their desks and then head out their designated evacuation route. If that route is blocked they use a secondary, then a tertiary route. The safety officer grabs a bright vest, a flag color-coded to their department, a bullhorn and the clipboard. Each clipboard has a full roster of every person in that department, along with two phone numbers for each person, email address, and vehicle information. Once out of the building, the safety officers conduct a roll call, then report to the IC who would be at the front of the building. The IC can assign people to direct traffic and prevent the public from entering the building at the time of the emergency. Once the IC has all of the role calls, they report to the fire department personnel on site.

Figure 14: Safety Officer's Gear & Checklist

While everyone is exiting the building, someone from Facilities Maintenance (usually the supervisor) has the responsibility to check the restrooms, ramps and stairwells. This person is often in the building, as they're in charge of all maintenance in the building. But if they're off-site in their office, they are located in the next building down the street (half a block away) and they're notified immediately by any alarms that are triggered in the building and respond immediately.

Full-occupancy fire drills are conducted twice a year. Additional tests of the fire alarm systems are performed by Facilities Maintenance Staff 4-5 times a year, after hours when the building is empty.

This level of training suggests that the pre-movement time of the employees would be fairly low for those people who work daily in an office environment. Once an alarm sounds, occupants would take some time to determine what was happening, then time to grab their belongings, and then to begin evacuation.

As the public are generally in contact with building staff while inside the building, it is assumed that they'd be notified by the staff (who are familiar with the alarms) what the alarm means and be instructed where to exit. That would help lower their pre-movement times.

In the BOS chambers, the majority of the people in the room would most likely be guests (the public). There would also be building staff present which could announce to people once they hear an alarm that they all need to leave. People in this room who aren't standing, are in a row of fixed chairs similar to a theater with row-exits on each side of the row (10 rows total, 5 deep). In an emergency, they'd have to grab their personal belongings from around their chairs, then wait in a queue to get out of their rows before exiting through one of the two main exits provided with double-doors at the back of the room (or the single door exit at the front of the room).

Overall, the pre-movement times for the building's occupants would be fairly low due to training of the staff and constant interactions of the public with the staff whenever they're in the building.

Required Safe Egress Times (RSET)

The Required Safe Egress Time (RSET) is a measurement of how long it will take the building's occupants to evacuate. To determine the RSET values, the occupancies were divided into departments. The highest occupancy load for each department was used. *Table 7* and *Table 8* below list the movement times calculated from each department, assuming usage of the primary evacuation route. These hand calculations can be seen in APPENDIX C. These values do not include detection or pre-movement delays:

Table 7: First Floor Movement Times

First Floor Location	Time (seconds)
Main Lobby	34
BOS Chambers	62
Cafeteria	122
Waiting Area (CDA)	51
Public Works	115
Planning	148
Environmental Health	145
Community Development Agency	114
Building	80
Child Support Services	170
Dept. of Social Services	147
Information & General Services	**204**
Sheriff's	60
Mail Room & Offices in North Corridor	88

Table 8: Second Floor Movement Times

Second Floor Location	Time (seconds)
BOS Offices	109
CEO Offices	146
Clerk Recorder	69
Auditor/Controller	89
Elections	192
Human Resources	174
County Counsel	137
LAFCo, Grand Jury & Conference Rooms	**293**
Office of Emergency Services	271
Tax Collector – Treasurer	169
Sheriff's	182
Assessor's	137

Located throughout every main exit corridor in the building are trash cans, recycle containers, vending machines, and miscellaneous temporary storage items (benches, racks of computer towers, etc.). These items are most likely placed in the hallways to provide people convenient locations for disposing of their trash and remembering to recycle. These items pose a fire hazard which could potentially block the main exit corridors, and they reduce the width of the corridors which could also cause egress issues.

Summary:

In general, the egress system met code requirements with regards to how many exits the building has, where those exits are located, how far people have to travel to get to them and exit discharge, but it still has some issues with dead ends and exit signs. The exit sign issue is easily fixed by swapping the indicator on a sign to point in a different direction.

While the dead end hallway on the second floor is acceptable to the requirements of the code (assuming a Group B building), the arrangement of the hallway and exit did have issues in the performance based analysis in multiple fire scenarios. These issues are discussed in more depth in Scenarios #2 and #4 as well as in the Comments & Recommendations section.

Overall, there are several different components that make up the building's egress system and ultimately determine what the RSET values will be. One item outside of the egress system that could potentially further lower the RSET values would be the building's alarm system. If the alarm system's detection times can be improved upon, then that would provide the occupants even more time to evacuate as they'll be notified of the fire earlier. The alarm system is discussed thoroughly in the next section.

Alarms

Requirements for the Fire Alarm System:

The 2013 version of NFPA 72 – National Fire Alarm and Signaling Code doesn't have any requirements regarding whether or not a fire alarm system is required.

The 2013 California Building Code requires a Group-B Business occupancy to have a manual fire alarm system installed only if certain conditions exist.

2013 CBC – Chapter 9 – Fire Protection Systems

> **907.2.2 Group B.** A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:
> 1. The combined Group B occupant load of all floors is 500 or more.
> 2. The Group B occupant load is more than 100 persons above or below the lowest level of exit discharge.

3. The fire area contains an ambulatory care facility.
4. *Group B occupancies containing educational facilities, see Section 907.2.2.2.*

The maximum occupancy of the building (~1360 people) was calculated regarding the egress analysis of the building. While this value is considered the maximum occupancy, the actual occupancy is much lower on a day-to-day basis. Therefore, the first condition might be met, but the second condition would certainly be met, thereby making a *manual* fire alarm system a requirement in the building.

The 2012 Life Safety Code (NFPA 101) requires a fire alarm system to be installed if conditions, similar to what was listed in the CBC, exist. However, unlike the CBC, in the LSC, there is no indication of what type of fire alarm system is to be installed.

2012 Life Safety Code – NFPA 101

> **39.3.4.1 General.** A fire alarm system in accordance with Section 9.6 shall be provided in all business occupancies where any one of the following conditions exists:
>
> (1) The building is three or more stories in height.
> (2) The occupancy is subject to 100 or more occupants above or below the level of exit discharge.
> (3) The occupancy is subject to 1000 or more total occupants.

"A required fire alarm system must have initiation means per 38/39.3.4.2." – NFPA 101 Handbook

Since the building is only two stories, the first condition does not apply. However, like mentioned above, on a day-to-day basis, the occupancy of the second floor is subject to 100 or more occupants. Therefore, the second condition does apply which makes the fire alarm system a requirement. Since the system in place was upgraded to a fire alarm system in 2002, the 2000 version of NFPA 101 states roughly the same thing with a change to the first condition stating, "The building is two or more stories in height above the level of exit discharge." So before the system was installed, the first two conditions would have required the installation of a fire alarm system.

According to the NFPA 101 Handbook, if the fire alarm system is required, then the fire alarm system must be initiated in accordance with section 39.3.4.2.

> **39.3.4.2 Initiation.** Initiation of the required fire alarm system shall be by one of the following means:
>
> (1) Manual means in accordance with 9.6.2.1(1)
> (2) Means of an approved automatic fire detection system that complies with 9.6.2.1(2) and provides protection throughout the building
> (3) Means of an approved automatic sprinkler system that complies with 9.6.2.1(3) and provides protection throughout the building

9.6.2.1 Where required by other sections of this *Code*, actuation of the complete fire alarm system shall be initiated by, but shall not be limited to, any or all of the following means:

(1) Manual fire alarm initiation
(2) Automatic detection
(3) Extinguishing system operation

According to the NFPA 101 Handbook, "When the required fire alarm system is initiated by one of the means specified in 38/39.3.4.2, the system must automatically sound a general alarm throughout the building." Therefore, audible notification appliances are required throughout the building and must be installed in accordance with NFPA 72 – Chapter 18.4.

While NFPA 72 does not require visible notification appliances, NFPA 101 does for new systems (not existing systems). Section 9.6.3.6 of the 2000 version of NFPA 101 states, "Notification signals for occupants to evacuate shall be by audible and visible signals in accordance with NFPA 72, *National Fire Alarm Code*, and CABO/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*, or other means of notification acceptable to the authority having jurisdiction shall be provided." Therefore, when the fire alarm system was installed sometime in 2002, it would have been required to install visible notification appliances in accordance with Chapter 18.5 of NFPA 72.

Overview of Fire Alarm Systems:

When the building was originally built, there wasn't a fire alarm system installed. Without the proper records or documentation available, the exact dates of when the first system was installed are unknown. Through interviews of the Facilities Management staff, it was discovered that sometime before 1996 a manually activated system was installed in the building with the intent of only being an "evacuation system." The system had a few pull stations installed in various office departments (near the corridors), and some horns spread throughout the building to notify the occupants of the need to evacuate.

Sometime after the current Facilities Manager started working for the county in 1996, they began to make upgrades to the fire alarm system and contracted with Gray Electric. Again, due to a lack of records or documentation, it's not clear exactly when the items were installed but it is believed to have occurred in March/April of 2002. During the upgrade process, pull stations were added at the exits, additional horns were added along with strobes, horn strobes, photoelectric smoke detectors, and self-closers on the hallway corridor doors. A secondary system was installed in April/May of 2002 to protect the buildings' servers located in the data center on the first floor.

Currently the building is protected by two fire detection and notification alarm systems. The main fire alarm system covers all of the second floor and a majority of the first floor; while a secondary system covers only the data rooms on the first floor.

Both fire alarm systems have their own Fire Alarm Control Panels (FACP). The FACP for the main fire alarm system is located in a locked closet on the first floor, along the south side of the west corridor. A remote annunciator panel for the main system is located on the first floor in the lobby, near the entrance to the cafeteria.

Figure 15: The main FACP, the remote annunciator, and the building's intercom system

The Secondary FACP is located inside one of the server rooms on the first floor. The Secondary FACP reports directly to the Main FACP. The second fire alarm system is linked to an ANSUL/Inergen clean agent dispersal system in the data center and has a completely separate automatic and manual detection system.

Figure 16: The secondary FACP located inside on of the server rooms

The main fire alarm system is a Supervising Station Alarm that is connected by two dedicated phone lines to a monitoring company's central station (located in Cypress, CA). The company that monitors this alarm system is Criticom Monitoring Services (CMS). CMS was contracted to monitor the fire alarm system by Gray Electric, the company that inspects, tests, and maintains the system.

For further detail regarding the layout of the alarm system, please see APPENDIX D.

Fire Alarm System Components:

The FACP connected to the main fire alarm system is an IntelliKnight Model 5820XL Addressable Fire Alarm Control System by Silent Knight (see *Figure 15* above). The previous panel (unknown make/model) was upgraded in December of 2008 after there were communication errors between the previous Main and Secondary FACP's. Inside the Main FACP cabinet are two FIAMM FG20722 12V 7.2Ah back-up batteries and two dedicated phone lines. The panel receives all of the alarm, supervisory, and trouble signals from throughout the building and notifies the monitoring company (CMS) via the two dedicated phone lines.

The main fire alarm system also has a Silent Knight 5860 Remote Annunciator connected in the lobby for remote access to the system (see *Figure 15* above).

The FACP connected to the secondary fire alarm system in the data center is an Autopulse ANSUL IQ-301R Analog Addressable Control Unit installed in 2002 (see *Figure 16* above). Inside the panel are two National (SigmasTek) NB-12 12V 7.5Ah back-up batteries. This FACP has a disable switch located next to it with a key lock designed to temporarily disable the system (for maintenance purposes). The disable switch is monitored by a module connected to the Secondary FACP which will send a trouble alarm to the Main FACP when the switch is turned and the system is disabled.

Fire Alarm Detection Devices:

Main System

The building's main fire alarm system utilizes two different types of automatic fire detection.

The first type of automatic detection that is used is smoke detection. On the first floor of the building there are 16 ceiling-mounted addressable photoelectric smoke detectors (Silent Knight SD 505-APS) tied into the main system (see *Figure 17* below). Nine of the smoke detectors are in the two main corridors, with two additional detectors located in the CDA waiting area. The remaining five smoke detectors are located in five different departments (Building, Community Development Agency, Environmental Health, Planning, and Public Works). That leaves three other departments (Child Support Services, Social Services, and Information & General Services) and the Board of Supervisors Chambers with no smoke detectors.

Figure 17: Photoelectric smoke detector connected to the main fire alarm system

On the second floor of the building there are 23 ceiling-mounted addressable photoelectric smoke detectors (Silent Knight SD 505-APS) (see *Figure 17* above). Twelve of the smoke detectors are in the three main corridors. The remaining eleven detectors are in most of the office departments, just inside the doors from the corridor. Though, the Elections and Tax-Collector/Treasurer departments do not have any smoke detectors installed. Two of the previously mentioned smoke detectors are in the public area entrance and small waiting area at the front of the Sheriff's department. The rear of the Sheriff's department is monitored by 4 older smoke detectors. It is unclear what make/model/type of smoke detectors these are, but they are local detectors, and are not monitored by or connected to the FACP. When asked, nobody had an answer as to why these smoke detectors were present, weren't monitored, and were different from the detectors in the rest of the building. One possibility was that they were installed for additional protection at a lower cost, but that was not confirmed.

The second type of automatic detection that is used in the building is heat detection. While there aren't any actual heat detectors in the building, the building is fully sprinklered and the sprinkler heads act as heat detectors in a way. There are three types of pendant sprinkler heads installed covering the occupied spaces, and one type of upright sprinkler head that is used in the attic spaces. For details on the sprinkler heads, please see the sprinkler section of the report below.

The wet-pipe system has a Notifier WFD-3 water-flow detection alarm installed. The dry-pipe system has two alarms installed; a Potter PS40-2A High/Low pressure switch to monitor the water pressure, and a Potter PS10-2 pressure switch to monitor the air pressure. The water pressure switch trips when there is a rise or decrease in water pressure of 10psi. The air pressure switch trips when the air pressure drops below 25 psig. All three alarms are connected to the Main FACP and will trigger the building's alarm system.

Secondary System

The building's secondary fire alarm system utilizes only one type of automatic fire detection, smoke detection.

While there are no heat detectors in the data center, there are two types of smoke detectors. The rest of the building used primarily photoelectric detectors, but this system includes both photoelectric (Autopulse SDX-551 Analog Addressable Photoelectric Detector) and ionization (Autopulse CPX-551 Analog Addressable Ionization Detector) smoke detectors (see *Figure 18* below). They're located on the ceiling, and underneath the raised floor. Unfortunately, cut sheets for these exact smoke detectors weren't found, however cut sheets for newer models (SDX-751 & CPX-751) were found and included in APPENDIX H.

In order for the clean agent system to be activated by automatic detection, at least two detectors in the data center need to activate, then a 30 second delay will follow before the clean agent will be released into the room. During the 30 second delay, the dispersal can be aborted by pressing an abort button/switch (Autopulse Abort Switch) located near the data center's entry door (see *Figure 19* below). If need be, the system can be manually activated by using a pull station (Autopulse Electric Manual Standard Pull Station IQ-318), located near the data center's entry door (see *Figure 19* below). The manual activation of the system will bypass any delay and immediately disperse the fire suppressant.


Figure 18: Photoelectric smoke detector on the left, Ionization smoke detector on the right connected to the secondary fire alarm system

Figure 19: Emergency intercom system, manual pull station, abort switch in server room

For the layout of the secondary alarm system, see APPENDIX D. For the catalog cut sheets, see APPENDIX H.

Location, Spacing, & Placement of Fire Alarm Detection Devices:

In the previous section it was noted that the detection devices installed in the building are sprinkler heads and smoke detectors (photoelectric and ionization). The requirements regarding the sprinkler heads are listed in NFPA 13 and are covered in the section regarding the building's sprinkler system.

While both the 2013 CBC and the 2012 LSC require a fire alarm system to be installed in the building, both state that a manually-activated system is sufficient. The LSC goes further and states that the fire alarm system can be activated automatically (separately from the sprinkler system) but is not required. Therefore, neither the CBC, nor the LSC require smoke detectors to be installed throughout the building in Group-B occupancies.

In the 2013 version of NFPA 72, there is no general requirement for smoke detectors in the building. Although there is a section that indicates that automatic smoke detection is required at the location of the FACP.

> **10.4.4*** In areas that are not continuously occupied, automatic smoke detection shall be provided at the location of each fire alarm control unit(s), notification appliance circuit power extenders, and supervising station transmitting equipment to provide notification of fire at that location.

This requirement was also present in earlier versions of NFPA 72 with the exception of the 2007 version. That version of the code stated there was an exception if the building was fully sprinklered as seen below:

> **4.4.5* Protection of Fire Alarm System.** In areas that are not continuously occupied, automatic smoke detection shall be provided at the location of each fire alarm control unit(s), notification appliance circuit power extenders, and supervising station transmitting equipment to provide notification of fire at that location.
>
> *Exception No. 1: Where ambient conditions prohibit installation of automatic smoke detection, automatic heat detection shall be permitted.*
>
> *Exception No. 2: Fully sprinklered buildings shall not require protection in accordance with 4.4.5.*

When the Main FACP was originally installed in 2002, a smoke detector would have been required in the same room. However, when the panel was updated in 2008, a smoke detector would not have been required in the same room. After checking with the AHJ, they did not have any records of inspecting the installation or update of the FACP in 2008, nor any indication as to whether or not they would have required the smoke detector near the FACP.

With regards to the spacing of the smoke detectors, in Chapter 17.5.3.3 of NFPA 72 (2013) regarding "Nonrequired Coverage", there is a section that states:

> **17.5.3.3.1** Detection installed for reasons of achieving specific fire safety objectives, but not required by any laws, codes, or standards, shall meet all of the requirements of this Code, with the exception of the prescriptive spacing criteria of Chapter 17.

This section was interpreted to mean there wasn't a smoke detector spacing (or quantity) requirement because smoke detectors weren't required throughout the building. However, directly above that section in the NFPA 72 Handbook is a commentary section that states:

> "Where the building owner or system designer elects to install fire detection systems or components that are not required by the relevant building codes, the systems still must be installed in accordance with the minimum-compliance criteria of this Code."

That statement appears to indicate that because the smoke detectors were installed, they need to be installed properly and need to meet all the requirements of NFPA 72.

As mentioned in a previous section, on the first floor (not counting the data center) there are only 16 smoke detectors protecting ~52,000 ft^2 of office space. That leaves a coverage area of ~3,250ft^2 per detector.

17.7.3.2.3.1* In the absence of specific performance-based design criteria, one of the following requirements shall apply:

(1) The distance between smoke detectors shall not exceed a nominal spacing of 30 ft. (9.1 m) and there shall be detectors within a distance of one-half the nominal spacing, measured at right angles from all walls or partitions extending upward to within the top 15 percent of the ceiling height.

(2) All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the nominal 30 ft. (9.1m) spacing (0.7S).

If the maximum distance between smoke detectors is 30 feet, that would be a maximum coverage area of 900ft^2 per detector, much lower than the 3,250ft^2 previously calculated.

Without taking into consideration the requirements of having to verify that each spot on the ceiling has a detector within 21 feet of it, that would mean that the 52,000ft^2 first floor, divided by 900ft^2 coverage area per detector, would need at least 58 smoke detectors for adequate coverage. Since we didn't take into consideration the rule of having a detector within 21 feet of every spot on the ceiling, 58 smoke detectors would be a low estimate.

The second floor is about the same size (~51,000ft^2) as the first but has 23 smoke detectors spread throughout it (not counting the 4 local smoke detectors). That means each detector has a coverage area of ~2,200ft^2. Like above, if we calculate how many smoke detectors we need base on the maximum coverage area per detector of 900ft^2, then we would need at least 56 smoke detectors for adequate coverage on the second floor.

Analysis of Fire Detector Response:

To determine the expected response characteristics of the fire detection devices, a fire scenario was designed.

Throughout the building, the corridors vary in width from 8 feet wide in the narrower sections, to 16 feet wide in the wider sections (see *Figure 3* above). In a majority of these wider sections, there are several large (~64 gallon) trash and recycling cans for the building occupants/office staff to use. Sometimes as many as 7-8 cans are side-by-side (see *Figure 20* below). One of the cans is usually a plastic lined trash can without a lid, with light combustible material inside. The growth rate of the fire was estimated to be similar to that of a fast t^2 growth rate. For comparison purposes, calculations were also done for a medium t^2 growth rate.


Figure 20: Trash and recycle containers in the second floor west corridor

The smoke detectors were treated as quick response detectors to negate any delay travel lag of the smoke particles entering the detector. To do so, a RTI value of 2 was assumed.

The ceiling height is 9 feet (108 inches). The height of the top of the trash cans is 42 inches. The detector would be 66 inches above the fire.

Table B.4.7.5.3 from NFPA 72 (2013) was used to estimate the average temperature rise before detection. As the trash cans are plastic, both the value of PVC and Polyurethane were used. The temperature rise for both was 7.2°C. With an ambient temperature of 25°C, that would mean the detectors should activate around 32.2°C.

The **medium** fire growth coefficient is α=0.012 kW/s^2
The **fast** fire growth coefficient is α=0.047 kW/s^2

A DETACT spreadsheet was used to do the calculations. Those calculations can be seen in APPENDIX F.

Table 9: DETACT spreadsheet results

Fire Growth Rate	Time to Detector Activation	Heat Release Rate
Medium	38 seconds	17.3 kW
Fast	20 seconds	18.8 kW

Elsewhere in the building (where smoke detectors are lacking), the first automatic detection might come from the sprinkler system rather than a smoke detector.

Fire Alarm Notification Appliances:

Main System
The building's main fire alarm system utilizes various types of bells, horns, strobes, and horn strobes.

Over the years that the system has been in the building, individual items have been added or replaced, and they often don't match previous items that were installed. At the time of this report, there are at least 4 different types of horns, 3 different types of strobes, 4 different types of horn strobes, and 1 bell. Some of the items were fairly new, and some appeared to be over 20 years old.

Table 10: Types of Alarm Notification Devices on the main system

Bell	**Horn**	**Strobe**	**Horn Strobe**
Amseco 10" MBA Series	Faraday 6120	Wheelock RSS-241575W Wall Mounted	Faraday AS-MC-R
–	System Sensor HR	System Sensor SCR Ceiling Mounted	Gentex GES3-24
–	System Sensor H12/24	Gentex GES24-15/75WR	Gentex GEC-24-15/75
–	System Sensor MA12/24D	–	System Sensor P2R

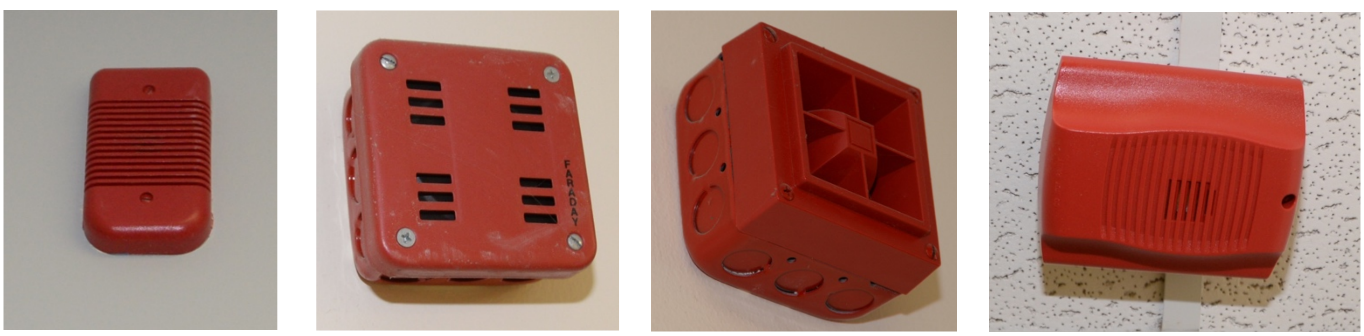

Figure 22: Four types of horns used

Figure 23: Three types of strobes used

Figure 24: Four types of horn strobes used

Secondary System

The fire alarm system in the data center doesn't have as many discrepancies with notification appliances as the main system does. Inside the data center are a single bell, and a single type of horn strobe used to indicate the activation of the clean agent system. The other horn strobes in the data center are connected to the main fire alarm system and don't activate with the secondary system.

Table 11: Types of Alarm Notification Devices on the secondary system

Bell	**Horn Strobe**
System Sensor 6" SSM24-6	System Sensor P2475

Compatible Appliances

A problem that can arise with using various types of notification appliances is that they may not be compatible with the FACP. Inside the manual for the IntelliKnight 5820XL FACP is a list of compatible notification appliances. Table 12 below lists the notification appliances that are found in the building and connected to the main fire alarm system. If the devices are not compatible, the device may not work at the designed capacity, or at all.

Table 12: Compatible and Incompatible Devices

Compatible	**Incompatible**
Faraday 6120 Horn Gentex GES3-24 Horn Strobe Gentex GEC-24-15/75 Horn Strobe System Sensor SCR Strobe System Sensor HR Horn System Sensor P2R Horn Strobe Wheelock RSS-241575W Strobe	Faraday AS-MC-R Horn Strobe System Sensor H12/24 Horn System Sensor SS24M Horn

There can also be a problem resulting from using older (pre-2000) notification appliances. Notification appliances designed before the year 2000 could have been designed for a different minimum voltage than if they were designed after the year 2000 due to changes in UL 1971. An older notification appliance may require a minimum voltage of 18V, but a newer appliance might only need 16V. If an older appliance is connected to a newer FACP, it may not receive the 18V it requires. That might cause the appliance to work in a diminished capacity, or not work at all. Without knowing the results of the system's electrical tests, and what each appliance requires, it is unclear if this is an issue.

Location, Spacing, & Placement of Fire Alarm Notification Appliances:

Vertical Placement of Appliances on Walls

There are two sections in NFPA 72 (2013) that dictate the vertical placement of the notification appliances on a wall, section 18.4 for audible appliances and section 18.5 for visible appliances in public mode. Audible appliances (horns, bells) shall be mounted so the top of the appliances is between 6" below the finished ceiling (BFC), and 90" above the finished floor (AFF). In this building with a 9ft (108 inch) tall ceiling, the area that is acceptable is between 90" and 102" AFF, or 18" to 6" BFC.

> **18.4.8.1** If ceiling heights allow, and unless otherwise permitted by 18.4.8.2 through 18.4.8.5, wall-mounted appliances shall have their tops above the finished floors at heights of not less than 90 in. (2.29 m) and below the finished ceilings at distances of not less than 6 in. (150 mm).
> **18.4.8.2** Ceiling-mounted or recessed appliances shall be permitted.

The locations for visible appliances are a little bit different. Instead of being measured by the top of the appliance, the code requires that the whole lens is within a certain height range. The whole lens can't be below 80" AFF, or more than 96" AFF. In relation to the ceiling, those values are 28" BFC to 12" BFC.

> **18.5.5.1*** Wall-mounted appliances shall be mounted such that the entire lens is not less than 80 in. (2.03 m) and not greater than 96 in. (2.44 m) above the finished floor or at the mounting height specified using the performance-based alternative of 18.5.5.6.

However, when the visual and audible appliances are combined in a horn strobe, the acceptable range is smaller. If for example the appliance is 4" tall, in this building the top of the appliance could be located between 18" and 6" BFC for the audible requirements, and between ~27" to 11" BFC for the visible requirements. Now combining those two requirements, and the acceptable range shrinks to the top of the appliance can be located between 18" and 11" BFC.

By applying these rules to appliances present in the building, it is apparent that there are multiple code violations throughout the building. Several appliances are too close to the ceiling, while others are too low. For example, a horn strobe on the main fire alarm system located in the data center is mounted such that the top of the appliances is only 4.5" below the ceiling. That is too close to the ceiling for both audible and visible requirements.


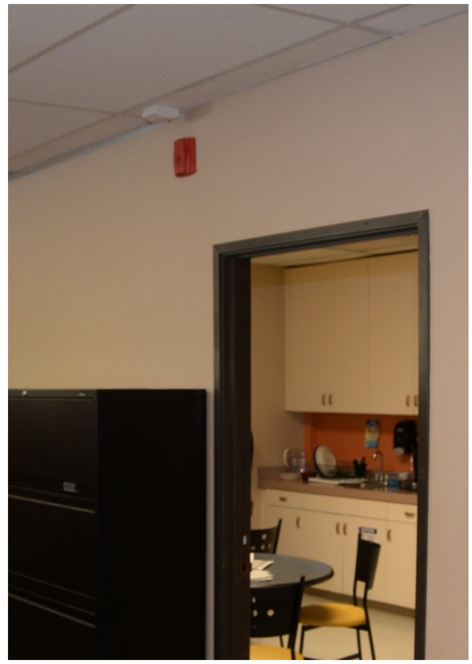

Figure 25: Notification devices installed too low, and too high in the building

<u>Visible Appliances in Corridors</u>
When visible appliances are required in a corridor, an appliance needs to be located no more than 15 feet from each end of the corridor, and they can't be spaced more than 100 feet apart:

> **18.5.5.5.5*** Visible notification appliances shall be located not more than 15 ft. (4.57 m) from the end of the corridor with a separation not greater than 100 ft. (30.5 m) between appliances.

In the building there are only two horn strobes in corridors. One located in the center of the northern corridor on the first floor, and one near the entrance in the northern corridor on the second floor. The corridor on the first floor is 66 feet in length and would require two strobes; one within 15 feet of each end of the corridor. That placement would leave 36 feet between the two which is acceptable. As there is only one horn strobe in the hallway, it does not satisfy the code. The corridor on the second floor is 48 feet in length and requires two strobes; one within 15 feet of each end of the corridor. That placement would leave 18 feet between the two which is acceptable. While the appliance is within 15 feet of one end of the corridor, there would need to be a second one at the other end of the corridor to satisfy the code.

The other much larger corridors are all less than 200 feet in length and require three strobes per corridor. One within 15 feet of each end of the corridor, and one in the center. That would leave at maximum, 85 feet between the appliances, which is acceptable under the code. However, none of the other corridors have any strobes, just one horn per corridor which is a violation of the code.

Number of Audible Appliances

According to NFPA 72, the number of audible appliances in a space is dependent on the size and arrangement of that space. The reason for that is because, according to section A.18.4.3:

> Sound levels can be significantly reduced due to distance and losses through building elements. Every time the distance from the source doubles, the sound level decreases by about 6 decibels (dB).

And according to section 18.4.3.1:

> To ensure that audible public mode signals are clearly heard, unless otherwise permitted by 18.4.3.2 through 18.4.3.5, 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 5 ft. (1.5 m) above the floor in the area required to be served by the system using the A-weighted scale (dBA).

For a Group-B business occupancy, Table A.18.4.3 lists the average ambient sound level at 55 dBA. Therefore, a horn strobe would need to put out a minimum of 70dBA anywhere in the room. The bigger the room, the more decibels the horn has to put out, or the more horns that are required.
While attempting to verify the decibel ratings of the horns in the building, it was determined that none of the horns were labeled with their decibel rating on the exterior of the appliance.

While walking through the building with the alarm technician (from Gray Electric) during a semi-annual test of the system, it was discovered by Mr. Carman that the sound of the alarm is very quiet in several areas of the building. As the building was empty at the time, it was apparent that those areas did not have the audible coverage necessary to satisfy NFPA 72.

To verify the sound levels in each department one would simply need to know the size and shape of the room, and how many horns are planned to go into the room. Since the decibel level decreases by 6 dBA every time the distance from the appliance is doubled, then a quick calculation can determine what decibel rating is required to have at least 70 dBA anywhere in the room.

For example, according to one of the catalog cut sheets, the System Sensor horn in the Planning Department has a decibel rating between 75 dBA and 85 dBA depending on the supplied voltage. If a calculation is done based on the size of the Planning Department, the minimum acceptable decibel rating for the horn can be determined. The room is ~60 feet wide (E/W) and ~40 feet long (N/S) with the horn located in the southwest corner. Since the horn isn't in the center of the west wall, the calculation for the decibel rating would be the same as if the horn was in the center of a wall in a room that was twice the size (N/S). With the longest distance in the room being 60 feet, the math can be worked backwards to see what decibel rating will produce a sound of 70 dBA at 60 feet from the appliance. A horn with a dBA rating of 85 decibels would read 85 dBA at 10 feet from the appliance.

Double that distance and the sound level would be 79 dBA at 20 feet. Double the distance again and it would be 73 dBA at 40 feet. If the distance is doubled again, it would reach 80 feet and another 6 dBA would be lost thus dropping the decibel level to 67 dBA. Since 60 feet is in the middle between 40 and 80 feet, the sound level at that distance would be exactly 70 dBA, thereby satisfying the minimum requirement. Since the System Sensor horn can produce a sound of 85 dBA, the audible coverage in this room would be sufficient. However, if the horn was not able to produce a decibel level at its maximum level of 85 dBA, the sound level at the other end of the room would be too quiet thus violating the code.

While the audible notification coverage is potentially acceptable in the Planning Department, in some locations like the Building department, there isn't a single horn or a horn strobe present which is a violation of the code.

<u>Number of Visible Appliances</u>

According to section 18.5.5.4.1 of NFPA 72:

> Spacing shall be in accordance with either Table 18.5.5.4.1(a) and Figure 18.5.5.4.1, or Table 18.5.5.4.1(b)

Table 18.5.5.4.1(a) lists room spacing for wall-mounted visible appliances, for both one-light or four-light options. The information in the table reads that if there is a 20' x 20' room, only one 15cd strobe is required. However, if there is a 40' x 40' room, four 15cd strobes, or one 60cd strobe would be needed.

The building's cafeteria is ~33' wide (E/W) x 20' long (N/S). To satisfy the number of strobes required in the cafeteria, the number and size of strobes can be varied. If only one strobe was desired, it would need to cover 40' x 40' to cover the length and the width, so a 60cd strobe would be required. If two strobes were desired, the area could be divided into two 20' x 20' sections, both of which could be covered by one 15cd strobe. Inside the cafeteria is a single Faraday AS-MC-R Horn Strobe on the east wall. The horn has a field selectable setting of either 15, 30, 75, or 110cd. Since there is only one strobe in the room, it would need to be at a rating of 75cd or above. In this case, the appliance was set to 110cd, far above the minimum.

While the visible notification coverage is acceptable in the cafeteria, there are some areas of the building that don't have any strobes and violate the requirements of the code. Those areas lacking visual notification coverage are the building, planning, environmental health, and social services departments.

In total there are only 11 horn strobes on the first floor, and 6 strobes (one in each bathroom). The second floor has only 13 horn strobes, and 6 strobes in the bathrooms. That means there are not enough strobes to ensure that every portion the building has at least the minimum level of visual notification coverage.

Data Center

The data center consists of three rooms, totaling just over 1000ft^2 in size. Inside the data center are two horn strobes (15/75cd rating) connected to the main system, one horn strobe (15/75cd rating) connected to the secondary system, and a 6" bell connected to the secondary system. The bell is located in the center of the first room and has an audible rating of 82dBA. By itself, the bell has just enough sound output capacity to cover the minimum requirements based on the room size. However, the bell is also paired with a horn strobe that can output between 75-85dBA, which when combined is more than enough audible notification coverage for the data center. The two horn strobes connected to the main system are located in different rooms within the data center. Each horn strobe is capable of putting out 70-82dBA. Combined, they have enough output capacity to meet the minimum requirements of the code.

The data center's visual notification comes from the same three horn strobes mentioned above. Each 15/75cd horn strobe can only cover an area of 20' x 20'. As the two horn strobes connected to the main system are located in different rooms, the visual notification coverage is different for each. The main room is smaller than 20' x 20' so the coverage provided by one horn strobe is sufficient. The second room is larger at ~21' x 24', therefore a horn strobe larger than 15/75cd would be required to satisfy the code. The third room doesn't have any visual notification in it at all. Even though the light from the first horn strobe would bounce into this room, it wouldn't satisfy the code requirements. The secondary alarm system only has the one horn strobe located in the first room. Since the room is smaller than 20' x 20', the coverage in that room is sufficient; but the coverage in the other two rooms doesn't meet the code requirements.

Emergency Communication System:

While the building doesn't have a typical mass notification system, there is an area of rescue with two-way communication at the top of each stairwell (East/West) (see *Figure 26* below). In each area of rescue is an intercom (AIPHONE NEM-NE-NVP-RA) with a speaker and push button. When the button is pushed for 5 seconds, a signal is sent to the master station (AIPHONE NEM-10) in the lobby and a dispatch center (see *Figure 15* above). The dispatch center immediately contacts the fire department and notifies them of the caller's location. The master station in the lobby beeps until someone answers the call. This system meets the standards for an emergency communication system set out in Section 24.5.3 of NFPA 72.

- **24.5.3.1*** Where required by the building code in force, an area of rescue assistance two-way emergency communications system shall be installed in accordance with 24.5.3.
- **24.5.3.2** The area of refuge (rescue assistance) emergency communications system shall be comprised of remotely located area of refuge stations and a central control point.
- **24.5.3.3** The remote area of refuge stations and the central control point shall communicate with each other.

- **24.5.3.4*** If the central control point is not constantly attended, it shall have a timed automatic communications capability to connect with a constantly attended monitoring location acceptable to the authority having jurisdiction where responsible personnel can initiate the appropriate response.

Figure 26: Emergency intercom system located at the top of the east stairwell

Another emergency communications system is located in the data center. A Viking E-1600a Emergency Phone system is located next to the pull station and abort button for the ANSUL system (see *Figure 19* below). When the button on the phone is pressed it begins dialing a sequence of numbers. First three numbers are dialed people associated with the Information & General Services Department (which manages the data center and is directly outside of the sever rooms). If there is no answer after three rings, it calls the Sheriff's Dispatch. If again there is no answer after three rings, it calls 911. Whomever answer hears a recorded message with the caller's location. If they person answering presses the asterisk key (*), they are connected with the person in the data center. This system also meets the code requirements.

Secondary Power Requirements:

Each FACP in the building is required by NFPA 72 to have backup power sources to maintain the fire alarm systems in the event of a power outage. The Main FACP has two 7.2-amp hour (Ah) batteries, while the Secondary FACP has two 7.5 Ah batteries. Section 10.6.7.2.1 of NFPA 72 (2013) states, "The secondary power supply shall have sufficient capacity to operate the system under quiescent load (system operating in a nonalarm condition) for a minimum of 24 hours and, at the end of that period, shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes…"Some of the notification appliances cut sheets didn't have complete data, or exact catalog cut sheet were not available. In those cases, either cut sheets from similar devices were used, or values were estimated based on similar devices.

Table 13: Voltage Loss Calculations Main Fire Alarm System – Floor 1

Type of Device	Item #	Device	Quantity	Standby Current Per Appliance (Amps)	Total Standby Current (Amps)	Alarm Current Per Appliance (Amps)	Total Alarm Current (Amps)
Pull Station - 16	1	Silent Knight SD500-PS	16	0.00055	0.0088	0.00055	0.0088
Smoke Detector – 16	2	Silent Knight SD505-APS	16	0.00055	0.0088	0.00055	0.0088
Strobe - 6	3	RSS-241575W	4	None	None	0.09	0.36
	4	Gentex GES24 15/75	2	None	None	0.063	0.126
Horn - 8	5	System Sensor HR	4	None	None	0.058	0.232
	6	System Sensor H12/24	2	None	None	0.038	0.076
	7	System Sensor MA12/24D	1	None	None	0.075	0.075
	8	Faraday 6120 Horn	1	None	None	0.35	0.35
Horn Strobe - 11	9	Gentex GEC 15/75	3	None	None	0.063	0.189
	10	Faraday AS-MC-R	3	None	None	0.8	2.4
	11	System Sensor P2475	2	None	None	0.164	0.328
	12	System Sensor P2R	3	None	None	0.08	0.24
Bell - 1	13	Amseco MBA Series	1	None	None	0.023	0.023
				Total=	**0.0176**	Total=	**4.4166**

*These values are estimations/approximations based on information from catalog cut sheets

5 minutes = 0.0833 hours
4.4166 amps X 0.0833 hours alarm = **0.37 Amp Hours**
0.0176 amps X 24 hours standby = **0.42 Amp Hours**

Table 14: Voltage Loss Calculations Main Fire Alarm System – Floor 2

Type of Device	Item #	Device	Quantity	Standby Current Per Appliance (Amps)	Total Standby Current (Amps)	Alarm Current Per Appliance (Amps)	Total Alarm Current (Amps)
Pull Station - 10	1	Silent Knight SD500-PS	9	0.00055	0.00495	0.00055	0.00495
	2	Faraday F1GT	1	None	None	0.0006	0.0006
Smoke Detector - 23	3	Silent Knight SD505-APS	23	0.00055	0.01265	0.00055	0.01265
Strobe - 6	4	RSS-241575W	6	None	None	0.09	0.54
Horn - 8	5	System Sensor HR	5	None	None	0.058	0.29
	6	System Sensor H12/24	1	None	None	0.038	0.038
	7	System Sensor MA12/24D	1	None	None	0.075	0.075
	8	Faraday 6120 Horn	1	None	None	0.35	0.35
Horn Strobe - 13	9	Gentex GEC 15/75	3	None	None	0.063	0.189
	10	Faraday AS-MC-R	3	None	None	0.8	2.4
	11	System Sensor P2475	2	None	None	0.164	0.328
	12	System Sensor P2R	5	None	None	0.08	0.4
				Total=	**0.0176**	Total=	**4.6282**

*These values are estimations/approximations based on information from catalog cut sheets

5 minutes = 0.0833 hours
4.6282 amps X 0.0833 hours alarm = **0.39 Amp Hours**
0.0176 amps X 24 hours standby = **0.42 Amp Hours**

In total, both floors have a combined alarm requirement of 0.76Ah and a combined standby requirement of 0.84Ah. There are two 7.2Ah batteries in the panel which have more than enough power to cover the requirements.

Inspection, Testing and Maintenance:

Chapter 14 of NFPA 72 (2013) details the requirements for inspection, testing, and maintenance of the fire alarm systems in the building. The Facilities Department of the Nevada County Government contracted with two companies to perform all of the inspection, testing, and maintenance of the fire alarm systems in the building which is allowed under section 14.2.3.3 of NFPA 72. Gray Electric is contracted with regards to the main fire alarm system, while Sentinel Fire Equipment Company is contracted with regards to the secondary fire alarm system (ANSUL/Inergen).

According to the requirements of Chapter 14 of NFPA 72, the contracted companies are required to have a plan for inspection, testing, and maintenance of the fire alarm system and to carry out that plan.

Inspections

Section 14.3 of NFPA 72 pertains to the Inspection of the fire alarm systems. Section 14.3.1 states that "…visual inspections shall be performed in accordance with the schedules in Table 14.3.1 or more often if required by the AHJ." The portions of "Table 14.3.1 Visual Inspection" that apply to the Rood Center can be found in the table below:

Table 15: Visual Inspection Schedule

Component(s)	Frequency of Visual Inspection
All equipment	Annually
Control equipment (Systems monitored for alarm, supervisory and trouble signals like Fuses, Interfaced Equipment, Lamps and LED's, and the Main Power Supply)	Annually (Trouble Signals are Semi-Annually)
Batteries (Lead Acid)	Monthly
Remote Annunciators	Semi-Annually
Manual Fire Alarm Pull Stations	Semi-Annually
Smoke Detectors	Semi-Annually
Supervisory Signal Devices	Quarterly
Waterflow Devices	Quarterly
Audible Appliances	Semi-Annually
Visible Appliances	Semi-Annually
Area of Rescue Two-Way Communication System	Annually

Testing
Section 14.4 of NFPA 72 pertains to the Testing of the fire alarm systems. Section 14.4.3.2 states "Systems and associated equipment shall be tested according to Table 14.4.3.2." The portions of "Table 14.4.3.2 Testing" that apply to the Rood Center can be found in the table below:

Table 16: Testing Schedule

Component(s)	**Frequency of Visual Inspection**
All equipment	See Table 14.3.1 (Annually)
Control equipment (Fuses, Interfaced Equipment, Lamps and LED's, and the Main Power Supply)	Annually
Fire Alarm Control Unit Trouble Signals	Annually
Transmission Equipment	Annually
Emergency Communications Equipment	Annually
Secondary Power Supply	Annually
Lead Acid Batteries Replacement	Annually
Lead Acid Batteries Charger/Discharge	Annually
Lead Acid Batteries Load Voltage	Semi-Annually
Lead Acid Batteries Specific Gravity	Semi-Annually
Remote Annunciators	Annually
System's Conductors	Annually
Electromechanical Releasing Device (Fusible Links)	Annually
Fire Suppression Systems	Annually
Manual Fire Alarm Pull Stations	Annually
Smoke Detectors Functional Test	Annually
Supervisory Signal Devices (High-low air pressure switch)	Annually
Waterflow Devices	Semi-Annually
Abort Switch	Annually
Audible Appliances	Annually
Visible Appliances	Annually
Area of Rescue Two-Way Communication System	Annually

Maintenance
Section 14.5 of NFPA 72 pertains to the Maintenance of the fire alarm systems. Section 14.5.1 states "System equipment shall be maintained in accordance with the manufacturer's published instructions." The frequency of the maintenance is also referred back to the manufacturer's published instructions in Section 14.5.2.

Records
The building owner or contracted companies are required to maintain all records in accordance with Chapter 7 and Section 14.6.

7.7.1.1 A complete record of the tests and operations of each system shall be kept until the next test and for 1 year thereafter unless more stringent requirements are required elsewhere in this Code.
7.7.1.4 Required documents regarding system design and function shall be maintained for the life of the system.
7.7.1.5 Revisions and alterations to systems shall be recorded and records maintained with the original system design documents.

14.6.1.1 A set of reproducible as-built installation drawings, operation and maintenance manuals, and a written sequence of operation shall be provided to the building owner or the owner's designated representative.
14.6.2.1 Records shall be retained until the next test and for 1 year thereafter.
14.6.2.4* A record of all inspections, testing, and maintenance shall be provided in accordance with 7.8.2.

When asked, the Facilities Department staff stated that they didn't have copies of the as-built installation diagrams or any paperwork/records associated with the inspection, testing or maintenance of the systems. They recommended following up with both Gray Electric and Sentinel Fire Equipment Company.

Follow-up with Gray Electric determined that they don't have copies of the as-built installation diagrams for the main portion of the fire alarm system. They also didn't have any records regarding the upgrades done to the system (Main FACP, notification appliances, or detection devices). The only records they had indicated when one of their technicians visited the building for a semi-annual inspection, but not what the details of that inspection included, nor the results of the inspection.

Sentinel Fire Equipment Company had copies of the as-built installation diagrams for the secondary alarm system, Inergen Clean Agent flow calculations, as well as the battery and notification line loss calculations stored on site in the building. They also had records regarding their semi-annual inspections of the secondary fire alarm system. Please see APPENDIX E for the installation diagrams and documents for the secondary system.

The Nevada City Fire Department (AHJ) was also contacted and asked what, if any, records they had regarding the fire alarm system. They stated that they didn't have any copies of the as-built diagrams or any other installation documents. Nor did they have any copies of any inspection, testing, maintenance or repair work done on the fire alarm system. When asked what information they did have, the AHJ stated that the work was done before their time, they really don't know much about the fire alarm system, and that they don't have any information pertaining to it.

Summary:

Overall the alarm system was pieced together over the years starting as just a manual system with a few pull stations and a few notification devices. Additional notification devices were added along with detection devices transforming the system into an automatic alarm system. The building's water suppression system also acts as an automatic detection device with the use of water flow alarms which will be discussed in the next section. As the alarm system was added onto, it doesn't appear that checks were done to ensure compatibility between devices, or if there were enough devices installed, or if the devices that were installed were in the correct locations. There are multiple issues with the primary alarm system on all fronts. The secondary system located in the data center is on the other end of the spectrum as it meets all of the requirements of the code. Further discussion of the issues associated with the alarm system can be found in the Comments & Recommendations section.

Sprinklers

System Overview

An automatic sprinkler system was installed when the building was built in 1985-1986. The applicable code at the time regarding the sprinkler systems would have been the 1983 edition of NFPA 13. The building is protected by both a wet-pipe and a dry-pipe system. The wet-pipe system protects the building's internal occupied spaces as well as the second floor's attic. The dry-pipe system protects the mansard roof, the lobby, and the exterior eaves. The riser room is a cement-lined room located on the first floor, east side of the building and contains the risers for both the wet and dry-pipe sprinkler systems. The pump room is separate from the main building located across the east side of the parking lot. It is a cement-lined room with a ceiling mounted space heater and contains a fire pump, pump controller, jockey pump, and a water booster system for the potable water.

Water Supply

The water supply for the building is supplied via a large storage tank located on a hill above the building to the northeast. The cylindrical tank is 99 feet in diameter by 22 feet tall and holds 1,380,000 gallons of water. The tank is supplied by the Nevada City water mains. The water is gravity fed through 14" then 10" Ductile Iron pipes into the pump room.

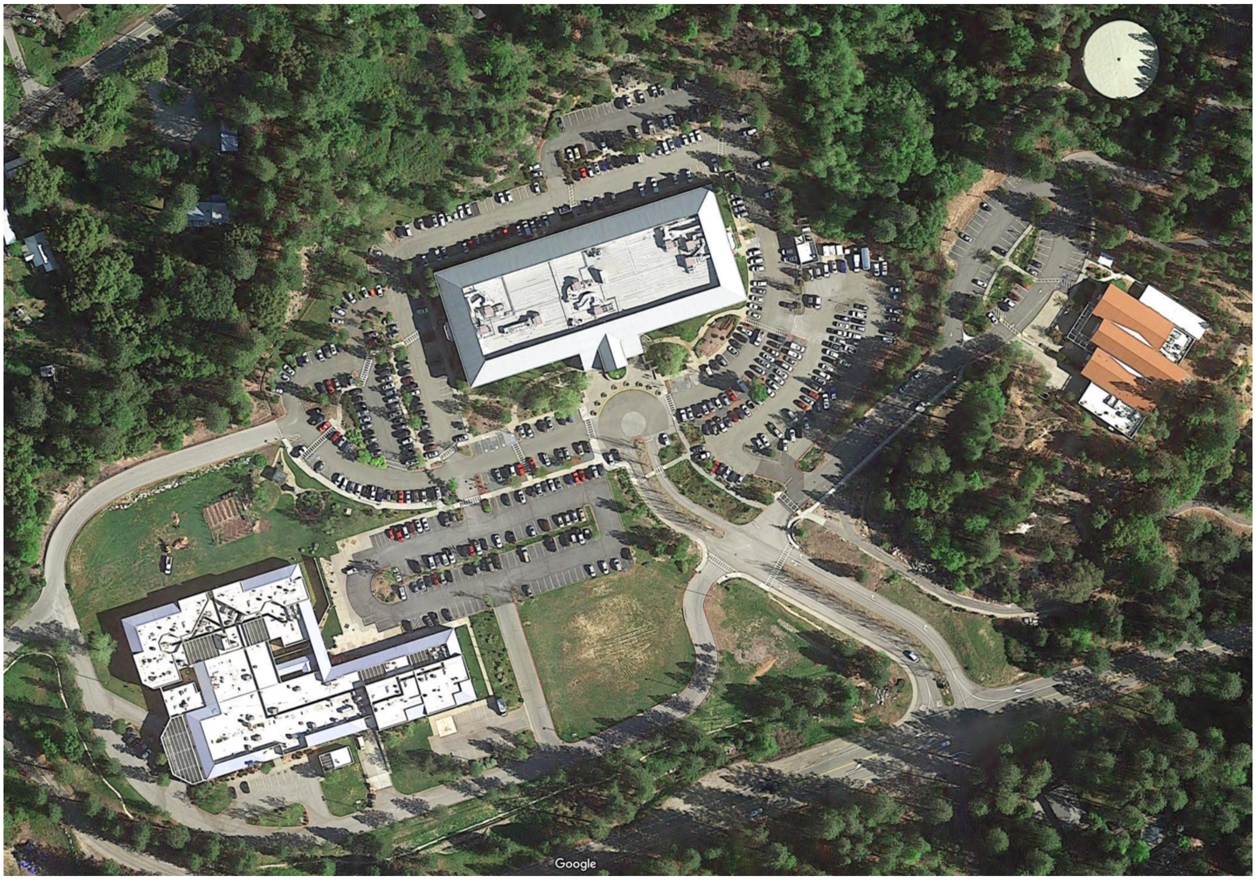

Figure 27: Google Maps overview of the Rood Center. To the top right of the photo is the water supply tank, to the right is the public library, and to the left is the county jail. The pump house is located across the parking lot from the right side of the rood center.

Once in the pump room, the water enters a split case, motor driven, centrifugal fire pump:

Patterson Fire Pump
Model # 8x6 MI
GPM: 1500
PISG: 70

The water pressure coming out of the fire pump is maintained at 100 psi by a Jockey Pump:

Grundfos
Model #CP3-40KU
GPM: 24
PSIG: 65

The fire pump provides water pressure to hydrants and several buildings on the property; including the Rood Center, the Nevada County Jail, and the Nevada County Public Library (see *Figure 27* above).

On the exterior of the pump room, the water pipe for the Rood Center runs through a backflow preventer (two gate valves, two check valves), and a post indicator valve (PIV).

Then runs underneath the parking lot (towards the west) where it comes up through the 4" concrete slab in the riser room.

According to the original hydraulic calculations (APPENDIX O), dated 4/26/1986:

Static Pressure	=	122.00 psi
Residual Pressure	=	74.00 psi
Flow	=	1500 gpm

**A hydrant flow test was done by the Nevada City Fire Department in 1993 which showed slightly lower numbers, but as the system was designed using the above numbers, those are the ones that will be referenced in this report.*

There is a fire department connection located in the parking lot on the north side of the building near a fire hydrant. The FDC is a 4" diameter stand-alone pipe with two connection ports, 2 ½" in diameter. A secondary fire department connection is located on the exterior of the pump room's west wall. This FDC is approximately 10" in diameter and sticks out of the wall with 8 separate connection ports on it (octopus), 2 of which were plugged. The remaining 6 ports are 2 ½" in diameter with a single globe valve controlling each port.

Refer to APPENDIX I for the Underground Water Supply Drawing.

Automatic Sprinkler System Design

The sprinkler system design criteria for the wet pipe and dry pipe systems are as follows:

Wet Pipe
Occupancy Hazard Classification = Light Hazard
Density = 0.10 gpm/ft^2
Area of Operation: 1500 ft^2
Number of Sprinklers: 14 most remote/demanding
Sprinkler Protection Coverage Area: Max coverage area is 130ft^2/sprinkler
K-Value: 5.6
Hose Stream Allowance: 100 gpm
Water Supply Duration: 30 minutes

The sprinkler system on the first floor is primarily a gridded system with some tree system components. The sprinkler system on the second floor is a tree system. The 14 most hydraulically remote sprinklers were located on the west end of the second floor.

Dry Pipe
Occupancy Hazard Classification = Light Hazard
Density = 0.10 gpm/ft^2
Area of Operation: 1950 ft^2 (30% increase due to inherent delays in response times)

Number of Sprinklers: 14 most remote/demanding
Sprinkler Protection Coverage Area: Max coverage area is 130ft^2/sprinkler
K-Value: 5.6
Hose Stream Allowance: 100 gpm
Water Supply Duration: 30 minutes

The dry pipe sprinkler system in the lobby and mansard is a loop system. The 14 most hydraulically remote sprinklers were located on the south end of the building, above the center and western portions of the lobby.

Sprinkler System Components

The water enters the building in a 4" ductile iron pipe as it comes up through the slab in the riser room on the east side of the building. The water travels up through a 4" T-valve where it splits to the wet pipe and dry pipe systems.

Wet Pipe
Once in the riser room, the wet pipe system rises up through a butterfly valve and water flow alarm valve. The water continues up through the ceiling, through the second story electrical room, and then up into the attic above the second story. In the attic, the top of the riser meets the feed main which travels west through the building. The feed main has six cross mains (3 on each side) and approximately eight branch lines (4 on each side) coming off of it.

The westernmost cross main (on the south side of the feed main) has twelve branch lines (6 on each side). Between the second and third branch line, the cross main is redirected around an air handler before returning to its original path.

Each branch line is connected to the cross main via a riser nipple with a one-foot rise. The branch lines have T-valves in them with a sprig going up to an upright sprinkler. At the base of the sprig is a second T-valve that feeds a drop to a pendant sprinkler. The upright sprinklers cover the attic, while the drop sprinklers penetrate the drop ceilings and cover the office spaces below. Each branch line has eight upright and eight pendant sprinklers on it.

The southernmost branch lines have 6 additional sprinklers on each line. These additional sprinklers are connected to the branch line via T-valves, and a sprig. The pipe travels vertically, then horizontally through the exterior wall into the mansard. The sprinkler plans indicate that the additional sprinklers are upright, but that was not visually confirmed. Due to these additional sprinklers being located in the mansard, they would be less likely to be involved in a fire; therefore, they were left out of the hydraulic calculations which determined the most remote sprinklers.

Riser:	3" SCH 10 black steel C=120
Feed Main:	3" SCH 10 black steel C=120

Cross Main: 2.5” SCH 10 black steel C=120
Riser Nipple: 1.5” SCH 40 black steel C=120
Branch Line: 1” – 1.5” SCH 40 black steel C=120
Sprigs: 1” – 1.5” SCH 40 black steel C=120
Drops: 1” – 1.5” SCH 40 black steel C=120

Dry Pipe
Once in the riser room, the dry pipe system rises up through a butterfly valve and into the dry pipe valve. The dry pipe valve has an air compressor hooked up to keep a pressure of 32 psi inside the valve. The dry pipe valve is also equipped with low pressure alarm (25 psi) and an accelerator which is designed to trip at 18 psi. Above the dry pipe valve is a water flow alarm valve. From there the water rises through the first and second stories into the attic above. At that location the feed main travels west across one intersection and tees into another. The feed main branches off at those two intersections and travels around the length of the building in the mansard roof as two loops. On the opposite end of the loop, the two feed main loops are connected by 2” diameter pipe. On the south side of the building, above the lobby, there are two cross mains and two branch lines which come off the outermost loop. The most remote sprinklers are located above the lobby on the southwest side.

Dry Pipe Valve: 4”
Riser: 3” SCH 10 black steel C=120
Feed Main:
Outer Loop: 2” SCH 40 black steel C=100
Inner Loop: 1.5” SCH 40 black steel C=100
Cross Main: 1.25” – 1.5” SCH 40 black steel C=100
Branch Line: 1” – 1.25” SCH 40 black steel C=100

Three types of sprinklers were installed with the original system; two different types of pendant sprinklers protecting the occupied spaces, and one type of upright sprinkler head that is used in the attic spaces.

Upright:
GEM Automatic Sprinkler
Model F950 Fusible Solder Type (1986)
458a SSU-3
Orifice = ½”
K = 5.6
Temperature Rating = 212°F / 100°C

Pendant:
1) GEM Automatic Sprinkler
Model F950 Fusible Solder Type (1986)
458a SSP-3
Orifice = ½”
K = 5.6

Temperature Rating = 212°F / 100°C

2) Central Sprinkler Corporation
Model "H" Fusible Center Strut (1986)
804a SSP-52
Orifice = ½"
K = 5.6
Temperature Rating = 165°F / 73°C

Starting in 1990, and continuing throughout the years, tenant improvements were done and a third type of pendant sprinkler was added.

Pendant:

3) Viking Micromatic Sprinkler
Model M – Glass Bulb
589a
Orifice = ½"
K = 5.6
Temperature Rating = 155°F / 68°C

See APPENDIX L for data sheets of the system components and APPENDIX J for the original sprinkler system layouts.

Hydraulic Calculations

When the system was first designed, the sprinkler contractors did hydraulic calculations for the first floor, the second floor, and the mansard. Their results are as follows:

Table 17: Original Hydraulic Calculation Results

System Location	Total Flow (No HSA)	Total Pressure
First Floor	189.77 gpm	95.97 psi
Second Floor	**291.76 gpm**	101.71 psi
Mansard	262.87 gpm	**109.07 psi**

The most demanding flow was located on the second floor, while the most demanding pressure was located in the mansard. The most likely location where a fire might potentially overwhelm the system would be inside the occupied space of the building and not in the mansard. Therefore, hand calculations were done for the second floor back to the base of the riser, then back to the fire pump.

The 14 most remote sprinklers were labeled 101 – 114 on the original sprinkler plans and calculation sheets, so that is how they'll be referred to in this report. The layout of the most remote sprinklers can be seen in *Figure 6* below.

The required area of coverage was 1500 ft^2 with a maximum protection coverage area of 130 ft^2 per sprinkler. The actual coverage area (indicated by the dashed line) is 1624 ft^2.

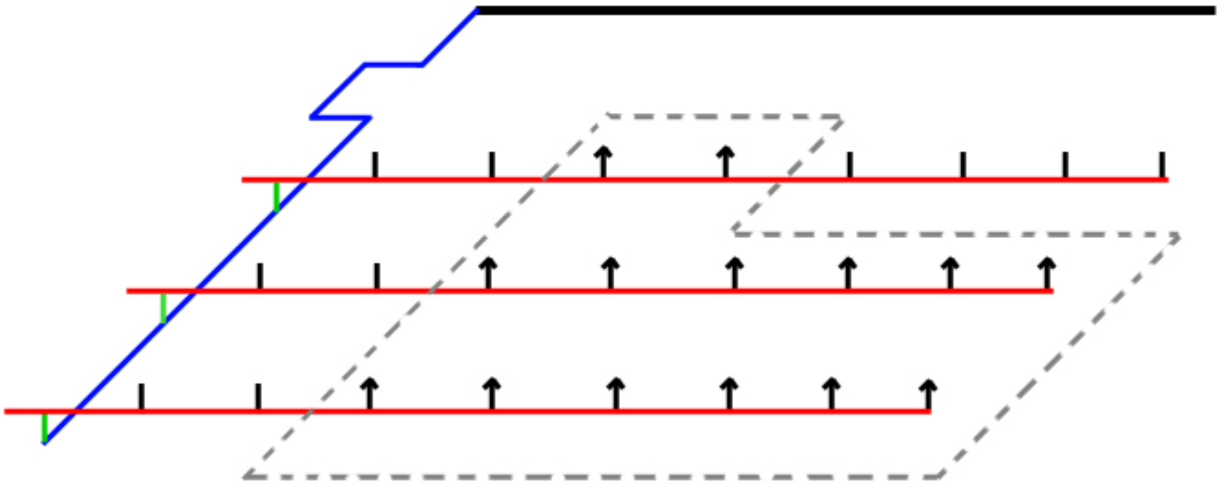

Figure 28: Basic Layout of the Most Remote Sprinklers

The sprinklers in the above diagram are numbered as follows:

#101 #104
#102 #105 #107 #109 #111 #113
#103 #106 #108 #110 #112 #114

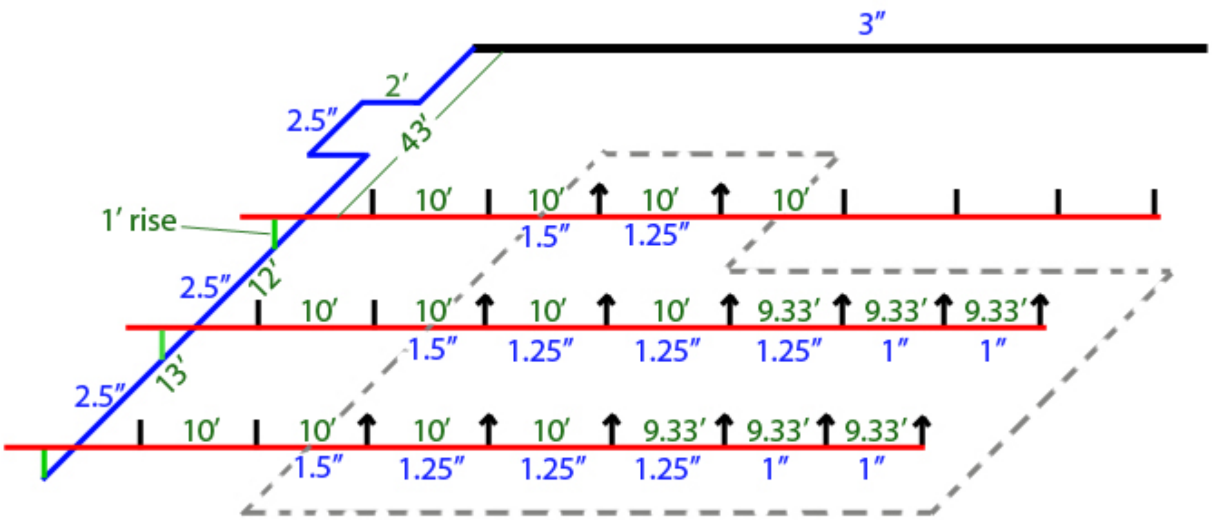

Figure 29: Layout of the most Remote Sprinklers with pipe diameters and distances

The blue numbers indicate pipe diameters in inches, the green numbers indicate distances in feet.

The maximum protection coverage area was calculated for each individual sprinkler indicated in the diagrams above. The calculations were done based on the formula from section 8.5.2.1.1 of NFPA 13 (2013):

$$A_s = L \times S$$

Where L is the distance between branch lines, and S is the distance between the sprinklers along the branch lines.

Table 18: Maximum Protection Coverage Area for Individual Sprinklers

Sprinkler	**L** (feet)	**S** (feet)	**A_S** (ft^2)	**Density** (gpm/ft^2)	**Flow (Q)** (gpm)
101	12	10	120	0.10	12.0
102	13	10	130	0.10	13.0
103	13	10	130	0.10	13.0
104	12	10	120	0.10	12.0
105	13	10	130	0.10	13.0
106	13	10	130	0.10	13.0
107	13	10	130	0.10	13.0
108	13	10	130	0.10	13.0
109	13	9.33	121.3	0.10	12.1
110	13	9.33	121.3	0.10	12.1
111	13	9.33	121.3	0.10	12.1
112	13	9.33	121.3	0.10	12.1
113	13	9.33	121.3	0.10	12.1
114	13	9.33	121.3	0.10	12.1
		Total	**1,748**		

The required coverage area was 1500 ft^2, the actual coverage area was 1624 ft^2, while the calculated coverage area for all the sprinklers was 1,748 ft^2. The maximum spacing between sprinklers was 130 ft^2, and the average spacing is only 124.8 ft^2.

Table 19: Hand Calculations vs. Original Calculations

	Hand Calculations		**Original Calculations**	
Sprinkler Demand Location	**Flow** (gpm)	**Pressure** (psi)	**Flow** (gpm)	**Pressure** (psi)
Most Remote Sprinkler (#114)	12.1	4.7	14.7	7.0
Base of Riser (BOR)	313.5	123.8	291.8	94.7
Fire Pump	313.5	131.8	291.8	101.7

See APPENDIX M for the hydraulic calculations done by hand, and APPENDIX O for the original hydraulic calculations.

There are a few things that could account for the differences in the calculations. One of which is that there have been tenant improvements since the original installation. For example, a section of the Cross Main feeding the most remote sprinklers was moved and rerouted to accommodate an air handler, which would increase the calculated demand. Also, when following the calculations from the most remote sprinkler back to the pump, several of the equivalent lengths for fittings didn't match up to what was seen on site. That could be due to the system having been changed since it was originally designed, or the individuals doing the calculations somehow over looked those items.

Based on the hydraulic graph (see *Figure 30* below), the water supply, in conjunction with the fire pump, is more than adequate for this system and the hose stream allowance. If the demands of the other buildings on the property are ignored, the combined supply has an extra ~1,224 gpm available at 131.8 psi beyond the HSA.

The static pressure from the combined graph can reach 220psi (at 140% capacity), which is far above the 170 psi working pressure rating of the sprinkler heads. However, as the pump also supplies water pressure to the hydrants, the Jail, and the County Library, the actual maximum static pressure would be much lower. Further calculations would need to be done for those systems to see what the exact values would be. At the pump's rating of 1500 gpm, the combined supply would reach a pressure of 144 psi, well within the working limits of the sprinkler heads.

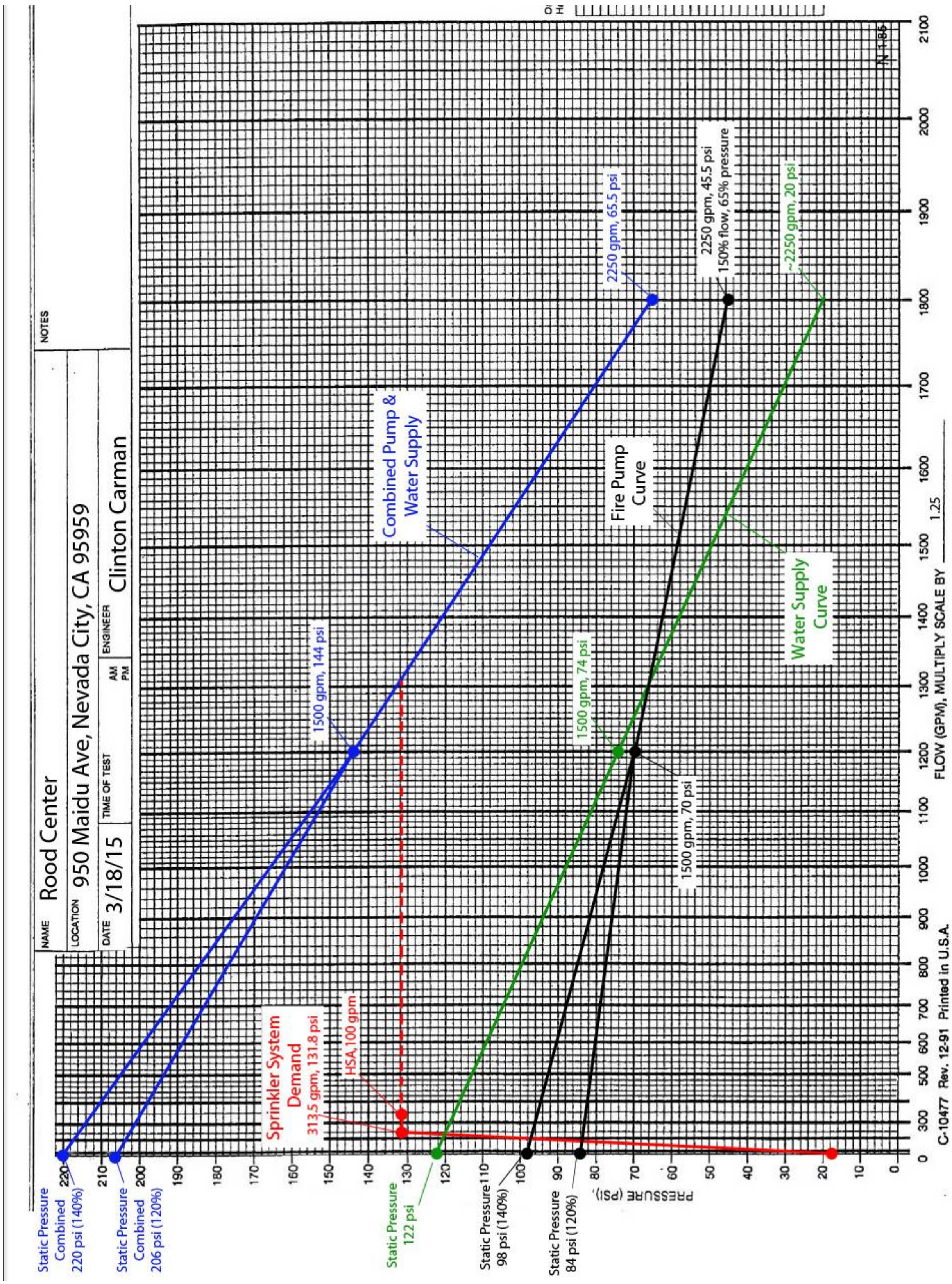

Figure 30: Hydraulic Graph

Clean Agent System

The server rooms are protected by an Inergen-ANSUL clean agent system. The system protects three server rooms that act as one data room located on the first floor, west side of the building. The three rooms and the underfloor space comprise 2,011ft^2 and 8,945ft^3. Smoke detectors and spray nozzles are located both at the ceiling and underneath the raised floors.

The system is comprised of 10 cylinders located in a closet off the first floor western corridor adjacent to the data room (see *Figure 31* below). The cylinders supply 4,390ft^3 of Inergen agent at 195 psi. The system can complete a 90% discharge in 46 seconds at an estimated flow rate of 5,153ft^3/min.

In order for the system to activate automatically, two smoke detectors need to activate, followed by a 30 second activation delay. If needed, an abort button can be pressed to deactivate the process during the 30 second delay. The system can also be activated manually with a pull station located next to the abort button near the entrance to the room (see *Figure 19* above).

Figure 31: Inergen cylinders and clean agent spray nozzle

Inspection, Testing and Maintenance

The responsibility for the maintenance and inspections of the system belong to the Facilities Department that oversees the building. The maintenance staff observe the system regularly during their routine work throughout the building and perform the weekly and monthly inspections. The quarterly and annual system maintenance and inspections are contracted out to a private sprinkler contractor. All inspections, testing and maintenance are done according to the guidelines of NFPA 25.

For a table showing the requirements for inspections, testing, and maintenance, please see APPENDIX P.

Summary

The water suppression system consisting of both wet pipe and dry pipe sprinkler systems met the code requirements set forth in NFPA 13. It is still unclear why the designer decided to use a dry pipe sprinkler system to protect the front of the lobby. In the next section the performance based analysis will exam four fire scenarios that examine how the building's systems will react to a fire. The fourth scenario discusses the dry pipe system in the front of the lobby in more detail and how it could potentially affect a fire.

Performance Based Analysis

Prescriptive based analyses examine how the existing building or new design compare with what is required in various codes and standards. These codes and standards are designed to ensure that the way in which a building is constructed will provide its occupants (who are not intimate with the initial fire) enough time to escape to safety. Unfortunately, there are situations where there may be no direct comparison between the building/design and the code(s). In those situations, the AHJ may allow a performance based analysis to be completed instead to determine if the building's fire protection systems will provide enough time to exit the building safely.

This performance based analysis utilized a computational fluid dynamics model, Fire Dynamics Simulator (FDS), to estimate how long occupants would have to get out of the Rood Center safely. Four different fire scenarios were considered in which the simulation would reflect a worst-case scenario for a given area. Once the simulations were complete, they were analyzed to determine if the conditions in the building remained tenable long enough for the occupants to escape to safety.

Tenability Criteria

The Required Safe Egress Time (RSET) estimates how long it will take people to evacuate a building. In the event of a fire, the building's fire protection systems need to be able to contain the fire and keep conditions tenable long enough for people to escape the building. That amount of time is known as the Available Safe Egress Time (ASET). The ASET begins when the fire is discovered and ends when either conditions become untenable, or everyone has escaped. If the ASET is greater than the RSET, then there is enough time available to get the people out of the building. If the ASET is less than the RSET, then the conditions will become untenable prior to everyone exiting the building.

To specify when conditions become untenable, criteria must be established to determine what thresholds for various factors affecting tenability. According to the Handbook of Smoke Control Engineering (2012 edition, the factors which affect tenability the most are reduced visibility, exposure to toxic gases like carbon monoxide (CO), and heat exposure (high temperatures and thermal radiation).

Visibility

Several factors need to be considered to determine proper values for determining visibility thresholds in smoky conditions. Dr. Tadahisa Jin proposes that these factors should include how familiar the occupants are with the building, how large are the rooms, how large is the building, and how complex is the layout of the building. If the layout is simple, the rooms and building are smaller (so one could see their target destination), and the occupants are familiar with the building, then the minimum criterion for visibility would be quite low. However, if the occupants aren't familiar with the building, the layout is complex, and the rooms are large, then the minimum criterion for visibility would need to be higher.

According to Dr. Jin, the minimum distance an occupant would need to be able to see to exit a building they're familiar with is 13 feet (4 meters). Whereas, if the occupant was unfamiliar with the building, the minimum distance they would need to be able to see would be 43 feet (13 meters).

As the occupants in the Rood Center would be primarily made up of staff who are familiar with the building, and the egress paths are fairly simple (and well-marked), the minimum visibility criterion for these simulations was 26 feet (8 meters).

Carbon Monoxide Exposure

While there are several chemicals in smoke that pose a health risk (including a lack of oxygen), exposure to CO accounts for the majority of fatalities in fires. Exposure to CO can result in carboxyhemoglobin (COHb) uptake in the blood which can decrease the capacity of the blood to carry oxygen to the brain. In the SFPE Handbook (4th edition), research by Dr. David Purser is presented which states that a dose of 27,000 parts per million per min (ppm-min) will cause incapacitation. Therefore, a dose of 2,700 ppm-min would cause incapacitation in 10 minutes.

The movement times calculated in APPENDIX C, state how long it would take people to escape from the building once they've started moving, but does not take into account the time from ignition to detection, pre-movement time delays, or a safety factor. The longest movement time from a department calculated was 4 minutes, 53 seconds. If it is assumed that detection takes 10 seconds, the recognition time takes 30 seconds, and the response time takes anywhere from 60 seconds to 180 seconds, with a safety factor of 1.5, complete evacuation could take about 13 minutes.

$$(4.88 \text{ min} + 0.16 \text{ min} + 0.5 \text{ min} + 3 \text{ min}) \times 1.5 = 12.81 \text{ minutes}$$

If an egress pathway(s) gets blocked by fire or smoke, that will cause the evacuation time will go up as the occupants have to re-route to another exit. A maximum threshold of 1,350 ppm-min would provide occupants with 20 minutes for safe egress before incapacitation would occur. That would give occupants enough time to re-route to another exit with tenable conditions.

Heat Exposure

In the SFPE Handbook (4th edition), research from Dr. David Purser indicates that 250°F (121°C) is the point where temperatures above will cause pain, blisters, and burns. To create a safety margin, the maximum threshold for heat exposure for these simulations was set at 212°F (100°C).

Research from Dr. Vyto Babrauskas in the SFPE Handbook (4th edition) indicates that the maximum threshold for thermal radiation exposure is 2.5 kW/m^2. At that level of thermal radiation exposure, bare skin would feel pain but burns could be avoided if exposures were short.

Table 20 below lists the various tenability thresholds for the computer fire modeling scenarios.

Table 20: Tenability Criteria Values

Tenability Criterion	**Threshold Limit**
Visibility	26 feet (8m)
Carbon Monoxide	1,350 ppm
Temperature	212°F (100°C)
Thermal Radiation	2.5 kW/m^2

These values will be monitored in the simulations at a height of 6 feet (1.8m) above each floor level. If any of these values are exceeded, the conditions in the building will be considered untenable thereby marking the end to the ASET.

Scenarios

Each of the following scenarios were designed to be a worst-case scenario for the room/area in which they were located. The computers models were originally designed three-dimensionally using a program called SketchUp with data from an AutoCAD file and measurements taken on-site. That 3D model was then transferred into a program called Pyrosim where the rest of the details (fire, fire protection systems, surface properties, etc.) were added. Pyrosim was used to run the models in Fire Dynamics Simulator (FDS). Once the calculations were complete, the simulations were viewed in a program called Smokeview. The screen renderings that will be included below were taken from either Pyrosim or Smokeview. As exact data wasn't available regarding the surfaces, fuels, sprinkler/detector responses, etc., estimates were made in each instance to try and best replicate reality.

Scenario #1

The first scenario evaluated a fire that could occur on the counter in the cafeteria. Stored on the counter are several small appliances including a cappuccino machine, a coffee grinder, and two drip coffee makers. Directly above the small appliances are wooden cabinets which extend to the acoustic tile drop-ceiling above. The north wall is covered with countertop and cabinets, the west wall is covered with several large vending machines, the south wall is made up of windows, and the east wall is where a bulletin board and a couple trash cans are located. There are two rows of rectangular tables with chairs on all sides in the center of the cafeteria.

The cafeteria is 35.5 feet wide (east/west) and 25 feet long (north/south). The main entrance/exit is at a 45-degree-angle to the room in the southeast corner. This doorway leads to the lobby and then to the exterior of the building. A secondary entrance is located on the north wall at the northeast corner. This doorway leads to a 35-foot-long hallway to the north that connects to the building's main western corridor.

The room has a 9-foot-tall acoustic tile drop ceiling, with gypsum walls and a tiled floor. The hallway to the north has the same type of construction as the cafeteria with 9-foot ceilings and a closed door at the north end. The lobby to the southeast has a ceiling that is 23-foot-tall and such a large air volume, that this portion of the model was left open.

There are six wet-pipe sprinkler heads in the cafeteria and three wet-pipe sprinkler heads in the hallway to the north. The activation temperature for all the sprinklers was 74°C. For a more detailed description of the sprinkler heads, please refer to the sprinkler section in this report. There are no smoke detectors in the cafeteria, hallway to the north, or in the lobby.

The fire was theorized to start in the cappuccino machine due to an electrical failure. The fire would spread to a coffee grinder, the wooden cabinets above, and countertop nearby. As an exact Heat Release Rate (HRR) of a cappuccino machine (and coffee grinder) was unavailable, an estimate HRR was needed. Figure 26.14 (see *Figure 32* below) from the SFPE Handbook (5th Edition) shows the HRR of a small air conditioner of similar size. The maximum HRR of that test was 300kW which was reached in 250-300 seconds. For this scenario, a maximum HRR of 300kW was used but a medium-speed t-squared fire growth-rate curve was used instead. A custom fire ramp was created to follow the t^2 medium growth fire curve and then diminish with time. The maximum HRR was reached 160 seconds after ignition. The burner was placed on a plastic box on the counter top in the northern portion of the cafeteria (see *Figure 33 below*). As the sprinklers were not directly above the fire, the fire ramp was not adjusted to reflect the activation of the sprinklers.

814 V. Babrauskas

Fig. 26.14 HRR of a small air conditioner with a plastic housing

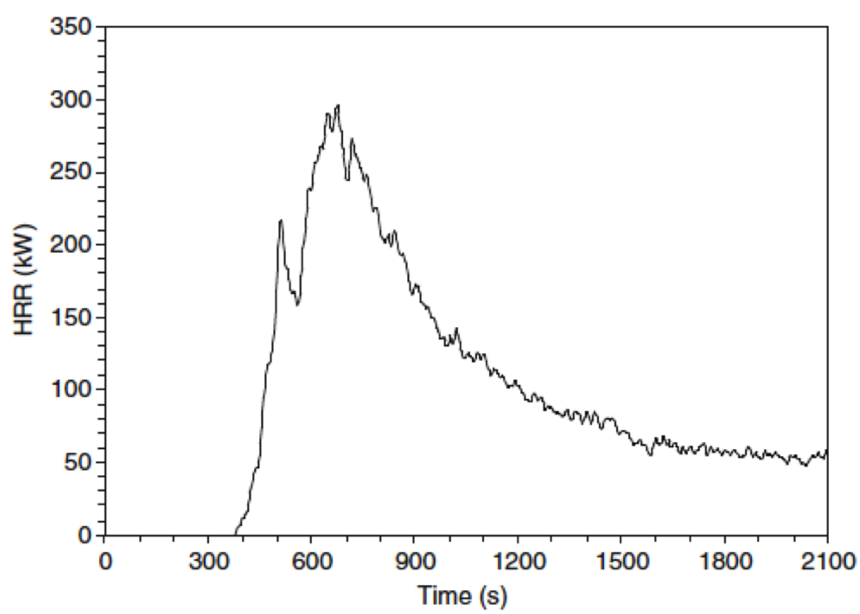

Figure #32: HRR of a small air conditioner (SFPE Handbook 5th Ed.)

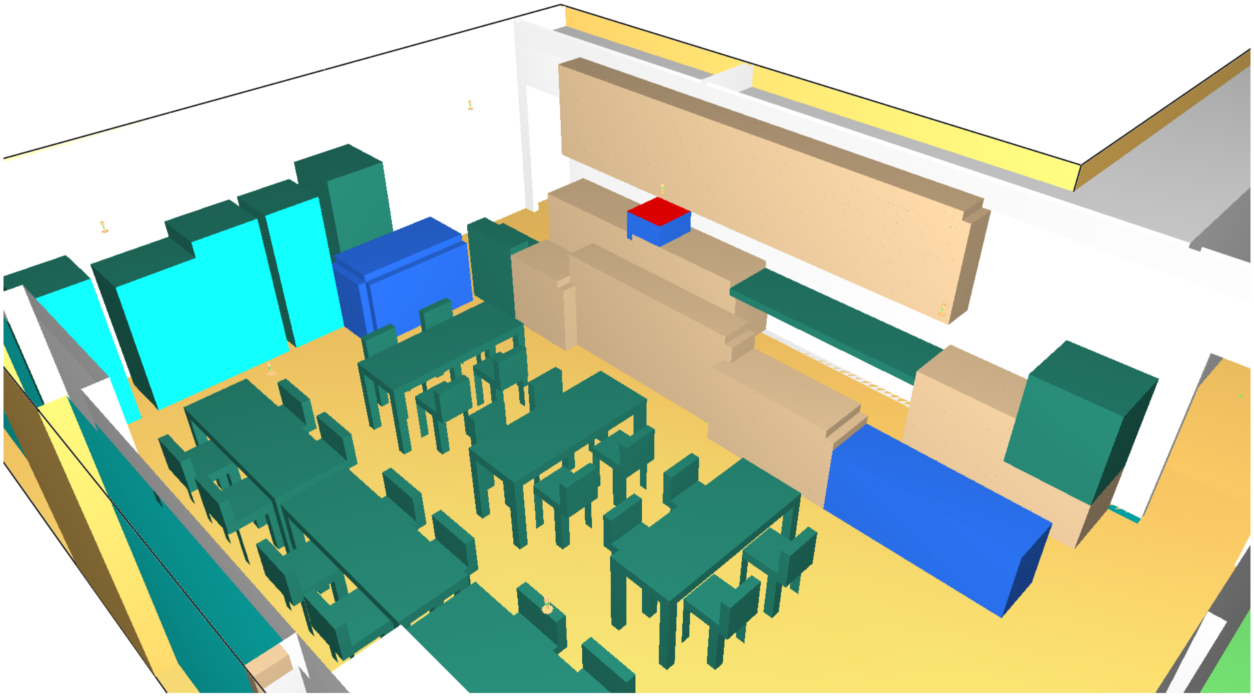

Figure #33: View of the cafeteria fire model in Smokeview. (The red square is the burner)

Figure #34: View of the cafeteria facing northwest from the exit door

Scenario #2

The second scenario evaluated a fire that could occur in a copy machine located in a dead-end hallway on the second floor. The hallway is located on the second floor at the north end of the lobby. In the hallway are four doors, one to the Grand Jury, one to the LAFCo offices, and the last two go to "named" conference rooms. The entrance door to the hallway is a 36" wide door at the south end of the hallway. The Grand Jury is located to the east, the LAFCo offices to the north, and the conference rooms to the west. At the south end of the hallway is a small common area. To the west is a large wooden table and three chairs, on the east side is a copy machine with a small recycle container next to it, a metal desk with a chair, and then a 64-gallon plastic recycle container behind the door.

The hallway has a 9-foot acoustic tile drop ceiling, with gypsum walls, and low-pile carpet over cement floor. At the southeast of the common area is a photo electric smoke detector. There are three Viking sprinkler heads in the common area and two more in the hallway. These sprinkler heads have glass bulbs as opposed to the metal fusible links the other sprinklers had. Their activation temperature is 68°C.

The fire was theorized to start in the area of the copy machine due to an electrical failure. The fire could potentially spread to the nearby small recycle container next to it, the foam and plastic desk chair, and then eventually the 64-gallon recycle container behind the door. While this fire could potentially get quite large, there is one sprinkler directly above the copy machine, and another within 6 feet. Therefore, the fire ramp was designed to stop the growth of the burner and begin diminishing the HRR when the second sprinkler activated.

An exact HRR value for a copy machine was not found, so an example HRR graph for business-machine cabinets was used from the SFPE Handbook (5^{th} Edition), Figure 26.36 (see *Figure 35* below). The graph indicated the maximum HRR was 600 seconds, which was reached in 150 seconds. This value is in-between the medium and fast t^2 growth-rates (227 seconds and 114 seconds respectively). Since a worst-case scenario is assumed, the fast t^2 growth-rate was chosen. Again, a custom fire ramp was created to follow the the fast t^2 growth-rate, but the growth was stopped at 90 seconds (time of the second sprinkler's original activation time). The burner was placed on top of an inert box approximately the same size as the copier. The 36"-wide door at the south end of the hallway is held open with a magnet which deactivates and closes the door upon activation of the fire alarm. To simulate this behavior, the door closes one second after the smoke detector activates (to simulate time for the door to close). The door to the Grand Jury room is kept closed, the door at the north end of the hallway to the LAFCo offices is propped open with a door stop, and the conference room doors vary whether they're open or closed. For the simulation they were considered to be closed.

This fire scenario was designed to see if the occupants of the dead-end hallway would be trapped by a fire in the common area at the south of the hallway. As the fire would be in close proximity to the only exit, the question was if the conditions would remain tenable long enough for them the occupants to escape into the second floor lobby.

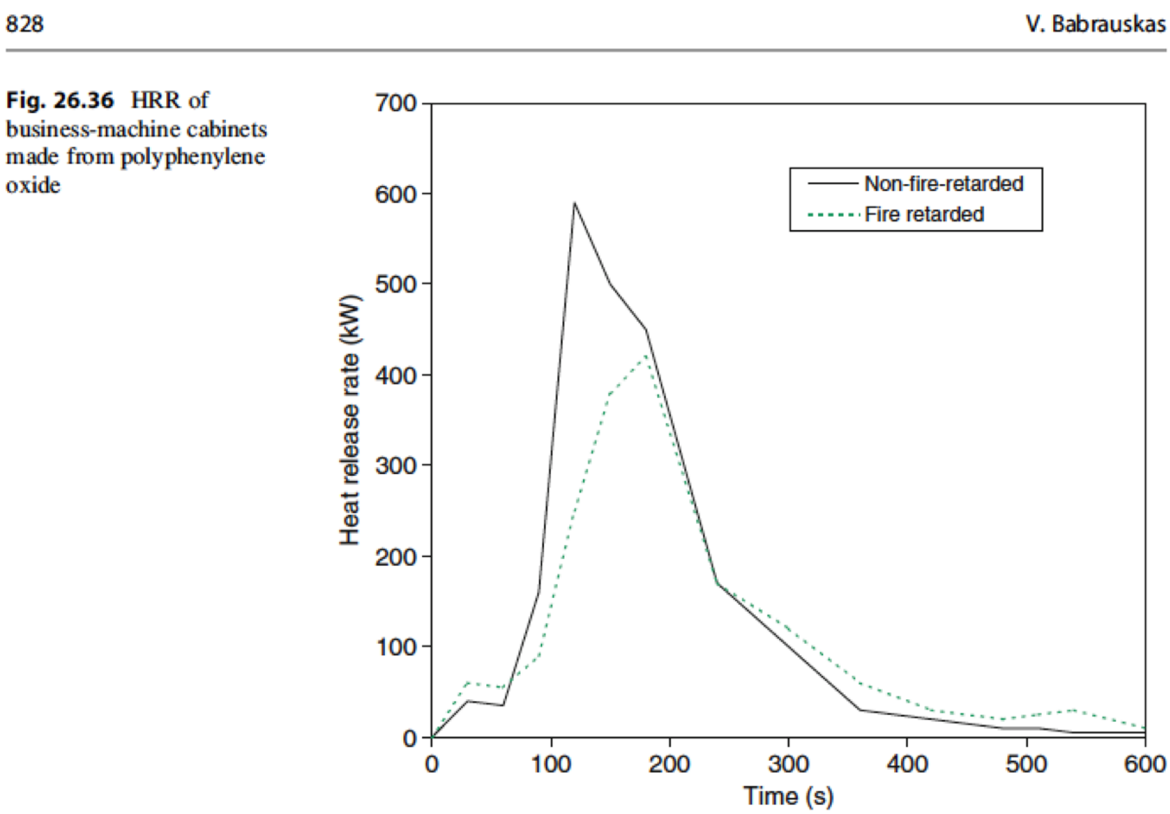

Figure #35: HRR of a small air conditioner (SFPE Handbook 5th Ed.)

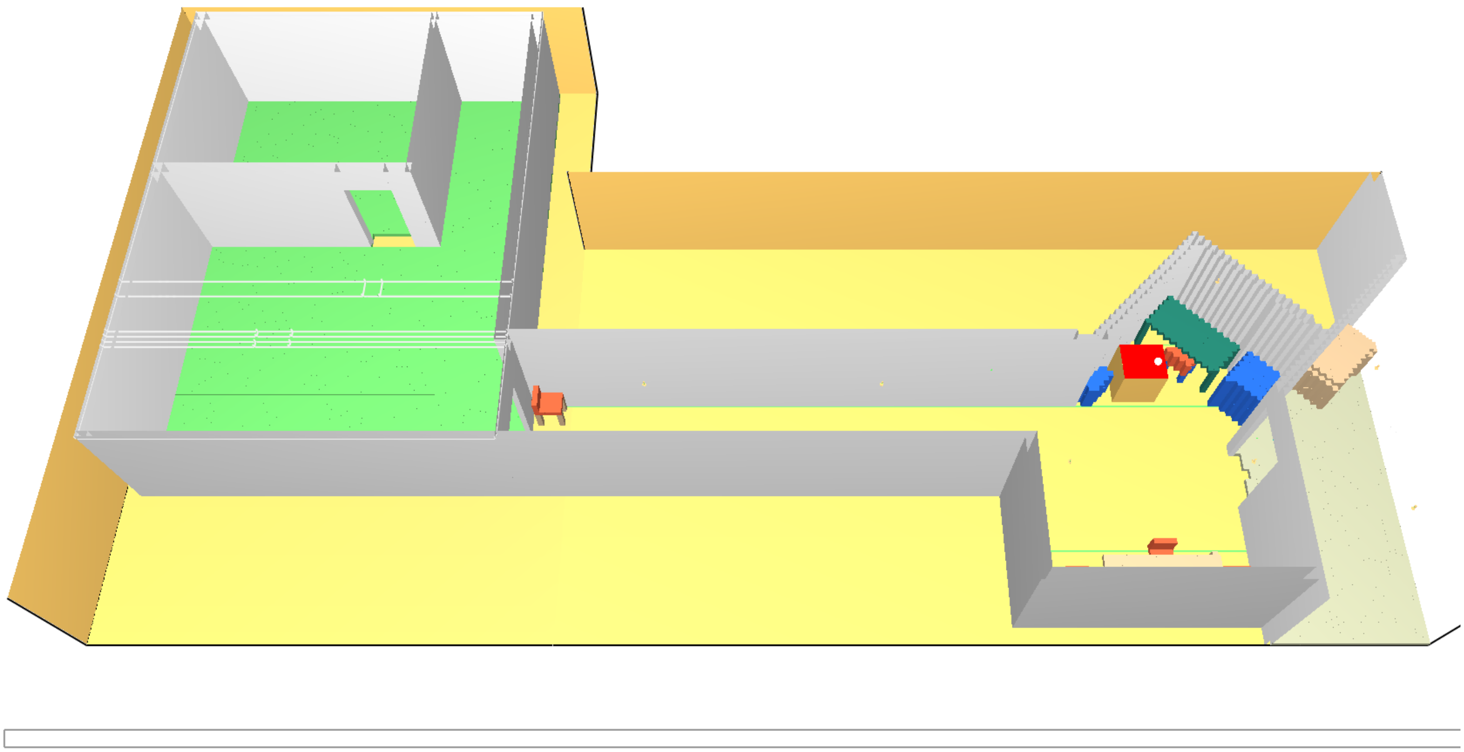

Figure #36: View of the 2nd Floor Hallway in Smokeview (facing east)

Figure #37: View of the copier, desk, and recycle containers in 2nd Floor Hall common area

Figure #38: View facing north down the 2nd Floor Hall from the common area

Scenario #3

The third scenario evaluated a fire that could occur in a trash can located in the western corridor on the first floor (see *Figure 43* below). Located on the north side of the corridor are three plastic recycle containers, a trash can, and two soda vending machines. Two of the recycle containers are 64-gallon while the third is significantly smaller. The 35-gallon trash can doesn't have a lid, while the two larger recycle containers both had lids (not locked). Stacks of loose cardboard boxes have also been seen piled around these containers during different visits to the site.

In this portion of the corridor, the width (N/S) is 16 feet. The ceiling is a 9-foot acoustic drop ceiling, the walls are gypsum, and the floor is tiled. To the southeast of this area is the hallway that leads to the northeast corner of the cafeteria. Directly to the northeast is the main northern exit corridor for the first floor. To the east at the end of the corridor is the exit into the CDA waiting area (~65' away). To the west at the end of the corridor is the exit into the western stairwell (~135' away).

The fire was theorized to start in one of the 64-gallon recycle containers due ignition by open flame (arson). Inside of the container on several visits have been plastics, cardboard, and paper. The fire would spread to the 64-gallon recycle container to the immediate west, the 35-gallon trash can to the immediate east, followed by the smaller recycle container and the soda machines. To simulate the fire spreading between the containers, three burners were used. The first burner was horizontal (Z-plane) on top of the easternmost 64-gallon recycle container. The second burner was located vertically (Y-plane) on the front of the westernmost 64-gallon recycle container. The third burner was also located vertically (Y-plane) on the front of the 35-gallon trash can. The vertical burners were used to simulate ignition of the sides/front of the secondary fuels due to radiant heating from the initial fire.

The fires' HRR values and growth rates were modeled after tests done on HDPE (high-density polyethylene) plastic trash/recycle containers at National Institute of Standards and Technology (NIST) and the Western Fire Center. The HRR for the first burner was 2400kW (64-gallon can with combustibles inside) and grew slightly slower than a t^2 fast growth rate fire, reaching a maximum HRR at 250 seconds. As the second container wasn't as full of combustible materials, a maximum HRR of 2100kW was used with a time of 240 seconds. However, the second burner didn't ignite until 60 seconds after the first burner did, to simulate the object igniting from the radiant heat. The third burner simulated a smaller 30-gallon trash can that was only partially full. The maximum HRR was 800kW with a time of 150 seconds, also delayed 60 seconds after the first burner ignited. Due to the large amount of fuel present, it was hypothesized that the fire would overwhelm the sprinklers, so the fire ramps were not adjusted to simulate the sprinklers having an effect.

There are a total of 20 sprinklers in the length of the western corridor, and one in the portion of the northern corridor that was modeled. Of the 20 sprinklers, 4 were in the same portion of the corridor as the fire, two at the north, and two at the south end. The sprinklers have an activation temperature of 74°C. There are a total of 7 photo electric smoke detectors in the western corridor, the closest to the fire is approximately 6 feet to the east of the easternmost recycle container.

All of the doors in the corridor are closed during normal operation, with the exception of the door into the northern corridor. It is held open by a magnet that disengages when the fire alarm goes off. To simulate this, the door would close one second after the nearest smoke detector activated.

This fire was chosen to show the danger of having such a large amount of fuel stored in an exit corridor, and adjacent to a second corridor's entry. As this fire grows, the smoke will spread throughout the corridor slowing the egress of several departments, and causing a few departments to choose an alternate egress pathway.

Fig. 26.113 HRR of 364 L (96 gal) PE garbage cans

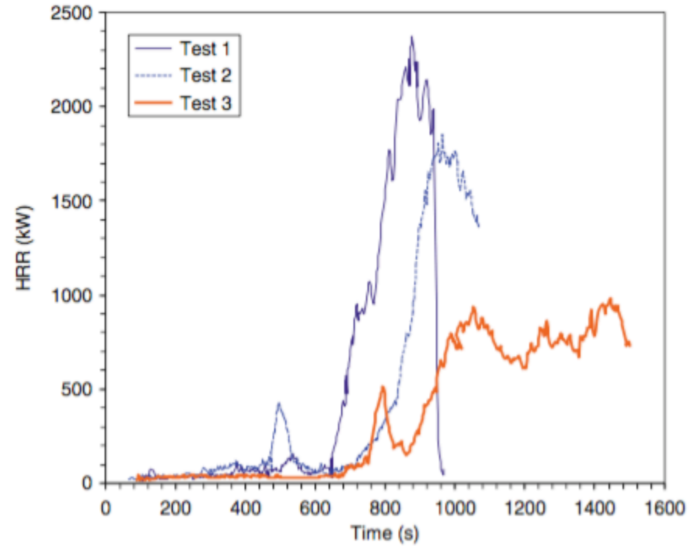

Figure #39: HRR of a 96 gal PE garbage can - Western Fire Center (SFPE Handbook 5th Ed.)

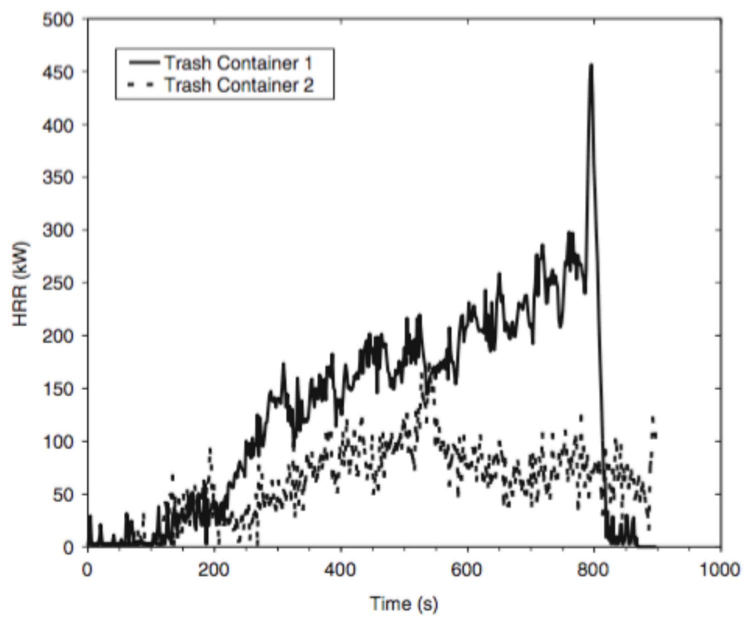

Fig. 26.112 HRR of 136-L HDPE trash containers filled with construction-site debris

Figure #40: HRR of a 30 gal PE garbage can from NIST (SFPE Handbook 5th Ed.)

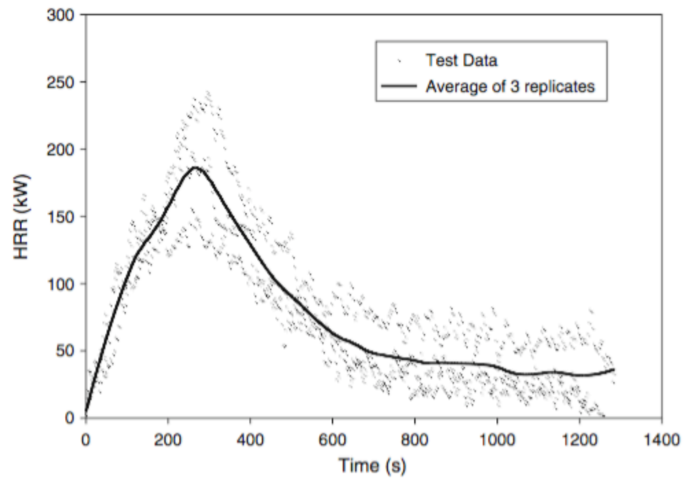

Fig. 26.111 HRR of 'standard' Amtrak trash bag, based on crumpled newspaper

Fig. 26.107 HRR of trash bags

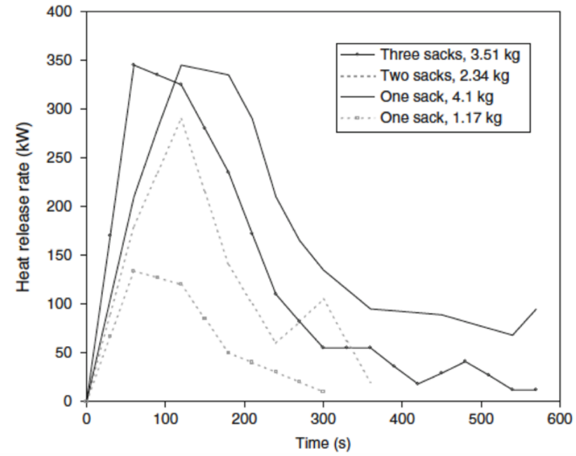

Figure #41: HRR of a trash bag with crumpled newspaper (SFPE Handbook 5th Ed.)

Figure #42: HRR of trash bags (SFPE Handbook 5th Ed.)

Figure #43: The recycle containers, trash can, and vending machines in the west corridor

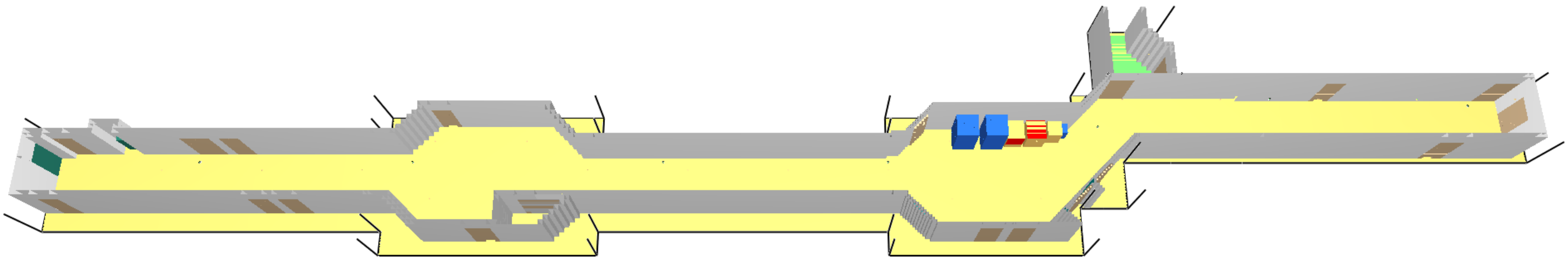

Figure #44: Overview of 1st Floor West Corridor in Smokeview (facing north)

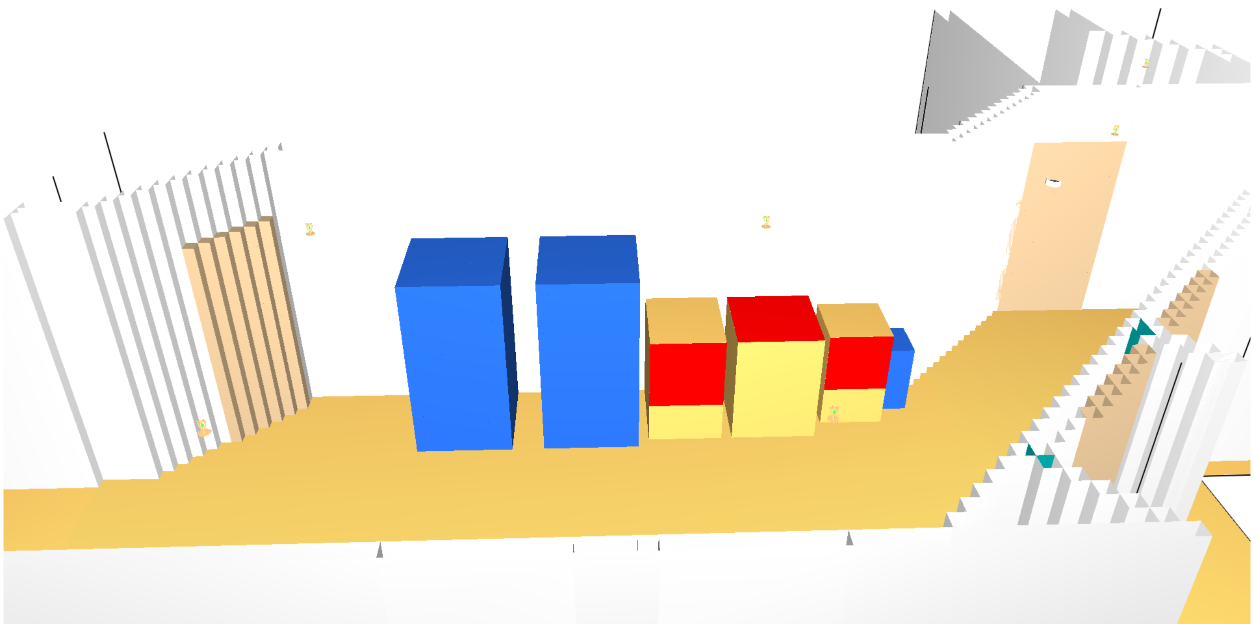

Figure #45: Close-up of the burners in the West Corridor in Smokeview (facing north)

Scenario #4

The fourth scenario evaluated a fire that could occur in a book fair in the lobby. During one visit to the Rood Center, a book fair was set up throughout the lobby. In total, 16 rectangular plastic folding tables were set up with cardboard boxes, books, and loose paper both on top of, and below, the tables. The tables were primarily set up at the south end of the lobby near the large two-story glass wall, but some were placed up against the northern wall of the lobby (southern wall of the BOS chambers). To the south of the tables, organizers had pushed four large wood/foam chairs up against the glass wall. On either side of the glass wall are walls covered with wood siding (T-111 tongue and groove). The rest of the lobby walls are covered with gypsum wall board. The ceiling of the lobby is the same T-111 tongue and groove wood and has a peak in the center (with a N/S ridgeline), and a matching ceiling on either side, which slopes from the south upwards to the north. At the north end of the lobby the ceiling changes to a flat acoustic drop-ceiling, 9 feet above the second floor walkway.

On either side of the glass wall at the front (south side) of the lobby are double 36"-wide glass doors. To the northwest is the 36"-wide door into the cafeteria, to the north are double 36"-wide doors into the CDA waiting area, and upstairs there are single 36"-wide wooden doors to the east and west leading to the respective exit corridors. The lobby is 72 feet wide (E/W) at the front, 84 feet long (N/S) on the first floor and 104 feet long (N/S) on the second floor. The ceiling height in the front of the lobby rises from 13 feet at the front on either side, to 23 feet at the rear, with the central peak reaching a height of 33.5 feet. The flat ceiling is 23 feet above the first floor, 9 feet above the second floor.

The fire was theorized to be started intentionally (arson) with an open flame in cardboard boxes underneath tables at the western and eastern ends of the central group of tables. The fires spread along boxes, books and paper underneath the table, eventually spreading to the plastic table tops and additional boxes, books and paper on top of the tables. Once the tables (and contents) are ignited, the fire spreads south to the foam chairs, and then to the wood siding. Once the wood siding is ignited, the fire would climb vertically until it began to spread across the wooden ceiling.

Two burners were used, placed on top of cardboard boxes underneath plastic tables. Both burners are ignited at the same time. Each burner had a maximum HRR of 80kW, which was reached at an ultra-fast t^2 growth rate of 20 seconds. These values were chosen to simulate that of a large wastebasket fire with paper inside (SFPE Handbook, 5th Edition, Table 26.31).

In the front portion of the lobby are 13 dry-pipe sprinklers, four in the western section, six in the center, and three in the eastern section. All of the sprinklers are at varying heights as the western and eastern sections of the ceiling are sloped. After several attempts at trying to determine what the dry-pipe system's delay is, an accurate value was not obtained. Therefore, a value was estimated for the computer model of 60 seconds. Spread throughout the northern portion of the lobby (where the flat ceiling is located) are 17 wet-pipe sprinklers. Two additional wet-pipe sprinklers are located underneath the open-air walkway near the elevator. All of the sprinklers had an activation temperature of 74°C. The only smoke detector in the entire lobby is a photoelectric detector on the second floor, ~6 feet from the northernmost wall. As the three doors in the upstairs lobby are all held open by a magnet which disengages when the fire alarm activates, all three doors closed one second after the single smoke detector activated.

Figure #46: View of the book fair in the south end of the lobby

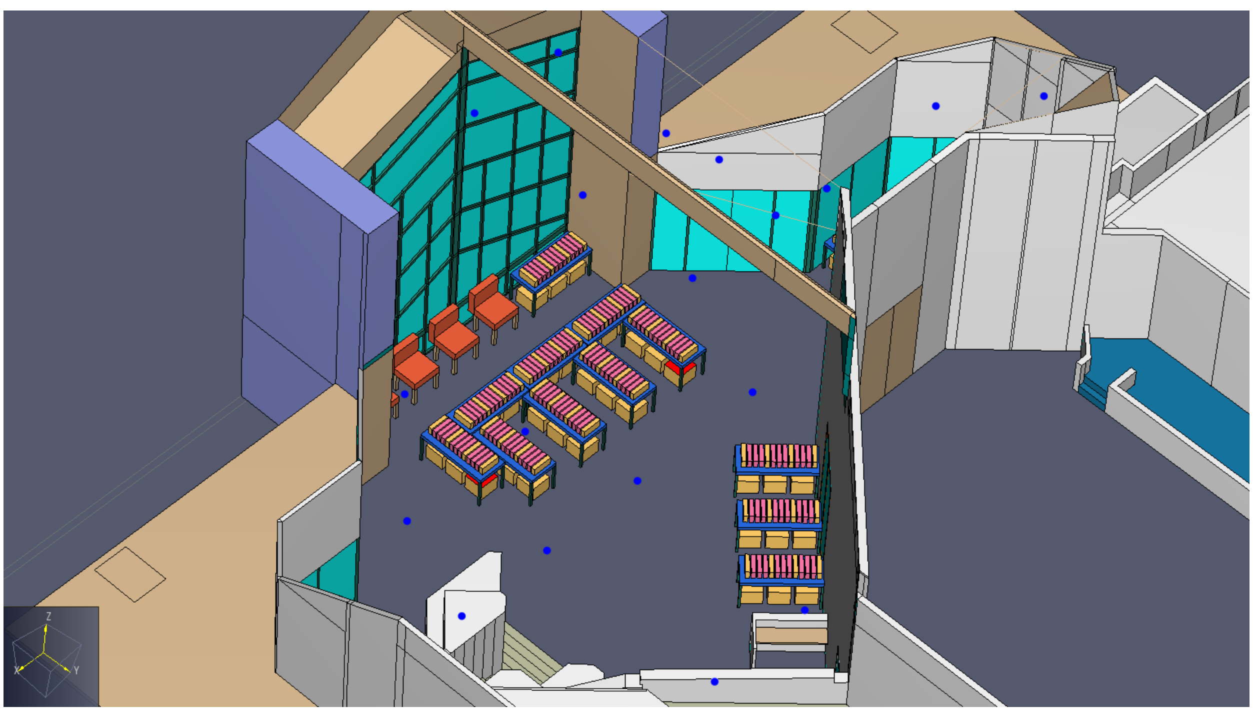

Figure #47: Overview of the book fair in the lobby facing southwest - Pyrosim

Figure #48: The book fair in the northern portion of the lobby and the open air walkway

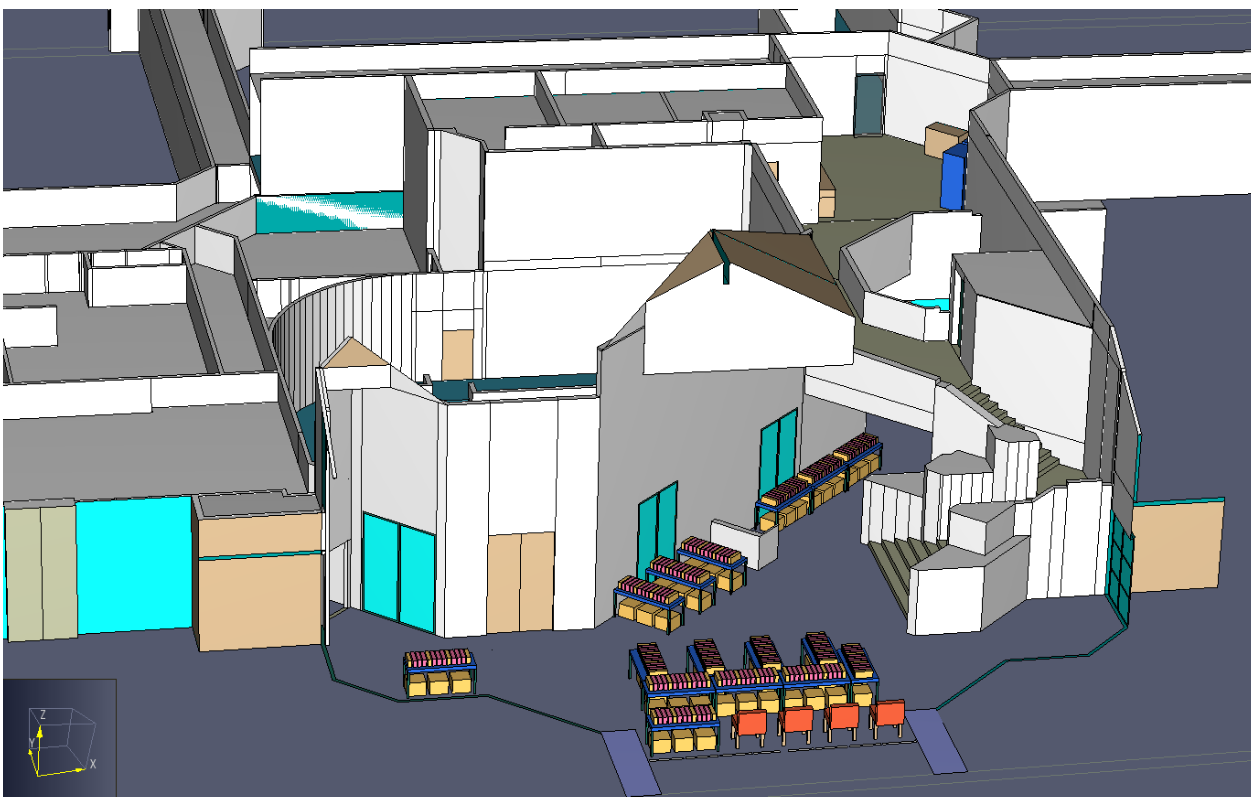

Figure #49: Overview of the book fair in the lobby facing north (south wall invisible) – Pyrosim. At the right and top of the photo: the stairs, open air walkway, and the door to the dead end hallway can be seen.

To define the smoke and carbon monoxide production in these simulations, values of 0.02 (2%) were selected for both the CO yield and the soot yield. As exact data was not available for any of the fuels, values were estimated and held constant through all four fire scenarios. These values may be conservative for some scenarios, and not for others.

Results

Scenario #1

The fire in the cafeteria grew following a medium speed t^2 fire growth curve. It reached a maximum HRR of 300kW at 160 seconds into the simulation.

All six of the sprinklers in the cafeteria activated, and one of the three sprinklers in the north hallway activated. The first two sprinklers in the cafeteria activated at 107.4 seconds into the model. The first two sprinklers were the north-west and north-center sprinklers. The last sprinkler in the cafeteria activated at 117.0 seconds. The only sprinkler in the north hallway activated at 147.6 seconds. The simulation was stopped at 162.6 seconds after the burner reached the maximum HRR.

Table #21: Cafeteria Sprinkler Activation Times and Locations

Sprinkler Name	Activation Time (s)	Location
Cafeteria #1	112.8	South-West
Cafeteria #2	111.6	South-Center
Cafeteria #3	116.4	South-East
Cafeteria #4	107.4	North-West
Cafeteria #5	107.4	North-Center
Cafeteria #6	117.0	North-East
North Hallway #1	147.6	Southern
North Hallway #2	N/A	Center
North Hallway #3	N/A	Northern

The maximum occupancy of the cafeteria is 60 people. According to the movement time calculations in APPENDIX C, the time it would take the occupants of the cafeteria to escape to safety was 122 seconds once they started their evacuation. The discovery time (t_d) in this scenario had to be estimated because there is no smoke detector in the cafeteria or northern hallway. The simulation was played in Smokeview and an estimate of 30 seconds was chosen based on when the smoke had traveled south across the ceiling and reached the southern wall of the cafeteria. By that time, everyone in the small cafeteria would be in a position to see/smell the smoke and potentially see the flames. This value would likely be less than 30 seconds as there is usually an employee working behind the serving counter who would be within a few feet of the ignition source. Once they discovered the fire, they'd likely yell to everyone else warning them of the fire.

Once the occupants in the cafeteria are alerted to the fire, the pre-movement time (t_{pre}) portion of the evacuation begins. As the occupants in the cafeteria would be able to see/smell the smoke and potentially see the fire, the recognition time (time it takes to understand evacuation is needed) would be instantaneous. Occupants in the cafeteria would likely be a mix of staff and the public. The staff would have a majority (if not all) of their belongings at their desk and not with them in the cafeteria. The public might have a few items with them but would likely keep those items close by. Therefore, the response time (time it would take someone to start evacuating after they realized a need to do so) was estimated at 10 seconds.

With a discovery time of 30 seconds, a pre-movement time of 10 seconds, and a movement time of 122 seconds, the evacuation time would be 162 seconds. With a safety factor of 1.5, the total RSET (Required Safe Egress Time) value is 243 seconds.

Because of the tall ceilings and large size of the lobby (~23 feet tall, 72 feet wide), once the occupants passed through the doorway from the cafeteria into the lobby, they would be out of the smoke layer and would be in tenable conditions for the remaining portion of the evacuation. All 60 people would have passed through the door into the lobby by 126 seconds (not counting the safety factor).

As this is a simulation of a worst-case scenario, the maximum occupancy value of 60 people was used. However, after several visits to the location, the normal day-to-day occupancy would be less than 10 people. If that occupancy value was used, RSET would be 113 seconds, and the time it would take to reach the lobby would be 64 seconds. The RSET would still be larger than the ASET, but occupants could reach the lobby before conditions became untenable.

Slice files at Z=1.8m (6 feet) and detectors near the doorways into the lobby and north hallway were used to determine when the conditions were no longer tenable (based on the criteria mentioned above). Table 22 below lists when/if conditions became untenable based on the four factors listed above.

Table #22: Cafeteria Tenability Criteria Factor Times

	Tenability Criteria Factor			
Location	**Visibility (< 8m)**	**Temperature (> 100°C)**	**Carbon Monoxide (> 1,350 ppm-min)**	**Radiant Heat Flux (> 2.5kW/m²)**
Exit to Lobby	102.0 sec	106.8 sec	N/A	154.8 sec
Exit to North Hallway	105.6 sec	111.0 sec	N/A	N/A
ASET Pass/Fail	**Fail**	**Fail**	**Pass**	**Pass***

**The radiant heat flux exceeded the threshold only after the occupants had escaped the cafeteria and were passing through the exterior doors of the lobby.*

Based on the values in the table above, conditions became untenable due to visibility and temperature before the first sprinklers activated (107.4 sec). Due to conditions becoming untenable, thereby marking an end to the ASET, RSET (243 sec) values are greater than the ASET values (102 sec).

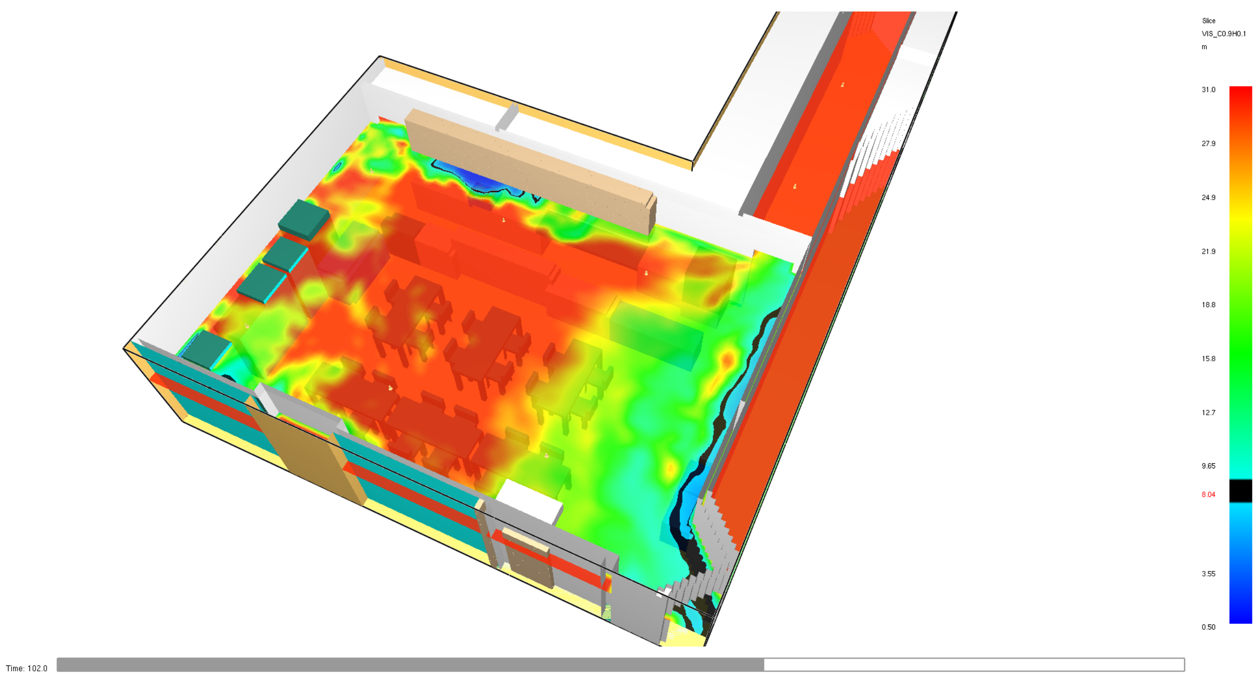

Figure #50: Cafeteria Fire - Visibility slice file at Z=1.8 facing northwest in Smokeview (102s) Tenability failure at southeast exit. Black indicates visibility threshold.

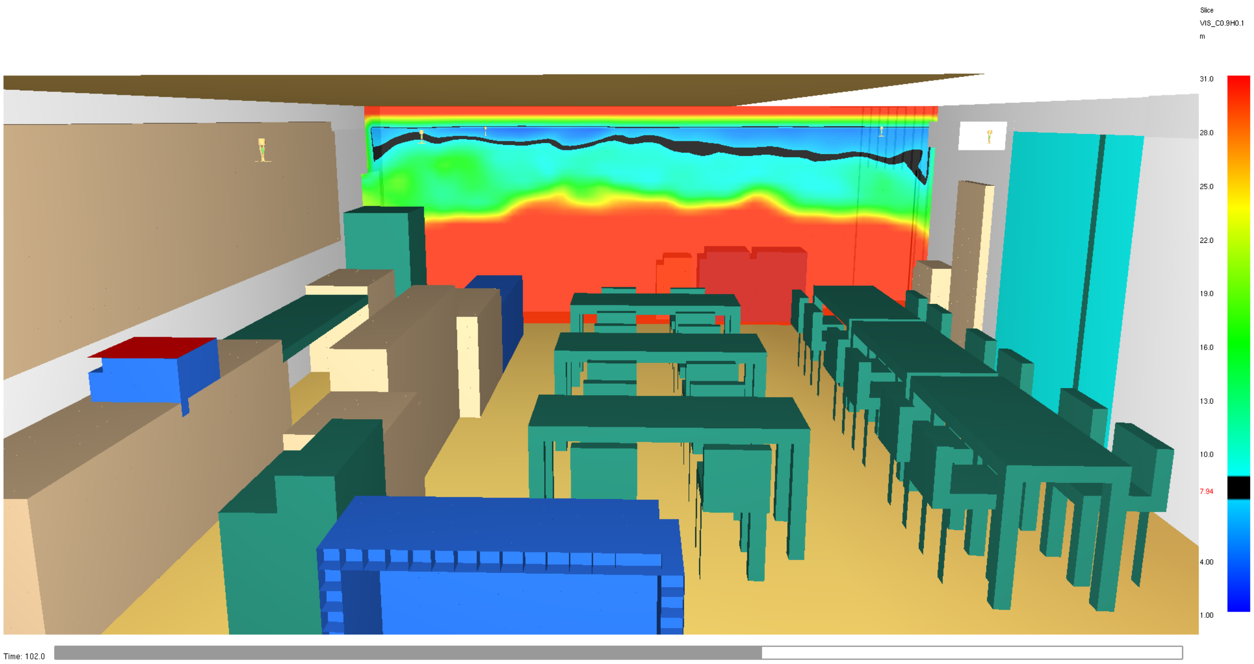

Figure #51: Cafeteria Fire - Visibility slice file at east side of room facing east (102 sec)

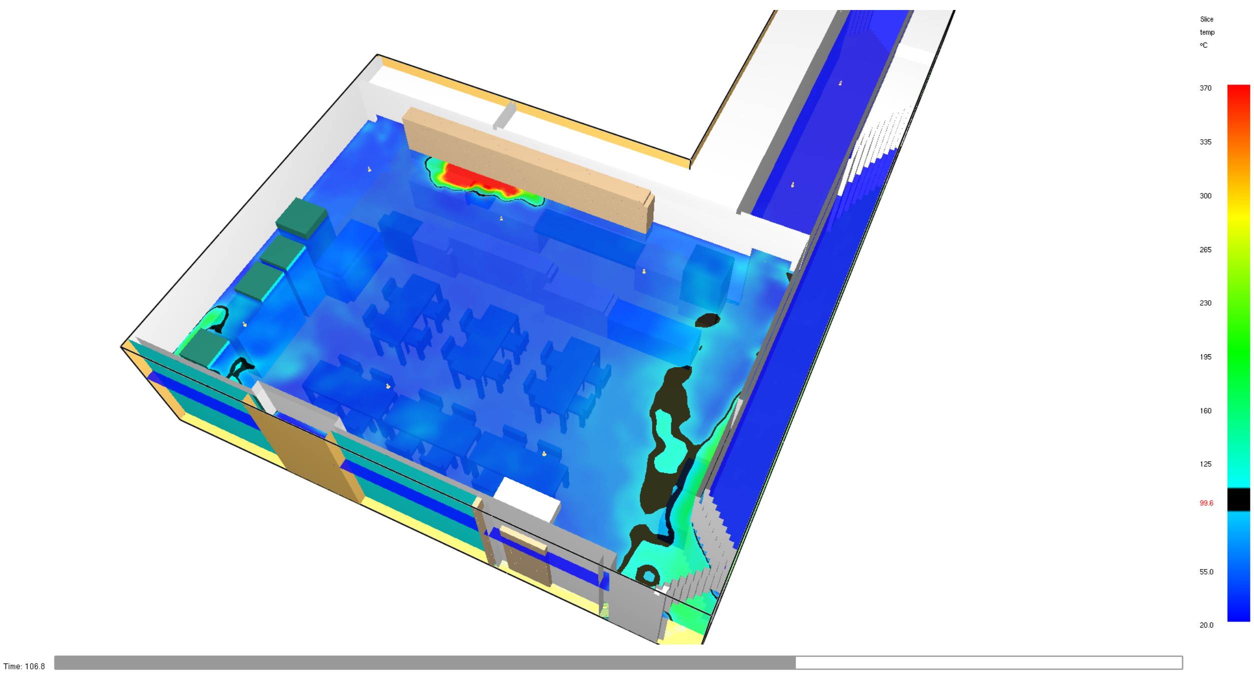

Figure #52: Cafeteria Fire – Temperature slice file at Z=1.8 facing northwest (106.8 sec) Tenability failure at southeast exit. Black indicates temperature threshold.

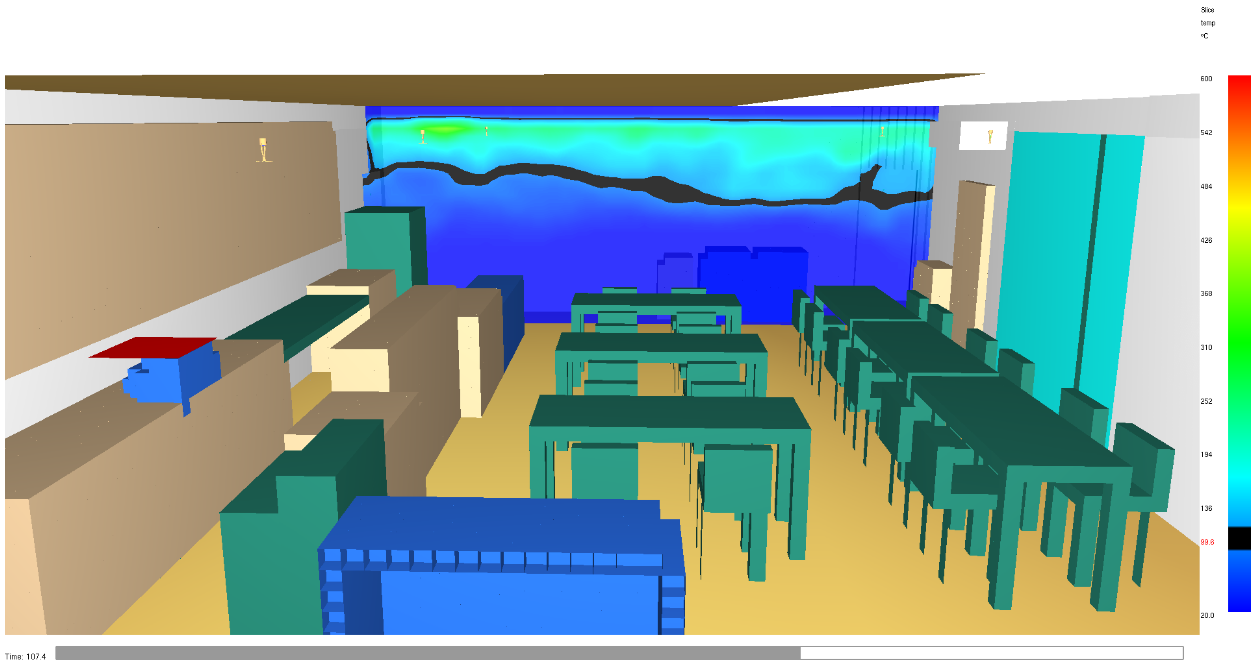

Figure #53: Cafeteria Fire - Temperature slice file at east side of room facing east (107.4 sec)

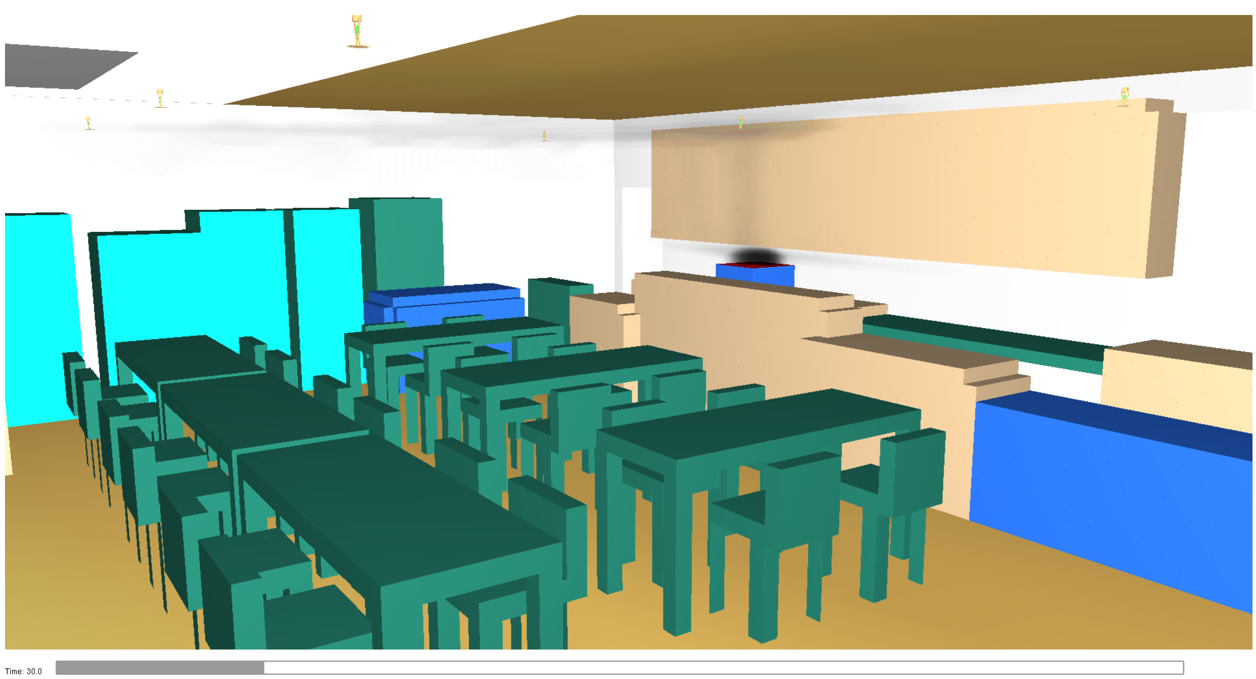

Figure #54: Cafeteria Fire – Visible smoke/fire detection (30.0 sec)

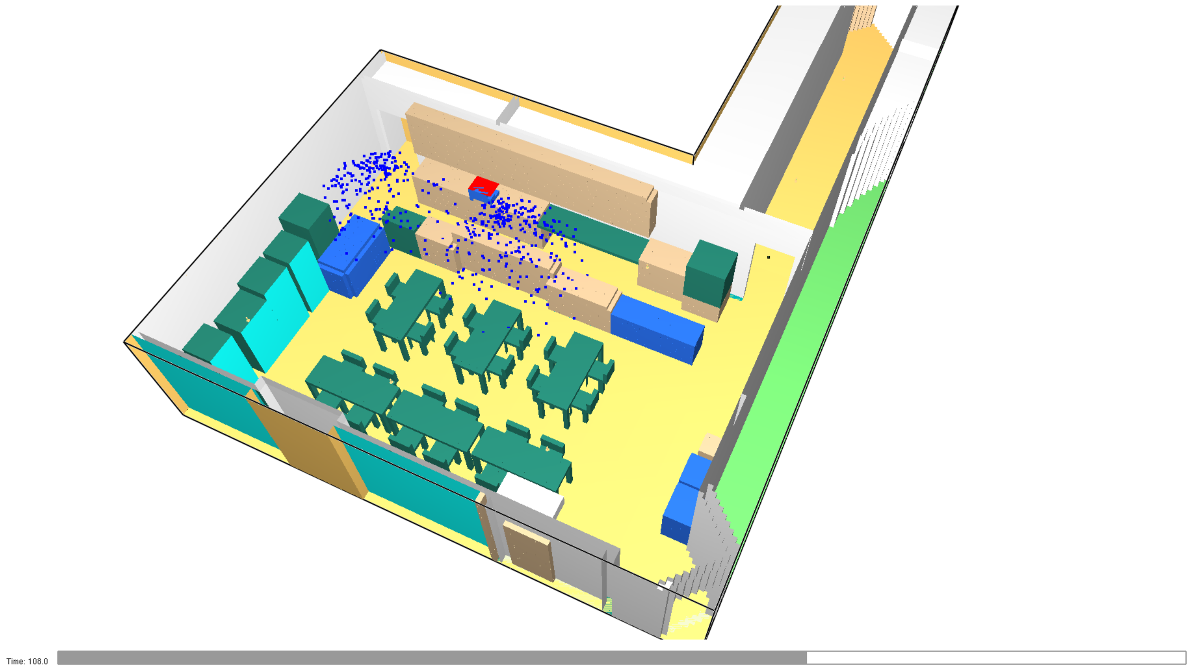

Figure #55: Cafeteria Fire – First sprinklers activate (107.4 sec)

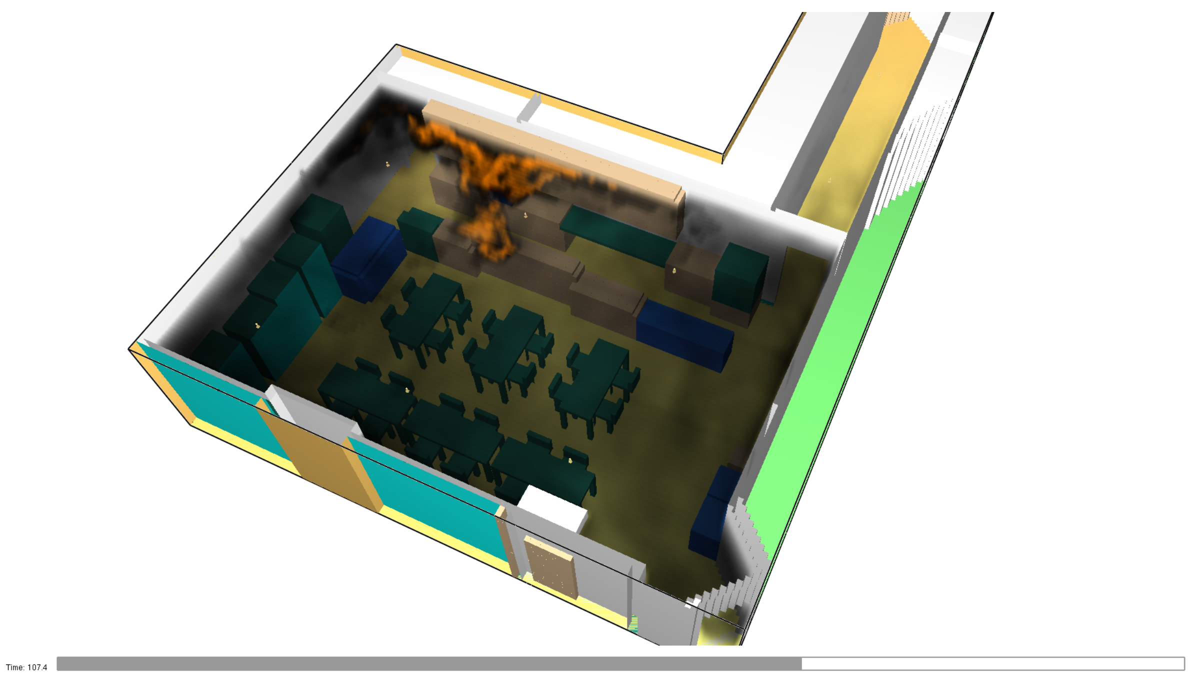

Figure #56: Cafeteria Fire – Smoke & Fire when the first sprinklers activate (107.4 sec)

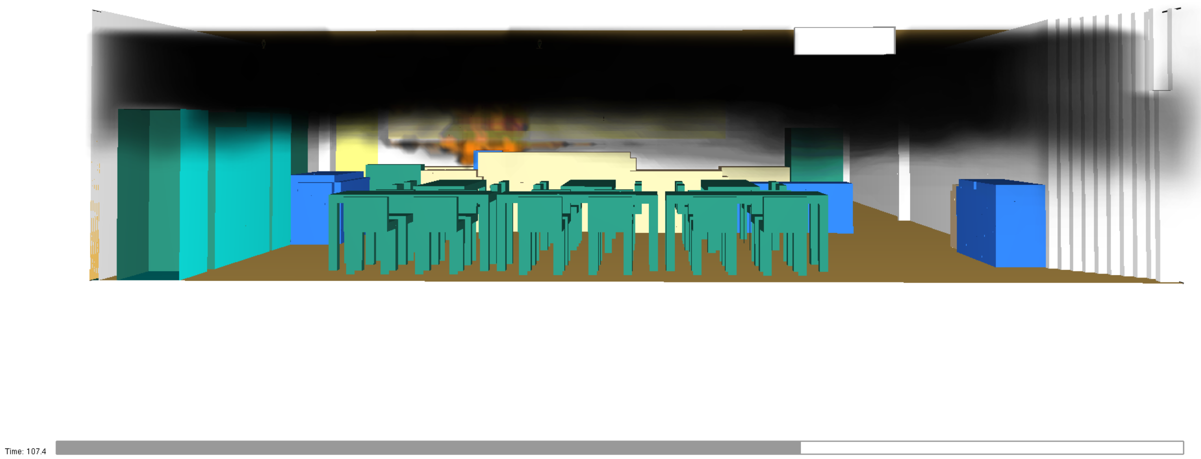

Figure #57: Cafeteria Fire – Smoke & Fire when first sprinklers activate facing north (107.4s) (South wall invisible)

Due to the fact that HRR, fire growth, soot yield, and CO yield values were estimated, actual results may be slightly different. Examining the graph of Total HRR vs. Time below, the HRR values did drop slightly when the sprinklers were activated. However, in the simulation, the burner's fire ramp was not modified to simulate activation of sprinklers. These facts may extend the ASET value slightly, however it is unlikely that there will be more time available for egress (ASET) than what is required (RSET).

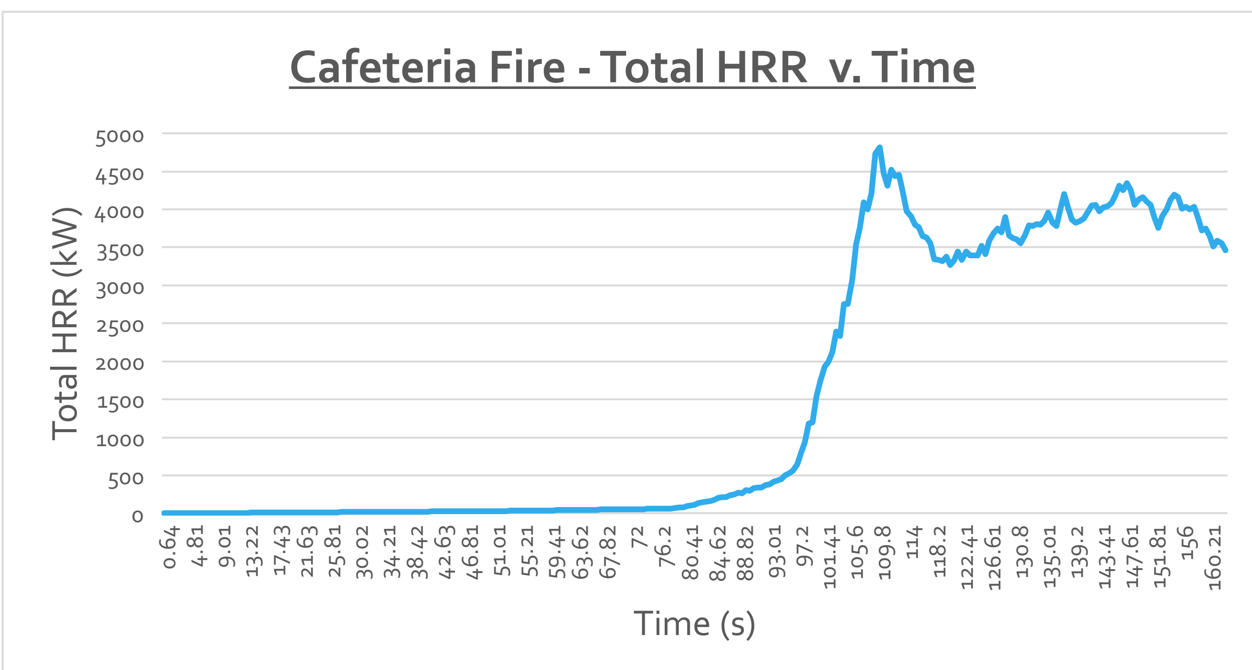

Figure #58: Cafeteria Fire - Total HRR v Time Graph

Scenario #2

The fire in the second floor northern hallway grew following a fast speed t^2 fire growth curve. It was designed to reach a maximum HRR of 600kW at 114 seconds into the simulation. However, due to the proximity of the sprinklers to the fire origin, the fire growth was halted when the second sprinkler activated at 90.0 seconds.

All three of the sprinklers in the small common area at the south end of the hallway activated. Neither of the two sprinklers in the northern portion of the hallway activated. Unlike the other three scenarios, the sprinklers in the second floor northern hallway are a different brand (Viking) and have a lower activation temperature of 68°C. The table below lists activation times of the sprinklers. The simulation was stopped at 200.4 seconds when the conditions in the hallway/office had plateaued.

Table #23: Second Floor Hallway Sprinkler Activation Times and Locations

Sprinkler Name	Activation Time (s)	Location
North Hall #1	76.2	Eastern Common Area
North Hall #2	90.0	Western Common Area
North Hall #3	97.8	Northern Common Area
North Hall #4	N/A	South in the Hallway
North Hall #5	N/A	North in the Hallway

The maximum occupancy of the second floor northern hallway is 102 people. According to the movement time calculations in APPENDIX C, the time it would take the occupants of the second floor hallway ("LAFCo, Grand Jury & Conference Rooms") to escape to safety was 293 seconds once they started their evacuation. The discovery time (t_d) in this scenario was the time it took the smoke detector in the hallway to activate. That time was 9.0 seconds. Once the smoke detector activates, it triggers the building's fire alarm system immediately notifying everyone in the building.

Once the occupants in the second floor hallway and adjoining rooms are alerted to the fire, the pre-movement time (t_{pre}) portion of the evacuation begins. Unlike the first scenario in the cafeteria, most of the occupants in the area of the second floor north hallway would not be able to see the smoke or fire by the time the fire alarm triggers. Therefore, the recognition time would be higher as it would take people time to realize the alarms are indicating there is a fire in the building. The department is composed primarily of staff, but there would be people in the Grand Jury room and potentially the conference rooms who are not familiar with the fire alarm system. Therefore, the recognition time was estimated to be 30 seconds. The response time of the occupants could vary greatly though. For people in the conference rooms or LAFCo offices, it might take only 30 seconds for them to respond, but for people in the Grand Jury room, it could take significantly longer if they try to finish a portion of testimony before exiting or try to pack all their belongings before leaving. Because of the large variance, two estimates will be used for the pre-movement times (recognition time plus response time), 60 seconds and 240 seconds.

With a discovery time of 9 seconds, a pre-movement time of 60/240 seconds, and a movement time of 293 seconds, the evacuation time would be 362/542 seconds. With a safety factor of 1.5, the total RSET (Required Safe Egress Time) value is 543/813 seconds which is equivalent to ~9/13.5 mins.

Because of the three sprinklers directly above the fire in the small common area, and the large solid-core wooden door that closes automatically, once the occupants could reach the second floor lobby, tenability conditions would drastically improve. Occupants could be completely out of the north hallway and into the lobby by 262/442 seconds, 100 seconds before they could exit the building. That does not take into account the opening of the door while the occupants would be exiting.

Slice files at Z=1.8m (6 feet) above the floor and detectors near the LAFCo office, Grand Jury, and the exit doorways were used to determine when the conditions were no longer tenable (based on the criteria mentioned above). Table 24 below lists when/if conditions became untenable based on the four factors listed above.

Table #24: 2nd Floor Hallway Tenability Criteria Factor Times

	Tenability Criteria Factor			
Location	***Visibility (< 8m)***	***Temperature (> 100℃)***	***Carbon Monoxide (> 1,350 ppm-min)***	***Radiant Heat Flux (> 2.5kW/m²)***
LAFCo Door	*79.2 sec*	*N/A*	*N/A*	*N/A*
Grand Jury Door	*74.4 sec*	*N/A*	*N/A*	*N/A*
Exit Door to Lobby	*76.2 sec*	*N/A*	*N/A*	*N/A*
ASET Pass/Fail	***Fail***	***Pass***	***Pass***	***Pass***

**The simulation was stopped at 200.4 seconds when conditions began to plateau. Because the egress times, were longer than 200 seconds, trends were analyzed to determine if any of the thresholds (other than visibility) would be exceeded.*

Based on the values in the table above, conditions became untenable due to visibility at 74.4 seconds in the center of the hallway. The first sprinklers didn't activate till 76.2 sec. Due to conditions becoming untenable, thereby marking an end to the ASET, RSET values are greater than the ASET values.

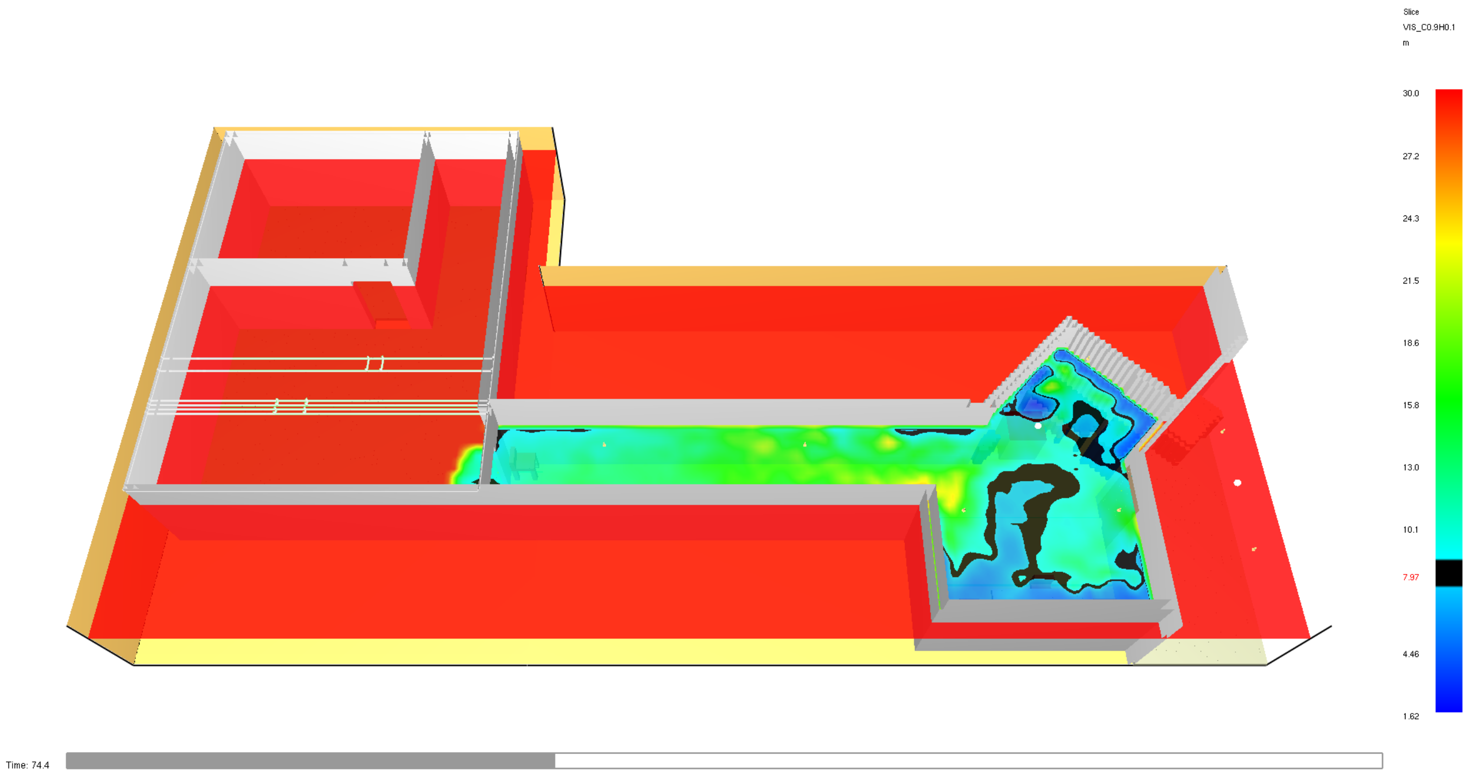

Figure #59: 2nd Floor Hall Fire - Visibility slice file at Z=1.8 facing east in Smokeview (74.4s) Tenability failure at Grand Jury doorway. Black indicates visibility threshold.

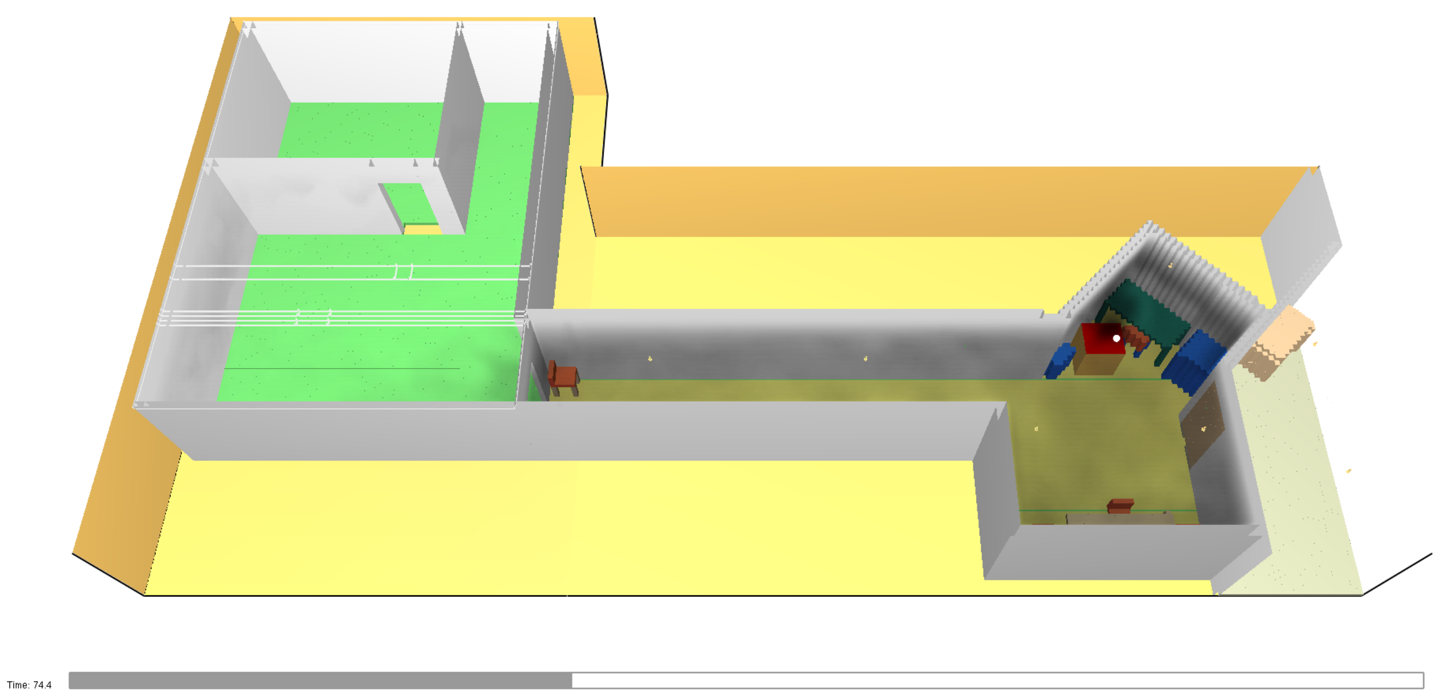

Figure #60: 2nd Floor Hall Fire – Smoke & fire facing east in Smokeview (74.4 sec)

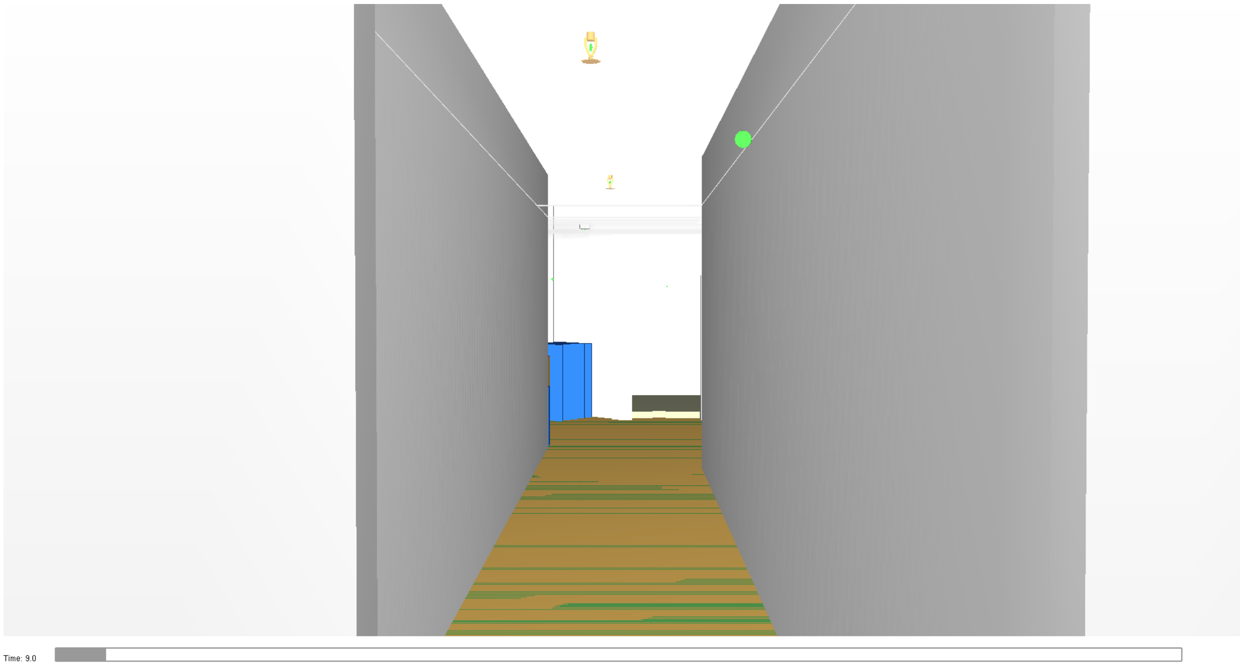

Figure #61: 2nd Floor Hall Fire – Smoke & fire facing south into the hallway from the LAFCo office doorway at the time of smoke detector activation (9.0 sec)

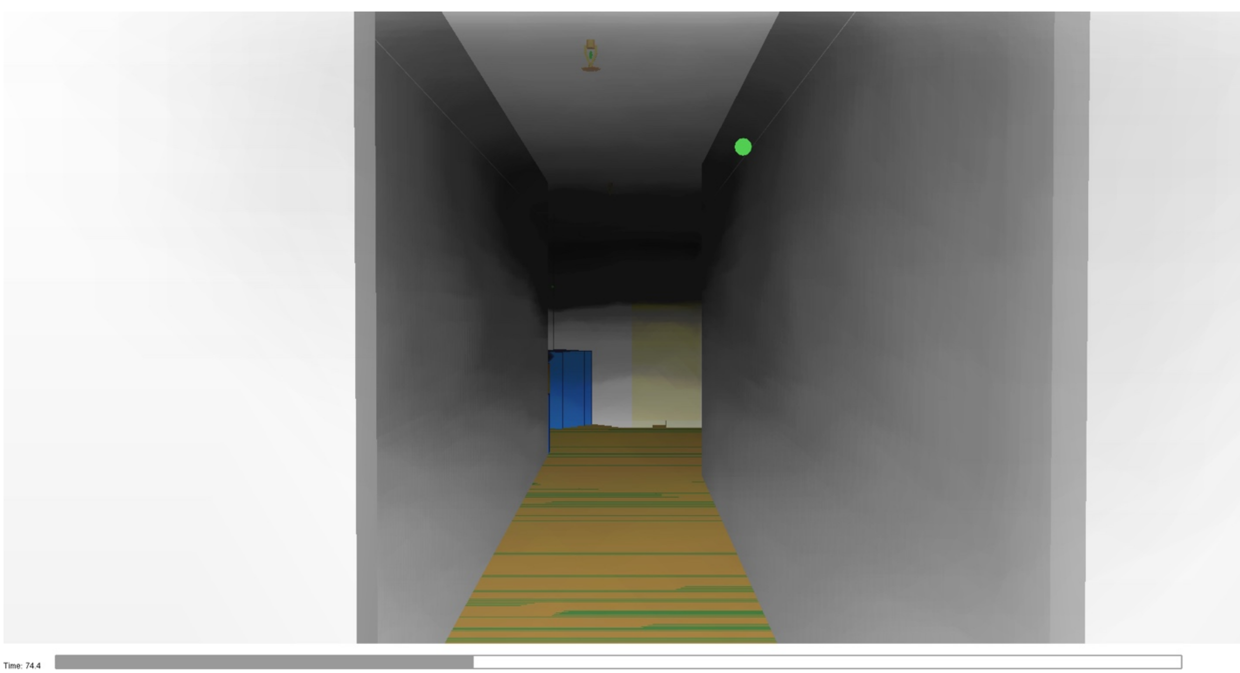

Figure #62: 2nd Floor Hall Fire – Smoke & fire facing south into the hallway from the LAFCo office doorway at the time of visibility tenability failure at Grand Jury doorway (74.4 sec)

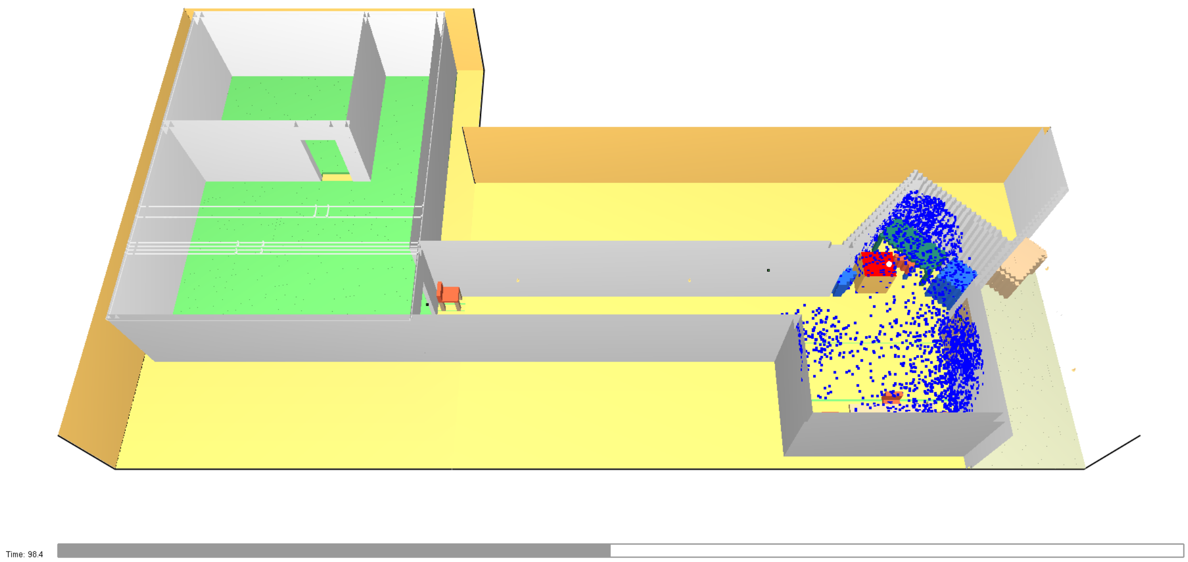

Figure #63: 2nd Floor Hall Fire – Last sprinkler activation facing east (97.8 sec)

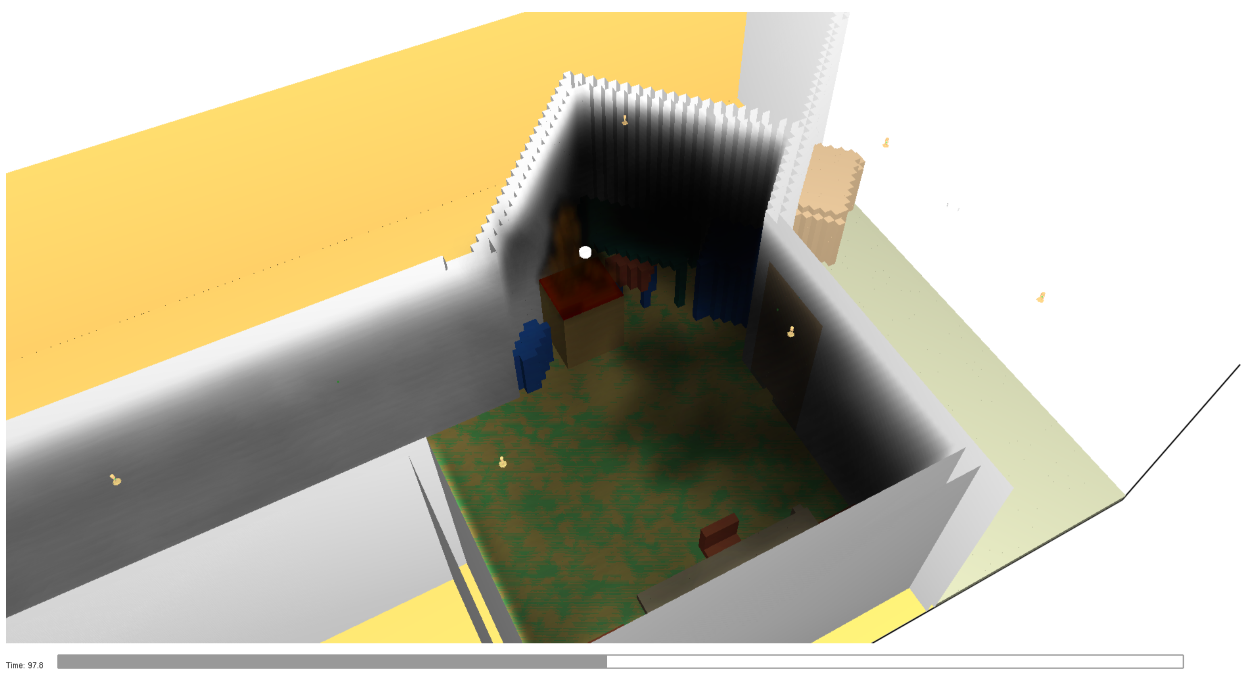

Figure #64: 2nd Floor Hall Fire – Smoke & fire facing southeast in the common area when the last sprinkler activated (97.8 sec)

Due to the fact that HRR, fire growth, soot yield, and CO yield values were estimated, actual results may be slightly different. That may extend the ASET value slightly, however it is unlikely that there will be more time available for egress (ASET) than what is required (RSET) due to long egress times and the visibility conditions failing so early in the fire.

With the current configuration, if the occupants can't exit the hallway in less than 74 seconds after detection, then they would be forced to either enter the hallway under untenable conditions, or retreat to the rooms/offices they started in and wait for the fire department to come rescue them. As there is no other way out of any of these rooms, the occupants would be trapped. In the simulation, the sprinklers maintained tenable conditions with the exception of visibility. If the other fuel packages would have ignited, (two plastic recycle containers and a foam chair) it is possible that the sprinklers could have been overwhelmed if the fire grew quickly in the early stages prior to the activation of the sprinklers. If that occurs, then the occupants would in danger of smoke leaking into the rooms and the fire spreading above them while they wait for the fire department to arrive.

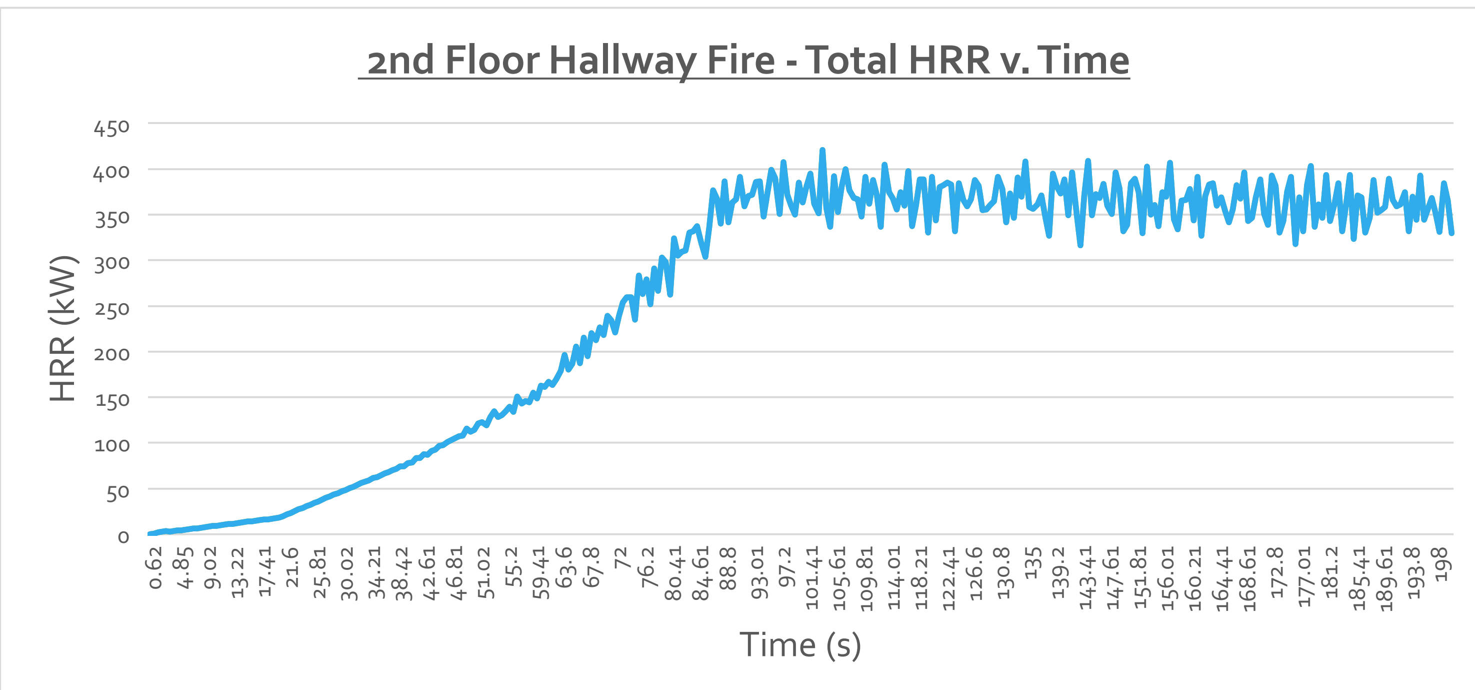

Figure #65: 2nd Floor Hallway Fire - Total HRR v Time Graph

Scenario #3

There are three fires (burners) in the first floor western corridor scenario. All three grew at a pace slightly slower a fast speed t^2 fire growth curve. The growth rates were based upon test data from burns of HDPE (high-density polyethylene) plastic at NIST and Western Fire Center. The first burner reached a maximum HRR of 2400kW at 250 seconds. The second burner didn't ignite until 60 seconds into the scenario but reached a maximum HRR of 2100kW in 240 seconds. The third burner also didn't ignite until 60 seconds into the scenario but reached a maximum HRR of 800kW in 150 seconds. Due to the large amount of fuel present, it was hypothesized that the fire would overwhelm the sprinklers, so the fire ramps were not adjusted to simulate the sprinklers having an effect.

17 of the 20 sprinklers in the western corridor activated, and the one in the portion of the northern corridor that was modeled did not activate. Of the three sprinklers that did not activate, one was at the easternmost end of the corridor, and the other two were at the westernmost end of the corridor. All of the sprinklers have an activation temperature of 74°C. The table below lists activation times of the sprinklers. The simulation was stopped at 240.0 seconds when the conditions in the corridor had plateaued.

Table #25: First Floor Hallway Sprinkler Activation Times

Sprinkler Name	***Activation Time (s)***
West Hall #1 *	N/A
West Hall #2	154.8
West Hall #3	138.0
West Hall #4	105.6
West Hall #5	55.8
West Hall #6	40.2
West Hall #7	76.8
West Hall #8	56.4
West Hall #9	72.0
West Hall #10	96.6
West Hall #11	88.2
West Hall #12	97.2
West Hall #13	111.6
West Hall #14	117.0
West Hall #15	126.0
West Hall #16	135.6
West Hall #17	133.2
West Hall #18	156.6
West Hall #19	N/A
West Hall #20 **	N/A
North Hall #1	N/A

* Easternmost Sprinkler
** Westernmost Sprinkler

As the location of this fire was in a corridor, there was no maximum occupancy associated with the space. However, two departments have to enter the first floor western corridor to exit the building (in different directions) so the occupancies of both departments will be discussed separately.

The first department required to enter the western corridor is the Child Support Services (CSS). Their primary evacuation route would take them from the east end of the corridor westward, and then north into the northern corridor. This fire scenario will change their evacuation route, but they'll still need to enter the western corridor before heading east into the CDA waiting area and out the front of the building.

The maximum occupancy of the CSS department is 38 people. According to the movement time calculations in APPENDIX C, the time it would take the occupants to escape to safety via their secondary evacuation route was 152 seconds once they started their evacuation. The discovery time (t_d) in this scenario was the time it took a smoke detector in the hallway to activate. That time was 6.0 seconds. Once the smoke detector activates, it triggers the building's fire alarm system immediately notifying everyone in the building.

Once the occupants in the CSS department are alerted to the fire, the pre-movement time (t_{pre}) portion of the evacuation begins. The occupants would not be able to see the smoke or fire by the time the fire alarm triggers, therefore, there would be a recognition time as people realize they need to evacuate. The recognition time was estimated to be 15 seconds as the department is composed entirely of staff who are trained to recognize the alarm. Once alerted to the fire, the response time would be fairly low as everyone is trained to evacuate. The response time was estimated to be 15 seconds for the same reasons just mentioned.

With a discovery time of 6 seconds, a pre-movement time of 30 seconds, and a movement time of 152 seconds, the evacuation time would be 188 seconds. With a safety factor of 1.5, the total RSET (Required Safe Egress Time) value is 282 seconds.

Like previous scenarios, once out of the corridor where the fire is located, the occupants would reach an area where tenability conditions would drastically improve and they would no longer be in immediate danger. Occupants could exit the western corridor via the eastern door into the CDA waiting area within 137 seconds; 53 seconds before exiting the building. At that time, both visibility and temperature levels would have been considered untenable.

The second department required to enter the western corridor is the Information & General Services (IGS). Their primary evacuation route would take them from the west end of the corridor westward to the western stairwell. This fire scenario will not change their evacuation route as there is not another option, but the occupants will be exposed to the smoke and heat from the fire

The maximum occupancy of the IGS department is 107 people. According to the movement time calculations in APPENDIX C, the time it would take the occupants to escape to safety via their primary evacuation route was 204 seconds once they started their evacuation. The discovery time (t_d) in this scenario was the same as above, 6.0 seconds. Once the smoke detector activates, it triggers the building's fire alarm system immediately notifying everyone in the building.

Once the occupants in the IGS department are alerted to the fire, the pre-movement time (t_{pre}) portion of the evacuation begins. For the same reasons as the CSS department, the recognition time and the response time were estimated to be 15 seconds each

With a discovery time of 6 seconds, a pre-movement time of 30 seconds, and a movement time of 204 seconds, the evacuation time would be 240 seconds. With a safety factor of 1.5, the total RSET (Required Safe Egress Time) value is 360 seconds.

Slice files at Z=1.8m (6 feet) above the floor were used to determine when the conditions were no longer tenable (based on the criteria mentioned above). Table 26 below lists when/if conditions became untenable based on the four factors listed above.

Table #26: 1st Floor Corridor Tenability Criteria Factor Times

	Tenability Criteria Factor			
Location	***Visibility (< 8m)***	***Temperature (> 100°C)***	***Carbon Monoxide (> 1,350 ppm-min)***	***Radiant Heat Flux (> 2.5kW/m²)***
Western End	*118.2 sec*	*135.6 sec*	*N/A*	*N/A*
Central/Origin	*70.2 sec*	*87.6 sec*	*N/A*	*72.0 sec*
Eastern End	*94.8 sec*	*128.4 sec*	*N/A*	*N/A*
ASET Pass/Fail	***Fail***	***Fail***	***Pass***	***Fail***

**The simulation was stopped at 240.0 seconds when conditions began to plateau. Because the RSET value is larger than 240 seconds, trends were analyzed to determine if the carbon monoxide threshold would be exceeded.*

Based on the values in the table above, conditions first became untenable due to visibility at 70.2 seconds in the center of the hallway. The first sprinklers activated at 40.2 sec. By the time conditions became untenable three sprinklers had already activated. Due to conditions becoming untenable, thereby marking an end to the ASET, RSET values are greater than the ASET values.

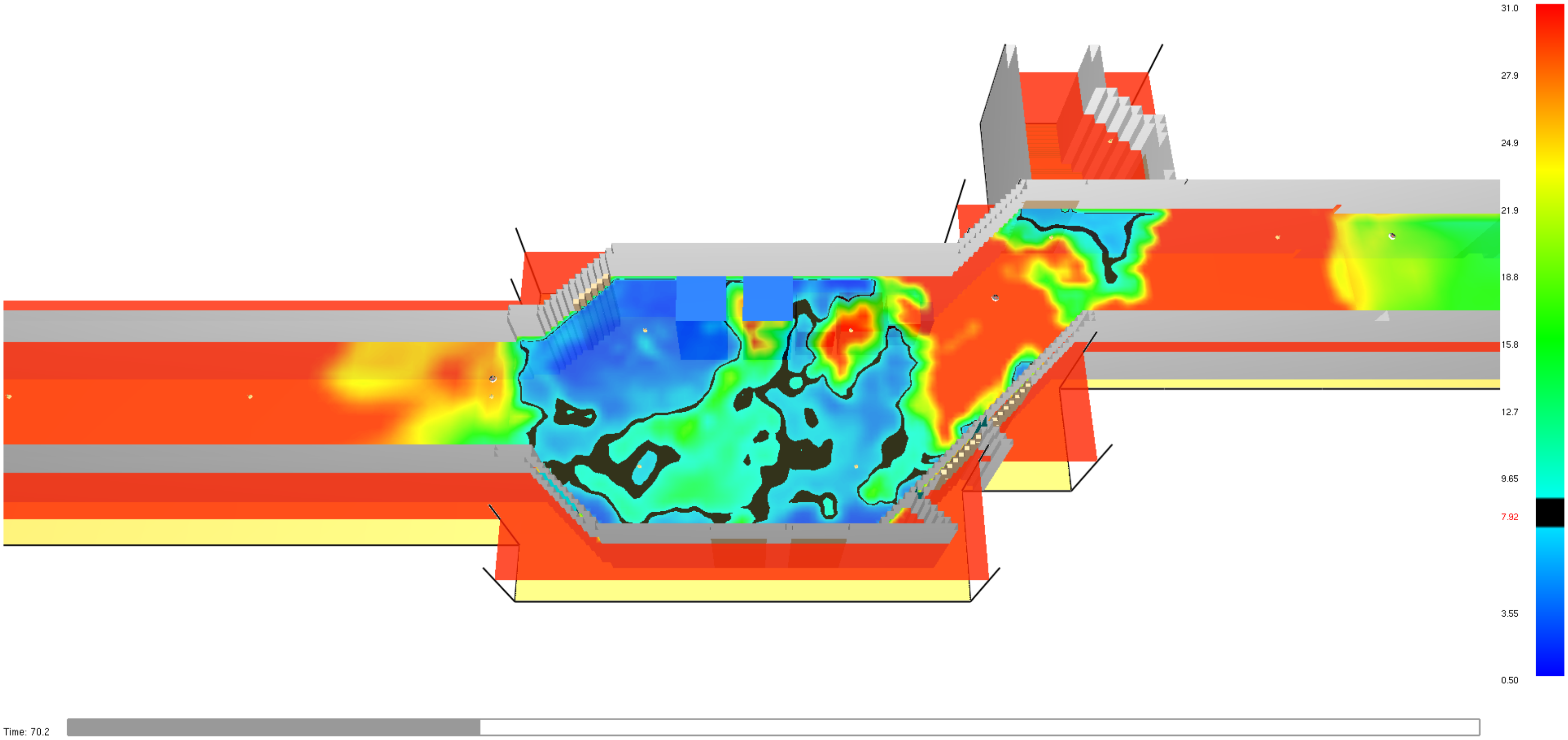

Figure #66: 1st Floor Hall Fire - Visibility slice file at Z=1.8 facing north in Smokeview (70.2s)
Tenability failure at the origin. Black indicates visibility threshold.

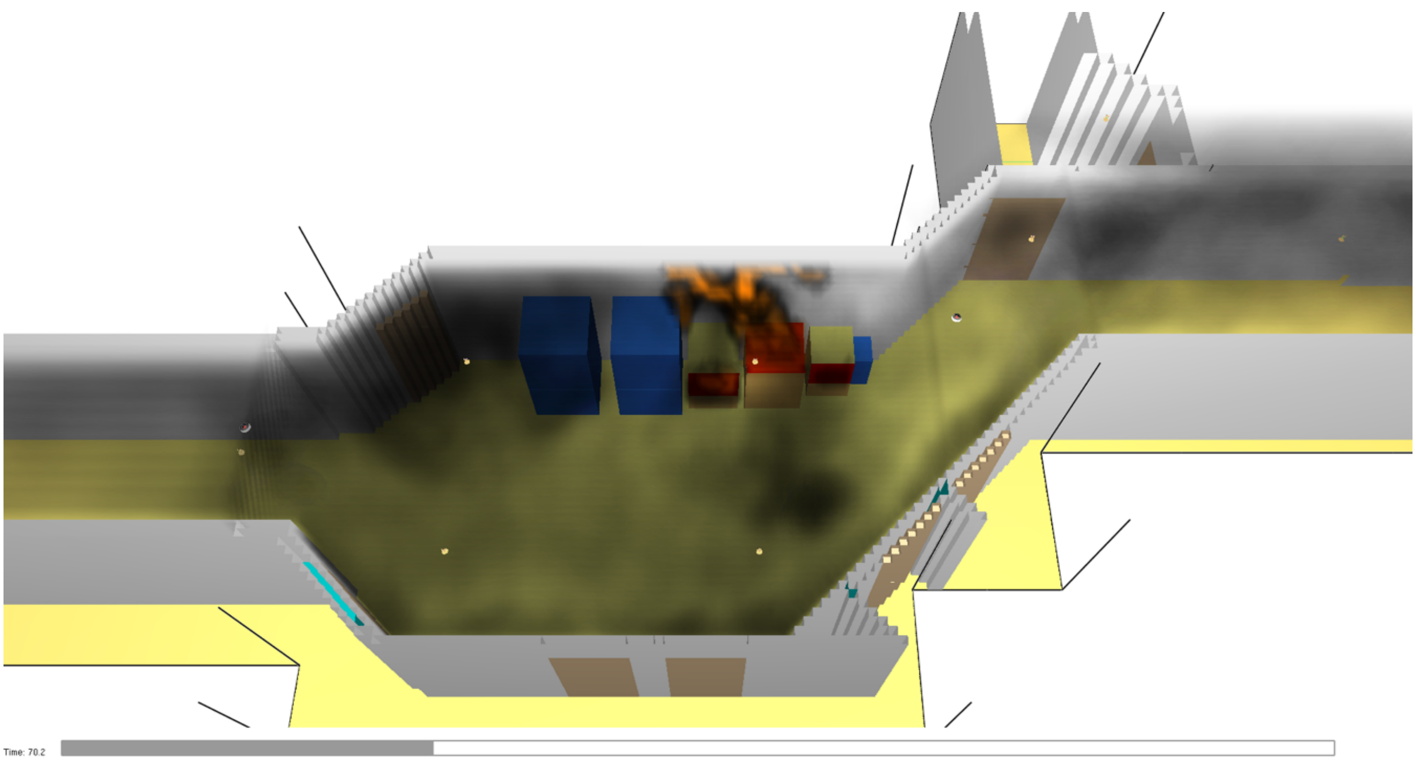

Figure #67: 1st Floor Hall Fire – Smoke/fire at the origin when visibility fails (70.2 sec)

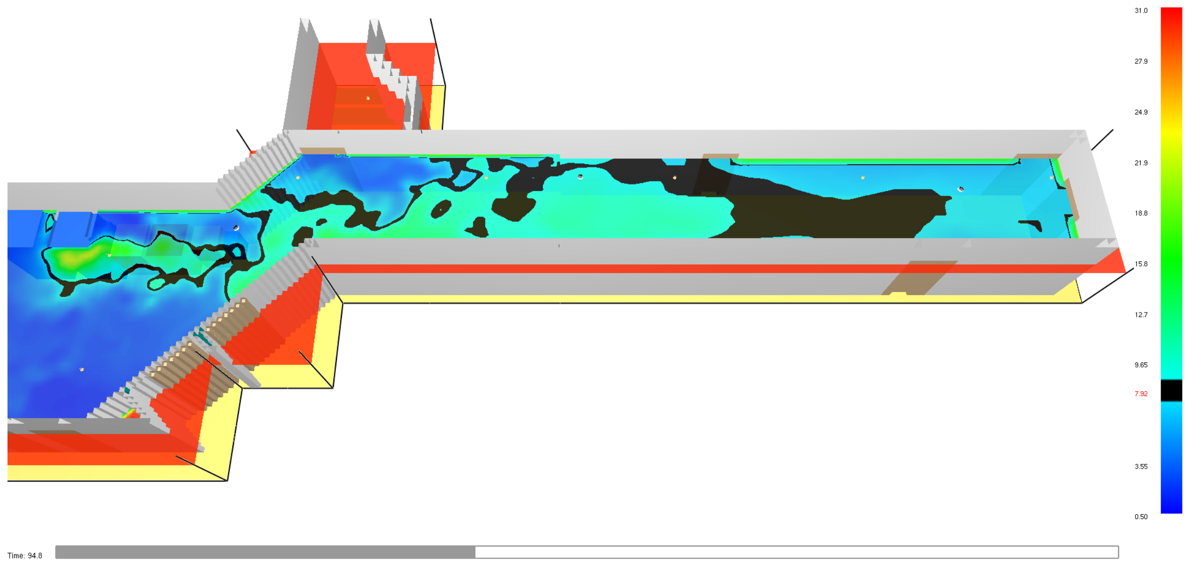

Figure #68: 1st Floor Hall Fire - Visibility slice file at Z=1.8. (94.8 sec)
Tenability failure at east end of hallway. Black indicates visibility threshold.

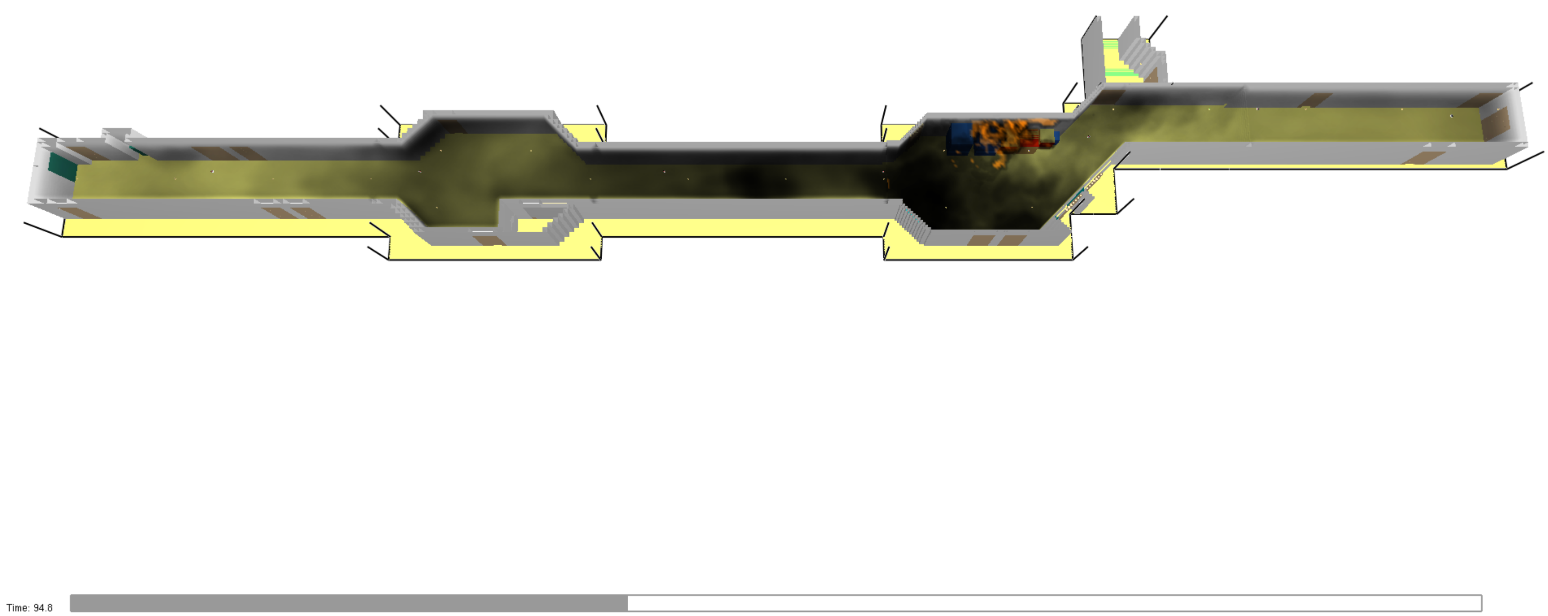

Figure #69: 1st Floor Hall Fire - Smoke/fire overview when visibility fails at the east end of the hallway (94.8 sec)

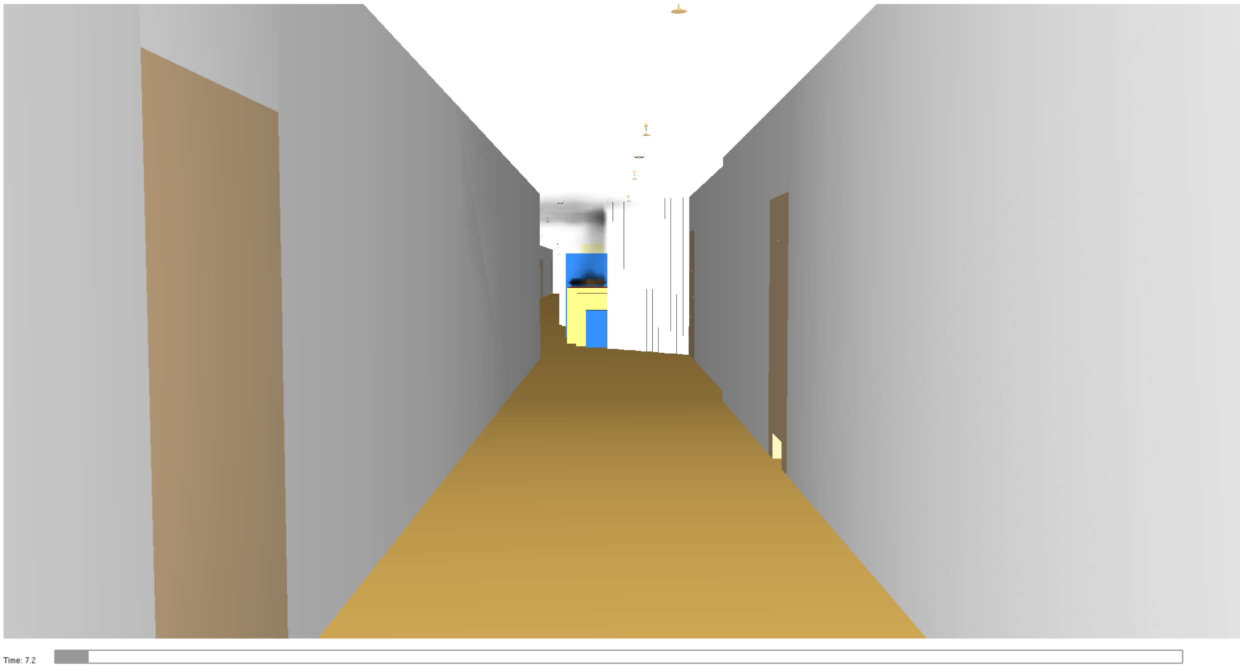

Figure #70: 1st Floor Hall Fire - Smoke/fire interior view from the east end of the hallway looking west towards the origin just after the smoke detector activated. (7.2 sec)

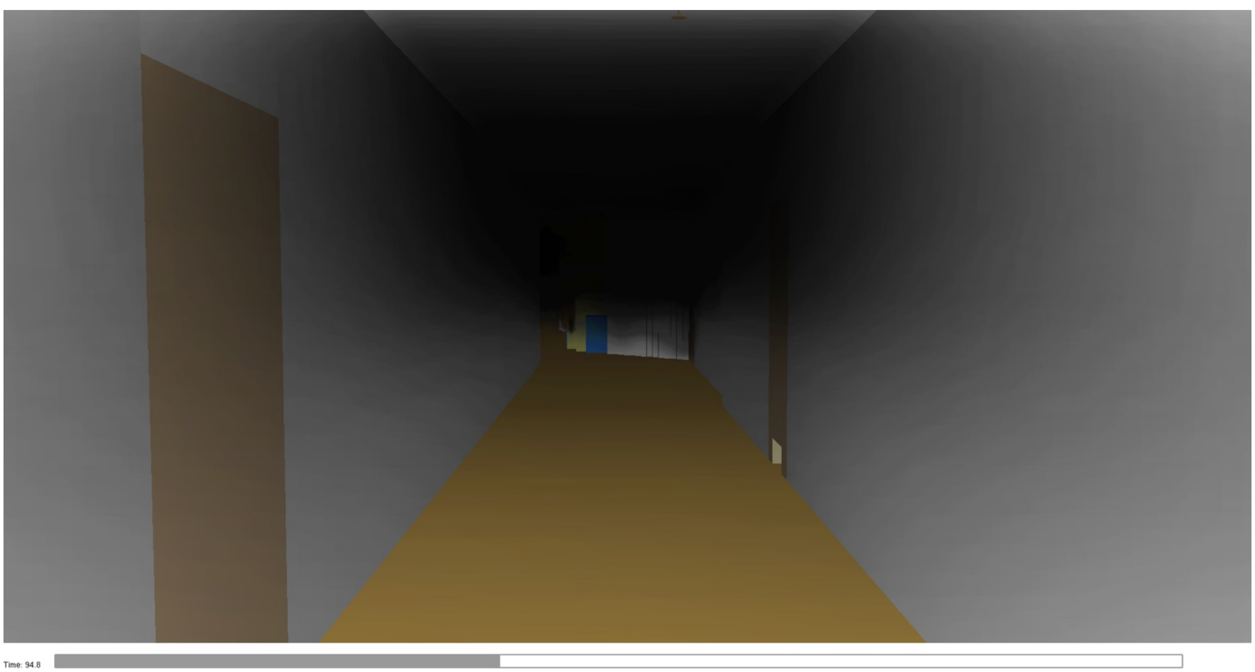

Figure #71: 1st Floor Hall Fire - Smoke/fire interior view from the east end of the hallway looking west towards the origin when tenability fails. (94.8 sec)

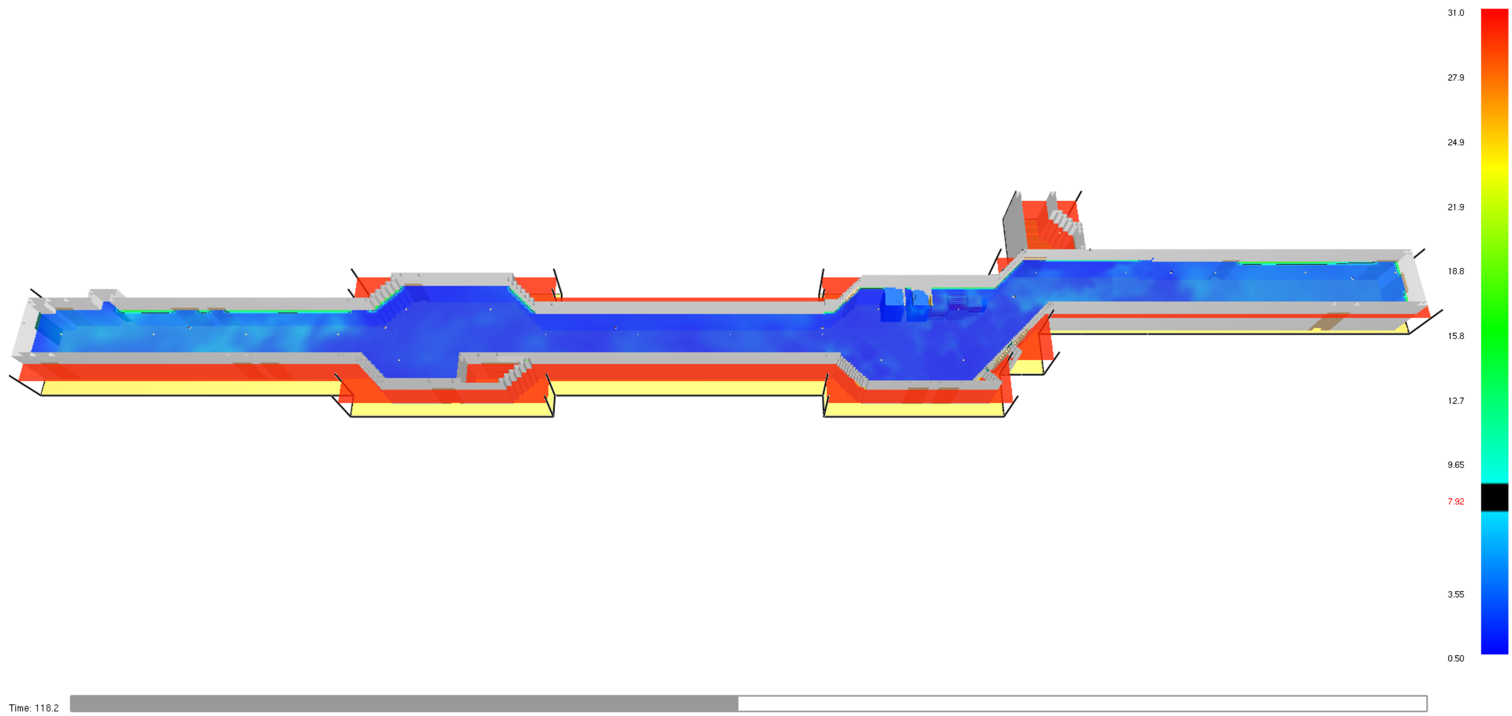

Figure #72: 1st Floor Hall Fire - Visibility slice file at Z=1.8. (118.2 sec)
Tenability failure at west end of hallway (and throughout)

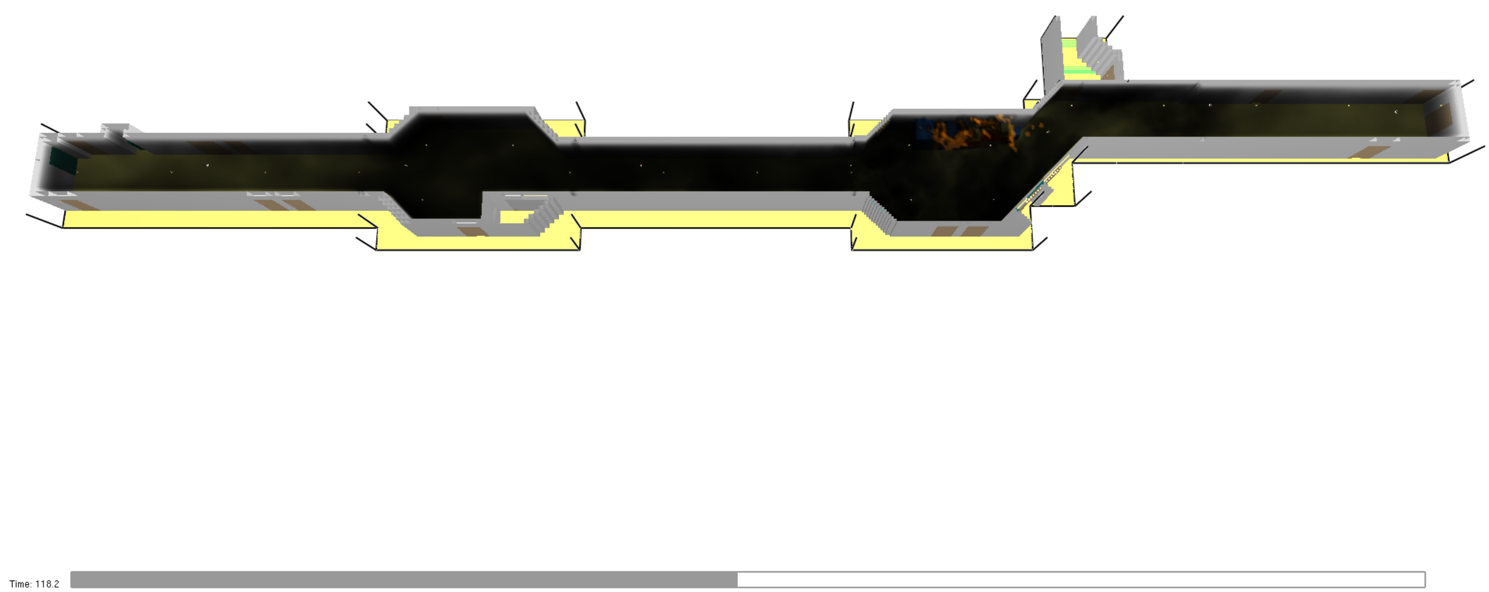

Figure #73: 1st Floor Hall Fire - Smoke/fire overview when visibility fails at the west end of the hallway (118.2 sec)

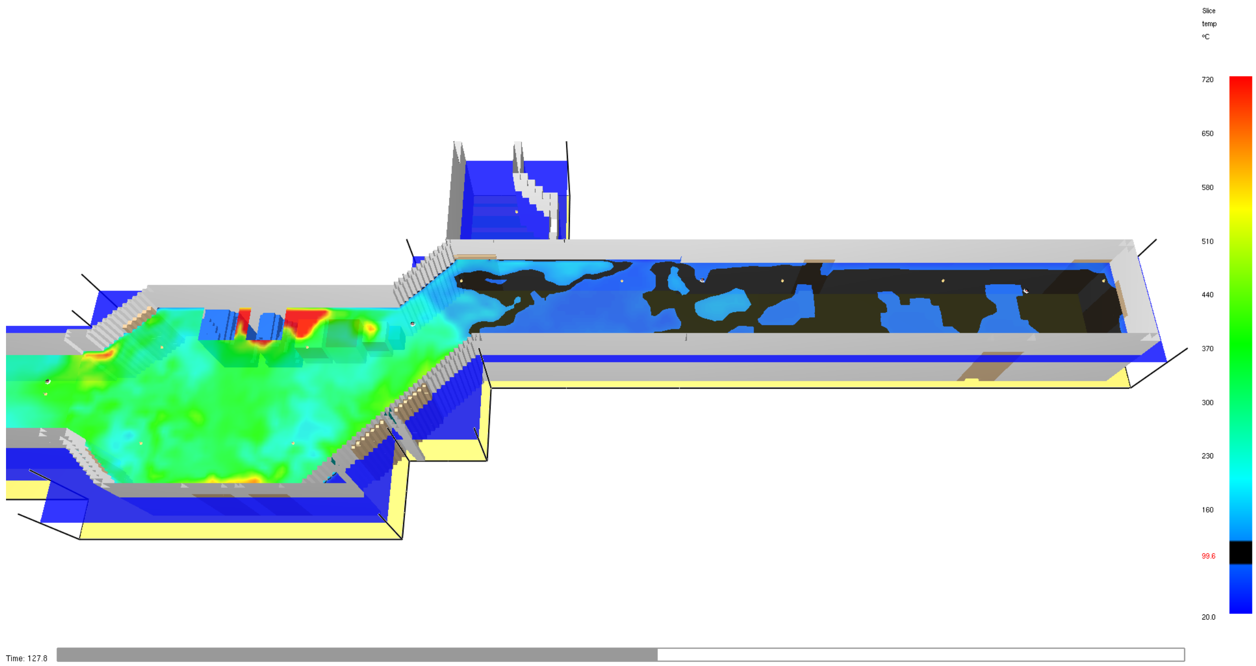

Figure #74: 1st Floor Hall Fire - Temperature slice file at Z=1.8. (127.8 sec)
Tenability failure at east end of hallway. Black indicates temperature threshold.

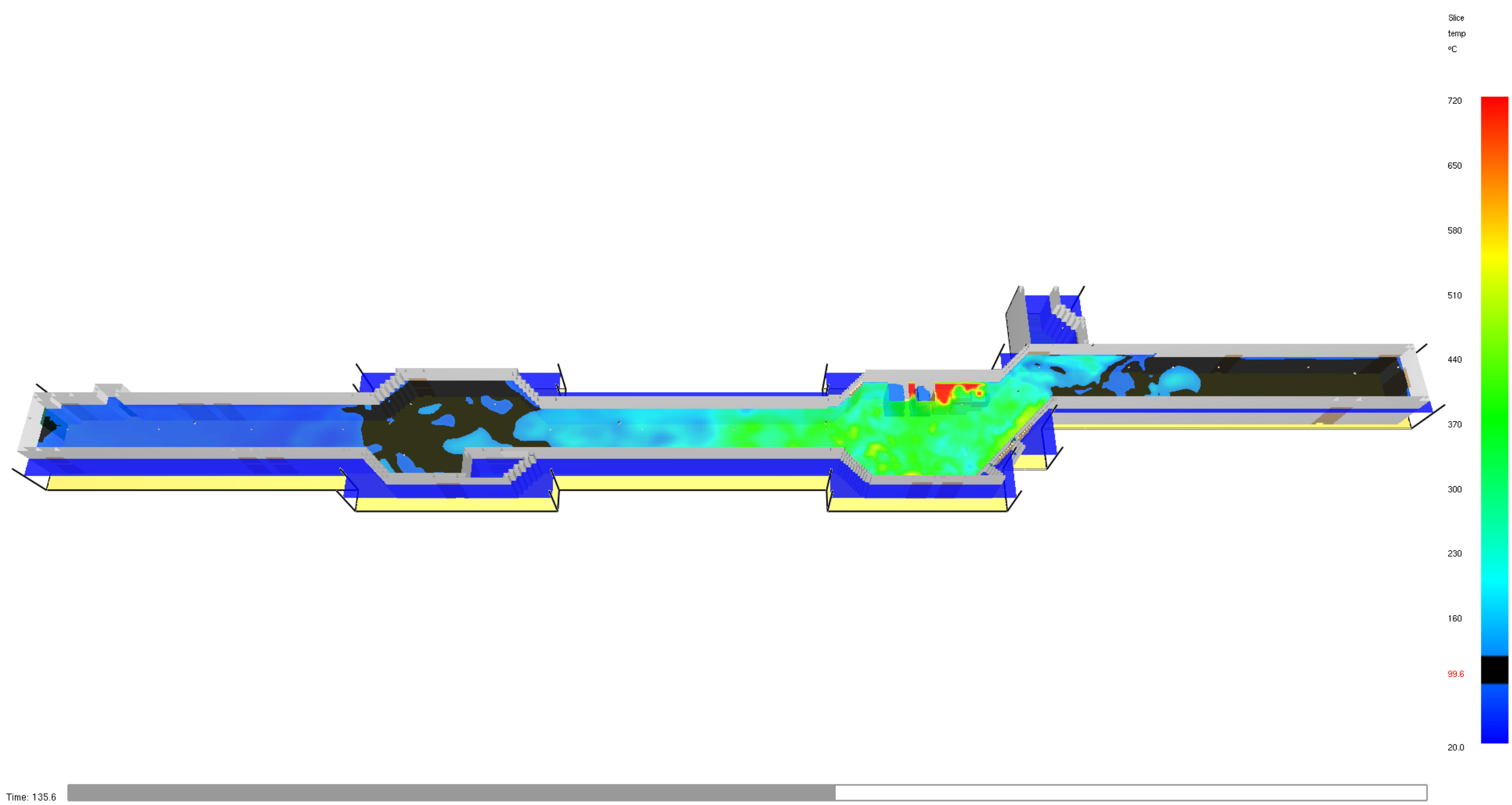

Figure #75: 1st Floor Hall Fire - Temperature slice file at Z=1.8. (135.6 sec)
Tenability failure at west end of hallway

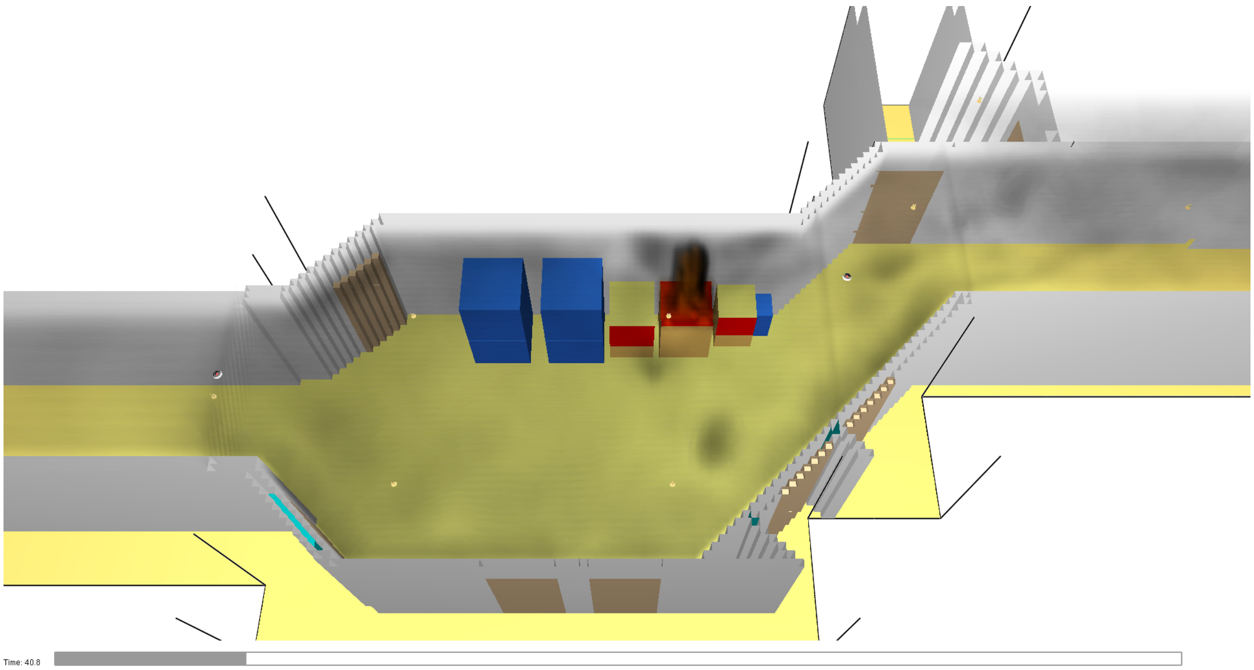

Figure #76: 1st Floor Hall Fire – Smoke/fire at the origin when 1st sprinkler activates (40.2s)

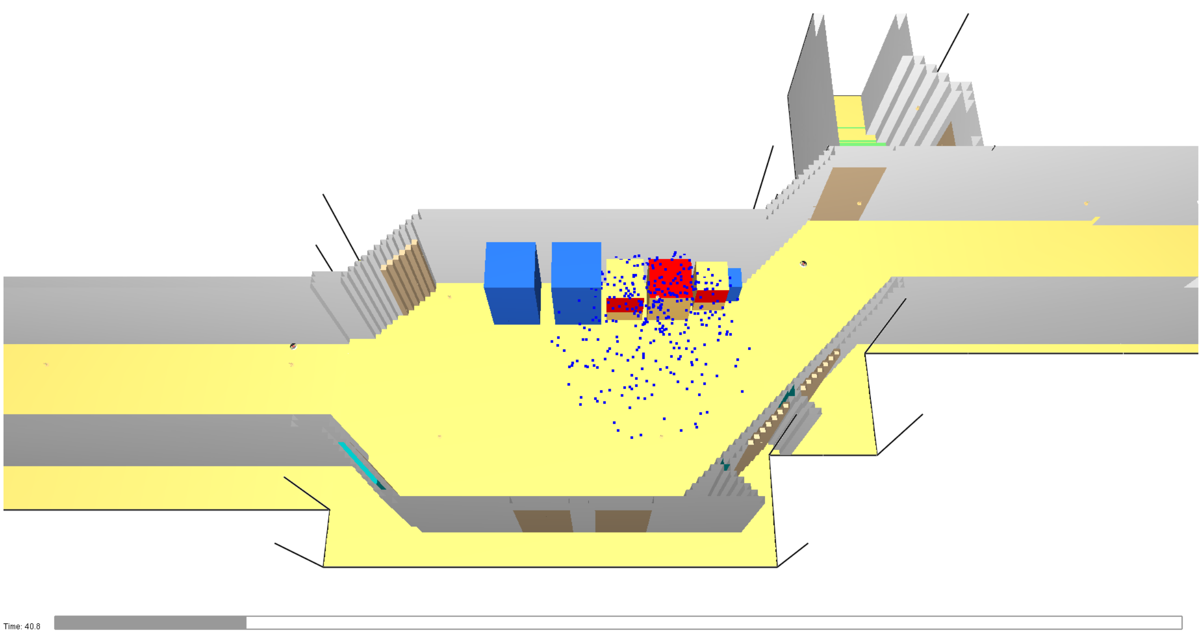

Figure #77: 1st Floor Hall Fire – First sprinkler activation (at the origin) (40.2 sec)

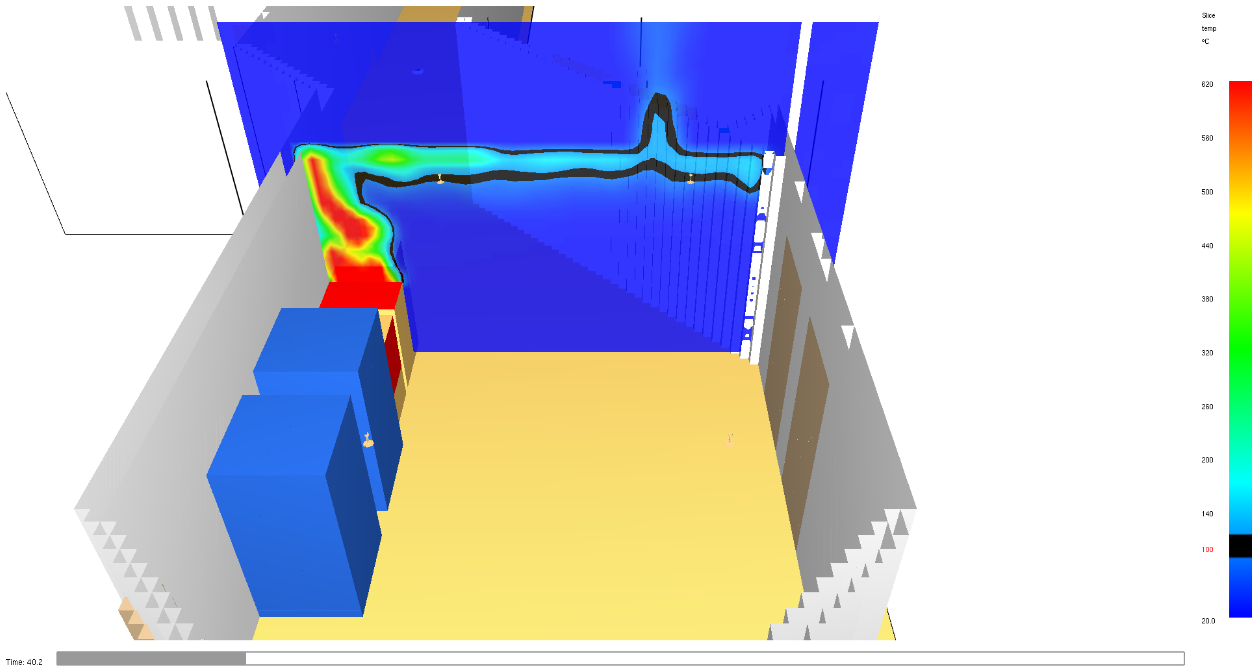

Figure #78: 1st Floor Hall Fire – Temp slice (looking east) through the first burner when the first sprinkler activates (40.2 sec). Vertical rise at ceiling level is through an HVAC vent.

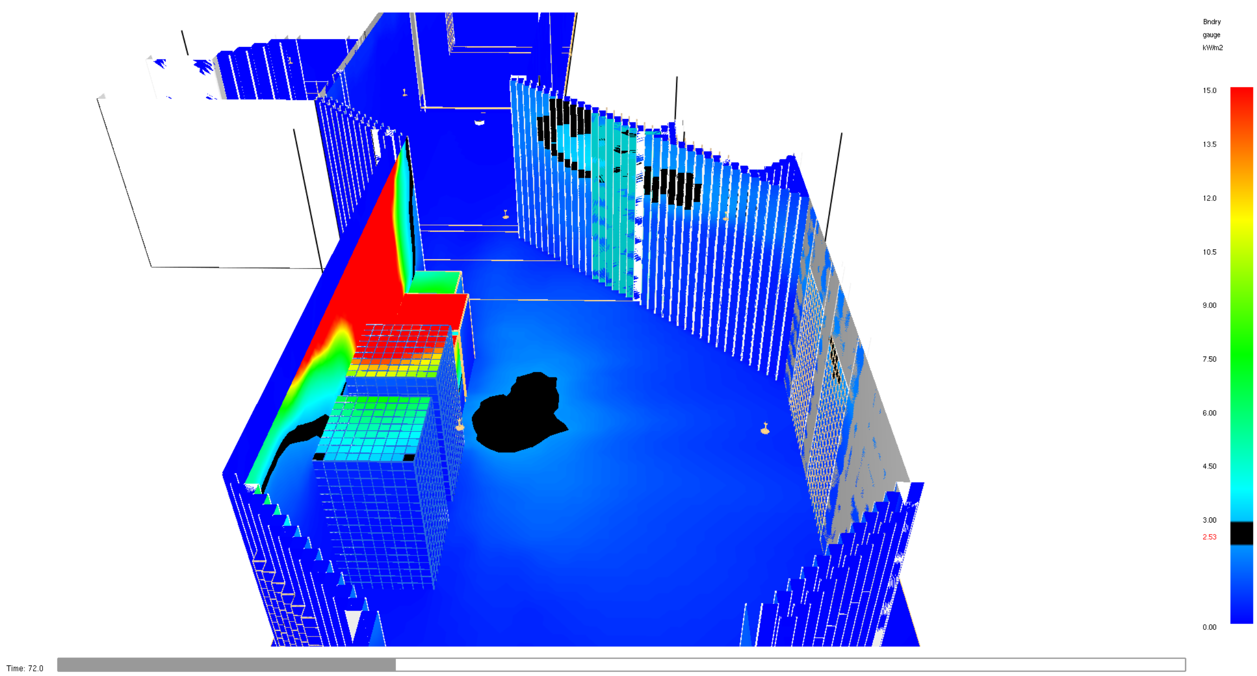

Figure #79: 1st Floor Hall Fire – Boundary Heat Flux looking east at the origin threshold is reached (72.0 sec). Black indicates the threshold value.

Due to the fact that HRR, fire growth, soot yield, and CO yield values were estimated, actual results may be slightly different. That may extend the ASET value slightly, however it is unlikely that there will be more time available for egress (ASET) than what is required (RSET) due to long egress times and the visibility conditions failing so early in the fire.

With the current configuration of the recycle/trash containers in the exit corridors, this fire scenario blocks one exit forcing three departments to use secondary exit routes, and two departments to be exposed to the effects of the fire, and untenable conditions for a portion of their evacuation. This setup contained three recycle containers, one trash can, and two soda vending machines. During one visit, as many as nine recycle containers and two trash cans were arranged next to each other in the exit corridors. This amount of fuel can overwhelm the sprinkler systems. In the fire models, the ceilings were modeled as gypsum wall board, but in reality, they're constructed of acoustic ceiling tiles on a metal T-bar frame. As seen in the HRR graph below, the total HRR from this fire exceeded 9,000kW which could potentially cause the ceiling to collapse above the fire, allowing the fire to spread into other areas.

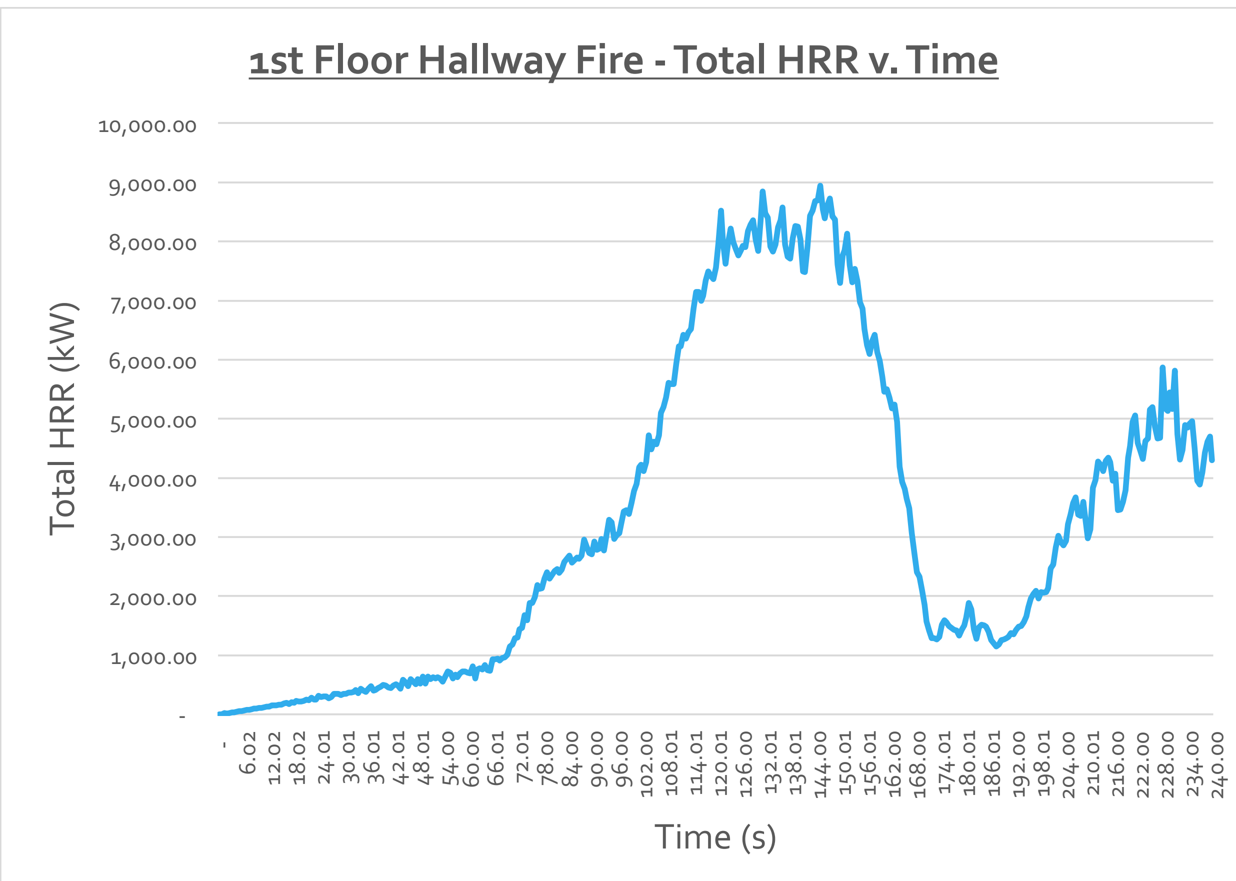

Figure #80: 1st Floor Hallway Fire - Total HRR v Time Graph

Scenario #4

There are two fires (burners) in the lobby fire scenario. Both grew following an ultra-fast speed t^2 fire growth curve. Both burners ignited at the same time and reached a maximum HRR of 80kW each at 20 seconds. Due to the large amount of fuel present, and the presence of dry-pipe sprinklers above the fire, the fire ramps were not adjusted to simulate the sprinklers having an effect on the fire.

All 13 of the dry-pipe sprinklers in the lobby activated, along with all 17 of the wet-pipe sprinklers on the second floor ceiling, and the two underneath the open air walkway. Both the wet-pipe and the dry-pipe sprinkler heads had an activation temperature of 74°C. One sprinkler was placed in the second floor north hallway as a comparison. That sprinkler was a Viking brand with an activation temperature of 68°C, and it never activated. The table below lists activation times of the sprinklers. The simulation was stopped at 270 seconds when the conditions in the lobby had plateaued.

Table #27: Lobby Sprinkler Activation Times

Sprinkler Name	***Activation Time (s)***
Dry Pipe East Lobby #1	93.0
Dry Pipe East Lobby #2	91.8
Dry Pipe East Lobby #3	99.6
Dry Pipe West Lobby #1	94.2
Dry Pipe West Lobby #2	93.0
Dry Pipe West Lobby #3	100.8
Dry Pipe West Lobby #4	96.0
Dry Pipe Center Lobby #1	82.8
Dry Pipe Center Lobby #2	84.6
Dry Pipe Center Lobby #3	78.6
Dry Pipe Center Lobby #4	81.0
Dry Pipe Center Lobby #5	79.8
Dry Pipe Center Lobby #6	84.6
Second Floor Lobby #1	109.2
Second Floor Lobby #2	112.8
Second Floor Lobby #3	101.4
Second Floor Lobby #4	104.4
Second Floor Lobby #5	97.8
Second Floor Lobby #6	101.4
Second Floor Lobby #7	94.8

Second Floor Lobby #8	95.4
Second Floor Lobby #9	111.0
Second Floor Lobby #10	92.4
Second Floor Lobby #11	92.4
Second Floor Lobby #12	90.6
Second Floor Lobby #13	94.2
Second Floor Lobby #14	92.4
Second Floor Lobby #15	92.4
Second Floor Lobby #16	93.0
Second Floor Lobby #17	116.4
Under Open Air Walkway #1	106.8
Under Open Air Walkway #2	106.8
Viking Second Floor Hall #1	N/A

The maximum occupancy of the lobby is 25 people. According to the movement time calculations in APPENDIX C, the time it would take the occupants of the lobby to escape to safety was a maximum of 34 seconds once they started their evacuation. Like the first scenario, discovery time (t_d) in this scenario had to be estimated because the only smoke detector was approximately 90 feet away from the fire. With this scenario, there is a book fair in the lobby which would have an attendant present at all times. If the fires were ignited, an attendant would realize fairly quickly. That person would likely yell out and alert others in the lobby, but they might not activate a pull station (located on the west side of the lobby near the cafeteria door entrance) because either they don't know where one is, or they choose to just yell out, evacuate, and call 911. If the BOS Chambers were occupied, then it is likely that someone in the lobby (possibly the book fair attendant) would know people were in the room and bang on the glass walls that separate the BOS Chambers from the lobby alerting the occupants to the fire. Therefore, the discovery time for the lobby and BOS Chambers will be estimated at 30 seconds. The discovery time for the rest of the building will be when the smoke detector at the north end of the lobby activates.

The recognition time for the occupants of the lobby would be near instantaneous, for the BOS Chambers it would be a bit longer, and for the rest of the building, even longer (once the alarm was triggered). Therefore, the recognition time for the lobby is estimated at 0 seconds, the BOS Chambers at 15 seconds, and the rest of the building at 30 seconds.

Once the occupants in the lobby and BOS Chambers are alerted to the fire, the pre-movement time (t_{pre}) portion of the evacuation begins. Similar to the first scenario in the cafeteria, most of the occupants in the area of the lobby would be able to see the smoke or fire. As the occupants of the lobby would likely be passing through, or browsing the book fair, they would already have their items on their person. Therefore, the response time for the lobby was estimated at 10 seconds. If the BOS Chambers are occupied, then their response time would be longer as they could have belongings around their chairs that they would have to gather, therefore their response time is estimated at 30 seconds.

Table #28: Lobby Scenario Pre-Movement Times

		Pre-Movement Time		
Location	**Discovery Time**	**Recognition Time**	**Response Time**	**Total Time**
Lobby	30 sec	0 sec	10 sec	40 sec
BOS Chambers	30 sec	15 sec	30 sec	75 sec
Rest of Building	Activation of Detector (72 sec)	30 sec	30 sec	132 sec

The movement times for both the lobby and the BOS Chambers utilize the two exits at the front of the lobby. The movement time for the lobby is 34 seconds and for the BOS Chambers is 62 seconds. If those values are added to those in the table above, and multiplied by a safety factor of 1.5, the RSET for the lobby is 111 seconds, and the RSET for the BOS Chambers is 206 seconds.

Slice files at Z=1.8m and Z=6.2m (6 feet above the first and second floors) and detectors at the BOS Chambers south exit, BOS Chambers east exit, under the Open Air Walkway, at the top of the stairwell, and at the northern portion of the second floor were used to determine when the conditions were no longer tenable (based on the criteria mentioned above). Table 29 below lists when/if conditions became untenable based on the four factors listed above.

Table #29: Lobby Tenability Criteria Factor Times

	Tenability Criteria Factor			
Location	***Visibility (< 8m)***	***Temperature (> 100℃)***	***Carbon Monoxide (> 1,350 ppm-min)***	***Radiant Heat Flux (> 2.5kW/m²)***
South BOS Chambers Exit	*84.6 sec*	*93.6 sec*	*N/A*	*99.0 sec*
East BOS Chambers Exit	*94.8 sec*	*100.2 sec*	*N/A*	*115.2 sec*
Under Open Air Walkway	*94.2 sec*	*100.2 sec*	*N/A*	*N/A*
Top of Stairwell	*77.4 sec*	*84.6 sec*	*N/A*	*91.8 sec*
North of 2nd Floor Lobby	*87.6 sec*	*96.0 sec*	*N/A*	*N/A*
ASET Pass/Fail	***Fail***	***Fail***	***Pass***	***Fail***

**The simulation was stopped at 270 seconds when conditions began to plateau.*

Based on the values in the table above, conditions became untenable due to visibility at 77.4 seconds on the second floor at the top of the stairwell, and at 84.6 seconds on the first floor near the BOS Chambers southern exit. The first dry-pipe sprinklers activated at 79.2 sec but due to a 60 second delay, didn't flow water until 139.2 sec. The first wet-pipe sprinklers (located on the second floor ceiling) activated at 90.6 seconds.

Without the safety factors included, the evacuation times for the lobby were below the ASET times. Therefore, it is possible that everyone in the lobby would be able to get out of the building using the front exit. More than likely though, some of the occupants would retreat away from the fire to the north and try to find another exit. In that case, the lobby occupants would have a similar evacuation time to the north of ~70 seconds before they enter the CDA Waiting Area which would have tenable conditions.

The BOS Chambers have an evacuation time of 137 seconds without the safety factor, so it is possible that some quick reacting people could get out through the front doors of the lobby. The rest of the occupants would have to exit to the east out of the chambers, then to the north out of the lobby. Assuming that 20% of the occupants were able to make it out of the lobby, that would leave an occupancy of 108 people remaining. For 108 people exiting out of one set of double doors at the east end of the BOS Chambers, then progressing north through the lobby through another set of double doors and into the CDA Waiting area, would take ~74 seconds of movement time. Add that to the pre-movement and detection time of 75 seconds, and the egress time would be 149 seconds till they reached tenable conditions in another portion of the building. (With a 1.5 safety factor, that value increases to 224 seconds.) The visibility conditions for the first floor becomes untenable in the northern portion of the lobby (in the BOS Chambers occupant's egress pathway) at 93.0 seconds; before they all could make it into the CDA Waiting Area. The temperature conditions become untenable in the same location at approximately 95.4 seconds. Heat flux conditions would become untenable in the same location at approximately 100.8 seconds.

For a total egress and RSET value from the building, the occupants would have to travel west out of the CDA Waiting Area into the western corridor, then north through the northern corridor. That would add 171 seconds to the egress time for a total egress time of 320 seconds, or an RSET value (with safety factor) of 480 seconds.

Another issue would be the smoke generation due to the height of the lobby ceiling. The smoke reaches the north end of the second floor lobby and activates the smoke detector at 72.6 seconds. Immediately the fire alarm system activates and one second later, the three doors in the second floor lobby close. The occupants in the east and west corridors on the second floor would most likely proceed with their normal evacuation routes and try and enter the second floor lobby. When they saw the smoke, they would turn around and exit the stairwells on either side of the building. The occupants in the dead end hallway where the LAFCo offices and the Grand Jury room are located, would open the door to the second floor lobby and discover the smoke, but be unable to turn around and find another egress route. Those occupants would have to travel into the second floor lobby, and then into either the western or eastern corridors.

At a maximum occupancy of 102 people, it would take them between 266 and 446 seconds to completely evacuate into either the west or east corridor where conditions would be tenable. The difference would be based upon whether the pre-movement time was 60 seconds, or 240 seconds as mentioned in Scenario #2. The visibility and temperature conditions become untenable at the second floor lobby within 87.6 and 96.0 seconds respectively. The occupants of the dead end hallway could not reach the door to the second floor lobby by that time. They would be trapped and forced to retreat and wait for fire department personnel.

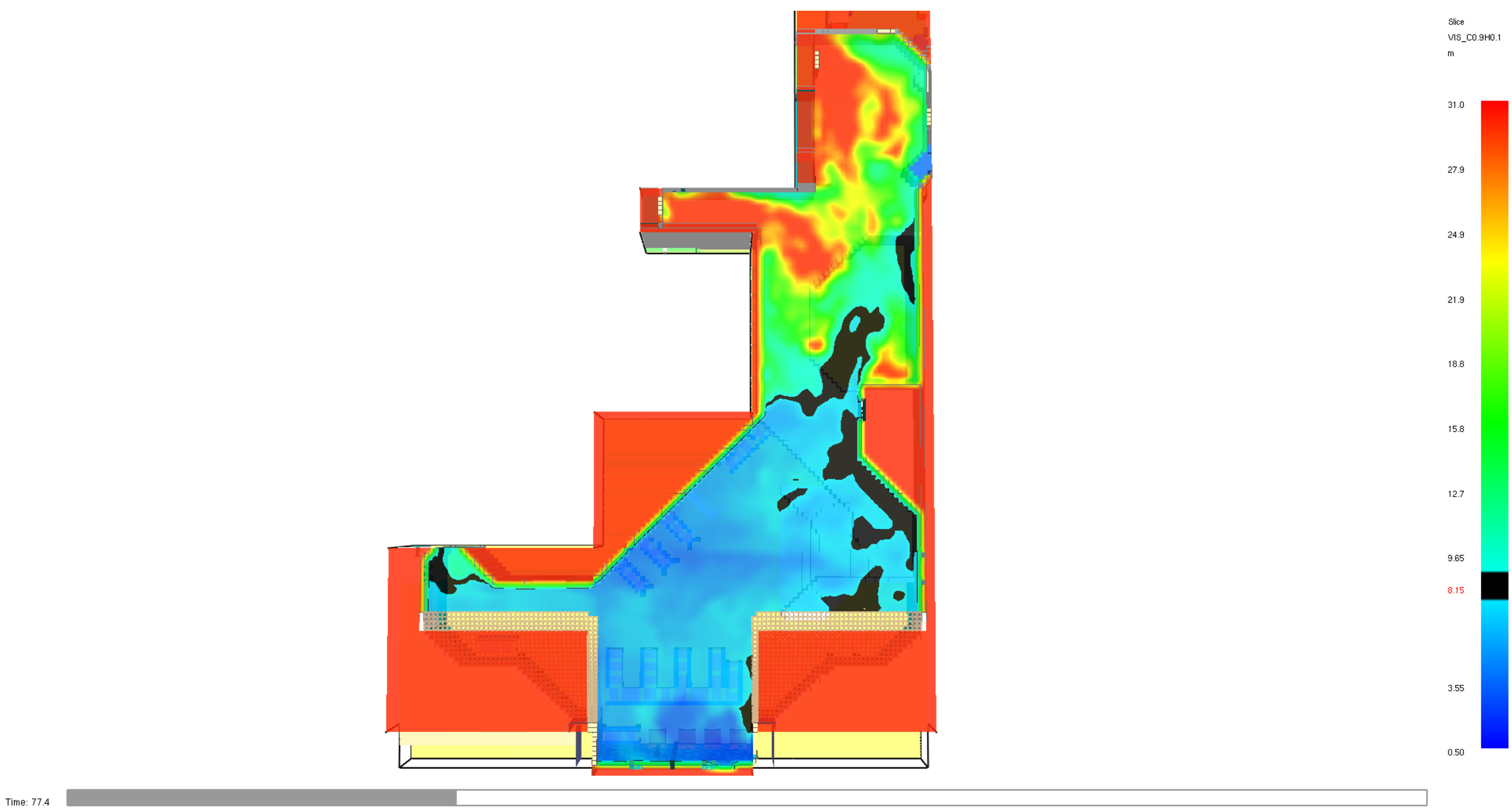

Figure #81: Lobby Fire - Visibility slice file at Z=6.2 looking down from above (77.4 sec)
Tenability failure at the top of the stairs. Black indicates visibility threshold.
Top of the image is north

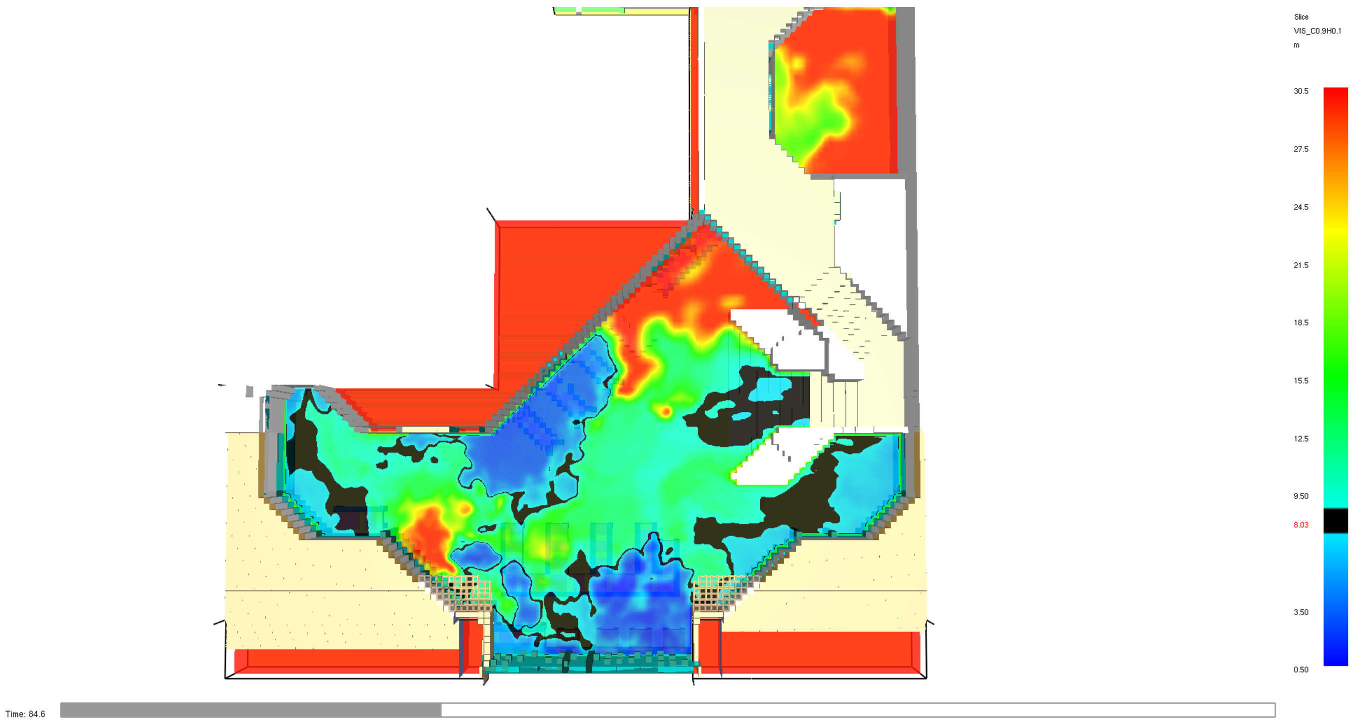

Figure #82: Lobby Fire - Visibility slice file at Z=1.8 looking down from above (84.6 sec)
Tenability failure at the south of BOS Chambers. Black indicates visibility threshold.

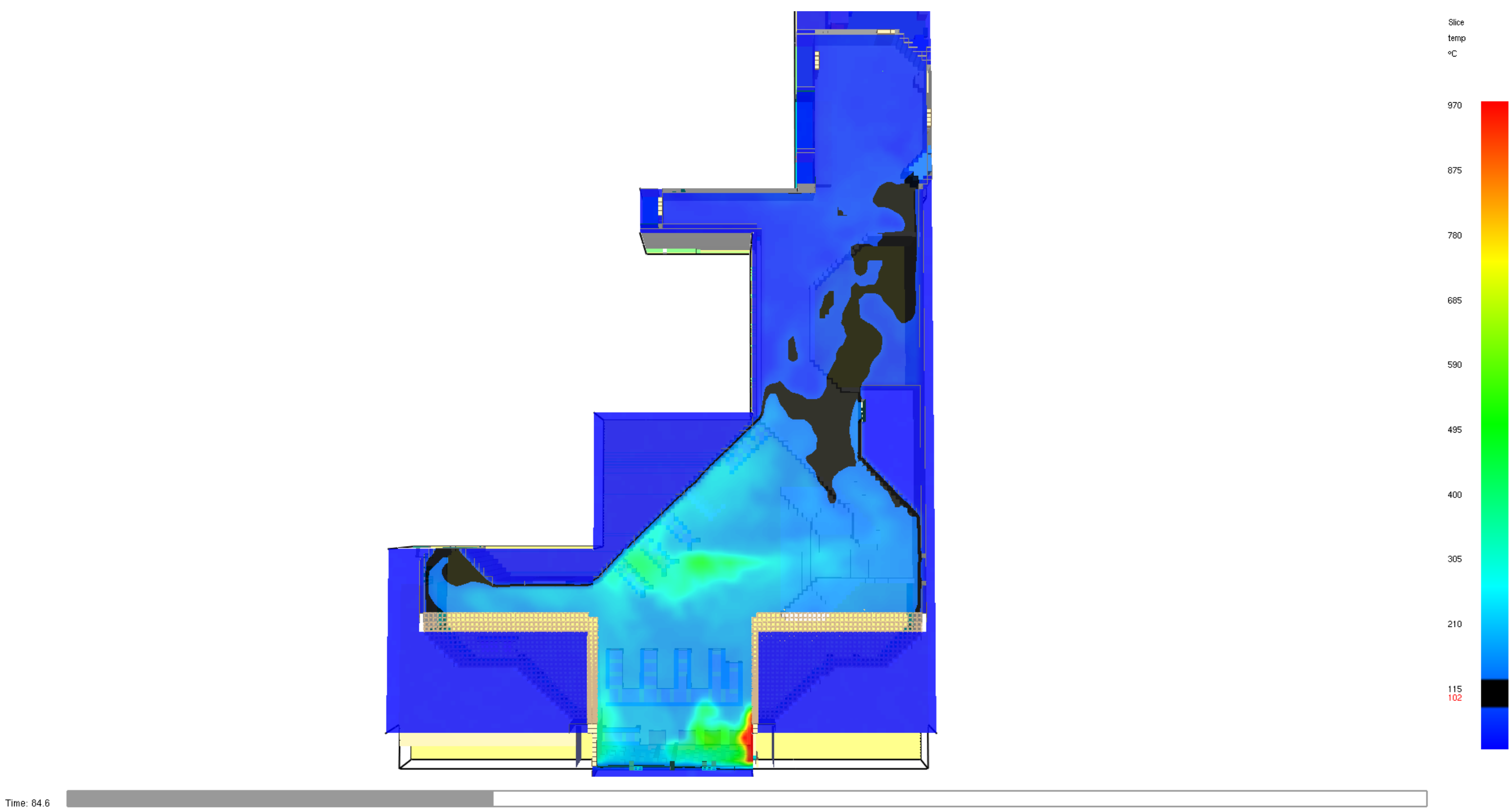

Figure #83: Lobby Fire - Temperature slice file at Z=6.2 (84.6 sec)
Tenability failure at the top of the stairs. Black indicates visibility threshold.

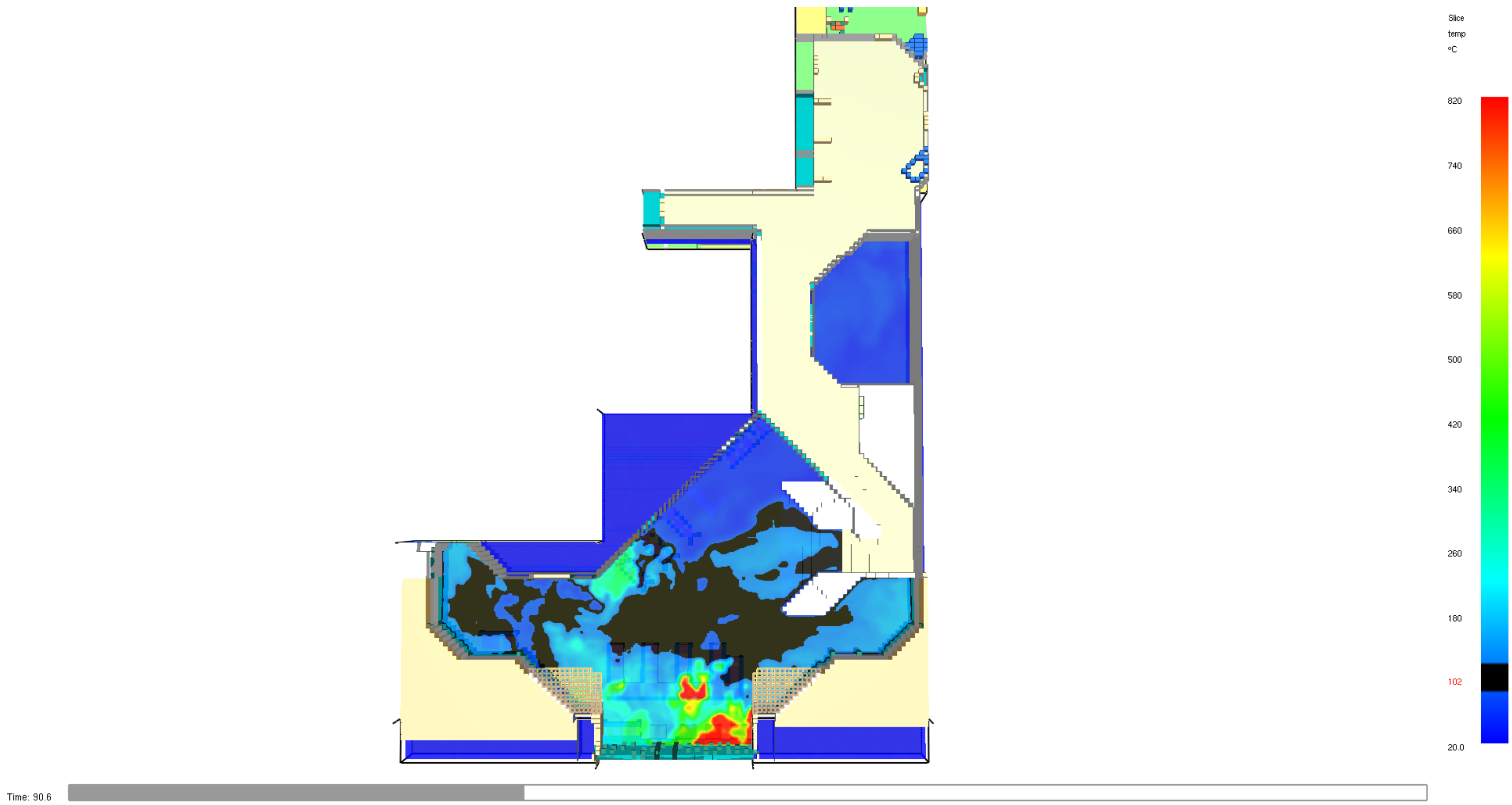

Figure #84: Lobby Fire - Temperature slice file at Z=1.8 (93.6 sec)
Tenability failure at the south BOS Chambers. Black indicates visibility threshold.

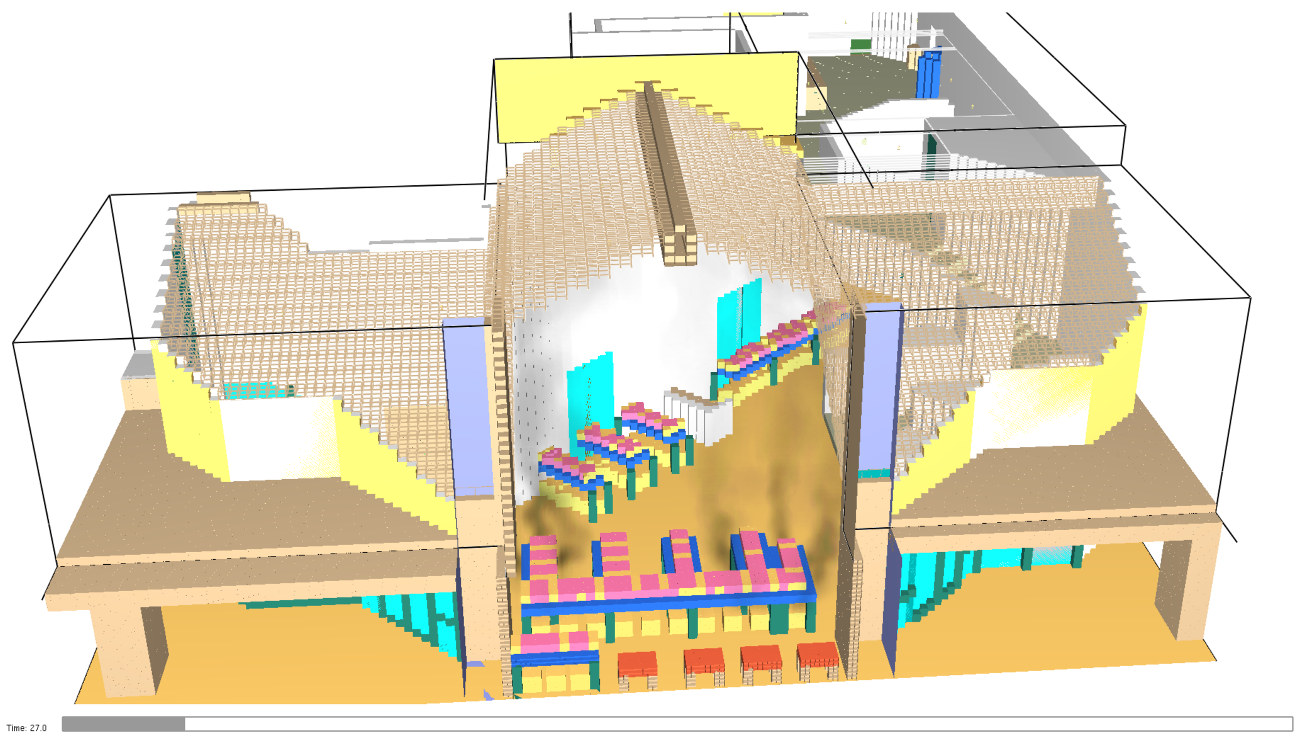

Figure #85: Lobby Fire – Smoke/Fire looking north (27.0 sec)
Approximate fire discovery time

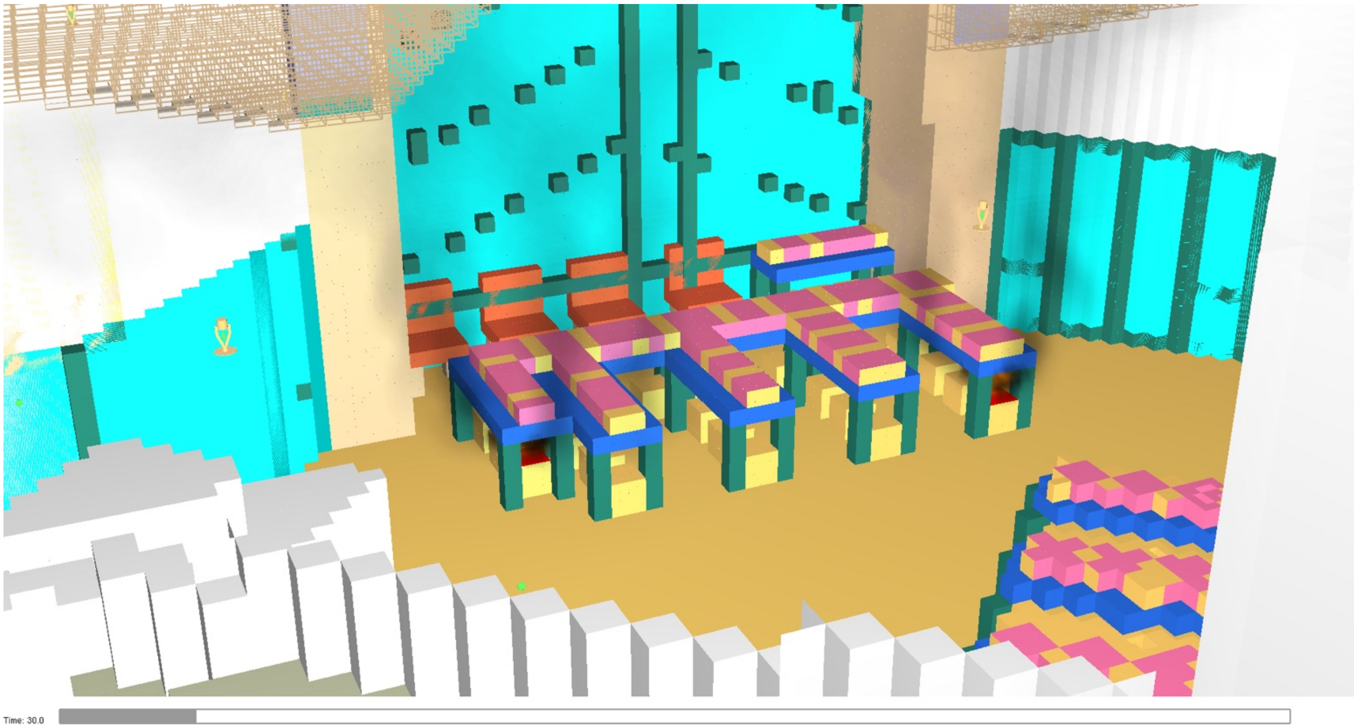

Figure #86: Lobby Fire – Smoke/Fire looking south inside the lobby (30.0 sec)
Approximate fire discovery time

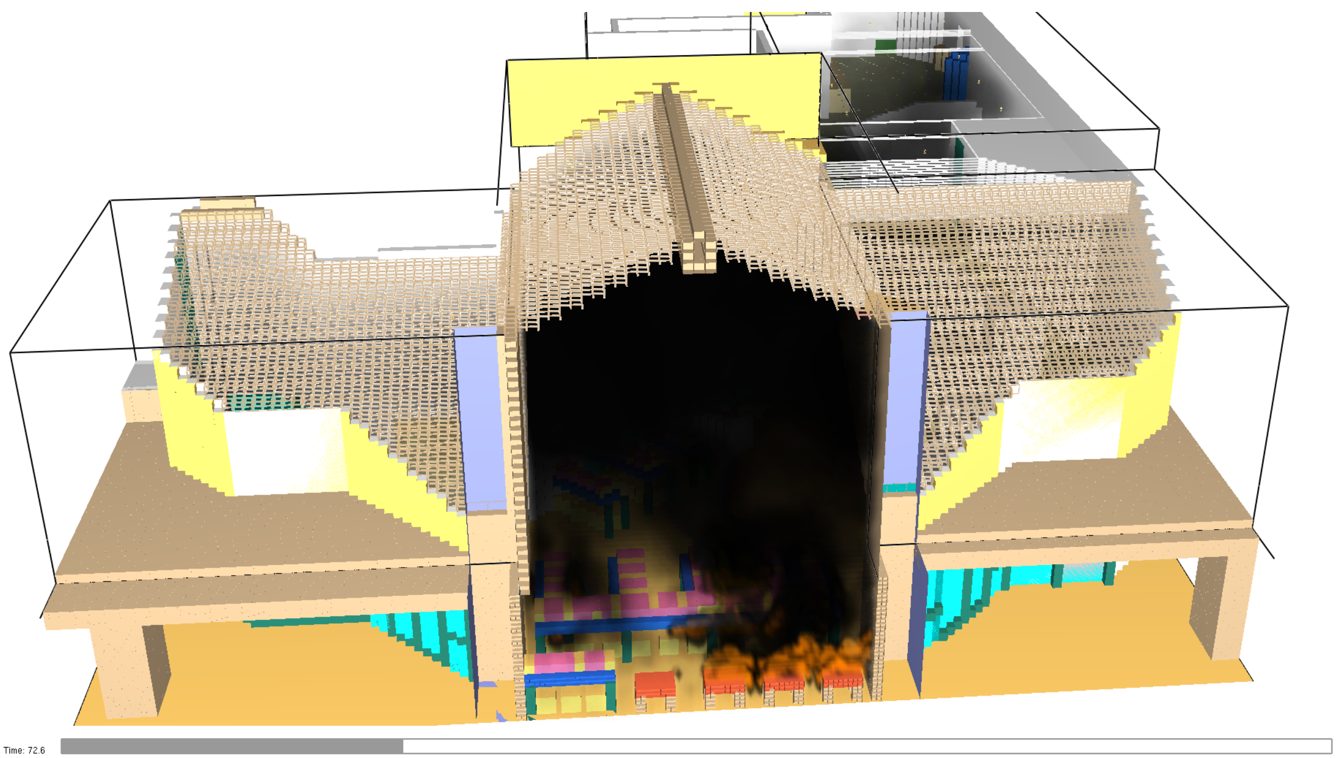

Figure #87: Lobby Fire – Smoke/Fire looking north (72.6sec)
Activation time of the smoke detector

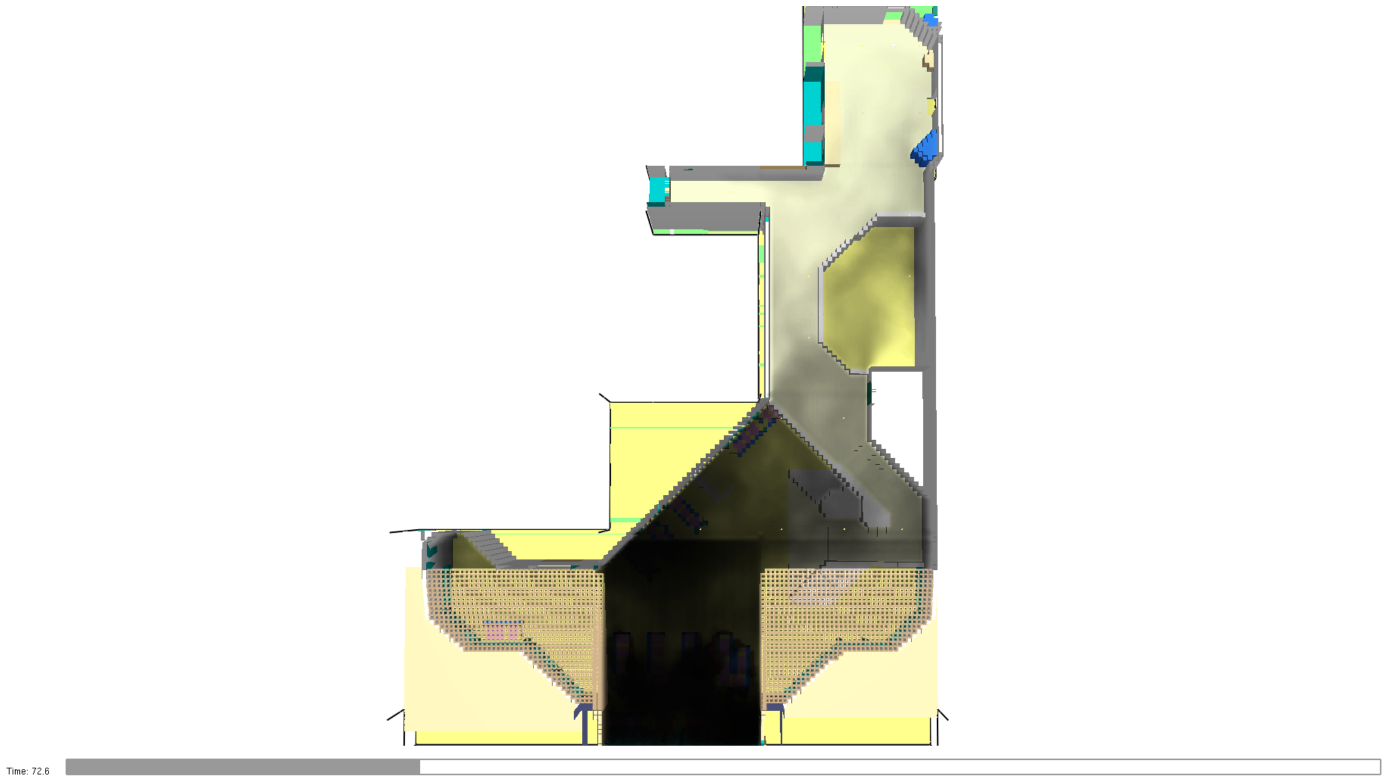

Figure #88: Lobby Fire – Smoke/Fire looking down from above (72.6sec)
Activation time of the smoke detector

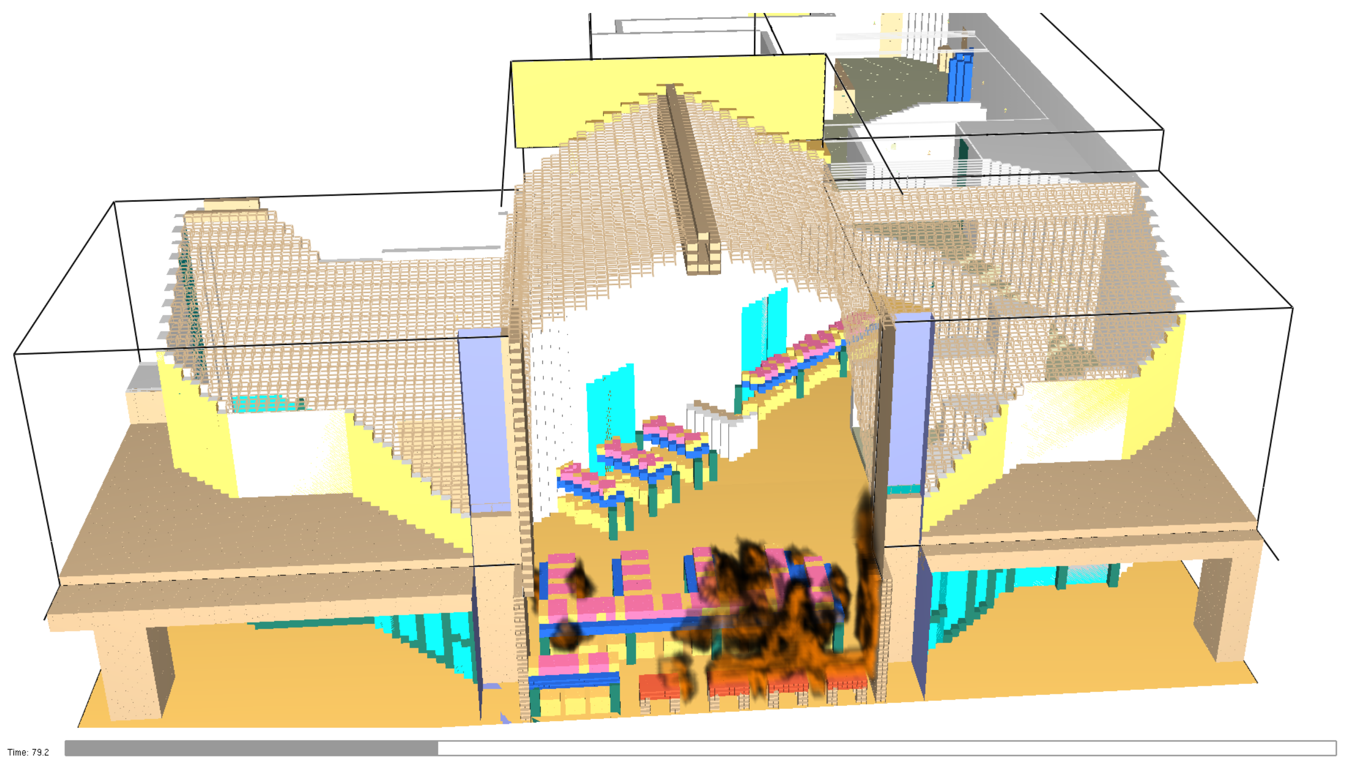

Figure #89: Lobby Fire – Fire only looking north (79.2 sec)
Activation time of the first dry-pipe sprinkler

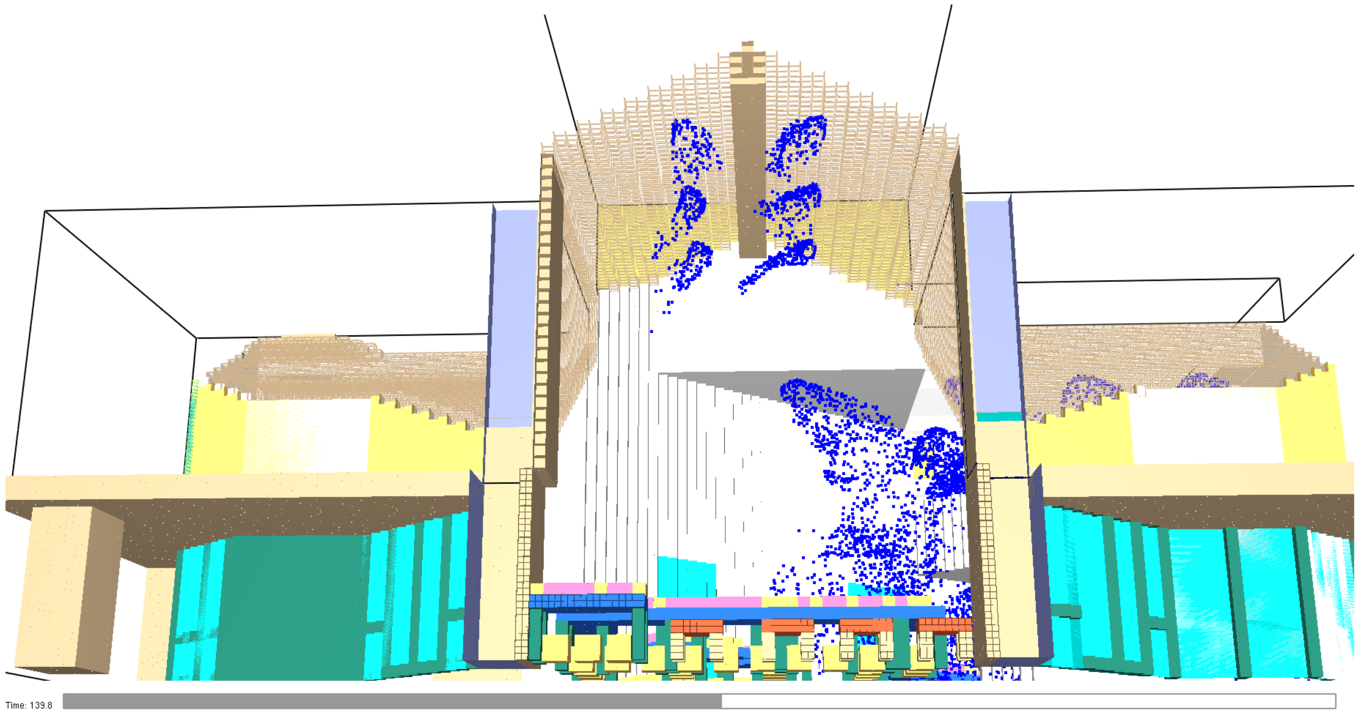

Figure #90: Lobby Fire – Activation of the first dry-pipe sprinklers looking north. (139.8 sec)

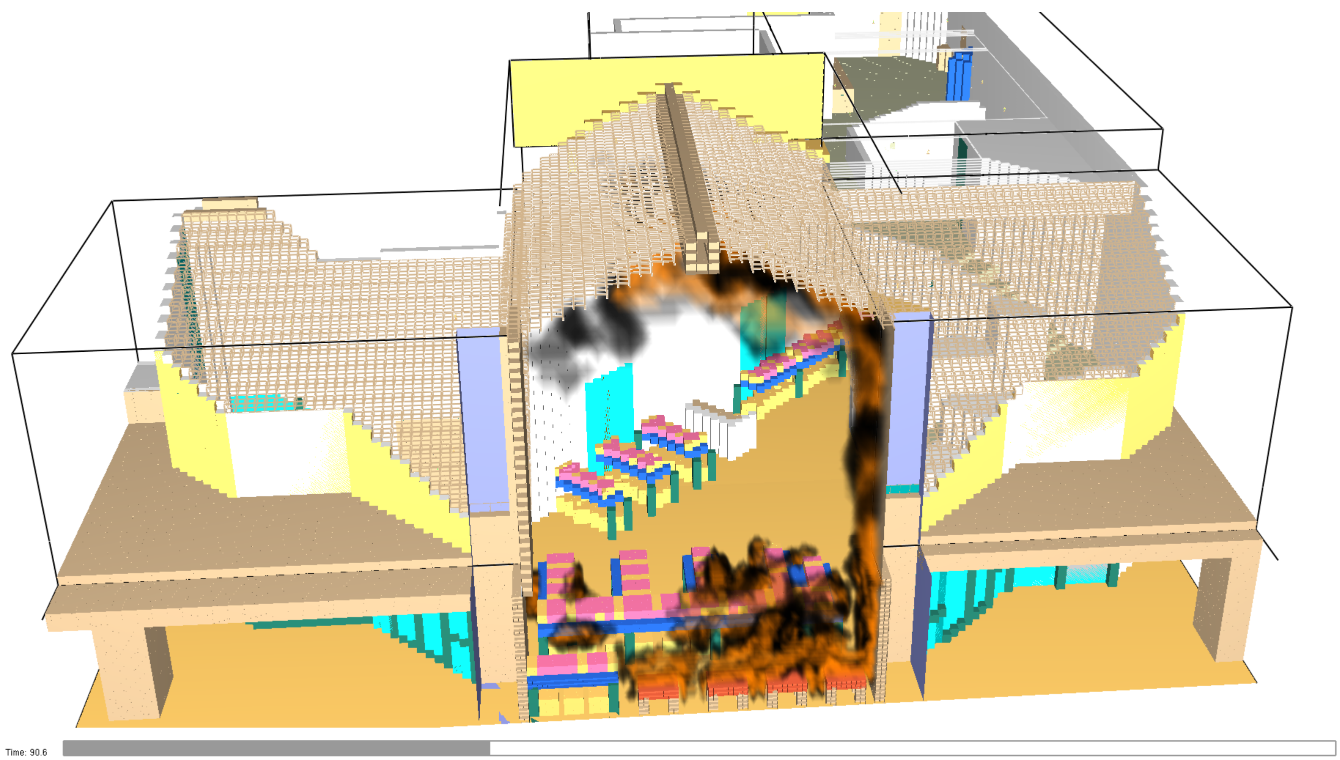

Figure #91: Lobby Fire – Fire only looking north (90.6 sec). Activation time of the first wet-pipe sprinkler. Fire has climbed the wall and spread across the ceiling

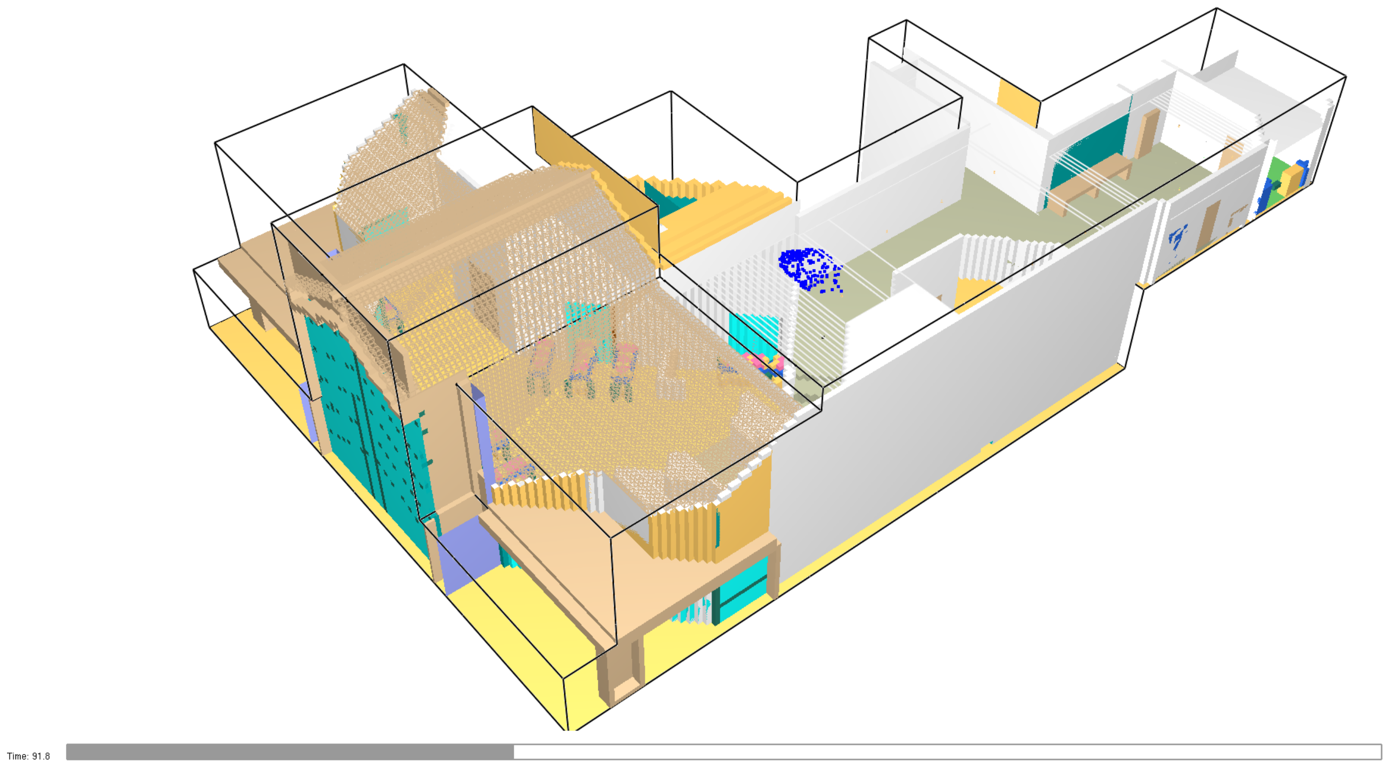

Figure #92: Lobby Fire – Activation of the first wet-pipe sprinkler. (91.8 sec)

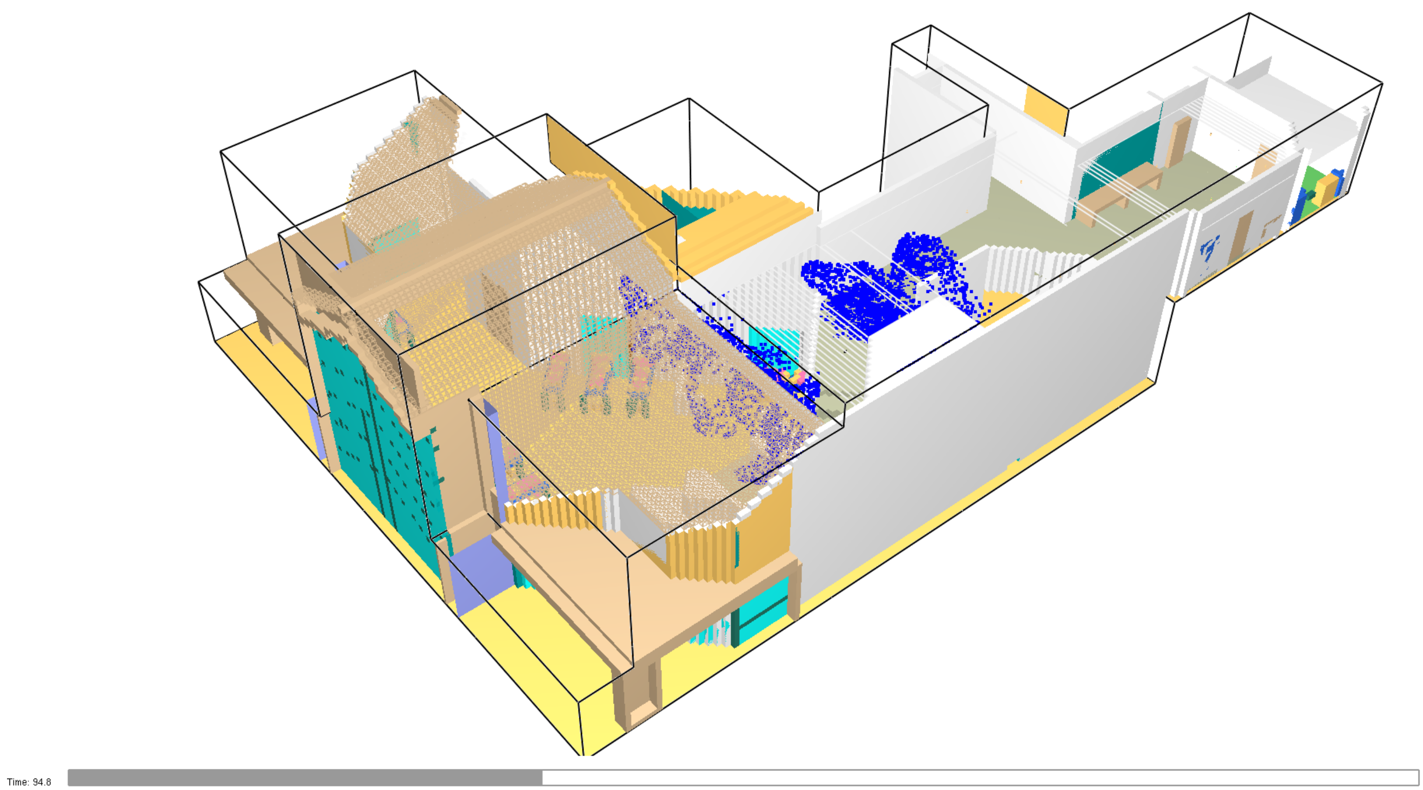

Figure #93: Lobby Fire – Activation of the closest wet-pipe sprinklers to the origin (94.8 sec)

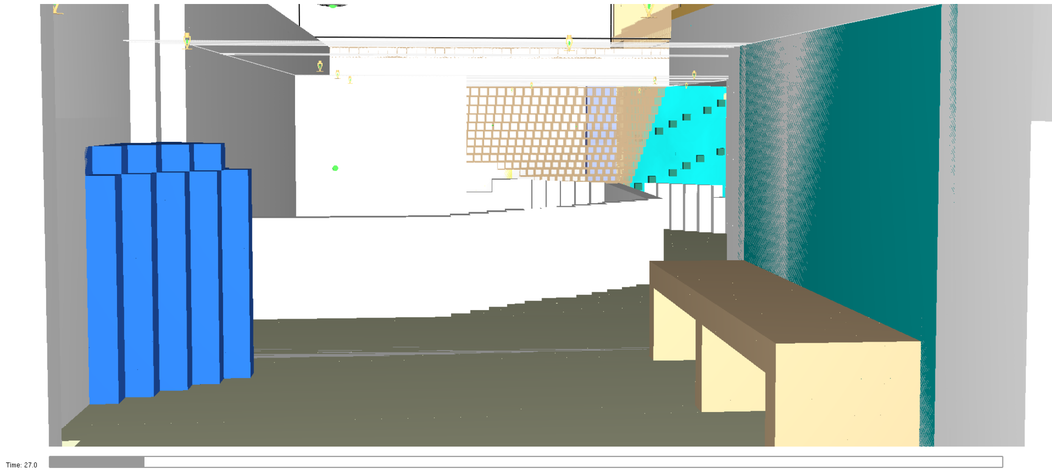

Figure #94: Lobby Fire – Smoke only – 2nd Floor looking south from dead end hallway (27.0s)
Visible fire detection in the lobby

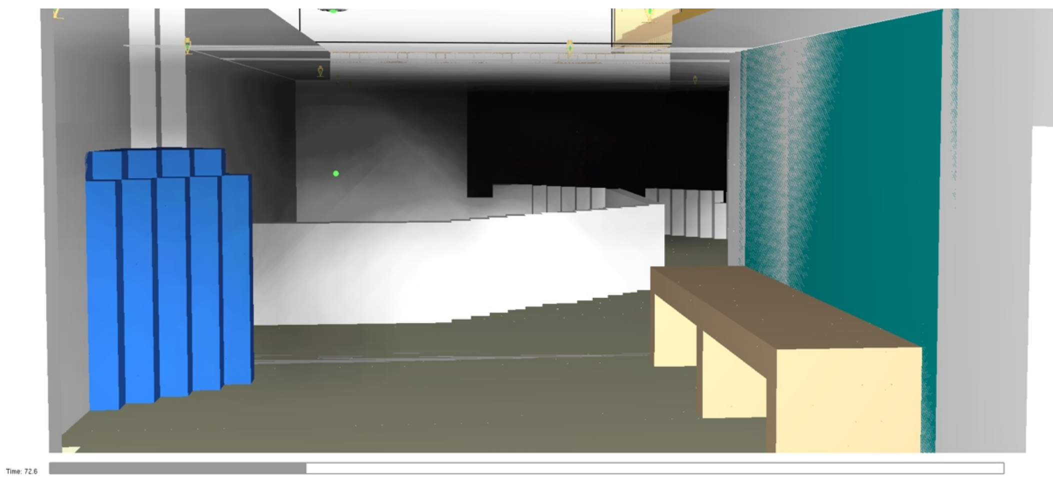

Figure #95: Lobby Fire – Smoke only – 2nd Floor looking south from dead end hallway (72.6s)
Activation of the smoke detector directly above this location

Figure #96: Lobby Fire – Smoke only – 2nd Floor looking south from dead end hallway (87.6s)
Visibility tenability failed in second floor lobby (15 seconds after detection)

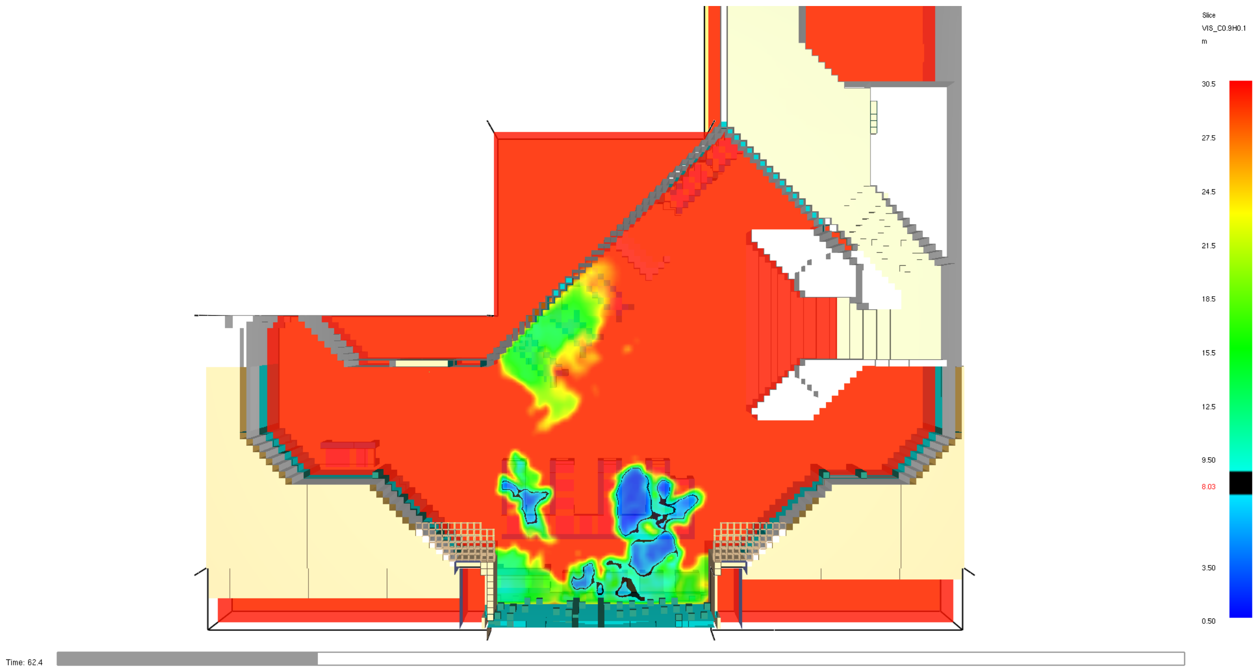

Figure #97: Lobby Fire – Visibility Slice at Z=1.8 looking top down 10 sec before the people can exit out the front doors without the safety factor (62.4 sec)

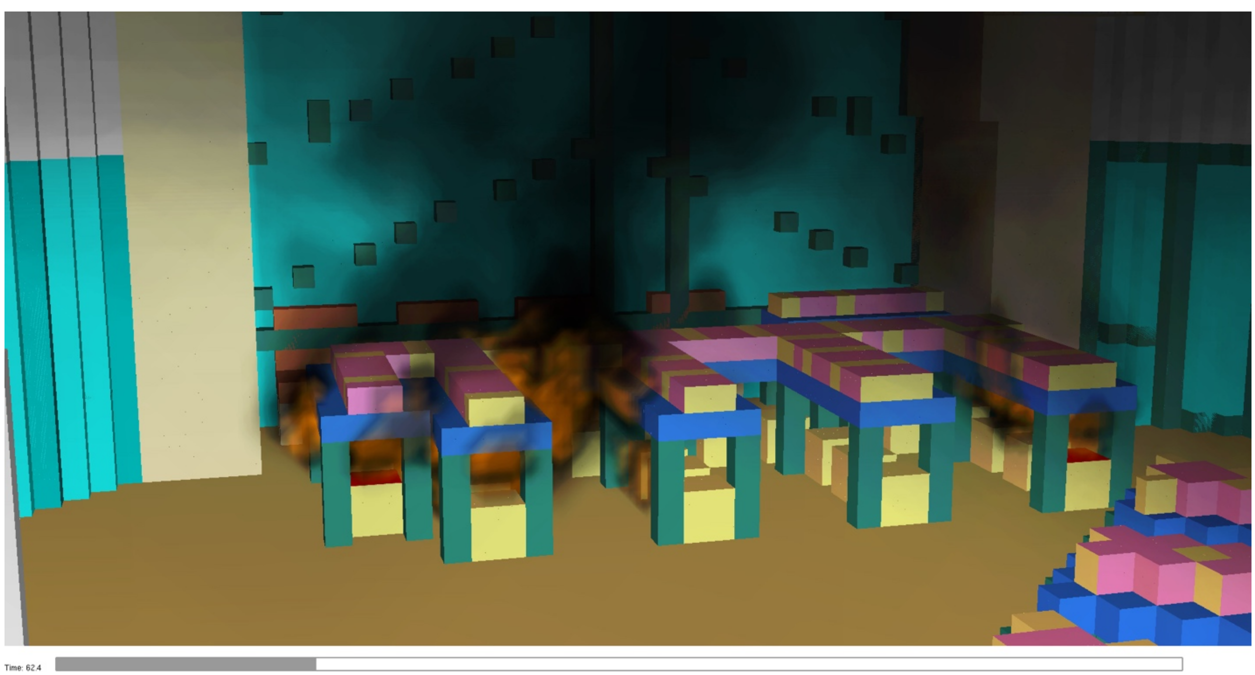

Figure #98: Lobby Fire – Smoke/Fire looking south inside the lobby 10 sec before the people can exit out the front doors without the safety factor (62.4 sec)

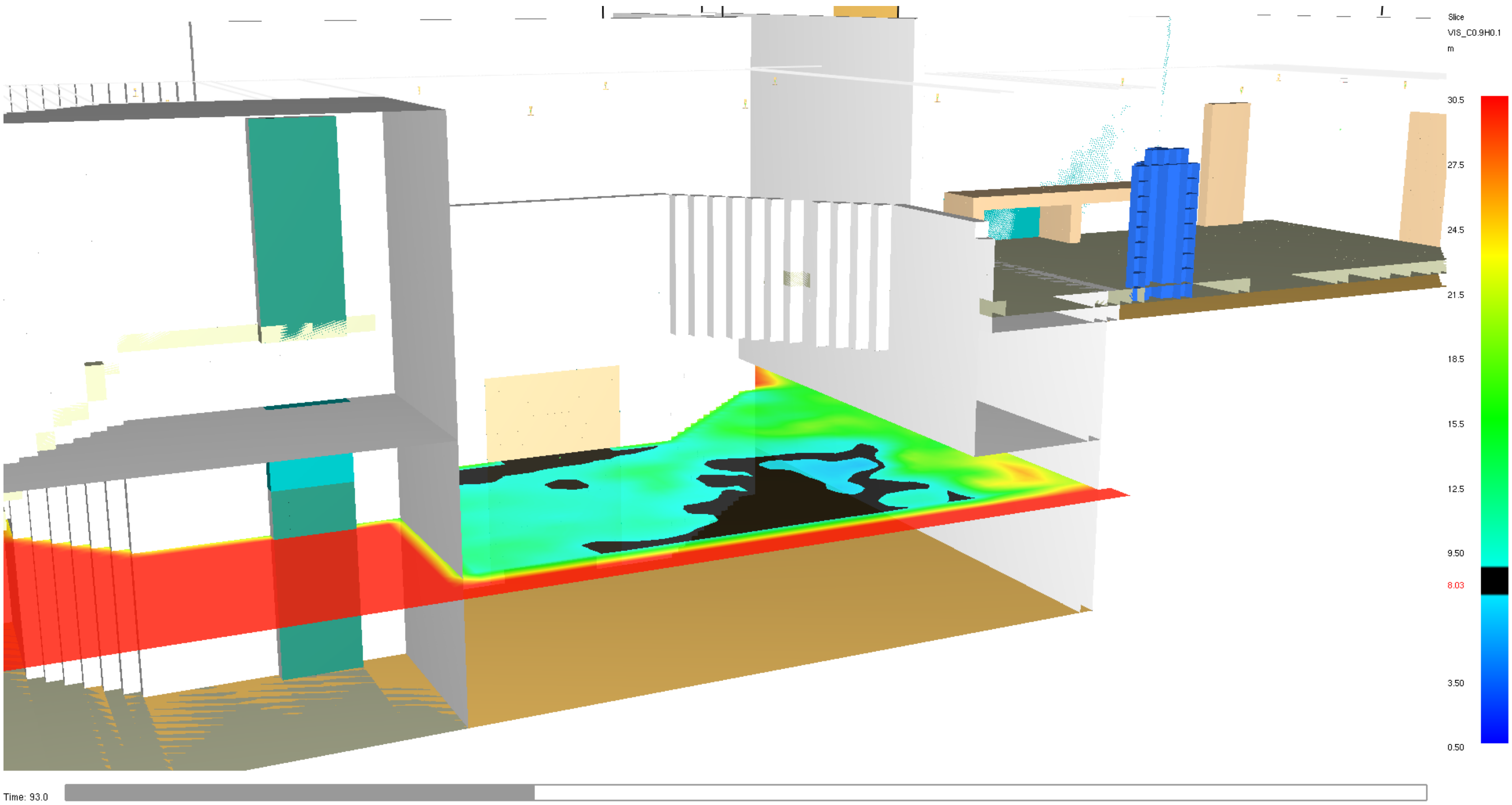

Figure #99: Lobby Fire – Visibility Slice at Z=1.8 looking northwest toward the east exit door from the BOS Chambers. Visibility tenability in the north lobby fails (93.0 sec) (East wall of the north lobby invisible)

Due to the fact that HRR, fire growth, soot yield, and CO yield values were estimated, actual results may be slightly different. That may extend the ASET value slightly, however it is unlikely that there will be more time available for egress (ASET) than what is required (RSET) due to conditions becoming untenable so early in the fire.

Below is a graph of the Total HRR v. Time for the Lobby Fire showing a peak HRR close to 90,000kW around 100 seconds as the fire spread up the wooden walls of the lobby and across the wooden ceiling.

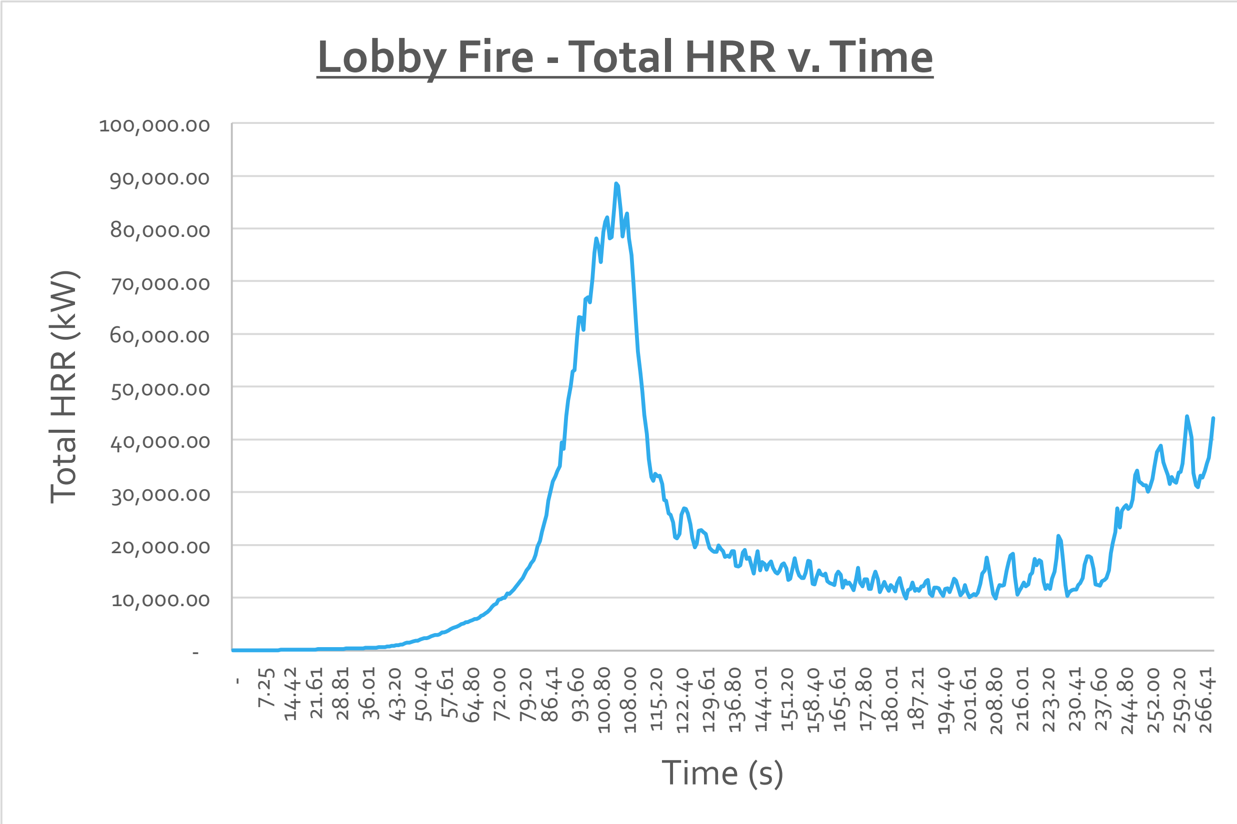

Figure #100: Lobby Fire - Total HRR v Time Graph

ASET v. RSET

The performance based analyses were conducted to determine if the building's fire protection system could provide the occupants enough time to evacuate to safety in four different fire scenarios. The original RSET values were calculated for the departments affected by the fire scenarios. If the occupants in a department had to alter their evacuation route, a modified RSET value was calculated. The fire models were analyzed and the ASET values were determined when conditions either first became untenable, or when all the occupants had exited the building; whichever came first. The following table shows the RSET values compared with the ASET values. Every fire scenario that was designed caused conditions to become untenable before people could evacuate the building. In some situations, conditions became untenable several minutes before evacuations were complete.

The last column in the table is present to act strictly as a comparison to show how quickly the conditions become untenable. The data shows the time it would take the occupants affected to evacuate into another room/corridor/area where conditions would be tenable and they could then proceed with their evacuation. Escaping into another room with tenable conditions does not signal an evacuation or that ASET is complete. These values did not include the safety factor of 1.5 that the RSET values did. None the less, there was only one scenario where the occupants of a department were able to get out of the building before conditions became untenable.

The occupants in the lobby had the advantage of quick discovery and pre-movement times, low occupancy, and large exit discharge capabilities. As the occupants would have to exit on either side of a rapidly growing fire, it is possible that some of the occupants in that department would have retreated and found another exit.

Table #30: ASET v. RSET Comparison

<table>
<tr><th>Scenario</th><th colspan="2">Location</th><th>Original RSET</th><th>Modified RSET</th><th>ASET</th><th>Pass/Fail</th><th>Evacuate to Tenable Conditions*</th></tr>
<tr><td>1</td><td colspan="2">Cafeteria Fire</td><td>243 sec</td><td>N/A</td><td>102.0 sec</td><td>Fail</td><td>126 sec
Fail</td></tr>
<tr><td>2</td><td colspan="2">Second Floor North Hallway Fire</td><td>543/813 sec</td><td>N/A</td><td>74.4 sec</td><td>Fail</td><td>262/442 sec
Fail</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">First Floor West Corridor Fire</td><td>CSS Dept.</td><td>309 sec</td><td>282 sec</td><td>94.8 sec</td><td>Fail</td><td>137 sec
Fail</td></tr>
<tr><td>IGS Dept.</td><td>360 sec</td><td>N/A</td><td>118.2 sec</td><td>Fail</td><td>N/A</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Lobby Fire</td><td>Lobby</td><td>111 sec</td><td>N/A</td><td>84.6 sec</td><td>Fail</td><td>62 sec
PASS</td></tr>
<tr><td>BOS</td><td>206 sec</td><td>480 sec</td><td>93.0 sec</td><td>Fail</td><td>149 sec
Fail</td></tr>
<tr><td>2nd Floor North Hall</td><td>543/813 sec</td><td>N/A</td><td>87.6 sec</td><td>Fail</td><td>266/446 sec
Fail</td></tr>
</table>

**Without safety margin of 1.5*

While none of the scenarios had an ASET value that surpassed RSET values, these are representations of worst-case scenarios. Normal day-to-day operations could result in different outcomes, but the fire protection system needs to be judged based off of the worst that could happen. These results are indications that improvements need to be made.

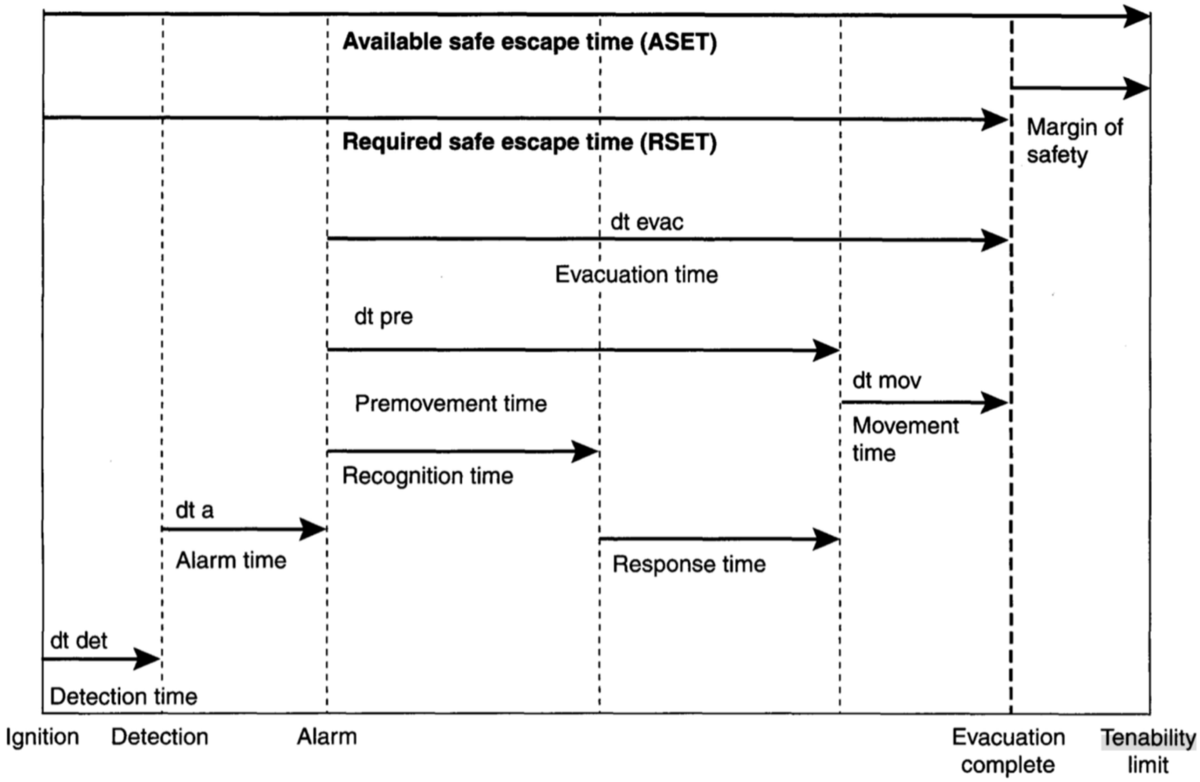

Figure 3-12.1. ***Egress time model.***

Figure #101: ASET & RSET breakdown (SFPE Handbook 4th Ed.)

Comments & Recommendations

The prescriptive and performance-based analyses of the Rood Center identified various issues that might affect the occupant's life safety. The four computer fire model scenarios discussed above show that even with an automatic sprinkler system, maximum occupancy loads will not have enough time to evacuate the building with tenable conditions intact. The comments and recommendations discussed below could potentially decrease the Required Safe Egress Times (RSET) and increase the Available Safe Egress Times (ASET), allowing occupants more time to escape. Some of these are simple fixes, while others could require significant alterations.

Alarm System

According to sections from the California Building Code and the Life Safety Code (NFPA 101), at minimum, a manual fire alarm system is required in the Rood Center. The fire alarm system is required to notify occupants in the building to the existence of a fire both audibly, and visually. Because audible and visible notification is required, the installation, location, placement, spacing, inspection, testing, and maintenance of the notification appliances must follow the requirements put forth in NFPA 72.

The system that is currently in place in the Rood Center is lacking in both detection and notification capabilities. According to NFPA 72, the CBC, and the LSC, the only smoke detector required in building would need to be in the same room as the Main FACP; the rest of the building is not required to have smoke detectors. While the code is vague, it is interpreted in this report that if smoke detectors are installed in the building, then they need to be installed in accordance with NFPA 72 requirements. If that is the case, then the number of smoke detectors would need to be greatly increased throughout the building.

As mentioned above in the prescriptive based alarm section, there are currently 16 smoke detectors on the first floor, and 23 on the second floor. Smoke detectors are not to exceed a nominal spacing of 30 feet from one-another, and all points on the ceiling shall have a detector within 21 feet. Based on the square footage of each floor, and each detector limited to no more than a 900 ft^2 coverage area, the first floor would require a minimum of 56 smoke detectors and the second floor would require a minimum of 58 smoke detectors. An analysis would need to be done for each floor to determine if that number of smoke detectors would satisfy the requirement of having a detector within 21 feet of every point on the ceiling.

With an adequate number of detectors, the detection time of fires would greatly decrease. In the cafeteria and lobby fires (scenarios #1 & #4), detection took 107 seconds and 73 seconds respectively. When compared with the other two scenarios, detection only took 9 seconds and 5 seconds. That additional time could be crucial to being able to evacuate everyone safely with tenable conditions.

An analysis of the building's notification system revealed that the current system is substantially lacking. A quick glance through the list of notification appliances in the building determined that there were appliances still in use that are not compatible with the Fire Alarm Control Panel (FACP). The appliances that are compatible with the panel are often installed in odd locations in the building, installed at the wrong heights, and are not in enough quantities to properly notify all the building's occupants.

When an alarm system technician from Gray Electric (who was conducting the semi-annual test) was asked if they ever test/verify the audible (dBA) and visible (cd) levels from the notification appliances, he stated that they don't. He explained that they (Gray Electric) don't have the money, the equipment, or the training to do such tests. Further questions were asked regarding whether or not the voltages at various notification appliances are tested, and again the response was that they don't do those types of tests. He stated that the type of FACP that is installed can tell when a connected device isn't working, and will send out a trouble alarm. In reality, the FACP can tell when there is a connection error to a device, but it can't tell if a device is receiving enough power, if it is out of sync, or if it is operating appropriately.

During the same semi-annual test of the system, the testing procedures of the alarm technician were witnessed and documented. The testing methods that were witnessed were not up to the requirements set forth in NFPA 72. The technician began the test with a can of smoke and a ~2-foot metal pipe (~1/2" diameter) in his hand. With someone ready to press the silence button on the Main FACP, the technician walked through to the planning department on the east end of the building. The technician walked underneath the detector and sprayed the can of smoke up through the metal pipe aimed at the opening in the detector. The technician then waited to see if the detector would activate, but it never did. He tried spraying the can of smoke through the pipe a second time, and still no activation. Instead of trying to determine why the detector wasn't activating, he moved on to try a pull station. After activating the pull station, the technician proceeded to test another smoke detector in the same manner and this time it activated immediately. The technician continued on testing pull stations and detectors.

On the first floor, the technician tested a total of 3 smoke detectors on the east end of the building (only 1 activated), and 3 pull stations (all functioned properly). On the second floor the technician tested only 1 smoke detector in the western corridor (no activation), then 2 pull stations near the entrances to each stairwell (all functioned properly.

After the test was completed, the technician cleared the alarms from the panel, put it back into the normal operating mode, and left the building. It is possible, but the technician didn't appear to document or notify anyone of the three smoke detectors that didn't activate. Overall the testing methods and procedures didn't follow those listed in NFPA 72.

In NFPA 72 (2013), section 14.2.3.6 lists the qualifications and experience that service personnel should have.

> **14.2.3.6* Service Personnel Qualifications and Experience.** Service personnel shall be qualified and experienced in accordance with the requirements of 10.5.3.
> **A.14.2.3.6** Service personnel should be able to do the following:
>
> (1) Understand the requirements contained in *NFPA 72*, *National Fire Alarm and Signaling Code*, and the fire alarm requirements contained in *NFPA 70*, *National Electrical Code*
> (2) Understand basic job site safety laws and requirements
> (3) Apply troubleshooting techniques, and determine the cause of fire alarm system trouble conditions
> (4) Understand equipment specific requirements, such as programming, application, and compatibility
> (5) Read and interpret fire alarm system design documentation and manufacturer's inspection, testing, and maintenance guidelines
> (6) Properly use tools and test equipment required for testing and maintenance of fire alarm systems and their components
> (7) Properly apply the test methods required by *NFPA 72*, *National Fire Alarm and Signaling Code*

In this case, it is highly recommended to have a qualified alarm service professional do a thorough and proper analysis of the fire alarm system and all of the components connected to it to verify any potential issues. Once that analysis is complete, and those issues have been addressed, then the location, spacing, and placement of the notification appliances and detectors should be reevaluated and compared with requirements set forth in NFPA 72. Lastly, the notification appliances and detectors should be updated to required standards. If Gray Electric cannot inspect, monitor, maintain, and update the system to industry standards, then another company who can should be contracted to do the work. Sentinel Fire Equipment Company already services the secondary alarm system and appears familiar with industry standards and requirements as they have met all of them with regards to their work on the secondary system. It is unknown if they would be able to handle the task of analyzing the entire building, or would want to, but they may be a good option to start with.

While the fire alarm system and its components need to be tested and updated, and the inspection, testing, maintenance and record keeping procedures need to be revised, the Authority Having Jurisdiction (Nevada City Fire Department) needs to get involved in the process and make sure everything is done according to the code and consequences are in place for when those codes are not met and followed.

A fire alarm system intended for life safety should alert the building's occupants and notify emergency personnel as quickly as possible. Without a properly designed/tested fire alarm system, early detection of a fire and notification of the occupants would be hindered and would not be guaranteed. The performance based analysis has shown how important early detection is for getting people safely out of the building.

While the number of pull stations in the building is sufficient, additional pull stations in public areas (or better labeling of the current locations), especially the lobby, could also help decrease detection times.

Suppression System

Analysis of the sprinkler system determined that it met the prescriptive requirements set forth in NFPA 13. However, as the fourth fire scenario showed, with dry-pipe sprinklers protecting the front portion of the lobby, the inherent delay could potentially lead to large and catastrophic fire growth. As the two primary exits of the building are located at the front of the lobby, maintaining tenable conditions in that area is very important. If the dry-pipe sprinklers in the lobby were converted to a wet-pipe system, it could provide water suppression much earlier in the fire, thereby helping to control the fire and maintain tenable conditions for longer periods of time. Estimates are that the current fire pump could handle the load of the additional sprinklers.

Another option could help would be to limit the types of events and furnishings that are allowed in the lobby. If an event is allowed to take place, like the book fair for example, then an attendant could be required who was trained on how to use fire extinguishers and would have one on hand at all times. This could be done by listing these items as potential fire hazards and requirements in the building's Fire Safety Management Plan (Section 404.3.2 of the 2013 California Fire Code).

Structural Fire Protection

As mentioned above, there were batts of insulation installed in the second floor attic with the Kraft paper side exposed. To remedy this, the batts of insulation could simply be turned over so the fiberglass insulation side was exposed. Or it could be protected from fire by covering it with gypsum wall board or something similar.

Another issue that needs to be addressed is the paper art projects and quilts hung in the exit corridors. It is recommended to remove the flammable interior wall decorations from the exit corridors or place them inside some sort of fire resistant display case.

The trash and recycle containers located throughout the building's exit corridors are convenient, but can be dangerous. As seen in scenario #3, a majority of these items have very large Heat Release Rate (HRR) values. If ignited, these items would block the main exit pathways. In some instances, people in the departments would be forced to enter the same corridor where the fire was in order to exit. This would expose the occupants to the smoke, toxic gases, and heat from the fire, potentially making conditions untenable. With enough of these stacked together, the fire could become so large that it could overwhelm the sprinklers and spread throughout the interstitial areas above the ceilings. A simple remedy would be to take these items out of the exit corridors and place them in locations where the occupants do not need to path during an evacuation. For example, one large trash and recycle container could be placed in each department in the building. That wouldn't change the fuel load dangers, but they would be out of the reach of the public (arson concerns), and if they were ignited, people could escape the department and into the corridor as designed.

Egress

The biggest egress issue in the building is the dead end hallway. While the length of the hallway is 48 feet, and would be acceptable for a Group B occupancy, it is unclear if the AHJ approved it for a Mixed Occupancy building or what their reasoning would have been. Without the AHJ's approval, Section 1018.4 of the CBC states that the hallway's length would be limited to 20 feet.

Whichever length is appropriate, the fact that there is only one way out of that hallway, yet multiple ways for occupants to be trapped, creates an issue where people could potentially get hurt or even die. In the second and fourth scenario, two situations were presented where fires could trap the occupants in the dead end hallway, long before they would be able to egress.

With the second scenario, a copier, a small desk, and a chair are located in the common area to provide easy access to the items for all departments in the hallway. For further convenience, small and large recycle containers are placed on either side of the copier and the desk. While the location and arrangement of these items may be convenient, they are potentially hazardous. The copier and the power cord are potential ignition sources, while the recycle containers and chair are large sources of fuel. In the fire model, the recycle containers never ignited, but if they did, the fire might have been able to break through the drop ceiling and gain access to the second floor attic. Once in the attic the fire would be able to spread across exposed insulation and lumber.

The fourth scenario is a little rarer as it requires an event to be occurring in the lobby, and a fire to be set intentionally. While the book fair may be a rare event, something similar could also happen around Christmas time with a large tree in the lobby. The tree would be positioned just in front of the large glass wall between the wooden walls. If that caught fire (intentionally or accidentally), the radiant heat could ignite the wood siding on the walls and the flames could spread up and reach the ceiling. With dry-pipe sprinklers as the only form of water suppression, the delay in water delivery would render the sprinklers to be of no help controlling the fire. With the large height of the lobby, smoke production levels are quite high. The arrangement of the lobby and the second floor walkway allow the smoke to travel back towards the entrance to the dead end hallway. When the smoke hits the wall just outside the dead end hallway, the momentum of the ceiling jet will carry that smoke to the floor very quickly. In the fire model, there were ~13 seconds between when the smoke detector indicated there was smoke just outside the dead end hallway, and when visibility conditions in that location were no longer tenable.

The addition of more smoke detectors in the lobby would decrease the detection time substantially, and if a fire in the lobby could be controlled, either by an attendant with a fire extinguisher, or by wet-pipe sprinklers in place of the dry-pipe system, the ASET value could be extended for the occupants of the dead end hallway. While not a permanent solution, one option that would help the people in the dead end hallway the most would be to put a door in one of the offices or conference rooms. That could allow a second option for an emergency evacuation route for the occupants to escape via a neighboring department in case they get trapped.

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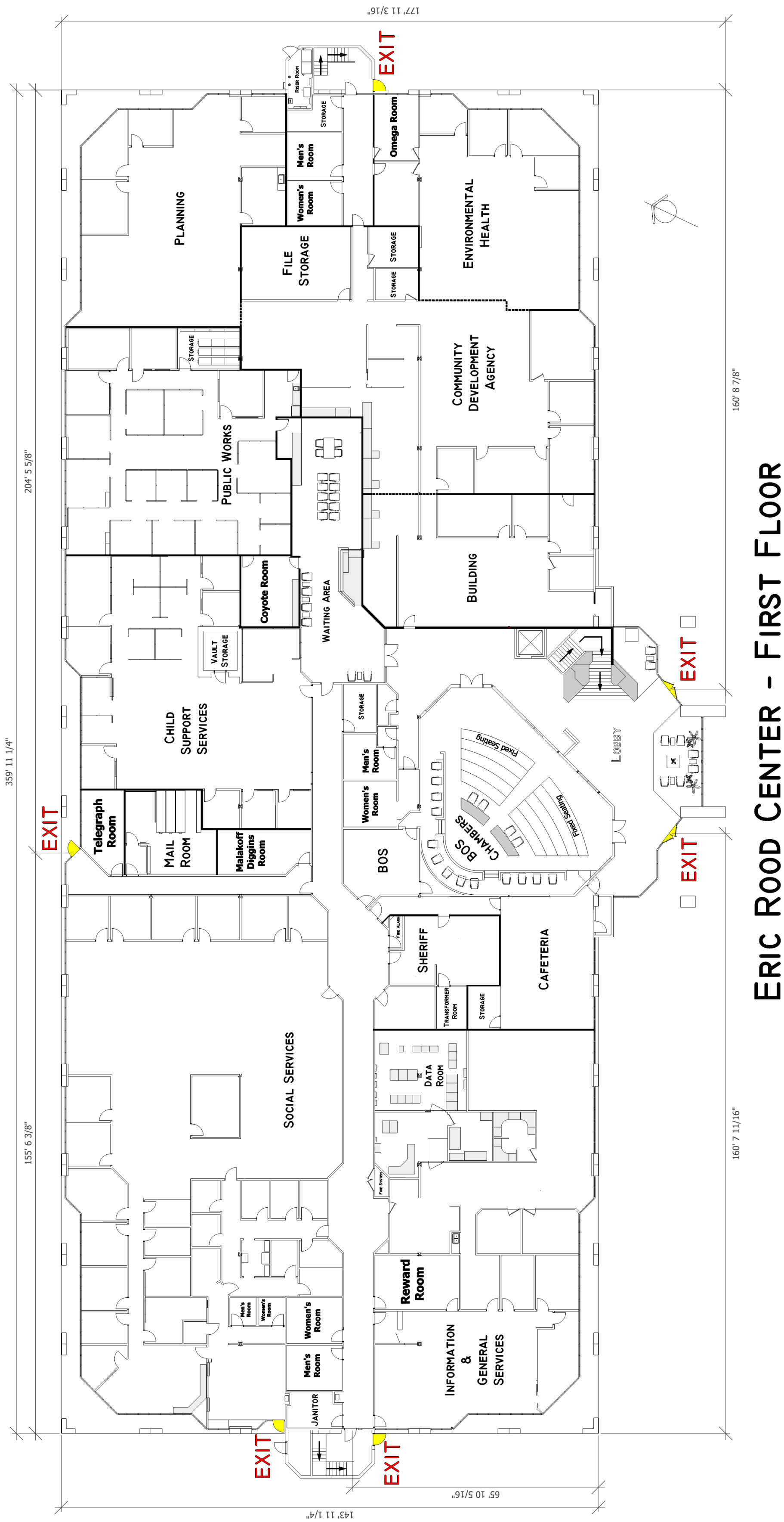
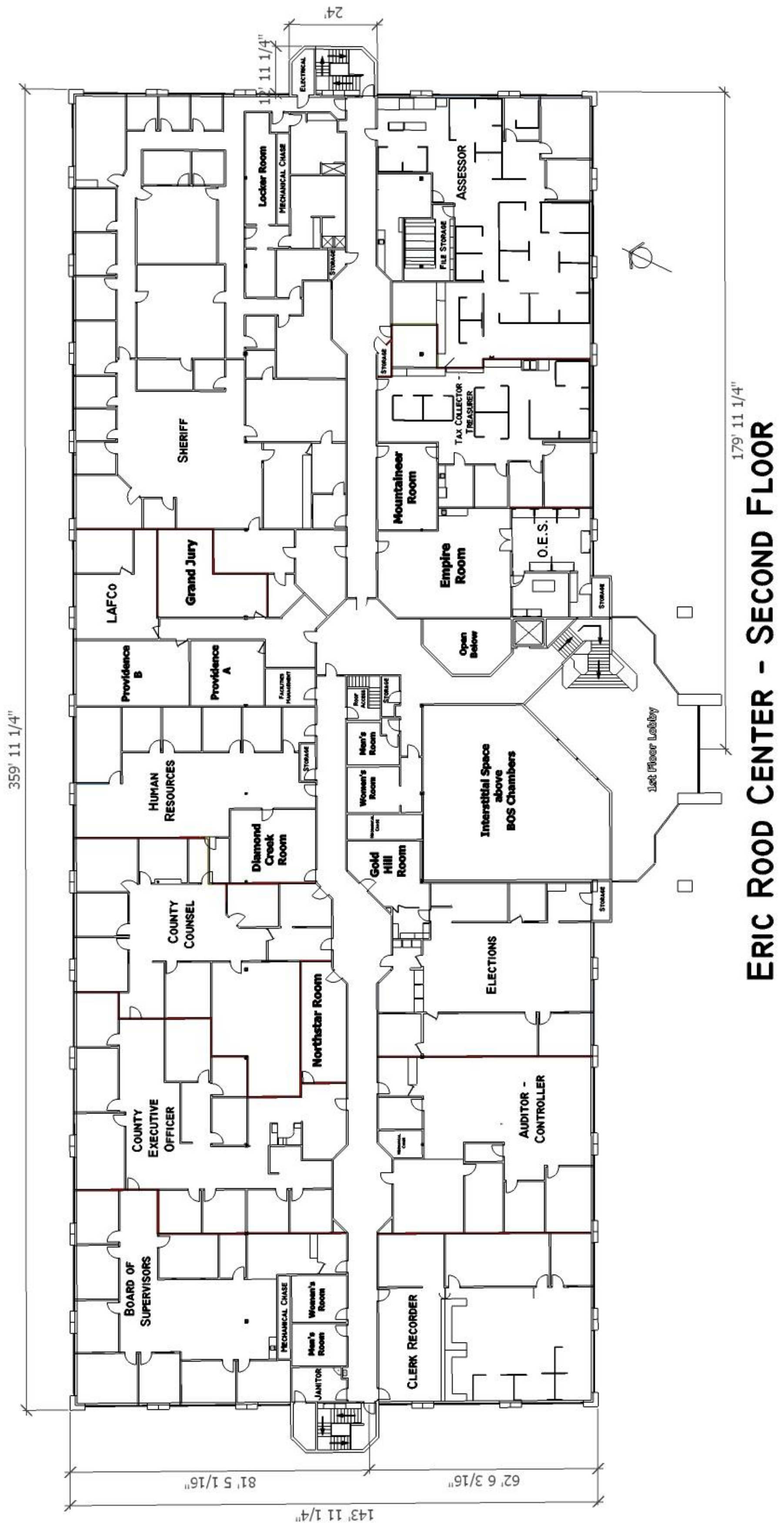
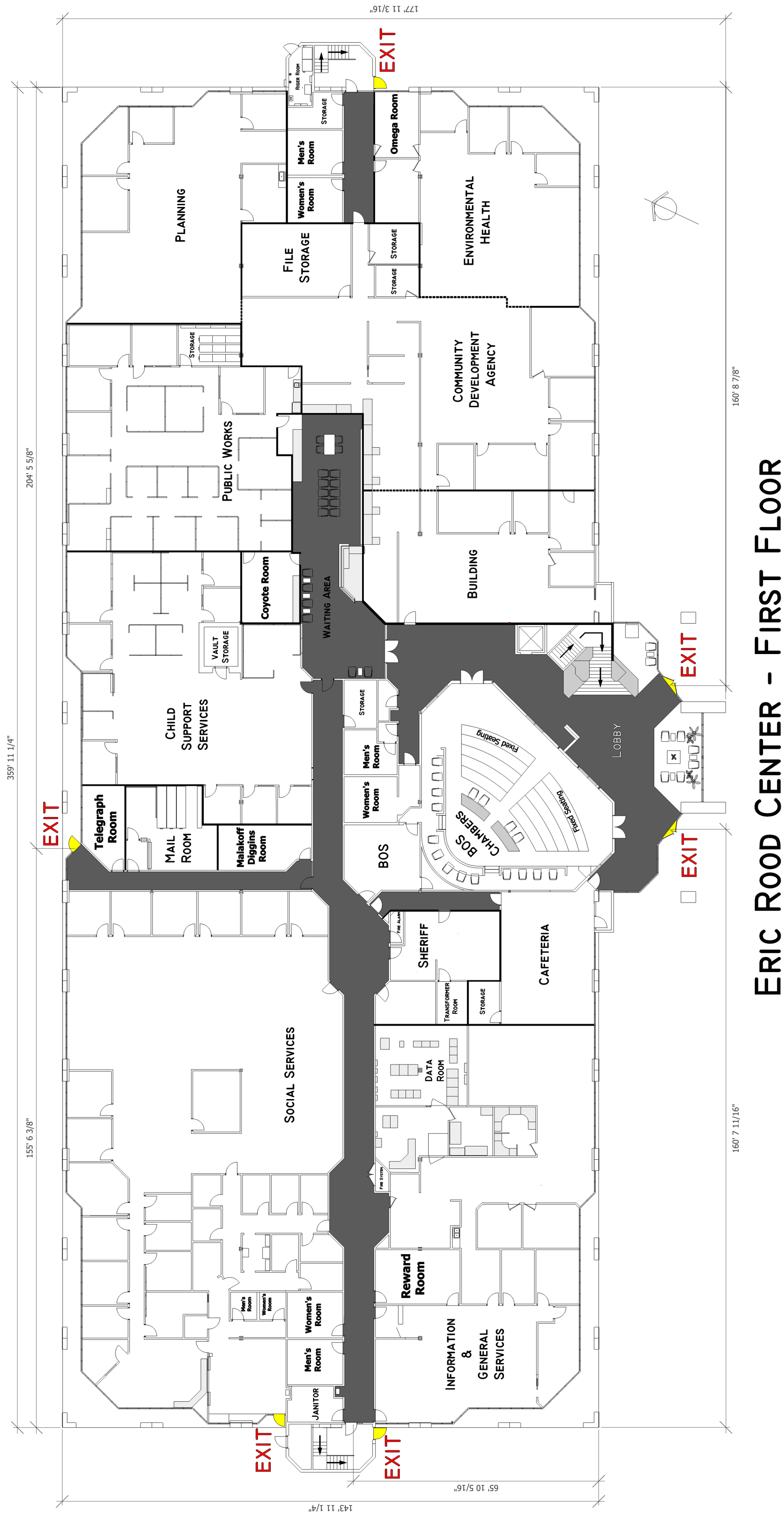
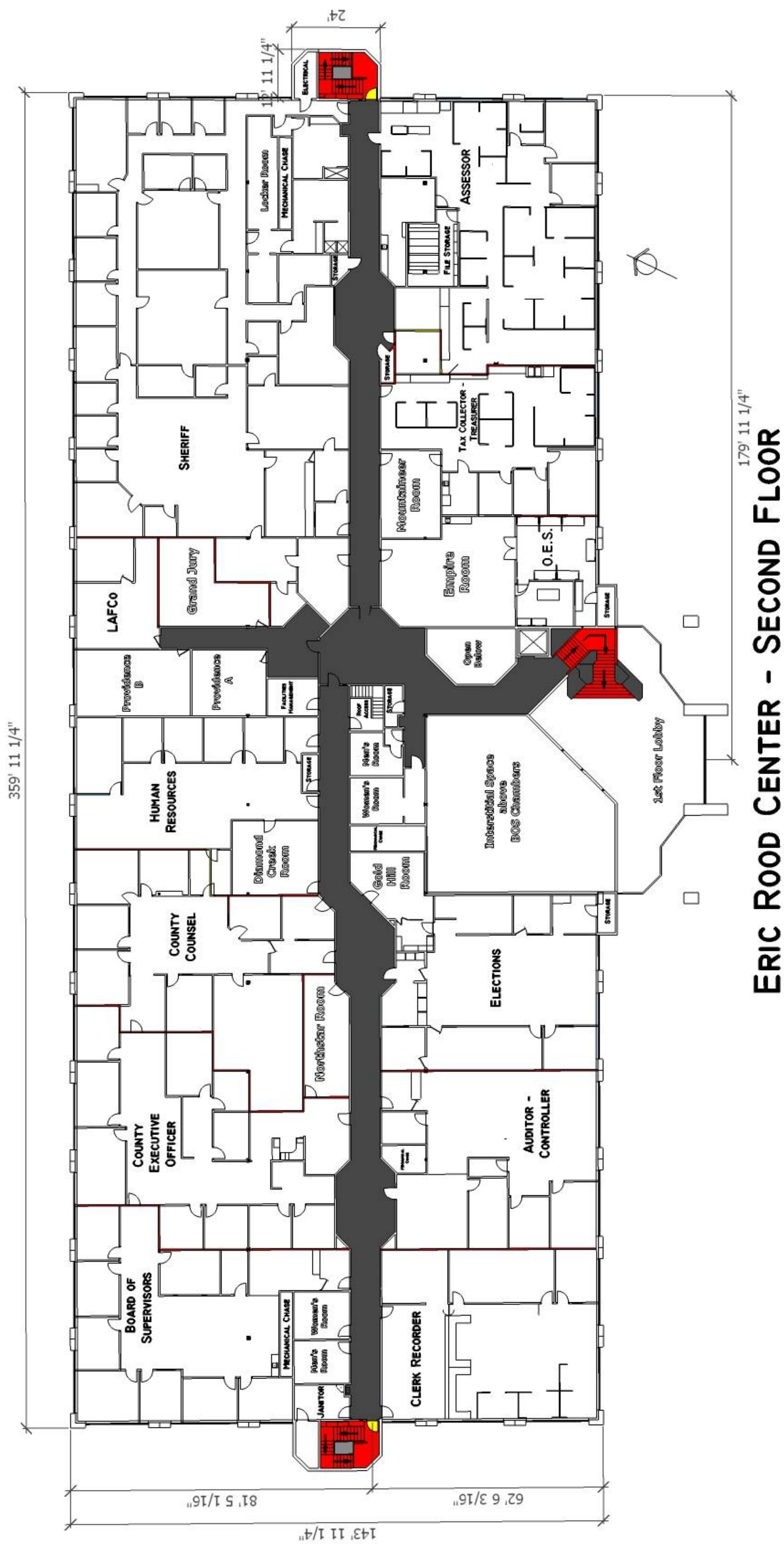
APPENDIX A

Building Floorplan


Eric Rood Center - First Floor
EXIT
EXIT
EXIT
EXIT
EXIT
EXIT
Planning
File Storage
Storage
Men's Room
Women's Room
Omega Room
Environmental Health
Community Development Agency
Public Works
Waiting Area
Coyote Room
Vault Storage
Building
Lobby
Fixed Seating
Fixed Seating
BOS Chambers
BOS
Child Support Services
Telegraph Room
Mail Room
Malakoff Diggins Room
Sheriff
Transformer Room
Cafeteria
Data Room
Social Services
Reward Room
Information & General Services
Janitor
177' 11 3/16"
204' 5 5/8"
359' 11 1/4"
155' 6 3/8"
160' 8 7/8"
160' 7 11/16"
65' 10 5/16"
143' 11 1/4"


ERIC ROOD CENTER - SECOND FLOOR
24'
12' 11 1/4"
179' 11 1/4"
359' 11 1/4"
81' 5 1/16"
62' 6 3/16"
143' 11 1/4"
ELECTRICAL
Locker Room
MECHANICAL CHASE
ASSESSOR
FILE STORAGE
STORAGE
TAX COLLECTOR - TREASURER
SHERIFF
Mountaineer Room
Empire Room
O.E.S.
Grand Jury
LAFCo
Open Below
Providence B
Providence A
FACILITIES MANAGEMENT
Men's Room
Women's Room
Interstitial Space above BOS Chambers
1st Floor Lobby
HUMAN RESOURCES
Diamond Creek Room
Gold Hill Room
COUNTY COUNSEL
ELECTIONS
Northstar Room
COUNTY EXECUTIVE OFFICER
AUDITOR - CONTROLLER
BOARD OF SUPERVISORS
CLERK RECORDER
JANITOR


Eric Rood Center - First Floor
EXIT
EXIT
EXIT
EXIT
EXIT
Planning
Men's Room
Women's Room
Omega Room
Storage
File Storage
Environmental Health
Community Development Agency
Public Works
Building
Coyote Room
Waiting Area
Vault Storage
Child Support Services
Telegraph Room
Mail Room
Malakoff Diggins Room
Lobby
BOS Chambers
Fixed Seating
Fixed Seating
BOS
Sheriff
Transformer Room
Storage
Cafeteria
Social Services
Data Room
Reward Room
Information & General Services
Women's Room
Men's Room
Janitor
204' 5 5/8"
359' 11 1/4"
155' 6 3/8"
177' 11 3/16"
160' 8 7/8"
160' 7 11/16"
65' 10 5/16"
143' 11 1/4"


ERIC ROOD CENTER - SECOND FLOOR
359' 11 1/4"
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24'
SHERIFF
ASSESSOR
TAX COLLECTOR - TREASURER
Mountaineer Room
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BOARD OF SUPERVISORS
CLERK RECORDER
Men's Room
Women's Room
JANITOR
MECHANICAL CHASE
Locker Room
FILE STORAGE
STORAGE
ELECTRICAL

APPENDIX B

Occupancy Load Spreadsheets

First Floor – 2013 CBC

Space/Room	Suite	Type of Occupancy	Area	OLF (sq.ft./person)	Exact Occ #	Rounded Occ #
Social Services	120	Business	8,516	100	85.16	**85**
Child Support Services	140	Business	3,765	100	37.65	**38**
Public Works	170	Business	2,609	100	26.09	**26**
Planning	170	Business	2,892	100	28.92	**29**
Environmental Health	170	Business	2,445	100	24.45	**24**
Community Development Agency	170	Business	4,099	100	40.99	**41**
Building	170	Business	2,214	100	22.14	**22**
Information & General Services	130	Business	8,455	100	84.55	**85**
Sheriff's Office	--	Business	688	100	6.88	**7**
Lobby Area	--	Business	1,970	100	19.70	**20**
Main Lobby Seating	--	Business	298	100	2.98	**3**
Side Lobby Seating	--	Business	150	100	1.50	**2**
CDA Seating	170	Business	1,197	100	11.97	**12**
Mail Room	--	Business	510	100	5.10	**5**
Malakoff Room	145	Assembly (A-3) - Unconcentrated	285	15	19.00	**19**
Telegraph Room	148	Assembly (A-3) - Unconcentrated	231	15	15.40	**15**
Coyote Room	160	Assembly (A-3) - Unconcentrated	302	15	20.13	**20**
Reward Room	130A	Assembly (A-3) - Unconcentrated	332	15	22.13	**22**
Omega Room	170	Assembly (A-3) - Unconcentrated	207	15	13.80	**14**
BOS Chambers	100	Assembly (A-3) - Standing Space	70	5	14.00	**14**
		Fixed Seating	121	1	121.00	**121**
Cafeteria	150	Assembly (A-2) - Unconcentrated	903	15	60.20	**60**
Janitors Closet (West)	--	Storage (S-1)	131	300	0.44	**1**
"Vault Storage"	140	Storage (S-1)	96	300	0.32	**1**
"File Storage" (PW)	170	Storage (S-1)	184	300	0.61	**1**
"IS Storage" (East)	--	Storage (S-1)	109	300	0.36	**1**
"File Storage" (CDA)	170	Storage (S-1)	567	300	1.89	**2**
Unmarked Storage (CDA)	170	Storage (S-1)	142	300	0.47	**1**
Secondary Unmarked Storage (CDA)	170	Storage (S-1)	94	300	0.31	**1**
"IS Storage" (Center)	--	Storage (S-1)	159	300	0.53	**1**

Cafeteria South	--	Storage (S-1)	48	300	0.16	**1**
Cafeteria North	--	Storage (S-1)	94	300	0.31	**1**
Exterior Storage	--	Storage (S-1)	68	300	0.23	**1**
"Transformer Room"	--	Utility	92	300	0.31	**1**
Fire Riser Room	--	Utility	95	300	0.32	**1**
"Integen Fire System for IS"	--	Utility	25	300	0.08	**0**
"Fire Alarm" Closet	--	Utility	31	300	0.10	**0**
Rest Rooms (x2) DSS	--	Utility	110	300	0.37	**2**
Rest Rooms (x2) West	--	Utility	381	300	1.27	**2**
Rest Rooms (x2) Center	--	Utility	409	300	1.36	**2**
Rest Rooms (x2) East	--	Utility	377	300	1.26	**2**
					Total:	**706**

First Floor – 2012 LSC

Space/Room	Suite	Type of Occupancy	Area	OLF (sq.ft./person)	Exact Occ #	**Rounded Occ #**
Social Services	120	Business	8,516	100	85.16	**85**
Child Support Services	140	Business	3,765	100	37.65	**38**
Public Works	170	Business	2,609	100	26.09	**26**
Planning	170	Business	2,892	100	28.92	**29**
Environmental Health	170	Business	2,445	100	24.45	**24**
Community Development Agency	170	Business	4,099	100	40.99	**41**
Building	170	Business	2,214	100	22.14	**22**
Information & General Services	130	Business	8,455	100	84.55	**85**
Sheriff's Office	--	Business	688	100	6.88	**7**
Lobby Area	--	Business	1,970	100	19.70	**20**
Main Lobby Seating	--	Business	298	100	2.98	**3**
Side Lobby Seating	--	Business	150	100	1.50	**2**
CDA Seating	170	Business	1,197	100	11.97	**12**
Mail Room	--	Business	510	100	5.1	**5**
Malakoff Room	145	Assembly (A-3) - Less concentrated	285	15	19.00	**19**
Telegraph Room	148	Assembly (A-3) - Less concentrated	231	15	15.40	**15**
Coyote Room	160	Assembly (A-3) - Less concentrated	302	15	20.13	**20**
Reward Room	130A	Assembly (A-3) - Less concentrated	332	15	22.13	**22**
Omega Room	170	Assembly (A-3) - Less concentrated	207	15	13.80	**14**
BOS Chambers	100	Assembly (A-3) - Concentrated	70	7	10	**10**
		Fixed Seating	121	1	121	**121**
Cafeteria	150	Assembly (A-2) - Less concentrated	903	15	60.2	**60**
Janitors Closet (West)	--	Storage (S-1)	131	500	0.26	**1**
"Vault Storage"	140	Storage (S-1)	96	500	0.19	**1**
"File Storage" (PW)	170	Storage (S-1)	184	500	0.37	**1**
"IS Storage" (East)	--	Storage (S-1)	109	500	0.22	**1**
"File Storage" (CDA)	170	Storage (S-1)	567	500	1.13	**1**
Unmarked Storage (CDA)	170	Storage (S-1)	142	500	0.28	**1**
Secondary Unmarked Storage (CDA)	170	Storage (S-1)	94	500	0.19	**1**

"IS Storage" (Center)	--	Storage (S-1)	159	500	0.32	**1**
Cafeteria South	--	Storage (S-1)	48	500	0.10	**1**
Cafeteria North	--	Storage (S-1)	94	500	0.19	**1**
Exterior Storage	--	Storage (S-1)	68	500	0.14	**1**
"Transformer Room"	--	Industrial	92	100	0.92	**1**
Fire Riser Room	--	Industrial	95	100	0.95	**1**
"Integren Fire System for IS"	--	Industrial	25	100	0.25	**0**
"Fire Alarm" Closet	--	Industrial	31	100	0.31	**0**
Rest Rooms (x2) DSS	--	Industrial	110	100	1.10	**2**
Rest Rooms (x2) West	--	Industrial	381	100	3.81	**4**
Rest Rooms (x2) Center	--	Industrial	409	100	4.09	**4**
Rest Rooms (x2) East	--	Industrial	377	100	3.77	**4**
					Total:	**707**

Second Floor – 2013 CBC

Space/Room	Suite	Type of Occupancy	Area	OLF (sq.ft./person)	Exact Occ #	Rounded Occ #
Assessor	290	Business	3,704	100	37.04	**37**
Auditor-Controller	230	Business	2,603	100	26.03	**26**
Board of Supervisors	200	Business	3,008	100	30.08	**30**
Clerk Recorder	210	Business	2,655	100	26.55	**27**
County Executive Officer	220	Business	3,369	100	33.69	**34**
County Counsel	240	Business	3,157	100	31.57	**32**
Human Resources	260	Business	2,157	100	21.57	**22**
LAFCo	270	Business	653	100	6.53	**7**
Sheriffs	280	Business	8,196	100	81.96	**82**
Tax Collector - Treasurer	290	Business	2108	100	21.08	**21**
Office of Emergency Services	--	Business	635	100	6.35	**6**
Elections	250	Business	2,511	100	25.11	**25**
Gold Hill Room	250A	Assembly (A-3) - Unconcentrated	413	15	27.53	**28**
Northstar Room	240	Assembly (A-3) - Unconcentrated	387	15	25.80	**26**
Providence A	270A	Assembly (A-3) - Unconcentrated	355	15	23.67	**24**
Providence B	270B	Assembly (A-3) - Unconcentrated	544	15	36.27	**36**
Mountaineer Room	290A	Assembly (A-3) - Unconcentrated	382	15	25.47	**25**
Diamond Creek Room	260A	Assembly (A-3) - Unconcentrated	461	15	30.73	**31**
Empire Room	278	Assembly (A-3) - Unconcentrated	963	15	64.20	**64**
Grand Jury	270	Assembly (A-3) - Unconcentrated	523	15	34.87	**35**
Locker Room/Rest Rooms Sheriff	280	Locker Rooms	963	50	19.26	**19**
Storage East Hall (Tax-Treasury)	--	Storage (S-1)	28	300	0.09	**1**
Second story landing closet	--	Storage (S-1)	49	300	0.16	**1**
Janitors Closet (West)	--	Storage (S-1)	136	300	0.45	**1**
Facilities Maintenance	--	Storage (S-1)	137	300	0.46	**1**
Elections South Storage	--	Storage (S-1)	47	300	0.16	**1**
Admin Storage (OES)	--	Storage (S-1)	51	300	0.17	**1**
File Storage (Assessor)	--	Storage (S-1)	251	300	0.84	**1**
Storage West Hall (HR)	--	Storage (S-1)	42	300	0.14	**1**
IS Storage (East)	--	Storage (S-1)	29	300	0.10	**1**

Central Closet/Roof Access	--	Storage (S-1)	109	300	0.36	**1**
Electrical Room East	--	Utility	70	300	0.23	**1**
Utility Room West	--	Utility	71	300	0.24	**1**
Rest Rooms (x2) West	--	Utility	365	300	1.22	**2**
Rest Rooms (x2) Center	--	Utility	447	300	1.49	**2**
					Total:	**651**
					Grand Total:	**1,357**

Second Floor – 2012 LSC

Space/Room	Suite	Type of Occupancy	Area	OLF (sq.ft./person)	Exact Occ #	**Rounded Occ #**
Assessor	290	Business	3,704	100	37.04	**37**
Auditor-Controller	230	Business	2,603	100	26.03	**26**
Board of Supervisors	200	Business	3,008	100	30.08	**30**
Clerk Recorder	210	Business	2,655	100	26.55	**27**
County Executive Officer	220	Business	3,369	100	33.69	**34**
County Counsel	240	Business	3,157	100	31.57	**32**
Human Resources	260	Business	2,157	100	21.57	**22**
LAFCo	270	Business	653	100	6.53	**7**
Sheriffs	280	Business	8,196	100	81.96	**82**
Tax Collector - Treasurer	290	Business	2,108	100	21.08	**21**
Office of Emergency Services	--	Business	635	100	6.35	**6**
Elections	250	Business	2,511	100	25.11	**25**
Gold Hill Room	250A	Assembly (A-3) Less Concentrated	413	15	27.53	**28**
Northstar Room	240	Assembly (A-3) Less Concentrated	387	15	25.80	**26**
Providence A	270A	Assembly (A-3) Less Concentrated	355	15	23.67	**24**
Providence B	270B	Assembly (A-3) Less Concentrated	544	15	36.27	**36**
Mountaineer Room	290A	Assembly (A-3) Less Concentrated	382	15	25.47	**25**
Diamond Creek Room	260A	Assembly (A-3) Less Concentrated	461	15	30.73	**31**
Empire Room	278	Assembly (A-3) Less Concentrated	963	15	64.20	**64**
Grand Jury	270	Assembly (A-3) Less Concentrated	523	15	34.87	**35**
Locker Room/Rest Rooms Sheriff	280	Locker Rooms	963	50	19.26	**19**
Storage East Hall (Tax-Treasury)	--	Storage (S-1)	28	500	0.06	**1**
Second story landing closet	--	Storage (S-1)	49	500	0.10	**1**
Janitors Closet (West)	--	Storage (S-1)	136	500	0.27	**1**
Facilities Maintenance	--	Storage (S-1)	137	500	0.27	**1**
Elections South Storage	--	Storage (S-1)	47	500	0.09	**1**
Admin Storage (OES)	--	Storage (S-1)	51	500	0.10	**1**
File Storage (Assessor)	--	Storage (S-1)	251	500	0.50	**1**
Storage West Hall (HR)	--	Storage (S-1)	42	500	0.08	**1**
IS Storage (East)	--	Storage (S-1)	29	500	0.06	**1**
Central Closet/Roof Access	--	Storage (S-1)	109	500	0.22	**1**

Electrical Room East	--	Industrial	70	100	0.70	**1**
Utility Room West	--	Industrial	71	100	0.71	**1**
Rest Rooms (x2) West	--	Industrial	365	100	3.65	**4**
Rest Rooms (x2) Center	--	Industrial	447	100	4.47	**5**
					Total:	**656**
					Grand Total:	**1,363**

<u>APPENDIX C</u>

Department Movement Time Calculations

These calculations are done by hand, and will be completed for each space in the building. Occupant load numbers can vary for a space depending if the CBC or the LSC are used. Therefore, whichever number is higher will be used to aid in a more conservative analysis. These values are only representative of the movement times from each department. As only one department's egress at a time is calculated, actual movement times would be longer due to multiple departments evacuating through the same pathways.

First Floor Spaces

Main Lobby:

The Main Lobby discharges through two exits with glass double-doors to the exterior of the building. The maximum occupancy of the lobby is 25 people. Since everyone is in visual distance of the glass front doors and could be spread out throughout the lobby, the limiting factors of egress would be people reaching the front doors.

Assuming people are spread throughout the lobby and will need to reach the front doors, the longest distance of travel one would need to take would be ~105 feet. From Table 3-13.4 from the SFPE Handbook (*4th Edition*), the maximum unimpeded exit speed across a flat surface is 235 feet/minute. At that rate, it would take someone:

(105 feet) / (235 ft./min) = **~27 seconds**

The interior width of the doors is 72 inches. The effective width = 72"-12" = 60" or 5'. From Table 3-13.5 in the SFPE Handbook (*4th Edition*), the maximum specific flow (F_{SM}) through a doorway is 24.0 people/min/foot of effective width.

F_{SM} = (24 people/min/foot e.w.) X (5 feet e.w.) = **120 people/minute PER EXIT**

Since there are two exits, that means:
The F_{SM} of the whole lobby is 240 people/minute

That means that it would take 25 people, at a rate of 240 people/minute a total of
~7 seconds to exit the building.

Total egress time from the lobby:
27 + 7 = 34 seconds.

BOS Chambers:

The BOS Chambers discharges through two exits at the south and east sides of the room with double-doors that feed into the lobby. The doorways are each 72"-wide leaving an effective width of 60" per exit.

The layout of the seating in the chambers is 107 fixed seats in rows. Each row has an aisle down the middle dividing each row into two sections. There are 5 rows divided in half, which equals 10 sections. There is 18 inches in-between the seat backs and the front of the seats behind. It is assumed that the occupants in each section will divide evenly with half going to the exterior exit, and the other half going to the interior aisle exit. With that assumption, the furthest someone would have to travel to the section would be ~15 feet.

In front of these fixed seats are 4 more seats (desk chairs) at desks. These occupants exit down either side of the fixed seats.

At the front of the room are 10 more seats (desk chairs) for the supervisors. They will get out of their chairs and travel behind the other chairs along the exterior of the room till they reach the exit doorways.

For the people in the fixed seats, the farthest someone would theoretically have to travel is 52 feet to reach the nearest double-door exit. At 235 feet/min that equals:

(52 feet) / (235 feet/min) = **13 seconds**

For the people in the two desks, they'll need to walk 54 feet to reach the exits. That works out to:

(54 feet) / (235 feet/min) = **14 seconds**

For the supervisors, if they choose the two main exits at the front of the building, they would need to travel ~52 feet to reach the exits.

(52 feet) / (235 feet/min) = **13 seconds**

There are also people standing at the back of the room, they'll travel approximately 27 feet to the exits which will take:

(27 feet) / (235 feet/min) = **7 seconds**

As calculated in the previous section, two sets of 72"-wide double-doors have a maximum specific flow of 240 people/minute. At a maximum capacity of 135 people, that would take:
(135 people) / (240 people/min) = **34 seconds** to completely evacuate the BOS Chambers.

Since it takes people a minimum of 7 seconds and a maximum of 14 seconds (assuming nobody else blocks their direct path) to reach the exits, and 34 seconds for everyone to exit through the doorways, any queue that may form at either exit that would clear rather quickly.

Once outside the BOS chambers, the occupants would need to travel to the discharge exits at the front of the building. The distance from the south BOS Chambers exit to the west discharge exit is 16 feet. The distance from the east BOS Chambers exit to the east discharge exit is 54 feet.

(16 feet) / (235 feet/min) = **4 seconds**
(54 feet) / (235 feet/min) = **14 seconds**

As these doors have a discharge capacity of 120 people/minute each, and people have to travel to them after exiting through exits of the same capacity, no queue is expected to form.

Since half of the people will be going to each exit, the people exiting out of the southern BOS chambers exit and then out of the western discharge exit would have a maximum egress time of:

14 seconds to reach the BOS exit, 34 seconds to clear the BOS Chambers, 4 seconds to reach the discharge exits at the front of the building and pass through:

14 + 34 + 4 = 5<u>2 seconds</u>

The other half of the occupants would be exiting out of the eastern BOS chambers exit and then out of the eastern discharge exit. The maximum egress time would be:

14 seconds to reach the BOS exit, 34 seconds to clear the BOS Chambers, 14 seconds to reach the discharge exits at the front of the building and pass through:

14 + 34 + 14 = <u>62 seconds</u>

<u>Cafeteria</u>:

The occupants in the cafeteria would exit through a single 36”-wide doorway at the southeast corner of the cafeteria into the lobby, and then out of the western discharge exit made up of double glass doors 72”-wide. Another 36”-wide doorway is located at the northeast corner of the cafeteria leads to a hallway and then into the western corridor, but it is NOT marked as an exit. Unless a staff member attempts to go back to their offices to grab personal effects, it is not likely that anyone would use this hallway as a primary exit as the travel distance is almost three times as long.

The maximum occupancy of the cafeteria is 60 people. The effective width of the exit doorway is:

36” – 12” = 24” or 2’.

(24.0 people/min/foot of effective width) X (2 feet of effective width) = **48 people/min**

The people would have to travel 43 feet to the exit into the lobby. At a rate of 235 feet/min, that would take:

(43 feet) / (235 feet/min) = **11 seconds**

The 60 people in the cafeteria could exit through that doorway in:

(60 people) / (48 people/min) = **75 seconds**

The people would then have to travel 25 feet to the main discharge exit which is a double-door. At a rate of 235 feet/min, that would take:

(25 feet) / (235 feet/min) = **6 seconds**

The two 36”-wide doorways can discharge 120 people/minute. For everyone to pass through the exit, that would take:

(60 people) / (120 people/min) = **30 seconds**

Total egress time from the cafeteria would take:

11 + 75 + 6 + 30 = <u>122 seconds</u>

<u>Waiting area (CDA)</u>:

The maximum occupancy for the waiting area is 12 people. There are two exits from this space, the eastern stairwell and the main lobby. As the occupants of this space would be the general public, they would be most likely try to exit out of the front of the building even though the eastern stairwell is closer. Assuming the occupants exit through the front of the building, the longest travel distance to the double-door (72”-wide) exit at the front of the waiting area would be 70 feet. That would take:

(70 feet) / (235 feet/min) = **18 seconds**

Like the main exit discharge rates calculated above, the maximum specific flow through these doors is 120 people/min. For all 12 people to pass through the doors, that would take:

(12 people) / (120 people/min) = ~**6 seconds**

Once in the lobby, people would have to travel the 105 feet to the front exit doors. Like calculated above, that would take **27 seconds.**

Total egress time from the CDA Waiting Area would take:

18 seconds + 6 seconds + 27 seconds = <u>51 seconds</u>

<u>Public Works</u>:

The maximum occupancy for the public works department is 26 people. Adding in the occupancy for the Coyote Room, that makes 46 people. Considering that most of the people work in the building and are familiar with exit procedures, The the most likely exit would be the main lobby. That would take the occupants through two 36”-wide doorways out of public works and into the waiting area (previously mentioned). The maximum distance someone would have to travel to reach the exit doorways out of public works would be 70 feet. That would take:

(70 feet) / (235 feet/min) = **18 seconds**

The two 36"-wide doorways can discharge 96 people/minute. To clear the department, that would take:

(46 people) / (96 people/min) = **~29 seconds**

At that point, people would be in the same location as the people calculated in the previous example. It would take the occupants **18 seconds** to reach the double doors. Then the 46 people could exit through the double doors in:

(46 people) / (120 people/min) = **23 seconds**

It would then take an additional **27 seconds** to reach and pass through the front exits. So in total the egress time would be:

18 + 29 + 18 + 23 + 27 = <u>115 seconds</u>

<u>Planning</u>:

The planning department has a maximum occupancy of 29 people. Their most likely path of exit would be through a 36" door leading to the 8-foot wide, 36-foot long eastern corridor. At the end of the corridor, they'd have to pass through another 36"-wide door, before traveling another 7 feet in the base of the stairwell, then exiting through the 36"-wide discharge door. The longest path of travel to reach the entrance of the corridor would be 114 feet. Both 36" doors have an F_{SM} of 48 people/min.
Therefore, the calculations would be as follows:

(114 feet) / (235 feet/min) = **29 seconds** to reach the corridor entrance

(29 people) / (48 people/min) = **36 seconds** to pass through the door into the corridor

(36 feet) / (235 feet/min) = **9 seconds** to travel through the corridor to the stairwell entrance

(29 people) / (48 people/min) = **36 seconds** to pass through the door into the stairwell

(7 feet) / (235 feet/min) = **2 seconds** to reach the discharge door

(29 people) / (48 people/min) = **36 seconds** to pass through the discharge door

So in total the egress time for the planning department would be:

29 + 36 + 9 + 36 + 2 + 36 = <u>148 seconds</u>

<u>Environmental Health</u>:

The maximum occupancy of the Environmental Health offices is 24 people. Add that to the occupancy of the Omega Room and that is a total of 38 people. The shortest path of travel for them would be to exit through either the break room or Omega conference room (which are side by side) and then into the eastern corridor and out of the stairwell. All of the doors are 36" wide. The length they'd have to travel to reach the break room/Omega room is 60 feet. Then another 12 feet to pass through those rooms. Then 19 feet through the corridor and into the stairwell. The calculations would be:

For those people already in the Omega room:

(12 feet) / (235 feet/min) = **3 seconds** to reach the door into the corridor

(14 people) / (48 people/min) = **18 seconds** to pass through the door into the corridor

(19 feet) / (235 feet/min) = **5 seconds** to reach the stairwell exit door

(14 people) / (48 people/min) = **18 seconds** to pass through the door into the stairwell

(7 feet) / (235 feet/min) = **2 seconds** to reach the discharge door

(14 people) / (48 people/min) = **18 seconds** to pass through the discharge door

For Environmental Health employees who aren't in the Omega room:

(60 feet) / (235 feet/min) = **15 seconds** to reach the break room/Omega room entrances
(24 people) / (48 people/min) = **30 seconds** to pass through the door into the room

**At this point, the occupants from the Omega room are already in the stairwell and not creating additional queuing for EH employees. Therefore, the following calculations assume only EH employees and no additional delays.

(12 feet) / (235 feet/min) = **3 seconds** to reach the door into the corridor

(24 people) / (48 people/min) = **30 seconds** to pass through the door into the corridor

(19 feet) / (235 feet/min) = **5 seconds** to reach the stairwell exit door

(24 people) / (48 people/min) = **30 seconds** to pass through the door into the stairwell

(7 feet) / (235 feet/min) = **2 seconds** to reach the discharge door

(24 people) / (48 people/min) = **30 seconds** to pass through the discharge door

So in total, the longest egress time for the Environmental Health department would be:

15 + 30 + 3 + 30 + 5 + 30 + 2 + 30 = 145 seconds

<u>Community Development Agency</u>:

The maximum occupancy for the CDA is 41 people. There are two exits which could be equally beneficial. One option would be to enter the eastern corridor and exit through the stairwell. The other option would be to travel through the building department, out into the north end of the main lobby, and out through the front doors. For these calculations, it is assumed that half the population exits using the stairwell and the other half uses the doors in the main lobby.

<u>Eastern Stairwell:</u>

(99 feet) / (235 feet/min) = **25 seconds** to reach the corridor entrance

(20.5 people) / (48 people/min) = **26 seconds** to pass through the door into the corridor

(36 feet) / (235 feet/min) = **9 seconds** to reach the stairwell entrance

(20.5people) / (48 people/min) = **26 seconds** to pass through the door into the stairwell

(7 feet) / (235 feet/min) = **2 seconds** to reach the discharge door

(20.5 people) / (48 people/min) = **26 seconds** to pass through the discharge door

The egress time for half of the planning department occupancy through the eastern stairwell would be:

25 + 26 + 9 + 26 + 2 + 26 = <u>114 seconds</u>

<u>Main Doors:</u>

(101 feet) / (235 feet/min) = **26 seconds** to reach the door into the main lobby

(20.5 people) / (48 people/min) = **26 seconds** to pass through the door into the lobby

(105 feet) / (235 feet/min) = **27 seconds** to reach the front doors

(20.5 people) / (240 people/min) = **5 seconds** to pass through the front doors

The egress time for half of the planning department occupancy through the lobby would be:

26 + 26 + 27 + 5 = <u>84 seconds</u>

<u>Building</u>:

The maximum occupancy of the building department is 22 people. The primary exit path would be out the single 36”-wide door at the west end of their department into the main lobby and out of the front doors. The calculation for their egress time is as follows:

(77 feet) / (235 feet/min) = **20 seconds** to reach the door into the main lobby

(22 people) / (48 people/min) = **27.5 seconds** to pass through the door into the lobby

(105 feet) / (235 feet/min) = **27 seconds** to reach the front doors

(22 people) / (240 people/min) = **5.5 seconds** to pass through the front doors

20 + 27.5 + 27 + 5.5 = <u>80 seconds</u>

<u>Child Support Services</u>:

The maximum occupancy of the CSS is 38 people. The CSS department has two exits at the south end of the department which open into the eastern end of the western corridor. After seeing their fire drill plan, the primary exit path is to exit into the western corridor, travel west till they reach the entrance to the northern corridor, then exit through the discharge door at the end of the north corridor. The calculation would be as follows:

Time to reach the exit doors at the south end of the department:
(91.5 feet) / (235 feet/min) = **23 seconds**

Time to pass through the two 36"-wide doors:
(38 people) / (96 people/min) = **24 seconds**

Time to reach the door to the north corridor:
(40 feet) / (235 feet/min) = **11 seconds**

Time to pass through the 36"-wide door into the corridor:
(38 people) / (48 people/min) = **48 seconds**

Time to travel through the north corridor and reach the discharge door:
(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the 36"-wide discharge door:
(38 people) / (48 people/min) = **48 seconds**

23 + 24 + 11 + 48 + 17 + 48 = <u>171 seconds</u>

If a secondary exit path is required (as in Scenario #3 in the performance based analysis), the occupants would exit south out of the department into the western corridor, then east into the CDA waiting area, then out through the lobby. The secondary path calculation would be as follows:

Time to reach the exit doors at the south end of the department:
(91.5 feet) / (235 feet/min) = **23 seconds**

Time to pass through the two 36"-wide doors:
(38 people) / (96 people/min) = **24 seconds**

Time to reach the east door to the CDA waiting area:

(24 feet) / (235 feet/min) = **6 seconds**

Time to pass through the 36"-wide door into the waiting area:

(38 people) / (48 people/min) = **48 seconds**

Time to reach the double doors at the south end of the CDA waiting area:

(20 feet) / (235 feet/min) = **5 seconds**

Like the main exit discharge rates calculated above, the maximum specific flow through these double doors is 120 people/min.

(38 people) / (120 people/min) = **19 seconds**

Once in the lobby, people would have to travel the 105 feet to the front exit doors. Like calculated above, that would take **27 seconds.**

Total secondary egress time from the CSS would take:

23 + 24 +6 + 48 + 5 + 19 + 27 = <u>152 seconds</u>

In reality, this secondary path would also be shared with people exiting the CDA waiting area, Public Works, the Building Department, and possibly the BOS Chambers thereby increasing the egress time. The primary path is shared with significantly less people and uses an exit primarily accessed by staff only.

<u>Social Services</u>:

The department of Social Services is quite wide and is pretty even between three exits therefore, it is assumed that the people will split evenly to the three exits. The maximum occupancy is 85 people. One exit is out through the DSS Lobby to the exterior door on the west side of the building. The other is out through the door into the western corridor, then traveling east to the north corridor and out of the north side of the building. The third is out through a second door into the western corridor, then travel west to the stairwell and exit out from the stairwell. The three calculations are as follows:

<u>Western Corridor to North Corridor:</u>

Time to reach the exit door:

(64 feet) / (235 feet/min) = **16 seconds**

Time to pass through the 36"-wide door:

(28 people) / (48 people/min) = **35 seconds**

Time to reach the door to the north corridor:

(33 feet) / (235 feet/min) = **~9 seconds**

Time to pass through the 36"-wide door into the corridor:
(28 people) / (48 people/min) = **35 seconds**

Time to travel through the north corridor and reach the discharge door:
(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the 36"-wide discharge door:
(28 people) / (48 people/min) = **35 seconds**

19 + 35 + 9 + 35 + 17 + 35 = <u>147 seconds</u>

<u>Out through the DSS Lobby:</u>

Time to reach the exit door into the DSS lobby:
(60 feet) / (235 feet/min) = **15 seconds**

Time to pass through the 36"-wide door:
(28 people) / (48 people/min) = **35 seconds**

Time to reach the doors to the discharge door:
(29 feet) / (235 feet/min) = **~8 seconds**

Time to pass through the 36"-wide discharge door:
(28 people) / (48 people/min) = **35 seconds**

15 + 35 + 8 + 35 = <u>93 seconds</u>

<u>Western corridor to the western stairwell:</u>

Time to reach the exit door into the west corridor:
(36 feet) / (235 feet/min) = **9 seconds**

Time to pass through the 36"-wide door:
(28 people) / (48 people/min) = **35 seconds**

Time to reach the stairwell door:
(56 feet) / (235 feet/min) = **14 seconds**

Time to pass through the 36"-wide door into the stairwell:
(28 people) / (48 people/min) = **35 seconds**

Time to reach the stairwell discharge door:
(7 feet) / (235 feet/min) = **2 seconds**

Time to pass through the 36”-wide discharge door:

(28 people) / (48 people/min) = **35 seconds**

9 + 35 + 14 + 35 + 2 + 35 = <u>130 seconds</u>

<u>Information & General Services</u>:

Information and General Services has a maximum occupancy of 85 people. With the Reward room that makes 107 people. There are three main exits (36”-wide doorways) from the department into the western corridor, and a fourth from the Reward room. From there people would travel west into the stairwell and out through the discharge door. The calculation is as follows:

Time to reach the exit door into the western corridor:

(91 feet) / (235 feet/min) = **23 seconds**

Time to pass through the four 36”-wide doors:

(107 people) / (192 people/min) = **33 seconds**

Time to reach the stairwell door:

(47 feet) / (235 feet/min) = **12 seconds**

Time to pass through the 36”-wide door into the stairwell:

(107 people) / (48 people/min) = **134 seconds**

Time to reach the stairwell discharge door:

(7 feet) / (235 feet/min) = **2 seconds**

As the discharge door is the same size as the previous door, a queue would not be expected to form:

23 + 33 + 12 + 134 + 2 = <u>204 seconds</u>

<u>Sheriff’s Office</u>:

The Sheriff’s offices on the first floor have a maximum occupancy of 7 people. There is one exit from the office space (36”-wide door) which leads into the western corridor, then northeast towards the northern corridor, and then out through the north side of the building. The time for evacuation is:

Time to reach the exit door into the west corridor:

(29 feet) / (235 feet/min) = **8 seconds**

Time to pass through the 36”-wide door:

(7 people) / (48 people/min) = **9 seconds**

Time to reach the door to the northern corridor:

(29 feet) / (235 feet/min) = **8 seconds**

Time to pass through the 36"-wide door:

(7 people) / (48 people/min) = **9 seconds**

Time to travel through the north corridor and reach the discharge door:

(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the 36"-wide discharge door:

(7 people) / (48 people/min) = **9 seconds**

8 + 9 + 8 + 9 + 17 + 9 = <u>60 seconds</u>

<u>Mail Room & Adjacent Rooms in the Northern Corridor</u>:

These three rooms have a total occupancy of 39 people. Their path of exit would be to enter the northern corridor then exit through the north side of the building. The calculation is as follows assuming the longest path of travel:

Time to reach the door to the northern corridor:

(24 feet) / (235 feet/min) = **6 seconds**

Time to pass through the three 36"-wide doors:

(39 people) / (144 people/min) = **16 seconds**

Time to travel through the north corridor and reach the discharge door:

(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the 36"-wide discharge door:

(39 people) / (48 people/min) = **49 seconds**

6 + 16 + 17 + 49 = <u>88 seconds</u>

Second Floor Spaces

There are only three exits from the second floor, and only two different types of exits (as both the East and West stairwell exits are identical). Therefore, the time it takes to go down the stairs and reach the exit door will be calculated for each type of stairwell, then that value will be used in each occupancy's egress time calculation.

For the East or West exit stairwells:

This stairway has a 36"-wide door at the top and the bottom of the stairs. The stairway is 42"-wide and 12' tall.

Doorways:

The doorways are 36 inches wide which gives an effective width of:

36 inches – 12 inches = 24 inches (2 feet)

The Maximum Specific Flow through each doorway is:

F_{SM} = (2 feet) x (24.0 persons/min/feet)

F_{SM} = 48 persons/min

Stairway:

The stairways are 42 inches wide which gives an effective width of:

42 inches – 12 inches = 30 inches (2.5 feet)

The Maximum Specific Flow through each stairway is:

F_{SM} = (2.5 feet) x (18.5 persons/min/feet)

F_{SM} = 46 persons/min

The portion of the egress system that would limit the evacuation time would be the stairway. The stairway could allow a maximum of 46 people/min to pass through the stairway system and exit. So to find out how quickly people can exit, their speed down the stairways needs to be calculated. That value is represented by the formula:

$$S = k - akD$$

S = Speed along the line of travel

D = Population density (persons/ft^2)

*Assuming a value of D=0.175 for ideal flow, from *Figure 3-13.8 from the SFPE Handbook (4th Edition)*

a = Constant = 2.86 feet/minute

k = Constant as shown in *Table 3-13.2* for "7/11" stairs = 212

Speed on the stairs = (212) – [(2.86) x (212) x (0.175)]

Speed on the stairs = 106 feet/minute

Table 3-13.3 from the SFPE Handbook (4th Edition) shows conversion factors for relating line of travel distance to vertical travel for various stair configurations. **For a "7/11" stair, the conversion factor=1.85.**

Using a stairway height of 12 feet from floor-to-floor
Distance traveled = 12 feet x 1.85 = 22.2 feet on the stairs

Distance traveled on the landings = 4 feet x 3 landings = 12 feet total
******(over estimation)*

The distance traveled at the base of the stairs to the doorway = 10.5 feet
**I'm assuming this distance will be traversed at the stairway speed of 106 ft. /min rather than the 235 ft. /min on flat ground because of a hand-rail that protrudes out beyond the stairs.*

The total distance traveled from floor-to-floor on the stairs is:
22.2 feet + 12 feet +10.5 feet = 44.7 feet

At a speed of 106 feet/minute, and a distance of 44.7 feet, it would take:
Time to travel floor-to-floor = (44.7 feet) / (106 feet/minute) = ~<u>25 seconds</u>

For the Main Stairwell and exit through the Lobby:

For this stairway, there is no door hindering entrance onto the stairwell. The stairway is in two main sections with a landing in between. The centerline of travel on the landing is 10.5 feet. The top set of stairs are 67"-wide (effective width of 55"), then below the landing the stairs are only 60"-wide (48" e.w.), then widen to 72"-wide (60" e.w.), then widen even further but have a handrail down the center. The handrail in the center essentially creates a pinch point on the stairs and the clearance from it to the edge of the stairs is only 35" (23" e.w.). Since that creates two stairwells, the total effective width would be 46", which is still the narrowest point on the stairs. Once at the bottom of the stairs, one would need to travel approximately 31 feet to reach one of the two exits (glass double-doors) that are 72"-wide (60" e.w.)

<u>Doorways:</u>
The doorways at the base are 72 inches wide which gives an effective width of:
72 inches – 12 inches = 60 inches (5 feet)

The Maximum Specific Flow through each doorway is:
F_{SM} = (5 feet) x (24.0 persons/min/feet)
F_{SM} = 120 persons/min

<u>Stairway:</u>
The stairway's narrowest point is 35 inches wide which gives an effective width of:
35 inches – 12 inches = 23 inches (1.92 feet)

The Maximum Specific Flow through each stairway is:
F_{SM} = (1.92 feet) x (18.5 persons/min/feet)
F_{SM} = 35 persons/min

With “two stairwells”, the maximum total flow would be 70 persons/min.

The area that would limit the egress time would be the stairway. The stairway could allow a maximum of 70 people/min to pass down the stairway system and exit. So to find out how quickly people can exit, we have to calculate their speed down the stairways. That value is represented by the formula:

$$S = k - akD$$

S = Speed along the line of travel
D = Population density (persons/ft^2)
*I’m going to use a value of D=0.175 for ideal flow, from *Figure 3-13.8 from the SFPE Handbook (4th Edition)*
a = Constant = 2.86 feet/minute
k = Constant as shown in *Table 3-13.2*
Stairway (“7/11” stairs) = 212

Speed on the stairs = (212) – [(2.86) x (212) x (0.175)]
Speed on the stairs = 106 feet/minute

Table 3-13.3 from the SFPE Handbook (4th Edition) shows conversion factors for relating line of travel distance to vertical travel for various stair configurations. **For a “7/11” stair, the conversion factor=1.85.**

Using a stairway height of 14 feet from floor-to-floor
Distance traveled = 14 feet x 1.85 = 25.9 feet on the stairs

The centerline distance traveled on the landing is 10.5 feet

The total distance traveled from floor-to-floor on the stairs is:
25.9 feet + 10.5 feet = 35.9 feet

At a speed of 106 feet/minute, and a distance of 35.9 feet, it would take:
Time to travel floor-to-floor = (35.9 feet) / (106 feet/minute) = 20.3 seconds

From the base of the stairs, it would be another 31 feet to reach the doorways. The maximum speed on flat ground is 235 feet/min.
(31 feet) / (235 feet/min) = **7.9 seconds**
So in total, the travel time from the top of the stairs to the exit doorways in the lobby is:
20.3 seconds + 7.9 seconds = <u>28 seconds</u>

<u>Board of Supervisors Offices</u>:

The maximum occupancy of the BOS offices is 30 people. Their path of travel would be south into the west corridor, then west into the stairwell. The maximum distance traveled in the office is 89 feet.

Time to reach the office door to the west corridor:

(89 feet) / (235 feet/min) = **23 seconds**

Time to pass through the 36"-wide door:

(30 people) / (48 people/min) = **37.5 seconds**

Time to travel in the west corridor and reach the door to the stairway:

(39 feet) / (235 feet/min) = **10 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 30 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42 minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell**.

With 30 people exiting, and 20 people in the stairwell, that leaves **10 people waiting in the queue** at the top of the stairs.

It would take the 10 people in the queue, at a maximum specific flow of 48 people/minute, 12.5 seconds to enter the top of the stairwell.

23 + 37.5 + 10 + 25.3 + 12.5 = ~<u>109 seconds</u>

<u>County Executive Officer Offices plus the Northstar Room</u>:

The maximum occupancy of the CEO offices is 34 people. If the Northstar room is included, the total occupancy is 50 people. Their path of travel would be south into the west corridor, then west into the stairwell. The maximum distance traveled in the office is 107 feet.

Time to reach the office door to the west corridor:

(107 feet) / (235 feet/min) = **27 seconds**

Time to pass through the two 36"-wide doors:

(50 people) / (96 people/min) = **31 seconds**

Time to travel in the west corridor and reach the door to the stairway:

(100 feet) / (235 feet/min) = **25.5 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 50 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42 minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell**.

With 50 people exiting, and 20 people in the stairwell, that leaves **30 people waiting in the queue** at the top of the stairs.

It would take the 30 people in the queue, at a maximum specific flow of 48 people/minute, 37.5 seconds to enter the top of the stairwell.

27 + 31 + 25.5 + 25.3 + 37.5 = ~<u>146 seconds</u>

<u>Clerk Recorder Offices</u>:

The maximum occupancy of the Clerk Recorder's offices is 27 people. Their path of travel would be north into the west corridor, then west into the stairwell. The maximum distance traveled in the office is 66 feet.

Time to reach the office door to the west corridor:
(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through two 36"-wide doors:
(27 people) / (96 people/min) = **17 seconds**

Time to travel in the west corridor and reach the door to the stairwell:
(29 feet) / (235 feet/min) = **7 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 27 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell.**

With 27 people exiting, and 20 people in the stairwell, that leaves **7 people waiting in the queue** at the top of the stairs.

It would take the 7 people in the queue, at a maximum specific flow of 48 people/minute, 8.75 seconds to enter the top of the stairwell.

17 + 17 +7 + 25.3 + 8.75 = ~<u>69 seconds</u>

<u>**Auditor-Controller Offices**</u>**:**

The maximum occupancy of the Auditor-Controller's offices is 26 people. Their path of travel would be north into the west corridor through two exits, then west into the stairwell. The maximum distance traveled in the office is 80 feet.

Time to reach the office door to the west corridor:

(80 feet) / (235 feet/min) = **20.4 seconds**

Time to pass through the two 36"-wide doors:

(26 people) / (96 people/min) = **16.3 seconds**

Time to travel in the west corridor and reach the door to the stairway:

(75 feet) / (235 feet/min) = **19.1 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 26 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42 minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell**.

With 26 people exiting, and 20 people in the stairwell, that leaves **6 people waiting in the queue** at the top of the stairs.

It would take the 6 people in the queue, at a maximum specific flow of 48 people/minute, 7.5 seconds to enter the top of the stairwell.

20.4 + 16.3 + 19.1 + 25.3 + 7.5 = <u>89 seconds</u>

<u>Elections Offices & Gold Hill Room</u>:

The maximum occupancy of the Elections offices is 25 people. If the Gold Hill room is included, the total occupancy is 53 people. Their path of travel would be north into the west corridor through two doorways, then east into the open-air walkway. From there, they'd travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 63.5 feet.

Time to reach the office door to the west corridor:

(63.5 feet) / (235 feet/min) = **16.2 seconds**

Time to pass through the two 36"-wide doors:

(53 people) / (96 people/min) = **33.2 seconds**

Time to travel in the west corridor and reach the door to the second floor lobby:

(72 feet) / (235 feet/min) = **18.4 seconds**

Time to pass through the 36"-wide door into the second floor lobby:

(53 people) / (48 people/min) = **66 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:

(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 53 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell**.

With 53 people exiting, and 33 people in the stairwell, that leaves **20 people waiting in the queue** at the top of the stairs.

It would take the 20 people in the queue, at a maximum specific flow of 71 people/minute, 17 seconds to enter the top of the stairwell.

16.2 + 33.2 + 18.4 + 66 + 13 + 28 + 17 = <u>192 seconds</u>

<u>Human Resources Offices and Diamond Creek Room</u>:

The maximum occupancy of the HR offices is 22 people. If the Diamond Creek room is included, the total occupancy is 53 people. Their path of travel would be south into the west corridor through three doorways, then east into the open-air walkway. From there, they'd travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 80 feet.

Time to reach the office door to the west corridor:

(80 feet) / (235 feet/min) = **20 seconds**

Time to pass through the three 36"-wide doors:

(53 people) / (144 people/min) = **22 seconds**

Time to travel in the west corridor and reach the door to the second floor lobby:

(32 feet) / (235 feet/min) = **8 seconds**

Time to pass through the 36"-wide door into the second floor lobby:

(53 people) / (48 people/min) = **66 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:

(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 53 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell**.

With 53 people exiting, and 33 people in the stairwell, that leaves **20 people waiting in the queue** at the top of the stairs.

It would take the 20 people in the queue, at a maximum specific flow of 71 people/minute, 17 seconds to enter the top of the stairwell.

20 + 22 + 8 + 66 + 13 + 28 + 17 = <u>174 seconds</u>

<u>County Counsel Offices</u>:

The maximum occupancy of the County Counsel offices is 32 people. Their path of travel would be south into the west corridor through two doorways, then east into the open-air walkway. From there, they'd travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 75 feet.

Time to reach the office door to the west corridor:

(75 feet) / (235 feet/min) = **19 seconds**

Time to pass through the two 36”-wide doors:
(32 people) / (96 people/min) = **20 seconds**

Time to travel in the west corridor and reach the door to the second floor lobby:
(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the 36”-wide door into the second floor lobby:
(32 people) / (48 people/min) = **40 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:
(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 32 people can’t fit in a single floor’s stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:
(0.47 minutes) X (F_{SM}=70 people/min) = **33 people could be in the stairwell**.

Therefore, there would be **no queue** at the top of the stairs.

19 + 20 + 17 + 40 + 13 + 28 = 137 seconds

LAFCo Offices, the Grand Jury and the nearby Conference Rooms:

The maximum occupancy of these offices is 102 people. Their path of travel would be into the dead end corridor through four doorways, then south into the open-air walkway. From there, they’d travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 77 feet.

Time to reach the office door to the dead end corridor:
(77 feet) / (235 feet/min) = **20 seconds**

Time to pass through the four 36”-wide doors:
(102 people) / (192 people/min) = **32 seconds**

Time to reach the door to the second floor lobby:
(48 feet) / (235 feet/min) = **13 seconds**

Time to pass through the 36”-wide door:
(102 people) / (48 people/min) = **128 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:

(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 102 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell**.

With 102 people exiting, and 33 people in the stairwell, that leaves **69 people waiting in the queue** at the top of the stairs.

It would take the 69 people in the queue, at a maximum specific flow of 70 people/minute, 59 seconds to enter the top of the stairwell.

20 + 32 + 13 + 128 + 13 + 28 + 59 = <u>293 seconds</u>

<u>Office of Emergency Services and the Empire Room</u>:

The maximum occupancy of the OES offices is 6 people. If the Empire room is included, the total occupancy is 70 people. Their path of travel would be north into the east corridor through one doorway, then west into the open-air walkway. From there, they'd travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 75 feet.

Time to reach the office door to the east corridor:

(75 feet) / (235 feet/min) = **19 seconds**

Time to pass through the one 36"-wide door:

(70 people) / (48 people/min) = **87.5 seconds**

Time to travel in the east corridor and reach the door to the second floor lobby:

(15 feet) / (235 feet/min) = **4 seconds**

Time to pass through the one 36"-wide door into the second floor lobby:

(70 people) / (48 people/min) = **87.5 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:

(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 70 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell**.

With 70 people exiting, and 33 people in the stairwell, that leaves **37 people waiting in the queue** at the top of the stairs.

It would take the 37 people in the queue, at a maximum specific flow of 71 people/minute, 32 seconds to enter the top of the stairwell.

19 + 87.5 + 4 + 87.5 + 13 + 28 + 32 = <u>271 seconds</u>

<u>Tax Collector-Treasurer's Offices and Mountaineer Room</u>:

The maximum occupancy of the Tax Collector & Treasurer's offices is 21 people. If the Empire room is included, the total occupancy is 46 people. Their path of travel would be north into the east corridor through two doorways, then west into the open-air walkway. From there, they'd travel south to the main stairwell and out the front doors. The maximum distance traveled in the office is 66 feet.

Time to reach the office door to the east corridor:
(66 feet) / (235 feet/min) = **17 seconds**

Time to pass through the two 36"-wide doors:
(46 people) / (96 people/min) = **29 seconds**

Time to travel in the east corridor and reach the door to the second floor-lobby:
(50 feet) / (235 feet/min) = **13 seconds**

Time to pass through the one 36"-wide door into the second floor lobby:
(46 people) / (48 people/min) = **58 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:
(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 46 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell**.

With 46 people exiting, and 33 people in the stairwell, that leaves **13 people waiting in the queue** at the top of the stairs.

It would take the 13 people in the queue, at a maximum specific flow of 71 people/minute, 11 seconds to enter the top of the stairwell.

17 + 29 + 13 + 58 + 13 + 28 + 11 = <u>169 seconds</u>

<u>Sheriff's Office</u>:

The maximum occupancy of the Sheriff's offices is 101 people. They would have two paths of travel as the office space is so wide. The first would be south into the east corridor, then west into the second floor lobby. From there, they'd travel south to the main stairwell and out the front doors. The other option would be to head south into the east corridor, then east into the eastern stairwell. It is assumed that the number of people split between the exits.

<u>Exit via the Main Stairwell</u>:

Time to reach the office door to the east corridor:

(102 feet) / (235 feet/min) = **26 seconds**

Time to pass through the two 36"-wide doors:

(50.5 people) / (96 people/min) = **32 seconds**

Time to travel in the east corridor and reach the door to the second floor lobby:

(17 feet) / (235 feet/min) = **4 seconds**

Time to pass through the one 36"-wide door into the second floor lobby:

(50.5 people) / (48 people/min) = **64 seconds**

Time to travel south along the open-air walkway and reach the main stairwell:

(51 feet) / (235 feet/min) = **13 seconds**

Time to exit the main stairwell = **28 seconds**

It would take people 28 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 51 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.47 minutes) X (F_{SM}=70 people/min) = **33 people would be in the stairwell.**

With 51 people exiting, and 33 people in the stairwell, that leaves **18 people waiting in the queue** at the top of the stairs.

It would take the 18 people in the queue, at a maximum specific flow of 71 people/minute, 15 seconds to enter the top of the stairwell.

26 + 32 + 4 + 64 + 13 + 28 + 15 = 182 seconds

Exit via the East Stairwell:

Time to reach the office door to the east corridor:
(102 feet) / (235 feet/min) = **26 seconds**

Time to pass through the one 36"-wide door into the east corridor:
(50.5 people) / (48 people/min) = **64 seconds**

Time to travel in the east corridor and reach the door to the eastern stairwell:
(5 feet) / (235 feet/min) = **1 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 50 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42 minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell.**

With 50 people exiting, and 20 people in the stairwell, that leaves **30 people waiting in the queue** at the top of the stairs.

It would take the 30 people in the queue, at a maximum specific flow of 48 people/minute, 37.5 seconds to enter the top of the stairwell.

26 + 64 + 1 + 25.3 + 37.5 = ~154 seconds

<u>Assessor's Offices</u>:
The maximum occupancy of the Assessor's offices is 37 people. Their path of travel would be north into the east corridor through two doorways, then east into the eastern stairwell. The maximum distance traveled in the office is 63 feet.

Time to reach the office door to the east corridor:

(63 feet) / (235 feet/min) = **16 seconds**

Time to pass through the one 36"-wide door into the east corridor:

(63 people) / (96 people/min) = **39 seconds**

Time to travel in the east corridor and reach the door to the eastern stairwell:

(9 feet) / (235 feet/min) = **2 seconds**

Time to exit the west stairwell = **25.3 seconds**

It would take people 25.3 seconds to travel down the stairs between floors and exit. Assuming everyone in the office was trying to leave at one time, and 63 people can't fit in a single floor's stairwell, a backup or queue would start at the entrance doorway to the stairway. That queue would be the total number of people traveling into that exit, minus how many people are already in the stairwell. So in the time it takes people to get to the bottom of the stairway and exit:

(0.42 minutes) X (F_{SM}=46.25 people/min) = **20 people would be in the stairwell**.

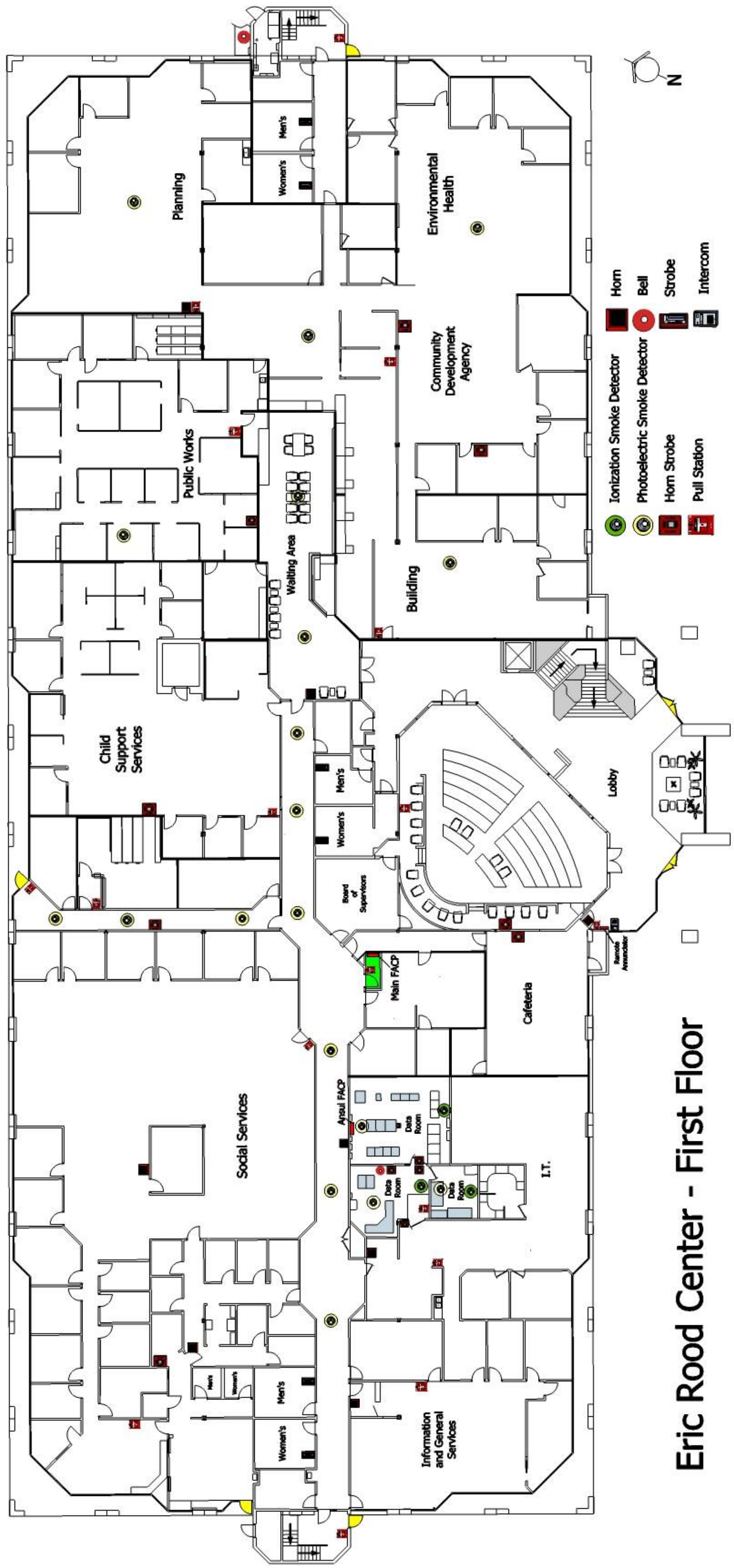
With 63 people exiting, and 20 people in the stairwell, that leaves **43 people waiting in the queue** at the top of the stairs.

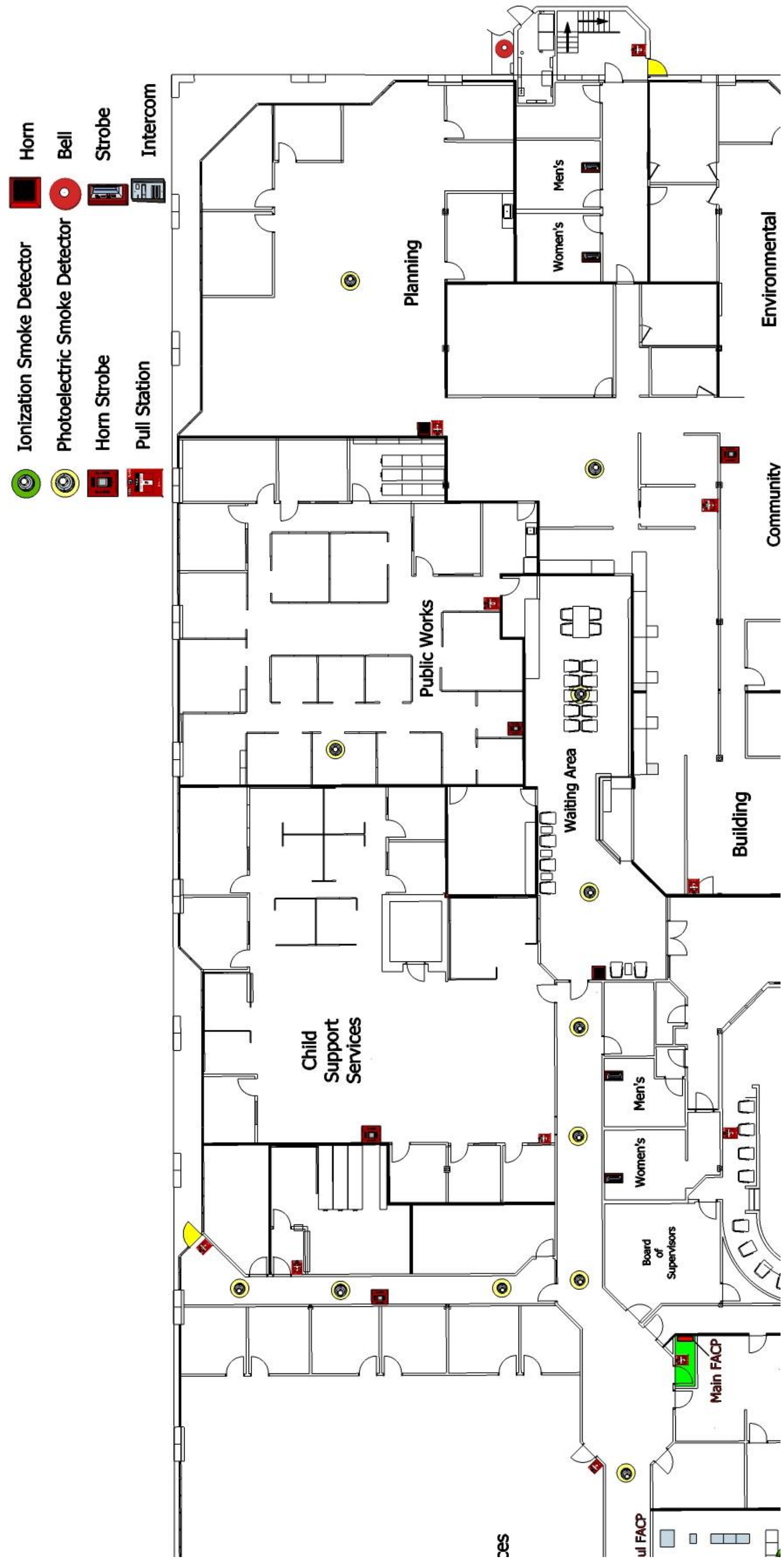
It would take the 43 people in the queue, at a maximum specific flow of 48 people/minute, 54 seconds to enter the top of the stairwell.

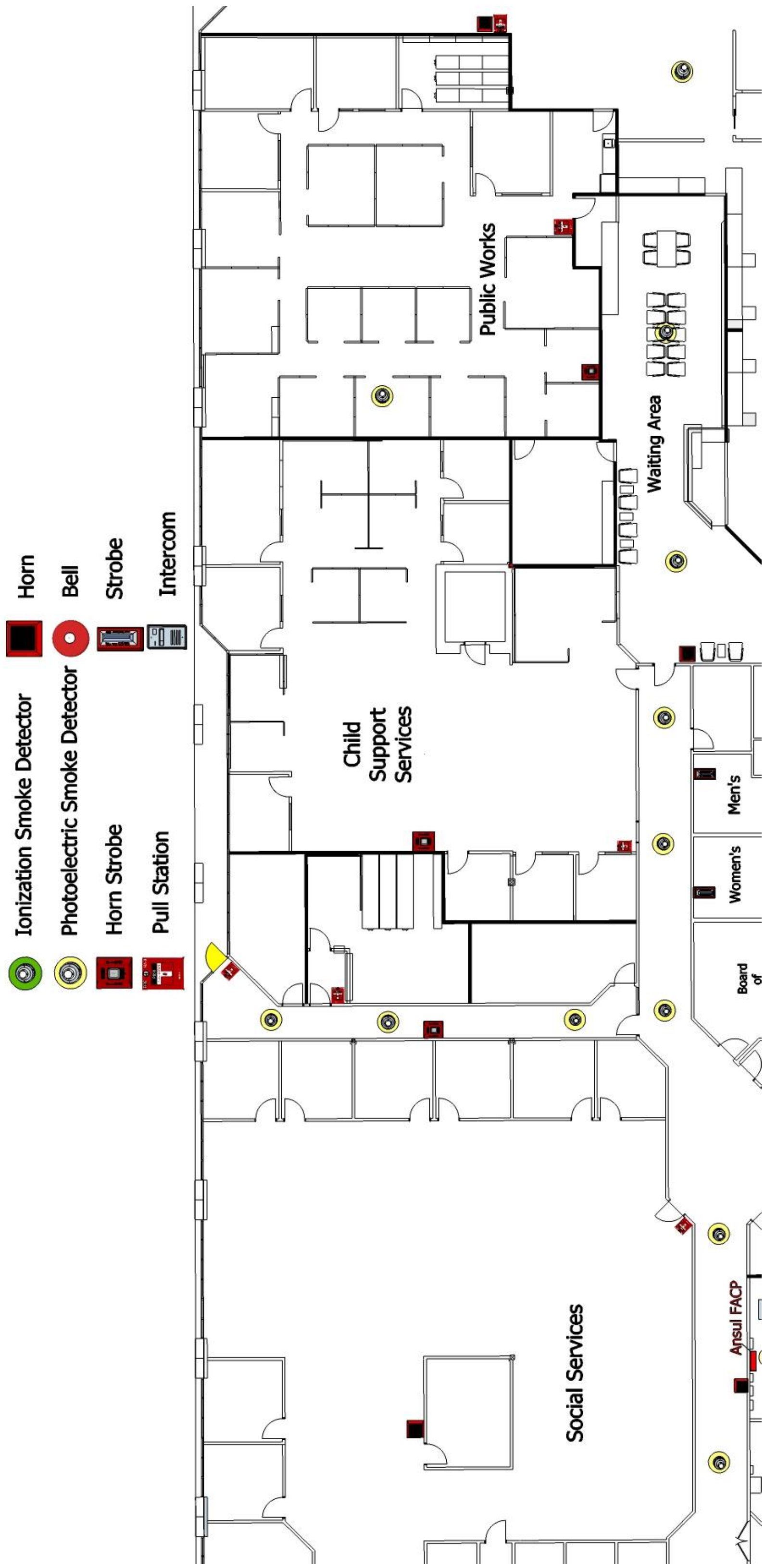
16 + 39 + 2 + 25.3 + 54 = ~<u>137 seconds</u>

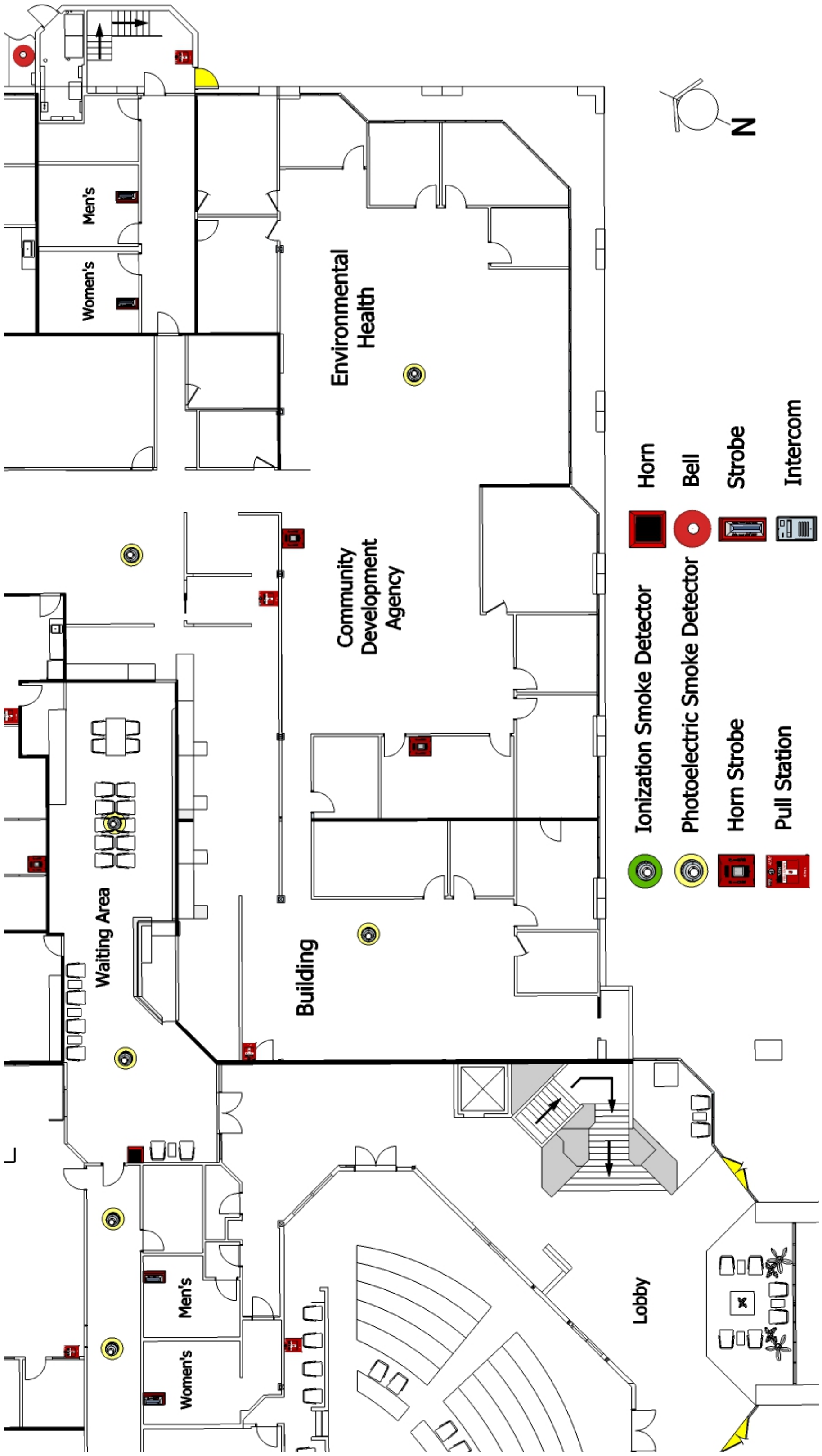
APPENDIX D

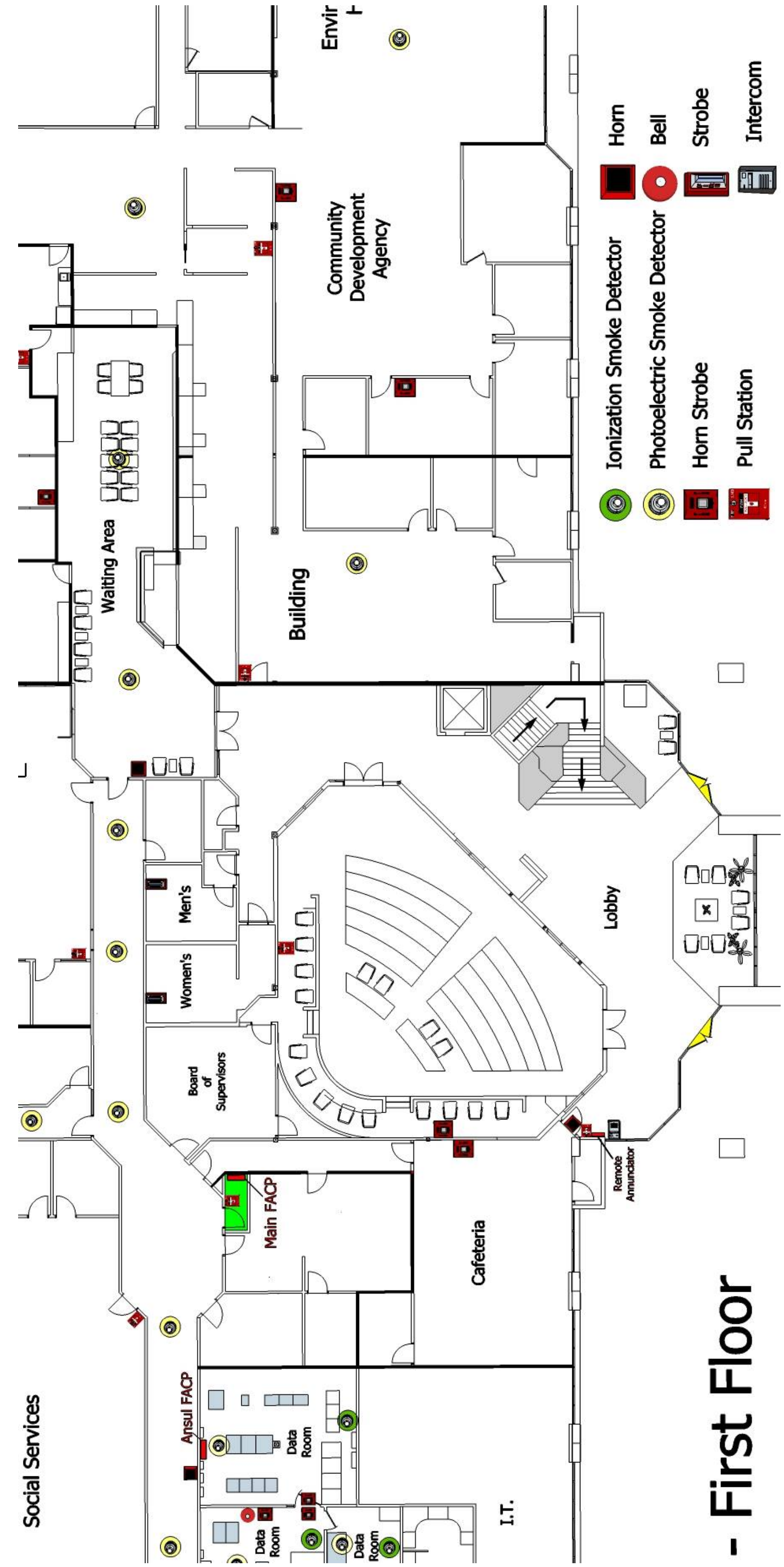
Fire Alarm System Layouts

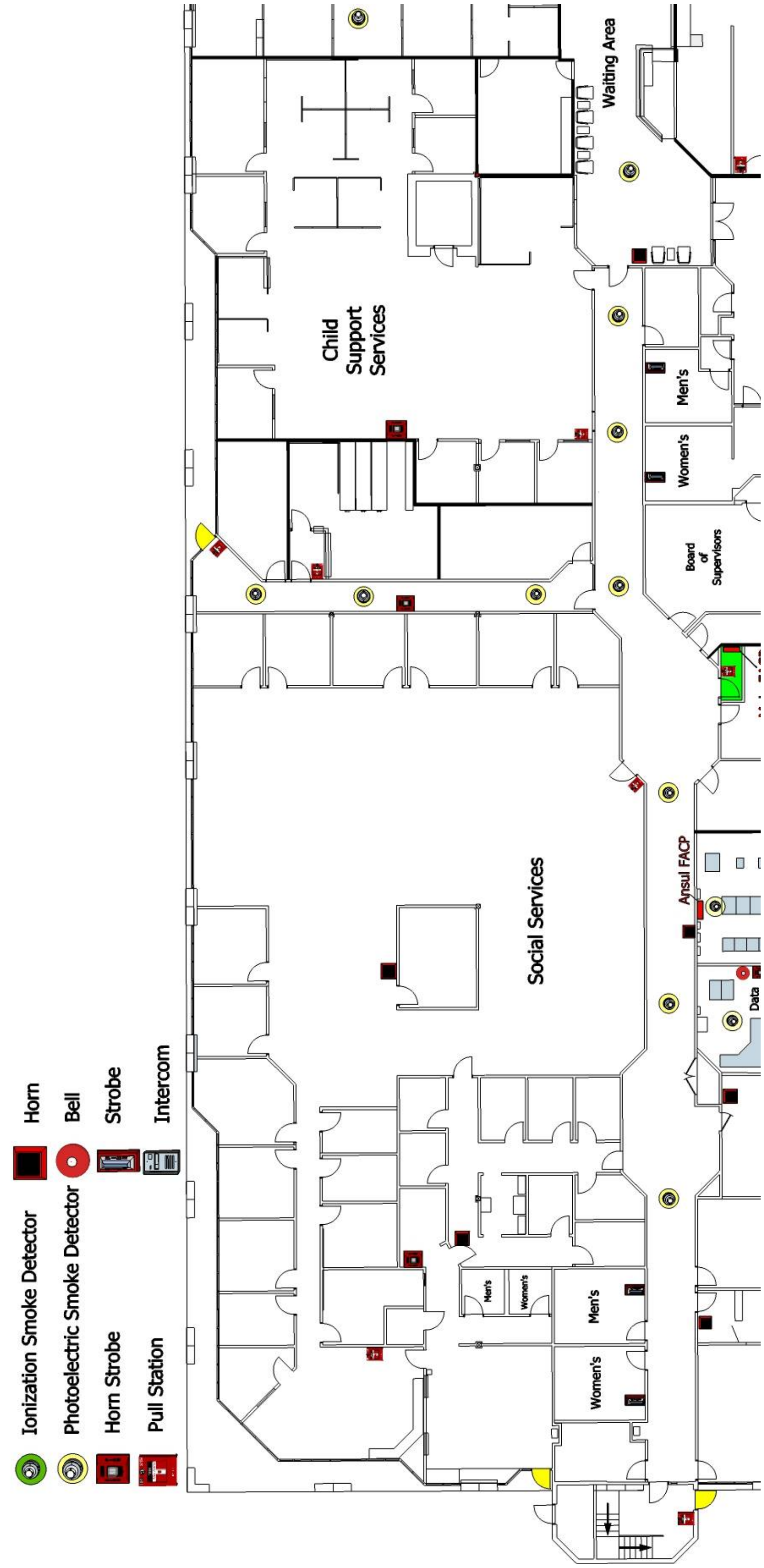

Planning
Men's
Women's
Environmental Health
Community Development Agency
Public Works
Waiting Area
Building
Child Support Services
Lobby
Men's
Women's
Board of Supervisors
Main FACP
Cafeteria
Remote Annunciator
Social Services
Ansul FACP
Data Room
Data Room
Data Room
I.T.
Men's
Women's
Men's
Women's
Information and General Services
N
Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom
Eric Rood Center - First Floor

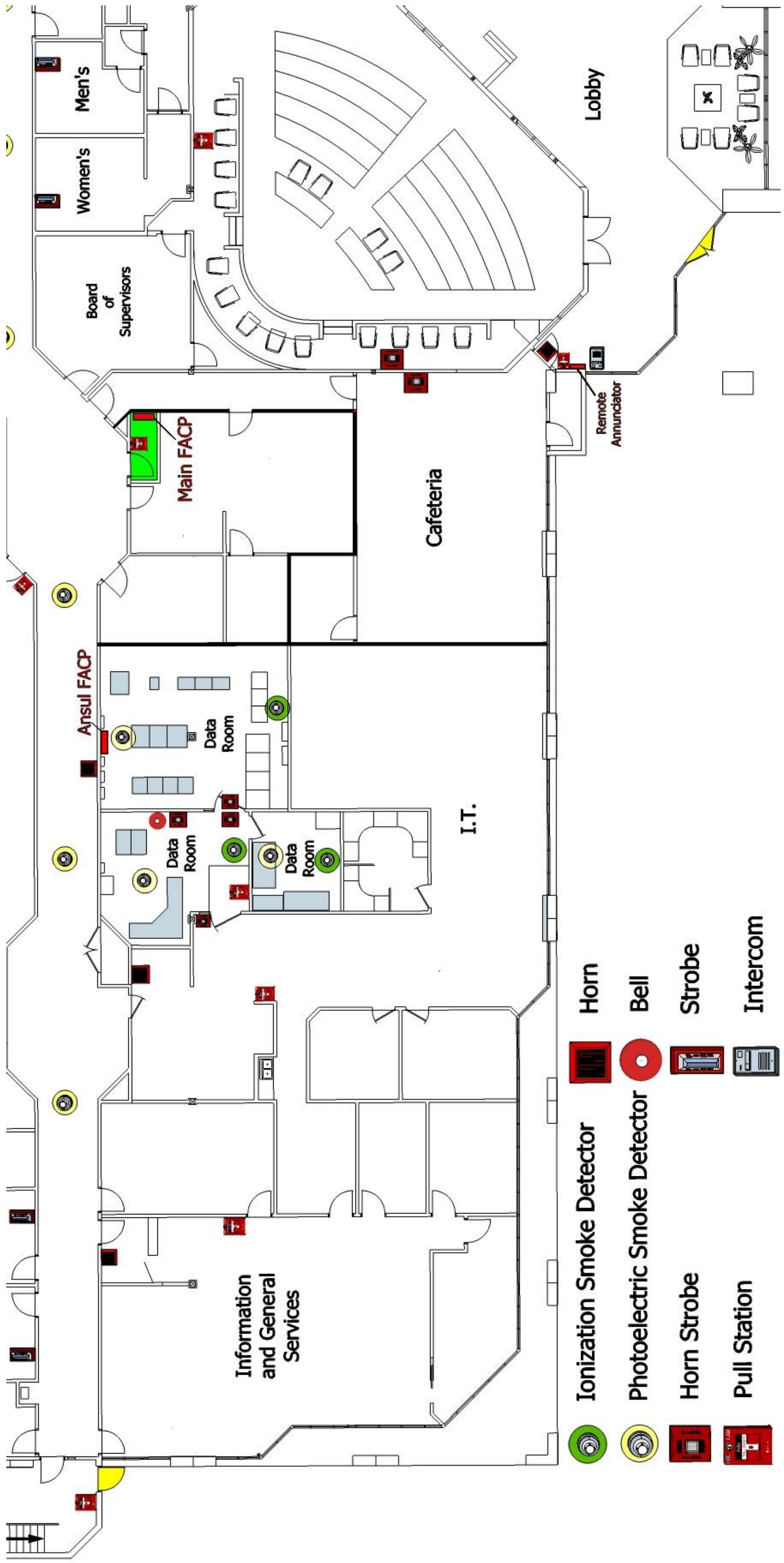

Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom
Planning
Men's
Women's
Environmental
Community
Public Works
Waiting Area
Building
Child Support Services
Men's
Women's
Board of Supervisors
Main FACP


Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom
Public Works
Waiting Area
Child Support Services
Men's
Women's
Board of
Social Services
Ansul FACP

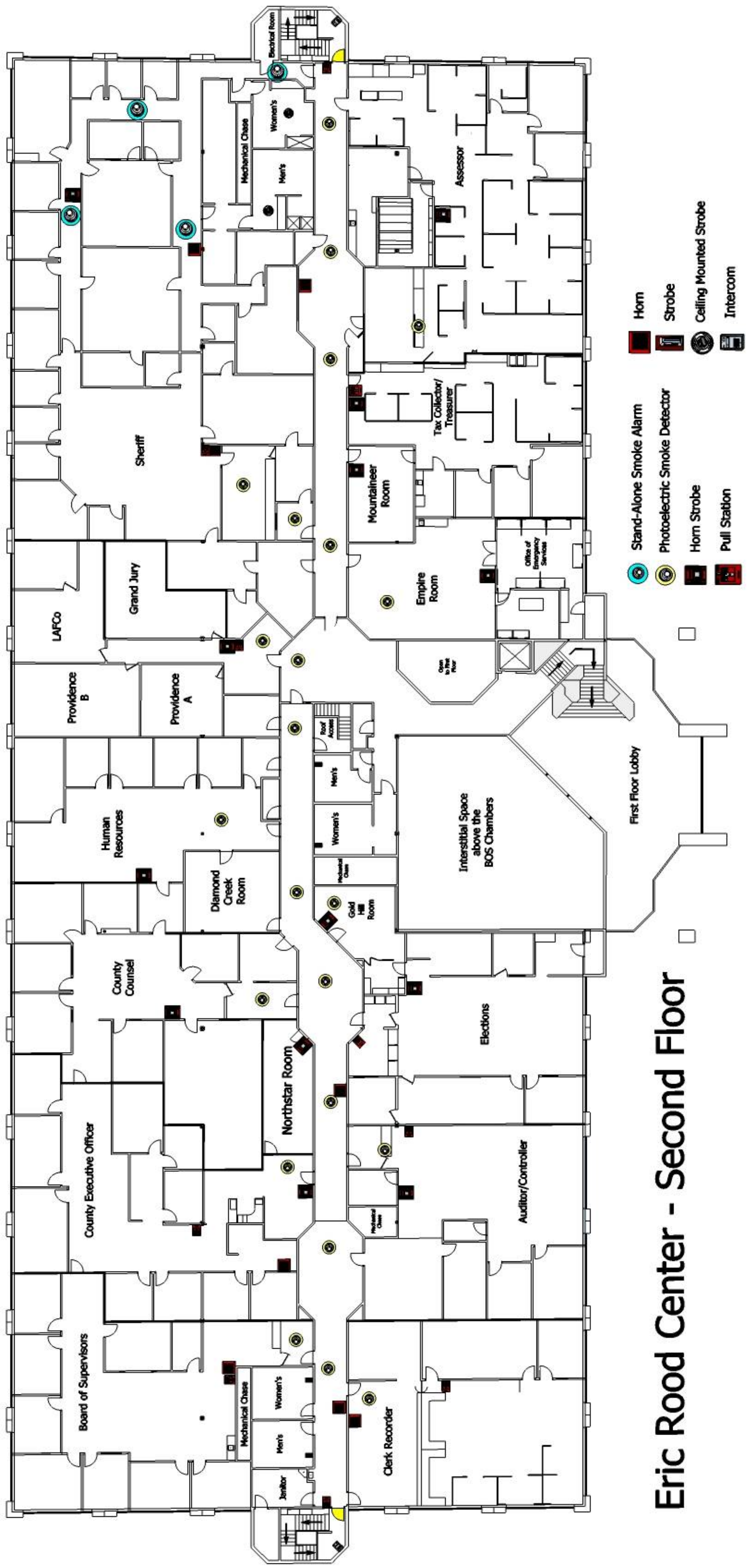

Men's
Women's
Environmental Health
Community Development Agency
Waiting Area
Building
Lobby
N
Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom

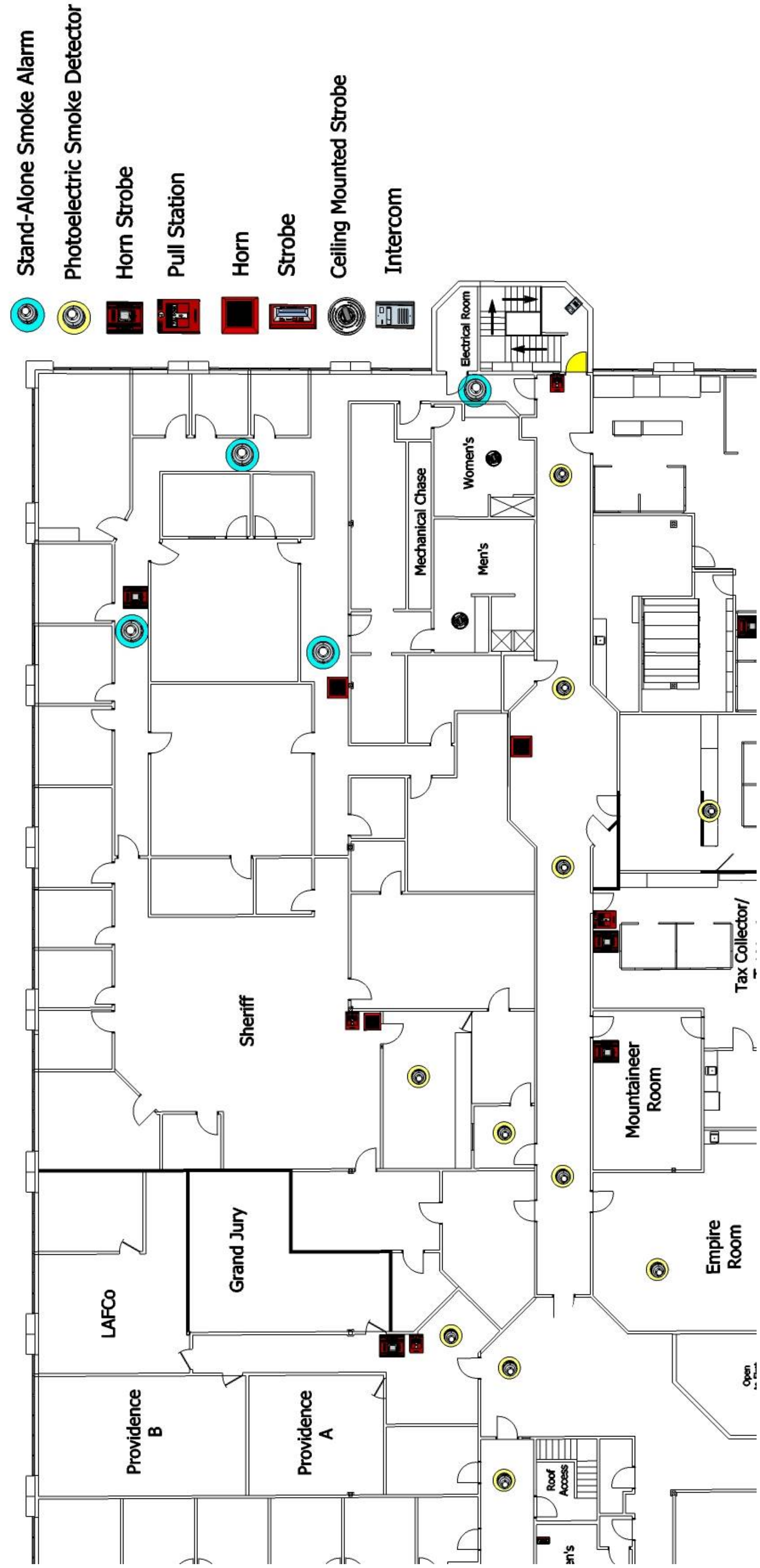

Community Development Agency
Waiting Area
Building
Lobby
Men's
Women's
Board of Supervisors
Main FACP
Cafeteria
Remote Annunciator
Social Services
Ansul FACP
Data Room
Data Room
Data Room
I.T.
- First Floor
Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom

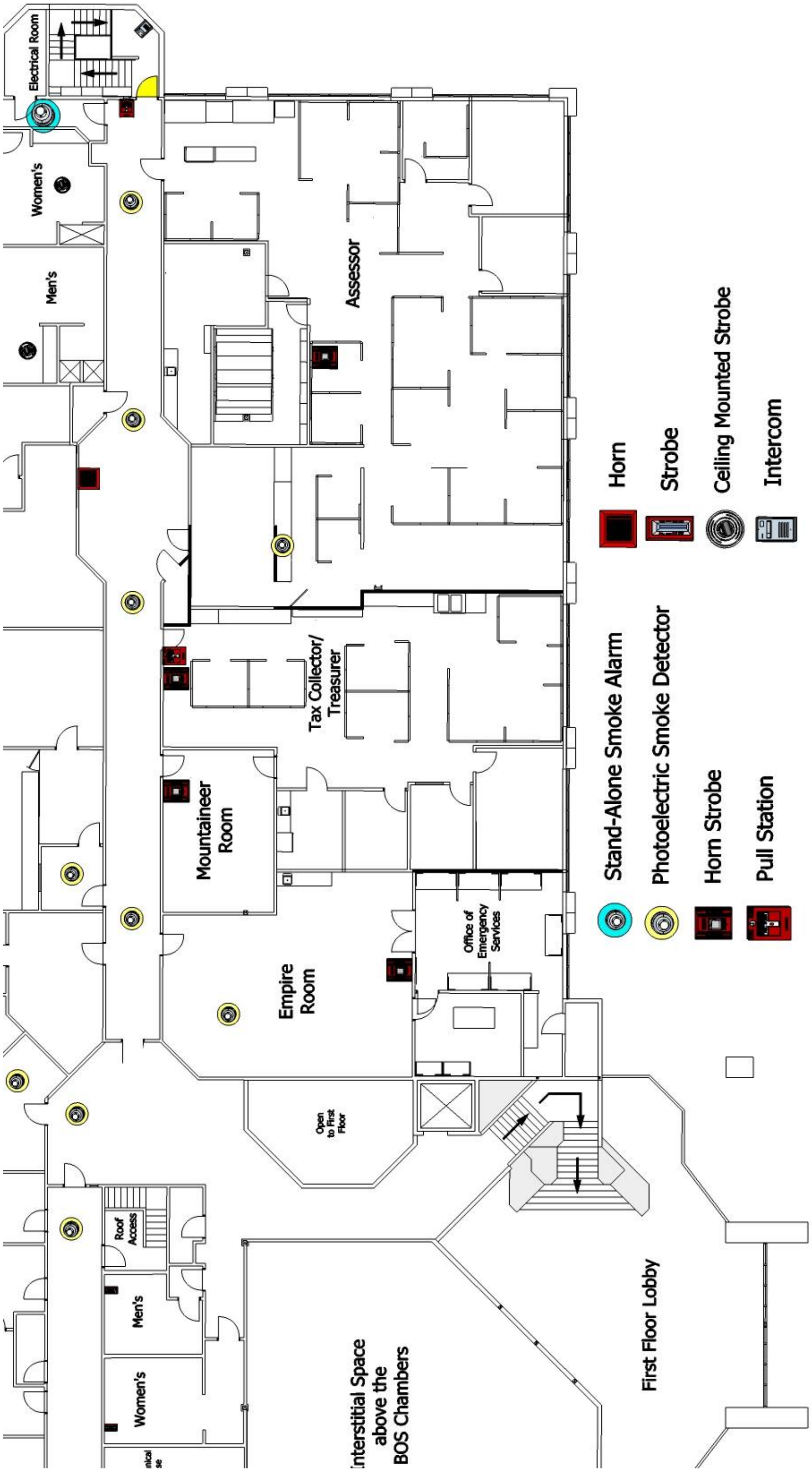

Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom
Waiting Area
Child Support Services
Men's
Women's
Board of Supervisors
Social Services
Ansul FACP
Data

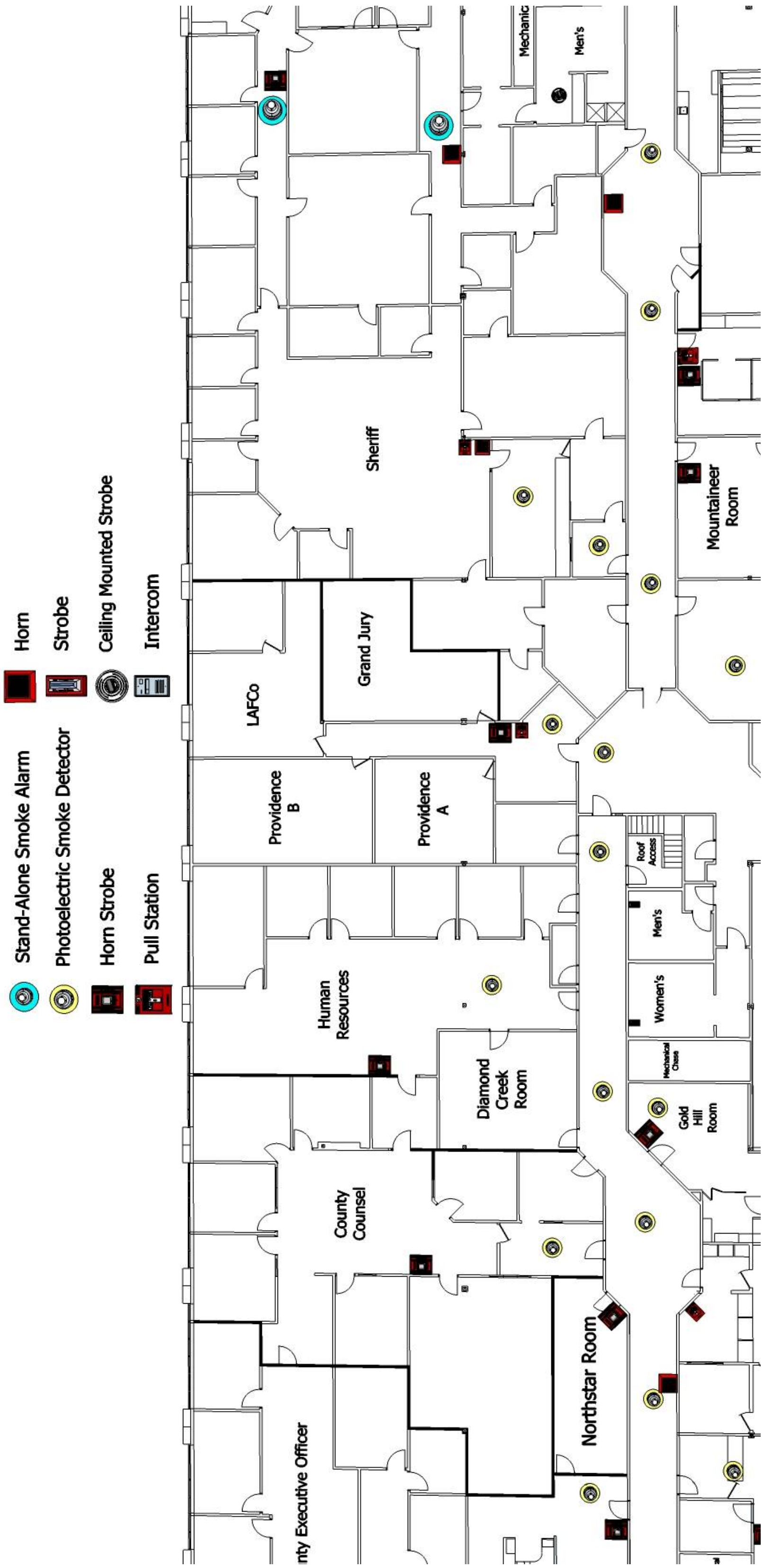


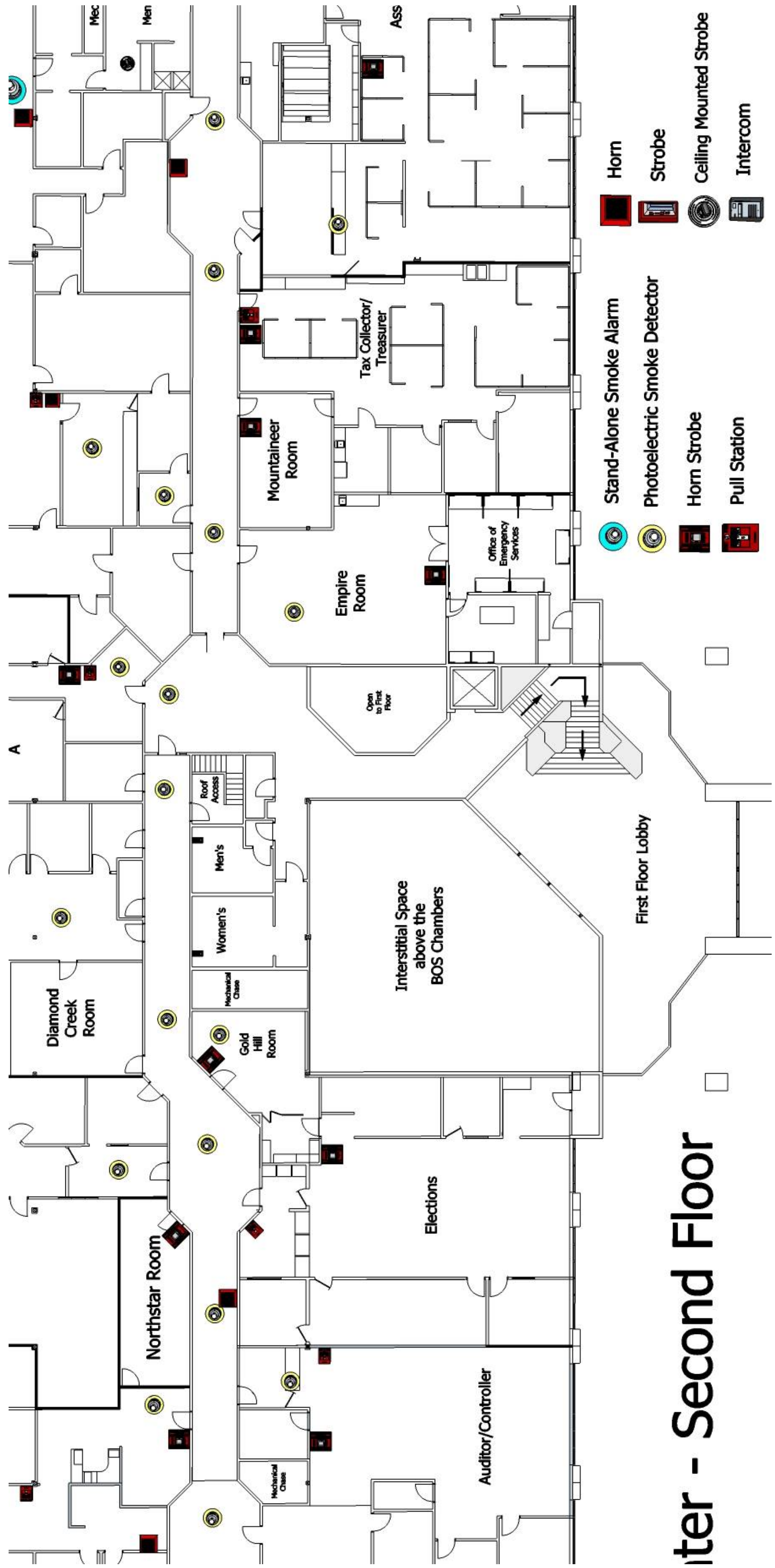
Men's
Women's
Board of Supervisors
Lobby
Remote Annunciator
Main FACP
Cafeteria
Ansul FACP
Data Room
Data Room
Data Room
I.T.
Information and General Services
Ionization Smoke Detector
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Bell
Strobe
Intercom


Eric Rood Center - Second Floor
Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Strobe
Ceiling Mounted Strobe
Intercom
Electrical Room
Women's
Men's
Mechanical Chase
Assessor
Sheriff
Tax Collector/ Treasurer
Mountaineer Room
Empire Room
Office of Emergency Services
Grand Jury
LAFCo
Providence B
Providence A
Roof Access
Men's
Women's
Interstitial Space above the BOS Chambers
First Floor Lobby
Human Resources
Diamond Creek Room
Gold Hill Room
County Counsel
Elections
Northstar Room
County Executive Officer
Auditor/Controller
Board of Supervisors
Mechanical Chase
Women's
Men's
Janitor
Clerk Recorder

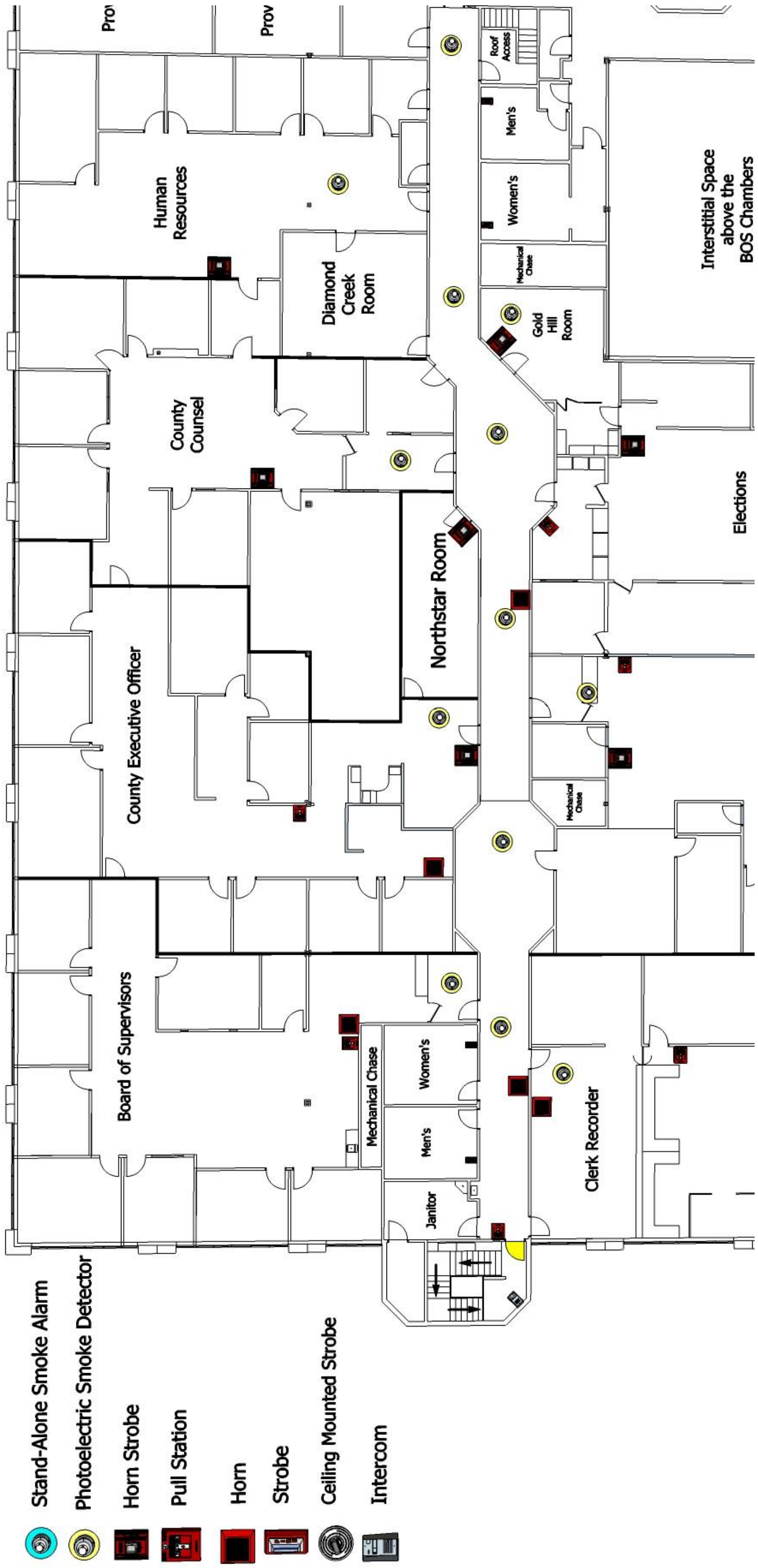

Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Strobe
Ceiling Mounted Strobe
Intercom
Electrical Room
Women's
Mechanical Chase
Men's
Sheriff
Tax Collector/
Mountaineer Room
Empire Room
Grand Jury
LAFCo
Providence B
Providence A
Roof Access

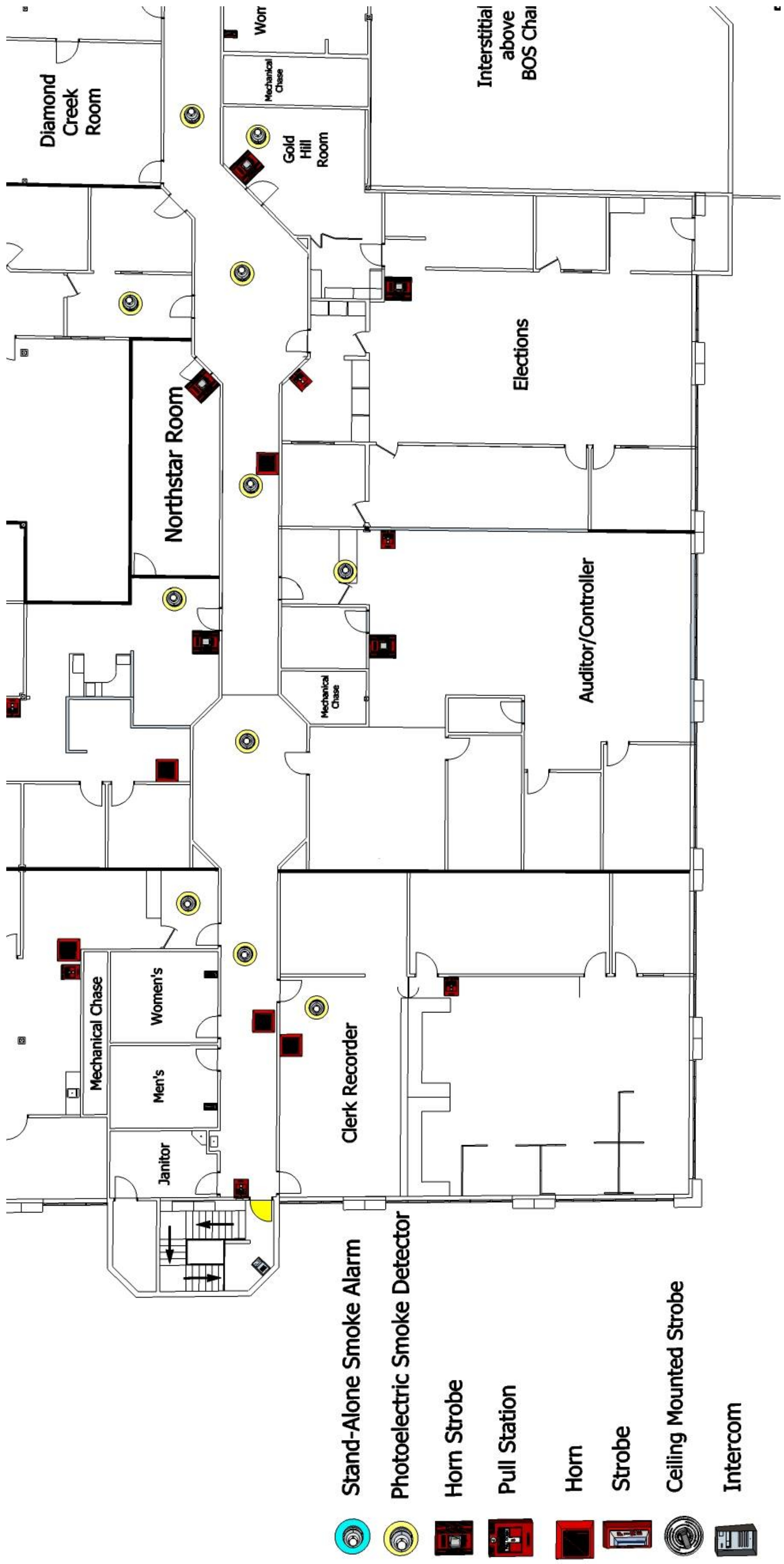

Electrical Room
Women's
Men's
Assessor
Tax Collector/ Treasurer
Mountaineer Room
Empire Room
Office of Emergency Services
Open to First Floor
Roof Access
Men's
Women's
Interstitial Space above the BOS Chambers
First Floor Lobby
Horn
Strobe
Ceiling Mounted Strobe
Intercom
Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station


Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Strobe
Ceiling Mounted Strobe
Intercom
Sheriff
Men's
Mountaineer Room
Grand Jury
LAFCo
Providence B
Providence A
Roof Access
Men's
Women's
Human Resources
Diamond Creek Room
Gold Hill Room
County Counsel
Northstar Room



Horn
Strobe
Ceiling Mounted Strobe
Intercom
Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Tax Collector/ Treasurer
Mountaineer Room
Empire Room
Office of Emergency Services
Open to First Floor
Roof Access
Men's
Women's
Mechanical Chase
Gold Hill Room
Interstitial Space above the BOS Chambers
First Floor Lobby
Diamond Creek Room
Northstar Room
Elections
Auditor/Controller
ter - Second Floor


Roof Access
Men's
Women's
Mechanical Chase
Interstitial Space above the BOS Chambers
Human Resources
Diamond Creek Room
Gold Hill Room
County Counsel
Elections
Northstar Room
County Executive Officer
Board of Supervisors
Mechanical Chase
Women's
Men's
Janitor
Clerk Recorder
Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Strobe
Ceiling Mounted Strobe
Intercom



Diamond Creek Room
Mechanical Chase
Gold Hill Room
Interstitial above BOS Cha
Elections
Northstar Room
Auditor/Controller
Mechanical Chase
Mechanical Chase
Women's
Men's
Janitor
Clerk Recorder
Stand-Alone Smoke Alarm
Photoelectric Smoke Detector
Horn Strobe
Pull Station
Horn
Strobe
Ceiling Mounted Strobe
Intercom

APPENDIX E

Secondary Alarm System Install Documents

COUNTY OF NEVADA
AREA-1, 2, 3 AND UNDERFLOOR

950 MAIDU AVENUE, NEVADA CITY, CA. 95959

FIRE ALARM/ INTERGEN RELEASING SYSTEM

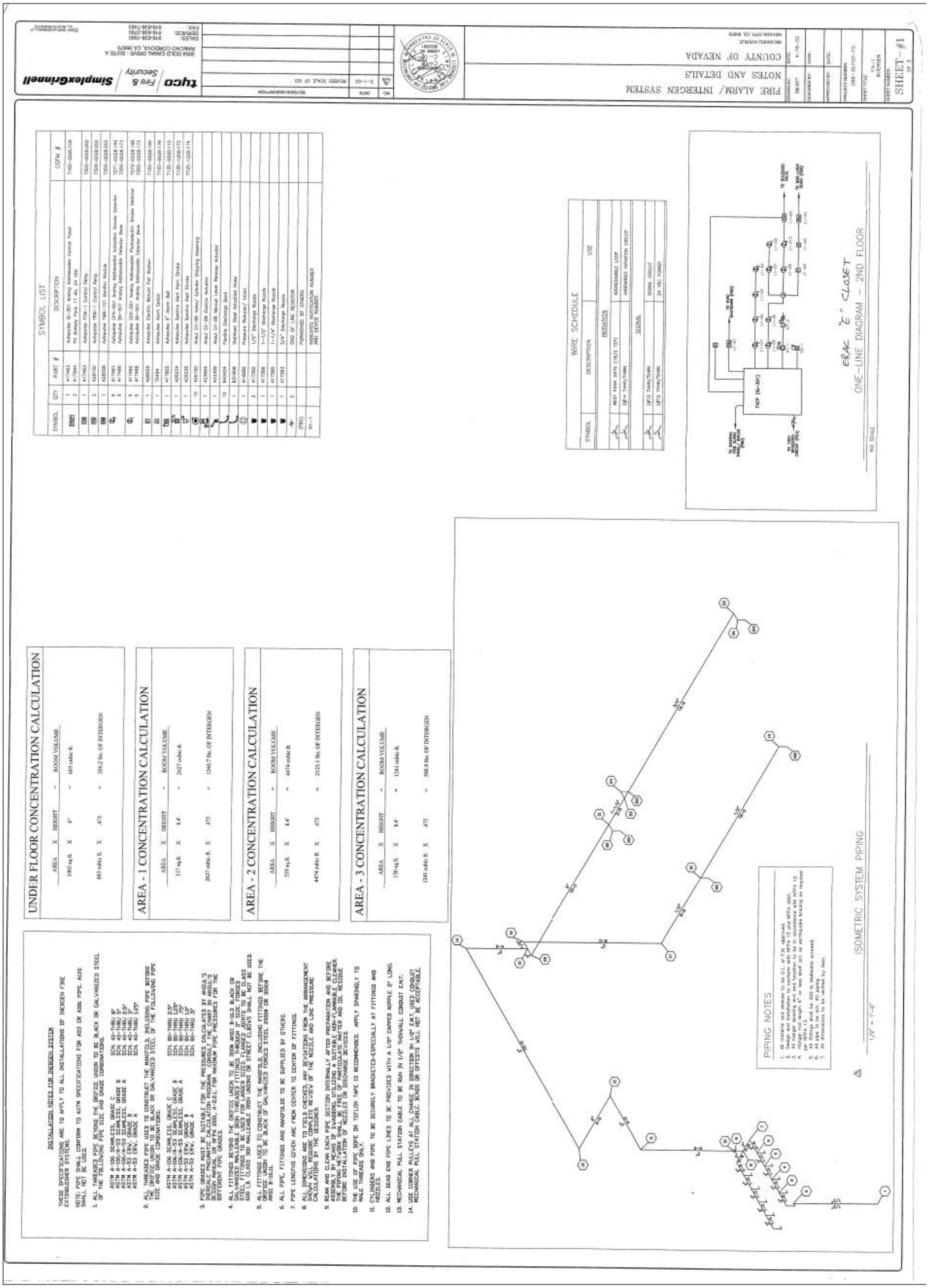
tyco / Fire & Security / SimplexGrinnell

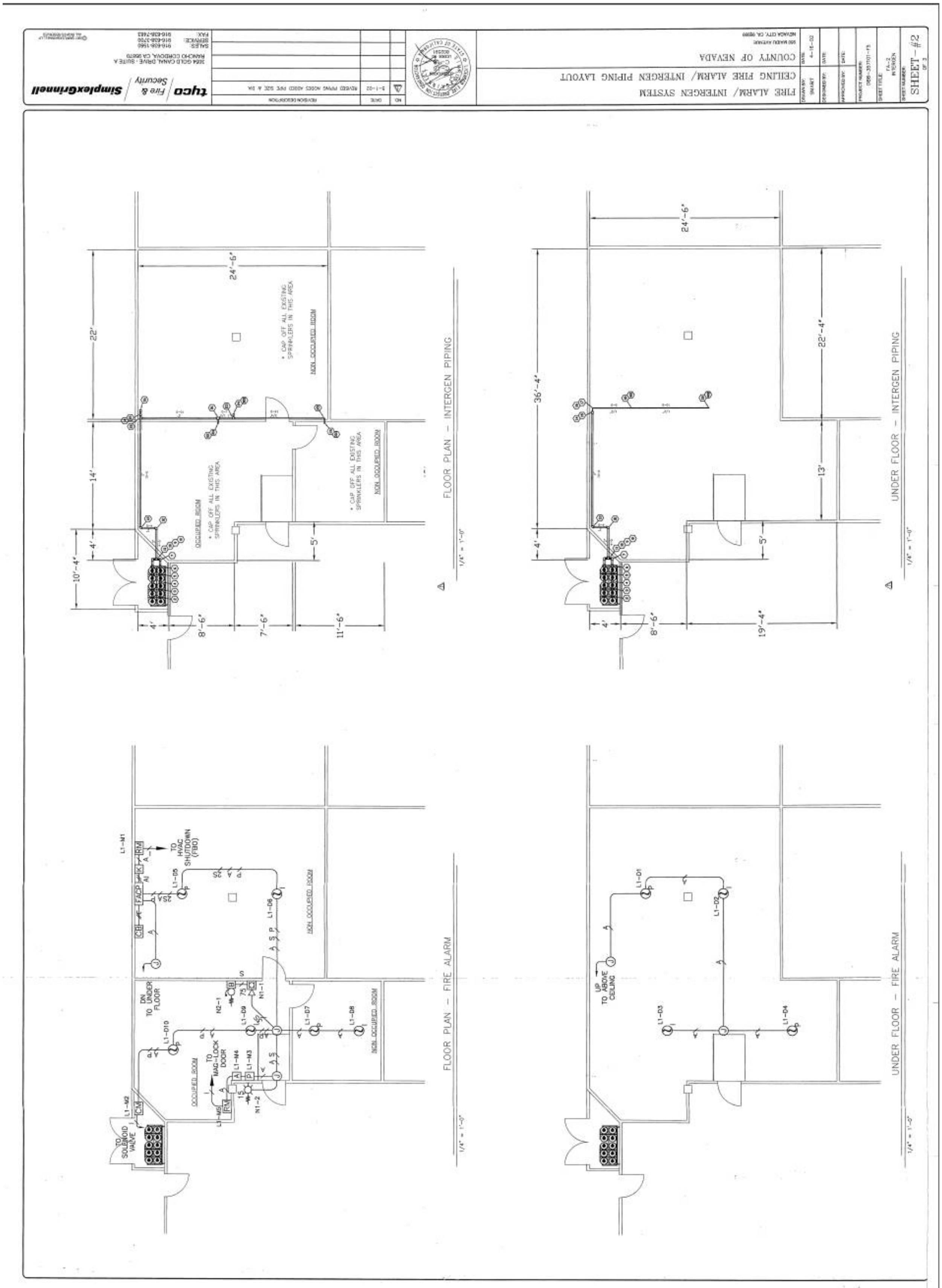
APPROVED AS SUBMITTED.
NOTES: CALL 24 HOURS PRIOR TO FIELD INSPECTION/TESTING.
D. Roy 4th FD
5/21/02

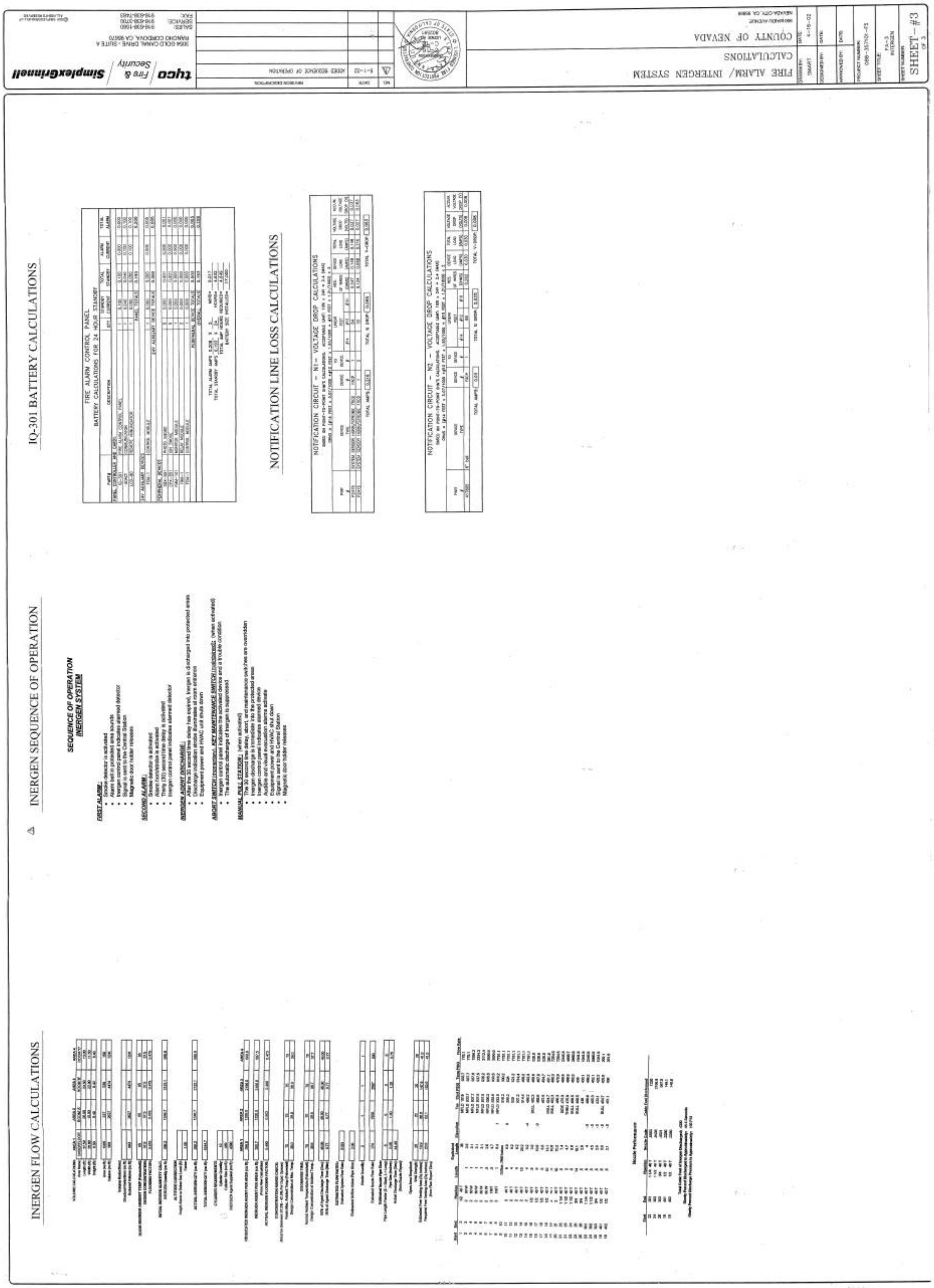
ENGINEERING CHANGES - 5-1-02

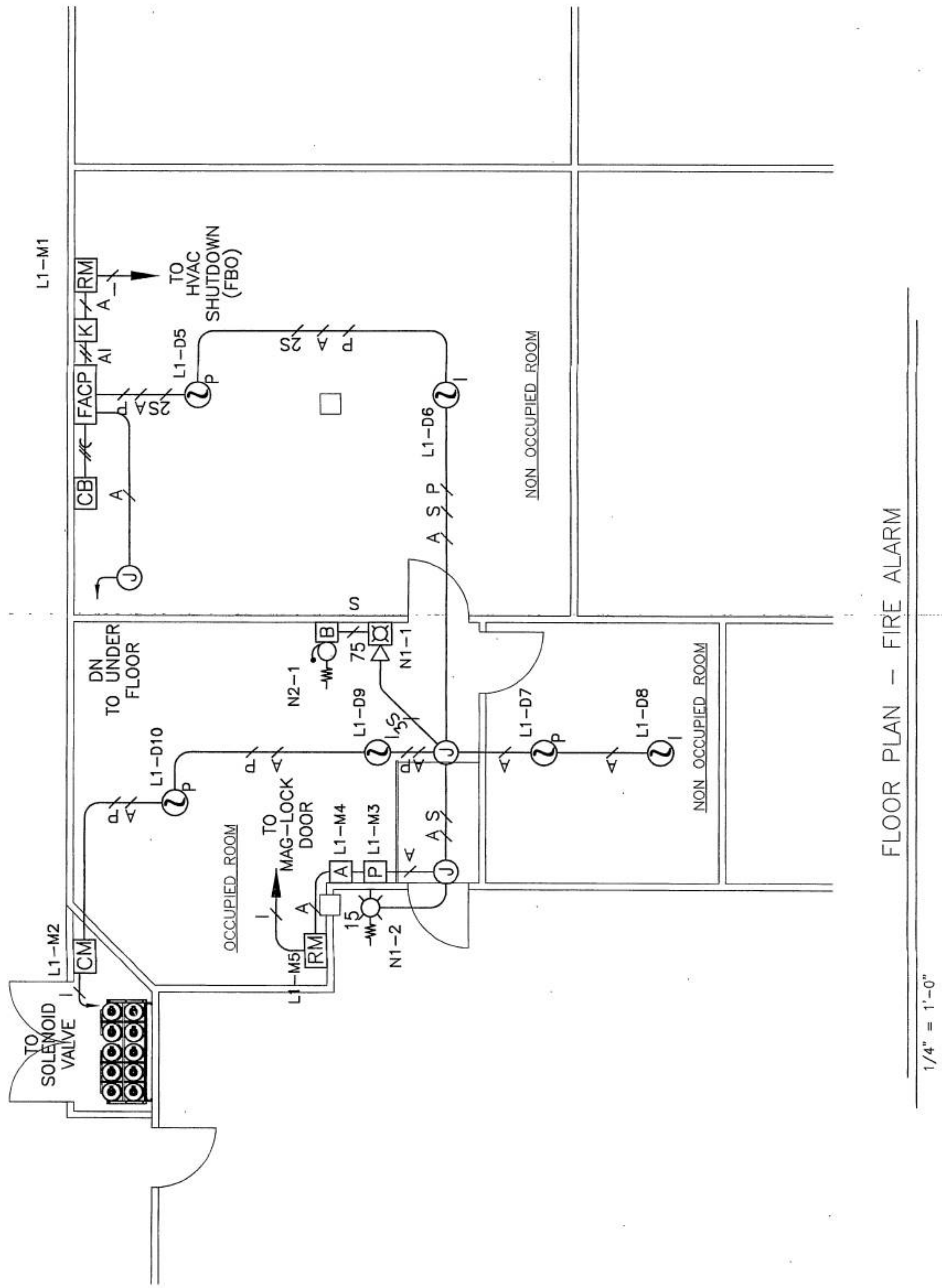
INTERGEN FIRE SUPPRESSION SYSTEM 5/21/02

COUNTY OF NEVADA
950 MAIDU AVENUE, NEVADA CITY, CA. 95959
FIRE ALARM/INTERGEN RELEASING SYSTEM

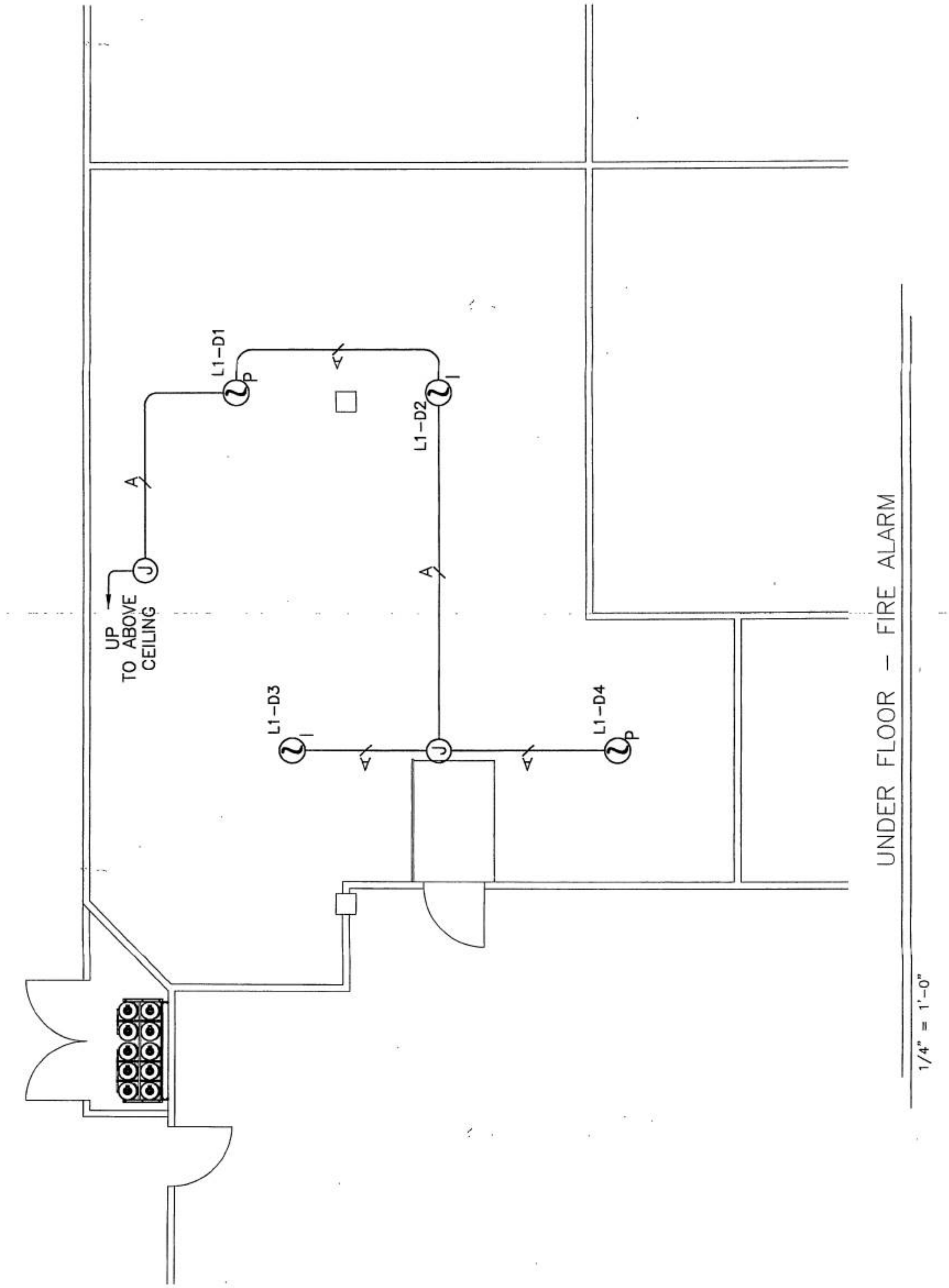



FIRE ALARM/ INTERGEN SYSTEM
CEILING FIRE ALARM/ INTERGEN PIPING LAYOUT
COUNTY OF NEVADA
SHEET - #2
FLOOR PLAN - INTERGEN PIPING
UNDER FLOOR - INTERGEN PIPING
FLOOR PLAN - FIRE ALARM
UNDER FLOOR - FIRE ALARM
NON OCCUPIED ROOM
OCCUPIED ROOM
* CAP OFF ALL EXISTING SPRINKLERS IN THIS AREA
1/4" = 1'-0"


IQ-301 BATTERY CALCULATIONS
NOTIFICATION LINE LOSS CALCULATIONS
INERGEN SEQUENCE OF OPERATION
INERGEN FLOW CALCULATIONS
FIRE ALARM/ INERGEN SYSTEM
CALCULATIONS
COUNTY OF NEVADA
SHEET #3
tyco Fire & Security
SimplexGrinnell



Close-Up – Floor Plan (Above the Floor)



Close-Up – Floor Plan (Below the Floor)

SYMBOL LIST

SYMBOL	QTY	PART #	DESCRIPTION	CSFM #
FACP	1 2	417463 417694	Autopulse IQ-301 Analog Addressable Control Panel PS Battery Pack 17 AH, 24 VDC	7165-0595:109
CM	1	417463	Autopulse FCM-1 Control Relay	7300-0028:202
RM	2	428102	Autopulse FRM-1 Control Relay	7300-0028:202
MM	1	428098	Autopulse FMM-101 Monitor Module	7300-0028:202
	5 5	417481 417486	Autopulse CPX-551 Analog Addressable Ionization Smoke Detector Autopulse BX-501 Analog Addressable Detector Base	7271-0028:149 7300-0028:173
	5 5	417482 417486	Autopulse SDX-551 Analog Addressable Photoelectric Smoke Detector Autopulse BX-501 Analog Addressable Detector Base	7272-0028:148 7300-0028:173
P	1	428655	Autopulse Electric Manual Pull Station	7150-0028:199
A	1	76494	Autopulse Abort Switch	7165-0026:178
B	1	417805	Autopulse 6" Alarm Bell	7135-0595:110
75	1	426234	Autopulse Spectra Alert Horn Strobe	7135-1209:173
15	1	426236	Autopulse Spectra Alert Strobe	7125-1209:174
	10	426150	Ansul CV-98 Valve/ Cylinder Shipping Assembly	
	1	423684	Ansul CV-98 Electric Actuator	
	1	423309	Ansul CV-98 Manual Lever Release Actuator	
	10	842424	Flexible Discharge Bend	
	1	831809	Stainless Steel Actuation Hose	
	1	416682	Pressure Reducer/ Union	
	2	417362	1/2" Discharge Nozzle	
	1	417366	1-1/2" Discharge Nozzle	
	1	417365	1-1/4" Discharge Nozzle	
	1	417363	3/4" Discharge Nozzle	
	2		END OF LINE RESISTOR	
(FBO)			FURNISHED BY OTHERS	
N1-1			INDICATES NOTIFICATION NUMBER AND DEVICE NUMBER	

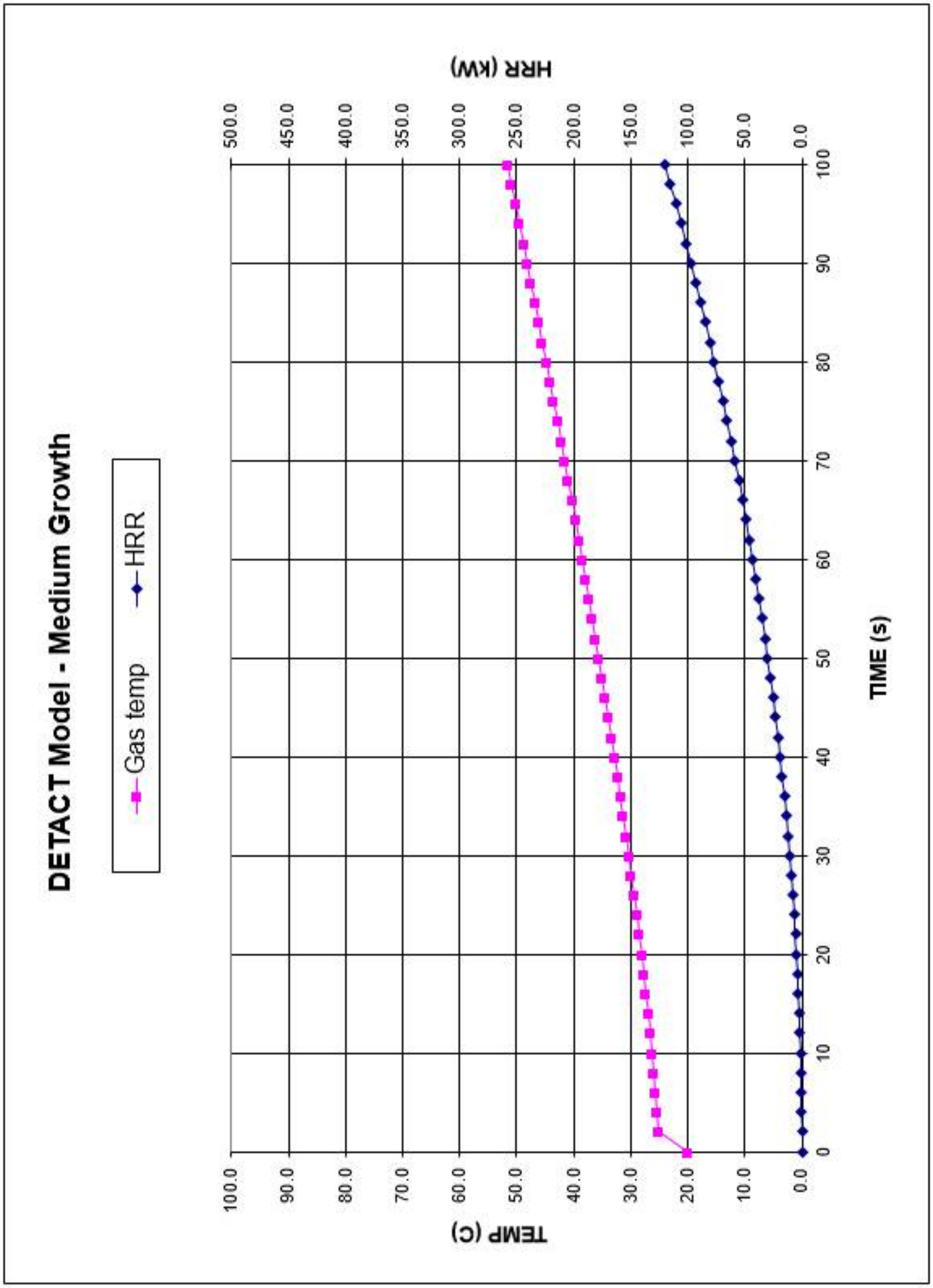
APPENDIX F

DETACT Model Calculations

Medium Growth

INPUT PARAMETERS			CALCULATED PARAMETERS	
Height above fire (H)	1.68	m	R/H	2.72
Radial distance (R)	4.57	m	dT(cj)/dT(pl)	0.15
Ambient temperature (To)	25	C	u(cj)/u(pl)	0.09
Actuation temperature (Td)	32.2	C	Rep. t2 coeff.	k
Response time index (RTI)	2	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (α)	0.012	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

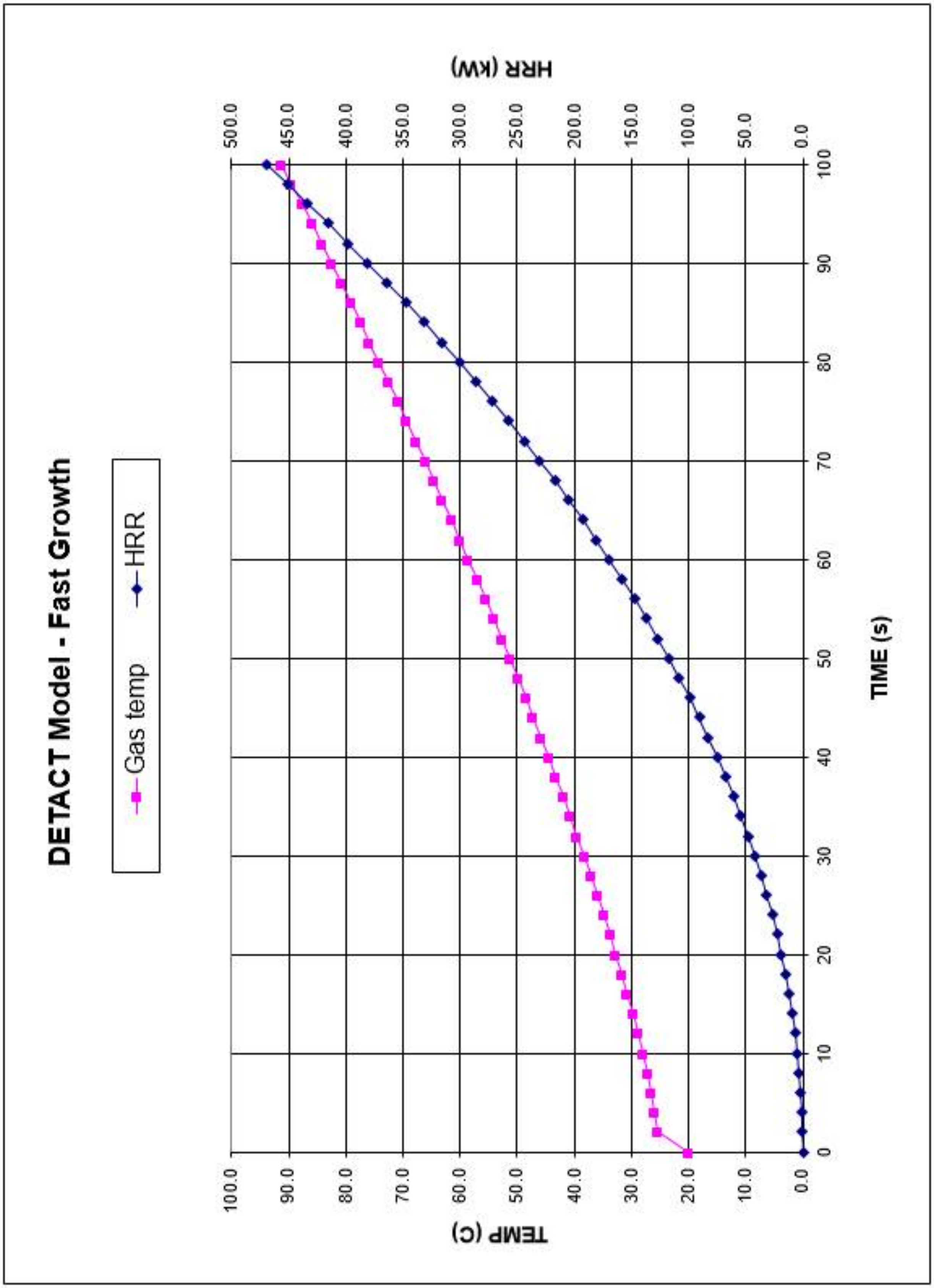
Calculation time (s)	HRR	Gas temp	Gas velocity	Det temp	dT/dt
0	0.0	20.0	0.00	20.00	0.00
2	0.0	25.1	0.03	20.00	0.42
4	0.2	25.4	0.04	20.84	0.46
6	0.4	25.6	0.06	21.77	0.45
8	0.8	25.9	0.07	22.67	0.42
10	1.2	26.2	0.08	23.51	0.38
12	1.7	26.6	0.09	24.27	0.34
14	2.4	26.9	0.10	24.96	0.31
16	3.1	27.3	0.11	25.57	0.28
18	3.9	27.7	0.11	26.14	0.27
20	4.8	28.1	0.12	26.67	0.25
22	5.8	28.5	0.13	27.18	0.25
24	6.9	29.0	0.14	27.67	0.24
26	8.1	29.4	0.15	28.16	0.24
28	9.4	29.9	0.15	28.64	0.24
30	10.8	30.4	0.16	29.13	0.25
32	12.3	30.8	0.17	29.62	0.25
34	13.9	31.3	0.18	30.12	0.25
36	15.6	31.8	0.18	30.63	0.26
38	17.3	32.3	0.19	31.14	0.26
40	19.2	32.9	0.20	31.66	0.26


DETACT Model - Medium Growth
Gas temp
HRR
TIME (s)
TEMP (C)
HRR (kW)

<u>Fast Growth</u>

INPUT PARAMETERS			CALCULATED PARAMETERS	
Height above fire (H)	1.68	m	R/H	2.72
Radial distance (R)	4.57	m	dT(cj)/dT(pl)	0.15
Ambient temperature (To)	25	C	u(cj)/u(pl)	0.09
Actuation temperature (Td)	32.2	C	Rep. t2 coeff.	k
Response time index (RTI)	2	(m-s)1/2	Slow	0.003
Fire growth power (n)	2	-	Medium	0.012
Fire growth coefficient (α)	0.047	kW/s^n	Fast	0.047
Time step (dt)	2	s	Ultrafast	0.400

Calculation time (s)	HRR	Gas temp	Gas velocity	Det temp	dT/dt
0	0.0	20.0	0.00	20.00	0.00
2	0.2	25.4	0.04	20.00	0.55
4	0.8	25.9	0.07	21.10	0.62
6	1.7	26.6	0.09	22.34	0.62
8	3.0	27.3	0.11	23.58	0.60
10	4.7	28.1	0.12	24.78	0.58
12	6.8	28.9	0.14	25.94	0.56
14	9.2	29.8	0.15	27.05	0.54
16	12.0	30.8	0.17	28.13	0.54
18	15.2	31.7	0.18	29.20	0.54
20	18.8	32.7	0.19	30.28	0.54
22	22.7	33.8	0.21	31.37	0.55
24	27.1	34.9	0.22	32.47	0.56
26	31.8	36.0	0.23	33.60	0.58
28	36.8	37.1	0.24	34.75	0.59
30	42.3	38.3	0.25	35.93	0.60
32	48.1	39.5	0.27	37.13	0.61
34	54.3	40.7	0.28	38.35	0.62
36	60.9	42.0	0.29	39.60	0.63
38	67.9	43.2	0.30	40.87	0.65
40	75.2	44.5	0.31	42.16	0.66


DETACT Model - Fast Growth
Gas temp
HRR
TIME (s)
TEMP (C)
HRR (kW)
0
10
20
30
40
50
60
70
80
90
100
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
50.0
100.0
150.0
200.0
250.0
300.0
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APPENDIX G

Alarm Zones List

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Open/Close List

Zones - NEVADA CO ROOD CENTER: CS# 135-0142 Site# 900034042

Order Zone ◉ Ascending ○ Descending

Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
1	Alarm	FIR655	Fire (C) FD-CL	PULL COPY RM FACP	N	
2	Alarm	FIR655	Fire (C) FD-CL	PULL INFO SYSTEM	N	
3	Alarm	FIR655	Fire (C) FD-CL	PULL @ZP100	N	
4	Alarm	FIR655	Fire (C) FD-CL	PULL SHERIFF OFFICE	N	
5	Alarm	FIR655	Fire (C) FD-CL	PULL AFS RECEPT AREA	N	
6	Alarm	FIR655	Fire (C) FD-CL	PULL AFS BACK OFFICE	N	
7	Alarm	FIR655	Fire (C) FD-CL	PULL AUDITOR@ZP100	N	
8	Alarm	FIR655	Fire (C) FD-CL	PULL COUNSIL CHAMBER	N	
9	Alarm	FIR655	Fire (C) FD-CL	PULL TAX COLLECTOR	N	
10	Alarm	FIR655	Fire (C) FD-CL	PULL ACCESSOR COUNTR	N	
11	Alarm	FIR655	Fire (C) FD-CL	PULL BUILDING DEPT	N	
12	Alarm	FIR655	Fire (C) FD-CL	PULL BLDG/@ZP100	N	
13	Alarm	FIR655	Fire (C) FD-CL	PULL COMMUN. DEVELPT	N	
14	Alarm	FIR655	Fire (C) FD-CL	PULL COUNTY EXECUTIV	N	
15	Alarm	FIR655	Fire (C) FD-CL	PULL BOARD OF SUPVSR	N	
16	Alarm	FIR655	Fire (C) FD-CL	PULL RECORDS OFFICE	N	
17	Alarm	FIR655	Fire (C) FD-CL	PULL HOUSING DEPT	N	
18	Alarm	FIR655	Fire (C) FD-CL	PULL D.O.T./D.D.S.	N	
19	Alarm	FIR655	Fire (C) FD-CL	WATERFLOW	N	
20	Alarm	FIR655	Fire (C) FD-CL	ANSIL FACP COMPUTER	N	Change
21	Alarm	TRO999	Trbl (C) LOG	ANSIL FACP TROUBLE	N	
22	Alarm	FIR655	Fire (C) FD-CL	PULL 2ND FLR/@ZP100	N	
23	Alarm	FIR655	Fire (C) FD-CL	PULL 2ND FLR/@ZP100	N	
24	Alarm	FIR655	Fire (C) FD-CL	PULL 1ST FLR/@ZP100	N	
25	Alarm	FIR655	Fire (C) FD-CL	PULL 1ST FLR/@ZP100	N	
26	Alarm	FIR655	Fire (C) FD-CL	PULL 1ST FLR/@ZP100	N	
27	Alarm	FIR655	Fire (C) FD-CL	PULL 1ST FLR/@ZP100	N	
28	Alarm	FIR655	Fire (C) FD-CL	PULL 2ND FLR/@ZP100	N	
30	Alarm	FIR655	Fire (C) FD-CL	FACP SMOKE	N	
31	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST/@ZP100	N	
32	Alarm	FIR655	Fire (C) FD-CL	2ND FLR LOBBBY SMOKE	N	
33	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EAST/@ZP101	N	
34	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST/@ZP101	N	
35	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST/@ZP101	N	
36	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST/@ZP101	N	
37	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST/@ZP101	N	
38	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EAST/@ZP101	N	
39	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EAST/@ZP101	N	
40	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EAST/@ZP101	N	
41	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EAST/@ZP101	N	
42	Alarm	FIR655	Fire (C) FD-CL	1ST FLR NORTH/@ZP101	N	
43	Alarm	FIR655	Fire (C) FD-CL	1ST FLR RHINO/@ZP101	N	
44	Alarm	FIR655	Fire (C) FD-CL	1ST FLR NORTH/@ZP102	N	
45	Alarm	FIR655	Fire (C) FD-CL	1ST FLR NORTH/@ZP102	N	
46	Alarm	FIR655	Fire (C) FD-CL	2ND FLR PERSN/@ZP102	N	
47	Alarm	FIR655	Fire (C) FD-CL	2ND FLR GOLD/@ZP102	N	
48	Alarm	FIR655	Fire (C) FD-CL	2ND FLR COUNT/@ZP102	N	
49	Alarm	FIR655	Fire (C) FD-CL	2ND FLR AUDIT/@ZP102	N	
50	Alarm	FIR655	Fire (C) FD-CL	2ND FLR COUNT/@ZP102	N	
51	Alarm	FIR655	Fire (C) FD-CL	2ND FLR NORTH/@ZP102	N	

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Order Zone ◉ Ascending ○ Descending

Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
52	Alarm	FIR655	Fire (C) FD-CL	2ND FLR RECOR/@ZP102	N	
53	Alarm	FIR655	Fire (C) FD-CL	2ND FLR BOARD/@ZP102	N	
54	Alarm	FIR655	Fire (C) FD-CL	2ND FLR HOUSI/@ZP102	N	
55	Alarm	FIR655	Fire (C) FD-CL	2ND FLR D.O.T/@ZP103	N	
56	Alarm	FIR655	Fire (C) FD-CL	2ND FLR SHERI/@ZP103	N	
57	Alarm	FIR655	Fire (C) FD-CL	2ND FLR SHERI/@ZP103	N	
58	Alarm	FIR655	Fire (C) FD-CL	2ND FLR EMPIR/@ZP103	N	
65	Alarm	FIR655	Fire (C) FD-CL	2ND FLOOR WEST@ZP103	N	
90	Alarm	FIR655	Fire (C) FD-CL	2ND FLR WEST@ZP103	N	
B	Alarm	OPE004	Open		N	
C	Alarm	CLO004	Close		N	
E	Alarm	RES499	Restore LOG		N	
E110	Alarm	FIR655	Fire (C) FD-CL	MANUAL	N	
E111	Alarm	FIR655	Fire (C) FD-CL	SMOKE DET.	N	
E112	Alarm	FIR655	Fire (C) FD-CL	COMBUSTION-FIRE	N	
E113	Alarm	FIR655	Fire (C) FD-CL	WATERFLOW	N	
E114	Alarm	FIR655	Fire (C) FD-CL	HEAT SENSOR	N	
E115	Alarm	FIR655	Fire (C) FD-CL	PULL STATION	N	
E116	Alarm	FIR655	Fire (C) FD-CL	DUCT	N	
E117	Alarm	FIR655	Fire (C) FD-CL	FLAME	N	
E118	Alarm	FIR655	Fire (C) FD-CL		N	
E137	Alarm	SUP499	Suprv LOG	(KEYSWITCH) TAMPER	N	
E140	Alarm	BUR526	Burg (C) PR-PD-CL-AL	GENERAL ALARM	N	
E141	Alarm	TRO999	Trbl (C) LOG	POLLING LOOP OPEN	N	
E142	Alarm	TRO999	Trbl (C) LOG	POLLING LOOP SHORT	N	
E143	Alarm	TRO999	Trbl (C) LOG	4152LMB MODULE FAIL	N	
E144	Alarm	SUP499	Suprv LOG	SENSOR TAMPER	N	
E145	Alarm	SUP499	Suprv LOG	EXPANSION MODULE	N	
E150	Alarm	BUR526	Burg (C) PR-PD-CL-AL	24 HR NON BURGLARY	N	
E151	Alarm	ENV528	Enviro (C) PR-FD-CL-AL	GAS DETECTED	N	
E152	Alarm	SUP499	Suprv LOG	REFRIGERATION	N	
E153	Alarm	SUP499	Suprv LOG	HEATING SYSTEM	N	
E154	Alarm	SUP499	Suprv LOG	WATER LEAKAGE	N	
E155	Alarm	TRO999	Trbl (C) LOG	FOIL BREAK	N	
E156	Alarm	TRO999	Trbl (C) LOG	DAY TROUBLE	N	
E157	Alarm	SUP499	Suprv LOG	LOW GAS LEVEL	N	
E158	Alarm	SUP499	Suprv LOG	HIGH TEMPERATURE	N	
E159	Alarm	SUP499	Suprv LOG	LOW TEMPERATURE	N	
E161	Alarm	SUP499	Suprv LOG	AIR FLOW	N	
E162	Alarm	COD527	CO Det (C) PR-FD-CL-AL	CARBON MONOXIDE DET.	N	
E163	Alarm	SUP499	Suprv LOG	TANK LEVEL	N	
E199	Alarm	FIR655	Fire (C) FD-CL	KEYPAD FIRE	N	
E200	Alarm	SUP499	Suprv LOG	FIRE SUPERVE	N	
E201	Alarm	SUP499	Suprv LOG	LOW H20 PRESSURE	N	
E202	Alarm	SUP499	Suprv LOG	LOW CO2	N	
E203	Alarm	SUP499	Suprv LOG		N	
E204	Alarm	SUP499	Suprv LOG	LOW WATER LEVEL	N	
E205	Alarm	SUP499	Suprv LOG	PUMP ACTIVATED	N	
E206	Alarm	SUP499	Suprv LOG	PUMP FAILURE	N	
E261	Alarm	SUP499	Suprv LOG	LOSS OF AIR FLOW	N	

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Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
E300	Alarm	TRO999	Trbl (C) LOG	SYSTEM	N	
E301	Alarm	ACF999	AC Fail (C) LOG	AC LOSS	N	
E302	Alarm	LOW999	Low Batt (C) LOG	LOW BATTERY	N	
E303	Alarm	TRO999	Trbl (C) LOG	RAM CHECKSUM BAD	N	
E304	Alarm	TRO999	Trbl (C) LOG	ROM CHECKSUM BAD	N	
E305	Alarm	RES499	Restore LOG	SYSTEM RESET	N	
E306	Alarm	SUP499	Suprv LOG	PROGRAM TAMPER	N	
E307	Alarm	TRO999	Trbl (C) LOG	SELF TEST FAILURE	N	
E308	Alarm	TRO999	Trbl (C) LOG	SYSTEM SHUTDOWN	N	
E309	Alarm	TRO999	Trbl (C) LOG	BATERY TEST FAILURE	N	
E310	Alarm	TRO999	Trbl (C) LOG	GROUND FAULT	N	
E311	Alarm	TRO999	Trbl (C) LOG	BATTERY MISSING	N	
E312	Alarm	TRO999	Trbl (C) LOG	PWR SPLY OVERCURRENT	N	
E313	Alarm	RES499	Restore LOG	ENGINE RESET	N	
E320	Alarm	TRO999	Trbl (C) LOG	SOUNDER/RELAY	N	
E321	Alarm	TRO999	Trbl (C) LOG	MAIN BELL CIRCUIT	N	
E322	Alarm	TRO999	Trbl (C) LOG	AUX BELL CIRCUIT	N	
E323	Alarm	TRO999	Trbl (C) LOG	ALARM RELAY	N	
E324	Alarm	TRO999	Trbl (C) LOG	TROUBLE RELAY	N	
E325	Alarm	TRO999	Trbl (C) LOG	REVERSING RELAY	N	
E326	Alarm	TRO999	Trbl (C) LOG	SOUNDER/RELAY	N	
E327	Alarm	TRO999	Trbl (C) LOG	SOUNDER/RELAY TRBL	N	
E330	Alarm	TRO999	Trbl (C) LOG	SYSTEM PERIPHERAL	N	
E331	Alarm	TRO999	Trbl (C) LOG	POLLING LOOP OPEN	N	
E332	Alarm	TRO999	Trbl (C) LOG	POLLING LOOP SHORT	N	
E333	Alarm	TRO999	Trbl (C) LOG	EXP MODULE FAIL	N	
E334	Alarm	TRO999	Trbl (C) LOG	REPEATER FAILURE	N	
E335	Alarm	TRO999	Trbl (C) LOG	PAPER-OUT TROUBLE	N	
E336	Alarm	TRO999	Trbl (C) LOG	TRBL LOCAL PRINTER	N	
E337	Alarm	TRO999	Trbl (C) LOG	EXP MODULAR DC LOSS	N	
E338	Alarm	LOW999	Low Batt (C) LOG	EXP MODULAR LOW BATT	N	
E339	Alarm	RES499	Restore LOG	EXP MODULAR RESET	N	
E341	Alarm	SUP499	Suprv LOG	EXP MODULAR TAMPER	N	
E342	Alarm	TRO999	Trbl (C) LOG	POLL LOOP SHORT	N	
E343	Alarm	TRO999	Trbl (C) LOG	EXPANSION MODULE	N	
E344	Alarm	TRO999	Trbl (C) LOG	RF RCVR JAM DETECT	N	
E350	Alarm	TRO999	Trbl (C) LOG	COMM TEST ABNORMAL	N	
E351	Alarm	TRO999	Trbl (C) LOG	PHONE LINE 1 TRBL	N	
E352	Alarm	TRO999	Trbl (C) LOG	PHONE LINE 2 TRBL	N	
E353	Alarm	TRO999	Trbl (C) LOG	LRR TRANSMITTER FAUL	N	
E354	Alarm	TRO999	Trbl (C) LOG	COMM FAIL	N	
E355	Alarm	SUP499	Suprv LOG	LOSS OF RADIO SUPV	N	
E356	Alarm	TRO999	Trbl (C) LOG	CENTRAL RADIO POLLIN	N	
E357	Alarm	TRO999	Trbl (C) LOG	LRR XMTR	N	
E370	Alarm	TRO999	Trbl (C) LOG	ZONE/SENSOR TROUBLE	N	
E371	Alarm	TRO999	Trbl (C) LOG	PROTECTION LOOP OPEN	N	
E372	Alarm	TRO999	Trbl (C) LOG	PROTECTION LOOP SHOR	N	
E373	Alarm	TRO999	Trbl (C) LOG	FIRE LOOP TROUBLE	N	
E374	Alarm	TRO999	Trbl (C) LOG	E/E ERROR BYPASS	N	
E375	Alarm	TRO999	Trbl (C) LOG	PANIC ZONE TROUBLE	N	

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Order Zone ◉ **Ascending** ○ **Descending**

Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
E376	Alarm	TRO999	Trbl (C) LOG	HOLD-UP ZONE TROUBLE	N	
E377	Alarm	TRO999	Trbl (C) LOG	ZONE SWINGER TRBLE	N	
E380	Alarm	TRO999	Trbl (C) LOG	CONTACT TROUBLE	N	
E381	Alarm	TRO999	Trbl (C) LOG	WIRELESS SUPVSN LOSS	N	
E382	Alarm	TRO999	Trbl (C) LOG	DCID SUPVSN LOSS	N	
E383	Alarm	SUP499	Suprv LOG	SENSOR TAMPER	N	
E384	Alarm	LOW999	Low Batt (C) LOG	WIRELESS TRANSMITTER	N	
E385	Alarm	TRO999	Trbl (C) LOG	SMOKE HI SENSOR	N	
E386	Alarm	TRO999	Trbl (C) LOG	SMOKE LOW SENSOR	N	
E387	Alarm	TRO999	Trbl (C) LOG	INTRUSION HI SENSOR	N	
E388	Alarm	TRO999	Trbl (C) LOG	INTRUSION LOW SENSOR	N	
E389	Alarm	TRO999	Trbl (C) LOG	DET SELF TEST FAIL	N	
E391	Alarm	TRO999	Trbl (C) LOG	SENSOR WATCH FAIL	N	
E392	Alarm	TRO999	Trbl (C) LOG	DRIFT COMP ERROR	N	
E393	Alarm	TRO999	Trbl (C) LOG	MAINTENANCE ALERT	N	
E406	Alarm	CAN499	Cancel/Abort LOG		N	
E411	Alarm	SUP499	Suprv LOG	CALLBACK REQUESTED	N	
E412	Alarm	SUP499	Suprv LOG	UP/DOWNLOAD ATTEMPT	N	
E413	Alarm	SUP499	Suprv LOG	UNSUCCESSFUL DWNLOAD	N	
E414	Alarm	SUP499	Suprv LOG	SYSTEM SHUTDOWN	N	
E415	Alarm	SUP499	Suprv LOG	DIALER SHUTDOWN	N	
E416	Alarm	SUP499	Suprv LOG	SUCCESSFUL UPLOAD	N	
E421	Alarm	SUP499	Suprv LOG	ACCESS DENIED BY USE	N	
E422	Alarm	SUP499	Suprv LOG	ACCESS GAINED BY USE	N	
E423	Alarm	SUP499	Suprv LOG	FORCED ACCESS	N	
E424	Alarm	SUP499	Suprv LOG	EGRESS DENIED	N	
E425	Alarm	SUP499	Suprv LOG	EGRESS GRANTED	N	
E426	Alarm	SUP499	Suprv LOG	S:DOOR LEFT OPEN	N	
E427	Alarm	TRO999	Trbl (C) LOG	ACCESS POINT DSM TRB	N	
E428	Alarm	TRO999	Trbl (C) LOG	ACCESS POINT RTE TRB	N	
E429	Alarm	SUP499	Suprv LOG	PROGRAM MODE ENTRY	N	
E430	Alarm	SUP499	Suprv LOG	PROGRAM MODE EXIT	N	
E431	Alarm	SUP499	Suprv LOG	ACSS THREAT LVL CHNG	N	
E432	Alarm	TRO999	Trbl (C) LOG	ACSS RLY/TRGGR FAIL	N	
E433	Alarm	TRO999	Trbl (C) LOG	ACCESS TRE SHUNT	N	
E434	Alarm	TRO999	Trbl (C) LOG	ACCESS DSM SHUNT	N	
E457	Alarm	SUP499	Suprv LOG	EXIT ERROR BY USER	N	
E461	Alarm	SUP499	Suprv LOG	WRONG CODE ENTRY	N	
E464	Alarm	SUP499	Suprv LOG	AUTO-ARM TIME EXT	N	
E501	Alarm	SUP499	Suprv LOG	ACCESS READER DISABL	N	
E520	Alarm	TRO999	Trbl (C) LOG	SOUNDER/RELAY BYPASS	N	
E521	Alarm	TRO999	Trbl (C) LOG	MAIN BELL DISABLE	N	
E522	Alarm	TRO999	Trbl (C) LOG	AUX BELL DISABLE	N	
E523	Alarm	TRO999	Trbl (C) LOG	AUX ALRM RELAY DISAB	N	
E524	Alarm	TRO999	Trbl (C) LOG	AUX RELAY DISABLE	N	
E525	Alarm	TRO999	Trbl (C) LOG	REV RELAY DISABLE	N	
E526	Alarm	TRO999	Trbl (C) LOG	NOTF APPLIANCE DISAB	N	
E527	Alarm	TRO999	Trbl (C) LOG	NOTF APPLIANCE DISAB	N	
E531	Alarm	SUP499	Suprv LOG	MODULE ADDED	N	
E532	Alarm	SUP499	Suprv LOG	MODULE REMOVED	N	

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Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
E551	Alarm	TRO999	Trbl (C) LOG	DIALER DISABLE	N	
E552	Alarm	TRO999	Trbl (C) LOG	RADIO BYPASS	N	
E553	Alarm	SUP499	Suprv LOG	RMT UP/DOWNLOAD DISA	N	
E570	Alarm	TRO999	Trbl (C) LOG	BYPASS	N	
E571	Alarm	TRO999	Trbl (C) LOG	ZONE/SENSOR DISABLE	N	
E572	Alarm	TRO999	Trbl (C) LOG	ZONE BYPASS	N	
E573	Alarm	TRO999	Trbl (C) LOG	ZONE BYPASS	N	
E574	Alarm	TRO999	Trbl (C) LOG	GROUP BYPASS	N	
E575	Alarm	TRO999	Trbl (C) LOG	SWINGER BYPASS	N	
E576	Alarm	TRO999	Trbl (C) LOG	ACCESS ZONE SHUNT	N	
E577	Alarm	TRO999	Trbl (C) LOG	ACCESS POINT BYPASS	N	
E601	Alarm	SUP499	Suprv LOG	MANUAL TEST	N	
E602	Alarm	20	Timer Test	TIMER TEST	N	
E603	Alarm	20	Timer Test	RADIO TEST	N	
E604	Alarm	SUP499	Suprv LOG	FIRE TEST	N	
E605	Alarm	SUP499	Suprv LOG	STATUS TO FOLLOW	N	
E606	Alarm	SUP499	Suprv LOG	LISTEN IN TO FOLLOW	N	
E607	Alarm	SUP499	Suprv LOG	WALK TEST MODE	N	
E608	Alarm	20	Timer Test	TEST W/SYS TROUBLE	N	
E609	Alarm	SUP499	Suprv LOG	VIDEO XMTR ACTIVE	N	
E611	Alarm	SUP499	Suprv LOG	FIRE WALK POINT TEST	N	
E612	Alarm	SUP499	Suprv LOG	FIRE/WLK PT NOT TEST	N	
E613	Alarm	SUP499	Suprv LOG	INTRSN ZN WALK TEST	N	
E614	Alarm	SUP499	Suprv LOG	FIRE ZN WALK TESTED	N	
E615	Alarm	SUP499	Suprv LOG	PANIC ZN WALK TESTED	N	
E616	Alarm	SUP499	Suprv LOG	SERVICE REQUEST	N	
E621	Alarm	RES499	Restore LOG	EVENT LOG RESET	N	
E622	Alarm	SUP499	Suprv LOG	EVENT LOG 50% FULL	N	
E623	Alarm	SUP499	Suprv LOG	EVENT LOG 90% FULL	N	
E624	Alarm	SUP499	Suprv LOG	EVENT LOG FULL	N	
E625	Alarm	RES499	Restore LOG	TIME/DATE RESET	N	
E626	Alarm	SUP499	Suprv LOG	TIME/DATE INACCURATE	N	
E627	Alarm	SUP499	Suprv LOG	PROGRAM MODE ENTRY	N	
E628	Alarm	SUP499	Suprv LOG	PROGRAM MODE EXIT	N	
E629	Alarm	SUP499	Suprv LOG	1.333 DAY NO READ LG	N	
E630	Alarm	TRO999	Trbl (C) LOG	SCHEDULE CHANGE TRBL	N	
E631	Alarm	SUP499	Suprv LOG	EXCPTN SCHED CHANGE	N	
E632	Alarm	SUP499	Suprv LOG	ACCESS SCHED CHANGE	N	
E641	Alarm	TRO999	Trbl (C) LOG	SENIOR WATCH TRBLE	N	
E642	Alarm	TRO999	Trbl (C) LOG	LATCHKEY	N	
E652	Alarm	SUP499	Suprv LOG	DOWNLOAD GOOD	N	
E9	Alarm	20	Timer Test		N	
E999	Alarm	SUP499	Suprv LOG	1 & 1/3 DAY NO READ	N	
EE	Alarm	20	Timer Test		N	
F65	Alarm	TRO513	Trbl (C) PR-CL	2ND FLOOR WEST@ZP103	N	
F90	Alarm	TRO999	Trbl (C) LOG	2ND FLR WEST@ZP103	N	
R	Alarm	RES499	Restore LOG		N	
R9	Alarm	20	Timer Test		N	
T65	Alarm	TRO513	Trbl (C) PR-CL	2ND FLOOR WEST@ZP103	N	
T90	Alarm	TRO999	Trbl (C) LOG	2ND FLR WEST@ZP103	N	

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Zone	State	Event ID	Description	Comment	Restore Reqd?	Pending
Z65	Alarm	SUP155	Suprv FD-CL	2ND FLOOR WEST@ZP103	N	
Z90	Alarm	SUP155	Suprv FD-CL	2ND FLR WEST@ZP103	N	

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APPENDIX H

Alarm System Component Data Sheets

SILENT KNIGHT
by Honeywell

IntelliKnight® Model 5820XL Addressable Fire Alarm Control System

The IntelliKnight System is the easy way to make the most of fire alarm technology.

IntelliKnight 5820XL is the first fire alarm system to provide you with revolutionary value and performance in addressable sensing technology. The 5820XL FACP offers exclusive, built-in digital communication, distributed intelligent power, a modular design and an expanded, easy to use interface. Powerful features such as drift compensation and maintenance alert are delivered in this powerful FACP from Silent Knight.

For more information about the 5820XL system, or to locate your nearest source, please call 800-328-0103.

Description

5820XL is an intelligent addressable fire alarm control panel (FACP). The basic 5820XL system can be expanded by adding modules such as 5860 remote annunciator, 5815XL signalling line circuit expander, 5824 serial/parallel printer interface module (for printing system reports), and 5895XL intelligent power module. 5820XL supports SD or SK devices. 5820XL also features a powerful built-in dual line fire communicator that allows for reporting of all system activity to a remote monitoring location.

Features

- Built in support for 99 SK detectors and 99 SK modules, expandable to 396 SK detectors and 396 SK modules using System Sensor protocol
- Built in support for 127 SD devices, expandable to 508 SD devices using the SD protocol.
- Uses standard wire—no shielded or twisted pair required
- Built-in digital communicator
- Central station reporting by point or by zone
- Built-in synchronization for appliances from AMSECO®, Gentex®, Faraday, System Sensor, and Wheelock®
- Flexput™ I/O circuits
- Supports Class B (Style 4) and Class A (Style 6) configuration for SLC, SBUS, and Flexput circuits
- 13 pre-programmed output cadences (including ANSI-3.41) and 4 programmable outputs
- Built-in annunciator with 80-character LCD display
- RS-485 bus provides communication to system accessories
- Built-in RS-232 and USB interface for programming via PC
- Built-in Form C trouble relay rated at 2.5 amps at 27.4 VDC
- Improvements in SKSS software deliver five times faster uploads/downloads
- Two built-in Form C programmable relays rated at 2.5 amps at 27.4 VDC
- Plex-1 door option combines a dead front cabinet door with a clear window, limiting access to the panel while providing single button operation of the reset and silence functions

Model 5820XL

- 6 amp power supply and maximum charging capacity of 35 amp hours (An additional cabinet enclosure is required for batteries in excess of 18 amp hours)
- Programmable date setting for Daylight Saving Time

Installation

The 5820XL can be surface or flush mounted

Compatibility

The 5820XL signal line circuit (SLC) supports multiple device types of the *same* protocol:

- SK (System Sensor)
- SD

You cannot mix SD and SK SLC devices on a FACP.

IntelliKnight Model 5820XL
Addressable Fire Alarm Control Panel

Indicator Lights

General Alarm (Red): Flashes when in alarm; solid when alarm silenced

Supervisory (Yellow): Flashes when a supervisory condition exists; solid when supervisory silenced

System Troubles (Yellow): Flashes when a trouble condition exists; solid when trouble silenced

System Silenced (Yellow): On when an alarm, trouble or supervisory condition has been silenced but not yet cleared

System Power (Green): Flashes for AC failure; solid when power systems are normal

System Application

5820XL has one built-in signalling line circuit (SLC) which supports multiple devices dependent on protocol being used. Three additional loops can be added using the 5815XL SLC expanders to increase overall capacity.

The 5820XL SLC loops support multiple device types, including:

- Addressable photoelectric smoke detector
- Addressable ionization smoke detector
- Addressable heat sensor
- Addressable duct smoke detector
- Contact module
- Relay output module
- Addressable notification module
- Addressable beam detector (SK protocol only)
- Addressable multi-criteria smoke detector (SK protocol only)
- Addressable multi modules (SK protocol only)

The following advanced sensor capabilities are available with 5820XL:

- Automatic drift compensation
- Maintenance alert
- Built-in sensor test to comply with NFPA 72 calibration testing requirements

5820XL features a 6 amp power supply and maximum battery charging capacity of 35 amp hours. An additional cabinet enclosure (PN RBB) is required for batteries in excess of 18 amp hours. Flexput circuits on 5820XL control can be individually programmed to function as notification circuits, auxiliary power outputs, or initiation circuits that support both 2- and 4-wire smoke detectors.

The 5820XL system operates on non-twisted, unshielded cable when wired in compliance with standard wiring practices as called out in the National Electric Code 760-51 specifications for power-limited fire protective signalling cables. No special wiring is required.

5820XL provides 13 preset notification cadence patterns (including ANSI 3.41) and four user programmable selections for fire alarm notification.

Two programmable general purpose Form C relay outputs are provided on 5820XL.

Additionally, the IntelliKnight system features a built-in walk test and auto-programming. Its innovative, dead-front cabinet design allows for flush or surface mounting. System maintenance is easy to perform.

User Interface

The 5820XL built-in annunciator with 80 character LCD display and large easy-to-use tactile touchpad can be used for system operation, programming and maintenance. It has five LEDs for alarm, supervisory, system trouble, system silenced and system power. System operations include silencing alarms and troubles, resetting alarms and the display of alarm troubles and memory. The system's non-volatile event history buffer stores 1000 events for viewing from the built-in or remote annunciator. System operation can be initiated with a mechanical firefighter's key or a valid 4- to 7-digit operator's code.

Programming

The IntelliKnight system offers several options to simplify and speed up programming. The JumpStart® feature minimizes programming required to start a new system. The built-in keypad and 5860 remote annunciator give on-site access to all programming. You can also program remotely using the 5660 Silent Knight Software Suite, which is Windows®-based software.

Built-In Digital Communicator

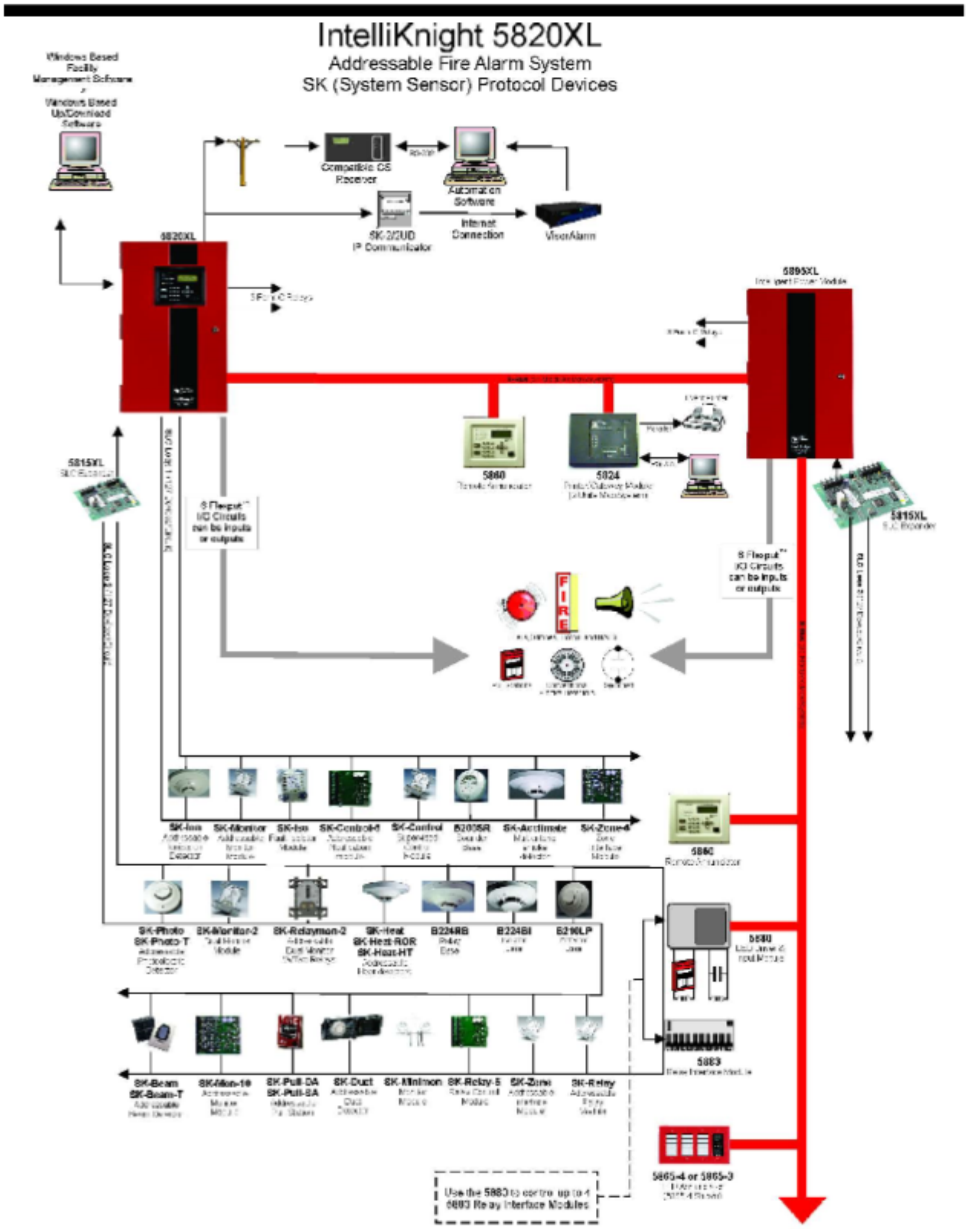
5820XL features a built-in UL listed digital communicator for remote reporting of system activity and system programming. The communicator has the ability to seize two telephone lines to report alarms and troubles to a monitoring facility. The communicator supervises two phone lines and will activate a trouble signal if a line failure is sustained for more than 45 seconds. Other communication features include: retry if communication fails, two phone number capability, download phone number capability and Touch-Tone or rotary dialing. The communicator is compatible with SIA and Ademco Contact ID. The format is selectable by account number.

Approvals

NFPA 13, NFPA 15, NFPA 16, NFPA 72: Central Station; Remote Signalling; Local Protective Signalling Systems; Auxiliary Protected Premises Unit; & Water Deluge Releasing Service. Suitable for automatic, manual, waterflow, sprinkler supervisory (DACT non-coded) signalling services.

Other Approvals: UL Listed; CSFM 7170-0559: 135; MEA 429-92-E Vol. VI; FM Approved

IntelliKnight Model 5820XL
Addressable Fire Alarm Control Panel



IntelliKnight Model 5820XL
Addressable Fire Alarm Control Panel

Specifications

Electrical

Primary AC:
120 VRMS at 50/60 Hz, 2.5A or
240 VRMS at 50/60 Hz, 1.4A

Total Accessory Load: 6A @ 27.4 VDC, power-limited

Standby Current: 215 mA

Alarm Current: 385 mA

Flexput Circuits:

Six programmable circuits which can be programmed individually as:

Notification circuits: 3A @ 27.4 VDC per circuit, power-limited

Auxiliary power circuits: 3A @ 27.4VDC per circuit, power-limited

Initiation Circuits: 100 mA @ 27.4VDC per circuit, power limited

Physical

Flush Mount Dimensions:
14.5"W x 24.75"H x 3.9"D
(36.8 W x 62.9 H x 9.8 D cm)

Overall Dimensions:
16.2"W x 26.4"H x 4.2"D
(40.6 W x 67 H x 11.8 D cm)

Weight: 28 lbs. (12.8 kg)

Color: Red

Battery Charging Capacity: 7.0-35 AH

Battery Size: 18 AH max allowed in control panel cabinet. Larger capacity batteries can be housed in RBB accessory cabinet.

Telephone Requirements:

FCC Part 15 and Part 68 approved

Type of Jack: RJ31X (two required)

S-BUS Accessories

5860/R Remote Fire Annunciator
Features the same 80 character backlit LCD display keypad and firefighter's keyswitch as the 5820XL. 5860 is gray and 5860R is red.

5815XL Signal Line Circuit Expander
The SLC expander is used to add more addressable devices to the IntelliKnight system. 5820XL supports three 5815XL's. Each 5815XL can support 99 SK detectors and 99 SK modules or 127 SD devices.

5895XL Intelligent Power Module
Adds 6 amps of power, 6 Flexput I/O circuits and 2 Form C relay circuits to a 5820XL system.

5496 Intelligent Power Module
A 6 amp notification power expander that provides four power-limited notification appliance circuit outputs.

5880 LED/IO Module
Features 40 LED outputs, 8 normally open dry contact inputs, and one piezo output.

5865-3 and 5865-4 Remote LED Annunciator
Features 30 programmable LED (15 red and 15 yellow) outputs, and a piezo sounder. The 5865-4 adds a silence and reset switch to the package.

5883 Relay Board
Features 10 general purpose Form C relays. Used with 5880 module.

5824 Serial/Parallel Printer Interface Module
Provides one parallel and one RS-232 serial port for connecting a printer to the 5820XL. Use to print a real-time log of system events, detector status reports, and event history. Interfaces with building control system.

Miscellaneous Accessories

5660 Silent Knight Software Suite (SKSS)
User-friendly Windows software for remote programming of 5820XLs using a PC. Upload and view panel account information, event history, and detector status.

5670 Silent Knight Software Suite (SKSS)
Powerful end-user facility management software allows viewing of detector status and event history via modem or direct connection.

Plex-1
Dead front cabinet door with clear window to limit access to the FACP.

RBB
Remote battery box accessory cabinet. Use if backup batteries are too large to fit into FACP cabinet. Dimensions:
16" W x 10" H x 6" D
(406 mm W x 254 mm H x 152 mm D)

SD505-DTS-K
Remote test switch. Used with SD505-DUCTR. Provides remote key operated test function and annunciation of detector alarm.

SD and SK Devices

See the specification sheets listed below for a complete listing of the SD and SK devices.

53624 SD Devices Data Sheet
53623 SK Devices Data Sheet

SILENT KNIGHT by Honeywell

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice. For more information, contact Silent Knight 12 Clintonville Road, Northford, CT 06472 Phone: (203) 484-7161, Fax: (203) 484-7118. **www.silentknight.com**.

Made in America

PN 350210 Rev H2

SILENT KNIGHT
by Honeywell

5860 Remote Annunciator

Bring the power to control an IntelliKnight fire alarm control panel to every area within your facility

Now you can operate and program your IntelliKnight system from up to twelve locations throughout your facility. The 5860 remote annunciator provides the same advanced, easy-to-use interface found on the IntelliKnight panel's built-in annunciator. The 80-character display and ergonomically designed keypad allow for simple and error-free system operation. All operations—including reset, silence, detector status checking, fire drill, and programming—are identical.

Access to the system is through a firefighter's key or an access code. For security, a special installation code is needed for programming functions. The 5860 connects to the IntelliKnight panel via the RS-485 system bus. Wire runs can be up to 6000 feet from the panel.

For more information about the IntelliKnight system, or to locate your nearest source, please call 1-800-328-0103.

Description

Features include an 80-character backlit LCD providing easy-to-understand system messages. The annunciator is ergonomically designed with over-sized buttons for the most frequently used features, like Reset and Silence.

In addition to status messages displayed on the LCD, there are five LEDs for alarm, supervisory, trouble, silence, and AC power status.

The annunciator is available in gray to match virtually any decor and red for applications where the annunciator must stand out. The annunciator enclosure can be surface or flush mounted. A trim ring kit is available for surface mounting.

Features

- 80-character backlit LCD display (4 lines with 20 characters on each line)
- Tactile and audible feedback
- Accepts user codes or fire fighter's key
- Larger keypad buttons for system reset and silence
- Install up to twelve 5860s per 5820XL/EVS or 5808 system
- Install up to eight 5860s per 5700 system
- Available in red or light gray
- Support for simultaneous use of multiple 5860s
- RS-485 interface to panel
- Operation and appearance is identical to 5860 built-in annunciator
- On-board piezo sounder audibly indicates alarms, troubles, and supervisories
- Five status LEDs for alarm, supervisory, trouble, silence and AC power conditions
- Wiring lengths up to 6000 ft. from the FACP (depending on wire gauge and number of devices on SBUS)
- UL listed, complies with NFPA 72
- CSFM approved

Electrical Specifications

Operating Voltage: 24 VDC

Standby Current: 20 mA max

Alarm Current: 25 mA

Wiring Distance: 6,000 max. from FACP (depending on wire gauge and number of devices on the SBUS)

Mechanical Specifications

Physical 9.1" W x 7.4" H x 1.5" D (23.1 W x 18.8 H x 3.8 D cm)

Shipping Weight: 2.8 lbs (1.3 kg)

Color
5860R: Red
5860: Gray

5860

Environmental

Operating Temperature: 32ºF – 120ºF (0ºC – 49ºC)

Humidity: 10% – 93% non-condensing

Compatibility

The 5860 is compatible with the following FACP's:

- 5820XL Addressable Fire Control Panel
- 5820XL-EVS Fire Control Panel with Emergency Voice System
- 5808 Addressable Fire Control Panel
- 5700 Addressable Fire Control Panel

PN 350224 Rev G

INTELLIKNIGHT ACCESSORY

5860 Remote Annunciator

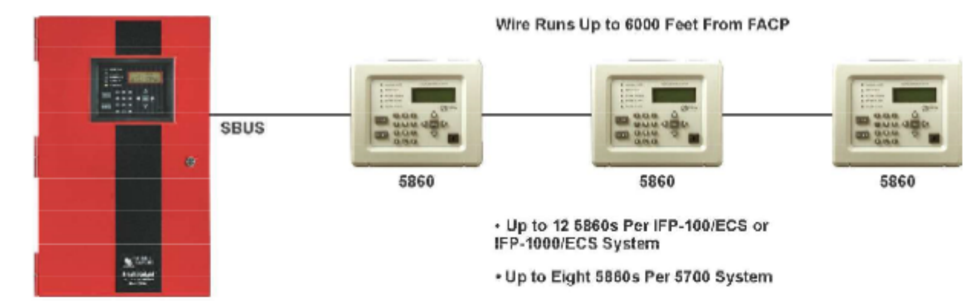
Engineering Specifications

The main control must have a built-in annunciator and must support up to 12 remote annunciators. Remote annunciators shall have the same control and display layout so as to match the appearance of the built-in annunciator. Remote annunciators shall be available in two colors, red or light gray.

Remote annunciators shall have identical functionality and operation as the built-in annunciator. All annunciators must have an 80-character LCD display and must feature five LEDs for: General Alarm, Supervisory, System Trouble, System Silence, and System Power.

All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 inches. No membrane style buttons will be permissible.

The annunciator must be able to silence and reset alarms through the use of a code entered on the annunciator keypad or by using a firefighter's key. The annunciator must have two levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple user input simultaneously.



Compatible IntelliKnight FACP

Listings
NFPA 72; UL Listed;
CSFM 7170-0559: 135;
MEA 429-92-E Vol. IX;
FM Approved

Ordering Information

5860R	Remote Annunicator four line LCD annunciator with 20 characters per line. Red
5860	Remote Annunciator four line LCD annunciator with 20 characters per line. Gray

Accessories

5860TR	Red Trim Ring for surface mounting
5860TG	Gray Trim Ring for surface mounting

SILENT KNIGHT
by Honeywell

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Assembled in America

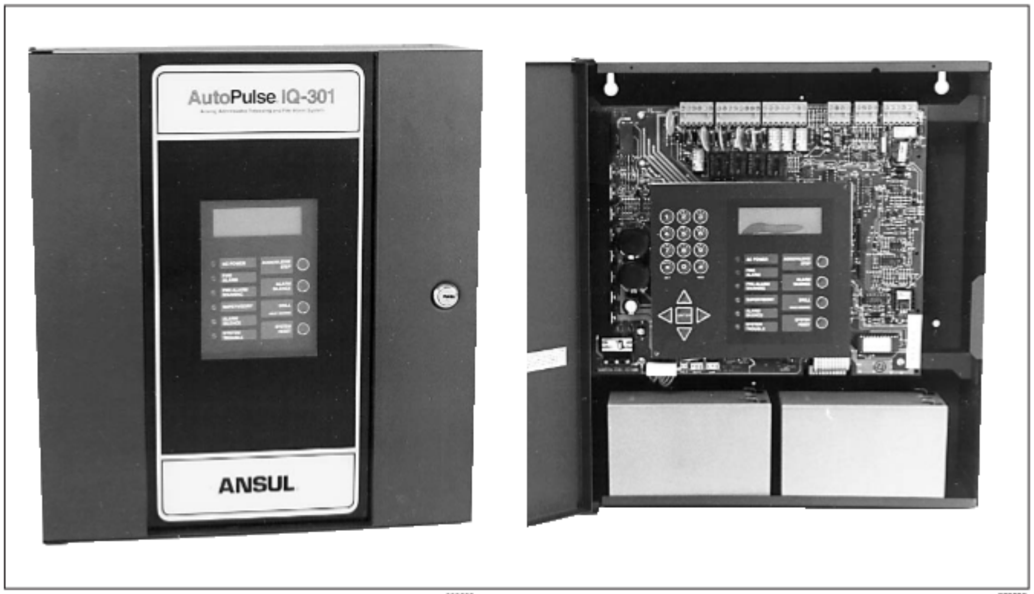
ANSUL®

DETECTION AND CONTROL EQUIPMENT DATA SHEET

AUTOPULSE® IQ-301 ANALOG ADDRESSABLE CONTROL UNIT

FEATURES

- 198 intelligent device capacity (99 analog detectors and 99 monitor/control modules). Style 4, 6, or 7.
- Overall 301 point capability (198 intelligent points, 4 programmable bell circuits, 99 programmable relays).
- Sensitivity display in % per foot obscuration.
- Manual sensitivity adjustment.
- Day/Night automatic sensitivity adjustment.
- Drift compensation (U.S. Patent Pending) meets UL requirements as a calibrated test instrument.
- Auto detector test (meets NFPA 72).
- Maintenance alert.
- Pre-alarm (AWACS™ – U. S. Patent Pending).
- LED blink control.
- Automatic device type check.
- Releasing capability of four independent hazards.
- Three cross-zone options.
- Delay timer and Discharge timers (adjustable).
- Abort (four options).
- Optional Digital Alarm Communicator/ Transmitter, with AC fail delay.
- LCD-80 remote display/control (up to 4 per control unit).
- Directory annunciators (R5-485), and lamp driver for graphic annunciators.
- Printer interface (80 column and 40 column printers).
- 5.0 A usable regulated output power, plus 3.0 A expander.
- 80 character LCD display, back-lit.
- Real time clock, with European format option.
- History file with 650 event capacity in nonvolatile memory.
- Waterflow or supervisory selection per point.
- Alarm Verification selection per point, with tally.
- Walk Test reports 2 devices set to same address.
- Positive Alarm Sequence (PAS) Presignal per NFPA 72.
- Silence inhibit and Auto Silence timer options.
- March time/temporal/California code for bell circuits.
- Field-programmable on panel or on PC with user-defined passwords, plus Autoprogram feature.
- Interactive modem interface allows readout of all status, program, history and analog information over dial-up phone lines to remote monitoring sites.
- Optional voltmeter and ammeter displaying battery voltage and charging current.



003292 003293

DESCRIPTION

The AUTOPULSE IQ-301 is a compact, cost effective, analog addressable, releasing and fire alarm control unit with a capacity of 301 individually identified and controlled points and an extensive list of powerful features. It provides capabilities that exceed most large intelligent systems at a cost comparable to conventional control systems.

Field programming can be accomplished in three different ways:

1. AUTO-PROGRAM – The AUTOPULSE IQ-301 system identifies all devices that are connected, determines the type of device, and loads default values (general alarm) into non-volatile memory. This is completed in less than 30 seconds.
2. ON-LINE EDIT – While still providing fire protection, the AUTOPULSE IQ-301 system program may be completely edited from the front keyboard. Menu trees permit easy change of any parameter without referral to the programming manual. New program check routine catches common errors.
3. OFF-LINE PC – The complete AUTOPULSE IQ-301 system program may be created in an off-line PC compatible computer, then loaded into the AUTOPULSE IQ-301 RS-232 port. The program may also be off-loaded to a PC at any time. High speed data transfer completes upload or download in less than one minute.

APPLICATION

The AUTOPULSE IQ-301 control system is ideal for industrial, commercial, and institutional facilities where an analog addressable control system is needed to detect fire, and if required, actuate a fixed fire suppression system. In addition this system can be used as a combination fire/burglary and burglary system, critical process monitoring, and tornado warning. Analog smoke detector sensitivity is monitored by the control unit which will indicate a special trouble condition if the detectors sensitivity moves outside the listed range. All devices can be installed on the single addressable loop with up to 99 analog addressable detectors and 99 addressable modules for conventional smoke detectors, heat detectors, manual pull stations, supervisory switches, alarm devices, releasing devices, and relays. The control unit can be programmed to provide the specific operating sequence required for the project.

Detectors can be programmed to operate as single zone or cross zoned for controlling agent release with time delays and abort capabilities. The control system is listed by UL and ULC and approved by FM and complies with NFPA 72 National Fire Alarm Code and should be installed in accordance with NFPA 70, National Electrical Code.

The control system also meets the requirements of the various standards for fire suppression systems including: NFPA 11, Foam Extinguishing Systems; NFPA 11A, Medium and High Expansion Foam Systems; NFPA 12, Carbon Dioxide Systems; NFPA 12A, Halon 1301 Systems; NFPA 13, Sprinkler Systems; NFPA 15, Water Spray Systems; NFPA 16, Foam/Water Deluge and Foam/ Water Spray Systems; NFPA 17, Dry Chemical Systems; NFPA 17A, Wet Chemical Systems; NFPA 2001, Clean Agent Fire Extinguishing Systems.

TECHNICAL SPECIFICATIONS

Primary input power – 120 VAC, 50/60 Hz, 3.0 Amp

Total output power – 24 VDC, 5.0 A

Four bell circuits – 2.25 A each

Auxiliary 24 VDC power available – 500 mA total

- Four-wire detector power
- Non-reset regulated power
- High ripple regulated power

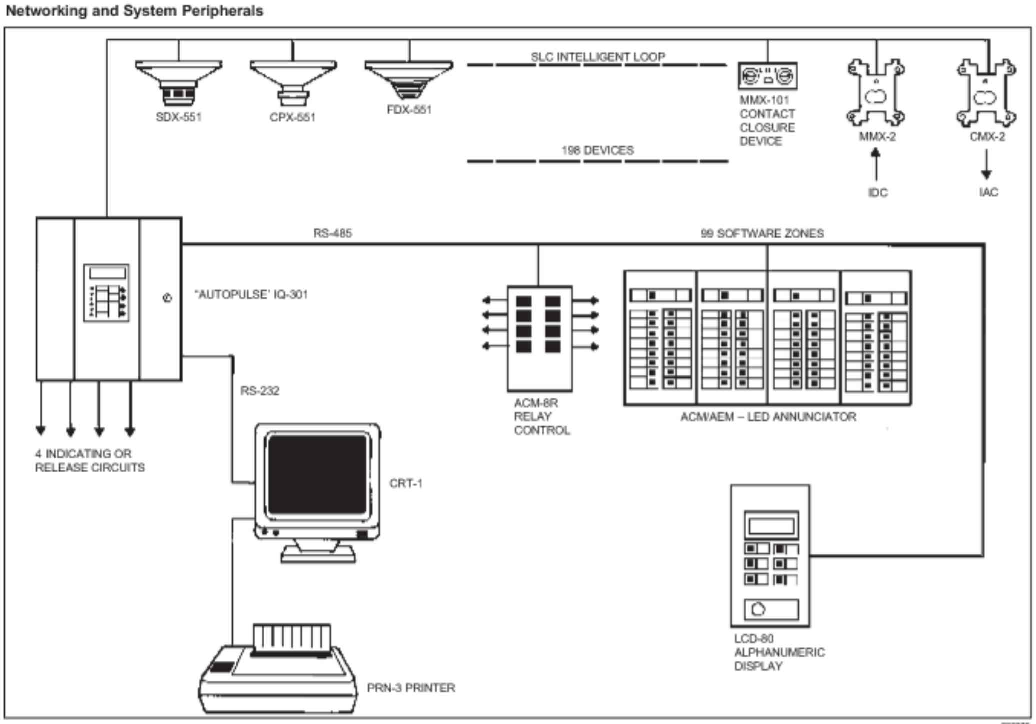
Battery charger range – 7 AH to 17 AH

Charge high rate – 29.1 VDC @ 0.7 Amp

Charge float rate – 27.6 VDC @ 0.5 Amp

Relay contact rating – 2.0 A @ 30 VDC resistive, 0.5 A @ 30 VAC resistive, alarm and trouble form-C, supervisory form-A.

Networking and System Peripherals



SYSTEM CAPACITY

Total programmable input/output points – 301

Intelligent detectors – 99

Addressable monitor/control modules – 99

Programmable IAC (bell) circuits in panel – 4

Programmable software zones – 99

Programmable remote relay/annunciator points – 99

LCD-80 annunciators per system – 4

ACS annunciators per system – 10

LISTINGS AND APPROVALS

UL Listed for Fire Signaling per Standard 864 (S4935)

UL Listed for Burglary applications per Standard 1076

UL Listed for Releasing per NFPA 12, 12A, 12 B, 13, 15, 16, 17, and 2001

UL Listed for Critical Process Monitoring

ULC Listed (CS333, CS412)

FMRC Approved (0V4A5.AY)

California State Fire Marshal Approved

MEA Approved (City of New York)

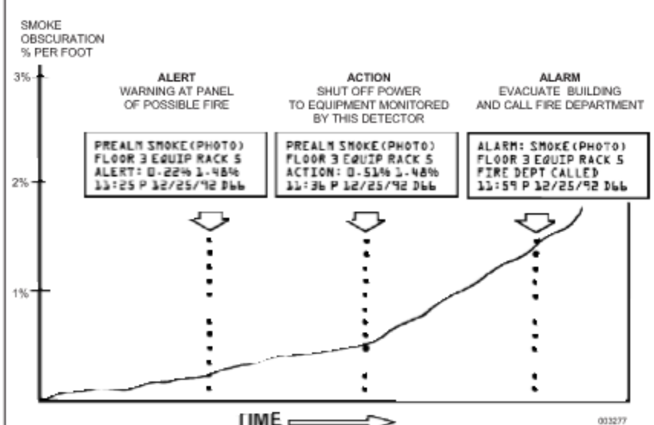
ARCHITECTURAL/ENGINEERING SPECIFICATIONS

Complete specifications available on disk.

ORDERING INFORMATION

Part No.	Description	Shipping Weight lb.	(kg)
417463	AUTOPULSE IQ-301, Analog Addressable Control Panel, Red, 120 VAC	30	(13.7)
417464	AUTOPULSE IQ-301, Analog Addressable Control Panel, Grey, 120 VAC	30	(13.7)
417465	AUTOPULSE IQ-301, Analog Addressable Control Panel, Grey, 220 VAC	30	(13.7)
417466	Audible/Visual 3 A Power Supply, AVPS-24	5	(2.3)
417467	PK-IQ-301, Programming Kit for AUTOPULSE IQ-301	2	(.9)
417692	Battery Pack, 7 AH, 24 VDC	15	(6.8)
417693	Battery Pack, 12 AH, 24 VDC	22	(9.9)
417470	4XTM, Plug In Transmitter Module, Municipal Box and Remote Station Connection	2	(.9)
417471	RTM-8, Plug In Relay/Transmitter Module, 8 Form C Relay Contacts Plus Transmitter	2	(.9)
417472	4XMM, Ammeter – Voltmeter Module	2	(.9)
417473	Full Length Dead Front Dress Plate (Canada)	2	(.9)
417474	TR-4XG, Trim Ring for Semi-Flush Mounting, Grey	2	(.9)
417475	TR-4XR, Trim Ring for Semi-Flush Mounting, Red	2	(.9)
417476	MMX-1, Monitor Module	2	(.9)
417477	MMX-2, Monitor Module, 2-Wire Detector	2	(.9)
417478	MMX-101, Mini Monitor Module	2	(.9)
417479	CMX-2, Control Module	2	(.9)
417480	ISO-X, Isolator Module	2	(.9)
417481	CPX551, Ionization Detector, Analog Addressable	2	(.9)
417482	SDX551, Photoelectric Detector, Analog Addressable	2	(.9)
417483	SDX551TH, Photoelectric with 135° F (57° C) Thermal Detector, Analog Addressable	2	(.9)
417484	FDX551, Thermal Detector, Analog Addressable	2	(.9)
417485	FDX551R, Thermal Detector/ROR, Analog Addressable	2	(.9)
417486	BX501, Detector Base, Analog Addressable	1	(.5)
417487	B501, Detector Base, Flangeless	1	(.5)
417488	B501BH, Detector Base with Audible, Analog Addressable	2	(.9)
417492	LCD-80, 80 Character LCD Annunciator	5	(2.3)
417493	Surface Mount Back Box for LCD-80	1	(.5)
417657	Flush Mount Back Box for LCD-80	1	(.5)
417660	Annunciator Key Switch	1	(.5)

AWACS™ Advance Warning Addressable Combustion Sensing (U.S. Patent Pending)



ALERT and **ACTION** levels are completely adjustable in the field to suit the cleanliness and stability of the environment.
ALARM levels are field adjustable to one of 3 levels within the UL permitted range.

FIAMM
Industrial Batteries

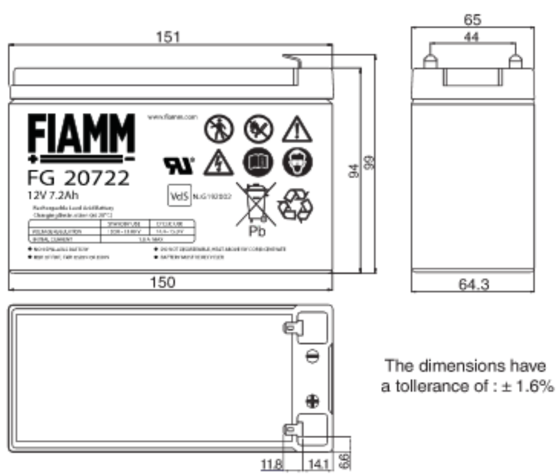
FG series

FG20722

12 Volt 7.2 Ah

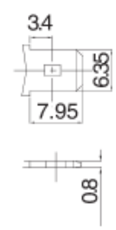
FG20722 is a general purpose application battery. Within the FG range FIAMM offer 6V and 12V monoblocs at various amp hour capacities enable the right battery selection for each requirement. FIAMM is a Manufacturer of VRLA batteries and is supported by a dedicated sales network with market knowledge and experience of small sealed lead acid battery applications.

Features	
Nominal Voltage	12 Volt
Nominal Capacity	7.2 Ah 20 hours rate to 1.75 Vpc at 25 °C
Float charging voltage	13.50 - 13.80 V/bloc at 25 °C
Boost charge voltage	14.40 - 15.00 V/bloc at 25 °C
Float voltage compensation	-18mV/°C
Maximum charging current	1.8 A
Case	ABS with HB fiammability rate (according UL 94)
Internal resistance	24.6 mΩ in full charged condition
Weight	2.45 kg
Dimensions	L x W x H (TH): 151 x 65 x 94 (99)
Operative temperature range	-20 °C to 50 °C
Shelf life procedures	As batteries lose part of their capacity, during storage, due to self discharge. Fiamm recommends FG range of batteries can be stored for 6 months at an ambient temperature of 20 and 25 °C (see attached graph on reverse). Longer storage requires a recharge. This should be carried out in line with Fiamm recommended method; 2.4 V/cell for no longer than 24 hours at 20 °C



The dimensions have a tollerance of : ± 1.6%

Faston 6.3 mm



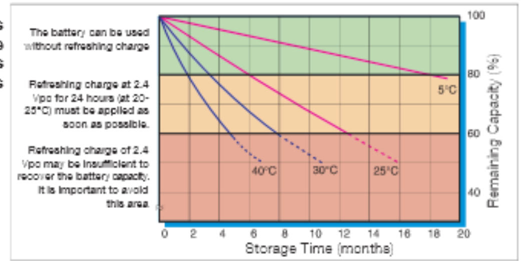
SSLA Products

FG series

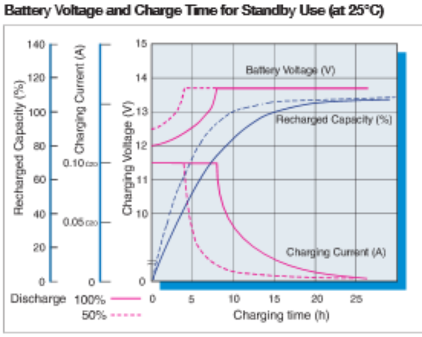
FG20722
12 Volt
7.2 Ah

AИ30 VdS N.:G192002 MH27980

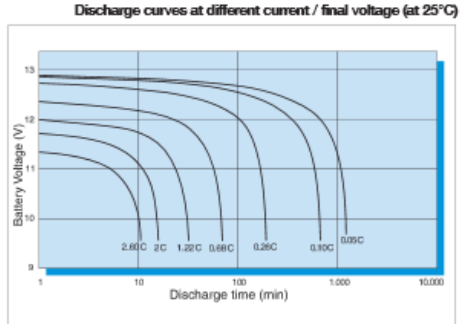
Capacity loss during storage at various temperatures



Battery Voltage and Charge Time for Standby Use (at 25°C)



Discharge curves at different current / final voltage (at 25°C)



Costant Current discharge table (Amperes)

End voltage	5 min	10 min	15 min	20 min	30 min	45 min	1 hour	2 hour	3 hour	5 hour	10 hour	20 hour
9.60 V	30.6	21.5	16.3	13.0	9.18	6.45	4.99	2.69	1.90	1.22	0.68	0.37
9.90 V	30.1	21.2	16.2	12.8	9.13	6.41	4.97	2.66	1.88	1.21	0.67	0.37
10.02 V	29.7	21.1	16.1	12.8	9.08	6.36	4.95	2.64	1.87	1.20	0.67	0.37
10.20 V	28.9	20.8	15.9	12.6	9.00	6.34	4.93	2.62	1.85	1.19	0.67	0.37
10.50 V	27.5	20.3	15.5	12.4	8.85	6.23	4.87	2.57	1.82	1.16	0.66	0.36
10.80 V	25.2	19.0	14.8	11.9	8.63	6.13	4.82	2.53	1.71	1.12	0.63	0.35

Costant Power discharge table (Watts per bloc)

End voltage	5 min	10 min	15 min	20 min	30 min	45 min	1 hour	2 hour	3 hour	5 hour	10 hour	20 hour
9.60 V	305	220	171	138	100	71.7	58.2	30.7	21.8	14.1	7.85	4.34
9.90 V	302	219	170	138	99.9	71.5	58.1	30.5	21.7	14.1	7.84	4.34
10.02 V	298	218	170	137	99.6	71.3	55.9	30.2	21.6	14.0	7.83	4.33
10.20 V	291	216	168	136	98.9	70.8	55.7	30.0	21.4	13.9	7.80	4.33
10.50 V	277	211	165	134	97.8	70.0	55.3	29.8	21.2	13.6	7.73	4.29
10.80 V	255	199	158	130	95.9	69.1	54.9	29.3	2.00	13.1	7.50	4.21

FG20722_Vers. 2_2009_10_08

FIAMM S.p.A.
Industrial Batteries Business Unit
SSLA Products
www.fiamm.com
e-mail: info.standby@fiamm.com

FIAMM
Industrial Batteries

SigmasTek

SP12-7.5
(12V7.5AH/T1)

Specifications

Nominal Voltage	12V	
Nominal Capacity (20HR)	7.5AH	
Dimension	Length	151mm (5.95 inches)
	Width	65mm (2.56 inches)
	Height	94mm (3.70 inches)
	Total Height (with Terminal)	100mm (3.94 inches)
Approximate Weight	2.20 kg (4.85 lbs)	
Battery Type	Valve Regulated Lead-Acid Battery, AGM Design	
Terminal Type	T1	
Rated Capacity	7.58AH	(20hr,1.75V/cell,25°C/77°F)
	7.16AH	(10hr,1.75V/cell,25°C/77°F)
	6.40AH	(5hr,1.75V/cell,25°C/77°F)
	6.33AH	(3hr,1.60V/cell,25°C/77°F)
	4.71AH	(1hr,1.60V/cell,25°C/77°F)
Max. Discharge Current	112.5A	
Internal Resistance	20mΩ	
Operating Temp. Range	Discharge:	-20°C(-4°F)~50°C (122°F)
	Charge:	-20°C(-4°F)~50°C (122°F)
	Storage:	-20°C(-4°F)~40°C (104°F)
Nominal Operating Temp. Range	25±3°C (77±5°F)	
Container Material	ABS (Option: 94-HB & 94-V0 flame retardant case)	
Capacity affected by Temperature	40°C (104°F)	103%
	25°C (77°F)	100%
	0°C (32°F)	86%
Self Discharge	SigmasTek SP series batteries may be stored for up to 6 months at 25°C (77°F) and then a freshening charge is recommended. For higher temperatures the time interval will be shorter.	

Applications

- Uninterruptible Power Supply (UPS)
- Electric wheelchairs, scooters, bikes
- Electronic apparatus and equipment
- Alarm and security systems
- Emergency first responder equipment
- Emergency lighting
- Medical devices
- Electric carts
- Telecom equipment
- Switchgear
- Solar power systems

MH47929

Constant Current Discharge (Amperes Per Battery) at 25°C (77°F)

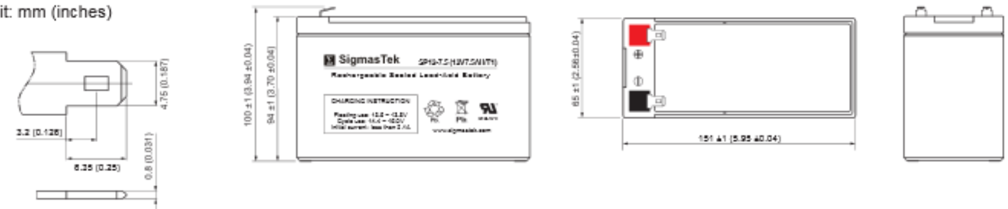
F.V. (V/cell) \ Discharge Time	5min	10min	15min	30min	1h	2h	3h	5h	8h	10h	20h
1.60V	29.0	19.7	14.6	8.63	4.71	2.74	2.11	1.39	0.909	0.754	0.393
1.65V	26.2	18.1	13.6	8.17	4.67	2.63	2.05	1.34	0.900	0.746	0.391
1.70V	23.8	16.8	12.8	7.74	4.56	2.59	1.97	1.31	0.886	0.731	0.386
1.75V	21.6	15.4	12.0	7.44	4.42	2.52	1.91	1.28	0.874	0.716	0.379
1.80V	19.2	14.0	11.0	7.17	4.22	2.43	1.88	1.24	0.859	0.698	0.375
1.85V	14.3	11.0	9.09	6.07	3.77	2.23	1.75	1.16	0.810	0.677	0.371

Constant Power Discharge (Watts Per Cell) at 25°C (77°F)

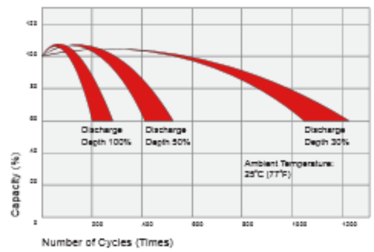
F.V. (V/cell) \ Discharge Time	5min	10min	15min	30min	1h	2h	3h	5h	8h	10h	20h
1.60V	55.5	34.3	26.3	15.5	8.88	5.12	3.72	2.47	1.660	1.367	0.734
1.65V	52.6	32.9	25.5	15.2	8.73	5.05	3.68	2.45	1.649	1.359	0.731
1.70V	49.2	31.3	24.5	14.7	8.48	4.96	3.62	2.42	1.633	1.347	0.725
1.75V	45.1	29.5	23.3	14.2	8.23	4.85	3.55	2.39	1.616	1.334	0.719
1.80V	40.2	24.5	21.9	13.5	7.96	4.72	3.47	2.34	1.593	1.318	0.708
1.85V	34.2	23.3	20.2	12.8	7.64	4.56	3.37	2.29	1.565	1.296	0.701

Dimensions

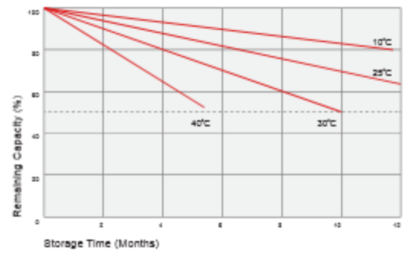
T1 Terminal
Unit: mm (inches)



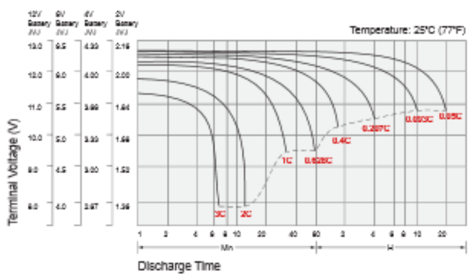
Cycle Service Life



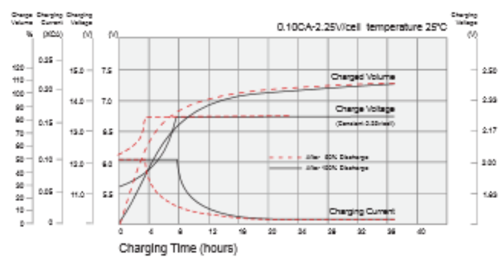
Self Discharge Characteristics



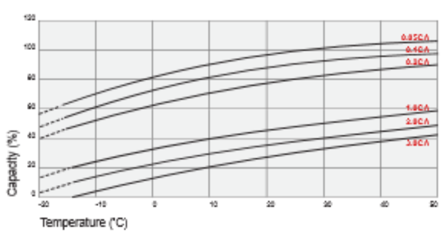
Discharge Characteristics



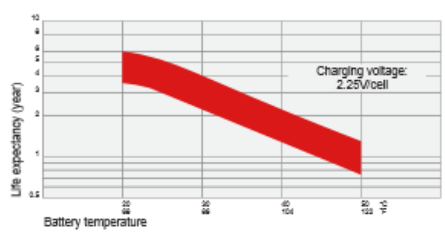
Float Charging Characteristics



Temperature Effects in Relation to Battery Capacity



Temperature Effects on Long Term Float Life



Contact Information

SigmasTek
105 East 34th Street, Suite 257
New York, NY 10016, USA

T: 800-404-3475
F: 877-661-7089
www.sigmastek.com

SD500-PS and SD500-PSDA Addressable Pull-Station

IntelliKnight's addressable pull stations combine fast response with pin-point location ID.

The SD500-PS and SD500-PSDA are a single action or dual action addressable manual fire alarm pull station for use with Silent Knight's IntelliKnight fire control panel. Extremely easy to operate, the SD500-PS/PSDA provides a fast and practical means of manually initiating a fire alarm signal. The IntelliKnight panel recognizes each manual pull station by its specific address saving precious seconds in determining the location of an alarm.
The SD500-PS/PSDA mounts to a single gang box and features a rugged metal construction that lasts and lasts.
Combine all this with the features you've come to expect from Silent Knight - easy installation and stable operation - and it adds up to a flexible solution for all your fire protection needs.

Model SD500-PS & SD500-PSDA Addressable Pull Station

The SD500-PS is a single action addressable fire pull station, and the SD500--PSDA is a dual action addressable fire pull station. The SD500-PS/PSDA feature rugged metal construction A terminal strip on back of the pull station allows interconnection of the pull station to the SLC of an IntelliKnight control panel. The SD500-PS/PSDA is designed for indoor use in non-explosive environments. The normally open initiating point contacts are gold-plated to avoid risk of corrosion. The SD500-PS/PSDA has been tested by UL for compliance to the requirements of the Americans with Disabilities ACT (ADA).

Features

- UL Listed
- CSFM listed
- ADA compliant
- Key reset (Same key as Silent Knight enclosures)
- Surface mount back box available
- Terminals - accept up to 14 gauge wire
- Extremely easy to operate
- Corrosion-resistant gold-plated contacts.
- Reflective label makes it easier to locate in low light

Operation

The SD500-PS/PSDA single action pull stations are operated by a pull on the front pull cover of the station. A plunger switch, wired to a self contained addressable module, is released as the pull station opens to initiate the alarm. Once operated, the cover hangs down and can be seen up to 100 feet away. The pull station is reset by returning the front cover to the normal upright position and relocking the station with a reset key. The reset keys are the same keys used on Silent Knight enclosures.

The SD500-PS/PSDA includes a status LED which blinks, indicating that the addressable module is communicating with the loop. The status LED lights continuously during an alarm. A dip switch on the addressable module is used to set the unique address.

Specifications

Operating Voltage:	24VDC
Standby Current:	.55mA
Alarm Current:	.55mA

SD500-PS

Ambient Temperature:	32°F to 120°F (0°C to 49°C)
Mounting:	Single gang box -

Optional Red Surface Mount Box PS-SMBB

SILENT KNIGHT
A Honeywell Company

INTELLIKNIGHT ACCESSORY

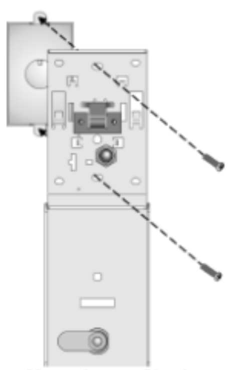
SD500-PS and SD500-PSDA Addressable Pull-Station

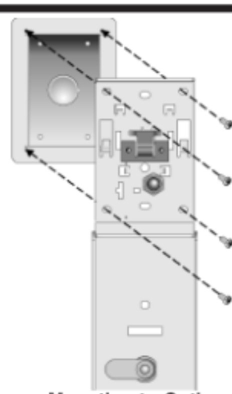
Engineering Specifications

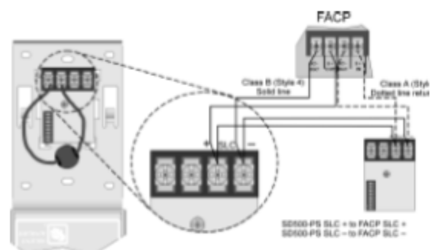
Manual pull station shall be addressable Module SD500-PS/SD500-PSDA. Equipment shall be made of 14 gauge C.R.S.(Cold Rolled Steel), painted with a red enamel . The label shall contain the words Fire Alarm and be made of a reflective material embossed text 3/8 inches tall. Operating instruction shall be clearly visible on the same label. Manual station Shall contain a key operated test and reset lock using a lock plate actuator, the key shall match the control panel.

Manual station shall contain four terminal blocks with two connected to the addressable module and two connect to the SLC loop. Manual station shall provide data to the control panel with an ID address programmed by dip switch settings .

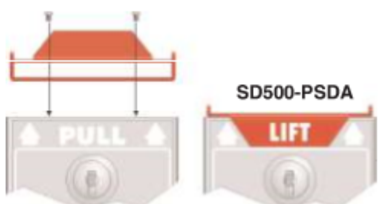
Manual stations shall be Underwriters Laboratories Inc. listed and installed within the limits defined in the American Disabilities Act.


Mounting to Single Gang Electrical Box

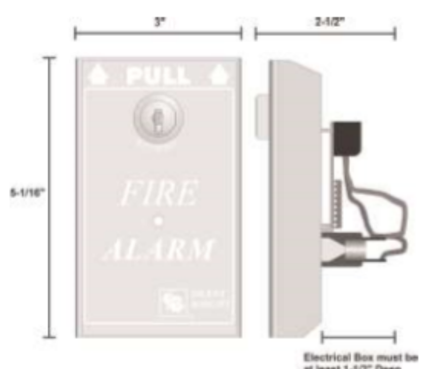

Mounting to Optional Surface Mount Box



Wiring



Installing SD500-LK



Dimensions

SILENT KNIGHT
A Honeywell Company
7550 Meridian Circle, Maple Grove, MN 55369-4927
800-446-6444 or in Minnesota 763-493-6435
FAX: 763-493-6475
World Wide Web: http://www.silentknight.com

MADE IN AMERICA
FORM# 350342, Rev. 09/03

FARADAY

Models F1GT, F1GGT & F1GHT Manual Non-Code Pull Stations

Features

- All metal construction
- Contacts are rated @ 3 amp, 120 Vac or .5 amp, @ 125 Vdc.
- Breakglass or Non-Breakglass operation
- Enclosed switch
- UL, CSFM & MEA listed
- Meets ADA guidelines w/o glass rod
- Made in USA, ISO 9001 quality crafted

Models F1G Manual Non-Code Station

Description

The Faraday non-code manual stations are of all metal construction and are available with contact arrangements to meet all fire alarm system requirements.The rugged construction and recessed pull lever, provide high resistance to inadvertent operation due to sudden shocks, vibrations or accidental contact with moving objects.The breakglass rod also acts as an added deterrent against false operation.

The stations can be semi-flush mounted on a standard single gang box, a 4" box with 3/4" raised single gang plaster ring or surface mounted on an F4 surface back box.

Other features include a compartment for storing a spare glass rod, an enclosed switch and provisions for testing the station.

All contacts are rated @ 3 amp, 120 Vac or .5 amp, @ 125 Vdc.

Operation

Alarm

To actuate the manual station requires a firm downward pull of the recessed pull lever. Such action locks the lever in the operated (down) position, breaks the glass rod and actuates the switch creating an alarm condition. For convenience the glass rod breaks into two pieces, elimination the need to remove glass fragments.

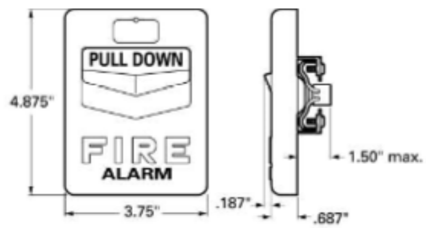
Reset

To restore an operated station to normal standby condition requires the use of a standard allen-head key.The latch, located just above the nameplate, is turned a quarter turn to the left.This allows the front of the station to swing down and allow the pull lever to be reset in the normal standby (up) position. Replacement of the glass rod is not necessary to reset the station. However, a spare glass rod is provided and can be stored directly inside the station.To lock the station, turn the allen-head latch a quarter turn to the right. Allen-head key is supplied with each station.

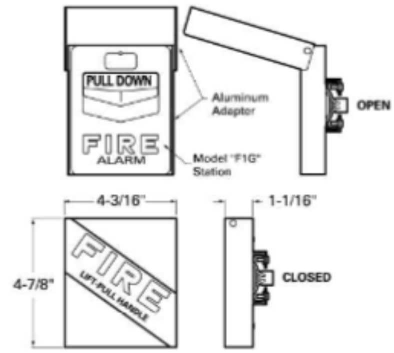
Test

To test the manual station, the allen-head latch is turned and the front of the station swings down. This action operates the switch and activates the alarm system.To restore the station to normal, merely close the frontplate and turn the latch a 1/4 turn to the right.

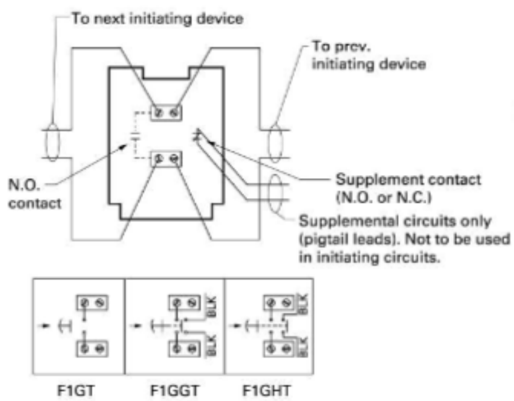
9629



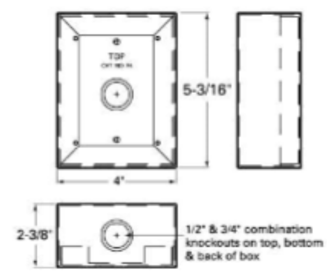
Dimensions - Models F1G



Dimensions - F451173 Double Action Adapter



Typical Wiring Diagrams - Models F1G



Dimensions - F4 Surface Mounting Box

Ordering Information

Model	Description	Part No.
17-450334-35	(1) N.O. contact terminals on initiation contact, F1G Series	500-694508FA
17-450334-38	(1) N.O. contact terminals & (1) N.O. supplemental contact pigtail leads on initiation contact, F1G Series	500-648122FA
17-450334-37	(1) N.O. contact terminals & (1) N.C. supplemental contact pigtail leads on initiation contact, F1G Series	500-694510FA
Accessories		
17-450333-00	Surface mounting box	500-694512FA
17-320001-00	Weatherproof enclosure	500-648123FA
17-340971-00	Spare glass rods, qty. 10	500-694513FA
17-340972-00	Spare hex keys, qty. 10	500-694514FA
17-451173-00	Double action adapter	500-694515FA
10545	ADA extender adapter (see FA/I-5)	500-648229FA
10513	Adapter plate, New York stripe	500-694516FA
10531	(STI1130) Cover, surface mount w/horn	500-648563FA
10539	(STI1200) Cover, flush mount, w/o horn	500-648253FA

FARADAY

Siemens Building Technologies, Inc.
8 Fernwood Road • Florham Park, NJ 07932
Tel: (973) 593-2600 • Fax: (973) 593-6670
Web: www.faradayllc.com

12/03 2M SBT/IG

December 2003 - Supersedes sheet dated 10/99

AutoPulse

Electric Manual Pull Station (IQ-318, IQ-636X-2, 542R, 542D, Z-10)

Features

- UL Listed/FM Approved
- Approved for ADA
- Dual action
- Die-cast metal construction
- Terminal block
- Optional auxiliary contacts
- Flush mounts on single gang box
- Surface mount back box available
- Weatherproof back box available
- High-gloss red enamel finish
- Customized labels
- Keyed to match AUTOPULSE control units

Applications

The Electric Manual Pull Station is a cost-effective, feature-packed, non-coded manual fire alarm pull station. It was designed to meet multiple applications with the installer and end-user in mind.

The pull station provides the AUTOPULSE control panels with an alarm initiating input signal. Its innovative design, durable construction, and multiple mounting options make the pull station simple to install, maintain, and operate.

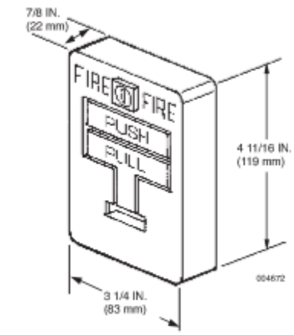
Description

The Electric Manual Pull Station is a high-quality, die-cast metal, dual action fire alarm pull station available with a SPST, DPST or DPDT switch with terminal strip connections. The contacts are rated for 1 Amp at 30 VDC. Gold plating on the contacts avoid the risk of corrosion. All models in the series have been tested by UL for compliance to the latest requirements of the American with Disabilities Act (ADA).

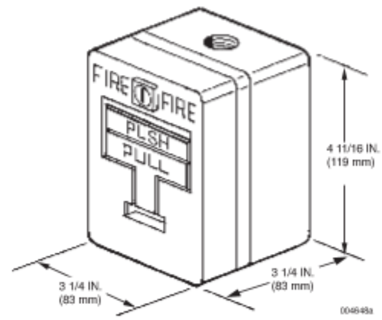
The Electric Manual Pull Station is operated by pushing in the top bar and pulling the handle on the front of the station as far down as it will go. At this point, the handle locks into place and is easily visible from up to 50 ft (15 m). Opening the station with the key, placing the handle in the normal upright position and re-locking the station resets the pull station.

The addressable ready pull station comes with a bracket on the back for securing the FMM-101 Mini Monitor Module (Part No. 428098) (sold separately). The terminal block provides clamping plates for easy connection to the SLC loop and N.O. switch contacts.

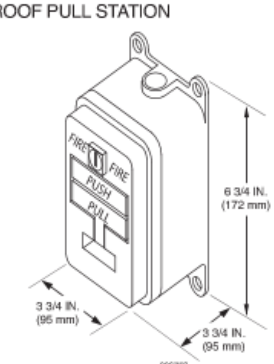
STANDARD PULL STATION



WEATHERPROOF PULL STATION



EXPLOSION-PROOF PULL STATION



TECHNICAL INFORMATION

Conventional

Switch Ratings: . . . . 1 A @ 30 VDC
1 A @ 120 VAC

Switch Type: . . . . SPST or DPST

Terminal Size: . . . . Up to 14 AWG

Color: . . . . Red with raised white letters, white PUSH/PULL HANDLES with raised red letters

Weather Proof with Weather Proof Back Box . . . NEMA 3R

Explosion-proof

Switch Ratings: . . . . 1 A @ 30 VDC,
10 A @ 120 VAC

Switch Type: . . . . DPDT

Terminal Size: . . . . Up to 14 AWG

Humidity: . . . . 90% Relative at 100 °F (37.7 °F)

Explosion Hazard Classifications: . Class I Groups B, C, D; Class II Groups E, F, G; Class III

Weatherproof Classifications: . . . . NEMA Type 4X

Other Classifications: . . . . UL Marine Listing

Conduit Fittings: 2

Conduit Fitting Size: . . . . 3/4 in. – 14 NPT

Color: . . . . Red with raised white letters, white PUSH/PULL handles with raised red letters

LISTINGS AND APPROVALS*

UL. S5654

UL (Explosion-proof Model) . . . . E 192508

ULC. . . . . Listed

Factory Mutual . . . . Approved

California State Fire Marshal (CSFM) 7150-1408:107

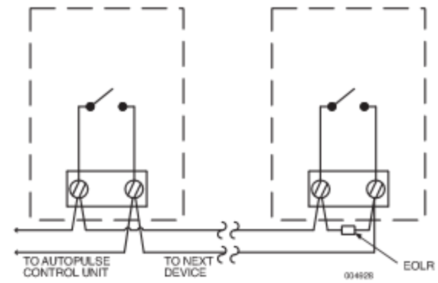
MEA. 382-94-E

* Listings and Approvals are under Signal Communications Corporation

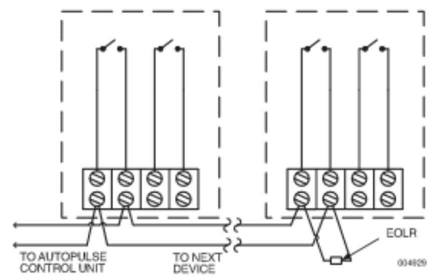
ORDERING INFORMATION

Part No.	Description	Shipping Weight lb	(kg)
428655	Manual Pull Station, SPST	1	(0.45)
428656	Manual Pull Station, DPST	1	(0.45)
428657	Explosion Proof Manual Pull Station	1	(0.45)
428658	Manual Pull Station, Addressable Ready	1	(0.45)
428659	Weatherproof Back Box	1	(0.45)
428660	Surface Back Box	1	(0.45)
428661	Break Rod	1	(0.45)
418336	Key	1	(0.45)
428654	Label Packet	1	(0.45)

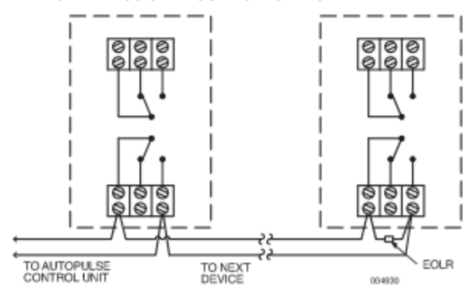
WIRING – SPST PULL STATION



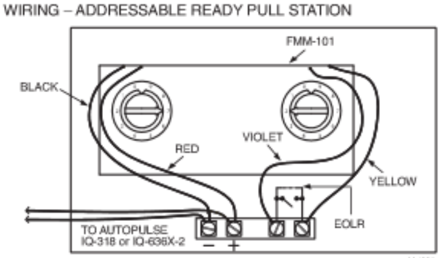
WIRING – DPST PULL STATION



WIRING – EXPLOSION PROOF PULL STATION



WIRING – ADDRESSABLE READY PULL STATION



TYCO FIRE PROTECTION PRODUCTS
ONE STANTON STREET
MARINETTE, WI 54143-2542 715-735-7411

SILENT KNIGHT
by Honeywell

Addressable Photoelectric Smoke Detector

Detect smoldering fires quickly and get help fast with IntelliKnight® photoelectric smoke detectors.

IntelliKnight addressable photoelectric smoke detectors are the clear choice for commercial settings where smoldering fires are a threat. In addition to accurately detecting a smoldering fire, each SD505-APS photoelectric detector has a unique address, which is recognized by the IntelliKnight panel. No precious seconds are wasted in determining location of an alarm.

The SD505-APS compensates automatically for contamination in the environment. And detector testing is simple—even from a remote site. Like other IntelliKnight detector models, the SD505-APS offers a low profile for pleasing aesthetics. The IntelliKnight family of detectors has been designed to use a common base, Model SD505-6AB, allowing complete application and placement flexibility. Combine all this with the features you've come to expect from Silent Knight smoke detectors—easy installation, stable operation, RF/transient protection, and vandal-resistant locking—and it adds up to a flexible solution for all your fire protection needs.

Model SD505-APS
Analog / Addressable
Photoelectric Type
Smoke Detector

The SD505-APS is particularly suited to detecting dense smoke typical of fires involving materials such as soft furnishings, plastic, foam or other similar materials which tend to smolder and produce large visible particles.

The detector features automatic compensation for contamination and a simple detector calibration test procedure that can be run from the panel or remotely (using the Windows™ based downloading software).

Operation

The SD505-APS units made up of an LED light source and a silicon photo diode receiving element. In a normal standby condition, the receiving element receives no light from the pulsing light source. In the event or fire, smoke enters the detector and light is reflected from the smoke particles to the receiving element.

The light received is converted into an electronic signal. Under normal conditions, the status LED blinks approximately every 15 seconds, indicating that the head is communicating with the loop. The LED lights continuously during the alarm period.

Features

- Low profile, 2 inches, including base
- Simple and reliable addressing without mechanical switches
- Automatic compensation for sensor contamination
- Built-in fire test feature
- Simple detector calibration testing through the control panel or remotely through a Windows™ based computer software.
- Vandal-resistance locking features
- Field cleanable
- UL listed, meets NFPA 72 Ch 7 requirements
- CSFM approved
- MEA approved
- FM Approved

SD505-APS Smoke Detector

Specifications

Operating Voltage:	17-41 VDC
Current Consumption:	
Standby:	.55 mA
Alarm:	.55 mA
Ambient Temperature:	32ºF to 120ºF (0ºC to 49ºC)
Mounting:	4" Square, 4" OCT, Single gang mud ring
Relative Humidity:	85% noncondensing
Air Velocity:	0 - 300 FPM
Compatible Bases: (Sold Separately)	SD505-6AB SD505-6IB SD505-6RB SD505-6SB

INTELLIKNIGHT ACCESSORY

Model SD505-APS Addressable Photoelectric Smoke Detector

Engineering Specifications

The contractor shall furnish and install where indicated on the plans, addressable photoelectric smoke detector Silent Knight SD505-APS. The combination detector head, and twist-lock base, shall be UL® listed compatible with Silent Knight's IntelliKnight fire control panels.

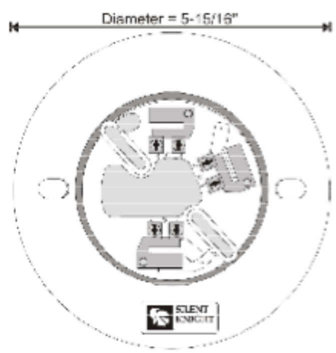
The base shall permit direct interchange with Silent Knight SD505-AIS Ionization Smoke Detector, or SD505-AHS Heat Detector. Base shall be the appropriate twist-lock base SD505-6AB.

The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady. The detector may be reset by actuating the control panel reset switch.

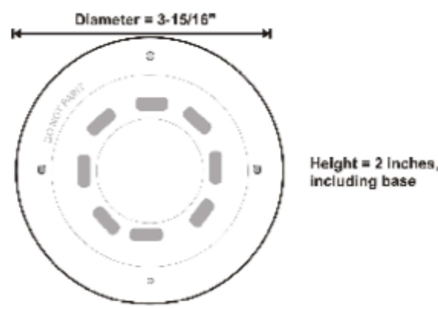
The calibration of the detector shall be capable of being selected and measured by the control panel without the need for external test apparatus.

The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable as required.

The SD505-APS shall automatically perform a functional test of the detector. The test method shall simulate effects of products of combustion in the chamber to ensure testing of detector circuits.



Model SD505-6AB Detector Base (front view)



Model SD505-APS Detector Head (front view)

SILENT KNIGHT by Honeywell

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice. For more information, contact Silent Knight 12 Clintonville Road, Northford, CT 06472-1610 Phone: (800) 328-0103, Fax: (203) 484-7118. www.silentknight.com

MADE IN AMERICA

FORM# 350225 Rev D

NOTIFIER by Honeywell

December 16, 2005 DN-7086

CPX-751 and SDX-751

Low-Profile Intelligent Plug-in Smoke Detectors

Section: Intelligent/Addressable Devices

GENERAL

The NOTIFIER SDX-751 (photo) and CPX-751 (ion) are analog, addressable, low-profile (height measures only 1.66"/ 42.164 mm) smoke detectors designed for the NFS-3030, AM2020, AFP1010, NFS-640, AFP-400, AFP-300, AFP-200, and System 5000 (when equipped with an AIM-200 module).

Because the SDX-751 and CPX-751 are addressable, the control panel can provide fire fighters with a pinpoint description of where the fire is located. The SDX-751 and CPX-751 are also analog devices. The control panel is capable of not only knowing the detector's location but exactly how much smoke is in the chamber of the detector. The detector may be set for different sensitivity settings appropriate to the environment of its location.

Analog devices continually send obscuration values to the control panel. These values may be gathered so as to allow the control panel to determine if a detector has accumulated an excessive amount of dirt or dust. A "maintenance" required indication allows the installer to clean the smoke detector before an unwanted false alarm occurs.

The CPX-751 Intelligent Ionization Sensor incorporates a unique single-source chamber design to respond quickly and dependably to a broad range of fires.

The SDX-751 Intelligent Photoelectric Sensor's unique optical sensing chamber is designed with superior signal to noise ratio. The optical chamber is engineered to sense the presence of smoke produced by a wide range of combustion sources.

FEATURES

- Sleek, low-profile design (height only 1.66"/42.164 mm).
- Common base for both photo and ion detectors.
- Compatible with current SDX-551 and CPX-551.
- Addressable-analog communication.
- Stable communication technique with noise immunity.
- Low standby current.
- Rotary decade 01 to 99 address switches.
- Optional remote, single-gang LED accessory (RA400Z).
- Dual LED design provides 360° viewing angle.
- Visible LEDs blink every time the detector is addressed, and illuminate steady on alarm (LED blink is optional on the NFS-3030, AM2020, AFP1010, NFS-640, AFP-400, AFP-300 and AFP-200).
- Built-in functional test switch activated by external magnet.
- Optional relay, isolator, or sounder bases.
- Listed to UL 268.

UL LISTED S1115

BASES separately listed. Contact factory. ***Optional SMOKE GUARD*** is UL listed with the SDX-751.

SDX-751 with B710LP base

SDX-751 with B501 base

SPECIFICATIONS

Size: 1.66" (42.164 mm) high x 4.1" (104.140 mm) dia.

Shipping weight: 3.6 oz. (104 g).

Operating temperature: 0°C to 49°C (32°F to 120°F).

UL listed velocity range: ***ION:*** 0 – 1500 fpm. ***PHOTO:*** 0 – 4000 fpm.

Relative humidity: 10% – 93% non-condensing.

ELECTRICAL SPECIFICATIONS:

Voltage range: 15 – 32 volts DC peak.

Standby current — *ION:* 200 µA @ 24 VDC (without communication); 300 µA @ 24 VDC (one communication every 5 seconds with LED enabled).

Standby current — *PHOTO:* 230 µA @ 24 VDC (without communication); 330 µA @ 24 VDC (one communication every 5 seconds with LED enabled).

LED current (maximum): 6.5 mA @ 24 VDC ("ON").

For more information, contact **NOTIFIER.** Phone: (203) 484-7161 FAX: (203) 484-7118

NOTIFIER by Honeywell 12 Clintonville Road, Northford, Connecticut 06472

ISO 9001 CERTIFIED ENGINEERING & MANUFACTURING QUALITY SYSTEMS

BASES AVAILABLE:

B710LP: 6.2" (157.48 mm) diameter.

B501: 4.0" (101.6 mm) diameter.

B501BH: Sounder base assembly. Includes B501 base.

B224RB Relay Base: ***Screw terminals:*** up to 14 AWG (2.0 mm²). ***Relay type:*** Form-C. ***Rating:*** 2.0 A @ 30 VDC resistive; 0.3 A @ 110 VDC inductive; 1.0 A @ 30 VDC inductive. ***Dimensions:*** 6.2" (157.48 mm) x 1.2" (30.48 mm).

B524BI Isolator Base: ***Dimensions:*** 6.2" (157.48 mm) x 1.2" (30.48 mm). ***Maximum:*** 25 devices between isolator bases.

INSTALLATION

The CPX-751 and SDX-751 plug-in detectors use a separate base to simplify installation, service, and maintenance. A special tool allows maintenance personnel to plug in and remove detectors without using a ladder.

Mount base on a box which is at least 1.5" (38.1 mm) deep. Suitable mounting base boxes include:

- 4" (101.6 mm) square box.
- 3-1/2" (88.9 mm) or 4" (101.6 mm) octagonal box.
- Single-gang box *(**except** relay or isolator base).*

SMOKE GUARD

Cover: 16 gauge perforated steel (3/16" [4.7625 mm] dia. perforations on 1/4" [6.35 mm] staggered centers). 51% open. SDG-773 is 3" (76.2 mm) deep by 7" (177.8 mm) wide.

Frame: 3/4" x 3/4" (19.05 x 19.05 mm) angle, 14 gauge solid steel.

All guards are supplied with the following:

1) Guards fasten to mounting frame with No. 10/24 x 3/8" (9.525 mm) long Allen-head screws *(10/24 spanner-head screws and tool option at extra cost).*

2) Standard finish: "Cool Tan" baked enamel.

ORDERING INFORMATION

CPX-751 Low-profile intelligent ***ionization*** sensor. Must be mounted to one of the bases listed below.

SDX-751 Low-profile intelligent ***photoelectronic*** sensor. Must be mounted to one of the bases listed below.

BASES:

B710LP Standard U.S. Low-Profile base.

B501 Standard European flangeless base.

B501BH Sounder base, includes B501 base above.

B224RB Intelligent relay base.

B224BI Intelligent isolator base. Isolates SLC from loop shorts.

ACCESSORIES:

SDG-773 Smoke Detector Guard. *For use with SDX-751 **only**.*

F110 Retrofit replacement flange for BX-501 base.

RA400Z* Remote LED annunciator. 3 – 32 VDC. Fits U.S. single-gang electrical box.

MOD400R Detector sensitivity test tool. Use with most analog or digital multimeters. Satisfies requirement of NFPA 72 for sensitivity testing.

SMK400 Surface mounting kit provides for entry of surface wiring conduit. *For use with B501 base **only**.*

M02-04-01 Test magnet.

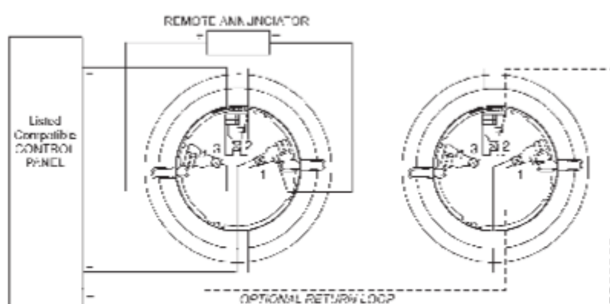
M02-09-00 Test magnet with telescope stick.

XR-2 Detector removal tool. Allows installation and/or removal of 700 Series detector heads from base in high ceiling installations.

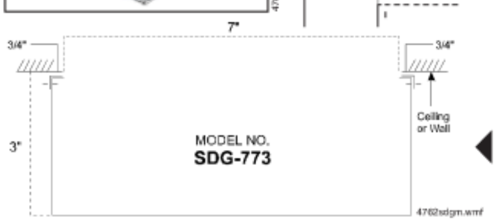
XP-4 Extension pole for XR-2. Comes in three five-foot sections.

**Supported by B710LP and B501 bases only.*

NOTIFIER® is a registered trademark of Honeywell International Inc.



▲ **WIRING DIAGRAM *(standard base)***



◀ **MOUNTING DIAGRAM *(SDG-773)***

Page 2 of 2 — DN-7086 • 12/16/05

WFD and WFDT(NR)

Waterflow Detectors

NOTIFIER® by Honeywell

Conventional Initiating Devices

GENERAL

WFD SERIES

The System Sensor WFD Series Waterflow Detectors are compatible with Schedule 10 through 40 steel pipe, sizes 2" through 8" (50.8 mm through 203.2 mm), and can be mounted in a vertical or horizontal position.

Robust construction. WFD Series detectors are contained in a rugged, NEMA 4-rated enclosure. Designed for both indoor and outdoor use, the WFD Series operates across a wide temperature range: 32°F to 120°F (0°C to 49°C).

Reliable performance. UL-Listed models are equipped with tamper-resistant cover screws to prevent unauthorized entry. Inside, two sets of SPDT (Form-C) synchronized switches are enclosed in a durable terminal block to assure reliable performance.

False-alarm immunity. WFD Series detectors incorporate a mechanical retard feature, which minimizes the risk of false alarm due to pressure surges or air trapped in the sprinkler system. Additionally, the mechanical retard's unique sealed design is immune to dust and other contaminants.

Simplified operation. The WFD Series is designed to simplify installation. Two conduit openings permit easy attachment to the local alarm system. The retard mechanism and dual SPDT switches are field-replaceable.

WFDT/WFDTNR T-TAP MODELS

The System Sensor WFDT Retard and WFDTNR Non-Retard T-Tap Waterflow Detectors are designed for branch-line signaling in larger systems and for primary signaling in residential systems. Both models fit any tee that has a 1" (25.4 mm) NPT branch, including: 1" (25.4 mm), 1.25" (31.75 mm), and 1.5" (38.1 mm) NPT threaded ferrous and brass tees; 1" (25.4 mm), 1.25" (31.75 mm), 1.5" (38.1 mm), and 2" (50.8 mm) copper sweat tees; Central, Spears®, and Victaulic® 1" (25.4 mm) CPVC tees; and 1.5" (38.1 mm) polybutylene tees.

Design. The design of the WFDT and WFDTNR makes them easy to install and simple to maintain. Either can be mounted in the vertical or horizontal position. Two conduit openings permit easy attachment to the local alarm system. The retard mechanism (models WFDT(A) only) and switch assemblies are field-replaceable.

Features. Nine different flexible plastic paddles fit 1" (25.4 mm), 1.25" (31.75 mm), 1.5" (38.1 mm), and 2" (50.8 mm) tees. Sizes are marked clearly on the paddle for ease of installation. Plastic paddles slip over the actuating lever and are securely fastened with one screw. The handy depth gauge ensures the proper installation depth and clearance of the detector to the tee.

Construction. The WFDT(A) and WFDTNR include a durable tamper-resistant enclosure and a rugged switch assembly. The long-lasting covers completely enclose the electrical components to keep out dust and dirt. Improved self-guiding security screws and removal tools make these detectors resistant to tampering and simplify field maintenance. Dual SPDT switches are enclosed in a durable terminal block for added strength.

WFD Series Waterflow Detector

FEATURES

- WFD30-2 models install in 2" (50.8 mm) hole sizes.
- UL-Listed models are NEMA 4-rated (WFD Series).
- Sealed retard mechanism (WFD Series and models WFDT(A)) assures that the retard is not contaminated by dust and dirt when the cover is removed.
- Visual switch activation (WFD Series and models WFDT(A)) permits installer to accurately set retard under noisy conditions.
- Rugged dual SPDT switches are enclosed in a durable terminal block.
- Durable construction: metal enclosure; heavy-duty aluminum pipe saddles; impact-resistant cover protects mechanism; steel U-bolts provide secure mounting.
- Tamper-resistant assembly; optional tamper indicator.
- Accommodates up to 12 AWG (3.25 mm²) wire.
- 100% synchronization activates both alarm panel and local bell simultaneously.
- 1" (25.4 mm) through 8" (203.2 mm) models available.
- Schedule 10/40 pipe.
- Water resistant.
- SEMS clamping plate.
- Can be vertically or horizontally mounted.
- Improved self-guiding security screws and removal tool.
- Adjustable pneumatic delay (0 to 70 seconds) prevents false alarms due to water surges.
- Serviceable without draining pipe.
- Requires no power to operate sensing mechanism.
- Useful for waterflow rates up to 15 feet per second (4.57 meters per second).

OPERATION

Water flowing in the pipe deflects the detector's vane, which operates a linkage to release the pneumatic delay shaft. The stop on the shaft then releases the switch levers at a rate determined by the presetting of the pneumatic delay mechanism. When the shaft and its stops have pulled far enough away, the spring operated switch levers actuate both SPDT switches, which each have N.O. and N.C. terminals that can be used to initiate an alarm or auxiliary indication.

When water stops flowing, the vane is no longer deflected and a spring draws the actuator arm of the linkage back against the stops on the pneumatic delay shaft, closing the switch levers and returning the device to its normal condition. Observe switch activation with cover open.

The pneumatic delay mechanism is adjustable within a range of 0 to 70 seconds. It incorporates an automatic, noncumulative reset to accommodate a sequence of surges without acquiring an accumulated delay greater or less than the preset value. As shipped, the adjustment dial is set for a delay of 20-30 seconds; but any value within the 0- to 70-second range can be selected in the field.

APPLICATIONS

Detectors are used in wetpipe sprinkler systems to signal waterflow of 4 to 10 GPM. The flow could be due to the opening of one or more sprinkler heads or test valves, or it could be due to leakage or rupture of the piping.

By the appropriate choice of installation sites, the detectors can be used to signal general flow (installed in mains) or flow by zones (installed in branch lines). Either horizontal or vertical pipes can be utilized.

Common usages of these waterflow detectors include operating a bell or horn at the riser and signaling a control panel or master box.

If the detectors are used at the upper limits of their temperature ranges, especially at a 100% duty cycle, their working life may be significantly shortened.

The vane and linkage of the waterflow detectors CAN BE DAMAGED by the sudden rush of water when the control valve opens. DO NOT USE vane-type waterflow detectors in drypipe sprinkler systems, deluge systems, or pre-action systems. Use a pressure-actuated detector on such systems instead.

SPECIFICATIONS

WFD SERIES

Static Pressure Rating: 450 PSI.

Triggering Threshold Bandwidth (flow rate): 4 to 10 GPM.

Maximum Surge: 18 feet per second (FPS) (5.4864 m/sec).

Compatible Pipe: steel water pipe, schedule 10 through 40.

Contact Ratings: two sets of SPDT (Form-C) contacts; 10.0 A @ 125/250 VAC; 2.5 A @ 24 VDC only.

Conduit Entrances: two openings for 0.5" (12.7 mm) conduit. One open, one knock-out type.

Operating Temperature Range: 32°F to 120°F (0°C to 49°C).

Enclosure Rating: NEMA 4, suitable for indoor/outdoor use (UL Listed only).

Cover Tamper Switch: standard for ULC models; optional for UL models (P/N 546-7000).

Shipping Weights: 4.2 lbs. (1.9 kg) for WFD20; 4.3 lbs. (1.95 kg) for WFD25; 4.5 lbs. (2.04 kg) for WFD30 and WFD30-2; 4.7 lbs. (2.13 kg) for WFD35; 5.2 lbs. (2.36 kg) for WFD40; 6.3 lbs. (2.86 kg) for WFD50; 6.8 lbs. (3.08 kg) for WFD60; 7.5 lbs. (3.4 kg) for WFD80.

Service Use: NFPA 13 for Automatic Sprinkler; NFPA 13D for One- or Two-Family Dwelling; NFPA 13R for Residential Occupancies up to Four Stories; NFPA 72 for National Fire Alarm Code.

Warranty: 3 years.

U.S. Patent Numbers: 3,845,259 • 4,782,333 • 5,213,205

WFDT AND WFDTNR MODELS

Static Pressure Rating: 250 PSI.

Triggering Threshold Bandwidth (flow rate): 4 to 10 GPM.

Maximum Surge: 18 feet per second (FPS) (5.4864 m/sec).

Compatible Tee Fittings: threaded ferrous and brass tees, copper sweat tees, CPVC tees, and polybutylene tees.

Contact Ratings: two sets of SPDT (Form-C) contacts; 10.0 A @ 125/250 VAC; 2.5 A @ 24 VDC.

Overall Dimensions (installed): WFDT: 4.5" (114.30 mm) x 3.75" (95.25 mm) x 6.7" (170.18 mm). WFDTNR: 3.75" (95.25 mm) x 3.25" (82.55 mm) x 4.25" (107.95 mm).

Conduit Entrances: 2 openings for 0.5" (12.7 mm) conduit.

Operating Temperature Range: 32°F to 120°F (0°C to 49°C).

Enclosure Rating: UL indoor/outdoor rating.

Cover Tamper Switch: standard for ULC models; optional for UL models (P/N 546-7000).

Shipping Weights: 2.6 lbs. (1.2 kg) for WFDT; 1.5 lbs. (0.7 kg) for WFDTNR.

Service Use: NFPA 13 for Automatic Sprinkler; NFPA 13D for One- or Two-Family Dwelling; NFPA 13R for Residential Occupancies up to Four Stories; NFPA 72 for National Fire Alarm Code.

Warranty: 3 years.

U.S. Patent Numbers: 3,845,259 • 4,782,333 • 5,213,205

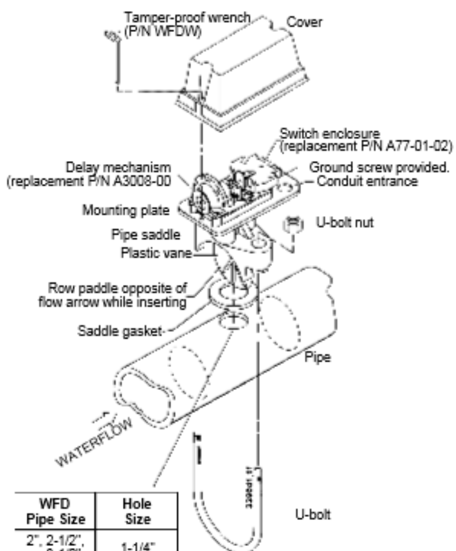
ARCHITECTURAL/ENGINEERING SPECIFICATIONS

WFD SERIES

Vane-type waterflow detectors shall be installed on system piping as designated on the drawing and/or as specified herein. Detectors shall mount on any clear pipe span of the appropriate nominal size, either a vertical upflow or horizontal run, at least 6" (152.4 mm) from any fittings which may change water direction, flow rate, or pipe diameter; or no closer than 24" (0.6096 m) from a valve or drain. Detectors shall have a sensitivity in the range of 4 to 10 gallons per minute and a static pressure rating of 450 psi for 2" (50.8 mm) to 8" (203.2 mm) pipes. The detector shall respond to waterflow in the specified direction after a preset time delay which is field-adjustable. The delay mechanism shall be a sealed mechanical pneumatic unit with visual indication of actuation. The actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and connected by a mechanical linkage to the delay mechanism. Outputs shall consist of dual SPDT switches (Form-C contacts). Two conduit entrances for standard fittings of commonly used electrical conduit shall be provided on the detectors. A grounding provision is provided. Unless noted, enclosures shall be NEMA 4 Listed by Underwriters Laboratories Inc. All detectors shall be Listed by Underwriters Laboratories Inc. for indoor or outdoor use.

WFDT or WFDTNR Models

Model shall be a WFDT or WFDTNR as manufactured by System Sensor. T-tap waterflow detectors shall be installed on a tee that has a 1" (25.4 mm) NPT branch, including: 1" (25.4 mm), 1.25" (31.75 mm), or 1.5" (38.1 mm) threaded ferrous or brass tees; 1" (25.4 mm) to 2" (50.8 mm) copper sweat tees; Central, Spears®, or Victaulic® brand 1" (25.4 mm) CPVC tees; or 1.5" (38.1 mm) polybutylene tee as designated on the drawings and/or specified herein. Detectors shall mount on any clear pipe span of the appropriate size, either a vertical or horizontal run at least 6" (152.4 mm) from any fittings or valves which may change water direction, flow rate, or pipe diameter; or no closer than 24" (0.6096 m) from a valve or drain. Detectors shall have a sensitivity in the range of 4 to 10 gallons per minute and a static pressure rating of 250 psi. The retard t-tap detector shall be a sealed mechanical pneumatic unit with visual indication of actuation. The actuation mechanism shall include a polyethylene vane inserted through the tee fitting and connected by a mechanical linkage to the delay mechanism. The non-retard t-tap detector shall respond with no time delay to waterflow in the specified direction and range. Outputs shall consist of dual SPDT switches (Form-C contacts). Two conduit entrances (one of which is knock-out type) for standard fittings of commonly used electrical conduit shall be provided on the detectors. A grounding provision is provided. All detectors shall be Listed by Underwriters Laboratories Inc. for indoor or outdoor use.



WFD Pipe Size	Hole Size
2", 2-1/2", or 3-1/2"	1-1/4"
3"	2"
4" to 8"	2"

3396pipe.tbl

Agency Listings and Approvals

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

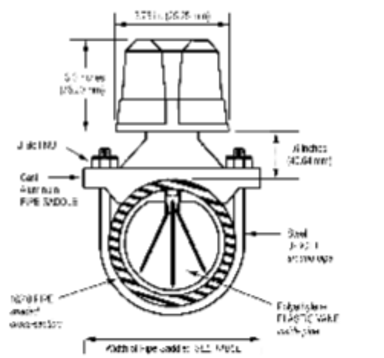
- **UL Listed:** S739
- **ULC Listed:** S739
- **MEA Listed:** 167-93-E
- **CSFM:** 7770-1653:114
- **FM Approved**

Mechanical Delay Adjustment

Dial Setting	0	1	2	3	4	5
Seconds (±50%)	0	15	30	45	55	70

3396dial.tbl

WFD Dimensions (installed)



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WFD Dimensions (installed)

Detector Model	Pipe Saddle Width
WFD20	4.6" (116.84 mm)
WFD25	4.6" (116.84 mm)
WFD30-2	5.2" (132.08 mm)
WFD35	5.7" (144.79 mm)
WFD40	6.8" (172.72 mm)
WFD50	7.8 (198.12 mm)
WFD60	9.0" (228.60 mm)
WFD80	10.8" (274.32mm)

Ordering Information

WFD Series Detectors			
UL Models	**ULC Models**	**Pipe Size**	**Hole Size**
WFD20	WFD20A	2.0" (50.8 mm)	1.25" (31.75 mm)
WFD25	WFD25A	2.5" (63.5 mm)	1.25" (31.75 mm)
WFD30-2	WFD30-2A	3.0" (76.2 mm)	2.00" (50.8 mm)
WFD35	WFD35A	3.5" (88.9 mm)	1.25" (31.75 mm)
WFD40	WFD40A	4.0" (101.6 mm)	2.00" (50.8 mm)
WFD50	WFD50A	5.0" (127 mm)	2.00" (50.8 mm)
WFD60	WFD60A	6.0" (152.4 mm)	2.00" (50.8 mm)
WFD80	WFD80A	8.0" (203.2 mm)	2.00" (50.8 mm)

WFDT(NR) T-Tap Detectors	
Model Number	**Description**
WFDT	Waterflow detector. Fits: 1" (25.4 mm), 1.25" (31.75 mm), 1.5" (38.1 mm) ferrous and brass threaded tees; 1" (25.4 mm), 1.25" (31.75 mm), 1.5" (38.1 mm), 2" (50.8 mm) copper sweat tees; 1" (25.4 mm) CPVC tees; and 1.5" (38.1 mm) polybutylene tees.

Accessories and Replacement Parts	
Model Number	**Description**
WFDW	*Tamper-proof wrench* for metal cover, WFD, WFDT(NR).

MODEL PS40A
HIGH/LOW PRESSURE SWITCHES

POTTER The Symbol of Protection

PS40-1A Single Switch - Stock No. 1340401
PS40-2A Double Switch - Stock No. 1340402

UL and CSFM Listed, FM and LPC Approved, NYMEA Accepted, CE Marked

Dimensions: 4 3/4" (12,1cm)W x 2 1/4" (5,7cm)D x 4 3/8" (11,1cm)H

Enclosure: Cover - Die-cast with textured red powdercoat finish.
Base - Plated Steel

Pressure Connection: 1/2" NPT Male

Factory Adjustment:
PS40-1A: Operates on decrease at 30 PSI (2,1 BAR)
PS40-2A: Operates on increase at 50 PSI (3,5 BAR), and on decrease at 30 PSI (2,1 BAR)

Pressure Range: 10 - 175 PSI (0,7 - 12,1 BAR)

Maximum Differential: Approx. 2 lbs. at 20 PSI (0,14@1,4 BAR)
5 lbs. at 175 PSI (0,35@12,1 BAR)

Maximum System Pressure: 250 PSI (17,2 BAR)

Switch Contacts: SPDT (Form C)
15.0 Amps at 125/250VAC, 2.5 Amps at 30VDC
One set in PS40-1A, Two sets in PS40-2A

Environmental Specifications:
Indoor or outdoor use
NEMA 4/IP55 Rated Enclosure - when used with proper conduit fittings
Temperature range: -40°F to 140°F (-40°C to 60°C)
(Not for use in hazardous locations)

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

Tamper: Cover incorporates tamper resistant fasteners that require a special key for removal. One key is supplied with each device. For optional cover tamper switch kit, order Stock No. 0090134.

The PS40A is designed as a pressure type supervisory switch. The NFPA 72, National Fire Alarm Code, requires that a low pressure signal is sent at 10 psi below normal air pressure and 10 psi above normal pressure on dry pipe valves. Therefore, the PS40-2A switches are factory set for a pressure decrease at 30 psi and a pressure increase at 50 psi with a normal air pressure of 40 psi. The switches are adjustable at any point between 10 and 175 psi.

The PS40-1A is intended for applications that are looking for a specific pressure, either increase or decrease. These applications would include monitoring city water pressure or monitoring a water tank pressure.

INSTALLATION AND TEST PROCEDURES

Mounting: The device should be mounted in the upright position (threaded connection down). Only teflon tape should be applied to the male threads. Using pipe joint cement or pipe thread compound (pipe dope) could obstruct the device and cause it to not work properly.

In outdoor applications, a NEMA type 4 conduit hub should be installed.

If the pressure needs to be adjusted from the factory settings, adjust the system pressure to the desired trip point. Use a ohm meter on the appropriate contacts (COM and NC for pressure decrease and COM and NO for pressure increase). Adjust the knurled knob until the meter indicates continuity. At that point the switch is set for that particular pressure. When the adjustments are complete, raise and lower the system pressure to ensure the switch is properly set.

On dry systems, connect the PS40A in the air supply line on the system side of any shutoff and check valves.

Provisions for testing the unit without affecting the entire system can be accomplished with the installation of a Potter Bleeder Valve (Model BVL) in the line to the PS40A.

Testing: The operation of the pressure supervisory switch should be tested upon completion of installation and periodically thereafter in accordance with the applicable NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

CAUTION: Testing the PS40A may activate other system connected devices.

Potter Electric Signal Company • 2081 Craig Road, St. Louis, MO, 63146-4161 • Phone: 800-325-3936/Canada 888-882-1833 • www.pottersignal.com

POTTER
The Symbol of Protection

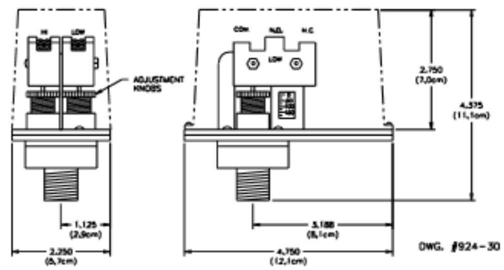
MODEL PS40A
HIGH/LOW PRESSURE SWITCHES

DIMENSIONS

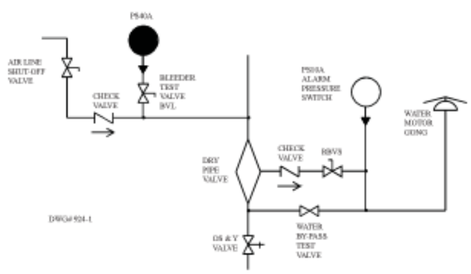
NOTE:
TO PREVENT LEAKAGE, APPLY TEFLON TAPE SEALANT TO MALE THREADS ONLY.

WARNING:
USE OF PIPE JOINT CEMENT MAY RESULT IN OBSTRUCTION OF APERTURE AND LOSS OF SIGNAL.

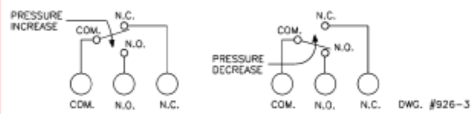
FIELD ADJUSTMENTS: The operating point of the switch (or switches on the PS40-2A) can be adjusted to any point between 10 and 175 PSI (0,7 and 12,1 BAR) by turning the adjustment knob(s) clockwise to raise the actuation point, and counter-clockwise to lower the actuation point. In the case of the PS40-2A, the two switches operate completely independently of one another, and each switch may be adjusted to actuate at any point the system requires. Final adjustment should be made with a pressure gauge.



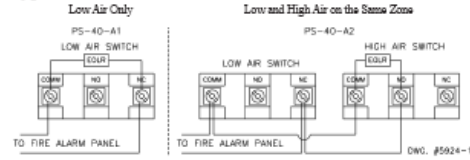
Typical Sprinkler Application - Dry System



Pressure Switch Terminations



Typical Electrical Connections

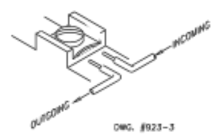


NOTE: High switch changes with pressure increase. Low switch changes with pressure decrease.

Ordering Information

Model	Description	Stk. No.
PS40-1A	Pressure switch with one set SPDT contacts	1340401
PS40-2A	Pressure switch with two sets SPDT contacts	1340402
BVL	Bleeder Valve	1000018
	Hex Key	5250062
	Cover Tamper Switch	0090134
RBVS	Ball Valve tamper switch	1000040

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.

Engineer/Architect Specifications

Air pressure supervisory switch shall be a Model PS40A as manufactured by Potter Electric Signal Co. of St. Louis, Mo. and shall be installed on the sprinkler systems as shown on the drawings and/or as specified herein.

Switches shall be provided with a 1/2" NPT male pressure connection to be connected into the air supply line on the system side of any shut-off valve. A Model BVL bleeder valve as supplied by Potter Electric Signal Co. of St. Louis, Mo. or equivalent shall be connected in line with the PS40A to provide a means of testing the operation of the supervisory switch. (See DWG. #924-1)

The switch unit shall contain SPDT (Form C) switch(es). One switch shall operate at a pressure decrease of 10 PSI (0,7 BAR) from normal. If two switches are provided, the second switch shall operate at a pressure increase of 10 PSI (0,7 BAR) from normal. Switch contacts shall be rated at 15.0 Amps at 125/250VAC and 2.5 Amps at 30VDC. The units shall have a maximum pressure rating of 250 PSI (17,2 BAR) and shall be adjustable from 10 to 175 PSI (0,7 to 12,1 BAR).

The switch housing shall be weatherproof and oil resistant. The cover shall incorporate tamper resistant screws.

The unit shall be UL and CSFM Listed, FM and LPC Approved, and NYMEA Accepted.

POTTER
The Symbol of Protection

PS10 SERIES
PRESSURE SWITCH

UL, cUL, and CSFM Listed, FM and LPC Approved, NYMEA Accepted, CE Marked

Dimensions: 3.78" (9,6cm)W x 3.20" (8,1cm)D x 4.22" (10,7cm)H

Conduit Entrance: Two knockouts provided for 1/2" conduit. Individual switch compartments and ground screws suitable for dissimilar voltages.

Enclosure: Cover - Die-cast with textured red powdercoat finish, single cover screw and rain lip.
Base - Die-cast

Pressure Connection: Nylon 1/2" NPT Male

Factory Adjustment: 4 - 8 PSI (0,27 - 0,55 BAR)
Differential: 2 PSI (0,13 BAR) typical

Maximum System Pressure: 300 PSI (20,68 BAR)

Switch Contacts: SPDT (Form C)
10.1 Amps at 125/250VAC, 2.0 Amps at 30VDC
One SPDT in PS10-1, Two SPDT in PS10-2

Environmental Specifications:
NEMA 4/IP66 Rated Enclosure - indoor or outdoor when used with NEMA 4 conduit fittings.
Temperature range: -40°F to 140°F (-40°C to 60°C)

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

Ordering Information

Model	Description	Stock No.
PS10-1	Pressure switch with one set SPDT contacts	1340103
PS10-2	Pressure switch with two sets SPDT contacts	1340104
	Hex Key	5250062
	Cover Tamper Switch Kit	0090200

Tamper
Cover incorporates tamper resistant fastener that requires a special key for removal. One key is supplied with each device. For optional cover tamper switch kit, order Stock No. 0090200. See bulletin #5401200 PSCTSK.

Installation
The Potter PS10 Series Pressure Actuated Switches are designed for the detection of a waterflow condition in automatic fire sprinkler systems of particular designs such as wet pipe systems with alarm check valves, dry pipe, preaction, or deluge valves. The PS10 is also suitable to provide a low pressure supervisory signal; adjustable between 4 and 15 psi (0,27 and 1,03 BAR).

1. Apply Teflon tape to the threaded male connection on the device. (Do not use pipe dope)
2. Device should be mounted in the upright position (threaded connection down).
3. Tighten the device using a wrench on the flats on the device.

Wiring Instructions
1. Remove the tamper resistant screw with the special key provided.
2. Carefully place a screwdriver on the edge of the knockout and sharply apply a force sufficient to dislodge the knockout plug. See Fig 9
3. Run wires through an approved conduit connector and affix the connector to the device.
4. Connect the wires to the appropriate terminal connections for the service intended. See Figures 2,4,5, and 6. See Fig 7 for two switch, one conduit wiring.

Testing
The operation of the pressure alarm switch should be tested upon completion of installation and periodically thereafter in accordance with the applicable NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

Wet System
Method 1: When using PS10 and control unit with retard - connect PS10 into alarm port piping on the input side of retard chamber and electrically connect PS10 to control unit that provides a retard to compensate for surges. Insure that no unsupervised shut-off valves are present between the alarm check valve and PS10.

Method 2: When using the PS10 for local bell application or with a control that does not provide a retard feature - the PS10 must be installed on the alarm outlet side of the retard chamber of the sprinkler system.

Testing: Accomplished by opening the inspector's end-of-line test valve. Allow time to compensate for system or control retard.

Note: Method 2 is not applicable for remote station service use, if there is an unsupervised shut-off valve between the alarm check valve and the PS10.

Wet System With Excess Pressure
Connect PS10 into alarm port piping extending from alarm check valve. Retard provisions are not required. Insure that no unsupervised shut-off valves are present between the alarm check valve and the PS10.

Testing: Accomplished by opening the water by-pass test valve or the inspector's end-of-line test valve. When using end-of-line test, allow time for excess pressure to bleed off.

Dry System
Connect PS10 into alarm port piping that extends from the intermediate chamber of the alarm check valve. Install on the outlet side of the in-line check valve of the alarm port piping. Insure that no unsupervised shut-off valves are present between the alarm check valve and the PS10.

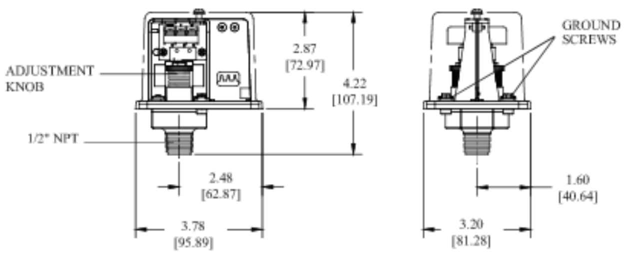
Testing: Accomplished by opening the water by-pass test valve.

Note: The above tests may also activate any other circuit closer or water motor gongs that are present on the system.

POTTER
The Symbol of Protection

PS10 SERIES
PRESSURE SWITCH

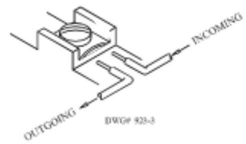
Dimensions
Fig. 1



NOTE: To prevent leakage, apply Teflon tape sealant to male threads only.

DWG# 930-1

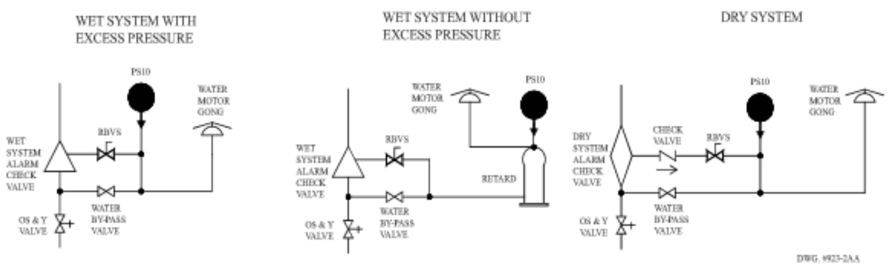
Switch Clamping Plate Terminal
Fig. 2



⚠ WARNING

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.

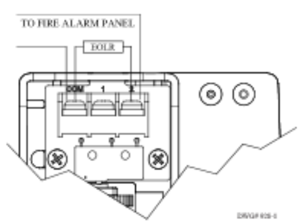
Typical Sprinkler Applications
Fig. 3



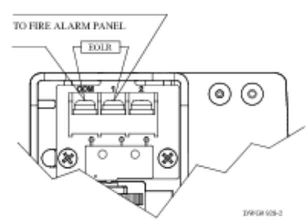
⚠ CAUTION

Closing of any shutoff valves between the alarm check valve and the PS10 will render the PS10 inoperative. To comply with NFPA-72 any such valve shall be electrically supervised with a supervisory switch such as Potter Model RBVS.

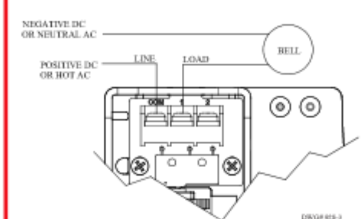
Low Pressure Signal Connection
Fig. 4



Waterflow Signal Connection
Fig. 5



Local Bell For Waterflow Connection
Fig. 6



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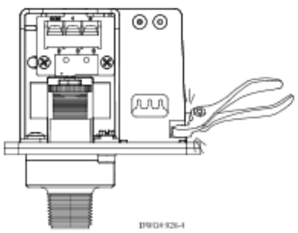
One Conduit Wiring

Fig. 7

Break out thin section of divider to provide path for wires when wiring both switches from one conduit entrance.



Switch Operation

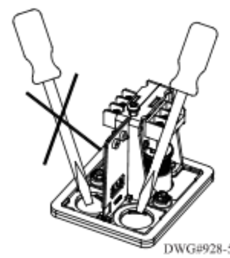
Fig. 8

Terminal
C: Common
1: Closed when installed under normal system pressure.
2: Open when installed under normal system pressure. Closes on pressure drop. Use for low pressure supervision.

Terminal
1: Open with no pressure supplied. Closes upon detection of pressure. Use for waterflow indication.
2: Closed with no pressure applied.

Removing Knockouts

Fig. 9



⚠ WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Read all instructions carefully and understand them before starting installation. Save instructions for future use. Failure to read and understand instructions could result in improper operation of device resulting in serious injury or death.
- Risk of explosion. Not for use is hazardous locations. Serious injury or death could result.

⚠ CAUTION

- Do not tighten by grasping the switch enclosure. Use wrenching flats on the bushing only. Failure to install properly could damage the switch and cause improper operation resulting in damage to equipment and property.
- To seal threads, apply Teflon tape to male threads only. Using joint compounds or cement can obstruct the pressure port inlet and result in improper device operation and damage to equipment.
- Do not over tighten the device, standard piping practices apply.

Engineer/Architect Specifications Pressure Type Waterflow Switch

Pressure type waterflow switches; shall be a Model PS10 as manufactured by Potter Electric Signal Company, St Louis MO., and shall be installed on the fire sprinkler system as shown and or specified herein.

Switches shall be provided with a ½" NPT male pressure connection and shall be connected to the alarm port outlet of; Wet Pipe Alarm Valves, Dry Pipe Valves, Pre-Action Valves, or Deluge Valves. The pressure switch shall be actuated when the alarm line pressure reaches 4 - 8 PSI (0,27 - 0,55 BAR).

Pressure type waterflow switches shall have a maximum service pressure rating of 300 PSI (20,68 BAR) and shall be factory adjusted to operate on a pressure increase of 4 - 8 PSI (0,27 - 0,55 BAR)

Pressure switch shall have one or two form C contacts, switch contact rating 10.1 Amps at 125/250 VAC, 2.0 Amps at 30 VDC.

Pressure type waterflow switches shall have two conduit entrances one for each individual switch compartment to facilitate the use of dissimilar voltages for each individual switch.

The cover of the pressure type waterflow switch shall be Zinc die-cast with rain lip and shall attach with one tamper resistant screw. The Pressure type waterflow switch shall be suitable for indoor or outdoor service with a NEMA 4/IP66 rating.

The pressure type waterflow switch shall be UL Ulc and CSFM listed, FM and LPC approved and NYMEA accepted.

SYSTEM SENSOR®

SSM/SSV Series Alarm Bells

System Sensor's SSM and SSV series alarm bells are low current, high decibel notification appliances for use in fire and burglary systems or other signaling applications.

Features

- Approved for indoor and outdoor use
- Low current draw
- High dB output
- Available in six-inch, eight-inch, and ten-inch sizes
- AC and DC models
- DC models polarized for use with supervision circuitry
- Mount directly to standard four-inch square electrical box indoors
- SSM and SSV series come pre-wired

Reliable Performance. The SSM and SSV series provide loud resonant tones. The SSM series operates on 24VDC and are motor driven, while the SSV series operates on 120VAC utilizing a vibrating mechanism.

Simplified Installation. For indoor use, the SSM and SSV series mount to a standard four-inch square electrical box. For outdoor applications, weatherproof back box, model number WBB, is used.

The SSM and SSV series come pre-wired, to reduce installation time. The SSM series incorporates a polarized electrical design for use with supervision circuitry.

Agency Listings

LISTED S4011

CS549

FM APPROVED 3005255

7135-1653:0217

MEA approved 331-01-E

SSM/SSV Specifications

Architectural/Engineering Specifications
Model shall be a SSM or SSV Series alarm bell. Bells shall have underdome strikers and operating mechanisms. Gongs on said bells shall be no smaller than nominal 6″/8″/10″ (specify size) with an operating voltage of 24VDC or 120VAC (specify by part number). Bells shall be suitable for surface or semi-flush mounting. Outdoor surface mounted installations shall be weatherproof (using optional WBB weatherproof electrical box). Otherwise bells shall mount to a standard 4″ square electrical box having a maximum projection of 2½″. Bells shall be located as shown on the drawings or as determined by the Authority Having Jurisdiction. Bells shall be listed for indoor/outdoor use by Underwriters Laboratories and the California State Fire Marshal, and approved by Factory Mutual and MEA.

Physical/Operating Specifications	
Operating Temperature Range	−31°F to 140°F
Operating Voltage	SSM series: 24 VDC SSV series: 120 VAC
Termination	Provided with 2 sets of leads for in/out wiring
Service Use	Fire Alarm, General Signaling, Burglar Alarm
Warranty	3 years

Electrical Specifications

Model	Gong Diameter (inches)	Nominal Voltage	Operating Voltage Limit	Maximum Current	Sound Output (dBA)
SSM24-6	6	Regulated 24VDC	16 to 33VDC	DC-31.1mA/ FWR-53.5mA	82
SSM24-8	8	Regulated 24VDC	16 to 33VDC	DC-31.1mA/ FWR-53.5mA	80
SSM24-10	10	Regulated 24VDC	16 to 33VDC	DC-31.1mA/ FWR-53.5mA	81
SSV120-6	6	Regulated 120VAC	96 to 132VAC	53mA	85
SSV120-8	8	Regulated 120VAC	96 to 132VAC	53mA	82
SSV120-10	10	Regulated 120VAC	96 to 132VAC	53mA	82

* Sound output measured at Underwriter Laboratories, as specified in UL464

Ordering Information

UL/FM Model No.	ULC/Canadian Model No.	Description
SSM24-6	SSM24-6A	Bell, 6″, 24VDC, Polarized, 82dBA
SSM24-8	SSM24-8A	Bell, 8″, 24VDC, Polarized, 80dBA
SSM24-10	SSM24-10A	Bell, 10″, 24VDC, Polarized, 81dBA
SSV120-6	SSV120-6A	Bell, 6″, 120VAC, 85dBA
SSV120-8	SSV120-8A	Bell, 8″, 120VAC, 82dBA
SSV120-10	SSV120-10A	Bell, 10″, 120VAC, 82dBA
WBB		Weatherproof back box for SSM and SSV series, when installed outdoors

SYSTEM SENSOR

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495

CORPORATE OFFICE & WAREHOUSE
2081 Craig Road
St. Louis, Missouri 63146
(800) 325-3936
Fax: (800) 768-8377
Local: (314) 878-4321

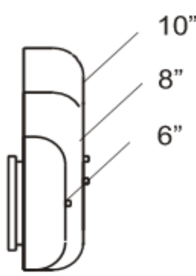
Www.amseco-kai.com/sales@pottersignal.com

MBA Series
Indoor/Outdoor Fire Alarm
DC Motor Driven Bells

Description:
AMSECO's MBA Series Indoor/Outdoor bells utilize a specially designed gong, that gives out a loud mechanical resonant tone. This improvement is designed to make the whole series more effective and provide performance and dependability at a low current consumption. The bell design incorporates a micro-motor with built-in varistor suppression element, to reduce RFI and EMI interference found in today's highly integrated microprocessor driven control panels. The terminal design makes it convenient when wiring or trouble-shooting. The design features as a result saves you time and provides a more effective installation for maximum performance. The MBA series bells are made available in 6", 8" and 10" gong size and are painted red to enhance its appearance and provide a long durability.

Application:
The MBA series bells is recommended for use Indoors or Outdoors in areas such as: schools, corridors, apartments, office buildings, hotels, and any other application where effective audible warning is required and approved by Federal, State, or local authority having jurisdiction.

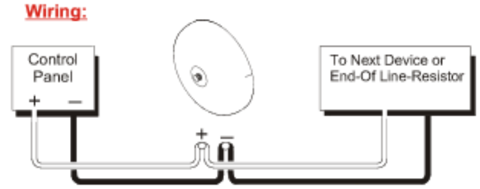
Gong Size 6, 8, and 10 inch:



MEA

Features:
* Indoor / Outdoor motor driven design
* UL Listed for fire protective service
* Polarized models with wide listed voltage range using filtered DC or unfiltered FWR input voltage.
* Terminals for fast in/out field wiring.
* High sound dB output with low current draw.
* Built-in trim plate for a clean flush mount installation.
* All models mount to a 4" square back box.
* A complete range of gong sizes 6", 8", and 10".
* Input terminals for field wiring using AWG 12 to 18.
* RFI and EMI noise suppression element built-in.
* Red color only.

Wiring:



WARNING:
Conductor Size (AWG), Lenght and capacity should be taken into consideration prior to design and installation of these products, particularly in retrofit installations.

Ordering Information:

Model Number	Gong Size	Rated Voltage (VDC)	Rated Current (Amps)	Operating Range (VDC)	UL Rating (dBA)	Indoor Measurement (dBA)	Operating Temperature Range
MBA-6-24	6î	24	0.012	16 ~ 33	83	86 ~ 89	-31 F ~ 150 F (-35 C ~ 66 C)
MBA-8-24	8î	24	0.025	16 ~ 33	83	90 ~ 93	
MBA-10-24	10"	24	0.023	16 ~ 33	85	92 ~ 94	

Engineering Specifications:

The alarm indicating appliance shall be AMSECO model MBA-Series or equivalent device. The Bell shall be listed for Indoor and Outdoor under UL Standard and shall be approved for fire protective service. The typical dB output shall be 87 ~ 91dB. The signaling device shall operate on 24VDC from a non-coded regulated DC supply or full-wave rectified, unfiltered supply. The signaling device shall be designed to produce an indoor dB signal output of 86 ~ 94 with continuously applied minimum voltage. The signaling device shall be capable of mounting to a 4" x 4" x 1-1/2" standard back box.

Specifications:

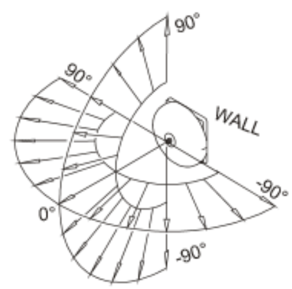
Model Number	Gong Size	Rated Current / Sound Output												
		16VDC				24VDC					33VDC			
		UL			Typical	UL			ULC	Typical	UL			Typical
		DC mA.	FWR mA.	dB	dB	DC mA.	FWR mA.	dB	dB	dB	DC mA.	FWR mA.	dB	dB
MBA-6-24	6î	7.0	8.0	77	81	12.1	12.4	83	85	87	13.5	24.2	85	89
MBA-8-24	8î	13.0	15.6	76	80	25.0	30.6	83	85	87	40.0	43.9	86	90
MBA-10-24	10"	11.0	13.6	79	83	23.0	26.8	85	85	91	34.0	46.0	87	91

Indoor/Outdoor Measurement

Sound level in the Indoor/outdoor installation may vary depending upon the spaces. Typical dB measurements with conventional sound level meters will be significantly higher in actual installations. UL and ULC dB measurement method are different.

Horizontal Dispersion:

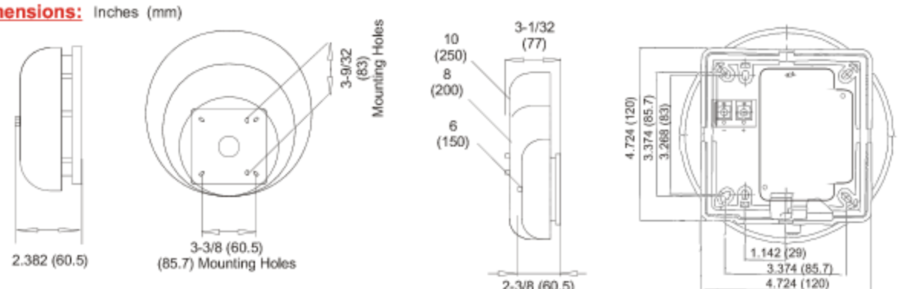
Angle	6"dB/m	8"dB/m	10"dB/m
-90	-5.1	0.3	3.4
-75	-4.3	0.8	4.8
-60	-1.9	1.8	4.5
-45	1.4	0.8	1.3
-30	-3.4	-0.6	-1.0
-15	-4.5	-2.1	0.0
0	0.0	0.0	0.0
15	-4.0	-0.9	0.8
30	-3.0	-3.3	-1.3
45	-1.5	-0.4	1.9
60	-2.9	1.8	2.9
75	-2.1	1.8	2.9
90	-1.8	-1.0	2.9



Vertical Dispersion:

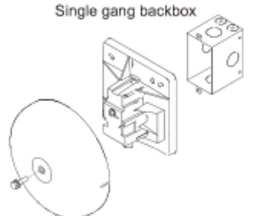
Angle	6"dB/m	8"dB/m	10"dB/m

Dimensions: Inches (mm)

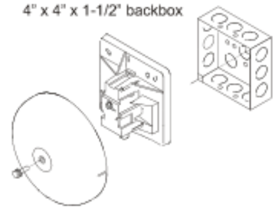


Mounting Options:

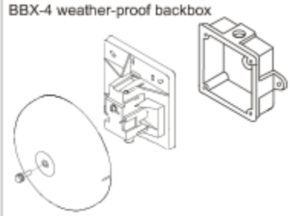
Single gang backbox



4" x 4" x 1-1/2" backbox



BBX-4 weather-proof backbox



* Due to continuous development of our product line, specifications are subject to change without notice.

MBA 10/04

AUDIBLE/VISIBLE NOTIFICATION

SPECTRAlert Wall-Mount Horns, Strobes, and Horn/Strobes

SYSTEM SENSOR®

Models Available*

Horn/Strobes

P1215	P121575
P2415	P241575
P2430	P2475
P24110	

Strobes

S1215	S121575
S2415	S241575
S2430	S2475
S24110	

Horns

H12/24

*Refer to Ordering Information for other configurations

Product Overview

Meet UL and ADA signaling requirements

Lower current draw
- More devices per loop
- Lower installed cost

Universal mounting plate included

Accessory mounting plates available

Field-selectable horn tones
- Electromechanical / 3kHz
- Temporal 3 / Non-temporal 3
- High / Low dBA output

Available in 15, 15/75, 30, 75, and 110 candela

Synchronizable horns and strobes with Sync•Circuit™ module

Aesthetic design

System Sensor's SpectrAlert® wall-mount series includes a complete line of electronic horns, strobes, and horn/strobes. Intended for primary signaling use, SpectrAlert products meet UL1971, UL464, and Americans with Disabilities Act requirements.

Technology. With its extremely efficient reflector design and Xenon flash tube, SpectrAlert offers current draw reductions as high as 40% over previous generation designs. By consuming less current, the flexibility to connect more devices per loop is possible, for a lower installed cost.

Installation. SpectrAlert products offer installation ease which also lowers the installed cost. By taking up no room in the back box, SpectrAlert strobes and horn/strobes make wiring connections simpler and faster. Each SpectrAlert includes a universal mounting plate for 4″ square and single gang back box mounting. Accessory mounting plates are also available for small footprint or surface mount applications.

Flexibility. SpectrAlert offers the flexibility to meet a broad range of requirements. The SpectrAlert horns and horn/strobes feature a number of field-selectable/reversible horn tones. For visible requirements, SpectrAlert strobes and horn/strobes are available in a wide variety of configurations to address non-sleeping area, sleeping area, and corridor requirements. Offerings include 24-volt models at 15, 15/75, 30, 75, and 110 candela, and 12-volt devices at 15 and 15/75 candela.

Aesthetics. To meet building owner aesthetic requirements, SpectrAlert incorporates a stylish, low profile design. And this aesthetic is consistent across all SpectrAlert wall-mount products.

UL LISTED ULC FM APPROVED MEA approved

Engineering Specifications

General

SpectrAlert horns, strobes and horn/strobes shall be capable of mounting to a standard 4" x 4"x 1 1/2" back box or a single gang 2" x 4" x 1 7/8" back box using the universal mounting plate included with each SpectrAlert product. Also, SpectrAlert products, when used in conjuction with the accessory Sync•Circuit Module, shall be powered from a non-coded power supply and shall operate on 12 or 24 volts. 12 volt rated devices shall have an operating voltage range of 10.7–17 volts. 24-volt rated devices shall have an operating voltage range or 20–30 volts. SpectrAlert products shall have an operating temperature of 32° to 120°F and operate from a regulated DC or full wave rectified, unfiltered power supply.

Horn

Horn shall be a System Sensor SpectrAlert Model ______ capable of operating at 12 and 24 volts. Horn shall be listed to UL 464 for fire protective signaling systems. The horn shall have two tone options, two audibility options (at 24 volts) and the option to switch between a temporal 3 pattern and a non-temporal continuous pattern. All horn models shall operate on a coded power supply.

Strobe

Strobe shall be a System Sensor SpectrAlert Model ______ listed to UL 1971 and be approved for fire protective service. The strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Horn/Strobe Combination

Horn/Strobe shall be a System Sensor SpectrAlert Model ______ listed to UL 1971 and UL 464 and shall be approved for fire protective service. Horn/strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have two tone options, two audibility options (at 24 volts) and the option to switch between a temporal 3 pattern and a non-temporal continuous pattern. Strobes shall be powered independently of the sounder with the removal of factory installed jumper wires. The horn on horn/strobe models shall operate on a coded or non-coded power supply (the strobe must be powered continuously).

Synchronization Module

Module shall be a System Sensor Sync•Circuit ______ listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1Hz and horns at temporal 3. Also, the module shall silence the horns on horn/strobe models, while operating the strobes, over a single pair of wires. The module shall be capable of mounting to a 4 11/16" x 4 11/16"x 2 1/8" back box and shall control two Style Y (class B) or one Style Z (class A) circuit. Module shall be capable of multiple zone synchronization by daisy chaining multiple modules together and re-synchronizing each other along the chain. The module shall not operate on a coded power supply.

Specifications

Walk Test SpectrAlert horn/strobe and horn only work on "walk tests" with time durations of 4 seconds or greater

Input Terminals
12 to 18 AWG

Dimensions
Strobe and horn/strobe with universal plate
5" x 5 5/8" x 2 15/16"
Strobe and horn/strobe with small footprint plate
3 3/8" x 5 5/8" x 2 5/16"
Horn with universal mounting plate
5" x 5 5/8" x 1 5/16"
Horn without mounting plate
2 15/16" x 5 5/16" x 1 5/16"

Weight, horn only
7.2 oz.

Weight, strobe and horn/strobe
8.8 oz.

Mounting
4" x 4" x 1 1/2" or 2" x 4" x 1 7/8" standard boxes

Indoor Operating Temperature
32°F to 120°F (0°C to 49°C)

Maximum humidity
95% as tested per UL464

Weatherproof (horn and horn/strobes)
Operating Temperature
32°F to 150°F (0°C to 66°C)
(outdoor strobe only)
–40°F to 158°F (–40°C to 70°C)
ULC Canadian Models
–40°C to 66°C

Voltages
12 or 24VDC and FWR unfiltered
Operating voltage range*
12V: 10.5-17V; 24V: 20-30V
Operating voltage range*
(with Sync•Circuit module, MDL)
12V, 11-17V; 24V, 20-30V

* These products should be operated within their rated voltage range; UL does, however, test functional integrity to -20% and +10% of manufacturer's stated ranges.

U.S. Patent Numbers
5,593,569
5,914,665
6,049,446

SpectrAlert Current Draw Table

Strobe Only

Average Current (mA)

	12V Models						24V Models					
	10.5V		12V		17V		20V		24V		30V	
Candela	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
15	133	159	114	157	81	128	50	61	43	60	38	60
15/75	168	182	142	171	99	150	56	65	49	64	44	62
30	NA	NA	NA	NA	NA	NA	78	84	67	82	58	72
75	NA	NA	NA	NA	NA	NA	145	170	123	159	102	141
110	NA	NA	NA	NA	NA	NA	169	220	140	191	115	174

Peak Current (mA)

	12V Models						24V Models					
	10.5V		12V		17V		20V		24V		30V	
Candela	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
15	460	460	450	460	420	480	135	204	135	208	135	185
15/75	490	520	490	520	460	480	150	199	150	207	150	198
30	NA	NA	NA	NA	NA	NA	183	201	183	219	183	216
75	NA	NA	NA	NA	NA	NA	350	440	340	460	330	480
110	NA	NA	NA	NA	NA	NA	460	560	450	570	420	620

In Rush Current (mA)

	12V Models						24V Models					
	10.5V		12V		17V		20V		24V		30V	
Candela	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
15	80	108	92	124	140	190	97	129	116	152	147	198
15/75	76	104	88	126	160	185	97	135	116	164	147	211
30	NA	NA	NA	NA	NA	NA	97	129	116	152	147	198
75	NA	NA	NA	NA	NA	NA	190	240	230	280	290	380
110	NA	NA	NA	NA	NA	NA	190	230	220	290	290	370

Horn Only

Average Current (mA)

			12V Models						24V Models					
	High/Low	Temp/	10.5V		12V		17V		20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	10	11	10	10	14	14	19	21	25	18	29	26
		Non	10	16	10	19	14	25	17	29	23	34	30	42
	Low	Temp	NA	NA	NA	NA	NA	NA	11	12	13	13	17	15
		Non	NA	NA	NA	NA	NA	NA	12	16	14	19	17	24
3000 Hz Interrupt.	High	Temp	11	13	11	11	16	16	24	26	28	23	37	33
		Non	11	17	11	21	14	28	19	34	27	39	35	45
	Low	Temp	NA	NA	NA	NA	NA	NA	14	14	17	15	21	19
		Non	NA	NA	NA	NA	NA	NA	13	18	16	21	22	25

Horn/Strobe 30 cd

Average Current (mA)

			24V Models					
	High/Low	Temp/	20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	97	105	92	100	87	98
		Non	95	113	90	116	88	114
	Low	Temp	89	96	80	95	75	87
		Non	90	98	81	101	75	96
3000 Hz Interrupt.	High	Temp	102	108	95	105	95	105
		Non	97	116	94	121	93	117
	Low	Temp	92	96	84	97	79	91
		Non	91	100	83	103	80	97

Horn/Strobe 15 cd

Average Current (mA)

			12V Models						24V Models					
	High/Low	Temp/	10.5V		12V		17V		20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	143	170	124	167	95	142	69	82	68	78	67	87
		Non	143	170	124	167	95	142	67	90	66	94	68	103
	Low	Temp	NA	NA	NA	NA	NA	NA	61	73	56	73	55	76
		Non	NA	NA	NA	NA	NA	NA	62	77	57	79	55	85
3000 Hz Interrupt.	High	Temp	144	172	125	168	97	144	74	87	71	83	75	94
		Non	144	173	125	168	95	146	69	95	70	99	73	106
	Low	Temp	NA	NA	NA	NA	NA	NA	64	75	60	75	59	80
		Non	NA	NA	NA	NA	NA	NA	63	79	59	81	60	86

Horn/Strobe 75 cd

Average Current (mA)

			24V Models					
	High/Low	Temp/	20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	164	191	148	167	131	167
		Non	163	188	146	169	132	169
	Low	Temp	156	182	136	162	119	156
		Non	157	182	137	162	119	157
3000 Hz Interrupt.	High	Temp	169	196	151	172	139	174
		Non	164	192	150	175	137	177
	Low	Temp	159	184	140	164	123	160
		Non	158	188	139	163	124	162

Horn/Strobe 1575 cd

Average Current (mA)

			12V Models						24V Models					
	High/Low	Temp/	10.5V		12V		17V		20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	178	193	152	181	113	164	75	86	74	82	73	88
		Non	178	193	152	181	113	164	73	94	72	98	74	104
	Low	Temp	NA	NA	NA	NA	NA	NA	67	77	62	77	61	77
		Non	NA	NA	NA	NA	NA	NA	68	81	63	83	61	86
3000 Hz Interrupt.	High	Temp	179	195	152	183	115	166	80	91	77	87	81	95
		Non	179	196	152	183	113	168	75	99	76	103	79	107
	Low	Temp	NA	NA	NA	NA	NA	NA	70	79	66	79	65	81
		Non	NA	NA	NA	NA	NA	NA	69	83	65	85	66	87

Horn/Strobe 110 cd

Average Current (mA)

			24V Models					
	High/Low	Temp/	20V		24V		30V	
Tone	Volume	Non	DC	FWR	DC	FWR	DC	FWR
Electro-mech.	High	Temp	188	241	165	209	144	200
		Non	186	238	163	211	145	202
	Low	Temp	180	232	153	204	132	189
		Non	181	232	154	204	132	190
3000 Hz Interrupt.	High	Temp	193	246	168	214	152	207
		Non	188	242	167	217	150	210
	Low	Temp	183	234	157	206	136	193
		Non	182	232	156	205	137	195

Sound Output Guide (dBA)

			UL Reverberant Room dBA @ volts DC						Anechoic Room Peak dBA @ 10ft./volts DC					
			10.5	12	17	20	24	30	10.5	12	17	20	24	30
Temporal	Low Tone	Electromechanical	NA	NA	NA	75	75	79	NA	NA	NA	94	96	98
		3000 HZ Interrupted	NA	NA	NA	75	79	79	NA	NA	NA	94	96	98
	High Tone	Electromechanical	75	75	79	82	82	82	94	95	98	100	101	102
		3000 HZ Interrupted	75	75	79	82	85	85	94	95	98	100	101	102
Non-Temporal	Low Tone	Electromechanical	NA	NA	NA	79	82	85	NA	NA	NA	94	96	98
		3000 HZ Interrupted	NA	NA	NA	82	82	85	NA	NA	NA	94	96	98
	High Tone	Electromechanical	79	79	85	85	88	88	94	95	98	100	101	102
		3000 HZ Interrupted	79	82	85	88	88	88	93	95	98	100	101	102

SpectrAlert Ordering Information

		Red	White	Voltage	Candela	Avg. mA* @Nom. VDC	Avg. mA* @Nom.FWR**
Horn/Strobes		P1215	P1215W	12	15	124	167
		P121575	P121575W	12	15/75	152	181
		P2415	P2415W	24	15	68	78
		P241575	P241575W	24	15/75	74	82
		P2430	P2430W	24	30	92	100
		P2475	P2475W	24	75	148	167
		P24110	P24110W	24	110	165	209
		P121575K (weatherproof)	—	12	15/75	124	167
		P241575K (weatherproof)	—	24	15/75	74	82
		P2475K (weatherproof)	—	24	75	148	167
		P24110K (weatherproof)	—	24	110	165	209
		P241575P (no lettering)	P241575PW	24	15/75	74	82
		P241575AG (AGENT)	—	24	15/75	74	82
		P241575EV (EVAC)	—	24	15/75	74	82
	Canada	P2415A	P2415WA	24	15	68	78
		P241575A	P241575WA	24	15/75	74	82
		P2475A	P2475WA	24	75	148	167
		P24110A	P24110WA	24	110	165	209
		P241575KA (weatherproof)	—	24	15/75	74	82
		P2475KA (weatherproof)	—	24	75	148	167
		P24110KA (weatherproof)	—	24	110	165	209
	Latin America	P241575F (FUEGO)	—	24	15/75	74	82
Strobes		S1215	S1215W	12	15	114	157
		S121575	S121575W	12	15/75	142	171
		S2415	S2415W	24	15	43	60
		S241575	S241575W	24	15/75	49	64
		S2430	S2430W	24	30	67	82
		S2475	S2475W	24	75	123	159
		S24110	S24110W	24	110	140	191
		S121575K (weatherproof)	—	12	15/75	142	171
		S241575K (weatherproof)	—	24	15/75	49	64
		S2475K (weatherproof)	—	24	75	123	159
		S24110K (weatherproof)	—	24	110	140	191
		S241575P (no lettering)	S241575PW	24	15/75	49	64
		S241575AG (AGENT)	—	24	15/75	49	64
		S241575EV (EVAC)	—	24	15/75	49	64
	Canada	S2415A	S2415WA	24	15	43	60
		S241575A	S241575WA	24	15/75	49	64
		S2475A	S2475WA	24	75	123	149
		S24110A	S24110WA	24	110	140	191
		S241575KA (weatherproof)	—	24	15/75	49	64
		S2475KA (weatherproof)	—	24	75	123	149
		S24110KA (weatherproof)	—	24	110	140	191
	Latin America	S241575F (FUEGO)	—	24	15/75	49	64
Horns		H12/24	H12/24W	12/24	NA	10/25	10/18
		H12/24K (weatherproof)	—	12/24	NA	10/25	10/18
	Canada	HC12/24A	HC12/24WA	12/24	NA	10/25	10/18
		HC12/24KA	—	12/24	NA	10/25	10/18
Sync•Circuit		MDL	MDLW	12/24	NA	10/11	12/15
Module	Canada	MDLA	MDLWA	12/24	NA	10/11	12/15
Small Footprint Mounting Plate for Single Gang Only		S-MP	S-MPW	NA	NA	NA	NA
Surface Mount Back Box Skirt		BBS	BBSW	NA	NA	NA	NA
Universal Mounting Plate (replacement)		D-MP	D-MPW	NA	NA	NA	NA
Weatherproof Back Box		WBB	—	NA	NA	NA	NA

Notes: Agency Listings – Indoor models: UL, ULC, FM, CSFM, MEA. Weatherproof models: UL, CSFM (strobe only), MEA, ULC.
All of these SpectrAlert products are designed for wall mount only. All weatherproof models must use weatherproof back box model WBB. Installation of less than 75 candela strobes may be permissible under the equivalent facilitation clause of the ADAAG (Sec. 2.2). However, it is the responsibility of the person or entity designing the fire alarm system to determine the acceptability of less than 75 candela strobes. All 15/75 candela strobes or horn/strobes are recommended for 20′ × 20′ rooms or less.
*Horn and horn/strobe current draws assume horn is set at temp 3, electromechanical tone and high audibility.
** FWR = Full Wave Rectified

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A05-0936-010•9/02•#1002

SYSTEM SENSOR®

Indoor Selectable-Output Horns, Strobes, and Horn Strobes for Wall Applications

SPECTRAlert® ADVANCE from System Sensor

SpectrAlert® Advance audible visible notification products are rich with features guaranteed to cut installation times and maximize profits.

Features

- Plug-in design with minimal intrusion into the back box
- Tamper-resistant construction
- Automatic selection of 12- or 24-volt operation at 15 and 15/75 candela
- Field-selectable candela settings on wall units: 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185
- Horn rated at 88+ dBA at 16 volts
- Rotary switch for horn tone and three volume selections
- Universal mounting plate for wall units
- Mounting plate shorting spring checks wiring continuity before device installation
- Electrically Compatible with legacy SpectrAlert devices
- Compatible with MDL3 sync module
- Listed for ceiling or wall mounting

The SpectrAlert Advance series offers the most versatile and easy-to-use line of horns, strobes, and horn strobes in the industry. With white and red plastic housings, wall and ceiling mounting options, and plain and FIRE-printed devices, SpectrAlert Advance can meet virtually any application requirement.

Like the entire SpectrAlert Advance product line, wall-mount horns, strobes, and horn strobes include a variety of features that increase their application versatility while simplifying installation. All devices feature plug-in designs with minimal intrusion into the back box, making installations fast and foolproof while virtually eliminating costly and time-consuming ground faults.

To further simplify installation and protect devices from construction damage, SpectrAlert Advance utilizes a universal mounting plate with an onboard shorting spring, so installers can test wiring continuity before the device is installed.

Installers can also easily adapt devices to a suit a wide range of application requirements using field-selectable candela settings, automatic selection of 12- or 24-volt operation, and a rotary switch for horn tones with three volume selections.

Agency Listings

SIGNALING UL LISTED
S4011 (chimes, horn strobes, horns)
S3512 (strobes)

FM APPROVED
3023572

MEA approved
MEA452-05-E

7125-1653:186 (indoor strobes)
7125-1653:188 (horn strobes, chime strobes)
7135-1653:189 (horns, chimes)

SpectrAlert Advance Specifications

Architect/Engineer Specifications

General

SpectrAlert Advance horns, strobes, and horn strobes shall mount to a standard 4 × 4 × 1½-inch back box, 4-inch octagon back box, or double-gang back box. Two-wire products shall also mount to a single-gang 2 × 4 × 17/8-inch back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance products, when used with the Sync•Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync•Circuit Module, 12-volt-rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt-rated notification appliance circuit outputs shall operate between 16.5 and 33 volts. Indoor SpectrAlert Advance products shall operate between 32 and 120 degrees Fahrenheit from a regulated DC or full-wave rectified unfiltered power supply. Strobes and horn strobes shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185.

Strobe

The strobe shall be a System Sensor SpectrAlert Advance Model _______ listed to UL 1971 and shall be approved for fire protective service. The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Horn Strobe Combination

The horn strobe shall be a System Sensor SpectrAlert Advance Model _______ listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a temporal three pattern and a non-temporal (continuous) pattern. These options are set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn on horn strobe models shall operate on a coded or non-coded power supply.

Synchronization Module

The module shall be a System Sensor Sync•Circuit model MDL3 listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1 Hz and horns at temporal three. Also, while operating the strobes, the module shall silence the horns on horn strobe models over a single pair of wires. The module shall mount to a 411/16 × 411/16 × 21/8-inch back box. The module shall also control two Style Y (class B) circuits or one Style Z (class A) circuit. The module shall synchronize multiple zones. Daisy chaining two or more synchronization modules together will synchronize all the zones they control. The module shall not operate on a coded power supply.

Physical/Electrical Specifications	
Standard Operating Temperature	32°F to 120°F (0°C to 49°C)
Humidity Range	10 to 93% non-condensing
Strobe Flash Rate	1 flash per second
Nominal Voltage	Regulated 12 DC/FWR or regulated 24 DC/FWR[1]
Operating Voltage Range[2]	8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)
Operating Voltage Range MDL3 Sync Module	8.5 to 17.5 V (12 V nominal) or 16.5 to 33 V (24 V nominal)
Input Terminal Wire Gauge	12 to 18 AWG
Wall-Mount Dimensions (including lens)	5.6″L × 4.7″W × 2.5″D (142 mm L × 119 mm W × 64 mm D)
Horn Dimensions	5.6″L × 4.7″W × 1.3″D (142 mm L × 119 mm W × 33 mm D)
Wall-Mount Trim Ring Dimensions (sold as a 5 pack) (TR-HS)	5.7″L × 4.8″W × 0.35″D (145 mm L × 122 mm W × 9 mm D)

Notes:

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. P, S, PC, and SC products will operate at 12 V nominal only for 15 and 15/75 cd.

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15	123	128	66	71
	15/75	142	148	77	81
	30	NA	NA	94	96
	75	NA	NA	158	153
	95	NA	NA	181	176
	110	NA	NA	202	195
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258

UL Max. Horn Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
Sound Pattern	dB	DC	FWR	DC	FWR
Temporal	High	57	55	69	75
Temporal	Medium	44	49	58	69
Temporal	Low	38	44	44	48
Non-temporal	High	57	56	69	75
Non-temporal	Medium	42	50	60	69
Non-temporal	Low	41	44	50	50
Coded	High	57	55	69	75
Coded	Medium	44	51	56	69
Coded	Low	40	46	52	50

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, Standard Candela Range (15–115 cd)

	8–17.5 Volts		16–33 Volts						
DC Input	15	15/75	15	15/75	30	75	95	110	115
Temporal High	137	147	79	90	107	176	194	212	218
Temporal Medium	132	144	69	80	97	157	182	201	210
Temporal Low	132	143	66	77	93	154	179	198	207
Non-Temporal High	141	152	91	100	116	176	201	221	229
Non-Temporal Medium	133	145	75	85	102	163	187	207	216
Non-Temporal Low	131	144	68	79	96	156	182	201	210
FWR Input									
Temporal High	136	155	88	97	112	168	190	210	218
Temporal Medium	129	152	78	88	103	160	184	202	206
Temporal Low	129	151	76	86	101	160	184	194	201
Non-Temporal High	142	161	103	112	126	181	203	221	229
Non-Temporal Medium	134	155	85	95	110	166	189	208	216
Non-Temporal Low	132	154	80	90	105	161	184	202	211

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, High Candela Range (135–185 cd)

	16–33 Volts					16–33 Volts			
DC Input	135	150	177	185	**FWR Input**	135	150	177	185
Temporal High	245	259	290	297	Temporal High	215	231	258	265
Temporal Medium	235	253	288	297	Temporal Medium	209	224	250	258
Temporal Low	232	251	282	292	Temporal Low	207	221	248	256
Non-Temporal High	255	270	303	309	Non-Temporal High	233	248	275	281
Non-Temporal Medium	242	259	293	299	Non-Temporal Medium	219	232	262	267
Non-Temporal Low	238	254	291	295	Non-Temporal Low	214	229	256	262

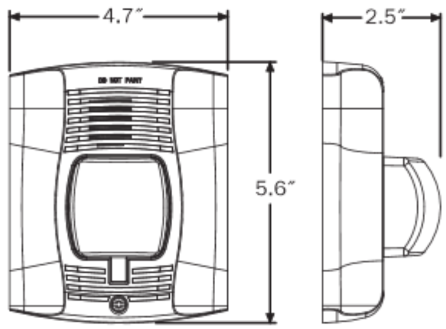
Horn Tones and Sound Output Data

Horn and Horn Strobe Output (dBA)

			8–17.5 Volts		16–33 Volts		24-Volt Nominal Reverberant		24-Volt Nominal Anechoic	
Switch Position	Sound Pattern	dB	DC	FWR	DC	FWR	DC	FWR	DC	FWR
1	Temporal	High	78	78	84	84	88	88	99	98
2	Temporal	Medium	75	75	80	80	86	86	96	96
3	Temporal	Low	71	71	76	76	83	80	94	89
4	Non-Temporal	High	82	82	88	88	93	92	100	100
5	Non-Temporal	Medium	78	78	85	85	90	90	98	98
6	Non-Temporal	Low	73	74	81	81	88	84	96	92
7†	Coded	High	82	82	88	88	93	92	101	101
8†	Coded	Medium	78	78	85	85	90	90	97	98
9†	Coded	Low	74	75	81	81	88	85	96	92

†Settings 7, 8, and 9 are not available on 2-wire horn strobes.

SpectrAlert Advance Dimensions



Wall-mount horn strobes

SpectrAlert Advance Ordering Information

Model	Description
Wall Horn Strobes	
P2R	2-Wire Horn Strobe, Standard cd, Red
P2R-P	2-Wire Horn Strobe, Standard cd, Red, Plain
P2R-SP	2-Wire Horn Strobe, Standard cd, Red, "FUEGO"
P2RH	2-Wire Horn Strobe, High cd, Red
P2RH-P	2-Wire Horn Strobe, High cd, Red, Plain
P2W	2-Wire Horn Strobe, Standard cd, White
P2W-P	2-Wire Horn Strobe, Standard cd, White, Plain
P2WH	2-Wire Horn Strobe, High cd, White
P2WH-P	2-Wire Horn Strobe, High cd, White, Plain
P4R	4-Wire Horn Strobe, Standard cd, Red
P4R-P	4-Wire Horn Strobe, Standard cd, Red, Plain
P4RH	4-Wire Horn Strobe, High cd, Red
P4W	4-Wire Horn Strobe, Standard cd, White
Wall Strobes	
SR	Strobe, Standard cd, Red
SR-P	Strobe, Standard cd, Red, Plain
SR-SP	Strobe, Standard cd, Red, "FUEGO"

Model	Description
Wall Strobes (cont.)	
SRH	Strobe, High cd, Red
SRH-P	Strobe, High cd, Red, Plain
SRH-SP	Strobe, High cd, Red, "FUEGO"
SW	Strobe, Standard cd, White
SW-P	Strobe, Standard cd, White, Plain
SWH	Strobe, High cd, White
SWH-P	Strobe, High cd, White, Plain
Horns	
HR	Horn, Red
HW	Horn, White
Accessories	
TR-HS	Trim Ring, Wall, Red
SBBR	Indoor Surface Mount Back Box, Red
SBBW	Indoor Surface Mount Back Box, White

Notes:
All -P models have a plain housing (no "FIRE" marking on cover)
All -SP models have "FUEGO" marking on cover
"Standard cd" refers to strobes that include 15, 15/75, 30, 75, 95, 110, and 115 candela settings.
"High cd" refers to strobes that include 135, 150, 177, and 185 candela settings.

SYSTEM SENSOR®
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Multi-Alert™ & Mini-Alert™ Sounders and Strobes

SYSTEM SENSOR®

Multi-Alert Models

Sounder
MA12/24D

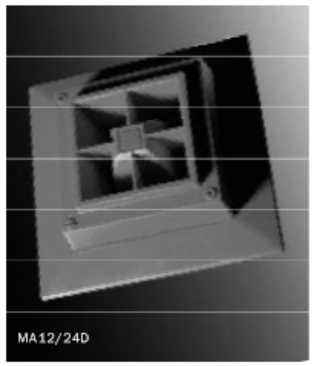
Strobes	**Sounder/Strobes**
SS24LO	MASS24LO
SS24M	MASS24M
SS24LOLA	MASSLOLA

Mini-Alert Sounders

Red	**Beige**	**White**
PA400	PA400	PA400W
PA400R-F	PA400B-F	PA400W-F

Add-on Strobes

Red	**White**
PS24LO	PS24LOW



MA12/24D

PA400R-F

Product Overview

Multi-Alert Sounder:
12 and 24V operation
8 field-selectable tones

Multi-Alert Strobes and Sounder/Strobes:
24V operation
1.5 or 15 candela
UL1638 listed

Mini-Alert Sounders:
12 and 24V operation
1.5 cd add-on strobe available

LISTED MEA approved

System Sensor's Multi-Alert sounder and sounder/strobes are suited to provide primary or secondary signaling for fire and security applications. The MA and MASS models provide eight field-selectable warning tones.

The Multi-Alert models mount directly to 4" square back boxes. Optional mounting plates are available for either flush or semi-flush installations. Model MA12/24D is suitable for outdoor applications when installed with the WBB weather-proof back box.

Multi-Alert Strobes. System Sensor's Multi-Alert strobes are UL1638 compliant electronic visible warning signals that flash approximately every 1.5 seconds. All circuits are polarized to be compatible with DC alarm supervision.

Mini-Alert Sounders. System Sensor's PA400 series Mini-Alert sounders operate at 12 and 24 volts and are ideal for hotel, motel or residential fire system applications, where a smaller notification device is desired. The PA400 sounders are available with or without FIRE identification, and are offered in red, beige, and white.

Engineering Specifications

Multi-Alert Sounders shall be a System Sensor Model MA 12/24D capable of operating at 12 and 24VDC. Sounder shall be listed to Underwriter's Laboratories Standard UL464 for fire protective signaling systems. Sounder shall have an operating temperature between –31°F and 151°F. Sounder shall have eight tone options, selected by means of clips.

Mini-Alert Sounders shall be a System Sensor Model _____ capable of operating at 12 and 24VDC. Sounder shall be listed to Underwriter's Laboratories Standard UL464 for fire protective signaling systems. Sounder shall have an operating temperature between 14°F and 140°F.

Multi-Alert and Mini-Alert Sounder/Strobes shall be a System Model _____ capable of operating at 24VDC. Sounder/strobe shall be listed to Underwriter's Laboratories Standards UL464 and UL1638 for fire protective signaling systems. Sounder/strobe shall have an operating temperature between 32°F and 120°F. Strobe shall be powered independently of the sounder and shall operate at 24VDC, with a UL range rating of 22.5 to 30VDC. Actual operating voltage must be between 18 and 33VDC. Strobe shall have a minimum light output of 1.5 or 15 candela and shall be UL1638 listed for private mode applications.

Multi-Alert Sounder Specifications

Dimensions
4" x 4" x 2¼"

Weight
5.7 oz. (162 g)

Operating Voltage
12VDC to 24VDC FWR unfiltered*

Mounting
Surface 4" x 4" back box (1½" to 2⅛" deep)
Flush 4" x 4" BBD deep back box (2¾" deep)
Semi-flush 4" x 4" back box (1½" to 2⅛" deep) with MP-SF mounting plate

Input Terminals
12 to 18 AWG

Operating Temperature Range
–32° to 151°F (–35° to 66°C)

*Actual 12 V operating voltage cannot be less than 9.6VDC or greater than 18.7VDC.
Actual 24 V operating voltage cannot be less than 18VDC or greater than 33VDC.

Multi-Alert Strobe Specifications

Dimensions
4" x 4" x 2¹⁵⁄₁₆"

Weight
8.2 oz. (232 g)

Operating Voltage
24VDC and FWR unfiltered*

Mounting
Surface 4" x 4" back box (1½" to 2⅛" deep)
Semi-flush 4" x 4" back box (1½" to 2⅛" deep) with MP-SF mounting plate

Input Terminals
12 to 18 AWG

Operating Temperature Range
–31° to 151°F (–35° to 66°C)

*Actual 24V operating voltage cannot be less than 18VDC or greater than 33VDC.

Mini-Alert Specifications

Dimensions
4½" x 2¾" x 1⅛"

Weight
2.4 oz. (159 g)

Operating Voltage
12VDC to 24VDC FWR unfiltered*

Mounting
Surface Single gang back box
Flush 4" x 4" BBD deep back box (2¾" deep)

Input Terminals
12 to 18 AWG

Operating Temperature Range
14° to 140°F (–10° to 60°C)

*Actual 12V operating voltage cannot be less than 9.6VDC or greater than 18.7VDC.
Actual 24V operating voltage cannot be less than 18VDC or greater than 33VDC.

Ordering Information/Current Draw

Multi-Alert/Mini-Alert Model Numbers

Red	Beige	White	Description	Voltage	Average Current	Candela	dB Output (UL)***
MA12/24D			Multi-Alert sounder	12/24VDC	*	—	75–85
SS24LO			Multi-Alert strobe	24VDC	25 mA	1.5	—
SS24M			Multi-Alert strobe	24VDC	75 mA	15.0	—
SS24LOLA			Multi-Alert strobe ("FUEGO" lens)	24VDC	25 mA	1.5	—
MASS24LO			Multi-Alert sounder /strobe	24VDC	**	1.5	75–85
MASS24M			Multi-Alert sounder /strobe	24VDC	**	15.0	75–85
MASS24LOLA			Multi-Alert sounder/strobe ("FUEGO" lens)	24VDC	**	1.5	75–85
PA400R	PA400B	PA400W	Mini-Alert sounder	12/24VDC	12/15 mA	—	82
PA400R-F	PA400B-F	PA400W-F	Mini-Alert sounder ("Fire" identification)	12/24VDC	12/15 mA	—	82
PS24LO		PS24LOW	Add-on strobe	12/24VDC	5 mA	1.5	82

Accessory Model Numbers

	Description
MP-F/MP-FB	Flush mounting plate (red/beige)
MP-SF/MP-SFB	Semi-flush mounting plate (red/beige)
BB-D	Flush mounting deep back box, 2¾" deep
WBB	Weatherproof back box for MA 12/24D

* Current ranges from 10mA to 55mA depending upon voltage and sound selected
** Current ranges from 35mA to 80mA depending upon voltage and sound selected
*** Sound output varies depending upon voltage and sound selected.
Note: LO and M style strobe and sounder/strobe models are not MEA approved.

System Sensor Sales and Service

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Fx: 905.812.0771

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Fx: 011.44.1403.276501

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Fx: 011.86.29.524.6259

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Ph: 011.65.273.2230
Fx: 011.65.273.2610

System Sensor– Far East
Ph: 011.85.22.191.9003
Fx: 011.85.22.736.6580

System Sensor– Australia
Ph: 011.613.54.281.142
Fx: 011.613.54.281.172

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Wheelock RSS & RSSP Series

Single- and Multi-Candela Strobes and Strobe Plates

NOTIFIER® by Honeywell

Audio/Visual Devices

General

Wheelock's patented Series RSS Strobe Appliances and Series RSSP Strobe Plates have lower current draw while maintaining outstanding performance, reliability and cost effectiveness. These versatile appliances will satisfy virtually all requirements for indoor, wall or ceiling mount appliances.

Strobe options for wall mount models include 15/75cd or Wheelock's patented MCW multi-candela strobe with field selectable candela settings of 15/30/75/110cd. Ceiling mount models include the patented MCC multi-candela ceiling strobe with field selectable intensities of 15/30/75/95cd or the high intensity MCCH strobe with field selectable 115/177cd.

All models may be synchronized when used in conjunction with the Wheelock SM or DSM Sync Modules or a power supply with Wheelock's patented Sync Protocol. Synchronized strobes can eliminate possible restrictions on the number of strobes in the field of view. Wheelock's synchronized strobes offer an easy way to comply with ADA recommendations concerning photosensitive epilepsy as well as meetings the requirements of NFPA 72.

Wheelock's Series RSS Strobes employ a Patented Integral Strobe Mounting Plate that can be mounted to a single-gang, double gang, 4" square, 100mm European backboxes or the SHBB surface backbox. If the flush backbox has side or top space between it and the finished wall, the NATP (Notification Appliance Trimplate) may be used. It provides an additional .65" of trim for the appliance. An attractive cover plate is provided for a clean, finished appearance on all models.

The Series RSSP Multi-Candela Strobe Plates are a cost effective way to retrofit required wall strobe appliances to bells, horns, chimes, multitones, or speakers and easily mounts to standard 4" backboxes or, for surface mount, use with Wheelock's SBL2 surface backbox.

Series RSS

RSS Round

Multi-Candela
(bottom of strobe lens)

Series RSSP

WARNING: PLEASE READ THESE SPECIFICATIONS AND ASSOCIATED INSTALLATION INSTRUCTIONS CAREFULLY BEFORE USING, SPECIFYING OR APPLYING THIS PRODUCT. FAILURE TO COMPLY WITH ANY OF THE FOLLOWING INSTRUCTIONS, CAUTIONS AND WARNINGS COULD RESULT IN IMPROPER APPLICATION, INSTALLATION AND/OR OPERATION OF THESE PRODUCTS IN AN EMERGENCY SITUATION, WHICH COULD RESULT IN PROPERTY DAMAGE AND SERIOUS INJURY OR DEATH TO YOU AND/OR OTHERS.

***NOTE:** Due to continuous development of our products, specifications and offering are subject to change without notice in accordance with Wheelock, Inc. standard terms and conditions.*

Features

- Wall mount multi-candela models are available with field selectable candela settings of 15/30/75/110cd or 135/185cd. Single candela models are available in 15/75cd.
- Ceiling mount multi-candela models are available with field selectable candela settings of 15/30/75/95cd or 115/177cd.
- Strobes produce 1 flash per second over the regulated voltage range.
- 12 and 24 VDC models with wide UL "Regulated Voltage" using filtered (DC) or unfiltered VRMS input voltage.
- Synchronize with Wheelock SM or DSM Sync Modules or power supplies with built-in Sync Protocol.
- ADA/NFPA/UFC/ANSI compliant. Meets OSHA 29 Part 1910.165.

General Notes

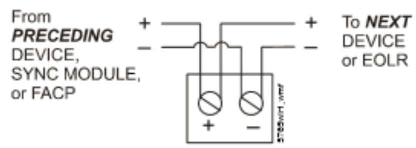
- RSS/RSSP Series strobe products are listed under UL 1971 for indoor use with a temperature range of 32°F to 120°F (0°C to 49°C) and maximum humidity of 93% (± 2%).
- "Regulated Voltage Range" is the newest terminology used by UL to identify the voltage range. Prior to this change, UL used the terminology "Listed Voltage Range."

Table 1: Audibles/Speakers for RSSP Strobe Plate

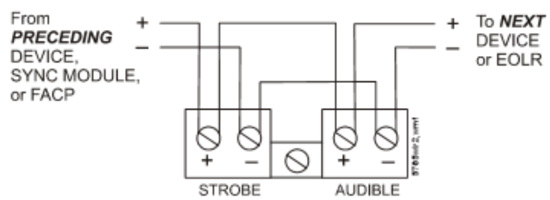
Product	Series
Multitone Appliances	AMT, MT
Horns	AH, NH, HS
Motor Bells	MB-G6/G10
Speakers	ET-1010/1080, E70, ET70
Chimes	CH70

Table 2: Average RMS Current*													
RSS/RSSP 24 VDC Models	RSS/RSSP - Wall Mount							Ceiling Mount					
	241575W	24MCW				24MCWH		24MCC				24MCCH	
	1575cd	15cd	30cd	75cd	110cd	135cd	185cd	15cd	30cd	75cd	95cd	115cd	177cd
UL max*	.090	.060	.092	.165	.220	.300	.420	.065	.105	.189	.249	.300	.420
RSS/RSSP 24 VDC Models	RSS/RSSP Wall Mount 121575W	* RMS current ratings are per UL average RMS method. UL max current rating is the maximum RMS current within the listed voltage range (16-33V for 24V units). For strobes, the UL max current is usually at the minimum listed voltage (16V for 24V units). For audibles, the max current is usually at the listed voltage (33V for 24V units). For unfiltered FWR ratings, see installation instructions.											
12VDC	.152												
UL max*	.255												

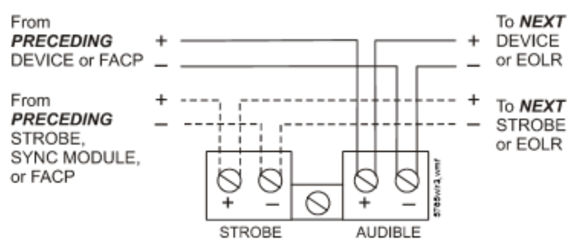
Wiring Diagrams



RSS/RSSP Device

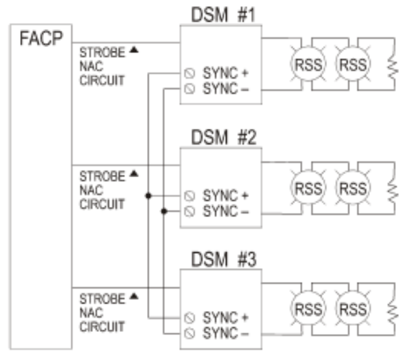


Strobe/Plate Assembly
(with Audible and Visible operating in unison)

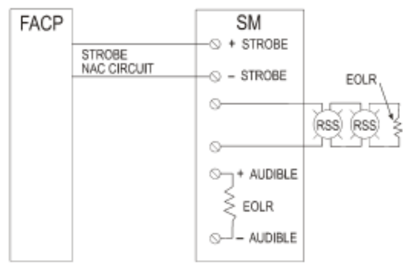


Strobe/Plate Assembly
(with Audible and Visible operating independently)

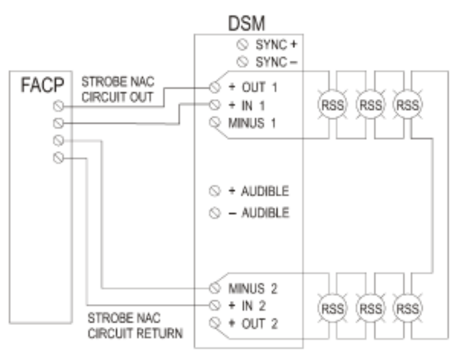
Wiring Diagrams (continued)



RSS/RSSP Devices
(synchronized with DSM module; single Class "A" NAC circuit)



RSS/RSSP Devices
(synchronized with SM module; single Class "B" NAC circuit)



RSS/RSSP Devices
(synchronized with multiple DSM modules)
(NOTE: INTERCONNECTING WIRING SHOWN. MAXIMUM OF 20 DSM MODULES)

For details on using the SM or DSM Sync Modules see installation instructions #P83123 (for SM) or #P83177 (for DSM).

WARNING: CONTACT WHEELOCK FOR THE CURRENT INSTALLATION INSTRUCTIONS AND GENERAL INFORMATION SHEET (P82380) ON THESE PRODUCTS. THESE DOCUMENTS UNDERGO PERIODIC CHANGES. IT IS IMPORTANT THAT YOU HAVE CURRENT INFORMATION ON THE PRODUCTS. THESE MATERIALS CONTAIN IMPORTANT INFORMATION THAT SHOULD BE READ PRIOR TO SPECIFYING OR INSTALLING THESE PRODUCTS, INCLUDING:

- **TOTAL CURRENT REQUIRED BY ALL APPLIANCES CONNECTED TO SYSTEM SECONDARY POWER SOURCES.**
- **FUSE RATINGS ON NOTIFICATION APPLIANCE CIRCUITS TO HANDLE PEAK CURRENTS FROM ALL APPLIANCES ON THOSE CIRCUITS.**
- **COMPOSITE FLASH RATE FROM MULTIPLE STROBES WITHIN A PERSON'S FIELD OF VIEW.**
- **ADDING, REPLACING OR CHANGING APPLIANCES OR CHANGING CANDELLA SETTINGS WILL AFFECT CURRENT DRAW. RECALCULATE CURRENT DRAW TO INSURE THAT THE TOTAL AVERAGE CURRENT AND TOTAL PEAK REQUIRED BY ALL APPLIANCES DO NOT EXCEED THE RATED CAPACITY OF THE POWER SOURCES OR FUSES.**
- **THE VOLTAGE APPLIED TO THE PRODUCTS MUST BE WITHIN THEIR "REGULATED VOLTAGE RANGE."**
- **INSTALLATION OF 110 CANDELA STROBE PRODUCTS IN SLEEPING AREAS.**
- **INSTALLATION IN OFFICE AREAS AND OTHER SPECIFICATION AND INSTALLATION ISSUES.**
- **USE STROBES ONLY ON CIRCUITS WITH CONTINUOUSLY APPLIED OPERATING VOLTAGE. DO NOT USE STROBES ON CODED OR INTERRUPTED CIRCUITS IN WHICH THE APPLIED VOLTAGE CYCLED ON AND OFF AS THE STROBE MAY NOT FLASH.**
- **FAILURE TO COMPLY WITH THE INSTALLATION INSTRUCTIONS OR GENERAL INFORMATION SHEETS COULD RESULT IN IMPROPER INSTALLATION, APPLICATION, AND/OR PROPERTY DAMAGE AND SERIOUS INJURY OR DEATH TO YOU AND/OR OTHERS.**
- **CONDUCTOR SIZE (AWG), LENGTH AND AMPACITY SHOULD BE TAKEN INTO CONSIDERATION PRIOR TO DESIGN AND INSTALLATION OF THESE PRODUCTS, PARTICULARLY IN RETROFIT INSTALLATIONS.**

Architectural/Engineering Specifications

The visual notification appliances shall be Wheelock Series RSS Strobe Appliances or approved equals. The Series RSS shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing Impaired) for indoor Fire Protection Service. The strobe shall be listed for indoor use and shall meet the requirements of FCC Part 15 Class B. The strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP). When Strobe Plates are to be installed, they shall be the Wheelock Series RSSP Strobe Plate and shall have the same electronic circuitry as the Wheelock Series RSS.

The Series RSS Strobe shall be of low current design. Where Multi-Candela appliances are specified, the strobe intensity shall have field selectable settings and shall be rated per UL Standard 1971 at 15/30/75/110cd or 135/185cd for wall mount and 15/30/75/95cd or 115/175cd for ceiling mount. The selector switch for selecting the candela shall be tamper resistant. The 1575 candela strobe shall be specified when 15 candela UL Standard 1971 Listing with 75 candela on axis is required (e.g. ADA compliance).

When synchronization is required, the appliance shall be compatible with Wheelock's SM or DSM Sync Modules or a power supply with built-in Patented Wheelock Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the Sync Module or power supply fail to operate (i.e. contacts remain closed), the strobe shall revert to a non-synchronized flash rate. The strobes shall be designed for indoor surface or flush mounting.

The Series RSS Strobe Appliances shall incorporate a Patented, Integral Strobe Mounting Plate that shall allow mounting to single-gang, double-gang, 4-inch square, 100mm European type backboxes, or the SHBB Surface Backbox. If required, an NATP (Notification Appliance Trimplate) shall be provided. An attaching cover plate shall be provided to give the appliance an attractive appearance. The appliance shall not have any mounting holes or screw heads visible when the installation is completed.

The Series RSSP Multi-Candela or single candela Strobe Plate shall mount to either a standard 4-inch square backbox for flush mounting, or the Wheelock SBL2 backbox for surface mounting.

All notification appliances shall be backward compatible. *NOTE: Due to continuous development of our products, specifications and offering are subject to change without notice in accordance with Wheelock, Inc. standard terms and conditions.*

Listings and Approvals

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in progress. Consult factory for listing status.

- **UL/ULC Listed:** S5391
- **CSFM:** 7125-0785:141
- **MEA:** 151-92-E Vol. 19, 20, Vol. 24 (RSS-24MCW-FR/-FW)
- **FM Approved**

Ordering Information

Model	Wall/ Ceiling Mount	Non-Sync	Strobe Candela	12/24 VDC	Model Color	Model Shape	Agency Approvals
RSS-24MCW-FR	Wall	X	15/30/75/110	24	Red	Square	UL, MEA, CSFM, FM, BFP
RSS-24MCW-FW	Wall	X	15/30/75/110	24	White	Square	UL, MEA, CSFM, FM, BFP
RSS-241575W-FR	Wall	X	15 (75 on axis)	24	Red	Square	UL, MEA, CSFM, FM, BFP
RSS-121575W-FR	Wall	X	15 (75 on axis)	12	Red	Square	UL, MEA, CSFM, FM, BFP
RSS-24MCC-FW	Ceiling	X	15/30/75/95	24	White	Square	UL, MEA, CSFM, FM
RSS-24MCC-FR	Ceiling	X	15/30/75/95	24	Red	Square	UL, MEA, CSFM, FM
RSS-24MCCR-FW	Ceiling	X	15/30/75/95	24	White	Round	UL, MEA, CSFM, FM
RSS-24MCCH-FR	Ceiling	X	115/177	24	Red	Square	UL, MEA, CSFM, FM
RSS-24MCCH-FW	Ceiling	X	115/177	24	White	Square	UL, MEA, CSFM, FM
RSS-24MCCHR-FR	Ceiling	X	115/177	24	Red	Round	UL, MEA, CSFM, FM
RSS-24MCCHR-FW	Ceiling	X	115/177	24	White	Round	UL, MEA, CSFM, FM
RSS-24MCWH-FR	Wall	X	135/185	24	Red	Square	UL, MEA, CSFM, FM
RSS-24MCWH-FW	Wall	X	135/185	24	White	Square	UL, MEA, CSFM, FM
RSSWP-2475W-FR	Wall	X	180 @ 77°F 75 @ -31°F	12/24	Red	Square	UL, MEA, CSFM, FM
RSSWP-2475W-FW	Wall	X	180 @ 77°F 75 @ -31°F	12/24	White	Square	UL, MEA, CSFM, FM
RSSP-121575W-FR	Wall	X	15 (75 on axis)	12	Red	Square	UL, MEA, CSFM, FM, BFP
RSSP-24MCW-FW	Wall	X	15/30/75/110	24	White	Square	UL, MEA, CSFM, FM, BFP
RSSP-24MCW-FR	Wall	X	15/30/75/110	24	Red	Square	UL, MEA, CSFM, FM, BFP
RSSP-241575W-FR	Wall	X	15 (75 on axis)	24	Red	Square	UL, MEA, CSFM, FM, BFP
RSSP-241575W-FW	Wall	X	15 (75 on axis)	24	White	Square	UL, MEA, CSFM, FM, BFP

GENTEX CORPORATION

Commander² Series Low Frequency Evacuation Signals

GEC/GES/GEH
24 VDC
SERIES

Applications

The Commander² Series is a low profile strobe, horn or horn/strobe combination that offers dependable audible and audible/visual alarms and the absolute lowest current available.

The GE Series is available in fixed candela options of 15/75 and 177.

The Commander² Series horn offers a continuous or synchable temporal three in 2400Hz and mechanical tone, a chime and whoop tone. All tones are easy for the professional to change in the field by using switches.

The GE Series has a minimal operation current and has a minimum flash rate of 1Hz regardless of input voltage.

The Commander² Series is shipped with the standard 4" mounting plate which incorporates the popular Super-Slide® feature that allows the installer to easily test for supervision. The product also features a locking mechanism which secures the product to the bracket without any screws showing.

The Commander² Series also features the patented Checkmate® - Instant Voltage Verification feature which allows the installer to check the voltage drop draw and match it to the blueprint.

The GE Series appliances are ANSI/UL 464, ANSI/UL 1971 and/or ANSI/UL 1638 listed for use with fire protective systems and are warranted for three years from date of purchase.

Standard Features

- Nominal voltage 24VDC
- Fixed candela options of 15/75 and 177
- GEH horn is available in 12VDC or 24VDC
- Super-Slide® Bracket - ease of supervision testing
- Checkmate® - instant voltage verification
- Unit Dimensions: 5" (12.7 cm) high x 4.5" (11.43 cm) wide x 2.5" (6.35 cm) deep
- Synchronize strobe and/or horn with Gentex AVSM Control Module
- Prewire entire system, install mounting bracket, then install signals
- Documented lower installation and operating costs
- Input terminals 12 to 18 AWG
- Switch selection for high or low dBA
- Switch for chime, whoop, mechanical and 2400Hz tone
- Switch for continuous or temporal 3 (not available on whoop tone)
- Tamperproof re-entrant grill
- Surface mount with the GSB (Gentex Surface Mount Box)
- Silence horn while strobes remain flashing
- Faceplate available in red or off-white

Product Listings

SIGNALING
LISTED

- ANSI/UL 464, ANSI/UL 1971 and/or ANSI/UL 1638 Listed
- CSFM: 7135-0569:122 (GEH-24 & GEC-24)
  7125-0569:123 (GES-24)
  7135-0569: 130 (GEH-12)
- MEA: 285-91-E-XV

Patents

- 7,375,617 May 20, 2008

Product Compliance

- NFPA 72
- Americans with Disabilities Act (ADA)
- IBC/IFC/IRC
- City & State Ordinances/Laws/Regulations
- Quality Management System is certified to: ISO 9001:2008

NEMA MEMBER

ASSEMBLED IN THE USA

GEH 12VDC and 24VDC Low Profile Evacuation Horn

Model Number	Part Number	Nominal Voltage	Reverberant dBA @ 10ft., per ANSI/UL 464	In Anechoic Room dBA @ 10ft.
GEH12-R	904-1239-002	12 VDC	70-82	100
GEH12-W	904-1241-002	12 VDC	70-82	100
GEH24-R	904-1205-002	24 VDC	70-82	100
GEH24-W	904-1207-002	24 VDC	70-82	100

GES 24 VDC Low Profile Evacuation Strobe

Model Number	Part Number	Nominal Voltage	Strobe Candela
GES24-177WR	904-1183-002	24 VDC	177
GES24-177WW	904-1203-002	24 VDC	177
GES24-15/75WR	904-1167-002	24 VDC	15 (ANSI/UL 1971) / 75 (ANSI/UL 1638)
GES24-15/75WW	904-1187-002	24 VDC	15 (ANSI/UL 1971) / 75 (ANSI/UL 1638)

Model Designations:
W = Wall mount
R = Red Faceplate W = White Faceplate

All units are available in plain (no lettering).
Plain units are non-returnable.

ALERT bezel available AGENT bezel available

GEC 24VDC Fixed Candela, Low Profile Evacuation Horn/Strobe

Model Number	Part Number	Nominal Voltage	Strobe Candela	Reverberant dBA @ 10ft., per ANSI/UL 464	In Anechoic Room dBA @ 10ft.
GEC24-177WR	904-1143-002	24 VDC	177	70-82	100
GEC24-177WW	904-1163-002	24 VDC	177	70-82	100
GEC24-15/75WR	904-1127-002	24 VDC	15 (ANSI/UL 1971) / 75 (ANSI/UL1638)	70-82	100
GEC24-15/75WW	904-1147-002	24 VDC	15 (ANSI/UL 1971) / 75 (ANSI/UL 1638)	70-82	100

GE-24 Product Strobe Current Ratings (mA)

	24VDC (16-33 Volts)	
Candela	**24VDC**	UL Max[1]
15/75cd	**63mA**	67mA
177cd	**96mA**	213mA

GEH-12 Product Horn Decibel and Current Ratings			
Horn Mode	Minimum dBA @ 10ft. per ANSI/UL 464 (HIGH)	Minimum dBA @ 10ft. per ANSI/UL 464 (LOW)	Regulated 12VDC Max. Operating @ High Setting (mA)
Temp 3 2400Hz	76	69*	29
Temp 3 Mechanical	75	68*	26
Temp 3 Chime	62*	60*	13
Continuous 2400Hz	79	74*	29
Continuous Mechanical	78	72*	26
Continuous Chime	63*	61*	13
Whoop	78	71*	55

GE-24 Product Horn Decibel and Current Ratings			
Horn Mode	Minimum dBA @ 10ft. per ANSI/UL 464 (HIGH)	Minimum dBA @ 10ft. per ANSI/UL 464 (LOW)	Regulated 24VDC Max. Operating @ High Setting (mA)
Temp 3 2400Hz	78	71*	28
Temp 3 Mechanical	76	70*	25
Temp 3 Chime	70*	66*	15
Continuous 2400Hz	81	74*	28
Continuous Mechanical	80	72*	25
Continuous Chime	70*	66*	15
Whoop	82	69*	56

NOTES:

- Operating temperature: 32°to 120°F (0° to 49°C). The GE Series is not listed for outdoor use.

  The sound output for the temporal 3 tone is rated lower since the time the horn is off is averaged into the sound output rating. While the horn is producing a tone in the temporal 3 mode its sound pressure is the same as the continuous mode.
- For nominal and peak current across UL regulated voltage range for filtered DC power and unfiltered (FWR [Full Wave Rectified]) power, see installation manual. 12VDC models are DC only.

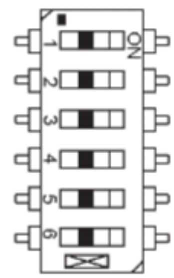
* Operating the horn in this mode at this voltage will result in not meeting the minimum ANSI/UL 464 reverberant sound level required for public mode fire protection service. These settings are acceptable only for private mode fire alarm use. Use the high dBA setting for public mode application (not applicable when using the chime tone. The chime tone is always private mode).

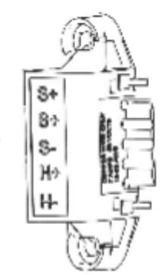
[1] RMS current ratings are per UL average RMS method. UL max current rating is the maximum RMS current within the listed voltage range (16-33VDC for 24VDC units) (8-17VDC for 12VDC units). For strobes the UL max current is usually at the minimum listed voltage (16VDC for 24VDC units) (8VDC for 12VDC units). For audibles the max current is usually at the maximum listed voltage. For unfiltered FWR ratings, see installation manual.

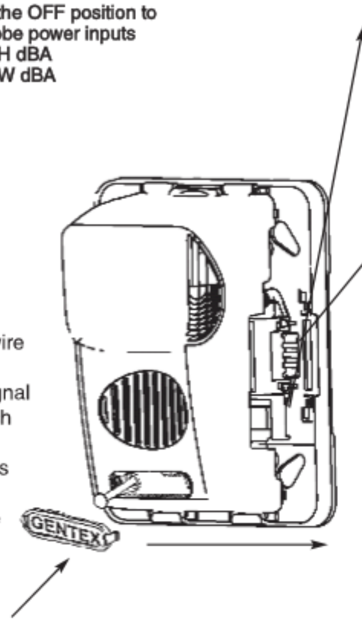
Tone Switch Locations

TONE	SWITCH POSITION		
	3	4	5
Mechanical Temporal 3	ON	ON	ON
Mechanical - Continuous	OFF	ON	ON
2400Hz - Temporal 3	ON	OFF	ON
2400Hz - Continuous	OFF	OFF	ON
Chime - Temporal 3	ON	ON	OFF
Chime - Continuous	OFF	ON	OFF
Whoop	ON	OFF	OFF
Whoop	OFF	OFF	OFF

NOTE:
- **Switch Positions 1 and 2 in the OFF position to select isolated horn and strobe power inputs**
- **Switch Position 6 ON = HIGH dBA**
- **Switch Position 6 OFF = LOW dBA**







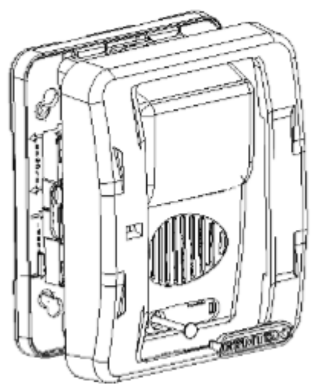
Gentex Super-Slide® Mounting Bracket

Allows the installer to pre-wire the system, test for system supervision, remove the signal head until occupancy, switch out Gentex signals without changing mounting brackets and has locking edge connector for snap-in-place installation.

Gentex Checkmate® Instant Voltage Verification

It is often necessary to confirm the voltage drop along a line of devices. The access holes are provided in the back of the terminal block to allow the voltage to be measured directly without removing the device. Typically this would be done at the end of the line to confirm design criteria. Most measurements will be taken using the S+ and S- locations although access is provided to other locations.

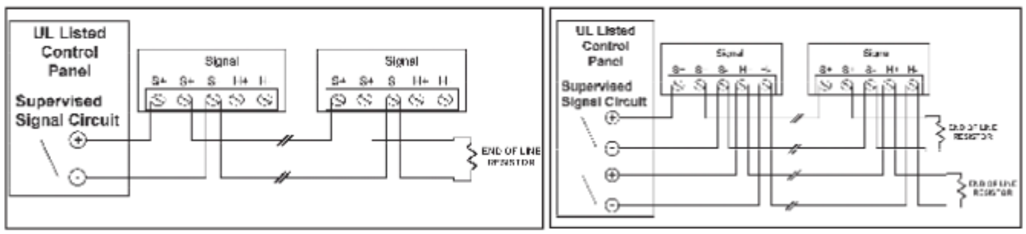
NOTE: Care should be taken to not short the test probes.



To remove bezel, grip both sides of bezel and pull in a downward and outward motion.

GEC/GES/GEH 24 VDC SERIES

Conventional GES/GEC Series Wiring Diagrams



NOTES:

- All strobes are designed to flash as specified with continuous applied voltage. Strobes should not be used on coded or pulsing signaling circuits. However, use of the Gentex AVSM control module or Gentex synchronization protocol is permitted to synchronize the strobe, horn and/or mute the horn. See Technical Bulletin 014 for additional information.
- FOR SYNCHRONIZATION WIRING INFORMATION, REFERENCE AVSM CONTROL MODULE DATA SHEET (551-0031) AND/OR AVSM CONTROL MODULE MANUAL (550-0284) FOR SYNCHRONIZATION MODULE WIRING DIAGRAMS. AVSM CONTROL MODULE DATA SHEET AND MANUAL CAN BE OBTAINED AT http://www.gentex.com OR CALL GENTEX CORPORATION AT 1-800-436-8391.
- When synchronizing the GEH 12VDC Series, the Gentex AVSM control module or Gentex synchronization protocol MUST be used.

Architect & Engineering Specifications

The audible and/or visible signal shall be Gentex GE Series or approved equal and shall be listed by Underwriters Laboratories Inc. per ANSI/UL 1971, ANSI/UL 1638 and/or ANSI/UL 464. The notification appliance shall also be listed with the California State Fire Marshal (CSFM) and the Bureau of Standards and Appeals (NYC).

The notification appliance (combination audible/visible and audible units only) shall produce a peak sound output of 100dBA or greater at 12VDC or 24VDC as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of a single pair of power wires. Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized.

The audible/visible and visible signaling appliance shall also maintain a minimum flash rate of 1Hz or up to 2Hz regardless of power input voltage. The appliance shall also be capable of meeting the candela requirements of the ADA (75Cd) for the combination listed (UL 1971/UL 1638) listed models. The appliance shall have an operating current of 67mA or less at 24 VDC for the 15/75Cd for the strobe circuit.

The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with a mounting bracket with terminals with barriers for input/output wiring and be able to mount to a single gang or double gang box or double workbox without the use of an adapter plate. The unit shall have an input voltage range of 16-33 volts with either direct current of full wave rectified power.

The appliance shall be capable of test supervision without disconnecting wires, verify voltage without removing unit and be capable of mounting to a surface back box.

24 units per carton
27 pounds per carton

GENTEX CORPORATION
Fire Protection Products Group • www.gentex.com
10985 Chicago Drive • Zeeland, Michigan 49464
616.392.7195 • 1.800.436.8391 • 616.392.4219 Fax

551-0049-02

SCR

Product Images

Model:	SCR
Type:	Strobes

The SpectrAlert Advance SCR is a red, ceiling-mount strobe with selectable strobe settings of 15, 15/75, 30, 75, 95, 110 and 115 cd.

Spanish Product Manual

Product Documentation / Drawings

Brochure: Audible Visible Prod…

CAD Drawing: SCR

Data Sheet: Indoor Ceiling Str…

Product Manual: Horns, Strobe…

Accessories

Required

There are no required accessories for this product.

Optional

SBBCR

The SpectrAlert Advance SBBCR is a red surface mount back box for ceiling installations.

Specifications

Candela	Selectable strobe settings of 15, 15/75, 30, 75, 95, 110 and 115 cd
Ceiling Mount Dimensions:	6.8" diameter x 2.5" high (173 mm diameter x 64 mm high)
Color	Red
DC Max Op Current	(see Data Sheet for complete current draw information)
FWR Max Op Current	(see Data Sheet for complete current draw information)
Location	Indoor
Marking	FIRE
Maximum Humidity	10 to 93% non-condensing
Mounting	Ceiling
Operating Temperature	-40°F to 151°F (-40°C to 66°C)
Operating Voltage Range	8 to 17.5 V (12V nominal) or 16 to 33 V (24 nominal)
Voltage	Regulated 12DC/FWR or regulated 24DC/FWR

AS/AH AS Audible Strobe Appliances and AH Audibles

Features

- UL listed. ULC, CSFM, and FM pending.
- ADA/NFPA/UFC/ANSI Compliant
- Wall mount models are available with Field Selectable Candela Settings of 15/30/75/110cd or 135/185cd (Multi-Candela models)
- Ceiling mount models are available with field selectable candela settings of 15/30/75/95cd or 115/177cd (Multi-candela ceiling models)
- Selectable Continuous Horn or Temporal (Code 3).
- 3 Selectable dBA settings (99, 95 and 90 dBA) in both tones
- Weatherproof models are available for outdoor use
- Strobes can be synchronized using the Siemens 5406B sync modules, MPC-6000 panel, MPC-7000 panel, or RSE-300 power supply with built-in sync protocol.
- Fast installation with IN/OUT screw terminals using #12 to #18 AWG wires

AS-MC-CW

AS-MC-R


AH-W


AH-R

Description

The Siemens 2-wire Series AS Audible Strobe Appliances and Series AH Audibles offer more features with low current draw.

Strobe options for wall mount models include the Siemens MC multi-candela wall strobes with field selectable candela settings of 15/30/75/110cd, or the high intensity HMC strobe with field selectable 135/185cd.

Ceiling mount models incorporate Siemens MC multi-candela ceiling strobe with field selectable settings of 15/30/75/95cd or the high intensity HMC strobe with field selectable settings of 115/177cd.

The audible provides a selectable choice of either a continuous horn or temporal pattern (Code 3) when constant voltage from a Fire Alarm Panel (FACP) is applied. Each tone has 3 dBA settings from which to choose.

When used with the Siemens 5406B sync modules, MPC-6000 panel, MPC-7000 panel, or RSE-300 power supply with built-in sync protocol, synchronization of the continuous horn tone provides the temporal (code 3) tone (mandated by NFPA 72) simultaneously for all audible appliances. This ensures a distinct temporal (code 3) pattern when 2 or more audibles are within hearing distance. If not synchronized the temporal sound could overlap and not be distinctive. At the same time the strobes will be synchronized. This provides the ability to comply with ADA guidelines concerning photosensitive epilepsy and the NFPA standards when installing 2 or more visual appliances within the field of view all of this plus the ability to silence the audible is achieved by using only 2 wires.

Engineering Specifications

The notification appliances shall be Siemens Series AS Audible Strobe appliances and Series AH Audible appliances or approved equals. The Series AS Audible be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service. The Series AH Audible shall be UL Listed under Standard 464 (Fire Protective Signaling). Both shall meet the requirements of FCC Part 15 Class B. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).

The audible portion of the appliance shall have a minimum of three (3) field selectable settings for dBA levels and shall have a choice of continuous or temporal (Code 3) audible outputs.

The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens. The Series AS shall be of low current design. Where Multi-Candela appliances are specified, the strobe intensity shall have

9668

field selectable settings and shall be rated per UL Standard 1971 at 15/30/75/110 or 135/185 candela for wall mount and 15/30/75/95 or 115/177 candela for ceiling mount. The selector switch for selecting the candela shall be tamper resistant.

When synchronization is required, the appliance shall be synchronized using the Siemens 5406B sync modules, MPC-6000 panel, MPC-7000 panel, or RSE-300 power supply with built-in sync protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash-rate. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with Siemens synchronization.

The Series AS Audible Strobe and Series AH Audible shall incorporate a Patented Universal Mounting Plate that shall allow mounting to a single-gang, double-gang, 4-inch square, 100mm European type backboxes, or the SHBBS Surface Backbox.

All notification appliances shall be listed for Special Applications.

- Strobes are designed to flash at 1 flash per second minimum over their "Regulated Input Voltage Range". Note that NFPA-72 specifies a flash rate of 1 to 2 flashes per second and ADA Guidelines specify a flash rate of 1 to 3 flashes per second.
- All candela ratings represent minimum effective Strobe intensity based on UL Standard 1971.

Technical Information

For complete technical information, please consult the relevant installation sheets as well as the Siemens Compatibility Guide.

Ordering Information / Mounting Requirements / Approvals

Model Number	Order Code	Wall Mount	Ceiling Mount	Mounting Options**	Agency Approvals			
					UL	ULC	CSFM	FM
AS-MC-R	500-636010	X	-	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-MC-W	500-636011	X	-	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-HMC-R	500-636012	X	-	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-HMC-W	500-636013	X	-	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-MC-CR	500-636006	-	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-MC-CW	500-636007	-	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-HMC-CR	500-636008	-	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-HMC-CW	500-636009	-	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AS-75-R-WP	500-636016	X	-	I	X	#	#	#
AS-75-CR-WP	500-636015	-	X	I	X	#	#	#
AH-R	500-636003	X	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AH-W	500-636004	X	X	A,B,D,E,F,G,J,N,R,X	X	#	#	#
AH-R-WP	500-636005	X	X	K	X	#	#	#

X = listed/approved # = pending * = Refer to Data Sheet #9675 for mounting options.

WARNING: PLEASE READ THESE SPECIFICATIONS AND INSTALLATION INSTRUCTIONS CAREFULLY BEFORE USING, SPECIFYING OR APPLYING THIS PRODUCT. FAILURE TO COMPLY WITH ANY OF THESE INSTRUCTIONS, CAUTIONS AND WARNINGS COULD RESULT IN IMPROPER APPLICATION, INSTALLATION AND/OR OPERATION OF THESE PRODUCTS IN AN EMERGENCY SITUATION, WHICH COULD RESULT IN PROPERTY DAMAGE, AND SERIOUS INJURY OR DEATH TO YOU AND/OR OTHERS.

FARADAY

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Web: www.faradayfirealarms.com

8/07 2M SBT/IG

August 2007 - New Issue

GENTEX CORPORATION

Commander³ Series Selectable Candela Evacuation Signals

GEC3/GES3
12 & 24 VDC
SERIES

Applications

The Commander³ Series is a low profile strobe and horn/strobe combination that offers dependable audible and visual alarms and the absolute lowest current available.

The GE3 Series 24VDC offers tamperproof field selectable candela options of 15, 30, 60, 75, and 110 candela. The 12VDC offers tamperproof field selectable candela options of 15, 30, 60, and 75 candela.

The Commander³ Series horn offers a continuous or synchable temporal three in 2400Hz and mechanical tone, a chime and whoop tone. All tones are easy for the professional to change in the field by the use of switches.

The GE3 Series has a minimal operating current and has a minimum flash rate of 1Hz regardless of input voltage.

The Commander³ Series is shipped with a standard 4" metal mounting plate which incorporates the popular Super-Slide® feature that allows the installer to easily test for supervision. The product also features a locking mechanism which secures the product to the bracket without any screws showing.

The Commander³ also features the patented Checkmate® - Instant Voltage Verification feature which allows the installer to check the voltage drop draw and match it to the blueprint.

The GE3 Series appliances are ANSI/UL 464 and ANSI/UL 1971, listed for use with fire protective systems and are warranted for three years from date of purchase.

Standard Features

- Nominal voltage 12VDC and 24VDC
- 24VDC units have field selectable candela options of 15, 30, 60, 75 & 110
- 12VDC units have field selectable candela options of 15, 30, 60 & 75
- GEH horn is available in 12VDC or 24VDC
- Unit Dimensions: 5" (12.7 cm) high x 4.5" (11.43 cm) wide x 2.5" (6.35 cm) deep
- Super-Slide® Bracket - Ease of Supervision Testing
- Checkmate® - Instant Voltage Verification
- Synchronize strobe and/or horn with Gentex AVSM Control Module
- Prewire entire system, install mounting bracket, then install signals
- Documented lower installation and operating costs
- Input terminals accept 12 to 18 AWG
- Switch selection for high or low dBA
- Switch for chime, whoop, mechanical and 2400Hz tone
- Tamperproof re-entrant style grill
- Switch for continuous or temporal 3 tone (not available on whoop tone)
- Surface mount with the GSB (Gentex Surface Mount Box)
- Silence audible while visual appliance will remain flashing (for use in accepted jurisdictions)
- Faceplate available in red or off-white

Product Listings

SIGNALING
UL
LISTED

- ANSI/UL 464 & ANSI/UL 1971 Listed
- CSFM: 7135-0569:122 (GEC3-24 & GEH-24)
  7125-0569:123 (GES3-24)
  7125-0569:129 (GES3-12)
  7135-0569:130 (GEC3-12 & GEH-12)
- MEA: 285-91-E (GEC3-24 & GES3-24)
  580-06-E (GEC3-12 & GES3-12)

Patents

- 7,375,617 May 20, 2008

Product Compliance

- NFPA 72
- Americans with Disabilities Act (ADA)
- IBC/IFC/IRC
- Quality Management System is certified to: ISO 9001:2008

NEMA MEMBER

ASSEMBLED IN THE USA

GEH 12VDC or 24VDC Low Profile Evacuation Horn

Model Number	Part Number	Nominal Voltage	Reverberant dBA at 10ft., per ANSI/UL 464	In Anechoic Room dBA at 10ft.
GEH12-R	904-1239-002	12VDC	62-82	100
GEH12-W	904-1241-002	12VDC	62-82	100
GEH24-R	904-1205-002	24VDC	62-82	100
GEH24-W	904-1207-002	24VDC	62-82	100

GES3 12VDC or 24VDC Selectable Candela, Low Profile Evacuation Strobe

Model Number	Part Number	Nominal Voltage	Candela (ANSI/UL 1971)
GES3-12WR	904-1235-002	12 VDC	15, 30, 60, 75
GES3-12WW	904-1237-002	12 VDC	15, 30, 60, 75
GES3-24WR	904-1321-002	24 VDC	15, 30, 60, 75, 110
GES3-24WW	904-1319-002	24 VDC	15, 30, 60, 75, 110

GEC3 12VDC or 24VDC Selectable Candela, Low Profile Evacuation Horn/Strobe

Model Number	Part Number	Nominal Voltage	Candela (ANSI/UL 1971)	Reverberant dBA at 10ft., per ANSI/UL 464	In Anechoic Room dBA at 10ft.
GEC3-12WR	904-1231-002	12 VDC	15, 30, 60, 75	62-82	100
GEC3-12WW	904-1233-002	12 VDC	15, 30, 60, 75	62-82	100
GEC3-24WR	904-1317-002	24 VDC	15, 30, 60, 75, 110	62-82	100
GEC3-24WW	904-1315-002	24 VDC	15, 30, 60, 75, 110	62-82	100

GE3 Product Strobe Current Ratings (mA)

	12 VDC (8-17.5 Volts)		24 VDC (16-33 Volts)	
Candela	**12VDC**	UL Max[1]	**24VDC**	UL Max[1]
15cd	**106mA**	92mA	**30mA**	42mA
30cd	**131mA**	141mA	**35mA**	58mA
60cd	**186mA**	260mA	**66mA**	97mA
75cd	**237mA**	312mA	**80mA**	116mA
110cd			**103mA**	161mA

Model Designations:

W = Wall mount
R = Red Faceplate W = White Faceplate

All units are available in plain (no lettering).
Plain units are non-returnable.

ALERT bezel available for order
AGENT bezel available for order

GE3-12 Product Horn Current Ratings

	Horn Decibel Levels		Horn Current Ratings
Horn Mode	Minimum SPL at 10ft., per ANSI/UL 464 (HIGH)	Minimum SPL at 10ft., per ANSI/UL 464 (LOW)	Regulated 12VDC Max. Operating @ High Setting (mA)
Temp 3 2400Hz	76 dBA	69* dBA	29mA
Temp 3 Mechanical	75 dBA	68* dBA	26mA
Temp 3 Chime	62* dBA	60* dBA	13mA
Continuous 2400Hz	79 dBA	74* dBA	29mA
Continuous Mechanical	78 dBA	72* dBA	26mA
Continuous Chime	63* dBA	61* dBA	13mA
Whoop	78 dBA	71* dBA	55mA

GE3-24 Product Horn Current Ratings

	Horn Decibel Levels		Horn Current Ratings
Horn Mode	Minimum SPL at 10ft., per ANSI/UL 464 (HIGH)	Minimum SPL at 10ft., per ANSI/UL 464 (LOW)	Regulated 24VDC Max. Operating @ High Setting (mA)
Temp 3 2400Hz	78 dBA	71* dBA	28mA
Temp 3 Mechanical	76 dBA	70* dBA	25mA
Temp 3 Chime	70* dBA	66* dBA	15mA
Continuous 2400Hz	81 dBA	74* dBA	28mA
Continuous Mechanical	80 dBA	72* dBA	25mA
Continuous Chime	70* dBA	66* dBA	15mA
Whoop	82 dBA	69* dBA	56mA

NOTES:

- Operating temperature: 32°to 120°F (0° to 49°C). The GEC3 and GES3 Series is **not** listed for outdoor use.
- For nominal and peak current across ANSI/UL regulated voltage range for filtered DC power and unfiltered (FWR [Full Wave Rectified]) power, see installation manual. 12VDC models are DC only.
- **Gentex does not recommend using a coded or pulsing signaling circuit with any of our strobe products (see Technical Bulletin Number 014).**
- The sound output for the temporal 3 tone is rated lower since the time the horn is off is averaged into the sound output rating. While the horn is producing a tone in the temporal 3 mode its sound pressure is the same as the continuous mode.

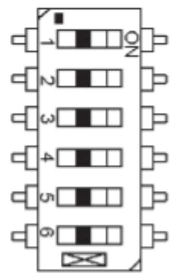
* Operating the horn in this mode at this voltage will result in not meeting the minimum ANSI/UL 464 reverberant sound level required for public mode fire protection service. These settings are acceptable only for private mode fire alarm use. Use the high dBA setting for public mode application (not applicable when using the chime tone. The chime tone is always private mode).

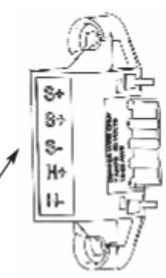
[1] RMS current ratings are per ANSI/UL average RMS method. ANSI/UL max current rating is the maximum RMS current within the listed voltage range (16-33VDC for 24VDC units) (8-17VDC for 12VDC units). For strobes the UL max current is usually at the minimum listed voltage (16VDC for 24VDC units) (8VDC for 12VDC units). For audibles the max current is usually at the maximum listed voltage. For unfiltered FWR ratings, see installation manual.

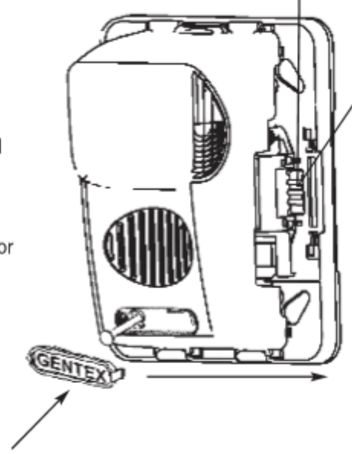
Tone Switch Locations

TONE	SWITCH POSITION		
	3	4	5
Mechanical Temporal 3	ON	ON	ON
Mechanical - Continuous	OFF	ON	ON
2400Hz - Temporal 3	ON	OFF	ON
2400Hz - Continuous	OFF	OFF	ON
Chime - Temporal 3	ON	ON	OFF
Chime - Continuous	OFF	ON	OFF
Whoop	ON	OFF	OFF
Whoop	OFF	OFF	OFF

NOTE:
- **Switch Positions 1 and 2 in the OFF position to select isolated horn and strobe power inputs**
- **Switch Position 6 ON = HIGH dBA**
- **Switch Position 6 OFF = LOW dBA**







Gentex Super-Slide® Mounting Bracket

Allows the installer to pre-wire the system, test for system supervision, remove the signal head until occupancy, switch out Gentex signals without changing mounting brackets and has locking edge connector for snap-in-place installation.

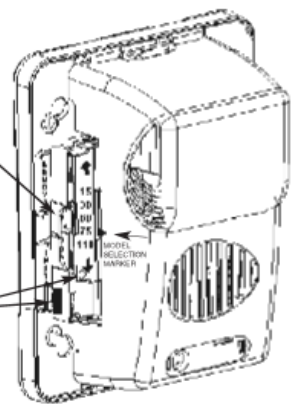
Gentex Checkmate® Instant Voltage Verification

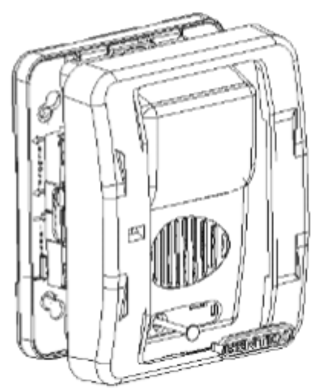
It is often necessary to confirm the voltage drop along a line of devices. The access holes are provided in the back of the terminal block to allow the voltage to be measured directly without removing the device. Typically this would be done at the end of the line to confirm design criteria. Most measurements will be taken using the S+ and S- locations although access is provided to other locations.

NOTE: Care should be taken to not short the test probes.

Candela selection slider switch. Depress center and slide switch to desire brightness level.

Break off pin and insert into hole at the bottom of the selector to lock candela setting. Signal must be removed from bracket and pin pushed forward from backside out of hole to change candela.

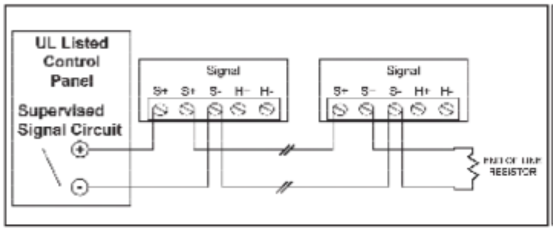


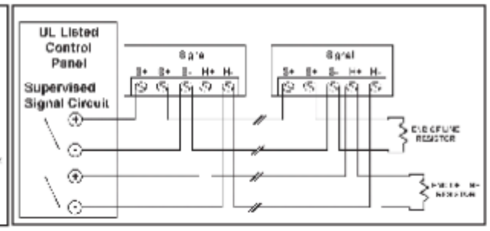


To remove bezel, grip both sides of bezel and pull in a downward and outward motion.

GEC3/GES3
12 & 24 VDC
S E R I E S

Conventional Wiring Diagrams for Emergency Notification Evacuation Series





NOTES:

- All strobes are designed to flash as specified with continuous applied voltage. Strobes should not be used on coded or pulsing signaling circuits. However, use of the Gentex AVSM control module or Gentex synchronization protocol is permitted to synchronize the strobe, horn and/or mute the horn. See Technical Bulletin 014 for additional information.
- **FOR SYNCHRONIZATION WIRING INFORMATION, REFERENCE AVSM CONTROL MODULE DATA SHEET (551-0031) AND/OR AVSM CONTROL MODULE MANUAL (550-0284) FOR SYNCHRONIZATION MODULE WIRING DIAGRAMS. AVSM CONTROL MODULE DATA SHEET AND MANUAL CAN BE OBTAINED AT http://www.gentex.com OR CALL GENTEX CORPORATION AT 1-800-436-8391.**
- **When synchronizing the GE3 12VDC Series, the Gentex AVSM control module or Gentex synchronization protocol MUST be used.**

Architect & Engineering Specifications

The audible and/or visible signal shall be Gentex GEH, GES3, GEC3 Series or approved equal and shall be listed by Underwriters Laboratories, Inc. per ANSI/UL 1971 and/or ANSI/UL 464. The notification appliance shall also be listed with Factory Mutual Listing Service (FM) and the California State Fire Marshal (CSFM).

The notification appliance (combination audible/visible) shall produce a peak sound output of 100dBA or greater at 12VDC or 24VDC as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of a single pair of power wires. Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized.

Unit shall be capable of being installed so that any unauthorized attempt to change the candela setting will result in a trouble signal at the fire alarm control panel.

The audible/visible and visible signaling appliance shall also maintain a minimum flash rate of 1Hz or up to 2Hz regardless of power input voltage. The strobe appliance shall have an operating current of 42mA or less at 24VDC for the 15Cd strobe circuit and 92mA or less at 12VDC for the 15Cd strobe circuit.

The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with a mounting bracket with terminals and barriers for input/output wiring and be able to mount to a single gang or double gang box or double workbox without the use of an adapter plate. The unit shall have an input voltage range of 16-33 volts with either direct current or full wave rectified power for 24VDC models or a voltage range of 8-17.5 volts for 12VDC models.

The appliance shall be capable of testing supervision without disconnecting wires, verify voltage without removing unit and be capable of mounting to a surface back box.

24 units per carton
28 pounds per carton

GENTEX CORPORATION

Fire Protection Products Group • www.gentex.com
10985 Chicago Drive • Zeeland, Michigan 49464
616.392.7195 • 1.800.436.8391 • 616.392.4219 Fax

551-0050-06

AUDIBLE/VISIBLE NOTIFICATION

SpectrAlert Selectable Output Strobe and Horn/Strobes

SYSTEM SENSOR®

Models Available

Strobes

Red	White
S1224MC	S1224MCW
S1224MCP	S1224MCPW
S1224MCK	
S1224MCSP	

Horn/Strobes

Red	White
P1224MC	P1224MCW
P1224MCP	P1224MCPW
P1224MCK	
P1224MCSP	

Horns

Red	White
H12/24	H12/24W
H12/24K	

Product Overview

Operates on either 12V or 24V

Widest range of candela options:
12V: 15 and 15/75 candela
24V: 15, 15/75, 30, 75, 110 candela

Easy candela selection

Lower current draw

Easy DIP switch selection for horn options

Easy mounting with QuickClick™

Synchronizable with MDL Sync•Circuit™ module

Meets UL1971, NFPA72, and ADA signaling requirements

All strobe and horn/strobe models incorporate a new patent-pending voltage booster design that has a more consistent flash bulb voltage over the range of candela selections. The benefit to the customer is a high quality strobe device.

LISTED
S5512
S4011

CS549W602NK17964
CS549W702NK13751

7125-1209:222
7135-1209:223

APPROVED
3014150

MEA approved
122-02-E
126-02-E

SpectrAlert® Selectable Output Horns, Strobes, and Horn/Strobes offer enhanced features that include the widest range of candela options available and the capability to recognize and self-adjust for either 12 or 24 volt operation. With an overall feature set that combines performance, installation ease, flexibility, and a consistent, aesthetically pleasing appearance, the SpectrAlert Selectable Output devices provide both the innovation and efficiency synonymous with the SpectrAlert name.

Performance. SpectrAlert selectable output wall-mount horns, strobes, and horn/strobes offer key performance features long associated with the SpectrAlert name. The selectable candela strobes and horn/strobes offer average current draws that are not only lower than conventional fixed-candela SpectrAlert products, but also lower than similar selectable candela products. By consuming less current, the ability to connect even more devices per loop is possible, resulting in a lower installed cost.

Installation. SpectrAlert selectable output horns, strobes, and horn/strobes offer the same installation-friendly features synonymous with the SpectrAlert name, such as the option of 2- and 4-wire operation; the ability to use standard size backboxes with no encroachment into the box; and universal mounting incorporating the labor-saving QuickClick™ feature. Such labor-savings features make wire connections simple and fast, further reducing installed cost.

Flexibility. SpectrAlert selectable output strobes and horn/strobes offer the broadest range of candela options. In addition, the selectable output strobes and horn/strobes can operate on either 12V or 24V, with no setting required; the device recognizes and self-adjusts to the correct current automatically. Temporal 3 or Continuous tone options continue to be available, in either an Electromechanical or 3kHz pattern.

Aesthetics. SpectrAlert selectable output horns, strobes, and horn/strobes incorporate the same stylish, low profile design of the conventional SpectrAlert products, for a consistent and aesthetically pleasing appearance across the entire product line.

Engineering Specifications

General

SpectrAlert horns, strobes and horn/strobes shall be capable of mounting to a standard 4" × 4" × 1 1/2" back box or a single gang 2" × 4" × 1 7/8" back box using the universal mounting plate included with each SpectrAlert product. Also, SpectrAlert products, when used in conjunction with the accessory Sync•Circuit Module, shall be powered from a non-coded power supply and shall operate on 12 or 24 volts. 12 volt rated devices shall have an operating voltage range of 9–17.5 volts. 24-volt rated devices shall have an operating voltage range or 17–33 volts. SpectrAlert products shall have an operating temperature of 32° to 120°F and operate from a regulated DC or full wave rectified, unfiltered power supply.

Strobe

Strobe shall be a System Sensor SpectrAlert Model _______ listed to UL 1971 and be approved for fire protective service. The strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Horn/Strobe Combination

Horn/Strobe shall be a System Sensor SpectrAlert Model _______ listed to UL 1971 and UL 464 and shall be approved for fire protective service. Horn/strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have two tone options, two audibility options (at 24 volts) and the option to switch between a temporal 3 pattern and a non-temporal continuous pattern. Strobes shall be powered independently of the sounder with the removal of factory installed jumper wires. The horn on horn/strobe models shall operate on a coded or non-coded power supply (the strobe must be powered continuously).

Synchronization Module

Module shall be a System Sensor Sync•Circuit _______ listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1Hz and horns at temporal 3. Also, the module shall silence the horns on horn/strobe models, while operating the strobes, over a single pair of wires. The module shall be capable of mounting to a 4 11/16" × 4 11/16" × 2 1/8" back box and shall control two Style Y (class B) or one Style Z (class A) circuit. Module shall be capable of multiple zone synchronization by daisy chaining multiple modules together and re-synchronizing each other along the chain. The module shall not operate on a coded power supply.

Specifications

Walk Test
SpectrAlert horn/strobe and horn only work on "walk tests" with time durations of 4 seconds or greater

Input Terminals
12 to 18 AWG

Dimensions
Strobe and horn/strobe with universal plate
5" × 5 5/8" × 2 15/16"

Strobe and horn/strobe with small footprint plate
3 3/8" × 5 5/8" × 2 5/16"

Horn with universal mounting plate
5" × 5 5/8" × 1 5/16"

Horn without mounting plate
2 15/16" × 5 5/16" × 1 5/16"

Weight, horn only
7.2 oz.

Weight, strobe and horn/strobe
8.8 oz.

Mounting
4" × 4" × 1 1/2" or 2" × 4" × 1 7/8" standard boxes

Indoor Operating Temperature
32°F to 120°F (0°C to 49°C)

Maximum humidity
95% as tested per UL464

Operating Temperature
Weatherproof (horn and horn/strobes)
32°F to 150°F (0°C to 66°C)

(outdoor strobe only)
–40°F to 158°F (–40°C to 70°C)

ULC Canadian Models
–40°C to 66°C

Voltages
12 or 24VDC and FWR unfiltered

Operating voltage range*
12V: 8–17.5V; 24V: 16–33V

Operating voltage range* (with Sync•Circuit module, MDL)
12V: 9–17.5V; 24V: 17–33V

*Note for Strobes: Do not exceed; 1) 16–33 or 8–17.5 voltage range limit; 2) maximum number of 70 strobe lights when connecting the MDL Sync module with a maximum line impedance of 4 ohms per loop and; 3) maximum line impedance as required by the fire alarm control manufacturer

U.S. Patent Numbers
5,593,569
5,914,665
6,049,446

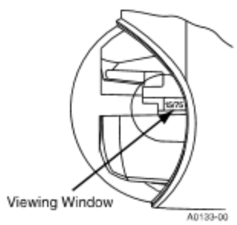
SpectrAlert Current Draw

Series	Candela Setting	FWR Operating Current–Strobe (mA RMS)		DC Operating Current–Strobe (mA RMS)		FWR Operating Current–Horn (mA RMS)		DC Operating Current–Horn (mA RMS)		Horn Audibility (dBA)
		12V	24V	12V	24V	12V	24V	12V	24V	
S1224MC Strobes	15	112	64	127	59					
	15/75	135	74	127	69					
	30		93		90					
	75		158		160					
	110		208		209					
P1224MC Horn/Strobes	15	112	64	127	59	45.7	57.5	44.4	57	75
	15/75	135	74	127	69	45.7	57.5	44.4	57	75
	30		93		90		57.5		57	75
	75		158		160		57.5		57	75
	110		208		209		57.5		57	75
H12/24 Horns						45.7	57.5	44.4	57	75

SpectrAlert Mounting and Operation

Candela Selections

For strobe candela selection, adjust slide switch located on the rear of the product while watching the viewing window on the side of the reflector.



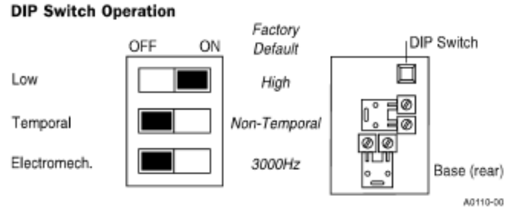
Permissible Candela Settings

Candela Setting	Operating Voltage	
	12V	24V
15	OK	OK
15/75	OK	OK
30		OK
75		OK
110		OK

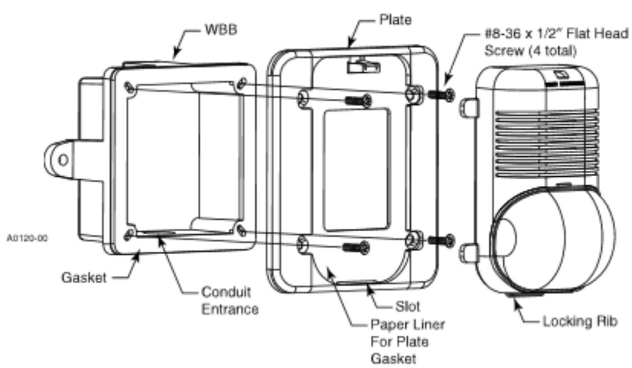
Selectable Horn Tones

Temporal	Low Volume	Electromechanical
		3000 Hz Interrupted
	High Volume	Electromechanical
		3000 Hz Interrupted
Non-Temporal	Low Volume	Electromechanical
		3000 Hz Interrupted
	High Volume	Electromechanical
		3000 Hz Interrupted

DIP Switch Operation



Typical weatherproof mounting with universal plate



SpectrAlert Ordering Information

Model	Description
P1224MC	Selectable Output Horn/Strobe, 12/24 volt, red
P1224MCW	Selectable Output Horn/Strobe, 12/24 volt, white
P1224MCP	Selectable Output Horn/Strobe, 12/24 volt, red, plain housing
P1224MCPW	Selectable Output Horn/Strobe, 12/24 volt, white, plain housing
P1224MCK	Selectable Output Horn/Strobe, 12/24 volt, red, weatherproof
P1224MCSP	Selectable Output Horn/Strobe, 12/24 volt, red, "FUEGO" housing
S1224MC	Selectable Output Strobe, 12/24 volt, red
S1224MCW	Selectable Output Strobe, 12/24 volt, white
S1224MCP	Selectable Output Strobe, 12/24 volt, red, plain housing
S1224MCPW	Selectable Output Strobe, 12/24 volt, white, plain housing
S1224MCK	Selectable Output Strobe, 12/24 volt, red, weatherproof
S1224MCSP	Selectable Output Strobe, 12/24 volt, red, "FUEGO" housing

Model	Description
H12/24	Horn, 12/24 volt, red
H12/24W	Horn, 12/24 volt, white
H12/24K	Horn, 12/24 volt, red, weatherproof
Accessories	
MDL	Sync•Circuit Module, red
MDLW	Sync•Circuit Module, white
MDLA	Sync•Circuit Module, red, Canadian model
MDLWA	Sync•Circuit Module, white, Canadian model
S-MP	Small Footprint Mounting Plate, red, for single-gang back box
S-MPW	Small Footprint Mounting Plate, white, for single-gang back box
BBS	Surface Mount Back Box Skirt, red
BBSW	Surface Mount Back Box Skirt, white
D-MP	Universal Mounting Plate (replacement), red
D-MPW	Universal Mounting Plate (replacement), white
WBB	Weatherproof Back Box

Notes

Agency Listings – Indoor models: UL, ULC, FM, CSFM, MEA. Weatherproof models: UL, CSFM (strobe only), MEA, ULC.

All of these SpectrAlert products are designed for wall mount only. All weatherproof models must use weatherproof back box model WBB. Installation of less than 75 candela strobes may be permissible under the equivalent facilitation clause of the ADAAG (Sec. 2.2). However, it is the responsibility of the person or entity designing the fire alarm system to determine the acceptability of less than 75 candela strobes. All 15/75 candela strobes or horn/strobes are recommended for 20' × 20' rooms or less.

System Sensor Sales and Service

System Sensor Headquarters
3825 Ohio Avenue
St. Charles, IL 60174
Ph: 800/SENSOR2
Fx: 630/377-6495
Documents-on-Demand
800/736-7672 x3
www.systemsensor.com

System Sensor Canada
Ph: 905.812.0767
Fx: 905.812.0771

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Ph: 44.1403.891920
Fx: 44.1403.891921

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Fx: 86.29.524.6259

System Sensor in Singapore
Ph: 65.6273.2230
Fx: 65.6273.2610

System Sensor – Far East
Ph: 85.22.191.9003
Fx: 85.22.736.6580

System Sensor – Australia
Ph: 613.54.281.142
Fx: 613.54.281.172

System Sensor – India
Ph: 91.124.237.1770 x.2700
Fx: 91.124.237.3118

System Sensor – Russia
Ph: 70.95.937.7982
Fx: 70.95.937.7983

A05-0325-003•5/04•#1200

SPECIAL ORDER PRODUCTS

AIPHONE®

NEM System for ADA Rescue Assistance Applications

VANDAL PROOF CALL STATION

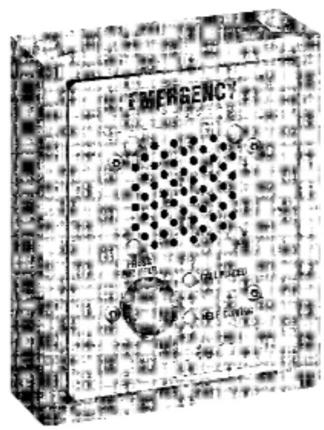
NE-NVP-RA

FEATURES/FUNCTIONS:

* Designed for Rescue Assistance applications to meet ADA requirements.
* *SPECIAL FEATURES INCLUDE:*
  - *Red mushroom call button to "press for help"*
  - *Green LED light and audible call tone for "call placed" indication.*
  - *Red LED light to acknowledge "help is coming".*
  - *Braille signage for visually impaired persons.*
  - *Reset button or key switch to be installed at each sub station to reset call.*
  - *Optional overhead lamps at each sub station to indicate call status.*
* 11 gauge carbon steel faceplate with mar-resistant, white powder-coated finish over heavy zinc plating.
* Metal barrier plates protect speaker from tampering.
* Surface mount box (SBX-NVP) is constructed from a 5/8" single piece of steel with pressure-welded folds.
* No sharp edges or exposed standard hardware.
* Flush mounts into a standard 3-gang masonry box.

SOME APPLICATIONS:
- Office Buildings
- Public Facilities
- Government Buildings
- Airports
- Military Facilities

Note: Install in an area not directly exposed to rainfall.



NE-NVP-RA (Shown mounted inside SBX-NVP)

SPECIFICATIONS:

SPEAKER:

Size:	3" dynamic impregnated-cone speaker Weather resistant / puncture resistant
Magnet weight:	2.5 oz.
Magnet material:	Ceramic
Impedance:	20Ω
Dimensions:	(H x W x D)
(NE-NVP-RA only)	7-1/2" x 5-1/2" x 2"
Call button:	SPST, normally open

SURFACE MOUNT BOX: SBX-NVP

Box dimension:	8-5/8"H x 6-5/8"W x 2-1/4"D
Weight:	2-1/2 lbs. (both pieces)
BACK BOX: (for flush mounting)	RACO 692 or 697, or STEEL CITY GW-335-C 3-gang masonry type or equal.

WIRING REQUIREMENTS: 4-conductor homerun from master to sub station, or Multi-conductor with 3 common wires plus 1 individual wire per sub, looped. Use Aiphone #822xx series cable (i.e. #822206, 6 cond. or 822210, 10 cond.)

Aiphone Corporation
1700 130th Ave. N.E.
Bellevue, WA 98005
(206) 455-0510
FAX: (206) 455-0071

Communication systems for business, home and industry.

TOLL FREE TECHNICAL DEPARTMENT
FAX LINE: (800) 832-3765

-23-

SYSTEM COMPONENTS AND DESCRIPTIONS:

MASTER STATIONS:

NEM-10	10-station master
NEM-10A	10-station master with handset
NEM-20	20-station master
NEM-20A	20-station master with handset
NEM-30	30-station master
NEM-30A	30-station master with handset
NEM-40	40-station master
NEM-40A	40-station master with handset

** When no reset switch is installed at sub, use:*

* NEM-*n*/RS	Master mod. with Reset Switch

ADD-ON SELECTORS:

N-20AS	20-station add-on selector
N-40AS	40-station add-on selector

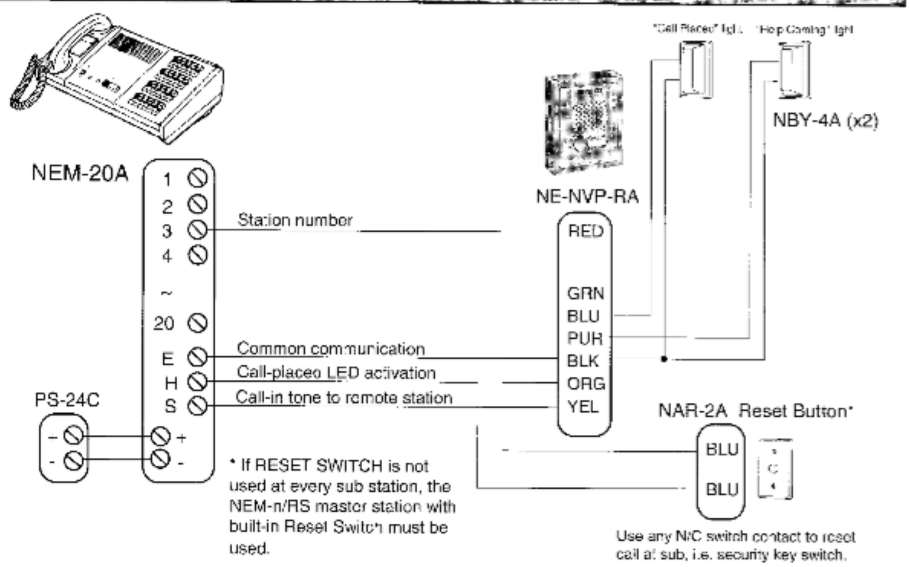
SUB STATION:

NE-NVP-RA	Vandal proof call station with mushroom button, call-placed and call-received indicator LEDs and emergency Braille signage

ACCESSORIES:

NBY-4A	Overhead call status lamp
NAR-2A	Reset button
NB-U	Background Music adaptor
PG-10A	10W Amplifier for NB-U
SBX-NVP	Surface mount box for NE-NVP-RA
PS-24C	1A power supply (1-20 stations)
PS-24N	2A power supply (21-40 stations)

WIRING DIAGRAM:



PRECAUTIONS AND WIRING TIPS:

1. Run intercom wires at least 20" away from any AC power lines, fluorescent lights, or dimmer switches. Avoid electrical devices that may emit signals or noise.
2. Shielded wire is recommended to help reduce possible interference from outside sources. Ground the shield at one end to an earth ground.
3. Avoid junction points. Terminate wires at the intercom stations.

For more information on these and other Special Order Products, please call the Technical Support department.

-24-

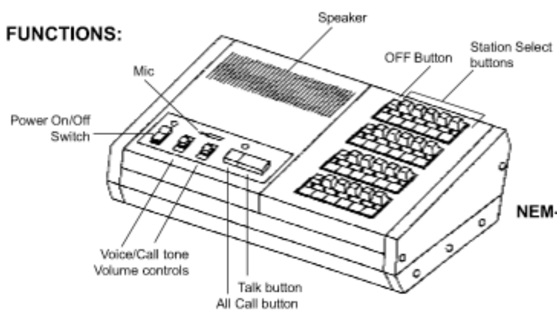
AIPHONE®

SPECIFICATIONS

NEM Master Stations

NEM-10, NEM-20, NEM-30, NEM-40

NAMES & FUNCTIONS:



NEM-20 Pictured

DESCRIPTION:

The NEM series is a selective calling open voice style intercom system. Masters are available in 10, 20, 30, and 40 station sizes, with optional 20 and 40 call add-on selectors. Maximum capacity is 120 stations. Master stations can be wall or desk mounted.

Sub stations are available in surface or flush mount styles, with or without privacy. Outdoor stations are available in surface or flush mount styles. Vandal and weather resistant sub stations are also available.

Incoming calls from a sub station are annunciated with an electronic tone and an LED, remaining activated until the call is answered at the master or reset at the calling location. The master answers the call by selecting the button with the lit LED. Communication at the master is press-to-talk, release-to-listen. Person at the sub station speaks hands free. The master station can selectively call and talk with any sub station in the system. The privacy feature on selected sub stations prevents eavesdropping from the master station.

Several Special Order Product variations of this system are available. Additional features available through SOP are selective door release, CCTV camera call-up, two levels of call signaling from sub stations, and master units modified for long distance/ elevator applications. See Aiphone's SOP catalog for more information on these systems.

FEATURES:

- Console master system with Lamp Memory, where call-in tone and LED remains active until answered
- 10, 20, 30 and 40 call master stations
- Expandable to 120 stations with the addition of 20 and 40 call add-on selectors
- Wide assortment of accessories to meet a variety of applications
- Push-to-talk at master, hands free at sub station
- Selective calling, Group calling, or All Call
- Separate transmit, recieve, All Call, and call tone volume controls
- Two master stations can be included in a system with NEW-5's (1 per 5 sub stations)

ARCHITECTS/ENGINEERS' SPECIFICATIONS:

The intercom system shall be of an open voice, selective calling type with individual selector buttons for each sub station. Master stations shall be available in 10, 20, 30, and 40 call sizes, with 20 and 40 call add-on selectors available for expansion. Master station shall be simplex operation, with hands free response from the called sub.

Master station shall be equipped with station selector switches in rows of five, with an OFF button for each row. Communication controls include a TALK button and an All Call button. Transmit, Receive, All Call, and Call Tone volume controls shall be provided on the back of the master station. Receive and Call Tone volume shall also have user-adjustable controls on the front of the master station.

An incoming call shall be annunciated by an electronic ringing call tone, and the corresponding station LED shall light. Both the call tone and the LED shall remain active until the call is answered at the master or reset at the calling location. The LEDs above the selector buttons shall illuminate when the station button is pressed at the calling master. The OFF LED shall light on the row that has a sub station selected.

Master station shall be wall or desk mounted. Sub stations shall be available in the following configurations: (1) surface or flush mount styles; (2) surface mount with privacy; (3) ceiling mount; (4) weather resistant door stations in surface or flush mount styles, mounted on or in standard 1-gang or 2-gang boxes; (5) vandal proof weather resistant style, with optional surface mount box.

Optional features shall include background music through all sub stations in the system, and the ability to integrate paging zones.

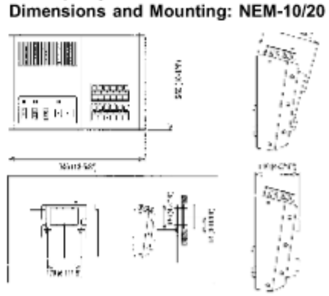
Wiring shall be shielded, with 2 conductors homerun per sub station, or a multi-conductor cable with one common and one individual wire per station on the run, looped.

Manufacturer must have earned ISO 9001 certification for quality standards.

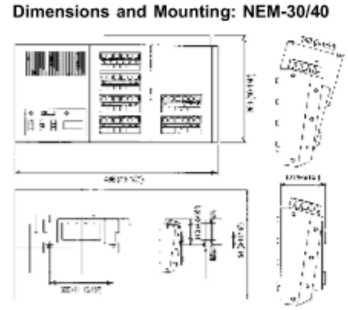
SPECIFICATIONS:

Power:	24V DC
Power Source:	PS-2410A (NEM-10, NEM-20) or PS-24E (NEM-30, NEM-40)
Current Consumption:	
NEM-10/20:	Max. 1A, 80mA in standby
NEM-30/40:	Max. 1.9A, 160mA in standby
Communication Output:	Maximum 500mW at 20 ohms at master (with receive volume control at maximum)
Communication:	Push-to-talk at master station Hands free at sub
All Call Output:	6W per 20 sub stations 12W in a system over 20 stations 3W per 10 sub stations in group call
Talk Channel:	1 talk channel, 2 channels in a 2-master system when using NEW-5 adaptors
Calling:	LED and intermittent ringing tone at master until answered Pretone at sub station when called
Signal-to-Noise Ratio:	40dB
Frequency Response:	770 - 6800Hz
Total Harmonic Distortion:	3% @ 1000Hz at 20 ohms
Mounting:	Wall or desk mount
Wiring:	2 conductors per sub station homerun, or 1 common plus 1 individual wire per station, looped.
Wiring Distance:	420' w/22AWG; 1,000' w/18AWG

Dimensions and Mounting: NEM-10/20



Dimensions and Mounting: NEM-30/40



Intercom Solutions For Communications and Security

NEM-SS 0200
Printed in USA

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(425) 455-0510 • FAX: (425) 455-0071 • (800) 692-0200 • www.aiphone.com

VIKING

TECHNICAL Practice

TELECOM SOLUTIONS FOR THE 21ST CENTURY

1600A Series

ADA Compliant Emergency Phones

September 18, 2014

ADA Compliant Emergency Phones with Built-In Digital Voice Announcer*

The **1600A Series** ADA Compliant Emergency Phones are designed to provide quick and reliable handsfree communication for any standard analog telephone line or analog phone system station port. All **1600A Series** phones meet ADA requirements for elevator/ emergency telephones, and can be programmed from any Touch Tone phone. The phones can dial up to 5 programmable emergency numbers, as well as 2 central station numbers. In addition, the **E-1600-20A** and **E-1600-52A** feature a second "**INFO**" button that will dial up to 3 non-emergency numbers.

The **1600A Series** phones can be programmed to automatically deliver a digital announcement to identify the location of the emergency call. Alternatively, a DTMF Touch Tone code may also be delivered. A "Call Connected" LED can be initiated manually or automatically. All programming parameters, including phone numbers and location numbers, are stored in non-volatile E^2 memory. All units are phone line powered, requiring no batteries or external power and are compatible with common Central Station Monitoring equipment.

For outdoor installations where the unit is exposed to precipitation or condensation, select **1600A Series** phones are available with Enhanced Weather Protection (**EWP**). EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards with internally sealed, field-adjustable trim pots and DIP switches for easy on-site programming. For more information, see **DOD# 859**.

Features

- **New Automatic Noise Canceling (ANC) feature for proper operation in noisy environments**
- Meets the latest ASME A17.1 code when used with the optional **LV-1K** Line Verification Panel, see **DOD# 246**
- Meets ADA requirements for Emergency Phones:
  - Automatically lights the "Call Connected" LED
  - Transmits a unique location I.D. code or voice announcement
  - Grade 2 Braille label for the visually impaired
- Non-volatile digital voice announcer with 16 seconds of voice memory
- Advanced call progress detection
- Handsfree operation
- Phone line powered
- Non-volatile memory (no batteries required)
- Marine grade 316 stainless steel prevents corrosion on stainless models
- Dials up to 5 emergency numbers
- **E-1600-20A** and **E-1600-52A** dial up to 3 non-emergency "INFO" numbers
- Cycles through backup phone numbers on busy or no-answer
- Optional Enhanced Weather Protection (EWP), EWP products are designed to meet IP66 Ingress Protection Rating, see **DOD# 859**
- Hangs up on CPC, silence, busy signal, dial tone, time-out or touch tone command
- Programmable to auto-answer on incoming calls
- Remotely programmable
- Extended temperature range (-15°F to 130°F)
- 9 different chassis or board only available
- Available in 42" tall tower phone model **E-1600A-BLT-EWP** (**DOD# 217**)
- Central Station Monitoring capability (dials 2 numbers)
- Optional **PB-100** Polling System available (**DOD# 232**)
- Optional **BLK-3-EWP** strobe light kit available (**DOD# 653**)
- Optional **LC-6** Six Port Concentrator available (**DOD# 245**)
- Optional **LV-1K** Line Verification Panel available (**DOD# 246**)
- Optional **E-1600A-MK-GNP** Pedestal Mounting Kit (**DOD# 227**)

Applications

- Elevators
- Parking ramps/lots
- Emergency pool phones
- ATM machines
- Area of refuge locations
- Lobbies
- Entryways
- Campus emergency stations
- Roadside emergency stations
- Stadiums
- Convention centers

** Americans with Disabilities Act of 1992 contains federal regulations regarding elevator telephones (Public Law 101-336).*

Specifications

Power: Telephone line powered. Minimum 24V DC talk battery voltage, with a minimum loop current of 20mA loop. Loop current may be boosted on low current lines with a Viking Model **TBB-1B** talk battery booster, see **DOD# 632**.
Dimensions: See Installation and Specifications
Operating Temperature: -26° C to 54° C (-15° F to 130° F)
Humidity - Standard Products: 5% to 95% non-condensing
Humidity - EWP Products: Up to 100%

CAUTION - When installing on an analog extension of a phone system: *Some phone systems do not conform to analog telecom standards and might not be compatible with the 1600A Series emergency phones. For a detailed description of the telephone line specifications required for any of the 1600A Series phones, see **DOD# 869**.*

IF YOU HAVE A PROBLEM WITH A VIKING PRODUCT, PLEASE CONTACT: VIKING TECHNICAL SUPPORT AT (715) 386-8666

Our Technical Support Department is available for assistance Monday 8am - 4pm and Tuesday through Friday 8am - 5pm central time. So that we can give you better service, before you call please:

1. Know the model number, the serial number and what software version you have (see serial label).
2. Have your Technical Practice in front of you.
3. It is best if you are on site.

RETURNING PRODUCT FOR REPAIR

The following procedure is for equipment that needs repair:

1. Customer must contact Viking's Technical Support Department at 715-386-8666 to obtain a Return Authorization (RA) number. The customer MUST have a complete description of the problem, with all pertinent information regarding the defect, such as options set, conditions, symptoms, methods to duplicate problem, frequency of failure, etc.
2. Packing: Return equipment in original box or in proper packing so that damage will not occur while in transit. Static sensitive equipment such as a circuit board should be in an anti-static bag, sandwiched between foam and individually boxed. All equipment should be wrapped to avoid packing material lodging in or sticking to the equipment. Include ALL parts of the equipment. C.O.D. or freight collect shipments cannot be accepted. Ship cartons prepaid to:
   Viking Electronics, 1531 Industrial Street, Hudson, WI 54016
3. Return shipping address: Be sure to include your return shipping address inside the box. We cannot ship to a PO Box.
4. RA number on carton: In large printing, write the R.A. number on the outside of each carton being returned.

RETURNING PRODUCT FOR EXCHANGE

The following procedure is for equipment that has failed out-of-box (within 10 days of purchase):

1. Customer must contact Viking's Technical Support at 715-386-8666 to determine possible causes for the problem. The customer MUST be able to step through recommended tests for diagnosis.
2. If the Technical Support Product Specialist determines that the equipment is defective based on the customer's input and troubleshooting, a Return Authorization (R.A.) number will be issued. This number is valid for fourteen (14) calendar days from the date of issue.
3. After obtaining the R.A. number, return the approved equipment to your distributor, referencing the R.A. number. Your distributor will then replace the product over the counter at no charge. The distributor will then return the product to Viking using the same R.A. number.
4. **The distributor will NOT exchange this product without first obtaining the R.A. number from you. If you haven't followed the steps listed in 1, 2 and 3, be aware that you will have to pay a restocking charge.**

TWO YEAR LIMITED WARRANTY

Viking warrants its products to be free from defects in the workmanship or materials, under normal use and service, for a period of two years from the date of purchase from any authorized Viking distributor. If at any time during the warranty period, the product is deemed defective or malfunctions, return the product to Viking Electronics, Inc., 1531 Industrial Street, Hudson, WI., 54016. Customer must contact Viking's Technical Support Department at 715-386-8666 to obtain a Return Authorization (R.A.) number.

This warranty does not cover any damage to the product due to lightning, over voltage, under voltage, accident, misuse, abuse, negligence or any damage caused by use of the product by the purchaser or others. This warranty does not cover non-EWP products that have been exposed to wet or corrosive environments. This warranty does not cover stainless steel surfaces that have not been properly maintained.

NO OTHER WARRANTIES. VIKING MAKES NO WARRANTIES RELATING TO ITS PRODUCTS OTHER THAN AS DESCRIBED ABOVE AND DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

EXCLUSION OF CONSEQUENTIAL DAMAGES. VIKING SHALL NOT, UNDER ANY CIRCUMSTANCES, BE LIABLE TO PURCHASER, OR ANY OTHER PARTY, FOR CONSEQUENTIAL, INCIDENTAL, SPECIAL OR EXEMPLARY DAMAGES ARISING OUT OF OR RELATED TO THE SALE OR USE OF THE PRODUCT SOLD HEREUNDER.

EXCLUSIVE REMEDY AND LIMITATION OF LIABILITY. WHETHER IN AN ACTION BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR ANY OTHER LEGAL THEORY, ANY LIABILITY OF VIKING SHALL BE LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, OR AT VIKING'S OPTION, REFUND OF THE PURCHASE PRICE AS THE EXCLUSIVE REMEDY AND ANY LIABILITY OF VIKING SHALL BE SO LIMITED.

IT IS EXPRESSLY UNDERSTOOD AND AGREED THAT EACH AND EVERY PROVISION OF THIS AGREEMENT WHICH PROVIDES FOR DISCLAIMER OF WARRANTIES, EXCLUSION OF CONSEQUENTIAL DAMAGES, AND EXCLUSIVE REMEDY AND LIMITATION OF LIABILITY, ARE SEVERABLE FROM ANY OTHER PROVISION AND EACH PROVISION IS A SEPARABLE AND INDEPENDENT ELEMENT OF RISK ALLOCATION AND IS INTENDED TO BE ENFORCED AS SUCH.

FCC REQUIREMENTS

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the ACTA. Located on the equipment is a label that contains, among other information, a product identifier in the format US:AAAEQ##TXXXX. If requested, this number must be provided to the telephone company.

The REN is used to determine the number of devices that may be connected to a telephone line. Excessive REN's on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of the REN's should not exceed five (5.0) To be certain of the number of devices that may be connected to a line, as determined by the total REN's, contact the local telephone company. For products approved after July 23, 2001, the REN for this product is part of the product identifier that has the format US:AAAEQ##TXXXX. The digits represented by ## are the REN without a decimal point (*e.g.*, 03 is a REN of 0.3). For earlier products, the REN is separately shown on the label.

The plug used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. If your home has specially wired alarm equipment connected to the telephone line, ensure the installation of this 1600A Series phone does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

If the 1600A Series phone causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with the 1600A Series phone, for repair or warranty information, please contact:

Viking Electronics, Inc., 1531 Industrial Street, Hudson, WI 54016 (715) 386-8666

If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

Connection to Party Line Service is subject to State Tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

WHEN PROGRAMMING EMERGENCY NUMBERS AND (OR) MAKING TEST CALLS TO EMERGENCY NUMBERS:

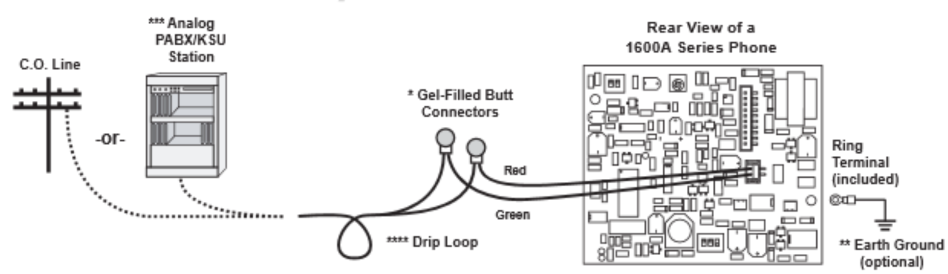
Remain on the line and briefly explain to the dispatcher the reason for the call. Perform such activities in the off-peak hours, such as early morning or late evenings.

It is recommended that the customer install an AC surge arrester in the AC outlet to which this device is connected. This is to avoid damaging the equipment caused by local lightning strikes and other electrical surges.

PART 15 LIMITATIONS

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Installation and Specifications



IMPORTANT: *Electronic devices are susceptible to lightning and power station electrical surges from both the AC outlet and the telephone line. It is recommended that a surge protector be installed to protect against such surges.*

**** Note:*** *The gel-filled (water-tight) butt connectors are designed for insulation displacement on 19-26 guage wire with a maximum insulation of 0.082 inches. Cut off bare wire ends prior to terminating.*

***** Note:*** *To increase surge protection, loosen the PCB mounting screw labeled ⏚ (as shown) and fasten a wire with spade terminal (included) from the mounting screw to Earth Ground (grounding rod, water pipe, etc.)*

****** Note:*** *When installing a line powered phone on a low voltage and/or low loop current phone system extension, a **TBB-1B** Talk Battery Booster may be required. For more information on the **TBB-1B**, retrieve **DOD# 632**.*

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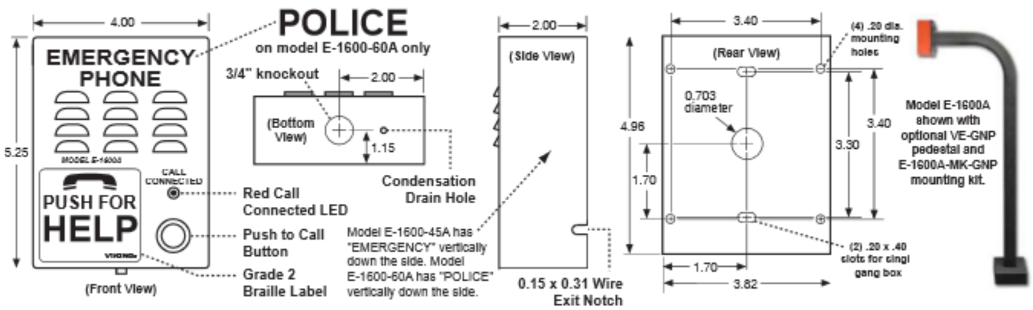
******* Note:*** *When wires are routed from above, a "drip loop" is recommended to keep water away from the circuit board.*

E-1600A/-40A/-45A/-60A/-65A (optional EWP)

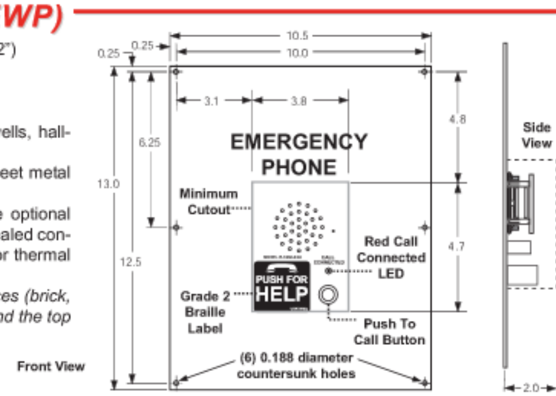
Dimensions: 133mm x 102mm x 51mm (5.25" x 4.0" x 2.0")
Shipping Weight: 1.13 kg (2.5 lbs.)
Material: .062" (16 gauge) steel, **E-1600A** - Red powder paint, **E-1600-40A** - Red powder paint without "EMERGENCY PHONE" verbiage, **E-1600-45A** - Yellow powder paint, **E-1600-60A/65A** - Blue powder paint
Connections: Gel-filled butt connectors
Mounting: Surface mount to walls, posts, single gang boxes or 4" x 4" electrical junction boxes or recess mount in elevator phone boxes.

Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.
Note: *For greater weather resistance, apply a bead of clear silicon caulking around the top edge and sides of the chassis.*
Optional Gooseneck Pedestal Mounting Kit: The **E-1600A-MK-GNP** Mounting Kit (**DOD# 227**) allows you to mount the **E-1600A**, **E-1600-40A**, **E-1600-45A**, **E-1600-60A** or **E-1600-65A** to a Viking **VE-GNP** Gooseneck Pedestal (**DOD# 424**).



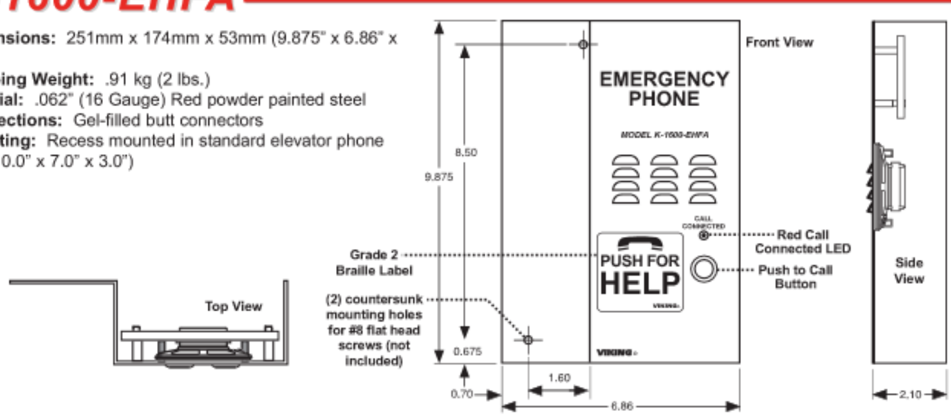
E-1600-02A (optional EWP)

Dimensions: 330mm x 267mm x 51mm (13" x 10.5" x 2")
Shipping Weight: 3.18 kg (7 lbs.)
Connections: Gel-filled butt connectors
Material: .125" (11 gauge) brushed stainless steel
Mounting: Flush mount in elevator cabs, ATMs, stairwells, hallways, etc.
Suggested Hardware: (6) #8 x 3/4 flat head phillips sheet metal type A screws (not included)
Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.
Note: *When mounting outside to rough or uneven surfaces (brick, stucco, etc.) apply a bead of clear silicone caulking around the top edge and sides of faceplate or* ***VE-5x5***.



K-1600-EHFA

Dimensions: 251mm x 174mm x 53mm (9.875" x 6.86" x 2.10")
Shipping Weight: .91 kg (2 lbs.)
Material: .062" (16 Gauge) Red powder painted steel
Connections: Gel-filled butt connectors
Mounting: Recess mounted in standard elevator phone box (10.0" x 7.0" x 3.0")

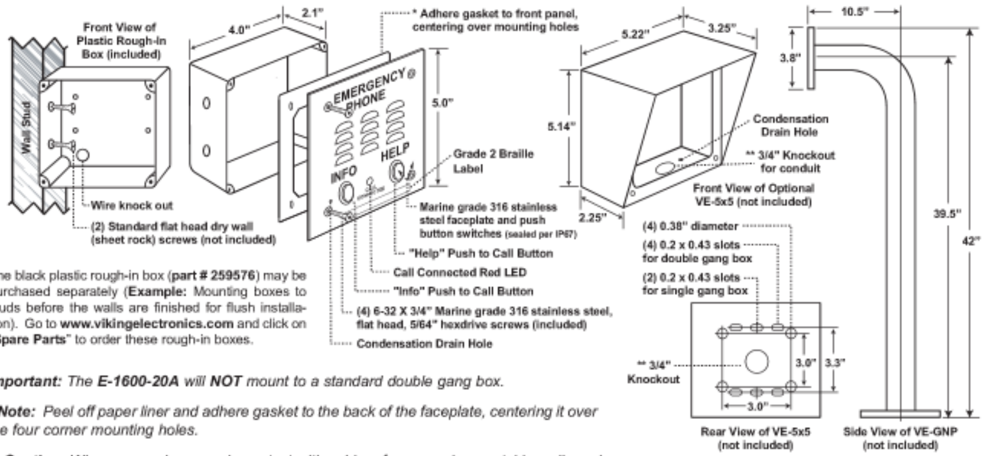


3

E-1600-20A (optional EWP available)

Dimensions: Overall - 127mm x 127 x 57mm (5.0" x 5.0" x 2.25"), Plastic Electrical Box - 102mm x 102mm x 54mm (4.0" x 4.0" x 2.14")
Shipping Weight: 1 kg (2.12 lbs.)
Front Panel Material: 14 gauge Marine grade 316 brushed stainless steel
Connections: Gel-filled butt connectors

Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.
Mounting with Plastic Rough-In Box (included): Flush into walls, mounts to side of wall stud **Mounting with Optional VE-5x5:** Surface mount to walls, single gang boxes, double gang boxes, posts, or to a Viking **VE-GNP** Gooseneck pedestal (see options below).
Note: *When mounting outside to rough or uneven surfaces (brick, stucco, etc.) apply a bead of clear silicone caulking around the top edge and sides of faceplate or* ***VE-5x5****.*



The black plastic rough-in box (**part # 259576**) may be purchased separately (**Example:** Mounting boxes to studs before the walls are finished for flush installation). Go to **www.vikingelectronics.com** and click on "**Spare Parts**" to order these rough-in boxes.

Important: *The* ***E-1600-20A*** *will* ***NOT*** *mount to a standard double gang box.*

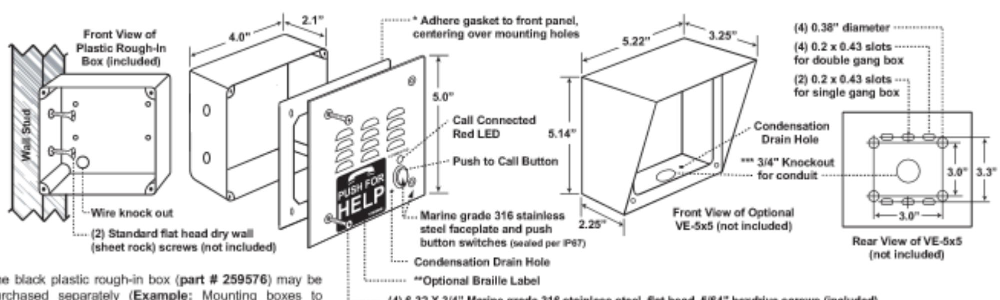
*** Note:*** *Peel off paper liner and adhere gasket to the back of the faceplate, centering it over the four corner mounting holes.*

***** Caution:*** *When warm air comes in contact with cold surfaces, such as outside walls and conduits, it causes condensation. To prevent condensation from accumulating inside the* ***E-1600-20A*** *always bring conduit into the bottom of the unit. If this is not possible, drill a 1/4" diameter hole in the bottom of the black plastic box.*

E-1600-30A (optional EWP available)

Dimensions: Overall - 127mm x 127 x 57mm (5.0" x 5.0" x 2.25"), Plastic Electrical Box - 102mm x 102mm x 54mm (4.0" x 4.0" x 2.14")
Shipping Weight: 1 kg (2.12 lbs.)
Front Panel Material: 14 gauge Marine grade 316 brushed stainless steel
Connections: Gel-filled butt connectors

Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.
Mounting with Plastic Rough-In Box (included): Flush into walls, mounts to side of wall stud **Mounting with Optional VE-5x5:** Surface mount to walls, single gang boxes, double gang boxes, posts, or to a Viking **VE-GNP** Gooseneck pedestal (as shown above).
Note: *When mounting outside to rough or uneven surfaces (brick, stucco, etc.) apply a bead of clear silicone caulking around the top edge and sides of faceplate or* ***VE-5x5****.*



The black plastic rough-in box (**part # 259576**) may be purchased separately (**Example:** Mounting boxes to studs before the walls are finished for flush installation). Go to **www.vikingelectronics.com** and click on "**Spare Parts**" to order these rough-in boxes.

*** Note:*** *Peel off paper liner and adhere gasket to the back of the faceplate, centering it over the four corner mounting holes.*

***** Important:*** *Optional Braille "Push for Help" label should be adhered to the faceplate in ADA applications. Clean surface with isopropyl alcohol, peel off backing and press firmly to the front panel in location as shown above.*

****** Caution:*** *When warm air comes in contact with cold surfaces, such as outside walls and conduits, it causes condensation. To prevent condensation from accumulating inside the* ***E-1600-30A*** *always bring conduit into the bottom of the unit. If this is not possible, drill a 1/4" diameter hole in the bottom of the black plastic box.*

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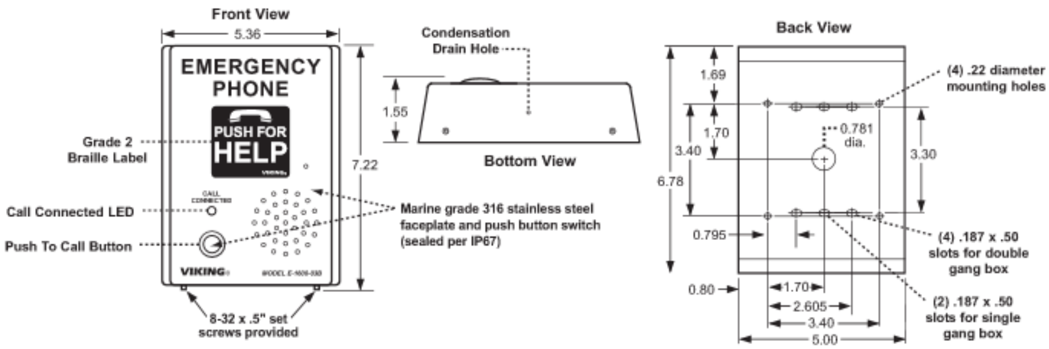
E-1600-03B (optional EWP available)

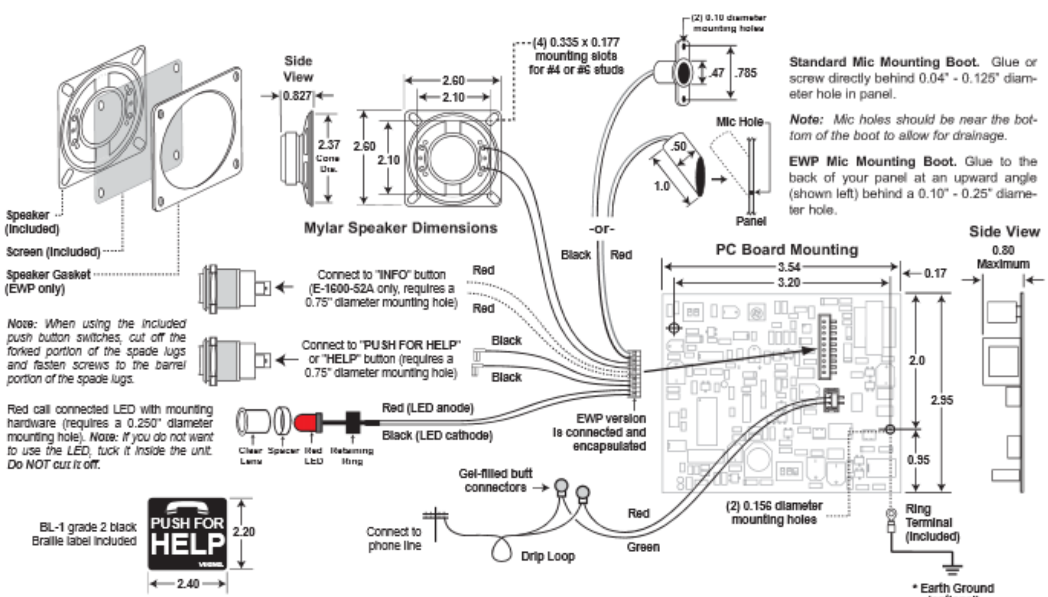
Dimensions: 183mm x 149mm x 39mm (7.22" x 5.36" x 1.55")
Material: 14 gauge Marine grade 316 brushed stainless steel panel
Shipping Weight: 1.36 kg (3 lbs.)
Connections: Gel-filled butt connectors
Mounting: Surface mount to walls, posts, single gang boxes, double gang boxes or 4" x 4" electrical junction boxes or recess mount in elevator phone boxes.
Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.
Note: *For greater weather resistance, apply a bead of clear silicon caulking around the top edge and sides of the chassis.*



E-1600-50A/52A (optional EWP available)

Note: *This is a* ***1600A*** *parts kit without chassis.*
Shipping Weight: .45 kg (1 lb)
Connections: Gel-filled butt connectors

Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.



Important: *If installing the* ***EWP*** *version outdoors, apply a non-corrosive silicone to back side of LED and push button switches after making all connections and testing. Completely encapsulate exposed switch connections (screw terminals/stripped wires) and bare wire connections.*

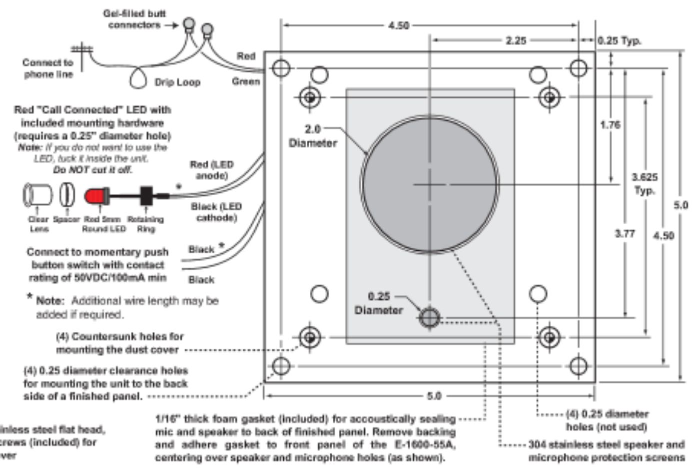
5

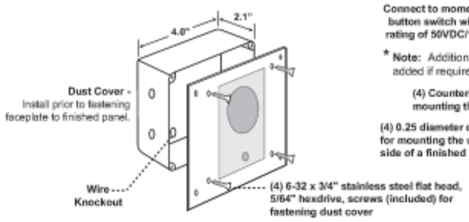
E-1600-55A (optional EWP available)

The **E-1600-55A** is a universal emergency phone kit for installing behind elevator panels, or an installation requiring a custom panel. The finished panel should provide: (4) studs (#6 diameter minimum) for mounting plate, audio holes for speaker and microphone, a momentary SPST push button switch and a 0.25" diameter mounting hole for the LED. Alternatively, the LED can be cut off and the wires connected to a integral switch with LED (often found in elevators). ***Note:*** *An LED must be connected to the red and black wires for the phone to operate.*

Optional Enhanced Weather Protection (EWP): The optional EWP products feature foam rubber gaskets and boots, sealed connections, gel-filled butt connectors, as well as urethane or thermal plastic potted circuit boards. See **DOD# 859**.

Shipping Weight: .73 kg (1.6 lb)
Connections: Telco and Switch - Gel-filled butt connectors
Material: 0.062" thick (16 gauge) zinc plated steel





Programming

A. Accessing the Programming Mode

The **1600A Series** emergency phones can be programmed from any Touch Tone phone using a C.O. line, analog PABX/KSU station, or a **DLE-200B** Line Simulator. For more information on the **DLE-200B**, see **DOD# 605**.

1. Using the Security Code

Step 1.	Move DIP switch 2 to the **ON** position (sets unit to answer incoming calls, see section **J**).
Step 2.	From a Touch Tone phone call the line attached to the **1600A Series** phone.
Step 3.	When the **1600A Series** phone answers, enter the 6-digit security code (factory set to **845464**, see section **C**). A double beep should then be heard indicating you have entered the programming mode.

2. Without the Security Code

Step 1.	Move DIP switch 2 to the **ON** position (sets unit to answer incoming calls, see section **J**).
Step 2.	Move DIP switch 3 to the **OFF** position (incoming calls enter Programming without security code, see section **J**).
Step 3.	From a Touch Tone phone call the line attached to the **1600A Series** phone.
Step 4.	When the **1600A Series** answers, a double beep will be heard and will automatically enter the programming mode.
Step 5.	When finished programming, move DIP switch 3 back to the **ON** position (see section **J**).

Warning: *Failure to do step 5 above will cause the **1600A Series** phone to call Viking Technical Support instead of your programmed emergency number.*

B. Security Code (memory location #19)

The security code allows the user/installer to program the **1600A** series phone while DIP switch **3** is in the **ON** (normal) position. The factory set security code is 845464 (V-I-K-I-N-G). It is recommended that the factory set security code be changed. **Example:** To store 123456 as the security code:

Step 1.	Access programming as shown is **Programming** section **A**.
Step 2.	Enter **123456 #19**..
Step 3.	Hang-up.

Enter Your Security Code Here:

						#19

Note: *The security code must be 6 digits and cannot include a * or a #.*

6

C. Quick Programming Features

	Enter Digits	- then -	Enter Memory Location
First emergency speed dial number	0-20 digits	then	**#00**
Second emergency speed dial number	0-20 digits	then	**#01**
Third emergency speed dial number	0-20 digits	then	**#02**
Fourth emergency speed dial number	0-20 digits	then	**#03**
Fifth emergency speed dial number	0-20 digits	then	**#04**
Central station receiver number	0-20 digits	then	**#05**
Central station voice number	0-20 digits	then	**#06**
First "Info" speed dial number (**E-1600-20A** and **E-1600-52A** only)	0-20 digits	then	**#07**
Second "Info" speed dial number (**E-1600-20A** and **E-1600-52A** only)	0-20 digits	then	**#08**
Third "Info" speed dial number (**E-1600-20A** and **E-1600-52A** only)	0-20 digits	then	**#09**
Voice announcer/miscellaneous options (factory set to 001210)	6 digits	then	**#17**
Timing/Dialing options (factory set to 234721)	6 digits	then	**#18**
Security code (factory set to 845464)	6 digits	then	**#19**
Identification number (factory cleared)	0-20 digits	then	**#20**
Second central station identification number (factory cleared)	0-20 digits	then	**#21**
To add a ∗ at any point in the dialing string	**∗∗**		
To add a **#** at any point in the dialing string	**∗#**		
To add a four second pause at any point in the dialing string	**∗7**		
To clear any speed dial number	(no digits)	then	**#00 - #09**
Diagnostic tones (used to check mic and speaker operation)	**∗0**		
Exit programming and disconnect	**#7**		
Reset all programming to factory default settings	**###**		

Note: *A double beep indicates a valid memory position, four beeps indicate an error.*

D. Speed Dial Numbers

Note: *Up to 20 digits can be stored in each dial position. Special features such as pause, mode change, touch tone ∗ and **#** count as single digits.*

1. Emergency Speed Dial Numbers (memory locations #00 - #04)

The emergency speed dial number programmed in location **#00** is the number that is dialed when the "**HELP**" / "**CALL**" button is first pressed. Additional speed dial numbers will be dialed when there is no answer or a busy signal is detected and the next number redial features are activated. To program, enter the desired speed dial number followed by the location number (**#00 - #04**). To clear a speed dial location, simply enter the memory location (**#00 - #04**) alone. The **1600A** series phone is factory set with no speed dial number programmed.

To Program:	Enter:
∗	∗∗
#	**∗#**
4 second pause	**∗7**
0, 1, 2...9	**0, 1, 2...9**

2. "INFO" Speed Dial Numbers (E-1600-20A/52A Only) (memory locations #07 - #09)

The information speed dial number programmed in location **#07** is the telephone or extension number that is dialed when the "**INFO**" button is first pressed. Additional information speed dial numbers will be dialed when there is no answer and the next number redial feature is activated. The **E-1600-20A** phone will cycle through the programmed speed dial numbers until answered. To program, enter the desired speed dial number followed by the location number (**#07 - #09**). To clear a speed dial location, simply enter the location (**#07 - #09**) alone.

3. Speed Dial Programming Examples

To Program the 1600A Series Phone...	Step 1 - See Section A	Step 2 - Enter Digits:
...to store 555-1234 as the first emergency speed dial number	Enter Programming	**5 5 5 1 2 3 4 # 0 0**
...to store a Touch Tone 9, a four second pause and then 333-4444 into the second "Info" speed dial memory position	Enter Programming	**9 ∗7 3 3 3 4 4 4 4 # 0 8**
...to clear the first emergency speed dial number	Enter Programming	**# 0 0**

E. Identification Number (memory location #20)

The Touch Tone I.D. number (up to 20 digits) is used by emergency personnel to identify the location of the caller and is given out when the receiving party presses a Touch Tone ∗. The security office can display the number using a Touch Tone decoder. To program the I.D. number, enter the desired number followed by **#20**. **Example:** To store 333 as the I.D. number, enter: **3 3 3 # 2 0**

F. Timing/Dialing Options (memory location #18)

There are six positions in the timing/dialing options. To program these options, enter the six desired timing/dialing numbers followed by **#18**. The six available timing/dialing options are defined as follows:

Dial: A + B + C + D + E + F + # + 1 + 8

Factory Default Setting: 2 + 3 + 4 + 7 + 2 + 1

Talk/Listen Delay
Call Length
Silence Time Out
Dial Next Number on Ring No Answer
Dial Next Number on Busy
Furutre Use (set to 1)

Enter Timing/Dialing Settings Here:

A	B	C	D	E	F	
						#18

Setting A - Talk/Listen Delay

This feature selects switching time between talk and listen modes (VOX switching time). Use chart at the right. * ***Note:*** *The factory default is .2 seconds.*

Touch Tone	Talk/Listen Delay
1	.1 sec
2	.2 sec *
3	.3 sec
4	.4 sec
5	.5 sec
6	.6 sec
7	.7 sec
8	.8 sec
9	.9 sec

Setting B - Call Length Time Out

This feature selects the maximum length of time that calls can be connected. Programmable in increments of 1 minute up to a maximum of 9 minutes (Touch Tones 1 - 9). Program 0 in this location to disable the call length time out. With the call length disabled, the **1600A** series phone must rely on a CPC signal, busy signal, silence or return to dial tone to hang-up. Use chart at the right. * ***Note:*** *The factory default is 3 minutes.*

Touch Tone	Call Length Time Out
0	Disabled
1	1 min
2	2 min
3	3 min*
4	4 min
5	5 min
6	6 min
7	7 min
8	8 min
9	9 min

Setting C - Silence Time Out

This feature selects the length of time that calls will remain connected without voice activity. Programmable in increments of 10 seconds up to a maximum of 90 seconds (Touch Tones 1 - 9). To disable the silence time out, program 0 in this location. Use chart at the far right. * ***Note:*** *The factory default is 40 seconds.*

Touch Tone	Silence Time Out
0	Disabled
1	10 sec
2	20 sec
3	30 sec
4	40 sec*
5	50 sec
6	60 sec
7	70 sec
8	80 sec
9	90 sec

Setting D - Dial Next Number on Ring No Answer

If enabled and a ring-no-answer is detected, the **1600A** series phone will dial the next programmed speed dial number, and continue to cycle through the emergency numbers until a call is completed. * ***Note:*** *Factory set to redial if not answered after 7 rings.*

Touch Tone	Setting D
1 or 0	Disabled
2, 3, 4...9	Dials second number after 2, 3, 4...9 rings respectively*

Setting E - Dial Next Number on Busy

If enabled and a busy is detected, the **1600A** series phone will dial the next programmed speed dial number, and continue to cycle through the numbers until a call is completed. * ***Notes:*** *This feature is enabled in the factory default setting. If the busy signal is interrupted with a promotional message, contact your central office to have it removed.*

Touch Tone	Setting E
1	Disabled
2	Enabled*

Setting F - Future Use (set to 1)

G. Voice Announcer/Miscellaneous Options (memory location #17)

The **1600A** series phones have a built-in non-volatile digital voice announcer that may be used to identify the location of the emergency phone call. The 16 seconds of digital record time is recorded remotely from a Touch Tone phone. Programming options are as follows:

Dial: A + B + C + D + E + F + # + 1 + 7

Factory Default Setting: 0 + 0 + 1 + 2 + 1 + 0

Two Digit Announcement Delay { (A, B)
Repeat Announcement Setting (C)
Hang-up on Return to Dial Tone (D)
Double Ring Cadence (E)
Lap Counter (F)

Enter Settings Here:

A	B	C	D	E	F	
						#17

Settings A and B - Announcement Delay

The **1600A** series phone is factory set to automatically start playing the voice announcement after it has determined the call has been answered. Alternately, the announcement may be programmed to play after a programmed amount of time, from 1 to 99 seconds after dialing.

Touch Tone	Setting A/B
00	Play automatically
01-99	1-99 seconds*

*** Note:** *If the announcement delay time is used, you must allow enough time for the **1600A** series phone to detect ring-no-answer and busy signals when using the redial features. The factory default is set to play automatically.*

Setting C - Repeat Announcement Option

The **1600A** can be programmed to play the announcement from 1-9 times, or to continuously repeat the announcement every 8 seconds until a Touch Tone ✱ is detected from the distant party. The call connected LED will turn on automatically after the announcement has stopped repeating. *** Note:** *The factory default for the **1600A** series phone is to play the voice announcement once (digit **1**).*

Touch Tone	Setting C
0	Repeat every 8 secs
1-9	Repeat 1-9 times*

Setting D - Hang Up on Return to Dial Tone

If enabled and a return dial tone is detected, the 1600A will hang up.
*** Note:** *The factory default setting is enabled.*

Touch Tone	Setting D
1	Disabled
2	Enabled*

Setting E - Double Ring Cadence Mode

The **1600A** series phone can be programmed to recognize the double ring cadence that is typical of many phone systems. If the **1600A** series phone is connected to an extension that provides a double ring cadence, enabling this mode will allow for proper call progress detection.
*** Note:** *This feature is disabled in the factory default setting.*

Touch Tone	Setting E
1	Disabled*
2	Enabled

Setting F - Lap Counter

With the lap counter disabled (factory setting), if the **1600A** series phone is programmed to dial the next number on ring-no-answer and/or busy signal (see page 8), the **1600A** series phone will continuously call its programmed phone numbers forever until the call is answered.

Touch Tone	Setting F
0	Disabled*
1-9	Lap count = 1-9 times

The lap counter is a programmable counter that determines how many times the **1600A** series phone will cycle through its list of up to 5 emergency number (or up to 3 "Info" phone numbers), before it stops the dialing process and hangs up. When all of the programmed phone numbers have been dialed, the lap counter is incremented and the dialing process repeats. When the lap counter has been met, the dialing process stops and the **1600A** series phone hangs up. *** Note:** *This feature is disabled in the factory default setting.*

H. Recording the Announcement

Step 1.	Call into the **1600A** series phone with a Touch Tone phone and access programming.
Step 2.	Enter ✱**4**, wait for the tone and then begin recording. Sixteen seconds of record time is available.
Step 3.	Enter any Touch Tone to stop the recording. Playback is automatic.
Step 4.	Enter ✱**5** to review the announcement again.
Step 5.	If you choose to not use a voice announcement, enter ✱**3** to clear the recording.

Example: "Elevator number 1215, located in the Financial Building, needs assistance. Press the asterisk (✱) key on your telephone to hear this announcement again."

9

I. Assisted Programming

When attempting to program the 1600A Series emergency phone, if the phone number of the line it is connected to is not known, the phone can be set to automatically call Viking technical support for assistance. With DIP switch 3 set to OFF (programming mode), pushing the CALL button will cause the **1600A Series** phone to call Viking, whether it be connected directly to a CO line, or behind a "dial 9" PBX.

The **1600A Series** phone will first dial 9, and then listen for second dial tone; if detected it will continue to dial Viking's assisted programming phone number. If a second dial tone is not detected, it then knows is not behind a PBX, so it will momentarily hang up and then directly dial Viking's assisted programming phone number. Since this is a long distance phone call, the line must be capable of placing long distance calls for the call to go through. When finished programming, it is very important to set DIP switch 3 back to ON (normal operating mode), and place a test emergency call to be sure all programming was done properly.

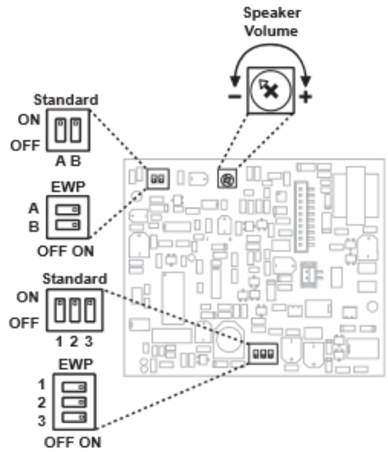
Warning: Failure to set DIP switch 3 back to ON when finished programming will cause the 1600A Series phone to only call Viking Technical Support, instead of your programmed emergency number.

J. DIP Switch Programming/Speaker and Microphone Adjustments

A speaker volume POT is provided to increase or decrease the speakerphone volume. ***Note:*** *The Microphone Sensitivity POT has been removed because the microphone sensitivity is now microprocessor controlled. This allows the mic gain to be automatically increased in a quiet environment, allowing the distant party to clearly hear even soft or distant sounds. The microprocessor will automatically reduce the mic sensitivity when the location becomes noisy. This Automatic Noise Canceling (ANC) feature will allow speakerphone two-way communications to continue to work properly, even when subjected to loud noise such as a diesel engine or traffic.*

Switch A	Switch B	Description
ON	ON	Normal audio detection
OFF	OFF	Increase audio detect sensitivity for low level lines. Useful in applications in which voice or busy signals have trouble breaking over the speaker.

DIP Switch	Position	Description
1	ON	"HELP" / "CALL" button alternately connects and disconnects calls (factory default)
1	OFF	"HELP" / "CALL" button connects calls only
2	ON	Incoming calls answered (factory setting)
2	OFF	Incoming calls are not answered
3	ON	Normal operation mode (factory setting)
3	OFF	Learn mode - Any incoming calls are automatically entered into the programming mode (no security code required). Use this option if you have forgotten your security code. Any outbound call will dial Viking Technical Support (see section I). ***Warning: When finished programming, set this switch back to the ON position, otherwise the 1600A Series phone will only call Viking Technical Support instead of your programmed emergency number.***



K. Central Station Programming

The standard **1600A** emergency phone is capable of communicating using the "Ademco Contact I.D.", "Ademco High Speed", "DTMF 4+1 Express", or the "DTMF 4+2 Express" formats. All formats use the programming memory location **#20** to store the account code and alarm details.

1. Central Station Programming Features

a. Accessing the Programming Mode

Before programming, you must access the programming mode (see **Programming** section **A**).

b. Enabling/Disabling Central Station Mode

The **1600A** Series emergency phone can be placed in the "Central Station Mode" by entering a central station phone number in position **#05** while programming. To cancel the "Central Station Mode," clear position **#05** by entering **#05** only (see **Programming** section **D**).

To Program the 1600A Series Phone...	Step 1:	Step 2 - Enter Digits:
...to enable central station programming and dial 952-2567	Enter Programming	**9 5 2 2 5 6 7 # 0 5**
...to disable central station programming	Enter Programming	**# 0 5**

c. Ring No Answer

When the **1600A** Series emergency phone is in the "Central Station Mode", it is best to have the ring no answer set to a minimum of three, because some receivers send a long tone after answering the line that sounds like a ring back. If the **1600A** is set to a ring no answer of two, the phone will disconnect (see **Programming** section **F**).

d. Speed Dial Numbers

The **1600A** Series phone can be programmed to dial a central station receiver only, or dial up to 5 voice numbers first, and if no answer, then dial the central station receiver. When calling the first numbers (memory positions **#00-#04** (see **Programming** section **D**), the phone stays in "two-way talk mode" allowing two-way conversation. When calling the Central Station number (memory position **#05**), the phone is in a "listen only mode" in order to interpret the hand shake signals of the receiver.

Location	Call Type
#00	Voice - Emergency
#01	Voice - Emergency
#02	Voice - Emergency
#03	Voice - Emergency
#04	Voice - Emergency
#05	Central Station Receiver
#06	Central Station Voice Line
#07	Voice - "Info" (**E-1600-20A/52A** only)
#08	Voice - "Info" (**E-1600-20A/52A** only)
#09	Voice - "Info" (**E-1600-20A/52A** only)

A second central station number position has been provided in location **#06** that is used when the central station receiver does not have a talk over mode. If a number is placed in position **#05** and position **#06** is cleared, the **E-1600A** will call the central station monitor receiver. One or two alarm messages can be sent to the receiver (see **Operation** section **B**, note **3**). After the receiver sends a kiss-off, the **E-1600A** lights the "Call Connected" LED and goes into two-way talk mode. If numbers are in both positions **#05** and **#06**, the **E-1600A** will call the receiver first, and after the kiss-off, will hang-up and redial the number in position **#06** for two-way voice communication. ***Notes:*** *If only a central station is to be dialed, the central station phone number must be preprogrammed in memory location **#05** and memory locations **#00-#04** must be cleared.*

2. Central Station Formats

The following examples explain the receiver formats and how to properly program memory location **#20**. Each format starts with a four digit account code. This is the code that is assigned by your central station for billing purposes. You must access the programming mode before programming these features (see **Programming** section **A**). ***Important:*** *If a number is shown, you must use that number. If an "**X**" is shown, use any appropriate number.* ***Note:*** *A second information alarm message can be sent to the receiver, for any receiver that requires two separrate messages. The second alarm message is programmed in **#21** location. For additional information about the second alarm mesage, see **Operation** section **B**.*

a. Ademco Contact ID Format

This DTMF format consists of a four digit account code, two digit message type, and a nine digit data field.

XXXX 18 1 14000 XXX #20

Account Code — XXXX
Message Type — 18
New Event — 1
General Alarm — 14000
Any number to identify phone — XXX
Memory Location — #20

Enter Contact ID Settings Here: [ ][ ][ ][ ] 18 1 14000 [ ][ ][ ] #20

Sometimes the central station receiver requires a secondary "listen-in to follow" code to be sent. This can be accomplished by programming memory location #21 as follows:

XXXX 18 1 60600 XXX #21

***Account Code** — XXXX
Message Type — 18
New Event — 1
Listen-In to Follow — 60600
***Any number to identify phone** — XXX
Memory Location — #21

** **Note:** Set the account code and the identifier the same as memory location #20.*

b. Ademco High Speed Format

This DTMF format consists of a four digit account code, eight zone codes and one alarm type digit. With this format you can identify up to eight different phones by using a zone per phone. A "5" in a zone position means no alarm. The following example shows an alarm from the third phone.

XXXX 55155555 7 #20

Account Code — XXXX
Idle Zones — 55
Alarmed Zone — 1
Idle Zones — 55555
Normal Alarm — 7
Memory Location — #20

Enter Ademco High Speed ID Settings Here: [ ][ ][ ][ ] 55155555 7 #20

c. 4+1 Express Format

This DTMF format consists of a four digit account code, two digit message type, and a single digit event code.

XXXX 17 X #20

Account Code — XXXX
Message Type — 17
Event Code — X
Memory Location — #20

Enter 4+1 Express ID Settings Here: [ ][ ][ ][ ] 17 [ ] #20

11

d. 4+2 Express Format

This DTMF format consists of a four digit account code, two digit message type, and a two digit event code.

XXXX 27 XX #20

Account Code — XXXX
Message Type — 27
Event Code — XX
Memory Location — #20

Enter 4+2 Express ID Settings Here:	☐☐☐☐	**27**	☐☐	**#20**

Operation

A. Standard Operation

1. "HELP" / "CALL" Button

When the "**HELP**" / "**CALL**" button is pressed, the **1600A** series phone goes off-hook and dials a pre-programmed telephone number. The Call Connected LED momentarily flashes during tone or pulse dialing. In the event the line is busy or there is a ring-no-answer, the unit can be programmed to call additional phone numbers.

The phone then cycles through up to 5 pre-programmed emergency numbers until the call is answered. When the call is answered, the digital voice announcer will automatically play to identify the location of the emergency call. The phones are factory programmed to play the announcement once, and then automatically light the "Call Connected" LED to show that handsfree communication to emergency personnel is established. The * key will send the I.D. number (if programmed), and play the announcement again. The distant party will know the location of the emergency call by either the voice announcement or by decoding the Touch Tone I.D. number. Once the "Call Connected" LED is on, the # key can be used to force the phone to hang-up.

2. "INFO" Button (E-1600-20A and E-1600-52A Only)

When the "**INFO**" button is pressed (**E-1600-20A** and **E-1600-52A** only), the phone goes off-hook and dials the first "**INFO**" phone number programmed. If a busy signal is detected or the call goes unanswered, the phone will cycle through all three "**INFO**" phone numbers until the call is answered. When answered, handsfree communication is established. ***Note:*** *The voice announcement is for **Emergency/Help** calls only and will not play on a call initiated from the "**INFO**" button.*

B. Central Station Operation

After the "**HELP**" / "**CALL**" button on the **1600A** Series phone has been pressed the **1600A** Series phone will begin to dial. If a voice number is programmed in memory locations **#00-#04**, these numbers will be dialed first. Upon detecting a busy signal or after a preprogrammed ring delay the **1600A** Series phone will hang-up and dial the central station phone number stored in memory location **#05**. When the central station receiver answers, it will send a handshake tone to the **1600A** phone. Upon detecting the handshake tone, the **1600A** Series phone will begin uploading the information stored in memory location **#20**.

Once the **1600A** Series emergency phone has sent the information stored in memory location **#20**, it waits for a "kiss-off" tone from the central station. When the "kiss-off" tone is received, the emergency phone turns on the call connected LED and goes into the "two-way talk mode" or hangs up and dials position **#06** if programmed (see Note 3 below).

Notes:

*1. The central station should have a "talk-over" feature that will allow a two-way conversation at this time. If your receiver does not support "talk-over", a voice phone number should be programmed into position **#06**.*

*2. If the central station answers the call, sends the handshake tone, but does not send a "kiss off" tone after the information is sent, the **1600A** resends the information three additional times, waiting for a "kiss-off" after each attempt. If "kiss-off" has not been received after the fourth attempt, the **1600A** hangs up and dials position **#05** again.*

*3. The **1600A** has the capability to send a second informational message to the receiver after the first "kiss-off" is received, but only if a second informational message is stored in memory location **#21**. After the first "kiss-off" is received, the **1600A** sends the information stored in memory location **#21**. It then waits for a second "kiss-off" from the central station receiver. When the second "kiss-off" is received, the emergency phone turns on the call connected LED and goes into the "two-way talk mode" or hangs up and dials position **#06** if programmed.*

ANSUL®

Detection and Control Components

AutoPulse

Abort Switch

Features

- Stackable, screw-terminal, contact blocks
- Compatible with AUTOPULSE® control units
- Surface-mount assemblies listed by Underwriters Laboratories, Inc.
- Components mounted on stainless steel switch plate

Applications

The Abort Switch is used to momentarily interrupt the release circuit signal when the control unit is in the alarm condition. As long as the abort pushbutton is held in, the fire suppression system will not release. **(Note:** When the control unit is programmed for IRI compliance, the abort will not be effective after pre-discharge.) When the pushbutton is released, the release circuit is activated (unless the control unit has been reset to the non-alarm condition).

Description

The Abort Switch assembly consists of a momentary-contact pushbutton switch, normally-open contact block, normally-closed contact block, and stainless steel switch plate with silk-screened label. Surface-mount assemblies include a single-gang weather-proof box with three 1/2 in. I.P.S. threaded conduit outlets and gasket.

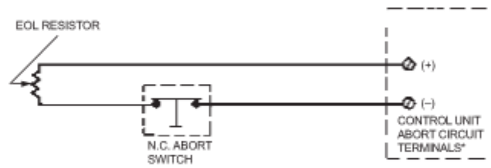
The stackable, screw-terminal contact blocks are rated for 28 VDC @ 1.1 amp make/break or 6 amp continuous carry.

Listings and Approvals

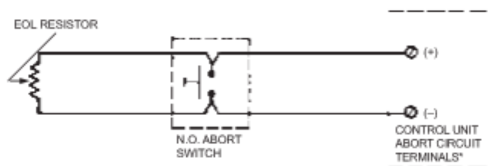
The switch is UL listed (S3623) when installed in the surface-mount box (with gasket) that is provided with the surface-mount assembly.

TYPICAL WIRING DIAGRAMS

ABORT SWITCH (SERIES)



ABORT SWITCH (PARALLEL)



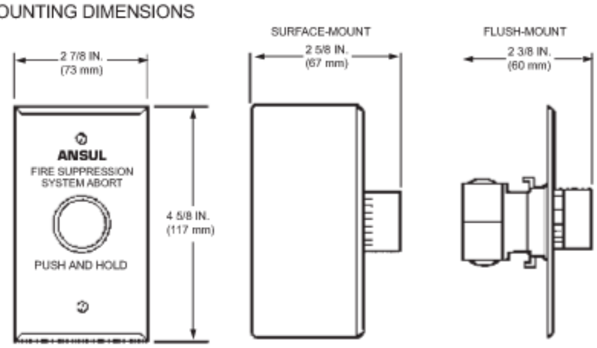
* SEE CONTROL UNIT MANUAL FOR SPECIFIC WIRING REQUIREMENTS.

Ordering Information

Part No.	Description	Shipping Weight lb.	(kg)
76494	Abort Switch, Surface-Mount	1.0	(0.45)
76495	Abort Switch, Flush-Mount	1.0	(0.45)
76485	Extra Contact Block, N.C.	0.25	(0.11)
76486	Extra Contact Block, N.O.	0.25	(0.11)

ANSUL and AUTOPULSE are registered trademarks.

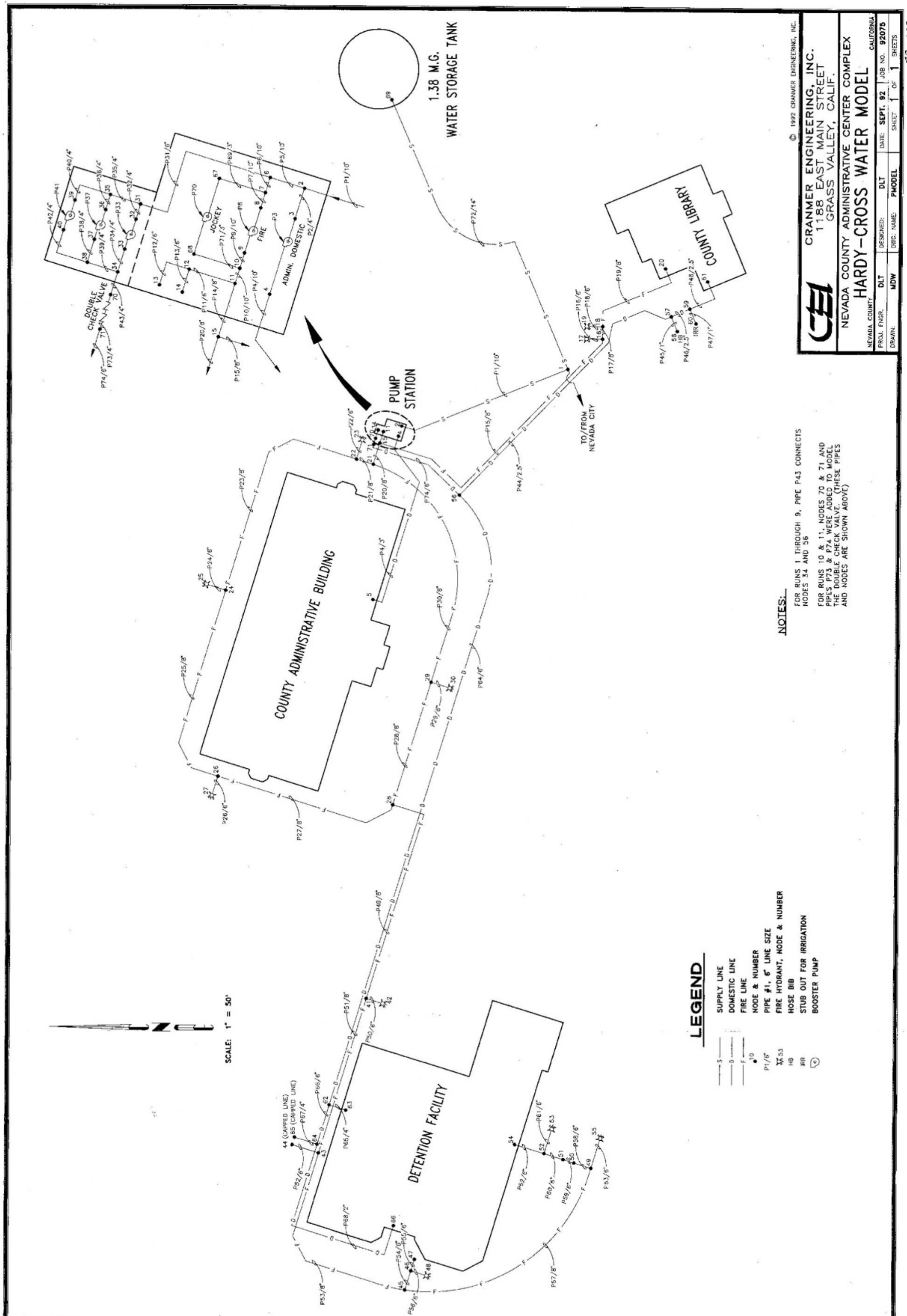
MOUNTING DIMENSIONS



3-34

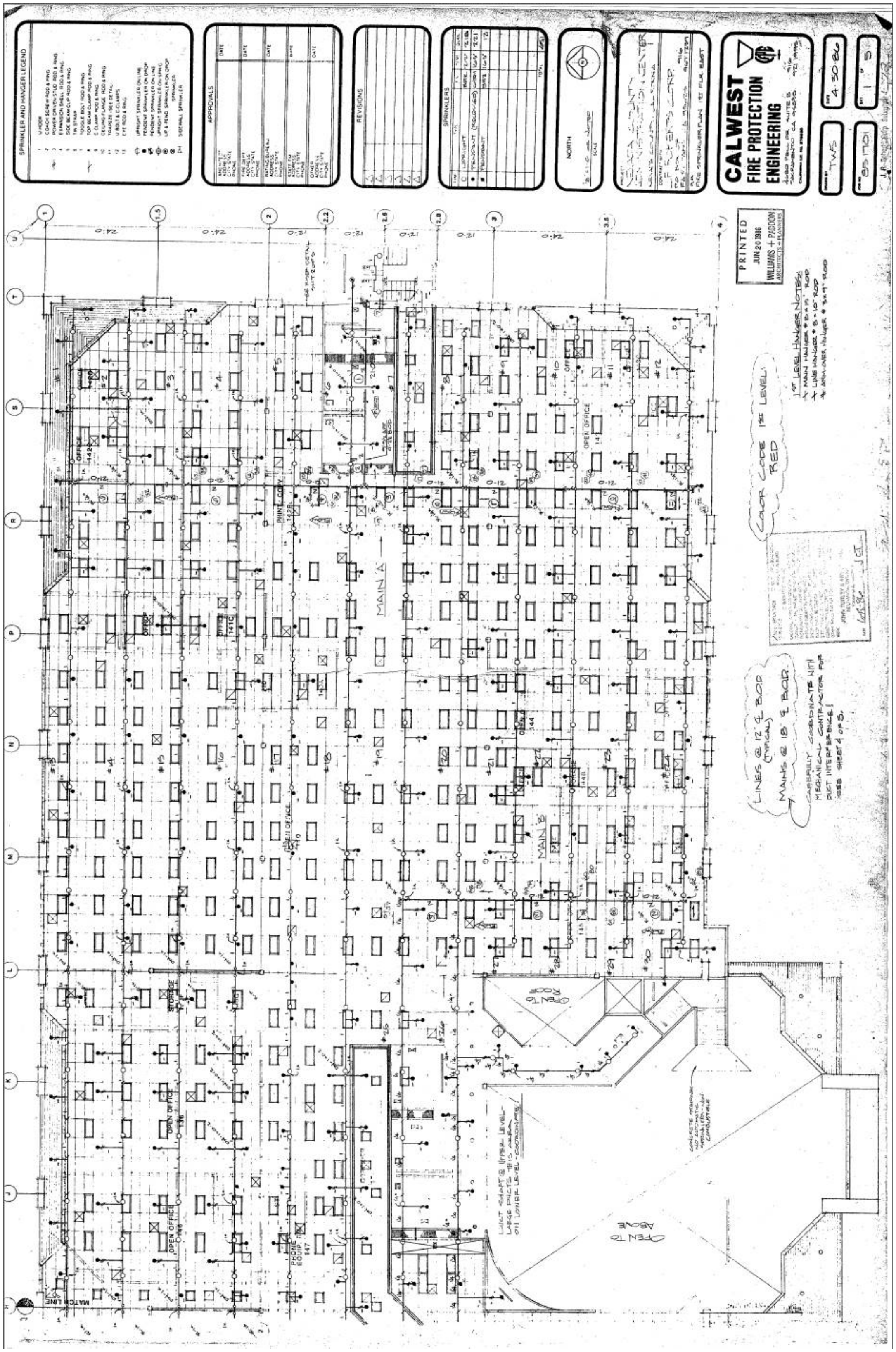
APPENDIX I

Underground Water Supply Drawing

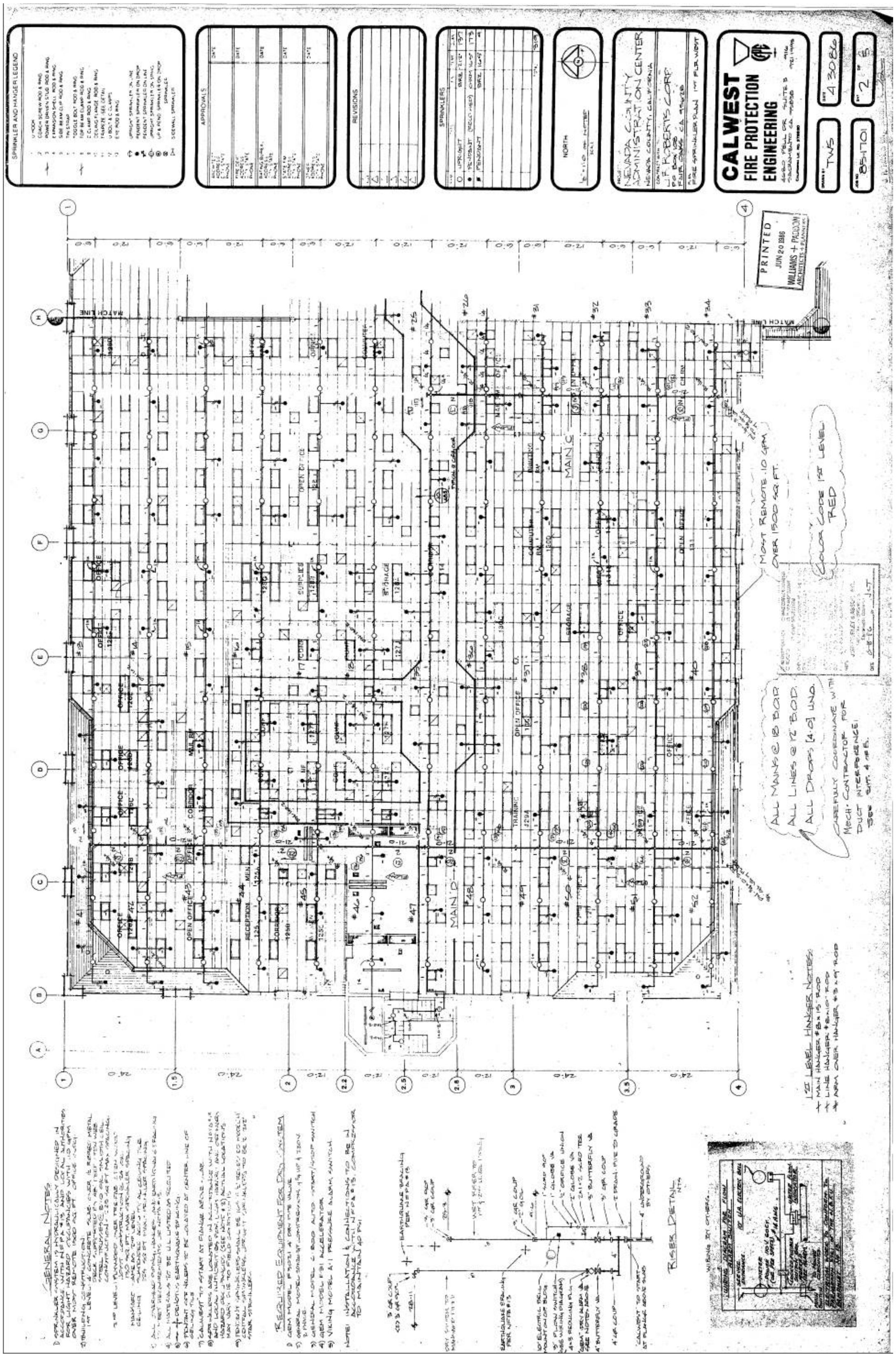

1.38 M.G.
WATER STORAGE TANK
PUMP STATION
TO/FROM NEVADA CITY
DOUBLE CHECK VALVE
JOCKEY
FIRE
ADMIN. DOMESTIC
COUNTY LIBRARY
COUNTY ADMINISTRATIVE BUILDING
DETENTION FACILITY
SCALE: 1" = 50'
LEGEND
SUPPLY LINE
DOMESTIC LINE
FIRE LINE
NODE & NUMBER
PIPE #1, 6" LINE SIZE
FIRE HYDRANT, NODE & NUMBER
HOSE BIB
STUB OUT FOR IRRIGATION
BOOSTER PUMP
NOTES:
FOR RUNS 1 THROUGH 9, PIPE P43 CONNECTS NODES 34 AND 56
FOR RUNS 10 & 11, NODES 70 & 71 AND PIPES P73 & P74 WERE ADDED TO MODEL THE DOUBLE CHECK VALVE. (THESE PIPES AND NODES ARE SHOWN ABOVE)
© 1992 CRANMER ENGINEERING, INC.
CRANMER ENGINEERING, INC.
1188 EAST MAIN STREET
GRASS VALLEY, CALIF.
NEVADA COUNTY ADMINISTRATIVE CENTER COMPLEX
HARDY-CROSS WATER MODEL
SEPT. 92
92075

APPENDIX J

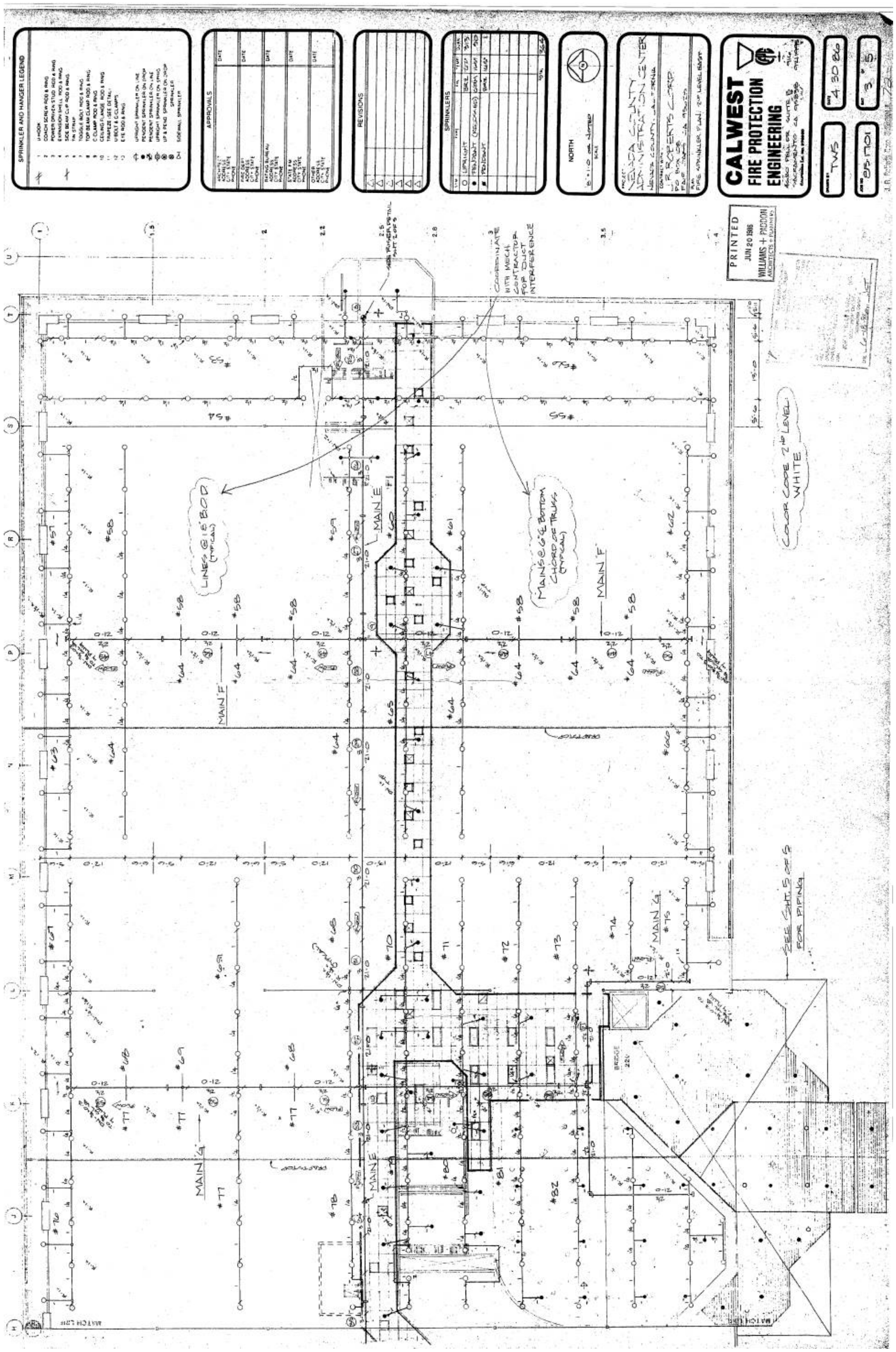
Sprinkler System Drawings



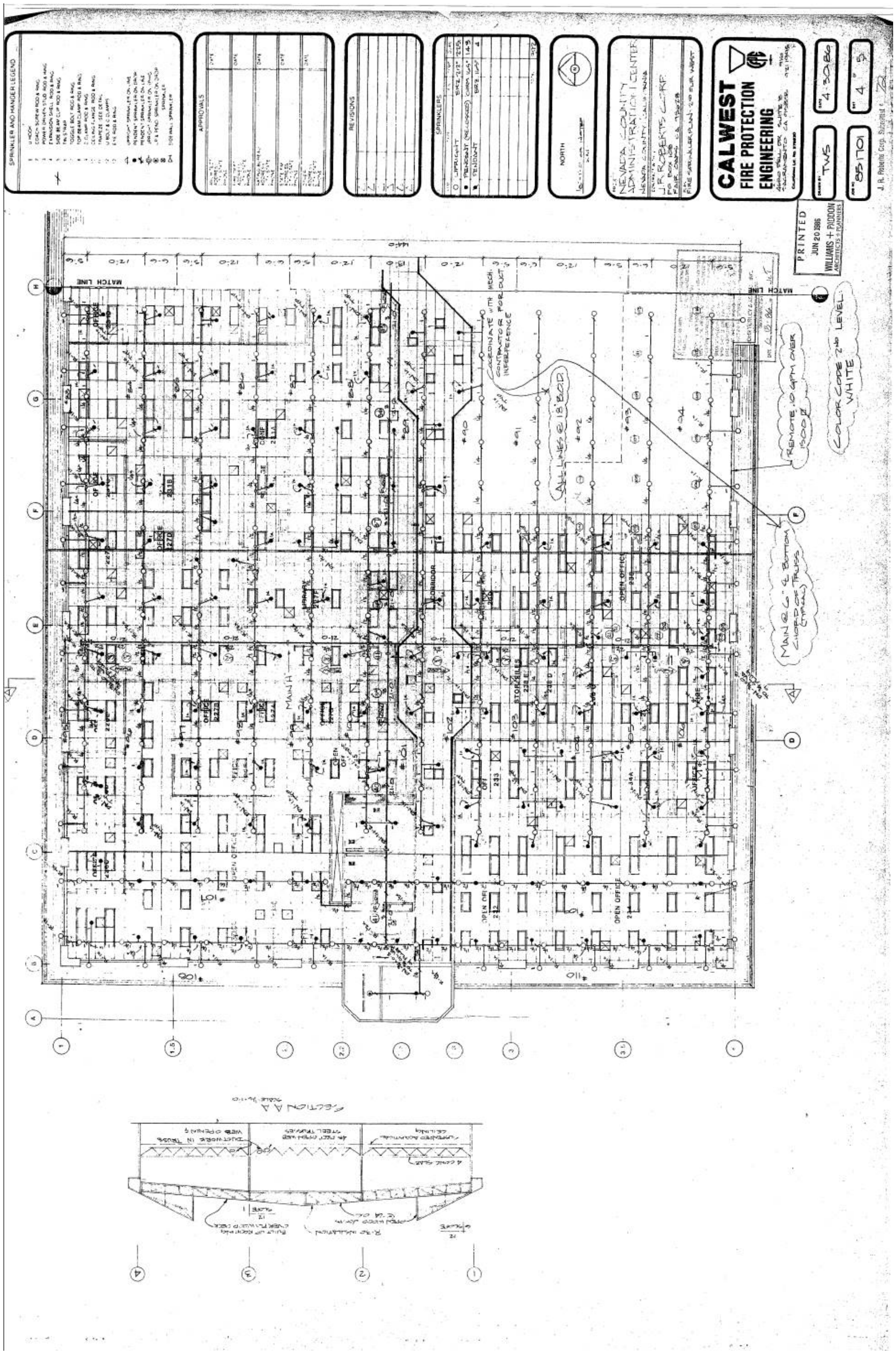
Rood Center – 1st Floor East (1 of 5)



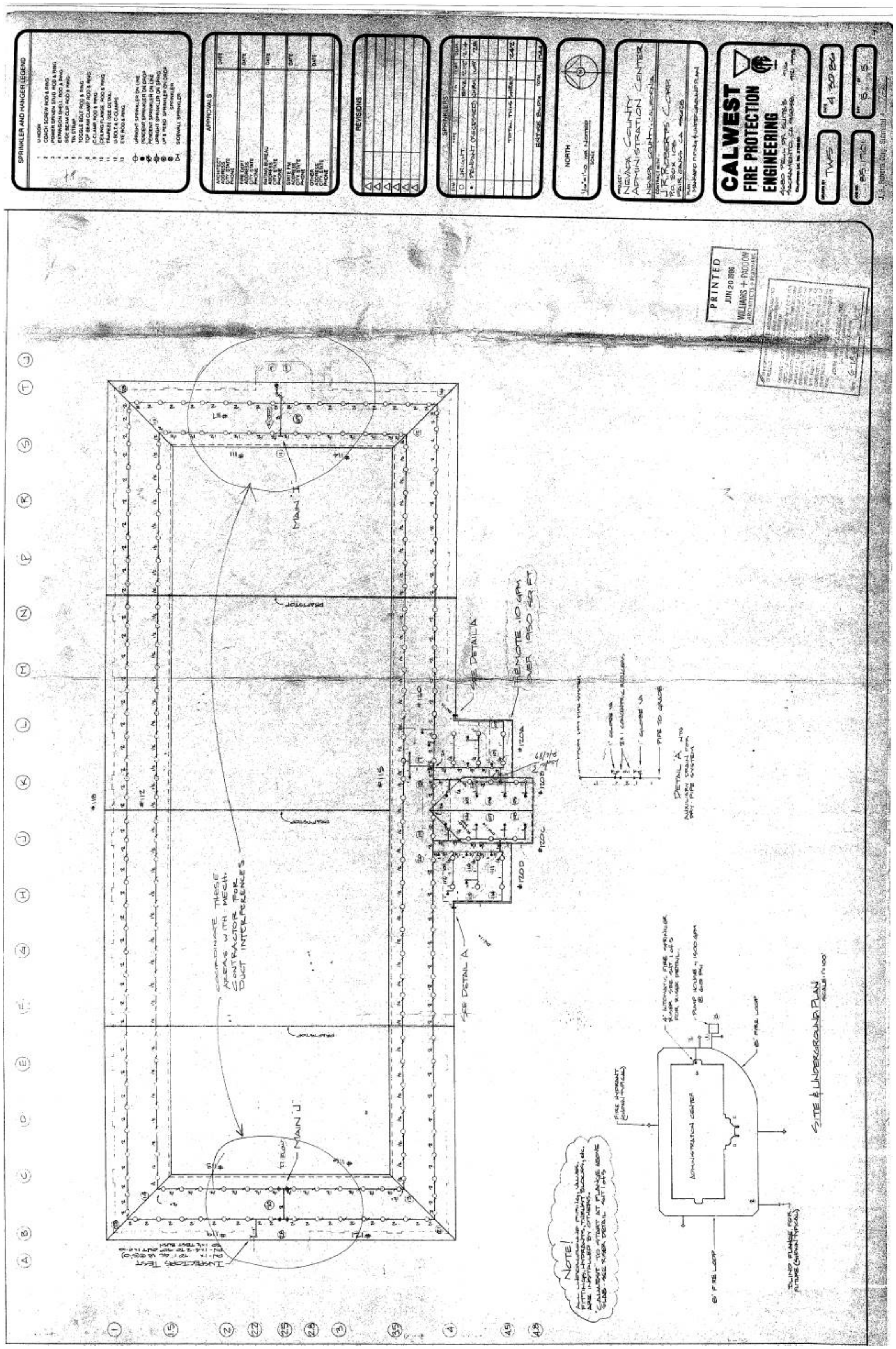
Rood Center – 1st Floor West (2 of 5)



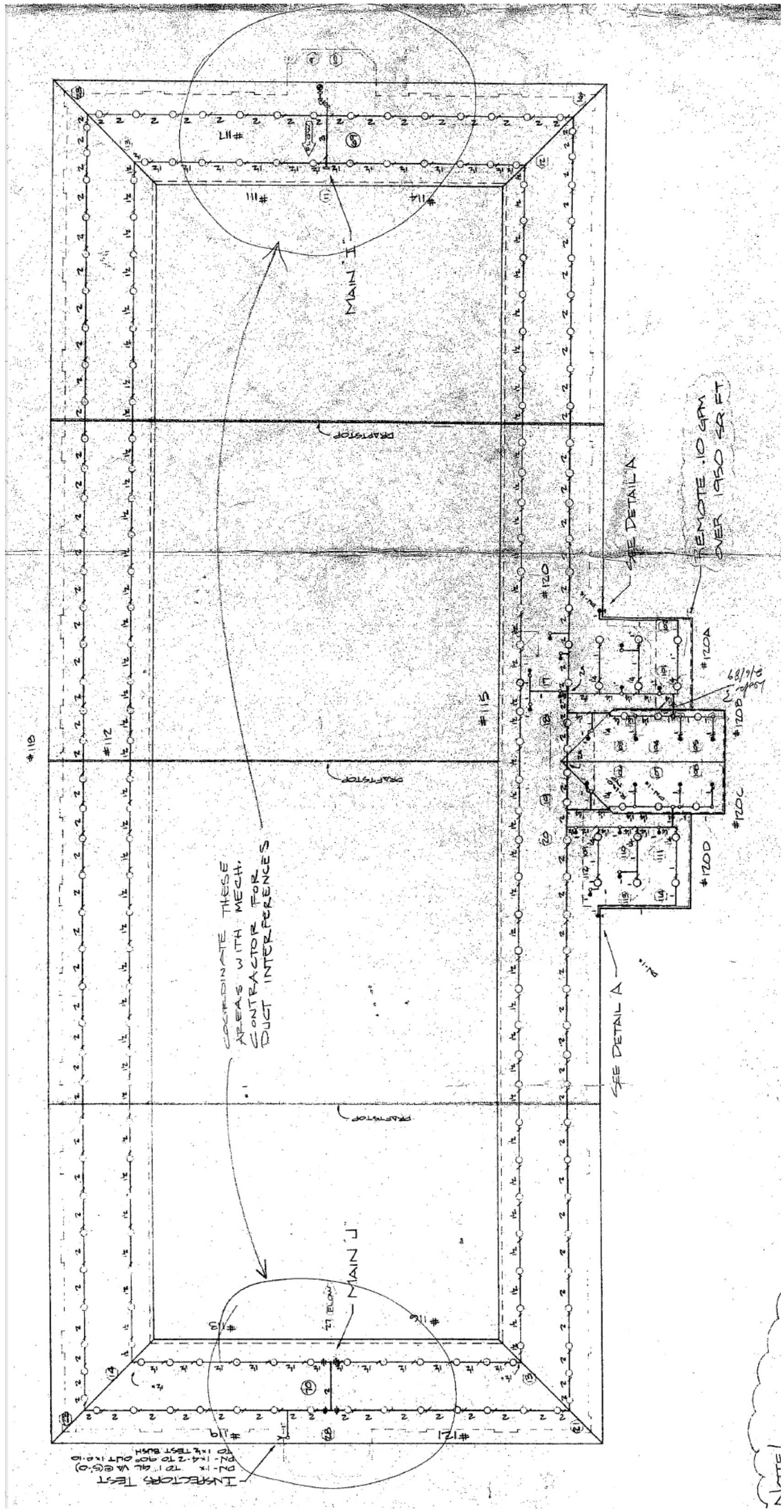
Rood Center – 2st Floor East (3 of 5)



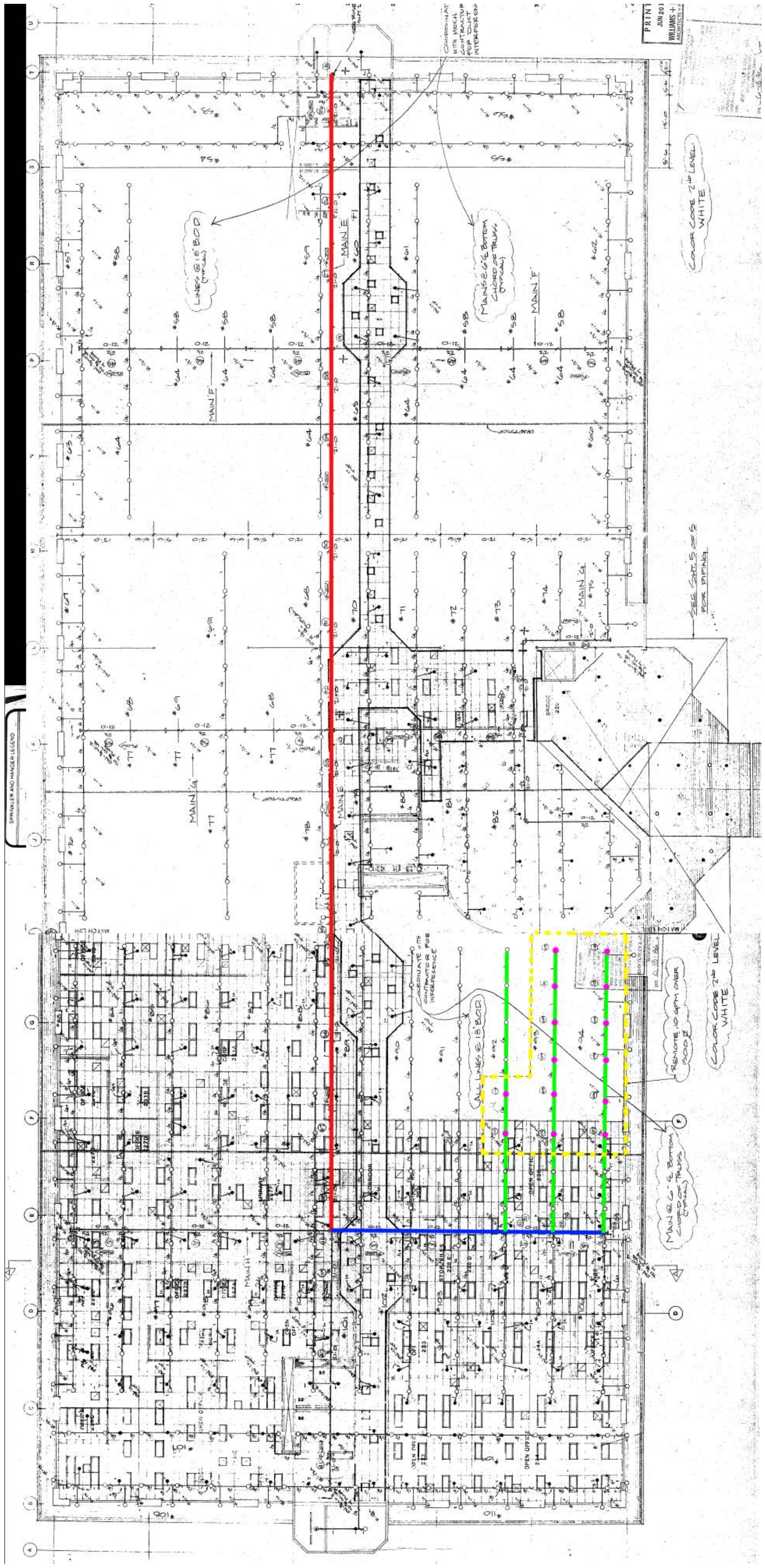
Rood Center – 2st Floor West (4 of 5)



Rood Center – Mansard (5 of 5)



Rood Center – Mansard (Close-Up)

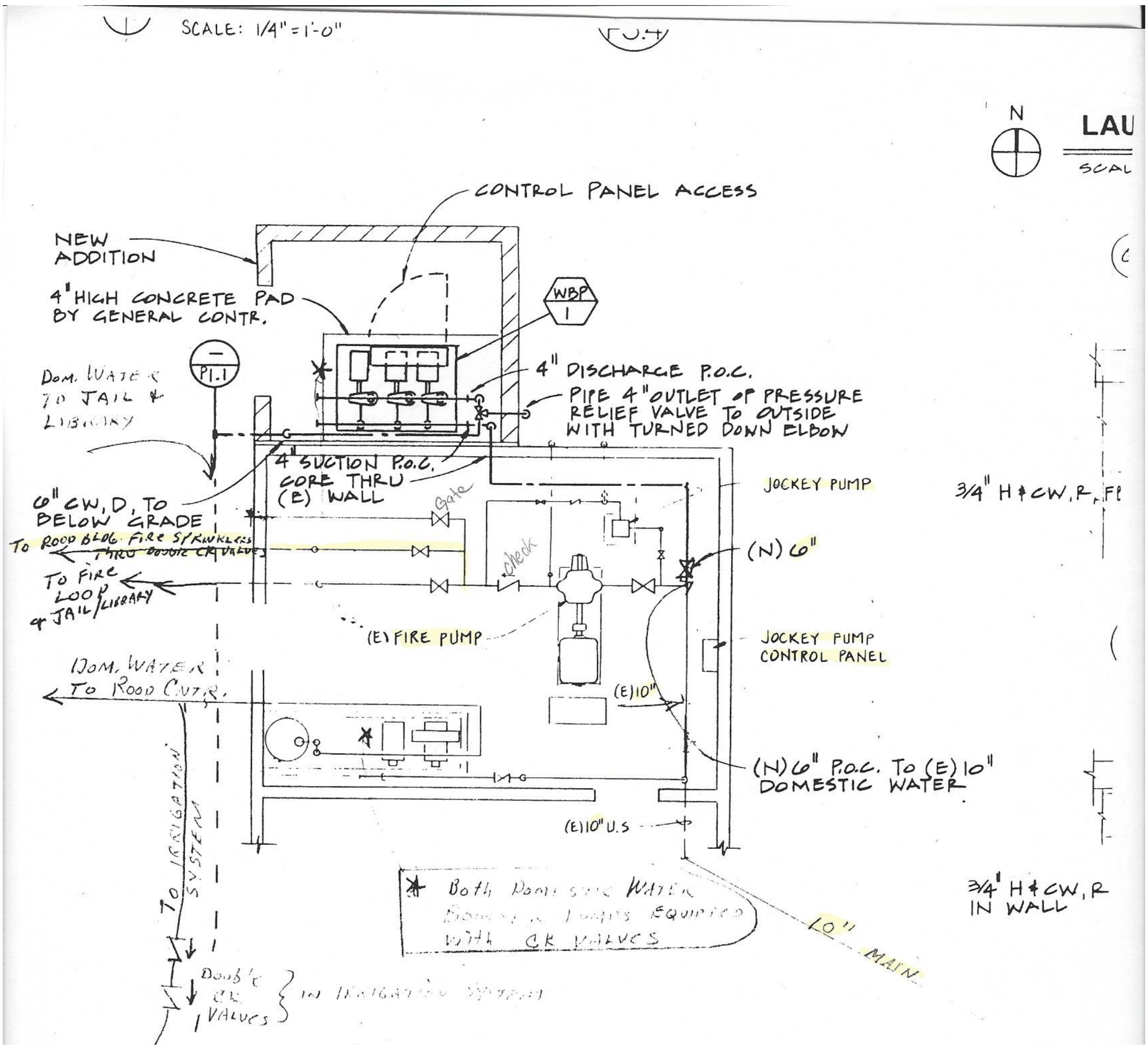


Rood Center – 2nd Floor Combined Overview with water path highlighted

Rood Center – 2nd Floor Combined Close-Up with water path highlighted

APPENDIX K

Pump Room Layout



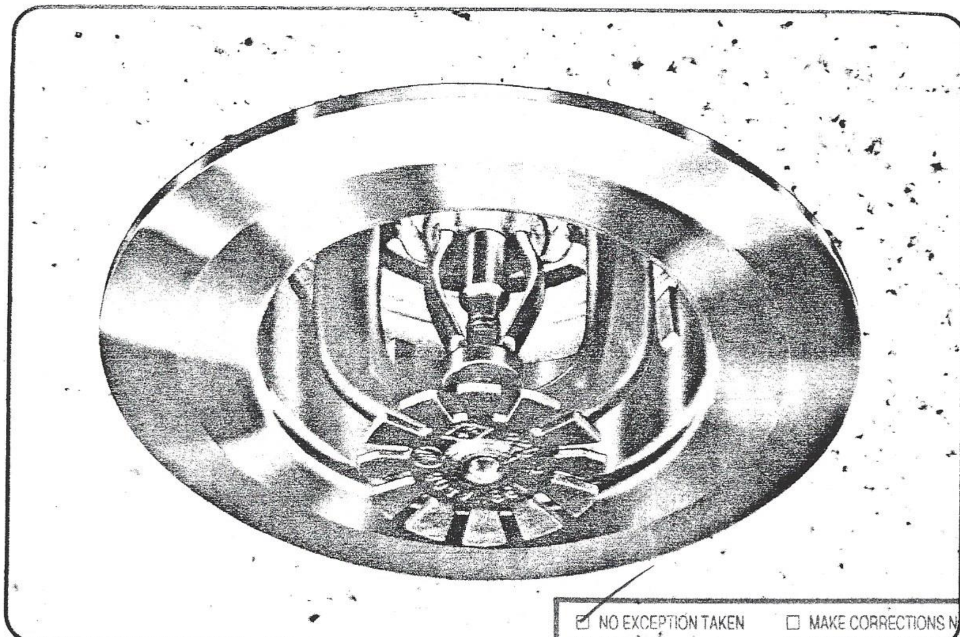
SCALE: 1/4"=1'-0"
N
LAU
CONTROL PANEL ACCESS
NEW ADDITION
4" HIGH CONCRETE PAD BY GENERAL CONTR.
WBP 1
P1.1
4" DISCHARGE P.O.C.
PIPE 4" OUTLET OF PRESSURE RELIEF VALVE TO OUTSIDE WITH TURNED DOWN ELBOW
4" SUCTION P.O.C. CORE THRU (E) WALL
6" CW, D, TO BELOW GRADE
JOCKEY PUMP
3/4" H & CW, R, FL
Gate
Check
(N) 6"
To Fire Loop & Jail/Library
(E) FIRE PUMP
JOCKEY PUMP CONTROL PANEL
(E) 10"
(N) 6" P.O.C. To (E) 10" DOMESTIC WATER
(E) 10" U.S.
3/4" H & CW, R IN WALL
10" MAIN
TO IRRIGATION SYSTEM

APPENDIX L

Sprinkler System Component Data Sheets

BULLETIN FR-H
Rev. No. 3

Model "H" ½" Inch Orifice Recessed Sprinkler



☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH [illegible] SPECIFICATIONS [illegible] SHALL BE [illegible] FABRICAT[illegible] CONSTRUCTION, COORDINATION [illegible] OTHER TRADES AND THE SATISFACTORY [illegible] WORK

[illegible]
MECHANICAL [illegible]
Sacramento California
DATE 6-11-86 BY CMM

Listed by: Underwriters Laboratories, Inc.
Approved by: Factory Mutual
B.S. & A. of New York City

Description • Operation • Technical Data

Central Sprinkler Corporation
451 North Cannon Avenue, Lansdale, PA 19446
(215) 362-0700

Description

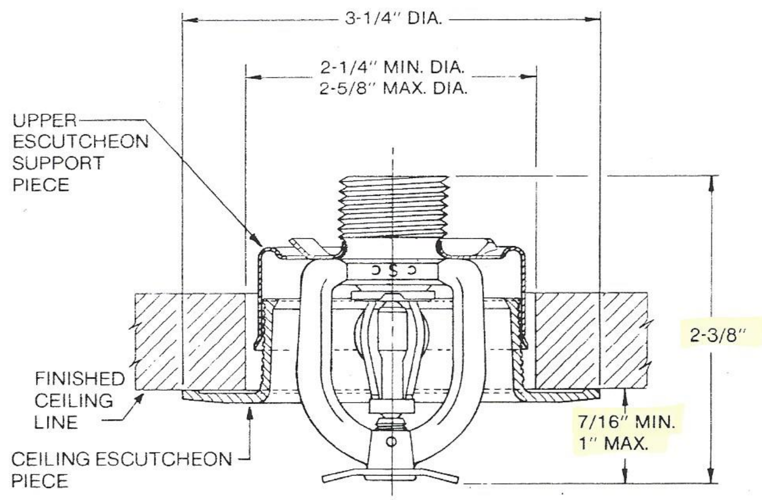
The Model "H" Recessed Sprinkler is a low cost, aesthetically pleasing sprinkler that incorporates the standard Central Model "H" Center Strut Sprinkler design and a special two-piece recessed plastic and metal retaining cup assembly having a 1/2" adjustment feature. The upper escutcheon support piece is factory installed on the base of the sprinkler frame. The ceiling escutcheon piece is easily installed after the sprinkler is in place by placing it over the sprinkler into the upper support piece and gently pushing upward until located flush with the ceiling. This feature allows removal of ceiling panels for easy access to ceiling equipment without the need for removal of the entire drop nipple assembly.

The Model "H" Recessed Sprinkler protrudes from 7/16" to 1" below the ceiling, providing a low profile, unobtrusive silhouette.

Operation

A fusible alloy is sealed into a bronze center strut by a stainless steel ball. When the alloy melts, the ball is forced upward into the center strut, releasing the two ejectors and operating the sprinkler. Unlike most other sprinkler designs, the alloy is not exposed to atmospheric conditions which could possibly affect its proper operation and it is less susceptible to mechanical injury since there are no protruding links or levers.

Cross Section

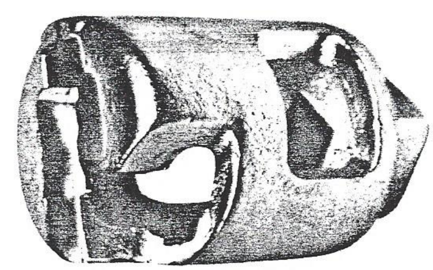


Technical Data

Nominal Orifice Size	Thread Size N.P.T.	"K" Factor	Available Temperature Ratings	Finishes Available
			135° F 57.2° C	Bronze
1/2"	1/2"	5.6	165° F 74° C	Satin Chrome Bright Chrome
			212° F 100° C	White* Black*

*White and black enamel finishes on sprinklers are not U.L. Listed

NOTE: F.M. Approved for Light Hazard only.



Universal Wrench—easily used with a standard ½" square ratchet or speed wrench.

Note: It is important, that the proper Central Sprinkler wrench is used to install Central Sprinklers. The use of any other type of wrench may result in damage to the sprinkler.

ORDERING INFORMATION

Specify: Quantity
Style
Orifice and Thread Sizes
Temperature Rating
Finish
Quantity—Universal Wrenches

Printed in U.S.A. 3/84

Gem

155 WESTMINSTER STREET PROVIDENCE, R. I. 02903

☒ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

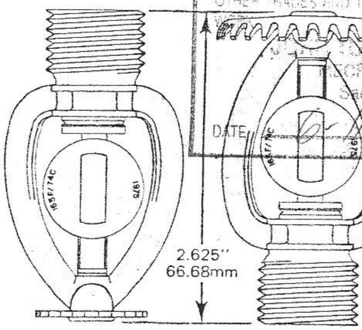
CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH ... OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF HIS WORK.

Sacramento, California

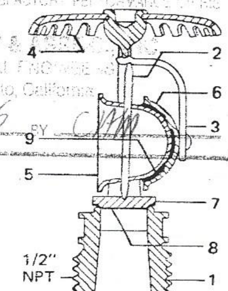
DATE 6-11-86 BY CMM

AUTOMATIC SPRINKLERS, MODEL F950 SOLDER TYPE

UPRIGHT AND PENDENT, 1/2" ORIFICE



PENDENT UPRIGHT



Components:
1–Frame
2–Strut
3–Hook
4–Deflector, SSU–3 for Upright Sprinkler, SSP–2 for Pendent Sprinkler
5–Heat Collector
6–Key
7–Button
8–Button Gasket
9–Solder

CROSS SECTION

TEMPERATURE RATINGS			APPROVALS									
			UNDERWRITERS LABORATORIES (L–LISTED, X–NOT LISTED)					FACTORY MUTUAL (A–APPROVED, X–UNAPPROVED)				
FAHRENHEIT	CELSIUS	COLOR CODED	PLAIN	CHROME PLATED	LEAD COATED	CORROPROOF*	LEAD COATED & CORROPROOF*	PLAIN	CHROME PLATED	LEAD COATED	CORROPROOF*	LEAD COATED & CORROPROOF*
165°	74°	PLAIN	L	L	L	L	L	A	A	A	A	A
212°	100°	WHITE	L	L	L	L	L	A	A	A	A	A
286°	141°	BLUE	L	L	L	†	L	A	A	X	X	X
350°	177°	RED	L	L	L	†	L	A	A	X	X	X

*165° and 212° sprinklers with a Corroproof finish are identified by Underwriters Laboratories and Factory Mutual as wax coated. 286° and 350° sprinklers with Corroproof or Lead Coated and Corroproof finishes are identified by Underwriters Laboratories as Enamel Coated and Enamel over Lead Coating, respectively.
†Furnished with Lead Coated and Corroproof finish.

DESCRIPTION

The Model F950 Upright and Pendent Sprinklers are fusible solder type sprinklers available in a variety of operating temperatures and with special finishes and coatings for aesthetic appeal or for protection from corrosive conditions.

Temperature ratings, color coding, finishes and coatings are listed in the table; design details and identification of components are shown in the cross section view of the sprinkler.

APPROVALS

Model F950 Sprinklers are listed by Underwriters Laboratories, Inc. and approved by Factory Mutual as shown in the table. Sprinklers listed by Underwriters Laboratories, Inc. are also listed by Underwriters' Laboratories of Canada.

INSTALLATION

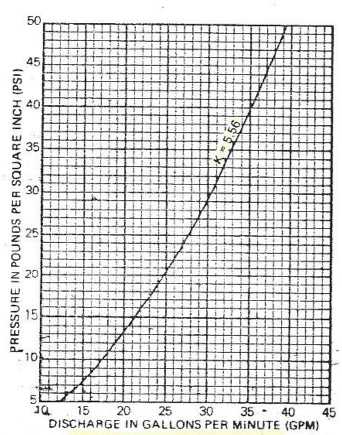
Model F950 Sprinklers should be installed in compliance with standards of the National Fire Protection Association and/or any other authorities having jurisdiction.

CARE AND MAINTENANCE

Sprinklers should never be stored where temperatures will exceed 100° F and should never be painted, plated, coated or otherwise altered after leaving the factory. Care should be exercised to avoid mechanical damage after the sprinklers have been installed; in some installations, sprinkler guards may be required.

DISCHARGE CAPACITY

Discharge capacity of ½" orifice Model F950 Sprinklers is plotted on the following graph.



DISCHARGE CURVE

The discharge curve plotted on the graph is based upon flow "Q" in gallons per minute (gpm) as determined by the formula: $Q = K \sqrt{p}$; where the sprinkler discharge coefficient "K" = 5.56 and "p" = pressure in pounds per square inch (psi). By substitution in the formula of appropriate SI (International System) units of measurement listed under "Conversion Factors" Q, K and p values in SI units can be calculated.

CONVERSION FACTORS

The following is a list of factors for converting English units of measurement referenced herein to equivalent SI (International System) units. Items marked with an asterisk are not SI units; however, are included since they are commonly used in many countries on the metric system.

1 inch = 25.400 mm
1 psi = 6.895 kPa
= 0.0689 bar*
1 gallon = 3.785 dm^3
= 3.785 litre*

wet

ORDERING PROCEDURE

Product Symbol Numbers (PSN) assigned to upright and pendent ½ inch orifice Model F950 Sprinklers with various temperature ratings, finishes and coatings are listed on the reverse side. All orders for Model F950 Sprinklers must reference the Product Symbol Numbers of the sprinklers required.

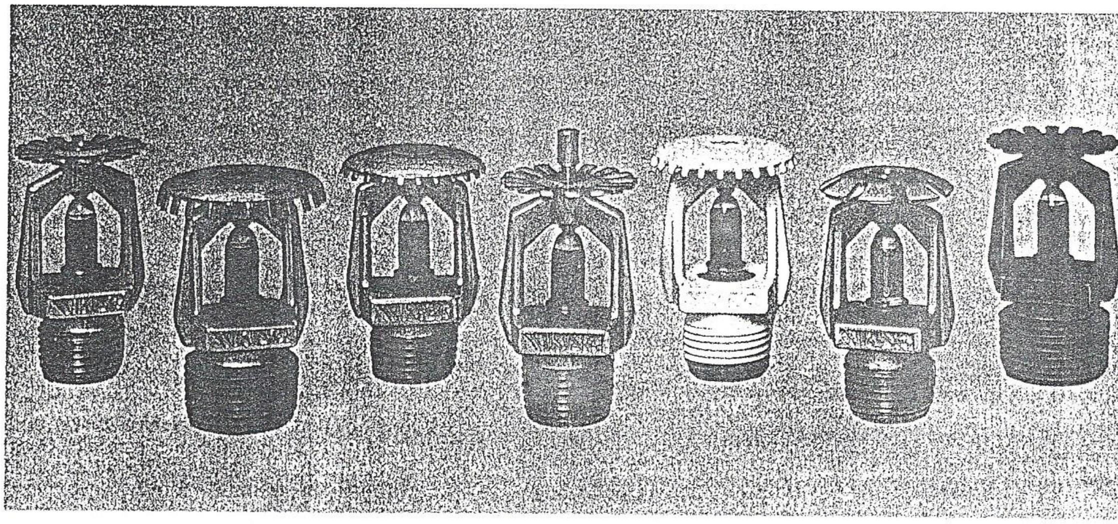
To Order Specify:
PSN (specify) ½" orifice, (temperature rating), (finish), (upright/pendent), Model F950 Sprinkler.

10–15–76
Printed in U.S.A.

VIKING

TECHNICAL DATA

MICROMATIC®
SPRINKLER
MODEL M



1. PRODUCT NAME

Viking Micromatic® Sprinkler
Model "M"
Style: Upright, Pendent and Conventional

2. MANUFACTURE

THE VIKING CORPORATION
210 N. Industrial Park Road
Hastings, Michigan 49058 U.S.A.
Fax Number: (616) 945-9599
Easylink Mailbox: 62884145
Telephone: (616) 945-9501
Telex Number: 22-6400

3. PRODUCT DESCRIPTION

The Viking Micromatic® Sprinkler is a small, thermosensitive glass-bulb spray sprinkler. The sprinkler is available in several styles, finishes, temperature ratings and orifice sizes to meet design requirements. The small frame and rugged 8mm glass-bulb provide a pleasing aesthetic appearance. Used in conjunction with one of the various corrosion resistant coatings the unit provides protection against many corrosive environments. In addition, the special polyester or Teflon® coatings can also be used in decorative applications where the colors are desired. During fire conditions, the heat sensitive liquid in the glass-bulb expands, causing the bulb to shatter, releasing the pip cap and sealing spring assembly. The water flowing through the sprinkler orifice strikes the sprinkler deflector forming a uniform spray pattern to extinguish or control the fire. The sprinklers may be ordered and/or used as open sprinklers (glass-bulb and pip cap assembly removed) on deluge systems.

4. TECHNICAL DATA

See Chart for list of approvals.
Glass Bulb Fluid Temperature rated to -65°F (-55°C).
Rated 175 PSI (1207 kPa) water working pressure.
Factory tested hydrostatically to 500 PSI (3448 kPa).
Spring USA Patent No. 4,167,974.

Materials:

Frame - Brass castings UNS-C84400 (ASTM B145 Class 5A).
Deflector - Brass UNS-C26000.
Bulb-Glass with Glycerin solution
Nominal 8mm diameter.
Bushing-Brass UNS-C36000.
Seal-Teflon® Tape.
Spring-Nickel Alloy.
Screw-Brass UNS-C36000.
Pip Cap - Copper UNS - C11000.
Polyester Sprinklers:
Spring-Nickel Alloy Exposed.
Screw-Brass UNS-C36000,
Tin Plated.
Pip Cap-Copper UNS-C11000
Tin Plated.
Teflon® Sprinklers:
Spring-Nickel Alloy Exposed
Screw-Brass UNS-C36000
Tin Plated.
Pip Cap-Copper UNS-C11000
Teflon® coated.

5. AVAILABILITY AND SERVICE

Viking sprinklers are available through a network of domestic, Canadian, and international distributors, see the Yellow Pages of the telephone directory (listed under "Sprinklers Automatic Fire") or write to The Viking Corporation.

6. GUARANTEES

Viking agrees to repair or replace goods found to be defective in material and workmanship for a period of one year from the date of shipment. For details of warranty, refer to price list.

7. INSTALLATION

WARNING: Viking sprinklers are manufactured and tested to meet the rigid requirements of the approving agency. The sprinklers are designed to be installed in accordance with recognized installation standards. Deviation from the standards or any alteration to

The Viking Corporation 15 FIRE EXTINGUISHING SYSTEMS automatic sprinklers

Form No. 072788

VIKING TECHNICAL DATA

MICROMATIC®
SPRINKLER
MODEL M

Sprinkler Temperature Classification	Nominal Sprinkler Temperature Rating (Fusing Point)	Ceiling Temperature at Sprinkler Max. Ambient Temp. Allowed[1]	Max. Recommend. Ambient Temp.[2]	Bulb Color	Frame Paint Color
Ordinary	135°F(57°C)	115°F(46°C)	100°F(38°C)	Orange	None
Ordinary	155°F(68°C)	135°F(57°C)	100°F(38°C)	Red	None
Intermediate	175°F(79°C)	155°F(68°C)	150°F(65°C)	Yellow	White
Intermediate	200°F(93°C)	180°F(82°C)	150°F(65°C)	Green	White
High	286°F(141°C)	266°F(130°C)	225°F(107°C)	Mauve	Red
Extra High	360°F(182°C)	340°F(171°C)	300°F(149°C)	Mauve	Red

Sprinkler Finishes: Brass, Bright Brass, Polished Chrome, White (Polyester), White Paint, Black Teflon® and Navajo White(Paint)
Corrosion Resistant Coatings[3] - Polyester and Teflon® in all temperatures and Wax, and/or Wax over Polyester in the following temperatures:
135°F (57°C) White Wax. 175°F (79°C) Dark Brown Wax
155°F (68°C) Light Brown Wax 200°F (93°C) Dark Brown Wax

[1]Based on National Fire Prevention and Control Administration Contract No. 7-34860.
[2]Based on NFPA-13. Other limits may apply depending on fire loading, sprinkler location and other authority having jurisdiction requirements. Refer to specific installation standards.
[3]The Corrosion Resistant Coatings have passed the standard corrosion test required by the listed approving agencies. These tests cannot and do not represent all possible corrosive environments. Prior to installing verify, through the end user, that the coatings are compatible or suitable for the proposed environment. The coatings indicated are applied to the exposed exterior surfaces only and therefore cannot be used as open sprinklers. Note that the spring is exposed on the teflon® and polyester sprinkler.

the sprinkler after it leaves the factory including, but not limited to, painting, plating, coating or modification, may render the sprinkler inoperative and will automatically nullify the approval and any guarantee made by The Viking Corporation.

A. Sprinklers are to be installed in accordance with the latest published standards of the National Fire Protection Association, Factory Mutual, Loss Prevention Council (F.O.C.), Assemblee Pleniere, Verband der Sachversicherer or other similar organizations and also with the provisions of governmental codes, ordinances and standards whenever applicable.

B. The sprinklers must be installed after the piping is in place to prevent mechanical damage. Before installing, make sure the appropriate model, style, orifice size and temperature rating is used. Apply a small amount of pipe joint compound or tape to the external threads only, taking care not to allow a build up of compound in the sprinkler orifice. Install the sprinkler on the piping using the special sprinkler wrench only, while taking care not to damage the sprinkler operating parts. (Any other type of wrench may damage the unit.) DO NOT use the sprinkler deflector to start or thread the sprinkler into a fitting.

C. Sprinklers must be handled with care. They must be stored in a cool, dry place in their original shipping container. Never install sprinklers that have been dropped, damaged or exposed to temperatures in excess of maximum ambient allowed. Never install any glass bulb sprinkler if the bulb is cracked or if there is a loss of liquid from the bulb. (These sprinklers should be destroyed immediately.) With the 8mm glass bulb sprinkler held horizontal, a small air bubble should be present. The diameter of the air bubble varies from approximately 1/16 inch for the 135°F (57°C) rating to 1/8 inch for the 286°F (141°C) rating and is approximately 3/16 inch diameter for the 360°F (182°C)rating.

D. Corrosion resistant sprinklers must be installed when subject to corrosive atmospheres. When installing corrosion resistant sprinklers, care must be taken not to damage the corrosion resistant coating. Use only the special sprinkler wrench and immediately replace any damaged units.

E. Sprinklers subject to mechanical damage must be protected with an approved sprinkler guard. Sprinklers installed on wet pipe systems must be provided with adequate heat. Pendent sprinklers in areas subject to freezing must be special dry pendent sprinklers.

F. After installation, the entire sprinkler system must be tested in accordance with the recognized installation standards. The test is applied after the sprinkler installation to insure no damage has occurred to the sprinkler during shipping and installation, and to make sure the unit has been properly tightened. If a thread leak should occur, normally the unit must be removed,new pipe joint compound or tape applied, and reinstalled. This is due to the fact that when the joint seal is damaged, the sealing compound or tape is washed out of the joint.

8. MAINTENANCE

NOTICE: The owner is responsible for maintaining the fire protection system and devices in proper operating condition. For minimum maintenance and inspection requirements, refer to the National Fire Protection Association Pamphlet number 13A, "Care and Maintenance of Sprinkler System". In addition, the "Authority Having Jurisdiction" may have additional maintenance, testing and inspection requirements which must be followed.

A. The Sprinklers must be inspected on a regular basis for corrosion, mechanical damage, obstructions, paint, etc. The frequency of the inspections may vary due to corrosive atmospheres, water supplies and activity around the device.

B. Sprinklers that have been painted or mechanically damaged must be replaced immediately. Sprinklers showing signs of corrosion shall be tested and/or replaced immediately as required. Microfast Sprinklers that

VIKING **TECHNICAL DATA**

MICROMATIC®
SPRINKLER
MODEL M

are 50 years old shall be tested and/or replaced as required. Sprinklers that have operated cannot be reassembled or reused, but must be replaced. When replacing sprinklers, use only new sprinklers.

C. The sprinkler discharge pattern is critical for proper fire protection, therefore, nothing should be hung from, attached to, or otherwise obstruct the discharge pattern. All obstructions must be immediately removed or, if necessary, additional sprinklers installed.

D. When replacing existing sprinklers, the system must be removed from service. Refer to the appropriate system description and/or valve instructions. Prior to removing the system from service, notify all Authorities Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected area.

1. Remove the system from service, draining all water and relieving all pressure on the piping.
2. Using the special sprinkler wrench, remove the old sprinkler and install the new unit. Care must be taken to replace the sprinkler with the proper model, style, orifice size and temperature rating. A fully stocked spare sprinkler cabinet should be provided for this purpose.
3. Place the system back in service and secure all valves, Check and repair all leaks.

E. Sprinkler systems that have been subject to a fire must be returned to service as soon as possible. The entire system must be inspected for damage and repaired or replaced as necessary. Sprinklers that have been exposed to corrosive products of combustion or high ambient temperatures, but have not operated, should be replaced. Refer to the Authority Having Jurisdiction for minimum replacement requirements.

Deflector Style	Thread Size	NPT	Nominal Orifice		Nominal K Factor		Overall Length		Approval[1]					
	Inch	MM	Inch	MM	US	Metric	Inch	MM	UL	ULC	FM	NYC	VDS	LPC (FOC)
Upright	1/2	-	1/2	-	5.5	-	2.3	58	A†	A	A	A	-	-
Upright[2]	1/2	-	5/16	-	1.8	-	2.7	69	A†*	A*	-	A*	-	-
Upright[2]	1/2	-	3/8	-	2.7	-	2.7	69	A†*	A*	B*	A*	-	-
Upright[2]	1/2	-	7/16	-	4.0	-	2.7	69	A†*	A*	-	A*	-	-
Pendent	1/2	15	1/2	15	5.5	79	2.3	58	A†	A	A	A	C	A††
Pendent[2]	1/2	-	5/16	-	1.8	-	2.7	69	A†*	A*	-	A*	-	-
Pendent[2]	1/2	-	3/8	-	2.7	-	2.7	69	A†*	A*	B*	A*	-	-
Pendent[2]	1/2	-	7/16	-	4.0	-	2.7	69	A†*	A*	-	A*	-	-
Upright[3]	1/2	-	17/32	-	8.0	-	2.9	74	A†	A	A	A	-	-
Upright	3/4	20	17/32	20	8.0	115	2.4	61	A†	A	A	A	C	A††
Pendent	3/4	20	17/32	20	8.0	115	2.4	61	A†	A	A	A	C	A††
Pendent[3]	1/2	-	17/32	-	8.0	-	2.9	74	A†	A	A	A	-	-
Upright	3/8	10	7/16	10	4.0	58	2.3	58	-	-	-	-	C	A††
Upright	1/2	15	1/2	15	5.5	79	2.3	58	-	-	D	-	C	A††
Pendent	3/8	10	7/16	10	4.0	58	2.3	58	-	-	-	-	C	A††
Conventional U/P	1/2	15	1/2	15	5.5	79	2.3	61	-	-	-	-	D	A††
Conventional U/P	3/4	20	17/32	20	8.0	115	2.4	61	-	-	-	-	D	A††

"A" - Denotes approved at 135°F, 155°F, 175°F, 200°F, 286°F, 360°F and wax and/or polyester coated at 135°F, 155°F, 175°F, and 200°F.
"B" - Denotes approved at 135°F, 155°F, 175°F, 200°F and/or wax coated at same temperatures.
"C" - Denotes approved at 155°F, 200°F, and 286°F.
"D" - Denotes approved at 135°F, 155°F, 175°F, 200°F, 286°F and 360°F.
"††" - Denotes approved with polyester coating.
"†" - Denotes approved with polyester and teflon® coating.
"*" - Denotes approved for light hazard occupancies only.

[1] This Chart shows the listings and approvals available at the time of printing. Other approvals are in process. Check with the manufacturer for any additional approvals. Approved by the New York City Board of Standards and Appeals under Calendar Number 219-76-SA
[2] The sprinkler frame is identified with the nominal orifice size and the deflector has a protruding pintle. The sprinkler orifice is bushed.
[3] The sprinkler frame is identified with the nominal orifice size and the deflector has a protruding pintle.
[4] Refer to Sprinkler Accessories for approved escutcheons and other accessories.

VIKING TECHNICAL DATA

MICROMATIC®
ADJUSTABLE ESCUTCHEON
MODEL E-1

1. PRODUCT NAME

ADJUSTABLE ESCUTCHEON
MODEL E-1

2. MANUFACTURER

THE VIKING CORPORATION
210 N. industrial Park Road
Hastings, Michigan 49058 U.S.A.
Fax Number: (616) 945-9599
Easylink Mailbox: 62884145
Telephone: (616) 945-9501
Telex Number: 22-6400

3. PRODUCT DESCRIPTION

The Viking Model E-1 two piece Adjustable Escutcheon is used with a pendent or horizontal sidewall Micromatic® Model M sprinkler to provide a low profile, decorative recessed sprinkler. The escutcheon's two piece design allows the installation and testing of the sprinklers prior to the installation of the ceiling. The outer cup can be removed and reinstalled allowing access above removable ceiling panels for servicing building equipment without shutting down the sprinkler system and removing the sprinkler. The slip-on feature allows for minor adjustments due to pipe or ceiling pitch.

4. TECHNICAL DATA

See Chart for list of approvals.

Adjustment range is flush to 3/4" (19mm) recessed.

Requires a minimum 2-1/8" (54mm) to a maximum 2-1/2" (64mm) diameter hole in ceiling or wall.

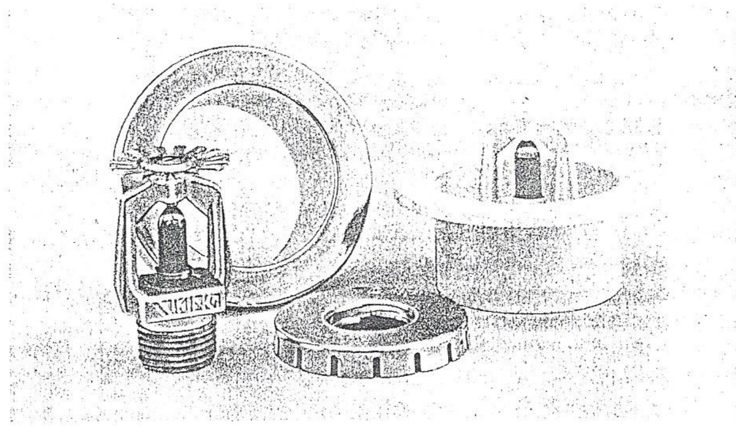
Material:
UNS-G10080 Cold Rolled Steel

Escutcheon Finishes:*
Bright Brass
Polished Chrome
Painted White
Painted Navajo White
Painted Black (Semi-Gloss)

*Note - the escutcheon is not coated or listed for corrosive environments and therefore should not be used for this purpose.

5. AVAILABILITY AND SERVICE

The Viking Model E-1 Adjustable Escutcheon is available through a network of domestic, Canadian, and international distributors, see the Yellow Pages of the telephone directory (listed under "Sprinklers Automatic Fire") or write to The Viking Corporation.



APPROVED FOR USE WITH THE FOLLOWING VIKING SPRINKLERS ONLY

Deflector Style	Nominal Orifice Size	Approval[1]			
		UL	FM	ULC	NYC
Pendent	5/16"	A*	-	D*	A*
Pendent	3/8"	A*	-	D*	A*
Pendent	1/2"	A	B†	D	A
Pendent	17/32"	A	B†	D	A
Horizontal	1/2"	C††	-	-	C††

"A"-Denotes approved in 135°F, 155°F and 175°F ratings in all sprinkler finishes.
"B"-Denotes approved in 135°F, 155°F, 175°F and 200°F ratings in Bright Brass and Polished Chrome sprinkler finishes.
"C"-Denotes approved in 135°F, 155°F, 175°F and 200°F ratings in all sprinkler finishes.
"D"-Denotes approved in 135°F, 155°F and 175°F ratings in Bright Brass and Polished Chrome sprinkler finishes.
"*"-Denotes approved for Light Hazard Occupancies only.
†"-Denotes approved for use in Occupancies up to and including Ordinary Hazard Group II when installed on wet pipe systems only.
"††"-Must be installed 4"-12" below ceiling.

[1] This chart shows the listings and approvals available at the time of printing. Other approvals are in process. Contact the manufacturer for any additional approvals.
[2] Approved by the New York City Board of Standards and Appeals under Calendar Number 219-76-SA.

6. GUARANTEES

Viking agrees to repair or replace goods found to be defective in material and workmanship for a period of one year from the date of shipment. For details of warranty, refer to price list.

7. INSTALLATION

WARNING: Viking sprinklers are manufactured and tested to meet the rigid requirements of the approving agency. The sprinklers are designed to be installed in accordance with recognized installation standards. Deviation from the standards or any alteration to the sprinkler after it leaves the factory including, but not limited to, painting, plating, coating or modification, may render the sprinkler inoperative and will automatically nullify the approval and any guarantee made by The Viking Corporation.

A. Sprinklers are to be installed in accordance with the latest published standards of the National Fire Protection Association, Factory Mutual, Loss Prevention Council (F.O.C.), Assemblee Pleniere, Verband der Sachversicherer or other similar organizations and also with the provisions of governmental codes, ordinances and standards whenever applicable.

B. Recessed sprinklers are decorative sprinklers and are generally considered special service. As such, if the proposed installation requires recessing any of the heat sensitive operating element (glass bulb), some Authorities Having Jurisdiction may limit the use depending on the occupancy classification. Refer to the Authority Having jurisdiction prior to installation.

C. Refer to the appropriate sprinkler data page for additional warnings and installation instructions then install units according to the following steps:

STEP 1: Install all piping and cut the sprinkler drop nipple so that the reducing coupling is at the desired elevation.

VIKING TECHNICAL DATA

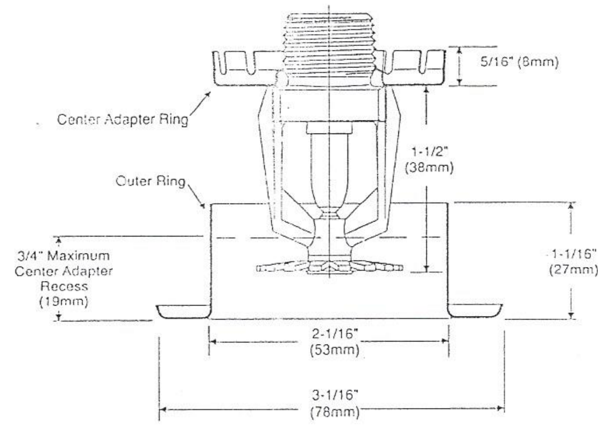
MICROMATIC®
ADJUSTABLE ESCUTCHEON
MODEL E-1

STEP 2: Screw the center adapter ring on the sprinkler. The adapter should rest on the shoulder of the sprinkler wrench boss.

STEP 3: Apply a small amount of pipe joint compound or tape to the male threads of the sprinkler only and screw into the coupling. Tighten with the recessed sprinkler wrench.

STEP 4: Test the system as required and repair all leaks. Note if a thread leak should occur, normally the unit must be removed, new joint sealer applied and then reinstalled in order to seal properly.

STEP 5: After installing the ceiling with a minimum 2-1/8" (54mm) hole for the escutcheon, press on the outer ring until the flanges touch the ceiling. Note the maximum center adapter recess is 3/4" (19mm). DO NOT modify the unit. If necessary re-cut the sprinkler drop nipple as required.



D. DISASSEMBLY - The outer ring can be removed and reinstalled without removing the sprinkler to allow access above the ceiling or to replace if necessary. If it is necessary to remove the entire unit the system must be removed from service. See maintenance instructions and follow all warnings and instructions.

8. MAINTENANCE

NOTICE: The owner is responsible for maintaining the fire protection system and devices in proper operating condition. For minimum maintenance and inspection requirements, refer to the National Fire Protection Association Pamphlet number 13A, "Care and Maintenance of Sprinkler System". In addition, the "Authority Having Jurisdiction" may have additional maintenance, testing and inspection requirements which must be followed.

A. The Sprinklers must be inspected on a regular basis for corrosion, mechanical damage, obstructions, paint, etc. The frequency of the inspections may vary due to corrosive atmospheres, water supplies and activity around the device.

B. Sprinklers that have been painted or mechanically damaged must be replaced immediately. Sprinklers showing signs of corrosion shall be tested and/or replaced immediately as required. Sprinklers that are 50 years old shall be tested and/or replaced as required. Sprinklers that have operated cannot be reassembled or reused, but must be replaced. When replacing sprinklers, use only new sprinklers.

C. The sprinkler discharge pattern is critical for proper fire protection, therefore, nothing should be hung from, attached to, or otherwise obstruct the discharge pattern. All obstructions must be immediately removed or, if necessary, additional sprinklers installed.

D. When replacing existing sprinklers, the system must be removed from service. Refer to the appropriate system description and/or valve instructions. Prior to removing the system from service, notify all Authorities Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected area.

1. Remove the system from service, draining all water and relieving all pressure on the piping.
2. Using the special sprinkler wrench, remove the old sprinkler and install the new unit. Care must be taken to replace the sprinkler with the proper model, style, orifice size and temperature rating. A fully stocked spare sprinkler cabinet should be provided for this purpose.
3. Place the system back in service and secure all valves. Check and repair all leaks.

E. Sprinkler systems that have been subject to a fire must be returned to service as soon as possible. The entire system must be inspected for damage and repaired or replaced as necessary. Sprinklers that have been exposed to corrosive products of combustion or high ambient temperatures , but have not operated, should be replaced. Refer to the Authority Having Jurisdiction for minimum replacement requirements.

☒ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

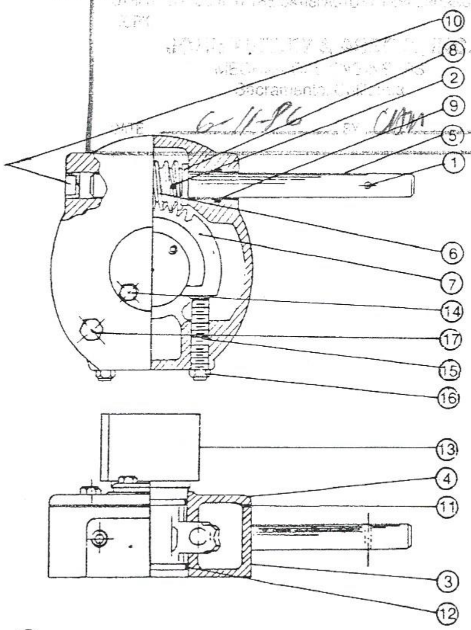
6-11-86

KENNEDY ◀FM▶ APPROVED BUTTERFLY VALVES

CONFORMS TO
FACTOR MUTUAL RESEARCH STANDARD CLASS NUMBER 1112

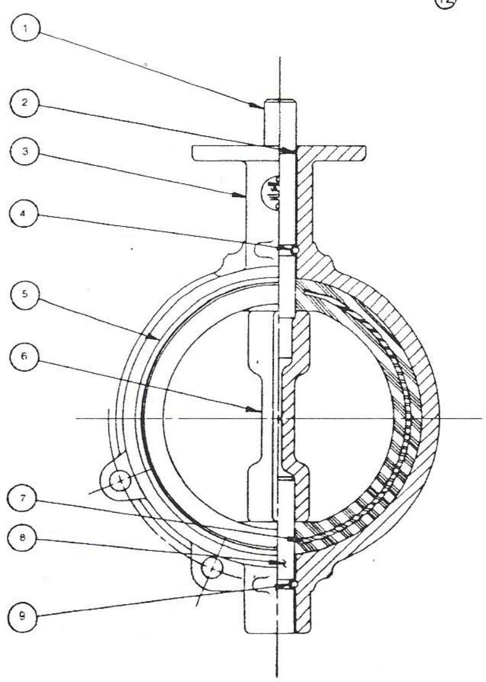
MAXIMUM WORKING PRESSURE: 175 PSI

Fig. 911 FM WE — Wafer Body
Fig. 911 FM LE — Lug Body



Actuator

Item	Description	Material
1	Shear Pin - Handwheel	Brass
2	Shear Pin - Worm Gear	Brass
3	Housing	C.I. ASTM A126 CL-B
4	Cover	C.I. ASTM A126 CL-B
5	Worm Shaft	Steel - Stress Proof
6	Worm	Steel - Stress Proof
7	Segment Gear	D.I. ASTM A536 65-45-12
8	Washer	Commercial Brass
9	"O" Ring	Buna "N"
10	Expansion Plug	Steel
11	Cover Gasket	Fibre
12	"O" Rings	Buna "N"
13	Indicator	Malleable Iron
14	Mounting Screws	Steel
15	Adjusting Screws	Steel
16	Lock Nuts	Steel
17	Cover Screws	Steel



Valve

Item	Description	Material
1	Upper Shaft	(R.C. 32)
2	"O" Ring	Buna-N
3	Body	C.I. ASTM A126 CL-B D.I. ASTM A536 65-45-12 (1)
4	Lock Pin	Steel C1010
5	Seat	EPDM (2)
6	Disc	D.I. A536, Nickel Crome Plated (2)
7	Reinforcing Ring	Steel H.R.
8	Lower Shaft	416 S.S. (2)
9	Lock Pin	Steel C1010
		(1) 4", 5", & 6" (2) 8", 10" & 12"

KENNEDY VALVE
Division of ITT Grinnell Valve Co., Inc.

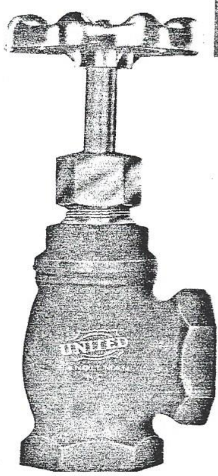
UNITED

☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

GLOBE & ANGLE VALVES

These valves are designed for general service where tight shut off and frequent use are desired. They are especially recommended for use with steam, air, oil, water and gas service, where non-metallic discs are suited.

A swivel disc holder permits disc to wear evenly and provide a tight seat under full load conditions. They are constructed so that they can be repacked with the valve in the fully opened position, while under full pressure. These valves feature easily replaceable non-metallic discs, Teflon* impregnated asbestos packing, and heavy duty, rugged construction. A choice of discs is available to make these valves suitable for most applications.

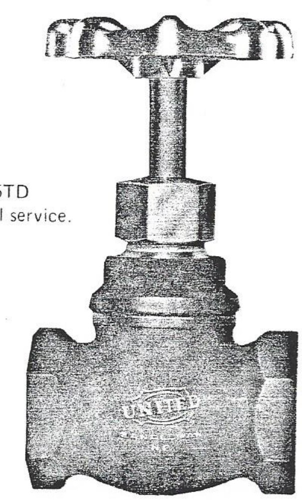


126S
126T

125S & 126S
Ⓤ Listed for fire sprinkler service.

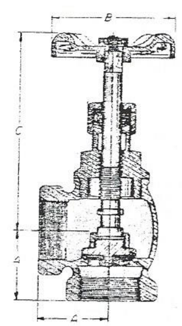
Equipped with No. 125SD Rubber Disc and rated for 200 WOG service (No Steam). Recommended for fire sprinkler service.

125T & 126T
Equipped with No. 125TD Teflon* disc for general service.

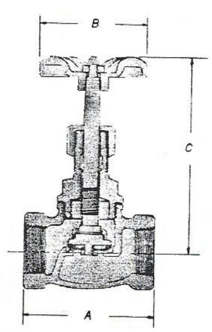


125S
125T

125 lbs. WSP
200 lbs. WOG
100% Hydrostatic Tested
Screwed Ends
Rising Stem
Swivel Disc Holder
Ventilated Aluminum Alloy Hand Wheel
Available with Plastic Hand Wheel Through 3/4"
Body Material: Bronze Conforming to ASTM B145-5A



	Size	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
No. 125S 125T	A	1 3/4"	1 27/32"	2 7/32"	2 15/32"	2 31/32"	3 9/16"	4 1/16"	4 11/16"
	B	1 3/4"	1 3/4"	2 1/32"	2 3/8"	2 3/4"	3"	3 23/32"	3 23/32"
	C (Closed)	3 1/16"	3 1/8"	3 1/4"	3 1/2"	4"	4 3/4"	5 1/2"	7"
	Ship Wt. (lbs.)	.44	.56	.80	1.00	1.81	2.57	3.69	5.88
No. 126S 126T	A	27/32"	15/16"	1 3/32"	1 7/32"	1 15/32"	1 3/4"	2"	2 11/32"
	B	1 3/4"	1 3/4"	2 1/32"	2 3/8"	2 3/4"	3"	3 23/32"	3 23/32"
	C (Closed)	2 3/4"	3"	3 1/4"	3 5/8"	4"	4 1/2"	5 1/4"	6 1/2"
	Ship Wt. (lbs.)	.44	.56	.69	.94	1.76	2.5	3.26	5.32
	Quan. Per Ctn.	12	12	12	6	6	4	2	2



For Replacement Seat Rings See Page 48

☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT

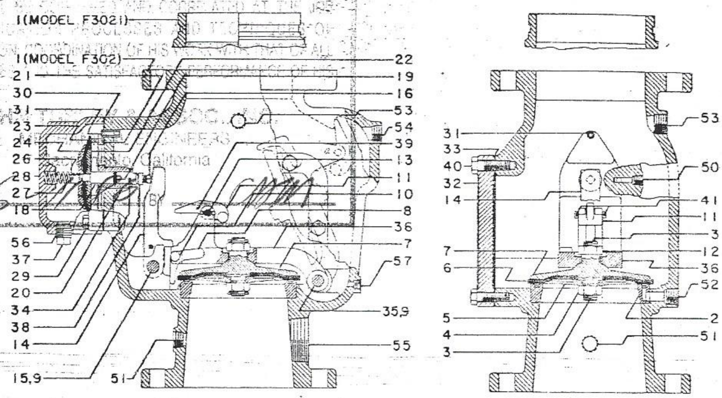
GEM DRY PIPE VALVE • MODEL F302 & F3021

With Basic Trimmings

DESCRIPTION

The Model F302 and F3021 Dry Pipe Valves are differential latch type valves used to control the flow of water to dry pipe sprinkler systems and to provide for actuation of fire alarms when the systems operate. Both model valves are identical except for the discharge connections. Model F302 Valves have flanged outlet connections whereas Model F3021 Valves are designed with grooved outlet connections. Both model valves are rated for 175 psi pressure service and are available in 4 and 6 inch sizes.

Basic Trimmings are suitable for use with both 4 and 6 inch size valves. The trimmings include materials for alarm test by-pass, priming, priming test, gauge and drain connections. Attachment of air pressure supply controls, alarm and supervisory devices — which are furnished separately — is also provided for.



1—Valve Body
2—Seat Ring
3—Cotter Pin, 1/8" x 1" (2 req'd)
4—Hex Jam Nut, 5/8"—11 UNC for 4" Valve, ¾"—10 UNC for 6" Valve
5—Clapper Washer
6—Clapper Facing
7—Clapper
8—Lower Latch
9—Washers (4 req'd)
10—Socket Head Shoulder Screw
11—Upper Latch
12—Clapper Nut
13—Upper Latch Pin
14—Clapper Latch
15—Clapper Latch Pin
16—Push Rod Screw
18—Auxiliary Clapper Rod
19—O Ring, Dash No. 111
20—Auxiliary Clapper Seat Ring
21—O Ring, Dash No. 044
22—Auxiliary Clapper Facing Retainer
23—Auxiliary Clapper Facing
24—Auxiliary Clapper
25—Pipe Plug, 3/8" for 4" Valve (2 req'd), ½" for 6" Valve (2 req'd)
26—Locknut
27—Auxiliary Clapper Spring
28—Auxiliary Clapper Chamber Cover
29—Hex Head Cap Screw, 3/8—16 UNC x 1¾" (4 req'd)
30—Auxiliary Clapper Chamber Cover Gasket
31—Spirol Pin
32—Handhole Cover
33—Handhole Cover Gasket
34—Spirol Pin
35—Clapper Arm Pin
36—Clapper Arm
37—Pipe Plug, ½"
38—Locknut
39—Spirol Pin
40—Hex Head Cap Screw, ½"—13 UNC x 1½", (6 req'd for 4" Valve, 8 req'd for 6" Valve)
41—Cotter Pin, 1/16" x 5/8" (2 req'd)
50—Auxiliary Clapper Chamber By-Pass Connection, ¼" NPT
51—Alarm Test By-Pass Connection, ½" NPT
52—Alarm Connection, ½" NPT
53—Air Supply Connection, ¾" NPT
54—Priming Connection, ½" NPT
55—Main Drain Connection, 2" NPT
56—Auxiliary Clapper Chamber Drain, ½" NPT
57—Body Drain Connection, ¼" NPT

FIGURE A
MODEL F302 & F3021 DRY PIPE VALVE

APPROVALS AND STANDARDS

Models F302 and F3021 Dry Pipe Valves are listed by Underwriters Laboratories, Inc. and Underwriters' Laboratories of Canada. The valves are approved by Factory Mutual and the Fire Offices' Committee.

NOTE: Fire Offices' Committee approval is based on the following requirements:

1. *The valve is to be maintained under a service contract with an agent accredited by FOC.*
2. *Approved FOC pressure switches are to be installed with the alarm trim referenced in Tech Data Sheets TD19—1 and/or TD19—2. The Model B2 Pressure Switch is not FOC approved and must be substituted by an approved device.*

The Model F302 and F3021 valves must be installed and maintained in compliance with the National Fire Protection Association Standard for the Installation of Sprinkler Systems, NFPA 13, and/or the standards of any other authorities having jurisdiction.

DESIGN (Fig. A)

Body Assembly. The Body Assembly consists of the Body (1), Handhole Cover (32), Auxiliary Clapper Chamber Cover (28) and two Gaskets (33, 30).

The Body of the Model F302 Valve is cast with integral flanges faced and drilled in compliance with ANSI Standard B16.1. The discharge outlet of the Model F3021 Valve is grooved in compliance with Military Specification MIL—C—10387D. Bodies of both model valves have eight female NPT Connections (50—57) for mounting the valve trimmings and for drains.

A Seat Ring (2) for the Clapper Assembly is permanently mounted in the inlet in the Body and the Auxiliary Clapper Seat Ring (20) is permanently mounted in the left side of the Body.

The Handhole Cover and Auxiliary Clapper Chamber Cover, with their respective Gaskets, are bolted to the Body with Cap Screws (40, 29). Communication between the interior of the Body and the Auxiliary Clapper Chamber is through a Spirol Pin (31) mounted in the upper left side of the Body.

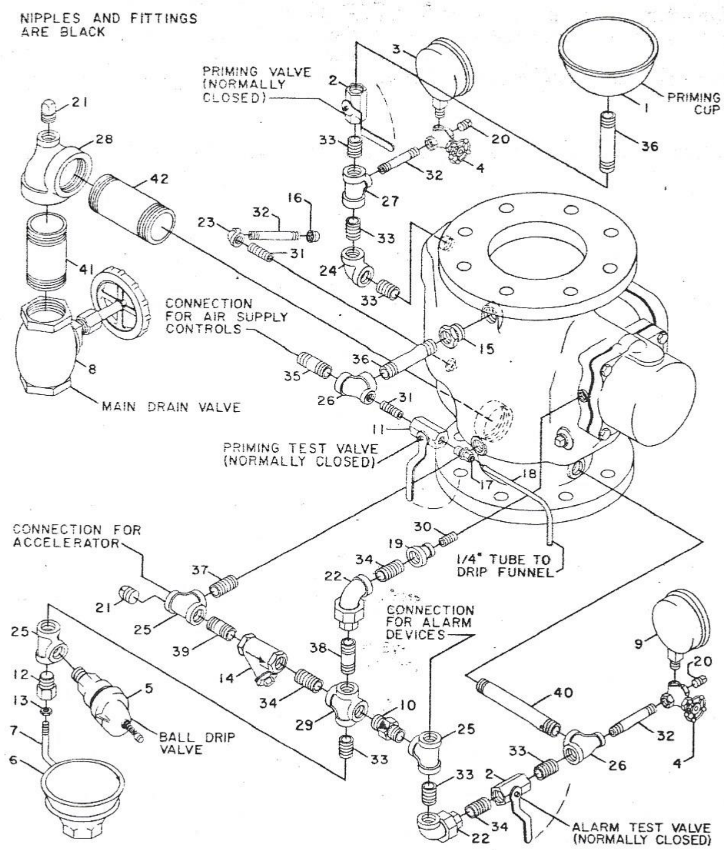
An Identification Label with the year of manufacture is mounted on the face of the Handhole Cover; other markings are cast in raised print on the Cover. A serial number is stamped on the front edge of the inlet flange. All exterior surfaces, except the Identification Label, are painted red.

Clapper and Arm Assembly. The Clapper (7), Clapper Facing (6) and Clapper Washer (5) are assembled to the Clapper Arm (36) with two Hex Nuts (4, 12) and Cotter Pins (3).

The Upper Latch (11) is mounted to the top of the Clapper Arm with the Upper Latch Pin (13) and two Cotter Pins (41). The Lower Latch (8) is mounted to the end of the Clapper Arm with a Socket Head Shoulder Screw (10).

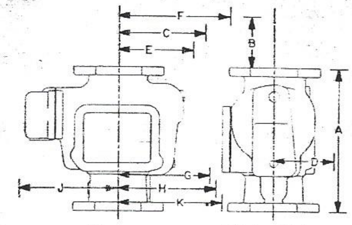
The Clapper and Arm Assembly is mounted in the lower right side of the Body with a Clapper Arm Pin (35), Washers (9) and a Plug (25) screwed into the back of the Body at a point opposite the end of the Pin.

Auxiliary Clapper Assembly. The Auxiliary Clapper (24), Clapper Facing (23) and Clapper Facing Retainer (22) are assembled to the Auxiliary Clapper Rod (18) with Locknut (26). The Auxiliary Clapper Assembly is mounted in the left side of the valve and is held seated against the Seat



1—Priming Cup
2—½" Ball Valve, Fig. 76—1—RT—1 (2 req'd)
3—250 lb. Air Pressure Gauge
4—¼" Gauge Test Valve (2 req'd)
5—½" Ball Drip Valve, F791
6—Drip Funnel
7—Drip Funnel Support
8—2" Globe Valve, Fig. 125S
9—300 lb. Water Pressure Gauge
10—½" Check Valve, Fig. 2259B—MM
11—¼" Ball Valve, Fig. 86—1—RT—1
12—Drip Funnel Support Plug
13—Hex Jam Nut, 3/8"—16 UNC
14—½" Strainer, Fig. 200
15—¾" x ½" Bushing
16—¼" Pipe Cap
17—¼" Connector, Fig. 68F
18—¼" Copper Tube, 18" Long
19—½" x ¼" Reducer
20—¼" Square Head Plug (2 req'd)
21—½" Square Head Plug (2 req'd)
22—½" 90° Union Elbow, Fig. 552 (2 req'd)
23—¼" 90° Elbow
24—½" 90° Elbow
25—½" Tee (3 req'd)
26—½" x ¼" x ½" Tee (2 req'd)
27—½" x ½" x ¼" Tee
28—2" x ½" x 2" Tee
29—½" Cross
30—¼" x 1" Nipple
31—¼" x 1½" Nipple (2 req'd)
32—¼" x 3½" Nipple (3 req'd)
33—½" x close Nipple (6 req'd)
34—½" x 1½" Nipple (3 req'd)
35—½" x 2½" Nipple
36—½" x 4" Nipple (2 req'd)
37—½" x 2½" Nipple for 4" Valve, ½" x 1½" Nipple for 6" Valve
38—½" x close Nipple for 4" Valve, ½" x 3½" Nipple for 6" Valve
39—½" x close Nipple for 4" Valve, ½" x 2" Nipple for 6" Valve
40—½" x 6½" Nipple
41—2" x 4" Nipple
42—2" x 5" Nipple

FIGURE B
BASIC TRIMMINGS FOR MODEL F302 & F3021 DRY PIPE VALVE



4"/100 mm Valve	Inches	MM
A—End to End of Valve†	15.00	381.0
B—To Top of Priming Cup	9.50	241.3
C—To Outside of Priming Cup	11.25	285.8
D—To Back of Drip Funnel	11.75	298.5
E—To Outside of Manual Air Supply Controls*	9.75	247.7
F—To Outside of Air Maintenance Device*	19.00	482.6
G—To Outside of Main Drain Connections	11.00	279.4
H—To Outside of Main Drain Connections with Accelerator	18.50	469.9
J—To Outside of Alarm By-Pass Test Connections	11.50	292.1
K—To Outside of Accelerator	23.00	584.2

6"/150 mm Valve	Inches	MM
A—End to End of Valve†	17.00	431.8
B—To Top of Priming Cup	9.50	241.3
C—To Outside of Priming Cup	12.50	317.5
D—To Back of Drip Funnel	11.75	298.5
E—To Outside of Manual Air Supply Controls*	9.75	247.7
F—To Outside of Air Maintenance Device*	19.00	482.6
G—To Outside of Main Drain Connections	12.00	304.8
H—To Outside of Main Drain Connections with Accelerator	19.50	495.3
J—To Outside of Alarm By-Pass Test Connections	12.50	317.5
K—To Outside of Accelerator	24.00	609.6

†Dimensions apply to Models F302 and F3021 Valves.
*Add 3"/76 mm if Low Pressure Alarm Switch is used.

FIGURE C
DIMENSIONS OF VALVE AND TRIMMINGS

Ring (20) by a Spring (27). A water tight seal between the Auxiliary Clapper and the interior of the Body is achieved by an O Ring (19) fitted to the Auxiliary Clapper Rod.

Clapper Latch. The Clapper Latch (14) is mounted in the lower left side of the Body with a Clapper Latch Pin (15), Washers (9) and a Plug (25) screwed into the back of the Body at a point opposite the end of the Pin.

Mechanical linkage between the Clapper/Clapper Arm Assembly and the Auxiliary Clapper Assembly is achieved by engagement of the Clapper Latch with the machined surface at the end of the Clapper Arm (36) and with the Push Rod Screw (16) in the end of the Auxiliary Clapper Rod.

DRY PIPE VALVE ACCELERATOR

MODEL F311

GENERAL DESCRIPTION

The Model F311 Accelerator (Ref. Figure A) is a quick opening device, which can be attached to 4 and 6 inch Model F302 and F3021 Dry Pipe Valves, for the purpose of obtaining a reduction in the time to valve operation following the operation of one or more automatic sprinklers.

The Accelerator automatically adjusts to small as well as slow changes in system pressure but trips when there is a rapid and steady drop in pressure (such as will occur when a sprinkler operates). Upon tripping, the Accelerator transmits system air pressure to the intermediate chamber of the dry pipe valve. This neutralizes the differential pressure holding the valve closed and permits its waterway clapper to open due to the force exerted by the supply pressure.

The F311 has a unique (Patent Pending), positive action, internal anti-flood device which prevents water and water borne debris from entering the more sensitive operating areas of the accelerator. The anti-flood device seals and latches immediately upon accelerator trip, without having to wait for a build-up in pressure in the line to the intermediate chamber of the dry pipe valve. The latching feature keeps the anti-flood device sealed even while the system is being drained down.

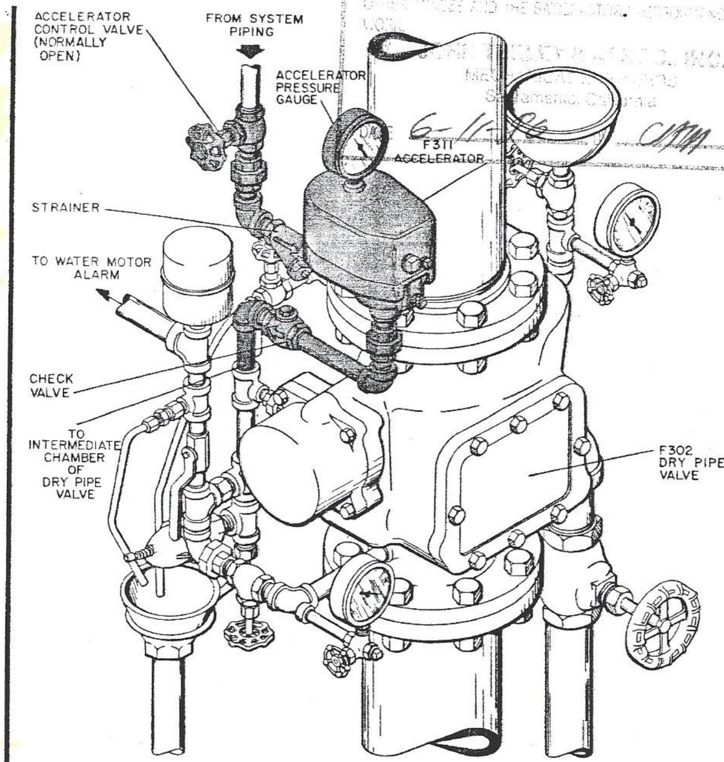


FIGURE A
MODEL F311 ACCELERATOR ATTACHED TO A MODEL F302 DRY PIPE VALVE

APPROVALS AND STANDARDS

The Model F311 Accelerator is listed by Underwriters Laboratories Inc. and by Underwriters' Laboratories of Canada. It is approved by Factory Mutual Research Corporation.

The listings and approval of the F311 only apply to its use with the 4 and 6 inch Model F302 and Model F3021 Dry Pipe Valves.

WARNING

The Model F311 Accelerator described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the integrity of this device.

The owner is responsible for maintaining his fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted relative to any questions.

TECHNICAL DATA

The Model F311 Accelerator is rated for use at a maximum water supply pressure of 175 psi and a maximum system air (or nitrogen) pressure of 60 psi. It is a light weight unit which features a small volume Differential Chamber for quick filling, a sintered metal Restriction that provides dependable high-sensitivity, an internal anti-flood device that seals immediately upon tripping, and self-draining of the connection to the sprinkler system piping.

The F311 is designed to trip when the system air pressure drops at a rate exceeding about 1 psi/minute. A graph of the typical times to Accelerator trip versus system volume is given in Figure B, for initial system air pressures of 20, 40 and 60 psi. The time to trip may be slightly longer than that indicated in Figure B for particularly complex or small diameter piping systems. Tripping of the dry pipe valve

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*Assume quick opening of a ¼" Inspector's Test Connection

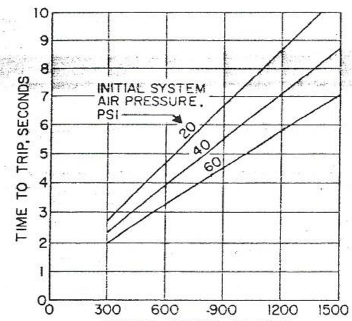


FIGURE B
TYPICAL OPERATING TIMES FOR F311 ACCELERATOR*

takes place immediately after the Accelerator trip.

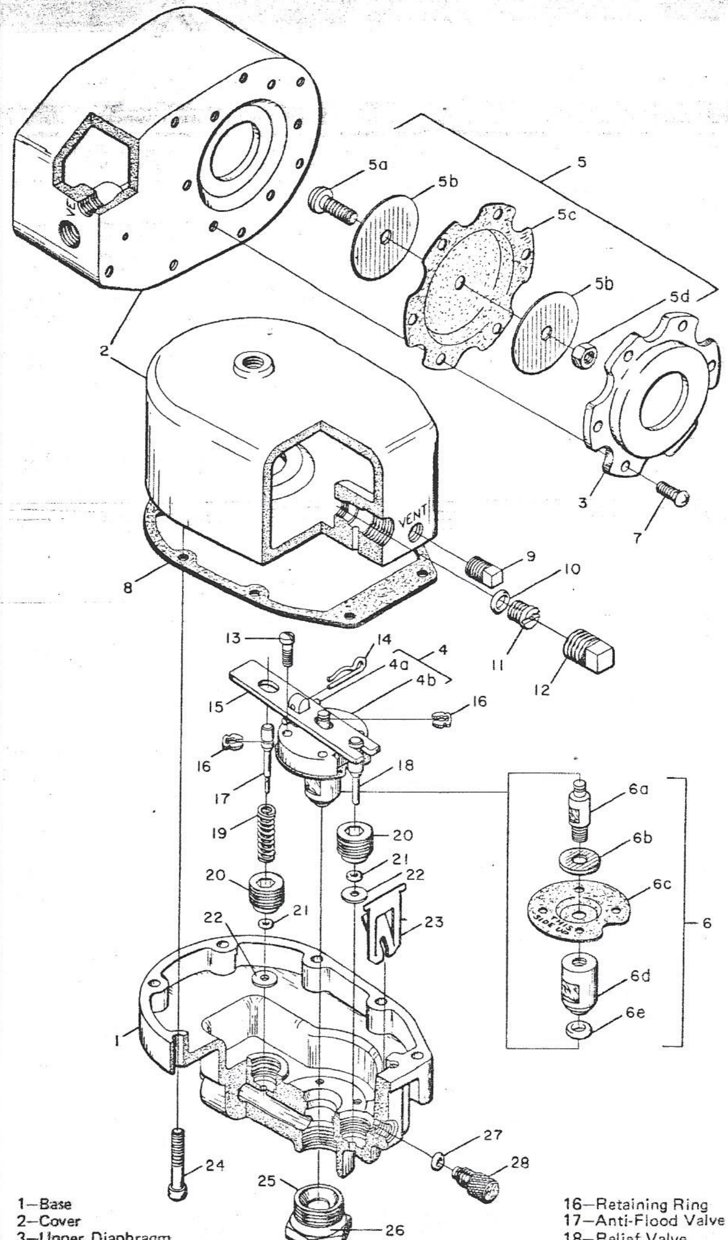
NOTE

Quick operation of the Accelerator does not ensure that the fire protection system will meet the water delivery time requirement of the authority having jurisdiction (following opening of the Inspector's Test Connection). The sprinkler system designer needs to be aware of the fact that the water delivery time is primarily determined by the configuration and volume of the piping network, system air pressure at time of Accelerator trip, and water supply characteristics.

The Accelerator components are illustrated in Figure C. The Base, Cover, Upper Diaphragm Plate, and Pivot Plate are cast from aluminum alloy A356.0-T6 (per ASTM B26 or B108) and they are anodized after machining per ASTM B244. The exterior surfaces of the Base and Cover are also painted red. Except for the cotter pin which is a plated carbon steel and the pipe plugs which are steel, all other metallic components are fabricated from an austenitic series stainless steel. The Restriction is a sintered stainless steel.

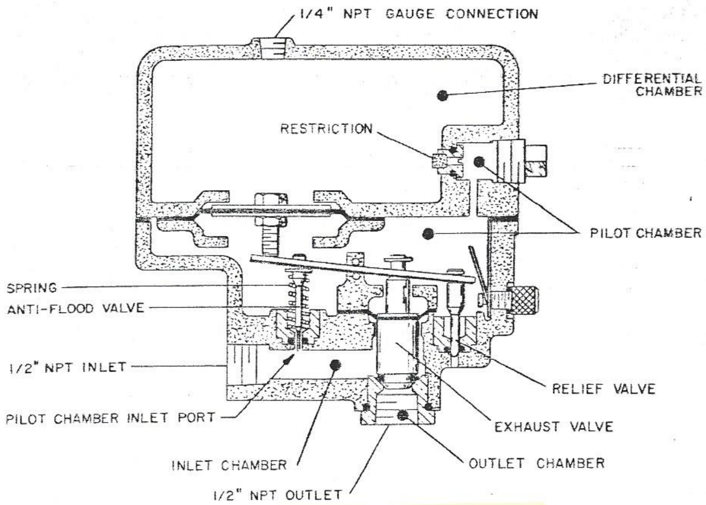
The Upper and Lower Diaphragms are molded from an EPDM grade of rubber while the Cover Gasket is Neoprene. The o-rings are molded from an EPDM rubber except in the case of the Pilot Chamber Inlet and Relief Port o-rings which are silicone.

The serial number and last two digits of the year of manufacture of the Accelerator are metal stamped on the right side of the Base.

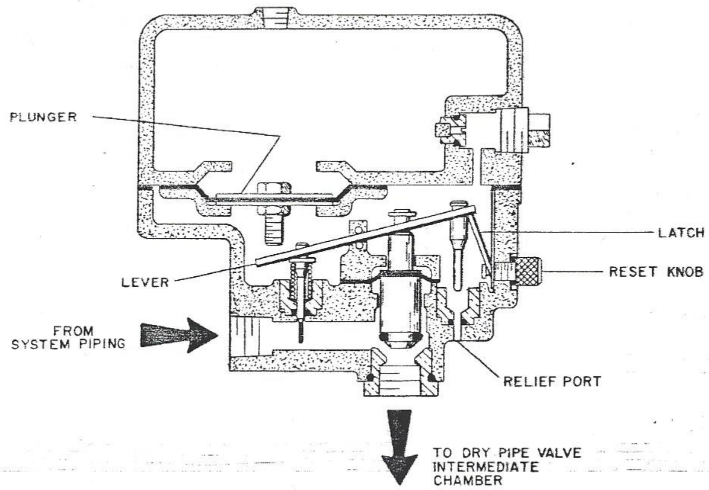


1—Base
2—Cover
3—Upper Diaphragm Plate
4—Pivot Plate Assembly
a-Spirol Pin
b-Pivot Plate
5—Plunger
a-Hex Hd. Mach. Screw
b-Upper Diaphragm Retaining Ring
c-Upper Diaphragm
d-Jam Nut
6—Exhaust Valve
a-Upper Plug
b-Washer
c-Lower Diaphragm
d-Lower Plug
e-O-Ring
7—Phillips Rd. Hd. Machine Screw, ¼"-20 UNC x 5/8" (6 req'd)
8—Cover Gasket
9—¼" NPT Steel Plug
10—O-Ring
11—Restriction
12—½" NPT Steel Plug
13—Fillister Hd. Mach. Screw No. 10—32 UNF x 5/8" (4 req'd)
14—Cotter Pin
15—Lever
16—Retaining Ring
17—Anti-Flood Valve
18—Relief Valve
19—Spring
20—Seat (2 req'd)
21—O-Ring
22—Seal Washer (2 req'd)
23—Latch
24—Fillister Hd. Mach. Screw ¼"—20 UNC x 1½" (8 req'd)
25—Plug Seat
26—O-Ring
27—O-Ring
28—Reset Knob

FIGURE C
MODEL F311 ACCELERATOR ASSEMBLY



ACCELERATOR IN SET POSITION



ACCELERATOR IN TRIP POSITION

FIGURE D
MODEL F311 ACCELERATOR IN SET AND TRIPPED POSITIONS

OPERATION

The Inlet Chamber of the Accelerator (Ref. Figure D-Set Position) is pressurized via its connection to the system (at a point above the maximum expected level of priming plus drain back water). The Pilot Chamber is, in-turn, pressurized through its inlet port which is formed by the annular opening around the lower tip of the Anti-Flood Valve. As the Pilot Chamber increases in pressure, the Differential Chamber is pressurized through the Restriction.

The Accelerator is in its Set position while it is being pressurized as well as after the Inlet, Pilot Chamber and Differential Chamber pressures have equalized. When in the Set position, the Outlet Chamber is sealed off by the Exhaust Valve which is held against its seat by a combination of the Spring pushing up against the Lever and the net downward force exerted by the pressure in the Pilot Chamber.

Small as well as slow changes in system pressure are accommodated by flow thru the Restriction. When, however, there is a rapid and steady drop in system (i.e., Inlet and Pilot Chamber) pressure, the pressure in the Differential Chamber reduces at a substantially lower rate. This condition creates a net downward force on the Plunger which rotates the Lever. As the Lever is rotated, the Relief Valve is raised out of the Relief Port and the Anti-Flood Valve is depressed downward into the Pilot Chamber Inlet Port, venting the Pilot Chamber.

The system pressure in the Inlet Chamber then forces (raises) the Exhaust Valve off its seat. This continues the rotation of the Lever into the Tripped (latched) position as shown in Figure D. As the Exhaust Valve is raised off its seat, system pressure is transmitted to the intermediate chamber of the dry pipe valve which neutralizes the differential pressure holding the valve closed.

Following the dry pipe valve trip, major water borne debris is prevented from entering the Accelerator (via the connection to the system piping) by the Strainer located at its Inlet. Water and any fine water borne debris such as silt is prevented from entering the Pilot Chamber by virtue of the Anti-Flood Valve having sealed off its inlet port. The Check Valve located downstream of the Accelerator Outlet prevents any water borne debris from entering the Accelerator via the connection to the intermediate chamber of the dry pipe valve.

After the Accelerator/dry pipe valve trip and the sprinkler system has been drained down, the piping from the system to the Accelerator must also be drained and the Accelerator reset/inspected according to the instructions given in the Operating Procedure Section. The Accelerator is reset simply by unscrewing the knurled Reset Knob until it resists further turning and then screwing the Reset Knob back in until it is finger tight.

The rate-of-flow through the Restriction has been set such that the F311 Accelerator provides the maximum practical sensitivity to a loss in system pressure due to a sprinkler operation while still being capable of automatically compensating for normal variations in system pressure such as are caused by environmental temperature changes. A test for verifying that the rate-of-flow through the Restriction is within the range for optimum Accelerator performance is given in the Operating Procedure Section.

August, 1977

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701

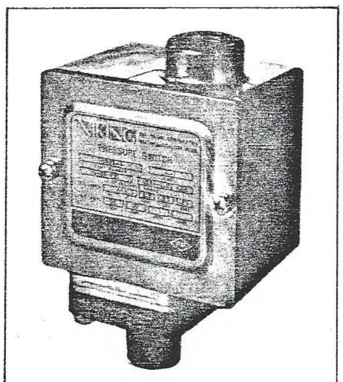
VIKING TECHNICAL DATA

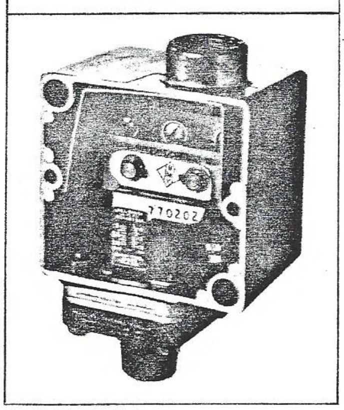
MODEL A-1 PRESSURE SWITCH

DATE 6-11-86 BY

1. PRODUCT NAME
Viking Pressure Switch
Model No. A-1
Part No. 03922 A

2. DISTRIBUTOR
THE VIKING CORPORATION
210 N. Industrial Park Road
Hastings, Michigan USA 49058
Telephone: (616) 945-9501
Telex: 22-6400





3. PRODUCT DESCRIPTION
The Viking Pressure Switch is designed to actuate electric alarms in wet pipe, dry pipe, preaction and deluge systems.

4. TECHNICAL DATA
UL Listed, Guide No. VOXZ
FM Approved
Pressure Rating: 400 PSI (2758 kPa)
Adjustable Range: 5 PSI — 15 PSI (34.0 kPa — 103.0 kPa)
Actuation Value (Differential): 0.2 PSI — 2.0 PSI (1.38 kPa — 13.8 kPa)
Switch: A single pole double throw snap-action switch
Diaphragm: BUNA "N"
Pressure Connection: Polysulfone 40% glass filled pressure fitting, 1/2" NPT male — 1/8 in. NPT female
Housing: Metal, water-tight Nema 4
Electrical Characteristics — Switch is rated at 12 V DC — 6.5 amps, 24 V DC — 1.5 amps, 125 V DC — .33 amps, 250 V DC — .25 amps, 125 V AC — 10.0 amps, 250 V AC — 10.0 amps. Switch can be wired for normally open or normally closed circuit.

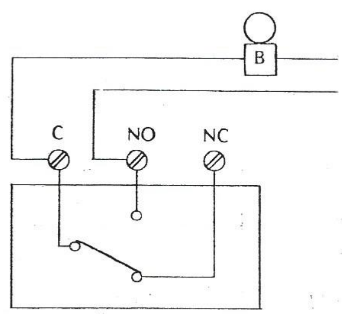
5. AVAILABILITY
The Viking Pressure Switch is available through a network of domestic and international distributors. See the Yellow Pages of the telephone directory for the closest distributor (listed under "Sprinklers-Automatic-Fire") or write: The Viking Corporation, Hastings, Michigan USA, 49058. Attn: Sales Department.

6. GUARANTEES
Viking agrees to repair or replace goods found to be defective in material and workmanship for a period of one year from date of shipment. For details of warranty refer to price list.

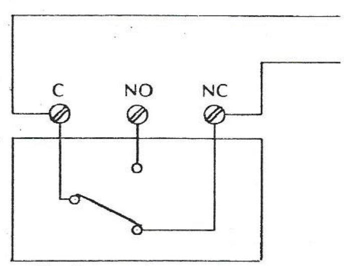
7. MAINTENANCE
Operate the alarm circuit weekly or as required by the authority having jurisdiction.

8. SERVICE
See the Yellow Pages of the telephone directory (listed under "Sprinklers-Automatic-Fire") or write: The Viking Corporation, Hastings, Michigan USA 49058 (Attn: Sales Department). Telephone: (616) 945-9501.

9. INSTALLATION
Install the pressure switch in a 1/2" (15 MM) pipe fitting. Do not use more than 400 inch pounds (45.2 m N) torque. To adjust, turn self-locking adjustment nut clockwise to raise and counter-clockwise to lower the actuation point. Range limit is 15 PSI (103 kPa).



To Electric Bell or other Open Circuit Devices



To Annunciator or other Closed Circuit Devices

WIRING DIAGRAM

The Viking Corporation August, 1977 15 FIRE EXTINGUISHING SYSTEMS automatic sprinklers

Form No. 2076

Litho U.S.A.

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JOHN ...
MECHANICAL ENGINEERS
Sacramento, ...
DATE 6-11-86 BY

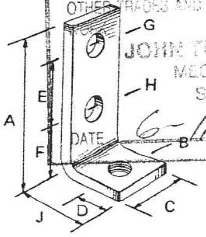

FIG. 56
TAPPED
SIDE BEAM CONNECTOR
Carbon Steel - Black or Plated

TAPPED SIDE BEAM CONNECTOR FIG. 56

U.L. LISTED

Size Range: 1/2" thru 4" pipe size

Service Application: Practical and economical bracket used to support hangers from steel or wood beams. Can be used with concrete shot-type inserts.

Note: 2 different hole sizes for fastener attachments: 1/2" and 3/8". Also hanger rod hole is threaded for 3/8" rod.

Ordering: Specify figure number and finish.

PIPE SIZE	A	ROD SIZE B	C	D	E	F	FASTENER SIZE G	FASTENER SIZE H	MATERIAL SIZE	J	APPROX. WEIGHT PER 100
1/2 thru 4	2-5/8	3/8	1	3/8	1-1/16	1-1/8	3/8	1/2	1/4 x 1	1-1/4	20

*Certified safety factor of 5 per NFPA 13

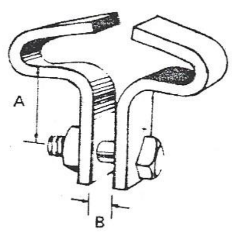

FIG. 62
CENTER I BEAM CLAMP
Carbon Steel - Black or Plated

CENTER I BEAM CLAMP FIG. 62

Specifications: Conforms to Federal Specification WW-H-171E (Type 21) and Manufacturers Standardization Society SP-69 (Type 21).

Service Application: For use when hanging from standard I beam. Centering weight load eliminates distortion. For use with Fig. 102 eye rod or socket.

Ordering: Specify figure number, clamp number, width of beam and thickness of flange.

CLAMP NUMBER	A	B	STEEL SIZE	BOLT SIZE	MAX. REC. LOAD LBS.
1	1	1/2	3/16 x 1-1/4	3/8	500
2	1-1/8	5/8	1/4 x 1-1/4	1/2	700
3	1-1/4	5/8	3/8 x 1-1/2	1/2	800
4	1-3/8	3/4	3/8 x 2	5/8	1000
5	1-5/8	7/8	1/2 x 2	3/4	1500

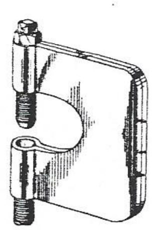

FIG. 64
PRESSED STEEL C-CLAMP
W/LOCKNUT

PRESSED STEEL C-CLAMP W/LOCKNUT FIG. 64

Size Range: 3/8" thru 7/8" rod sizes.

Specifications and Approvals: Underwriters' Laboratories listed and Factory Mutual approved for fire sprinkler service and general water piping.

Service Application: For attachment to I beams, channels and wide flange beams where the thickness does not exceed 3/4". Hardened set screw secures C-Clamp to beam.

Ordering: Specify figure number and rod size.

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FIG. 65
REVERSIBLE "C" TYPE BEAM CLAMP 3/4" THROAT OPENING

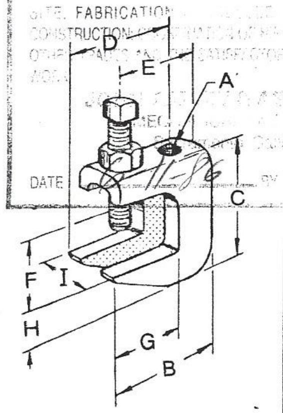

FIG. 65
REVERSIBLE "C" TYPE
BEAM CLAMP

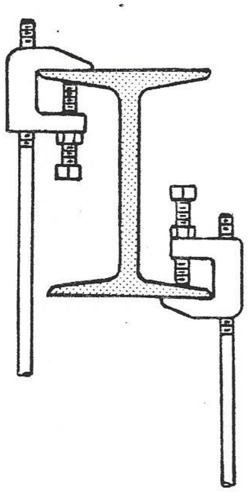

FIG. 65
REVERSIBLE "C" TYPE
BEAM CLAMP

REVISION (JANUARY, 1985)

Size: 3/8" Rod

Material: Carbon Steel with Hardened Cup Point Set Screw and Jam Nut.

Specifications and Approvals:

- Underwriters' Laboratories Listed
- Factory Mutual Approved.
- Conforms to Federal Specification WW-H-171E (Type 19 & 23) and Manufacturers Standardization Society SP-90 (Type 19 & 23).
- Meets or exceeds requirements of the National Fire Protection Association (N.F.P.A.) Pamphlet 13. 3/8" will support up to 4" pipe.*

*(Minimum safety factor of 5)

Service Application & Features:

- Recommended for hanging from steel beam where the flange thickness does not exceed 3/4".
- Unique design allows hanging from either top or bottom flanged beams.
- Offset design permits unlimited rod adjustment by allowing rod to be threaded completely through the clamp.
- Beveled lip allows hanging from top beam where clearance is limited.
- Open design permits inspection of thread engagement.
- Can be used in either set screw up or set screw down position.
- **Application Note:** Additional rod length of 1½" should be added when clamp is used in set screw up position.
- Superior all steel construction eliminates structural deficiencies sometimes associated with malleable casting type beam clamps.

Finish: Plain, Zinc Plated and Hot Dip Galvanized are available.

NOTE: Stainless Steel clamp is available as special order.

ROD SIZE "A"	PIPE SIZE	DIMENSIONS (inches)								LAB TEST LOAD	WT./100
		B	C	D	E	F	G	H	I		
3/8"	½"-4"	1-1/2"	1-5/8"	1-3/16"	1-1/16"	3/4"	1"	7/16"	1"	1500#	28 Lbs.

Patent Pending

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14a

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CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT [illegible] PROJECT AND GENERAL [illegible] CONTRACT DOCUMENTS [illegible] SPECIFICATIONS [illegible] WHICH SHALL BE [illegible] SITE, FABRICATION [illegible] CONSTRUCTION, COORDINATION OF HIS WORK WITH THAT OF ALL OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF HIS WORK.
JOHN [illegible] & ASSOC., INC.
MECHANICAL ENGINEERS
Sacramento, California
DATE 6-11-86 BY [signature]

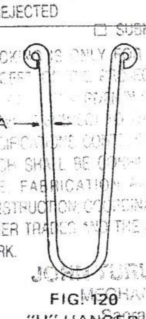


FIG. 120
"U" HANGER
Carbon Steel - Black or Plated

"U" HANGER FIG. 120

Size Range: 3/4" thru 8" pipe.

Service Application: Used to support piping from wood beams where no contraction or expansion is expected. Used extensively in automatic fire sprinkler systems. Conforms to National Fire Protection Association Pamphlet 13.

Ordering: Specify figure number, pipe size, and length.

PIPE SIZE	A	SIZE SCREWS	MAX. REC. LOAD LBS.*
3/4	5/16	16 x 2	250
1	5/16	16 x 2	250
1-1/4	5/16	16 x 2	250
1-1/2	5/16	16 x 2	250
2	5/16	16 x 2	250
2-1/2	3/8	3/8 x 2-1/2	320
3	3/8	3/8 x 2-1/2	320
3-1/2	1/2	1/2 x 2-1/2	560
4	1/2	1/2 x 3	560
5	1/2	1/2 x 3	560
6	5/8	1/2 x 3	760
8	3/4	5/8 x 3	1120

*With minimum safety factor of 5.

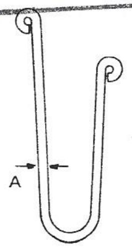


FIG. 120 MJ
MUTT & JEFF "U" HANGER
Carbon Steel - Black or Plated

MUTT AND JEFF "U" HANGER FIG. 120 MJ

Size Range: 3/4" thru 8" pipe.

Service Application: Same as in Fig. 120 above except is used with wood beam where beam is on a diagonal.

Ordering: Specify figure number, pipe size, and side lengths.

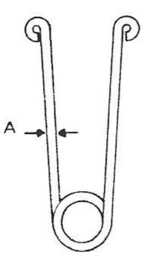


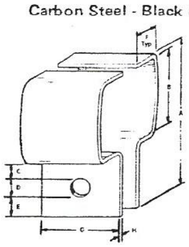
FIG. 120 W
WRAP AROUND "U" HANGER
Carbon Steel - Black or Plated

WRAP AROUND "U" HANGER FIG. 120 W

Size Range: 3/4" thru 2" pipe.

Service Application: Required by many automatic fire protection agencies to be used on the end of branch lines to prevent pipe from whipping up and down and striking ceiling or beam.

Ordering: Specify figure number, pipe size and length.



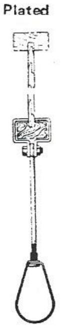


FIG. 130
BEAM CLAMP
Carbon Steel - Black or Plated

BEAM CLAMP FIG. 130

Size Range: Fig. 130-1 = TJI 35
Fig. 130-2 = TJI 45
Fig. 130-3 = TJI 25
Other sizes available, check with Our Engineering Department.

Approvals: Sizes 1, 2, and 3 Underwriters Laboratories and Factory Mutual approved through 4" pipe. All Fig. 130 Beam Clamps meet requirements of NFPA No. 13, through 4" pipe.

Service Application: Effective and economical method of hanging from trus joist "Type" Beams. Use with Fig. 102 (Eye Rod).

Ordering: Specify Fig. Number with dash designation.

SIZE 130-	MATERIAL SIZE	A	B	C	D	E	F	BEAM DIMENSIONS H	BEAM DIMENSIONS W
1	1/8 x 2	3-1/4	1-1/2	3/4	1/2	1/2	7/8	1-1/2	2-5/16
2	1/8 x 2	3-1/2	1-3/4	3/4	1/2	1/2	7/8	1-3/4	2-1/2
3	1/8 x 2	3-1/4	1-1/2	3/4	1/2	1/2	5/8	1-1/2	1-3/4

3/8" x 1-1/2" bolt with 3/8" nut available on separate order.

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ADJUSTABLE RING HANGER FIG. 2

Size Range: 1/2" thru 6"

Approvals: Underwriters' Laboratories listed and Factory Mutual approved. Conforms to Federal Specification WW-H-171E (Type 10) and Manufacturers Standardization Society SP-69 (Type 10).

Service Application: For general piping purposes. Knurled swivel nut design permits hanger adjustment after installation. Spring tension on swivel nut holds it securely in hanger before installation. Swivel nut easily removed.

Special Note: Also available to accomodate the new rod schedule per the National Fire Protection Association Pamphlet 13, 1973. i.e., 1/2" - 4" . . . 3/8" rod; 5", 6" and 8" . . . 1/2" rod. Specify Fig. 2 NFPA and pipe size.

Ordering: Specify pipe size and figure number.

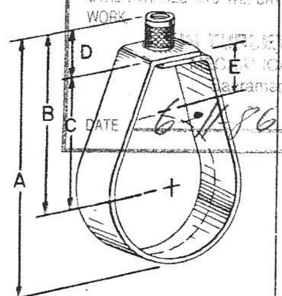

FIG. 2
ADJUSTABLE RING HANGER
Carbon Steel - Plated or Galvanized

PIPE SIZE	ROD SIZE	HOLE SIZE	A	B	C	D	E	MATERIAL SIZE	MAX. LOAD
1/2	3/8	35/64	3-1/4	2-7/8	2	15/16	1-1/2	1 x 16 ga	400
3/4	3/8	35/64	3	2-1/2	1-5/8	15/16	1-1/8	1 x 16 ga	400
1	3/8	35/64	3-1/4	2-5/8	1-7/8	15/16	1-1/4	1 x 16 ga	400
1-1/4	3/8	35/64	3-1/2	2-11/16	1-13/16	15/16	1	1 x 16 ga	400
1-1/2	3/8	35/64	3-7/8	2-7/8	2	15/16	1	1 x 16 ga	400
2	3/8	35/64	4-1/2	3-5/16	2-3/8	15/16	1-3/16	1 x 16 ga	400
2-1/2	1/2*	43/64	5-3/8	3-7/8	2-13/16	1	1-5/16	1-3/16 x 14 ga	600
3	1/2*	43/64	6	4-1/4	3-1/4	1	1-1/2	1-3/16 x 14 ga	600
3-1/2	1/2*	43/64	7	5	4	1	2	1-3/16 x 14 ga	600
4	5/8*	51/64	7-1/4	5	4-1/4	1-1/8	1-3/4	1-1/4 x 14 ga	1000
5	5/8**	51/64	9	6-1/4	5-3/8	1-1/8	2-1/4	1-1/4 x 12 ga	1250
6	3/4**	63/64	9-7/8	6-5/8	5	1-1/4	2-1/8	1-5/8 x 12 ga	1250

* 3/8" nut is used when 1973 NFPA rod sizing is requested.
** 1/2" nut is used when 1973 NFPA rod sizing is requested.

WEIGHTS ON RING HANGERS
NET PER HUNDRED

PIPE SIZE	FIG. 2	FIG. 2 WON	FIG. 2 NFPA
1/2	17	14	17
3/4	17	14	17
1	18	16	18
1-1/4	19	17	19
1-1/2	21	18	21
2	23	20	23
2-1/2	41	37	40
3	45	40	43
3-1/2	52	48	50
4	59	53	56
5	97	91	95
6	139	130	134

RING HANGER LESS NUT FIG. 2 WON

Made the same as Fig. 2 except without swivel nut. Generally hung using nuts and washers, or spring type tension nuts. Conforms to Federal Specification WW-H-171E (Type 7) and Manufacturers Standardization Society SP-69 (Type 7), 3/4" - 6".

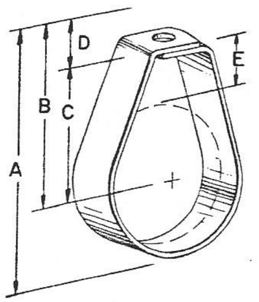

FIG. 2 WON
RING HANGER LESS NUT
Carbon Steel - Plated or Galvanized

PIPE SIZE	HOLE SIZE	A	B	C	D	E	MATERIAL SIZE
1/2	35/64	3-1/4	2-7/8	2	15/16	1-1/2	1 x 16 ga
3/4	35/64	3	2-1/2	1-5/8	15/16	1-1/8	1 x 16 ga
1	35/64	3-1/4	2-5/8	1-7/8	15/16	1-1/4	1 x 16 ga
1-1/4	35/64	3-1/2	2-11/16	1-13/16	15/16	1	1 x 16 ga
1-1/2	35/64	3-7/8	2-7/8	2	15/16	1	1 x 16 ga
2	35/64	4-1/2	3-5/16	2-3/8	15/16	1-3/16	1 x 16 ga
2-1/2	43/64	5-3/8	3-7/8	2-13/16	1	1-5/16	1-3/16 x 14 ga
3	43/64	6	4-1/4	3-1/4	1	1-1/2	1-3/16 x 14 ga
3-1/2	43/64	7	5	4	1	2	1-3/16 x 14 ga
4	51/64	7-1/4	5	4-1/4	1-1/8	1-3/4	1-1/4 x 14 ga
5	51/64	9	6-1/4	5-3/8	1-1/8	2-1/4	1-1/4 x 12 ga
6	63/64	9-7/8	6-5/8	5	1-1/4	2-1/8	1-5/8 x 12 ga

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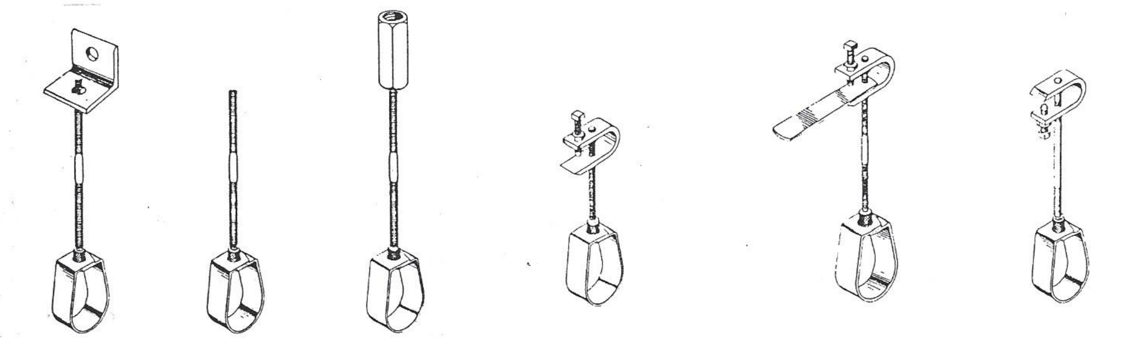
STANDARD PIPE HANGER UNITS



UNIT 1
MTR W/ANGLE CLIP & RING

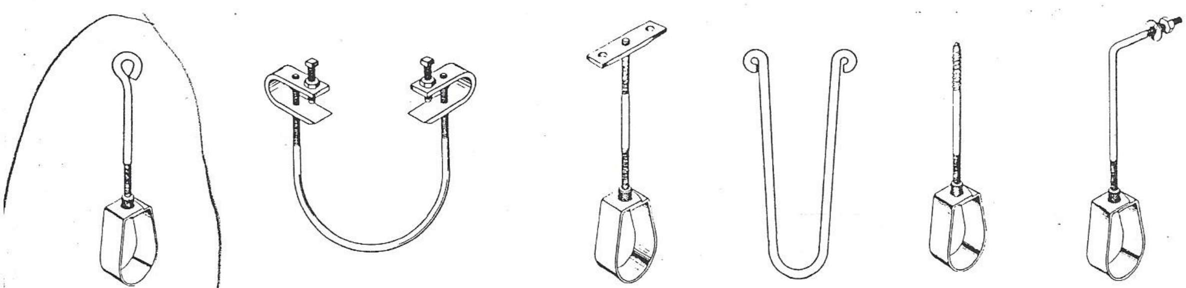
UNIT 2
MTR & RING

UNIT 3
MTR W/ROD COUPLING & RING

UNIT 4
MTR W/LOCKNUT "C" CLAMP & RING

UNIT 6
MTR W/LOCKNUT "C" CLAMP, RETAINING STRAP & RING

UNIT 7
MTR W/TOP BEAM "C" CLAMP & RING



UNIT 8
EYE ROD & RING

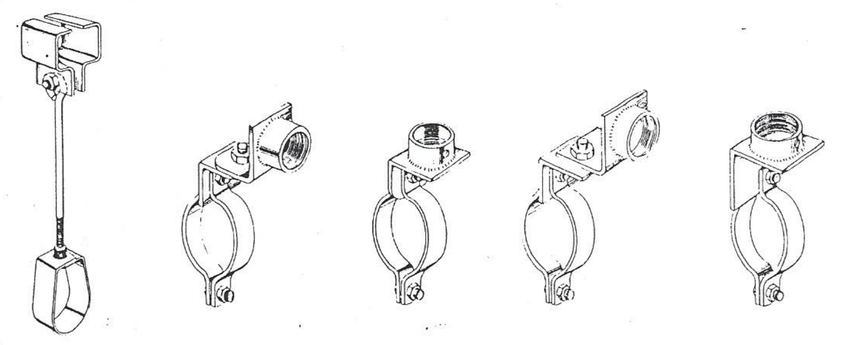
UNIT 9
THREADED "U" W/"C" CLAMPS

UNIT 10
MTR W/CEILING FLANGE & RING

UNIT 12
"U" HANGER

UNIT 13
CSR W/RING

UNIT 14
L-ROD W/RING



UNIT 15
FIG. 130
I-ROD-RING

UNIT 16
1" 900
& FIG. 4A

UNIT 16A
1" 925
& FIG. 4A

UNIT 17
1-1/4" FIG. 900
& FIG. 4A

UNIT 17A
1-1/4" FIG. 900

TOLCO will fabricate any of these assemblies at nominal prices.

NOTE: On all units where Ring Hangers are shown, Clevis Hangers may be specified.

TOLCO INCORPORATED / 601 W. LAMBERT ROAD / BREA, CALIFORNIA 92621

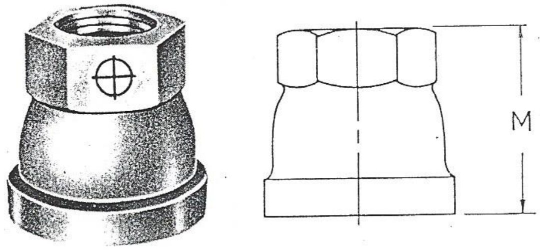
SPRINK-LINE

Ductile Iron

UL LISTED Factory Mutual System

Ductile Iron Screwed Fittings

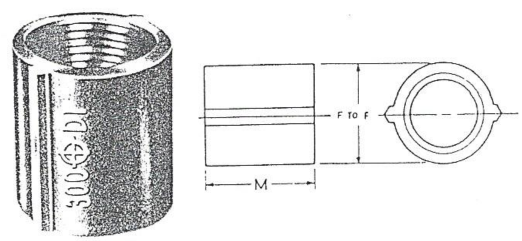
Fig. 816 Ductile Iron Reducing Couplings with hexagonal end



Size, in.	M	Wrench Size	Weight Lbs.	Box Q'ty
1 x ¾	1¾	1½	.53	120
1 x ½	1 11/16	1¼	.38	140

All hex. end reducing couplings are good for box wrench operation.

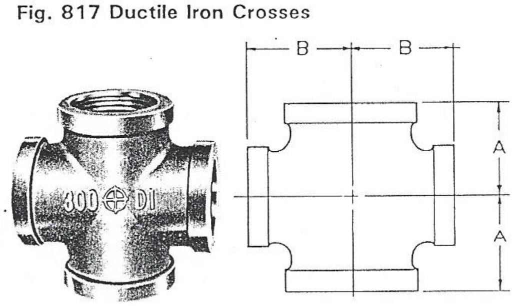
Fig. 818 Ductile Iron straight Couplings



Size, in.	M	Wrench Size	Weight Lbs.	Box Q'ty
½	1⅜	1⅛	.18	360
¾	1⅝	1⅜	.26	200
1	1¾	1 11/16	.44	110
1¼	2	2	.54	75
1½	2 3/16	2¼	.71	60
2	2⅝	2¾	1.15	30
2½	3	3⅜	2.29	18

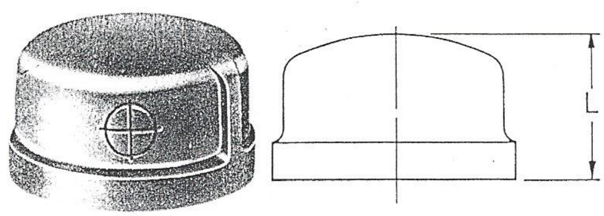
All straight couplings are good for box wrench operation.

Fig. 817 Ductile Iron Crosses



Size, in.	A	B	Weight Lbs.	Box Q'ty
1	1½	1½	.97	45
1¼	1¾	1¾	1.59	25
1½	1 15/16	1 15/16	1.89	20
2	2¼	2¼	2.93	10
Reducing				
1¼x1¼x1x1	1 11/16	1 9/16	1.25	30
1½x1½x1x1	1 13/16	1⅝	1.48	24
2 x 2 x 1 x 1	2	1¾	2.64	10

Fig. 820 Ductile Iron Caps



Size, in.	L		Weight Lbs.	Box Q'ty
½	⅞		.15	160
¾	1		.22	120
1	1 3/16		.33	85
1¼	1 5/16		.54	80
1½	1⅜		.68	70
2	1½		.96	50
2½	1¾		1.80	25

D-3

SPRINK-LINE

Ductile Iron Screwed Fittings

Ductile Iron

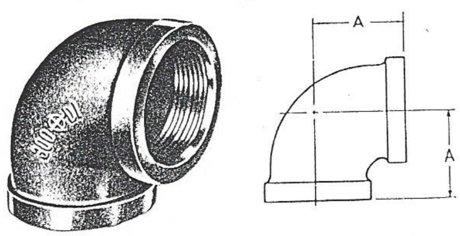
UL LISTED

Factory Mutual System Approved

SPRINK-LINE Ductile Iron screwed Fittings are 100% air-tested in a watersoluble oil solution for porosity, and thread-checked at the beginning and end of each tooling change.

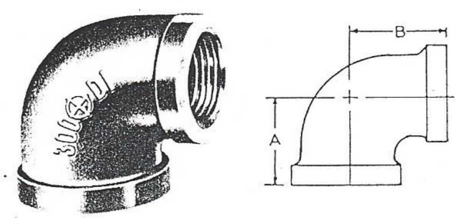
Dimensions conform to ANSI B16.3; Material is to ASTM A536; Threading is to ANSI B2.1 NPT. Underwriters Laboratories LISTED and Factory Mutual APPROVED at 300 pounds working pressure.

Fig. 811 Ductile Iron Elbows-90°



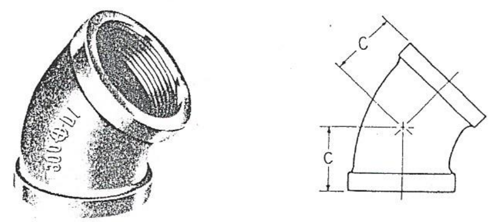
Size	A	Weight Lbs.	Box Q'ty
½	1⅛	.24	240
¾	1 5/16	.40	120
1	1½	.64	70
1¼	1¾	.95	40
1½	1 15/16	1.24	30
2	2¼	1.74	20
2½	2 11/16	3.28	10

Fig. 812 Ductile Iron Elbows-90° Red.



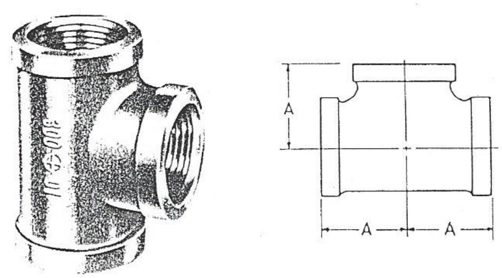
Size	A	B	Weight Lbs.	Box Q'ty
¾ x ½	1 3/16	1 3/16	.33	160
1 x ¾	1⅜	1 7/16	.53	90
1 x ½	1¼	1⅜	.44	110
1¼ x 1	1 9/16	1 11/16	.77	55
1¼ x ¾	1 7/16	1⅝	.75	60
1¼ x ½	1 5/16	1½	.64	75
1½ x 1¼	1 13/16	1⅞	1.14	35
1½ x 1	1 11/16	1 13/16	.99	40
1½ x ¾	1 9/16	1¾	.95	45
2 x 1½	2	2 3/16	1.67	20
2 x 1	1¾	2 1/16	1.58	25
2 x ¾	1⅝	1 15/16	1.39	30
2½ x 2	2 7/16	2⅝	3.01	15

Fig. 813 Ductile Iron Elbows-45°



Size	C	Weight Lbs.	Box Q'ty
½	⅞	.22	250
¾	1	.33	150
1	1⅛	.48	90
1¼	1 5/16	.73	50
1½	1 7/16	.93	35
2	1 11/16	1.55	18
2½	1 15/16	2.70	12

Fig. 814 Ductile Iron Tees



Size	A	Weight Lbs.	Box Q'ty
½	1⅛	.33	150
¾	1 5/16	.50	90
1	1½	.85	60
1¼	1¾	1.30	35
1½	1 13/16	1.63	24
2	2¼	2.63	12
2½	2 11/16	4.55	8

D-1

APPENDIX M

Manual Hydraulic Calculations

Project name: Rood Center - Second Floor Most Remote Sprinkler Calculation — Date: 3/11/2015

Step No.	Nozzle Ident and Location		Flow (gpm)		Pipe size (inch)	Pipe Fittings and Devices	Equivalent Pipe Length (ft)		Friction loss (psi/ft)		Pressure Summary (psi)		Notes D = 0.1 gpm/ft^2 K=5.6
1	From-112		q	12.1	1		L	9.33	C=	120	Pt	4.7	Q1 = 121.3*(0.1) = 12.1
		BL-1			(SCH 40)	1x(E-2)	F	2			Pe	1.3	Pt = (12.1/5.6)^2 = 4.7
	To-114		Q	12.1	1.049		T	11.33	pf	0.051	Pf	0.6	Pe = 3' * 0.433 = 1.3
2	From-110		q	14.4	1		L	9.33	C=	120	Pt	6.6	q = 5.6 * (6.6)^1/2
		BL-1			(SCH 40)	1x(T-5)	F	5			Pe	1.3	q= 14.4
	To-112		Q	26.5	1.049		T	14.33	pf	0.219	Pf	3.1	Pe = 3' * 0.433 = 1.3
3	From-108		q	18.6	1.25		L	9.33	C=	120	Pt	11.0	q = 5.6 * (11.0)^1/2
		BL-1			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 18.6
	To-110		Q	45.1	1.38		T	15.33	pf	0.154	Pf	2.4	Pe = 3' * 0.433 = 1.3
4	From-106		q	21.4	1.25		L	10	C=	120	Pt	14.7	q = 5.6 * (14.7)^1/2
		BL-1			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 21.4
	To-108		Q	66.5	1.38		T	16	pf	0.316	Pf	5.1	Pe = 3' * 0.433 = 1.3
5	From-103		q	25.7	1.25		L	10	C=	120	Pt	21.0	q = 5.6 * (21.0)^1/2
		BL-1			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 25.7
	To-106		Q	92.2	1.38		T	16	pf	0.578	Pf	9.2	Pe = 3' * 0.433 = 1.3
6	From-33		q	31.5	1.5		L	24.5	C=	120	Pt	31.6	q = 5.6 * (31.6)^1/2
		BL-1			(SCH 40)	2x(T-8)	F	16			Pe	1.3	q= 31.5
	To-103		Q	123.6	1.61		T	40.5	pf	0.470	Pf	19.0	Pe = 3' * 0.433 = 1.3
7	From-23		q		1.5		L	1	C=	120	Pt	51.9	
		RN-1			(SCH 40)	1x(T-8)	F	8			Pe	0.4	Pe = 1' * 0.433 = 0.4
	To-33	(BL-1 to CM-1)	Q	123.6	1.61		T	9	pf	0.470	Pf	4.2	
											Pt	**56.6**	K1 at CM-1 = Q/(Pt^0.5)
													16.44

8	From-111		q	12.1	1		L	9.33	C=	120	Pt	4.7	Q1 = 121.3*(0.1) = 12.1
		BL-2			(SCH 40)	1x(E-2)	F	2			Pe	1.3	(12.1/5.6)^2 = 4.7
	To-113		Q	12.1	1.049		T	11.33	pf	0.051	Pf	0.6	Pe = 3' * 0.433 = 1.3
9	From-109		q	14.4	1		L	9.33	C=	120	Pt	6.6	q = 5.6 * (6.6)^1/2
		BL-2			(SCH 40)	1x(T-5)	F	5			Pe	1.3	q= 14.4
	To-111		Q	26.5	1.049		T	14.33	pf	0.219	Pf	3.1	Pe = 3' * 0.433 = 1.3
10	From-107		q	18.6	1.25		L	9.33	C=	120	Pt	11.0	q = 5.6 * (11.0)^1/2
		BL-2			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 18.6
	To-109		Q	45.1	1.38		T	15.33	pf	0.154	Pf	2.4	Pe = 3' * 0.433 = 1.3
11	From-105		q	21.4	1.25		L	10	C=	120	Pt	14.7	q = 5.6 * (14.7)^1/2
		BL-2			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 21.4
	To-107		Q	66.5	1.38		T	16	pf	0.316	Pf	5.1	Pe = 3' * 0.433 = 1.3
12	From-102		q	25.7	1.25		L	10	C=	120	Pt	21.0	q = 5.6 * (21.0)^1/2
		BL-2			(SCH 40)	1x(T-6)	F	6			Pe	1.3	q= 25.7
	To-105		Q	92.2	1.38		T	16	pf	0.578	Pf	9.2	Pe = 3' * 0.433 = 1.3
13	From-32		q	31.5	1.5		L	24.5	C=	120	Pt	31.6	q = 5.6 * (31.6)^1/2
		BL-2			(SCH 40)	2x(T-8)	F	16			Pe	1.3	q= 31.5
	To-102		Q	123.6	1.61		T	40.5	pf	0.470	Pf	19.0	Pe = 3' * 0.433 = 1.3
14	From-22		q		1.5		L	1	C=	120	Pt	51.9	
		RN-2			(SCH 40)	1x(T-8)	F	8			Pe	0.4	Pe = 1' * 0.433 = 0.4
	To-32	(BL-2 to CM-2)	Q	123.6	1.61		T	9	pf	0.470	Pf	4.2	
											Pt	**56.6**	K2 at CM-2 = Q/(Pt^0.5)
													16.44

15	From-101		q	12.0	1.25		L	10	C=	120	Pt	4.6	Q1 = 120.0*(0.1) = 12.0
		BL-3			(SCH 40)	1x(T-6)	F	6			Pe	1.3	Pt = (12.0/5.6)^2 = 4.6
	To-104		Q	12.0	1.38		T	16	pf	0.013	Pf	0.2	Pe = 3' * 0.433 = 1.3
16	From-31		q	13.8	1.5		L	24.5	C=	120	Pt	6.1	
		BL-3			(SCH 40)	2x(T-8)	F	16			Pe	1.3	q2 = 5.6 * (6.1)^1/2 = 13.8
	To-101		Q	25.8	1.61		T	40.5	pf	0.026	Pf	1.1	Pe = 3' * 0.433 = 1.3
17	From-21		q		1.5		L	1	C=	120	Pt	8.5	
		RN-3			(SCH 40)	1x(T-8)	F	8			Pe	0.4	Pe = 1 * 0.433 = 0.4
	To-31	(BL-3 to CM-3)	Q	25.8	1.61		T	9	pf	0.026	Pf	0.2	
											Pt	**9.1**	K3 at CM-3 = Q/(Pt^0.5)
													8.55

18	From-22	CM-2 to CM-1	q		2.5	none	L	13	C=	120	Pt	56.6	K1 at CM-1 = 16.44
					(SCH 10)		F	0			Pe	0.0	
	To-23		Q	123.6	2.635		T	13	pf	0.043	Pf	0.6	
19	From-21	CM-3 to CM-2	q	124.2	2.5	none	L	12	C=	120	Pt	57.1	K2 at CM-2 = 16.44
					(SCH 10)		F	0			Pe	0.0	q =16.44 * (57.1)^1/2
	To-22		Q	247.9	2.635		T	12	pf	0.154	Pf	1.9	q= 124.2
20	From-11	FM-1 to CM-3	q	65.7	2.5	1x(T-15)	L	47	C=	120	Pt	59.0	K3 at CM-3 = 8.55
					(SCH 10)	4x(E-5.5)*	F	37			Pe	0.0	q =8.55 * (59.0)^1/2
	To-21		Q	313.5	2.635		T	84	pf	0.239	Pf	20.0	q= 65.7
21	From-10	FM-2 to FM-1	q		3	none	L	127	C=	120	Pt	79.0	
					(SCH 10)		F	0			Pe	2.4	Pe = 5.43 ft * 0.433 = 2.4 psi
	To-11		Q	313.5	3.26		T	127	pf	0.085	Pf	10.7	
22	From-9	FM-3 to FM-2	q		3	none	L	96	C=	120	Pt	92.1	
					(SCH 10)		F	0			Pe	0.0	
	To-10		Q	313.5	3.26		T	96	pf	0.085	Pf	8.1	
23	From-8	TOR to FM-3	q		3	1x(T-20)	L	69	C=	120	Pt	100.2	
					(SCH 10)		F	20			Pe	1.8	Pe = 4.09 ft * 0.433 = 1.8 psi
	To-9		Q	313.5	3.26		T	89	pf	0.085	Pf	7.5	
24	From-7	Down Riser to 1st Floor Junction	q		3	none	L	15.75	C=	120	Pt	109.6	
					(SCH 10)		F	0			Pe	6.8	Pe = 15.75 ft * 0.433 = 6.8 psi
	To-8		Q	313.5	3.26		T	15.75	pf	0.085	Pf	1.3	
25	From-6	1st Floor Junction down to BOR	q		3	1x(BV-13.4)	L	9.5	C=	120	Pt	117.7	
					(SCH 10)		F	13.4			Pe	4.1	Pe = 9.5 ft * 0.433 = 4.1 psi
	To-7		Q	313.5	3.26		T	22.9	pf	0.085	Pf	1.9	
											Pt	123.8	
26	From-5	BOR to Slab	q		4	2x(T-31.1)*	L	4	C=	140	Pt	123.8	
					D.I. Pipe		F	62.2			Pe	0.8	Pe = 2 ft * 0.433 = 0.8 psi
	To-6		Q	313.5	4.16		T	66.2	pf	0.019	Pf	1.3	
27	From-1	Slab (UG) into Pump Room	q		4	3x(GV-2')*	L	142	C=	140	Pt	125.8	
					D.I. Pipe	2x(CV-22')	F	161.8			Pe	0.0	
	To-5		Q	313.5	4.16	9x(LtE-6')	T	303.8	pf	0.019	Pf	5.9	
28	From-0	Pump Room into Fire Pump	q		10	2x(TV-50')*	L	7.5	C=	140	Pt	131.7	
					D.I. Pipe	1x(CV-55')	F	163.4			Pe	0.0	
	To-1		Q	313.5	10.34		T	170.9	pf	0.0002	Pf	0.0	
												131.8	

Sprinkler System Demand

	Pressure	Flow
At BOR	123.8 psi	313.5 gpm
At Fire Pump	131.8 psi	313.5 gpm

APPENDIX N

Original Hydraulic Calculations

FIREOUT SUBMITTAL CREATED 04-07-1986 23:10:16 PAGE 1
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

PROJECT: NEVADA COUNTY ADMINISTRATION
ORCHARD ST. NEAR HWY. 49
NEVADA COUNTY, CALIFORNIA
*
*
CONTRACTOR: CALWEST FIRE PROTECTION ENGINEERING
4680 PELL DRIVE, SUITE "B"
SACRAMENTO, CALIFORNIA 95838
(916) 921-1995
*
*
DESIGN: .10/1,500 - LIGHT HAZARD - 1/2" SPKRS. - K=5.55
*
*

FLOW TEST RESULTS

STATIC		122.00 PSI
RESIDUAL AT 1500.0 GPM		74.00 PSI
PRESSURE AVAILABLE AT	289.8 GPM	119.71 PSI

☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF HIS WORK WITH THAT OF ALL OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF HIS WORK.

JOHN TURLEY & ASSOC., INC.
MECHANICAL ENGINEERS
Sacramento, California

DATE 6-11-86 BY [illegible]

SUMMARY OF SPRINKLER OUTFLOWS

SPR	PRESSURE	ACTUAL FLOW	MINIMUM FLOW	K-FACTOR
201	18.56	23.91	16.80	5.55
202	18.83	24.08	16.80	5.55
203	10.06	17.61	16.80	5.55
204	9.48	17.09	16.80	5.55
205	9.78	17.35	16.80	5.55
206	12.36	19.51	16.80	5.55
207	9.70	17.28	16.80	5.55
208	9.16	16.80	16.80	5.55
209	9.40	17.01	16.80	5.55
210	11.86	19.12	16.80	5.55

TOTAL WATER REQUIRED FOR SYSTEM	189.77	GPM
OUTFLOWS AT 1	0.00	GPM
OUTSIDE HOSE STREAMS AT 0	100.00	GPM
TOTAL WATER REQUIREMENT	289.77	GPM
PRESSURE REQUIRED AT 0	95.97	PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS	0.089	PSI
MAXIMUM VELOCITY IN PIPES	18.63	FPS

J. R. Roberts Corp. Submittal # 72

Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:18         PAGE 2
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO         FLOW    DIAM        EQUIV    P-LOSS     PRESSURE
                GPM     IN          PIPE     PSI/FT     SUMMARY
                                    LEN/FT              PSI

 -----------------
209 208            1.0490        L    14.00 0.0176 PT   9.16 (208)
        Q    6.78           F=0  F     0.00        PE   0.00
                BL3    C120  T    14.00        PF   0.25

210 209DQ    17.01 1.0490        L    14.00 0.1794 PT   9.41 (209)
        Q    23.79          F=0  F     0.00        PE   0.00
                BL3    C120  T    14.00        PF   2.51

162 210DQ    19.12 1.0490        L     7.00 0.5342 PT  11.92 (210)
        Q    42.91        F=0/T  F     5.00        PE   0.00
                BL3    C120  T    12.00        PF   6.41

142 162            1.3799        L     0.50 0.1405 PT  18.33 (162)
        Q    42.91          F=T  F     6.00        PE   0.22
                RN4    C120  T     6.50        PF   0.91

141 142            1.6100        L    12.00 0.0663 PT  19.46 (142)
        Q    42.91          F=0  F     0.00        PE   0.00
                CM4    C120  T    12.00        PF   0.80
                                                   PT  20.26 (141)
 -----------------
207 208            1.0490        L    14.00 0.0363 PT   9.16 (208)
        Q    10.02          F=0  F     0.00        PE   0.00
                BL3    C120  T    14.00        PF   0.51

122 207DQ    17.28 1.0490        L    51.00 0.2306 PT   9.67 (207)
        Q    27.30          F=T  F     5.00        PE   0.00
                BL3    C120  T    56.00        PF  12.91

102 122            1.3799        L     0.50 0.0609 PT  22.58 (122)
        Q    27.30          F=T  F     6.00        PE   0.22
                RN3    C120  T     6.50        PF   0.40

101 102            1.3799        L    12.00 0.0609 PT  23.20 (102)
        Q    27.30          F=0  F     0.00        PE   0.00
                CM3    C120  T    12.00        PF   0.73
                                                   PT  23.93 (101)
 -----------------
205 204            1.0490        L    14.00 0.0186 PT   9.48 (204)
        Q     6.99          F=0  F     0.00        PE   0.00
                BL3    C120  T    14.00        PF   0.26

206 205DQ    17.35 1.0490        L    14.00 0.1872 PT   9.74 (205)
        Q    24.34          F=0  F     0.00        PE   0.00
                BL3    C120  T    14.00        PF   2.62

161 206DQ    19.51 1.0490        L     7.00 0.5561 PT  12.36 (206)
        Q    43.85        F=0/T  F     5.00        PE   0.00
                BL3    C120  T    12.00        PF   6.67
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL                CREATED  04-07-1986  23:10:25        PAGE 3
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO         FLOW    DIAM         EQUIV    P-LOSS    PRESSURE
                GPM     IN           PIPE     PSI/FT    SUMMARY
                                     LEN/FT             PSI

141 161             1.3799       L      0.50 0.1463 PT 19.03 (161)
        Q    43.85          F=T F      6.00         PE  0.22
                    RN4    C120 T      6.50         PF  0.95

140 141DQ    42.91 1.6100       L     12.00 0.2440 PT 20.20 (141)
        Q    86.76          F=0 F      0.00         PE  0.00
                    CM4    C120 T     12.00         PF  2.93
                                                    PT 23.13 (140)
 -----------------
203 204             1.0490       L     14.00 0.0368 PT  9.48 (204)
        Q    10.10          F=0 F      0.00         PE  0.00
                    BL3    C120 T     14.00         PF  0.52

121 203DQ    17.61 1.0490       L     51.00 0.2370 PT 10.00 (203)
        Q    27.71          F=T F      5.00         PE  0.00
                    BL3    C120 T     56.00         PF 13.27

101 121             1.3799       L      0.50 0.0626 PT 23.27 (121)
        Q    27.71          F=T F      6.00         PE  0.22
                    RN3    C120 T      6.50         PF  0.41

100 101DQ    27.30 1.3799       L     12.00 0.2225 PT 23.90 (101)
        Q    55.01          F=0 F      0.00         PE  0.00
                    CM3    C120 T     12.00         PF  2.67
                                                    PT 26.57 (100)
 -----------------
202 201             1.0490       L     14.00 0.0205 PT 18.56 (201)
        Q     7.36          F=0 F      0.00         PE  0.00
                    BL3    C120 T     14.00         PF  0.29

160 202DQ    24.08 1.0490       L      7.00 0.3005 PT 18.85 (202)
        Q    31.44        F=0/T F      5.00         PE  0.00
                    BL3    C120 T     12.00         PF  3.61

140 160             1.3799       L      0.50 0.0790 PT 22.46 (160)
        Q    31.44          F=T F      6.00         PE  0.22
                    RN4    C120 T      6.50         PF  0.51

139 140DQ    86.76 1.6100       L     12.00 0.4323 PT 23.19 (140)
        Q   118.20          F=0 F      0.00         PE  0.00
                    CM4    C120 T     12.00         PF  5.19
                                                    PT 28.38 (139)
 -----------------
200 201             1.0490       L     14.00 0.0917 PT 18.56 (201)
        Q    16.55          F=0 F      0.00         PE  0.00
                    BL3    C120 T     14.00         PF  1.28

199 200             1.0490       L     14.00 0.0917 PT 19.84 (200)
        Q    16.55          F=0 F      0.00         PE  0.00
                    BL3    C120 T     14.00         PF  1.28
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:27         PAGE 4
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO         FLOW    DIAM        EQUIV     P-LOSS     PRESSURE
                GPM     IN          PIPE      PSI/FT     SUMMARY
                                    LEN/FT               PSI

120 199              1.0490       L     51.00 0.0913 PT 21.12 (199)
         Q    16.55          F=T F      5.00         PE  0.00
                      BL3   C120 T     56.00         PF  5.11

100 120              1.3799       L      0.50 0.0241 PT 26.23 (120)
         Q    16.55          F=T F      6.00         PE  0.22
                      RN3   C120 T      6.50         PF  0.16

 99 100DQ     55.01 1.3799        L     12.00 0.3620 PT 26.61 (100)
         Q    71.57          F=0 F      0.00         PE  0.00
                      CM3   C120 T     12.00         PF  4.34
                                                     PT 30.95 ( 99)
-----------------
159 139              1.3799       L      0.50 0.0060 PT 28.30 (139)
         Q     7.79          F=T F      6.00         PE -0.22
                      RN4   C120 T      6.50         PF  0.04

119 159              1.0490       L    100.00 0.0228 PT 28.12 (159)
         Q     7.79        F=T/T F     10.00         PE  0.00
                      BL3   C120 T    110.00         PF  2.51

 99 119              1.3799       L      0.50 0.0060 PT 30.63 (119)
         Q     7.79          F=T F      6.00         PE  0.22
                      RN3   C120 T      6.50         PF  0.04

 98  99DQ     71.57 1.3799        L     12.00 0.4382 PT 30.89 ( 99)
         Q    79.36          F=0 F      0.00         PE  0.00
                      CM3   C120 T     12.00         PF  5.26

 97  98DQ    -39.16 1.3799        L     12.00 0.1245 PT 36.15 ( 98)
         Q    40.20          F=0 F      0.00         PE  0.00
                      CM3   C120 T     12.00         PF  1.49

117  97              1.3799       L      0.50 0.1245 PT 37.64 ( 97)
         Q    40.20          F=T F      6.00         PE -0.22
                      RN3   C120 T      6.50         PF  0.81

 77 117DQ      6.36 1.3799        L    109.00 0.1634 PT 38.23 (117)
         Q    46.55        F=T/T F     12.00         PE  0.00
                      BL2   C120 T    121.00         PF 19.77

 57  77DQ    -20.39 1.3799        L      0.50 0.0563 PT 58.00 ( 77)
         Q    26.17          F=T F      6.00         PE  0.22
                      RN2   C120 T      6.50         PF  0.37

 58  57              1.3799       L     12.00 0.0563 PT 58.59 ( 57)
         Q    26.17          F=0 F      0.00         PE  0.00
                      CM2   C120 T     12.00         PF  0.68

 59  58DQ     29.82 1.3799        L     12.00 0.2298 PT 59.27 ( 58)
         Q    55.99          F=0 F      0.00         PE  0.00
                      CM2   C120 T     12.00         PF  2.76
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:29        PAGE 5
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO         FLOW     DIAM        EQUIV    P-LOSS     PRESSURE
                GPM      IN          PIPE     PSI/FT     SUMMARY
                                     LEN/FT              PSI

 60   59DQ   -15.86 1.3799        L    12.00 0.1241 PT 62.03 ( 59)
         Q    40.13          F=0 F     0.00         PE  0.00
                    CM2     C120 T    12.00         PF  1.49

 61   60DQ   -14.06 1.3799        L    12.00 0.0559 PT 63.52 ( 60)
         Q    26.07          F=0 F     0.00         PE  0.00
                    CM2     C120 T    12.00         PF  0.67

 62   61DQ   -13.16 1.3799        L    12.00 0.0152 PT 64.19 ( 61)
         Q    12.92          F=0 F     0.00         PE  0.00
                    CM2     C120 T    12.00         PF  0.18

 82   62            1.3799        L     0.50 0.0152 PT 64.37 ( 62)
         Q    12.92          F=T F     6.00         PE -0.22
                    RN2     C120 T     6.50         PF  0.10

 42   82            1.0490        L    84.00 0.0579 PT 64.25 ( 82)
         Q    12.92        F=T/T F    10.00         PE  0.00
                    BL1     C120 T    94.00         PF  5.44

 22   42            1.3799        L     0.50 0.0152 PT 69.69 ( 42)
         Q    12.92          F=T F     6.00         PE  0.22
                    RN1     C120 T     6.50         PF  0.10

 21   22            2.1570        L    12.00 0.0017 PT 70.01 ( 22)
         Q    12.92          F=0 F     0.00         PE  0.00
                    CM1     C120 T    12.00         PF  0.02

 20   21DQ    13.16 2.1570        L    12.00 0.0063 PT 70.03 ( 21)
         Q    26.07          F=0 F     0.00         PE  0.00
                    CM1     C120 T    12.00         PF  0.08

 19   20DQ    14.06 2.1570        L    12.00 0.0141 PT 70.11 ( 20)
         Q    40.13          F=0 F     0.00         PE  0.00
                    CM1     C120 T    12.00         PF  0.17

 18   19DQ    15.86 2.1570        L    12.00 0.0261 PT 70.28 ( 19)
         Q    55.99          F=0 F     0.00         PE  0.00
                    CM1     C120 T    12.00         PF  0.31

 17   18DQ    19.38 2.1570        L    12.00 0.0453 PT 70.59 ( 18)
         Q    75.37          F=0 F     0.00         PE  0.00
                    CM1     C120 T    12.00         PF  0.54

  9   17DQ    20.39 2.1570        L     9.00 0.0705 PT 71.13 ( 17)
         Q    95.76        F=0/T F    12.00         PE  0.00
                    CM1     C120 T    21.00         PF  1.48
                                                    PT 72.61 (  9)
-----------------
138 139             1.6100        L    12.00 0.3811 PT 28.30 (139)
         Q   110.41          F=0 F     0.00         PE  0.00
                    CM4     C120 T    12.00         PF  4.57
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:31      PAGE 6
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO        FLOW     DIAM       EQUIV    P-LOSS    PRESSURE
               GPM      IN         PIPE     PSI/FT    SUMMARY
                                   LEN/FT             PSI

158 138DQ -100.37 1.3799       L     0.50 0.0096 PT 32.87 (138)
       Q   10.04          F=T F      6.00        PE -0.22
                  RN4    C120 T      6.50        PF  0.06

118 158           1.0490       L   100.00 0.0364 PT 32.71 (158)
       Q   10.04        F=T/T F     10.00        PE  0.00
                  BL3    C120 T    110.00        PF  4.00
                                                 PT 36.71 (118)
-----------------
137 138           1.6100       L    12.00 0.3194 PT 32.87 (138)
       Q  100.37          F=0 F      0.00        PE  0.00
                  CM4    C120 T     12.00        PF  3.83

157 137DQ  -94.01 1.3799       L     0.50 0.0041 PT 36.70 (137)
       Q    6.36          F=T F      6.00        PE -0.22
                  RN4    C120 T      6.50        PF  0.03

117 157           1.0490       L   100.00 0.0156 PT 36.51 (157)
       Q    6.36        F=T/T F     10.00        PE  0.00
                  BL3    C120 T    110.00        PF  1.72
                                                 PT 38.23 (117)
-----------------
136 137           1.6100       L    12.00 0.2830 PT 36.70 (137)
       Q   94.01          F=0 F      0.00        PE  0.00
                  CM4    C120 T     12.00        PF  3.40

156 136DQ  -76.99 1.3799       L     0.50 0.0254 PT 40.10 (136)
       Q   17.02          F=T F      6.00        PE -0.22
                  RN4    C120 T      6.50        PF  0.17

116 156           1.0490       L   100.00 0.0965 PT 40.05 (156)
       Q   17.02        F=T/T F     10.00        PE  0.00
                  BL3    C120 T    110.00        PF 10.61

 76 116           1.0490       L   109.00 0.0965 PT 50.66 (116)
       Q   17.02        F=T/T F     10.00        PE  0.00
                  BL2    C120 T    119.00        PF 11.48

 36  76           1.0490       L    84.00 0.0965 PT 62.14 ( 76)
       Q   17.02        F=T/T F     10.00        PE  0.00
                  BL1    C120 T     94.00        PF  9.07

 16  36           1.3799       L     0.50 0.0254 PT 71.21 ( 36)
       Q   17.02          F=T F      6.00        PE  0.22
                  RN1    C120 T      6.50        PF  0.17
                                                 PT 71.60 ( 16)
-----------------
135 136           1.6100       L    12.00 0.1956 PT 40.10 (136)
       Q   76.99          F=0 F      0.00        PE  0.00
                  CM4    C120 T     12.00        PF  2.35
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:33      PAGE 7
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO         FLOW    DIAM         EQUIV    P-LOSS     PRESSURE
                GPM     IN           PIPE     PSI/FT     SUMMARY
                                     LEN/FT              PSI

155 135DQ   -60.85 1.3799        L     0.50 0.0230 PT 42.45 (135)
        Q    16.15          F=T F      6.00        PE -0.22
                     RN4   C120 T      6.50        PF  0.15

115 155             1.0490        L   100.00 0.0876 PT 42.38 (155)
        Q    16.15        F=T/T F    10.00        PE  0.00
                     BL3   C120 T   110.00        PF  9.64

 75 115             1.0490        L   109.00 0.0876 PT 52.02 (115)
        Q    16.15        F=T/T F    10.00        PE  0.00
                     BL2   C120 T   119.00        PF 10.42

 35  75             1.0490        L    84.00 0.0876 PT 62.44 ( 75)
        Q    16.15        F=T/T F    10.00        PE  0.00
                     BL1   C120 T    94.00        PF  8.23

 15  35             1.3799        L     0.50 0.0230 PT 70.67 ( 35)
        Q    16.15          F=T F      6.00        PE  0.22
                     RN1   C120 T      6.50        PF  0.15
                                                   PT 71.04 ( 15)
-----------------
134 135             1.6100        L    12.00 0.1266 PT 42.45 (135)
        Q    60.85          F=0 F      0.00        PE  0.00
                     CM4   C120 T     12.00        PF  1.52

154 134DQ   -45.29 1.3799        L     0.50 0.0215 PT 43.97 (134)
        Q    15.56          F=T F      6.00        PE -0.22
                     RN4   C120 T      6.50        PF  0.14

114 154             1.0490        L   100.00 0.0818 PT 43.89 (154)
        Q    15.56        F=T/T F    10.00        PE  0.00
                     BL3   C120 T   110.00        PF  9.00

 74 114             1.0490        L   109.00 0.0818 PT 52.89 (114)
        Q    15.56        F=T/T F    10.00        PE  0.00
                     BL2   C120 T   119.00        PF  9.73

 34  74             1.0490        L    84.00 0.0818 PT 62.62 ( 74)
        Q    15.56        F=T/T F    10.00        PE  0.00
                     BL1   C120 T    94.00        PF  7.69

 14  34             1.3799        L     0.50 0.0215 PT 70.31 ( 34)
        Q    15.56          F=T F      6.00        PE  0.22
                     RN1   C120 T      6.50        PF  0.14
                                                   PT 70.67 ( 14)
-----------------
133 134             1.6100        L    12.00 0.0733 PT 43.97 (134)
        Q    45.29          F=0 F      0.00        PE  0.00
                     CM4   C120 T     12.00        PF  0.88

153 133DQ   -30.06 1.3799        L     0.50 0.0207 PT 44.85 (133)
        Q    15.22          F=T F      6.00        PE -0.22
                     RN4   C120 T      6.50        PF  0.13
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Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:35      PAGE 8
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO        FLOW    DIAM        EQUIV    P-LOSS     PRESSURE
               GPM     IN          PIPE     PSI/FT     SUMMARY
                                   LEN/FT              PSI

113 153             1.0490      L  100.00 0.0786 PT 44.76 (153)
         Q   15.22        F=T/T F   10.00        PE  0.00
                   BL3    C120  T  110.00        PF  8.65

 73 113             1.0490      L  109.00 0.0786 PT 53.41 (113)
         Q   15.22        F=T/T F   10.00        PE  0.00
                   BL2    C120  T  119.00        PF  9.35

 33  73             1.0490      L   84.00 0.0786 PT 62.76 ( 73)
         Q   15.22        F=T/T F   10.00        PE  0.00
                   BL1    C120  T   94.00        PF  7.39

 13  33             1.3799      L    0.50 0.0207 PT 70.15 ( 33)
         Q   15.22          F=T F    6.00        PE  0.22
                   RN1    C120  T    6.50        PF  0.13
                                                 PT 70.50 ( 13)
-----------------
132 133             1.6100      L   12.00 0.0343 PT 44.85 (133)
         Q   30.06          F=0 F    0.00        PE  0.00
                   CM4    C120  T   12.00        PF  0.41

152 132DQ    -15.01 1.3799      L    0.50 0.0202 PT 45.26 (132)
         Q   15.06          F=T F    6.00        PE -0.22
                   RN4    C120  T    6.50        PF  0.13

112 152             1.0490      L  100.00 0.0770 PT 45.17 (152)
         Q   15.06        F=T/T F   10.00        PE  0.00
                   BL3    C120  T  110.00        PF  8.47

 72 112             1.0490      L  109.00 0.0770 PT 53.64 (112)
         Q   15.06        F=T/T F   10.00        PE  0.00
                   BL2    C120  T  119.00        PF  9.16

 32  72             1.0490      L   84.00 0.0770 PT 62.80 ( 72)
         Q   15.06        F=T/T F   10.00        PE  0.00
                   BL1    C120  T   94.00        PF  7.24

 12  32             1.3799      L    0.50 0.0202 PT 70.04 ( 32)
         Q   15.06          F=T F    6.00        PE  0.22
                   RN1    C120  T    6.50        PF  0.13
                                                 PT 70.39 ( 12)
-----------------
131 132             1.6100      L   12.00 0.0095 PT 45.26 (132)
         Q   15.01          F=0 F    0.00        PE  0.00
                   CM4    C120  T   12.00        PF  0.11

151 131             1.3799      L    0.50 0.0201 PT 45.37 (131)
         Q   15.01          F=T F    6.00        PE -0.22
                   RN4    C120  T    6.50        PF  0.13

111 151             1.0490      L  100.00 0.0765 PT 45.28 (151)
         Q   15.01        F=T/T F   10.00        PE  0.00
                   BL3    C120  T  110.00        PF  8.41
```

Original Calculations – 1st Floor

```
FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:37       PAGE 9
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO        FLOW    DIAM        EQUIV    P-LOSS     PRESSURE
               GPM     IN          PIPE     PSI/FT     SUMMARY
                                   LEN/FT              PSI

 71 111            1.0490       L  109.00 0.0765 PT 53.69 (111)
        Q   15.01        F=T/T F   10.00           PE  0.00
                   BL2    C120 T  119.00           PF  9.10

 31  71            1.0490       L   84.00 0.0765 PT 62.79 ( 71)
        Q   15.01        F=T/T F   10.00           PE  0.00
                   BL1    C120 T   94.00           PF  7.19

 11  31            1.3799       L    0.50 0.0201 PT 69.98 ( 31)
        Q   15.01          F=T F    6.00           PE  0.22
                   RN1    C120 T    6.50           PF  0.13

 12  11            2.1570       L   12.00 0.0023 PT 70.33 ( 11)
        Q   15.01          F=0 F    0.00           PE  0.00
                   CM1    C120 T   12.00           PF  0.03

 13  12DQ   15.06 2.1570       L   12.00 0.0083 PT 70.36 ( 12)
        Q   30.06          F=0 F    0.00           PE  0.00
                   CM1    C120 T   12.00           PF  0.10

 14  13DQ   15.22 2.1570       L   12.00 0.0176 PT 70.46 ( 13)
        Q   45.29          F=0 F    0.00           PE  0.00
                   CM1    C120 T   12.00           PF  0.21

 15  14DQ   15.56 2.1570       L   12.00 0.0305 PT 70.67 ( 14)
        Q   60.85          F=0 F    0.00           PE  0.00
                   CM1    C120 T   12.00           PF  0.37

 16  15DQ   16.15 2.1570       L   12.00 0.0471 PT 71.04 ( 15)
        Q   76.99          F=0 F    0.00           PE  0.00
                   CM1    C120 T   12.00           PF  0.57

  9  16DQ   17.02 2.1570       L    3.00 0.0678 PT 71.61 ( 16)
        Q   94.01          F=T F   12.00           PE  0.00
                   CM1    C120 T   15.00           PF  1.02
                                                   PT 72.63 (  9)
-----------------
118  98            1.3799       L    0.50 0.1186 PT 36.14 ( 98)
        Q   39.16          F=T F    6.00           PE -0.22
                   RN3    C120 T    6.50           PF  0.77

 78 118DQ   10.04 1.3799       L  109.00 0.1810 PT 36.69 (118)
        Q   49.20        F=T/T F   12.00           PE  0.00
                   BL2    C120 T  121.00           PF 21.90
                                                   PT 58.59 ( 78)
-----------------
 81  61            1.3799       L    0.50 0.0158 PT 64.22 ( 61)
        Q   13.16          F=T F    6.00           PE -0.22
                   RN2    C120 T    6.50           PF  0.10

 41  81            1.0490       L   84.00 0.0600 PT 64.10 ( 81)
        Q   13.16        F=T/T F   10.00           PE  0.00
                   BL1    C120 T   94.00           PF  5.64
```

Original Calculations – 1st Floor

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FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:39        PAGE 10
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO        FLOW     DIAM        EQUIV    P-LOSS     PRESSURE
               GPM      IN          PIPE     PSI/FT     SUMMARY
                                    LEN/FT              PSI

 21  41              1.3799       L    0.50 0.0158 PT 69.74 ( 41)
        Q   13.16           F=T F      6.00           PE  0.22
                     RN1    C120 T     6.50           PF  0.10
                                                      PT 70.06 ( 21)
-----------------
 80  60              1.3799       L    0.50 0.0178 PT 63.55 ( 60)
        Q   14.06           F=T F      6.00           PE -0.22
                     RN2    C120 T     6.50           PF  0.12

 40  80              1.0490       L   84.00 0.0678 PT 63.45 ( 80)
        Q   14.06         F=T/T F     10.00           PE  0.00
                     BL1    C120 T    94.00           PF  6.37

 20  40              1.3799       L    0.50 0.0178 PT 69.82 ( 40)
        Q   14.06           F=T F      6.00           PE  0.22
                     RN1    C120 T     6.50           PF  0.12
                                                      PT 70.16 ( 20)
-----------------
 79  59              1.3799       L    0.50 0.0223 PT 62.06 ( 59)
        Q   15.86           F=T F      6.00           PE -0.22
                     RN2    C120 T     6.50           PF  0.14

 39  79              1.0490       L   84.00 0.0847 PT 61.98 ( 79)
        Q   15.86         F=T/T F     10.00           PE  0.00
                     BL1    C120 T    94.00           PF  7.96

 19  39              1.3799       L    0.50 0.0223 PT 69.94 ( 39)
        Q   15.86           F=T F      6.00           PE  0.22
                     RN1    C120 T     6.50           PF  0.14
                                                      PT 70.30 ( 19)
-----------------
 38  78              1.0490       L   84.00 0.1228 PT 58.62 ( 78)
        Q   19.38         F=T/T F     10.00           PE  0.00
                     BL1    C120 T    94.00           PF 11.54

 18  38              1.3799       L    0.50 0.0323 PT 70.16 ( 38)
        Q   19.38           F=T F      6.00           PE  0.22
                     RN1    C120 T     6.50           PF  0.21
                                                      PT 70.59 ( 18)
-----------------
 37  77              1.0490       L   84.00 0.1349 PT 58.02 ( 77)
        Q   20.39         F=T/T F     10.00           PE  0.00
                     BL1    C120 T    94.00           PF 12.68

 17  37              1.3799       L    0.50 0.0355 PT 70.70 ( 37)
        Q   20.39           F=T F      6.00           PE  0.22
                     RN1    C120 T     6.50           PF  0.23
                                                      PT 71.15 ( 17)
-----------------
 58  78              1.3799       L    0.50 0.0717 PT 58.62 ( 78)
        Q   29.82           F=T F      6.00           PE  0.22
                     RN2    C120 T     6.50           PF  0.47
                                                      PT 59.31 ( 58)
```

Original Calculations – 1st Floor

```
FIREOUT SUBMITTAL              CREATED  04-07-1986  23:10:41       PAGE 11
NEVADA COUNTY ADMINISTRATION -- 1ST FLOOR -- .10/1,500

FROM TO        FLOW    DIAM        EQUIV     P-LOSS     PRESSURE
               GPM     IN          PIPE      PSI/FT     SUMMARY
                                   LEN/FT               PSI

 -----------------
  1   3             8.3249      L    30.00 0.0003 PT 95.93 (  3)
        Q  189.77          F=T F    55.00        PE  0.00
                    LU     C140 T    85.00        PF  0.03
                                                  PT 95.96 (  1)
 -----------------
  8   9             2.1570      L     2.50 0.2498 PT 72.63 (  9)
        Q  189.77          F=E F     6.00        PE  1.08
                    FM     C120 T     8.50        PF  2.12

  7   8             2.1570      L    40.00 0.2498 PT 75.83 (  8)
        Q  189.77          F=E F     6.00        PE  0.00
                    FM     C120 T    46.00        PF 11.49

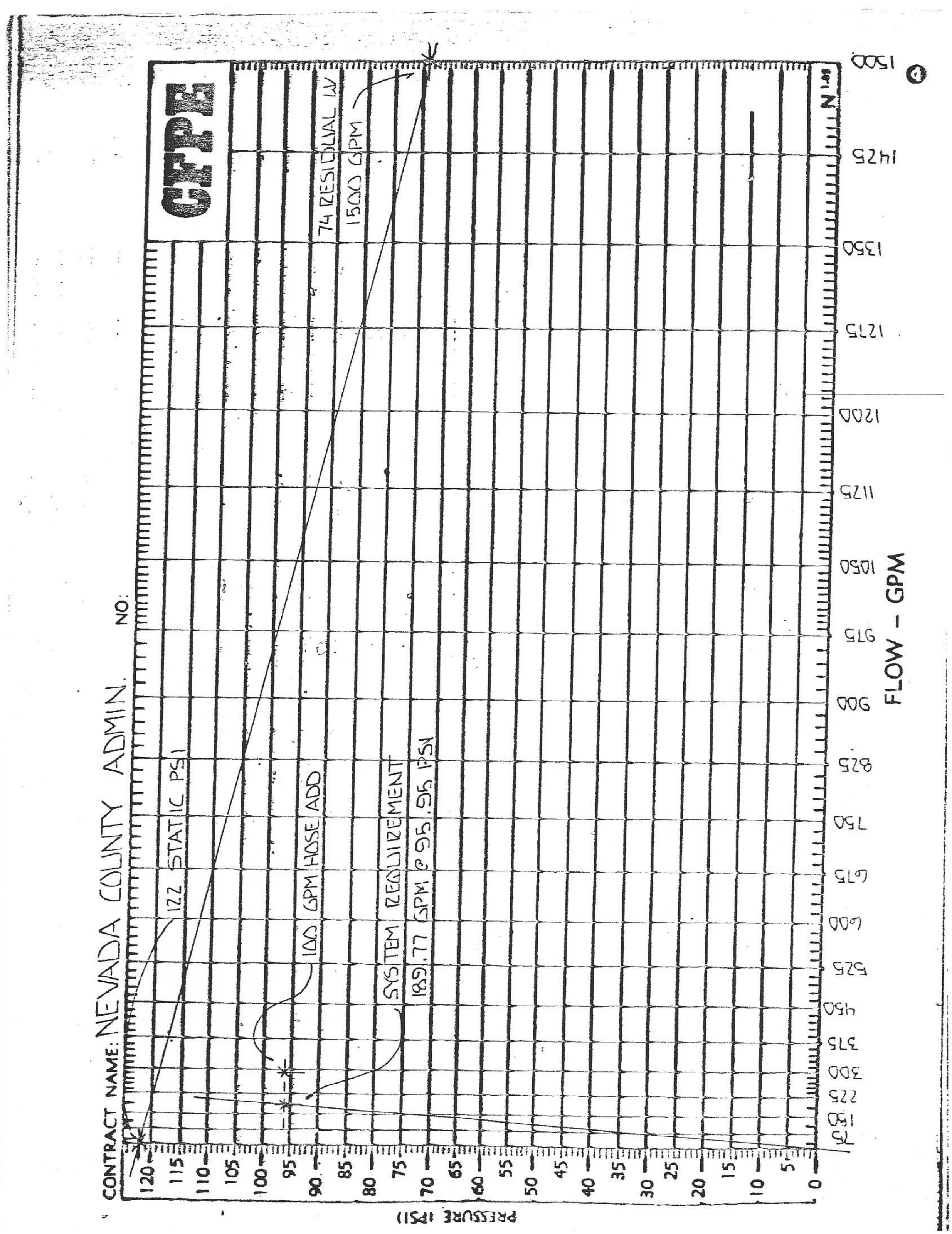
  6   7             2.1570      L     9.50 0.2498 PT 87.32 (  7)
        Q  189.77          F=E F     6.00        PE  4.11
                    FR     C120 T    15.50        PF  3.87

  3   6             4.1550      L    50.00 0.0077 PT 95.30 (  6)
        Q  189.77       F=T,GV F    34.00        PE  0.00
                    UN     C140 T    84.00        PF  0.65
                                                  PT 95.95 (  3)
 -----------------
  0   1             10.335      L    40.00 0.0001 PT 95.93 (  1)
        Q  189.77    F=T,GV/CV F   156.00        PE  0.00
                    UN     C140 T   196.00        PF  0.02
COMMENT:  ADD 100 GPM HOSE @ POINT OF CONNECTION

                                                  PT 95.95(  0)

PRESSURE AVAILABLE AT NODE 0 AT       289.8 GPM     119.7 PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS   0.089 PSI
MAXIMUM VELOCITY IN PIPES            18.63  FPS
```

Original Calculations – 1st Floor



Original Calculations – 1st Floor – Page 12

FIREOUT SUBMITTAL CREATED 04-26-1986 18:49:56 PAGE 1
NEVADA COUNTY ADMINISTRATION -- 2ND FLOOR -- .10/1500

PROJECT: NEVADA COUNTY ADMINISTRATION
ORCHARD STREET & HIGHWAY 49
NEVADA COUNTY, CALIFORNIA
*
*
CONTRACTOR: CALWEST FIRE PROTECTION ENGINEERING
4680 PELL DRIVE, SUITE "B"
SACRAMENTO, CALIFORNIA 95838
(916) 921-1995
*
*
DESIGN: .10/1500 - LIGHT HAZARD - 1/2" SPKRS. - K=5.55
*
*

FLOW TEST RESULTS

STATIC	122.00 PSI
RESIDUAL AT 1500.0 GPM	74.00 PSI
PRESSURE AVAILABLE AT 391.8 GPM	118.00 PSI

SUMMARY OF SPRINKLER OUTFLOWS

SPR	PRESSURE	ACTUAL FLOW	MINIMUM FLOW	K-FACTOR
101	33.39	32.07	14.69	5.55
102	20.68	25.24	14.69	5.55
103	20.42	25.08	14.69	5.55
104	32.60	31.69	14.69	5.55
105	15.27	21.69	14.69	5.55
106	15.07	21.55	14.69	5.55
107	12.04	19.25	14.69	5.55
108	11.88	19.13	14.69	5.55
109	10.41	17.91	14.69	5.55
110	10.27	17.79	14.69	5.55
111	7.80	15.50	14.69	5.55
112	7.69	15.39	14.69	5.55
113	7.10	14.79	14.69	5.55
114	7.01	14.69	14.69	5.55

☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF HIS WORK WITH THAT OF ALL OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF HIS WORK.

JOHN TURLEY & ASSOC., INC.
MECHANICAL ENGINEERS
Sacramento, California

DATE 6-11-86 BY CAM

TOTAL WATER REQUIRED FOR SYSTEM	291.76 GPM
OUTFLOWS AT 1	0.00 GPM
OUTSIDE HOSE STREAMS AT 0	100.00 GPM
TOTAL WATER REQUIREMENT	391.76 GPM
PRESSURE REQUIRED AT 0	101.71 PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS	0.071 PSI
MAXIMUM VELOCITY IN PIPES	25.62 FPS

J. R. Roberts Corp. Submittal # 72

Original Calculations – 2nd Floor

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FIREOUT SUBMITTAL                CREATED  04-26-1986  18:49:57        PAGE 2
NEVADA COUNTY ADMINISTRATION -- 2ND FLOOR -- .10/1500

FROM TO          FLOW     DIAM        EQUIV    P-LOSS     PRESSURE
                 GPM      IN          PIPE     PSI/FT     SUMMARY
                                      LEN/FT              PSI

 -----------------
112 114              1.0490       L     9.33 0.0735 PT   7.01 (114)
          Q   14.69          F=0 F      0.00        PE   0.00
                      BN1   C120 T      9.33        PF   0.69

110 112DQ     15.39  1.0490       L     9.33 0.2769 PT   7.70 (112)
          Q   30.08          F=0 F      0.00        PE   0.00
                      BN2   C120 T      9.33        PF   2.58

108 110DQ     17.79  1.3799       L     9.33 0.1720 PT  10.28 (110)
          Q   47.87          F=0 F      0.00        PE   0.00
                      BN3   C120 T      9.33        PF   1.60

106 108DQ     19.13  1.3799       L    10.00 0.3204 PT  11.88 (108)
          Q   67.00          F=0 F      0.00        PE   0.00
                      BN4   C120 T     10.00        PF   3.20

103 106DQ     21.55  1.3799       L    10.00 0.5367 PT  15.08 (106)
          Q   88.54          F=0 F      0.00        PE   0.00
                      BN5   C120 T     10.00        PF   5.37

 33 103DQ     25.08  1.6100       L    24.50 0.4018 PT  20.45 (103)
          Q  113.62          F=T F      8.00        PE   0.00
                      BN6   C120 T     32.50        PF  13.06

 23   33             1.6100       L     1.00 0.4018 PT  33.51 ( 33)
          Q  113.62          F=T F      8.00        PE   0.43
                      NR1   C120 T      9.00        PF   3.62

 22   23             2.6349       L    13.00 0.0365 PT  37.56 ( 23)
          Q  113.62          F=0 F      0.00        PE   0.00
                      NC    C120 T     13.00        PF   0.47
                                                    PT  38.03 ( 22)
-----------------
111 113              1.0490       L     9.33 0.0745 PT   7.10 (113)
          Q   14.79          F=0 F      0.00        PE   0.00
                      BN1   C120 T      9.33        PF   0.70

109 111DQ     15.50  1.0490       L     9.33 0.2805 PT   7.80 (111)
          Q   30.29          F=0 F      0.00        PE   0.00
                      BN2   C120 T      9.33        PF   2.62

107 109DQ     17.91  1.3799       L     9.33 0.1742 PT  10.42 (109)
          Q   48.20          F=0 F      0.00        PE   0.00
                      BN3   C120 T      9.33        PF   1.63

105 107DQ     19.25  1.3799       L    10.00 0.3244 PT  12.05 (107)
          Q   67.45          F=0 F      0.00        PE   0.00
                      BN4   C120 T     10.00        PF   3.24

102 105DQ     21.69  1.3799       L    10.00 0.5434 PT  15.29 (105)
          Q   89.14          F=0 F      0.00        PE   0.00
                      BN5   C120 T     10.00        PF   5.43
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Original Calculations – 2nd Floor

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FIREOUT SUBMITTAL              CREATED  04-26-1986  18:50:00         PAGE 3
NEVADA COUNTY ADMINISTRATION -- 2ND FLOOR -- .10/1500

FROM TO         FLOW    DIAM         EQUIV    P-LOSS     PRESSURE
                GPM     IN           PIPE     PSI/FT     SUMMARY
                                     LEN/FT              PSI

 32 102DQ    25.24 1.6100         L    24.50 0.4068 PT 20.72 (102)
         Q  114.38           F=T F     8.00         PE  0.00
                    BN6     C120 T    32.50         PF 13.22

 22  32            1.6100         L     1.00 0.4068 PT 33.94 ( 32)
         Q  114.38           F=T F     8.00         PE  0.43
                    NR1     C120 T     9.00         PF  3.66

 21  22DQ  113.62 2.6349          L    12.00 0.1323 PT 38.03 ( 22)
         Q  228.00           F=0 F     0.00         PE  0.00
                  NC        C120 T    12.00         PF  1.59
                                                    PT 39.62 ( 21)
-----------------
101 104            1.3799         L    10.00 0.0802 PT 32.60 (104)
         Q   31.69           F=0 F     0.00         PE  0.00
                    BN5     C120 T    10.00         PF  0.80

 31 101DQ    32.07 1.6100         L    24.50 0.1380 PT 33.40 (101)
         Q   63.76           F=T F     8.00         PE  0.00
                    BN6     C120 T    32.50         PF  4.48

 21  31            1.6100         L     1.00 0.1380 PT 37.88 ( 31)
         Q   63.76           F=T F     8.00         PE  0.43
                    NR1     C120 T     9.00         PF  1.24

 11  21DQ  228.00 2.6349          L    43.00 0.2088 PT 39.55 ( 21)
         Q  291.76           F=T F    16.00         PE  0.00
                  NC        C120 T    59.00         PF 12.32
                                                    PT 51.87 ( 11)
-----------------
  1   3            8.3249         L    30.00 0.0006 PT101.62 (  3)
         Q  291.76           F=T F    55.00         PE  0.00
                  LU        C140 T    85.00         PF  0.05
                                                    PT101.67 (  1)
-----------------
 10  11            3.2599         L   127.00 0.0741 PT 51.95 ( 11)
         Q  291.76           F=0 F     0.00         PE  2.35
                   FM3      C120 T   127.00         PF  9.41

  9  10            3.2599         L    96.00 0.0741 PT 63.71 ( 10)
         Q  291.76           F=0 F     0.00         PE  0.00
                   FM2      C120 T    96.00         PF  7.11

  8   9            3.2599         L    69.00 0.0741 PT 70.82 (  9)
         Q  291.76           F=T F    20.00         PE  1.77
                   FM1      C120 T    89.00         PF  6.59

  7   8            2.1570         L    15.75 0.5535 PT 79.18 (  8)
         Q  291.76           F=0 F     0.00         PE  6.82
                   FR1      C120 T    15.75         PF  8.72
```

Original Calculations – 2nd Floor

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FIREOUT SUBMITTAL              CREATED  04-26-1986  18:50:01       PAGE 4
NEVADA COUNTY ADMINISTRATION -- 2ND FLOOR -- .10/1500

FROM TO        FLOW    DIAM        EQUIV    P-LOSS     PRESSURE
               GPM     IN          PIPE     PSI/FT     SUMMARY
                                   LEN/FT              PSI

  6   7               3.2599       L     9.50 0.0741 PT 94.72 (   7)
        Q  291.76           F=E F     9.00          PE  4.11
                      FR      C120 T    18.50          PF  1.37

  3   6               4.1550       L    50.00 0.0171 PT100.20 (   6)
        Q  291.76         F=T,GV F    34.00          PE  0.00
                      UN      C140 T    84.00          PF  1.44
                                                     PT101.64 (   3)
 -----------------
  0   1               10.335       L    40.00 0.0002 PT101.62 (   1)
        Q  291.76    F=T,GV/CV F   156.00          PE  0.00
                      UN      C140 T   196.00          PF  0.04
COMMENT:  ADD 100 GPM @ POINT OF CONNECTION FOR HOSE

                                                     PT101.66(  0)

PRESSURE AVAILABLE AT NODE 0 AT       391.8 GPM     118.0 PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS  0.071 PSI
MAXIMUM VELOCITY IN PIPES           25.62  FPS
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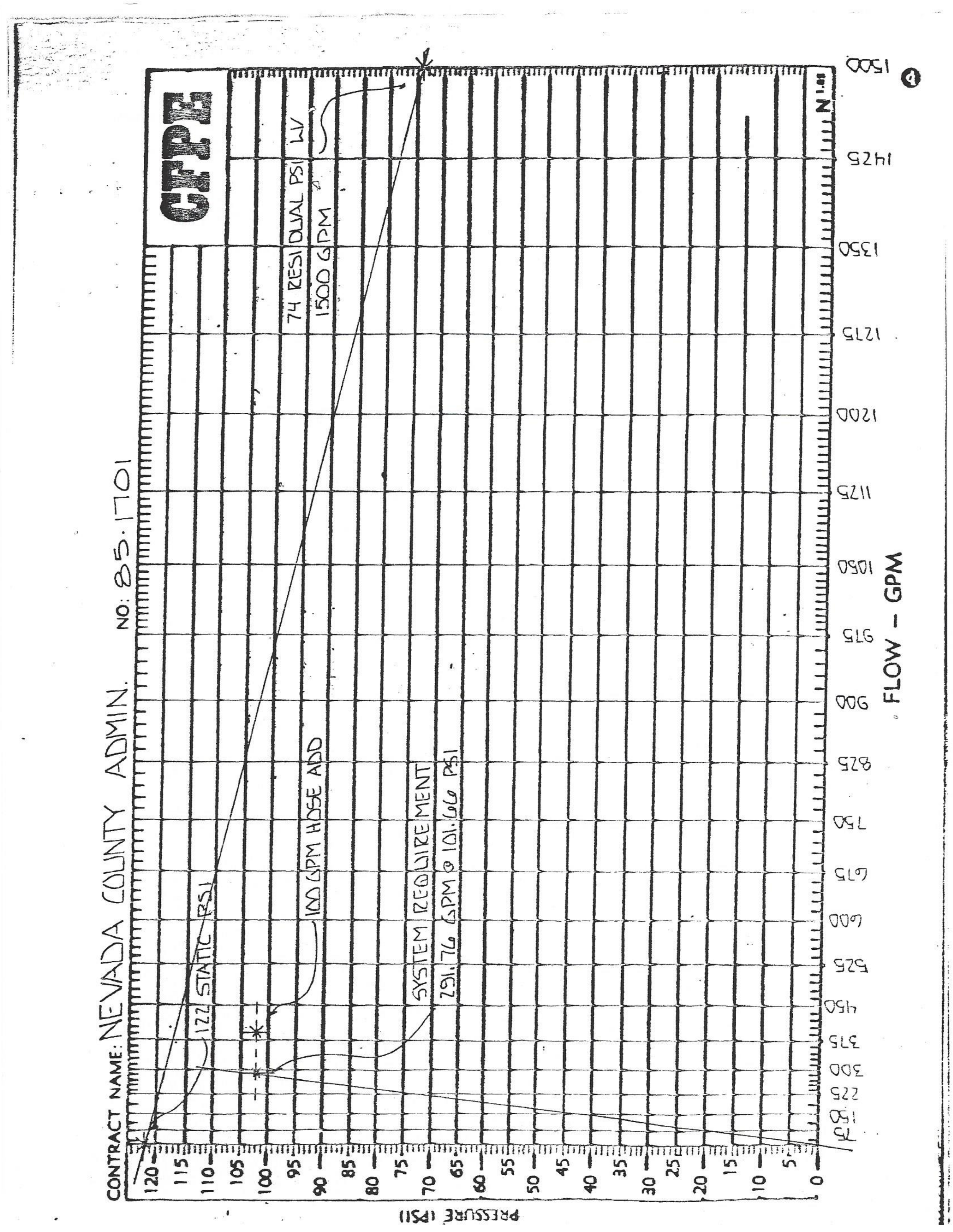
Original Calculations – 2nd Floor



Original Calculations – 2nd Floor – Page 5

FIREOUT SUBMITTAL CREATED 04-29-1986 14:52:51 PAGE 1
NEVADA COUNTY ADMINISTRATION -- MANSARD -- .10/1,950

PROJECT: NEVADA COUNTY ADMINISTRATION
ORCHARD STREET & HIGHWAY 49
NEVADA COUNTY, CALIFORNIA

*
*

CONTRACTOR: CALWEST FIRE PROTECTION ENGINEERING
4680 PELL DRIVE, SUITE "B"
SACRAMENTO, CALIFORNIA 95838
(916) 921-1995

*
*

DESIGN: .10/1,950 - LIGHT HAZARD - DRYSYSTEM - C=100
1/2" SPRINKLERS - K=5.55

*
*

FLOW TEST RESULTS

STATIC	122.00 PSI
RESIDUAL AT 1500.0 GPM	74.00 PSI
PRESSURE AVAILABLE AT 362.9 GPM	118.52 PSI

SUMMARY OF SPRINKLER OUTFLOWS

SPR	PRESSURE	ACTUAL FLOW	MINIMUM FLOW	K-FACTOR
101	15.21	21.64	14.68	5.55
102	13.36	20.29	14.68	5.55
103	14.41	21.07	14.68	5.55
104	12.96	19.98	14.68	5.55
105	11.51	18.83	14.68	5.55
106	13.93	20.71	14.68	5.55
107	12.52	19.64	14.68	5.55
108	11.11	18.50	14.68	5.55
109	13.37	20.29	14.68	5.55
110	9.30	16.92	14.68	5.55
111	8.23	15.92	14.68	5.55
112	11.45	18.78	14.68	5.55
113	7.92	15.62	14.68	5.55
114	7.00	14.68	14.68	5.55

☑ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

CHECKING IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF HIS WORK WITH THAT OF ALL OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF HIS WORK.

JOHN TURLEY & ASSOC., INC.
MECHANICAL ENGINEERS
Sacramento, California

DATE 6-11-86 BY CMM

TOTAL WATER REQUIRED FOR SYSTEM	262.87 GPM
OUTFLOWS AT 1	0.00 GPM
OUTSIDE HOSE STREAMS AT 0	100.00 GPM
TOTAL WATER REQUIREMENT	362.87 GPM
PRESSURE REQUIRED AT 0	109.07 PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS	0.083 PSI
MAXIMUM VELOCITY IN PIPES	16.11 FPS

J. R. Roberts Corp. Submittal # 72

Original Calculations – Mansard

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FIREOUT SUBMITTAL                CREATED  04-29-1986  14:52:52       PAGE 2
NEVADA COUNTY ADMINISTRATION -- MANSARD -- .10/1,950

FROM TO         FLOW     DIAM          EQUIV    P-LOSS      PRESSURE
                GPM      IN            PIPE     PSI/FT      SUMMARY
                                       LEN/FT               PSI

  ------------------
111 114              1.0490       L     12.00 0.1030 PT   7.00 (114)
        Q     14.68          F=0 F       0.00         PE   0.00
                      BN1    C100 T     12.00         PF   1.24

 26 111DQ    15.92 1.3799       L      3.00 0.1054 PT   8.24 (111)
        Q    30.61          F=T F       4.00         PE   0.00
                     BN2    C100 T      7.00         PF   0.74

 25   26             1.3799       L     11.00 0.1054 PT   8.98 ( 26)
        Q    30.61          F=0 F       0.00         PE   0.00
                     BN5    C100 T     11.00         PF   1.16
                                                      PT  10.14 ( 25)
  ------------------
110 113              1.0490       L     12.00 0.1154 PT   7.92 (113)
        Q    15.62          F=0 F       0.00         PE   0.00
                     BN1    C100 T     12.00         PF   1.38

 25 110DQ    16.92 1.3799       L      3.00 0.1180 PT   9.30 (110)
        Q    32.54          F=T F       4.00         PE   0.00
                     BN2    C100 T      7.00         PF   0.83

 24   25DQ   30.61 1.3799       L     11.00 0.4024 PT  10.13 ( 25)
        Q    63.15          F=0 F       0.00         PE   0.00
                     BN5    C100 T     11.00         PF   4.43
                                                      PT  14.56 ( 24)
  ------------------
109 112              1.0490       L     12.00 0.1622 PT  11.45 (112)
        Q    18.78          F=0 F       0.00         PE   0.00
                     BN1    C100 T     12.00         PF   1.95

 24 109DQ    20.29 1.3799       L      3.00 0.1655 PT  13.40 (109)
        Q    39.07          F=T F       4.00         PE   0.00
                     BN2    C100 T      7.00         PF   1.16

 20   24DQ   63.15 1.6100       L      8.00 0.4630 PT  14.56 ( 24)
        Q   102.22          F=T F       6.00         PE   0.00
                     BN6    C100 T     14.00         PF   6.48
                                                      PT  21.04 ( 20)
  ------------------
107 108              1.0490       L      9.00 0.1579 PT  11.11 (108)
        Q    18.50          F=0 F       0.00         PE   0.00
                     BN4    C100 T      9.00         PF   1.42

106 107DQ    19.64 1.3799       L      9.00 0.1583 PT  12.53 (107)
        Q    38.14          F=0 F       0.00         PE   0.00
                     BN4    C100 T      9.00         PF   1.42

 19 106DQ    20.71 1.3799       L     16.00 0.3532 PT  13.95 (106)
        Q    58.85          F=T F       4.00         PE   0.00
                     BN3    C100 T     20.00         PF   7.06
                                                      PT  21.01 ( 19)
```

Original Calculations – Mansard

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FIREOUT SUBMITTAL              CREATED  04-29-1986  14:52:55       PAGE 3
NEVADA COUNTY ADMINISTRATION -- MANSARD -- .10/1,950

FROM TO         FLOW    DIAM         EQUIV    P-LOSS      PRESSURE
                GPM     IN           PIPE     PSI/FT      SUMMARY
                                     LEN/FT               PSI

 -----------------
104 105             1.0490      L     9.00 0.1630 PT 11.51 (105)
        Q   18.83          F=0 F      0.00        PE  0.00
                     BN4   C100 T     9.00        PF  1.47

103 104DQ   19.98 1.3799      L       9.00 0.1634 PT 12.98 (104)
        Q   38.80          F=0 F      0.00        PE  0.00
                     BN4   C100 T     9.00        PF  1.47

 18 103DQ   21.07 1.3799      L      16.00 0.3646 PT 14.45 (103)
        Q   59.87          F=T F      4.00        PE  0.00
                     BN3   C100 T    20.00        PF  7.29
                                                  PT 21.74 ( 18)
 -----------------
101 102             1.0490      L    10.00 0.1873 PT 13.36 (102)
        Q   20.29          F=0 F      0.00        PE  0.00
                     BN1   C100 T    10.00        PF  1.87

 17 101DQ   21.64 1.3799      L      32.00 0.1886 PT 15.23 (101)
        Q   41.93        F=E,T F      6.00        PE  0.00
                     BN2   C100 T    38.00        PF  7.17
                                                  PT 22.40 ( 17)
 -----------------
 20  19             2.0669      L     5.00 0.0044 PT 21.02 ( 19)
        Q   16.00          F=0 F      0.00        PE  0.00
                     CM2   C100 T     5.00        PF  0.02

 21  20DQ  102.22 2.0669      L     158.00 0.1794 PT 21.04 ( 20)
        Q  118.22          F=0 F      0.00        PE  0.00
                     CM2   C100 T   158.00        PF 28.35

 28  21             2.0669      L    66.00 0.1794 PT 49.39 ( 21)
        Q  118.22          F=0 F      0.00        PE  0.00
                     CM2   C100 T    66.00        PF 11.84

 22  28DQ  -61.18 2.0669      L      66.00 0.0466 PT 61.23 ( 28)
        Q   57.04          F=0 F      0.00        PE  0.00
                     CM2   C100 T    66.00        PF  3.08

 23  22             2.0669      L   352.00 0.0466 PT 64.31 ( 22)
        Q   57.04          F=E F      4.00        PE  0.00
                     CM2   C100 T   356.00        PF 16.59

 10  23             2.0669      L    66.00 0.0466 PT 80.90 ( 23)
        Q   57.04          F=E F      4.00        PE  0.00
                     CM2   C100 T    70.00        PF  3.26
                                                  PT 84.16 ( 10)
 -----------------
 27  28             2.0669      L    12.00 0.0530 PT 61.24 ( 28)
        Q   61.18          F=T F      7.00        PE -1.82
                     CM4   C100 T    19.00        PF  1.01
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Original Calculations – Mansard

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FIREOUT SUBMITTAL               CREATED  04-29-1986  14:52:57         PAGE 4
NEVADA COUNTY ADMINISTRATION -- MANSARD -- .10/1,950

FROM TO         FLOW    DIAM        EQUIV     P-LOSS      PRESSURE
                GPM     IN          PIPE      PSI/FT      SUMMARY
                                    LEN/FT                PSI

 14  27DQ   -30.46 1.6100        L    54.00 0.0501 PT 60.43 ( 27)
        Q    30.71          F=0 F      0.00        PE  0.00
                     CM3   C100 T     54.00        PF  2.71

 15  14            1.6100        L   324.00 0.0501 PT 63.14 ( 14)
        Q    30.71          F=E F      3.00        PE  0.00
                     CM3   C100 T   327.00         PF 16.38

 11  15            1.6100        L    52.00 0.0501 PT 79.52 ( 15)
        Q    30.71          F=E F      3.00        PE  0.00
                     CM3   C100 T     55.00        PF  2.76
                                                   PT 82.28 ( 11)
-----------------
 13  27            1.6100        L    52.00 0.0491 PT 60.42 ( 27)
        Q    30.46          F=E F      3.00        PE  0.00
                     CM3   C100 T     55.00        PF  2.70

 12  13            1.6100        L   324.00 0.0493 PT 63.12 ( 13)
        Q    30.46          F=E F      3.00        PE  0.00
                     CM3   C100 T   327.00         PF 16.12

 11  12            1.6100        L    54.00 0.0493 PT 79.24 ( 12)
        Q    30.46          F=T F      6.00        PE  0.00
                     CM3   C100 T     60.00        PF  2.96

 10  11DQ    30.71 3.2599        L    12.00 0.0058 PT 82.20 ( 11)
        Q    61.18          F=T F     14.00        PE  1.82
                     CM1   C100 T     26.00        PF  0.15
                                                   PT 84.17 ( 10)
-----------------
 18  19            2.0669        L    26.00 0.0275 PT 21.02 ( 19)
        Q    42.85          F=0 F      0.00        PE  0.00
                     CM2   C100 T     26.00        PF  0.71

 17  18DQ    59.87 2.0669        L     5.00 0.1384 PT 21.73 ( 18)
        Q   102.72          F=0 F      0.00        PE  0.00
                     CM2   C100 T      5.00        PF  0.69

 16  17DQ    41.93 2.0669        L   158.00 0.2607 PT 22.42 ( 17)
        Q   144.66          F=E F      4.00        PE  0.00
                     CM2   C100 T   162.00         PF 42.23

 10  16            2.0669        L    68.00 0.2607 PT 64.65 ( 16)
        Q   144.66          F=T F      7.00        PE  0.00
                     CM2   C100 T     75.00        PF 19.55
                                                   PT 84.20 ( 10)
-----------------
  1   3            8.3249        L    30.00 0.0005 PT108.99 (  3)
        Q   262.87          F=T F     55.00        PE  0.00
                     LU    C140 T     85.00        PF  0.04
                                                   PT109.03 (  1)
```

Original Calculations – Mansard

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FIREOUT SUBMITTAL                 CREATED  04-29-1986  14:52:58        PAGE 5
NEVADA COUNTY ADMINISTRATION -- MANSARD -- .10/1,950

FROM TO        FLOW     DIAM        EQUIV    P-LOSS     PRESSURE
               GPM      IN          PIPE     PSI/FT     SUMMARY
                                    LEN/FT              PSI

 -----------------
 9  10                3.2599      L     8.00 0.0856 PT 84.18 ( 10)
        Q  262.87           F=3E F    19.00        PE  1.84
                      FM    C100 T    27.00        PF  2.31

 8   9                3.2599      L    25.00 0.0856 PT 88.33 (  9)
        Q  262.87     F=CV,T/BV F    39.00        PE 12.09
                      FR    C100 T    64.00        PF  5.48

 7   8                4.1240      L     3.00 0.0272 PT105.90 (  8)
        Q  262.87            F=T F    16.00        PE  0.00
                      MA    C100 T    19.00        PF  0.52

 6   7                3.2599      L     5.00 0.0856 PT106.42 (  7)
        Q  262.87            F=E F     6.00        PE  0.43
                      FR    C100 T    11.00        PF  0.94

 3   6                4.1550      L    50.00 0.0141 PT107.79 (  6)
        Q  262.87       F=T,GV F    34.00        PE  0.00
                      UN    C140 T    84.00        PF  1.18
                                                   PT108.97 (  3)
 -----------------
 0   1                10.335      L    40.00 0.0002 PT108.99 (  1)
        Q  262.87     F=T,GV/CV F   156.00        PE  0.00
                      UN    C140 T   196.00        PF  0.04
COMMENT:  ADD 100 GPM @ POC FOR HOSE ALLOWANCE

                                                   PT109.03(  0)

PRESSURE AVAILABLE AT NODE 0 AT      362.9 GPM     118.5 PSI
MAXIMUM PRESSURE UNBALANCE IN LOOPS  0.083 PSI
MAXIMUM VELOCITY IN PIPES           16.11  FPS
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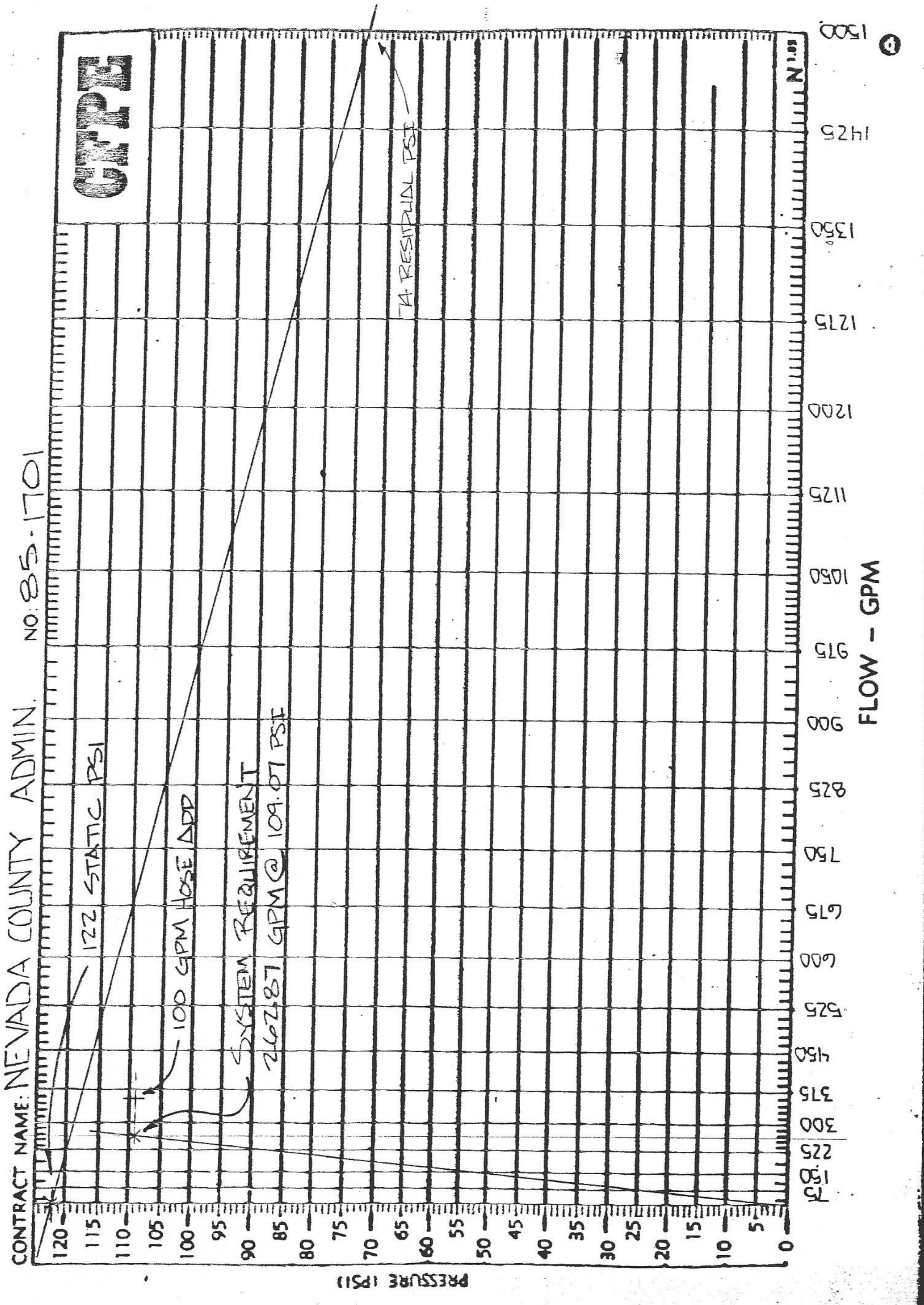
Original Calculations – Mansard



Original Calculations – Mansard – Page 6

APPENDIX O

Sprinkler System Inspection, Testing and Maintenance Schedule

Major Sprinkler System Components	Inspections, Testing and Maintenance	Frequency	NFPA 25 (2014) Reference
Fire Department Connections	Connection visible and accessible	Quarterly	13.7.1
	Couplings checked for damage	Quarterly	13.7.1
	Plugs, Caps, Couplings gaskets in place/undamaged	Quarterly	13.7.1
	ID signs in place	Quarterly	13.7.1
	Verify ball drip valve is free of leaks	Quarterly	13.7.1
	Interior is inspected for obstructions	Quarterly	13.7.1
	Piping from the FDC to the FD Check Valve hydrostatically tested at 150 psi for 2 hours	Every 5 years	13.7.4
	Check valve – internal moves freely, in good condition	Every 5 years (maintained as necessary)	13.4.2.1
Backflow Prevention	Check that the Isolation valves and double check detector assemblies are open	Weekly (Monthly if locked)	13.6.1.1
	Inspected internally to verify all components operate correctly, move freely and are in good condition	Every 5 years	13..1.4
	Forward flow test (or internal inspection during water rationing)	Annually	13.6.2.1
Pressure Reducing Valve	In the open position/not leaking	Quarterly	13.5.1.1
	Maintaining downstream pressure	Quarterly	13.5.1.1

	In good condition Full flow test conducted on each valve	Quarterly Every 5 years	13.5.1.1 13.5.1.2
Riser	Inspect gauges Gauges tested or replaced Nameplate attached Seismic bracing checked Main drain test	Quarterly Every 5 years Annually Annually Annually	5.2.4.1 5.3.2.1 5.2.6 5.2.3 13.3.3.4
Control Valves	Wrenches/hand wheel available Operated/Lubricated Valve is free of damage and leaks Control Valve supervisory alarm devices In the correct (open or closed) position Sealed, locked, or supervised Accessible Has proper signage Post Indicator Valves opened until spring or torsion is felt in the rod	Monthly Annually Weekly (Monthly if locked) Quarterly Monthly Monthly Monthly Monthly Every time the valve is closed	13.3.2.2 13.3.3.1 13.3.2.1 13.3.2.1.2 13.3.2.2 13.3.2.2 13.3.2.2 13.3.2.2 13.3.3.2
Supervisory Switches	Valve supervisory switches shall be tested	Semi-Annually	13.3.3.5.1
Waterflow Alarm Device	Inspect to verify system is free of damage Waterflow alarm test Vane-type and pressure switch-type Waterflow alarm devices	Quarterly Quarterly Semi-Annually	5.2.5 5.3.3.1, 13.2.6 5.3.3.2/13.2.6/2

	Test the audible alarm and visual signals activate within 90 seconds.	Annually	13.2.6
Alarm Valves	Free of damage	Monthly	13.4.1
	Accessible	Monthly	13.4.1
	Retard chamber/alarm drains, not leaking	Monthly	13.4.1
	Interior checked (strainers, filters and restriction orifice)	Every 5 years	13.4.1.2
Sprinklers	No damage or leaks	Annually	5.2.1.1.1
	Free of corrosion, foreign materials, paint and damage	Annually	5.2.1.1.1
	Installed in proper orientation	Annually	5.2.1.1.1
	Distance from ceilings and to storage below	Annually	5.2.1.2
	If fast-response sprinklers are 20 years old	Check at 20 years, and every 10 years thereafter	5.3.1.1.1.5
	If sprinklers are 50 years old	Check at 50 years and every 10 years thereafter	5.3.1.1.1
	If sprinklers are 75 years old	Check at 75 years and every 5 years thereafter	5.3.1.1.1.5
	High temperature sprinklers	Every 5 years	5.3.1.1.1.4
	Check hangers and seismic	Annually	5.2.3

	bracing are installed and undamaged At least 6 spare sprinklers – proper number and type. Complete with wrench?	Annually	5.2.1.4, 5.4.1.5
Fittings & Supports	Free of leaks, corrosion and mechanical damage Verify proper alignment and free of external loads Hose racks inspected per NFPA 1962 Full flow test on each device OS&Y Valves shall be lubricated annually	Annually Annually Annually Every 5 years Annually	5.2.2.1 5.2 13.5.3.1 13.5.3.2 13.3.4.1

Additional Requirements and Frequency data should follow Table 5.1.1.2, Table 6.1.12, and Table 13.1.1.2 from NFPA 25 (2014) seen below.

Table 5.1.1.2 Summary of Sprinkler System Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Gauges (dry, preaction, and deluge systems)	Weekly/quarterly	5.2.4.2, 5.2.4.3, 5.2.4.4
Control valves		Table 13.1.1.2
Waterflow alarm devices	Quarterly	5.2.5
Valve supervisory signal devices	Quarterly	5.2.5
Supervisory signal devices (except valve supervisory switches)	Quarterly	5.2.5
Gauges (wet pipe systems)	Quarterly	5.2.4.1
Hydraulic nameplate	Quarterly	5.2.6
Buildings	Annually (prior to freezing weather)	4.1.1.1
Hanger/seismic bracing	Annually	5.2.3
Pipe and fittings	Annually	5.2.2
Sprinklers	Annually	5.2.1
Spare sprinklers	Annually	5.2.1.4
Information sign	Annually	5.2.8
Fire department connections		Table 13.1.1.2
Valves (all types)		Table 13.1.1.2
Obstruction, internal inspection of piping	5 years	14.2
Heat trace	Per manufacturer's requirements	5.2.7
Test		
Waterflow alarm devices		
Mechanical devices	Quarterly	5.3.3.1
Vane and pressure switch–type devices	Semiannually	5.3.3.2
Valve supervisory signal devices		Table 13.1.1.2
Supervisory signal devices (except valve supervisory switches)		Table 13.1.1.2
Main drain		Table 13.1.1.2
Antifreeze solution	Annually	5.3.4
Gauges	5 years	5.3.2
Sprinklers (extra-high or greater temperature solder type)	5 years	5.3.1.1.1.4
Sprinklers (fast-response)	At 20 years and every 10 years thereafter	5.3.1.1.1.3
Sprinklers	At 50 years and every 10 years thereafter	5.3.1.1.1
Sprinklers	At 75 years and every 5 years thereafter	5.3.1.1.1.5
Sprinklers (dry)	At 10 years and every 10 years thereafter	5.3.1.1.1.6
Sprinklers (in harsh environments)	5 years	5.3.1.1.2
Valves (all types)		Table 13.1.1.2
Valve status test		13.3.1.2.1
Maintenance		
Valves (all types)		Table 13.1.1.2
Low-point drains (dry pipe system)		13.4.4.3.2
Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems	Annually	5.4.1.9
Investigation		
Obstruction		14.3

Table 6.1.1.2 Summary of Standpipe and Hose Systems Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Control valves		Table 13.1.1.2
Pressure-regulating devices		Table 13.1.1.2
Piping	Annually	6.2.1
Hose connections		Table 13.1.1.2]
Cabinet	Annually	NFPA 1962
Gauges	Weekly/quarterly	6.2.2
Hose	Annually	NFPA 1962
Hose storage device	Annually	NFPA 1962
Hose nozzle	Annually and after each use	NFPA 1962
Hydraulic design information sign	Annually	6.2.3
Hose valves		Table 13.1.1.2
Hose connection		Table 13.1.1.2
Test		
Waterflow alarm devices		Table 13.1.1.2
Valve supervisory devices		Table 13.1.1.2
Supervisory signal devices (except valve supervisory switches)		Table 13.1.1.2
Hose storage device	Annually	NFPA 1962
Hose	5 years/3 years	NFPA 1962
Pressure control valve		Table 13.1.1.2
Pressure-reducing valve		Table 13.1.1.2
Hydrostatic test	5 years	6.3.2
Flow test	5 years	6.3.1
Main drain test		Table 13.1.1.2
Hose valves		Table 13.1.1.2
Hose connections		Table 13.1.1.2
Valve status test		13.3.1.2.1
Maintenance		
Hose connections	Annually	Table 6.1.2
Valves (all types)	Annually/as needed	Table 13.1.1.2
Hose valves		Table 13.1.1.2

Table 13.1.1.2 Summary of Valves, Valve Components, and Trim Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Control Valves		
Sealed	Weekly	13.3.2.1
Locked or electrically supervised	Monthly	13.3.2.1.1
Valve Supervisory Signal Initiating Device	Quarterly	13.3.2.1.2
Alarm Valves		
Exterior	Monthly	13.4.1.1
Interior	5 years	13.4.1.2
Strainers, filters, orifices	5 years	13.4.1.2
Check Valves		
Interior	5 years	13.4.2.1
Preaction/Deluge Valves		
Enclosure (during cold weather)	Daily/weekly	13.4.3.1
Exterior	Monthly	13.4.3.1.6
Interior	Annually/5 years	13.4.3.1.7
Strainers, filters, orifices	5 years	13.4.3.1.8
Dry Pipe Valves/ Quick-Opening Devices		
Gauges	Weekly/monthly	13.4.4.1.2.4, 13.4.4.1.2.5
Enclosure (during cold weather)	Daily/weekly	13.4.4.1.1
Exterior	Monthly	13.4.4.1.4
Interior	Annually	13.4.4.1.5
Strainers, filters, orifices	5 years	13.4.4.1.6
Pressure-Reducing and Relief Valves		
Sprinkler systems	Quarterly	13.5.1.1
Hose connections	Annually	13.5.2.1
Hose racks	Annually	13.5.3.1
Fire pumps		
Casing relief valves	Weekly	13.5.7.1, 13.5.7.1.1
Pressure-relief valves	Weekly	13.5.7.2, 13.5.7.2.1
Backflow Prevention Assemblies		
Reduced pressure	Weekly/monthly	13.6.1
Reduced-pressure detectors	Weekly/monthly	13.6.1
Fire Department Connections	Quarterly	13.7.1
Testing		
Main Drains	Annually/quarterly	13.2.5, 13.2.5.1, 13.3.3.4
Gauges	5 years	13.2.7.2
Waterflow Alarms	Quarterly/semiannually	13.2.6
Control Valves		
Position	Annually	13.3.3.1
Operation	Annually	13.3.3.1
Supervisory	Semiannually	13.3.3.5
Preaction/Deluge Valves		
Priming water	Quarterly	13.4.3.2.1
Low air pressure alarms	Quarterly/annually	13.4.3.2.13, 13.4.3.2.14
Full flow	Annually	13.4.3.2.2
Air leakage	3 years	13.4.3.2.6

Table 13.1.1.2 ***Continued***

Item	Frequency	Reference
Dry Pipe Valves/ Quick-Opening Devices		
Air leakage	3 years	13.4.4.2.9
Priming water	Quarterly	13.4.4.2.1
Low air pressure alarm	Quarterly	13.4.4.2.6
Quick-opening devices	Quarterly	13.4.4.2.4
Trip test	Annually	13.4.4.2.2
Full flow trip test	3 years	13.4.4.2.2.2
Pressure-Reducing and Relief Valves		
Sprinkler systems	5 years	13.5.1.2
Circulation relief	Annually	13.5.7.1.2
Pressure relief valves	Annually	13.5.7.2.2
Hose connections	5 years	13.5.2.2
Hose racks	5 years	13.5.3.2
Backflow Prevention Assemblies	Annually	13.6.2
Maintenance		
Control Valves	Annually	13.3.4
Preaction/Deluge Valves	Annually	13.4.3.3.2
Dry Pipe Valves/ Quick-Opening Devices	Annually	13.4.4.3