Fictitious Architects

Court House Project

Fire Protection Report

RyanRigsbee_CulminatingProject.docx

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Executive Summary

This fire protection report intends to provide Fictitious Architects (The Client) with sufficient information about code requirements and best practices pertaining to occupant and building safety. The chapters within this report include specific design requirements to aid the client during the design of the Court House Project. The following recommendations have been prepared by Ryan Rigsbee to address all major building code requirements for life safety systems. These life safety systems include egress, fire alarm and signaling, water-based fire suppression, structural fire protection, smoke control, and an emergency management plan.

This project details the requirements for a new courthouse containing a four story atrium. The design of the Court House Project has enabled Ryan Rigsbee to provide both prescriptive and performance-based solutions to not only meet the aesthetic desires of the client, but also to provide its future occupants with a level of safety commensurate with the expectations set forth for a public building of this nature. Adjacent spaces include offices and courtroom spaces as well as supporting circulation and assembly occupancies.

The Court House Project has been designed primarily in accordance with Title 24 of the California Code of Regulations, with some exceptions requested from the authority having jurisdiction (AHJ) to use particular codes for specific conditions and systems. Further detail of adapted codes and standards is provided in the following chapters of this report.

Systems that must be installed along with their requirements have been separated by chapter so that the client may use this report as a checklist to ensure that all of the requirements have been met. It is important to note that Chapter 1 includes critical elements of the building design that each of the following chapters will build upon to develop a code compliant design. Codes adopted into law by the state of California, the standards these codes reference, and additional industry references have been included as the benchmark that the design must abide by. Subsequently, the eventual construction of the Court House Project must also adhere to the requirements described in this report.

1 Introduction

Ryan Rigsbee has prepared this Fire Protection Report to document the overall approach and design for systems pertaining to fire protection and life safety engineering analysis for the Court House Project (CHP) in Somewhere, California. This document describes key assumptions, design criteria, and analysis methodology pertaining to prescriptive- and performance-based design of the egress, fire alarm and signaling, water-based fire suppression, structural fire protection, and smoke control systems. Additionally, preparation of the fire safety management plan has been included. The methodology proposed in this report conforms to industry-standard practices and the intent of applicable codes, standards and regulations as identified in Section 1.2 of this Fire Protection Report (FPR).

Chapter 1 consists of a general overview of the Court House Project including a building description and the codes, standards, and references used during the design and analysis of the fire protection and life safety systems.

The design and analysis of the egress system is detailed in Chapter 2. The egress system has been designed in accordance with the Life Safety Code – NFPA 101 as requested by the authorities having jurisdiction. Development of classification for each room and space within the building is provided as well as accompanying occupant load factors to discern the total occupant load of the building and determine if the exits provided are sufficient. Required safe egress time has been calculated using two methods, (1) NFPA Handbook calculations and (2) performance-based simulation using the computer egress program STEPS, including tenability performance criteria.

A system description of the fire alarm and signaling systems is expounded in Chapter 3. The California Building Code references NFPA 72 – National Fire Alarm and Signaling Code. The Court House Project has been designed in accordance with NFPA 72 for the fire alarm and detection system design and includes power requirements, and inspection testing and maintenance requirements. Fire scenarios in select representative spaces have been calculated for activation times expected for UL listings as referenced by the manufacturer's data sheets.

The water-based fire suppression system is designed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems as referenced by the

California Building Code. Chapter 4 clarifies the system description including occupant classification, system components, and the standard of care for inspection testing and maintenance. An analysis of the water demand and the existing water supply is also described.

Construction classification, fire resistance requirements, and general structural fire protection is described in Chapter 5. This analysis includes building height and area modifications based on frontage and fire sprinkler allowances. Additionally, requirements for the interior elements of the Court House Project are included.

The Court House Project includes a four story atrium, which required by the California Building Code, will have a smoke management system. In accordance with NFPA 92B – Standard for Smoke Management Systems in Malls, Atria, and Large Spaces, the design of smoke management systems requires a rational analysis. Chapter 6 details the methods, assumptions, and design of the smoke management system. This rational analysis includes; initial calculations, the modeling approach, definitions of the design fires simulated with Fire Dynamics Simulator, tenability criteria, the results from Fire Dynamics Simulator, and detailed information of the performance-based engineering approach.

The authority having jurisdiction requested a fire safety management plan to be provided in accordance with the 2012 International Fire Code. Chapter 7 describes the fire safety management plan including a fire safety and evacuation plan, requirements for emergency evacuation drills, and employee training and response procedures.

After the conclusion of this report, an extensive section of appendices has been provided. Each chapter in this report makes reference to appendices which have been specifically developed for this project, include essential product information, and enable the reader to have a full understanding of the Court House Project's geometry and system layout. Additionally, slides from the formal presentation of this material are provided in Appendix T.

1.1 Building Description

This project involves the construction of a four story (plus basement) courthouse of approximately 118,100 square feet containing a four story atrium. The slab to

slab elevation change is 16 feet. Level 4 is the highest level of occupancy and is approximately 48 feet above the floor surface of Level 1. CHP will be protected by a supervised automatic fire sprinkler, fire alarm and signaling, and smoke control systems.

The floor plan is divided into spaces including offices and courtrooms as well as supporting circulation and assembly occupancies, all of which are designated as light hazard occupancies. The building includes 11 large assembly spaces with between 100 and 200 occupants. Occupants include mostly capable adults aware of their surroundings, along with children (0-18 years of age) accompanied by parents. The basement level is comprised of secured judge's parking and Occupancy Group I-3.

Approximate Floor Areas:

- Basement: 17,800 square feet
- Level 1: 26,600 square feet
- Level 2: 24,300 square feet
- Level 3: 24,900 square feet
- Level 4: 24,500 square feet
- Total area: 118,100 square feet

1.2 Applicable Codes, Standards, and References

The following subsections include a list of documents appropriate for use in designing CHP. It is not the intent of this list to be exhaustive.

1.2.1 Codes Adopted by the State of California

- Title 19 C.C.R., Public Safety, State Fire Marshal Regulations
- 2010 Building Standards Administrative Code, C.C.R. Title 24, Part 1
- 2010 Building Code (CBC), C.C.R. Title 24, Part 2
- 2010 Building Electrical Code (CEC), C.C.R. Title 24, Part 3
- 2010 Building Mechanical Code (CMC), C.C.R. Title 24, Part 4
- 2010 Building Plumbing Code (CPC), C.C.R. Title 24, Part 5
- 2010 Building Fire Code (CFC), C.C.R. Title 24, Part 9

    - The AHJ required this analysis be conducted in accordance with the 2012 International Fire Code (IFC).
- 2010 California Referenced Standards, C.C.R. Title 24, Part 12

1.2.2 Standards Referenced by the 2010 CBC, Chapter 35

- NFPA 13 – *Standard for the Installation of Sprinkler Systems* – 2010 Edition
- NFPA 14 – *Standard for the Installation of Standpipe and Hose Systems* – (CA Amended) 2007 Edition
- NFPA 20 – *Standard for the Installation of Stationary Pumps for Fire Protection* – 2007 Edition
- NFPA 24 – *Standard for the Installation of Private Fire Service Mains and Their Appurtenances* – (CA Amended) 2010 Edition
- NFPA 25 – *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* – 2011 Edition
    - Not specifically referenced in CBC Chapter 35. The AHJ requested information on inspection testing and maintenance. The provisions of NFPA 25 have been accepted by the AHJ.
- NFPA 72 – *National Fire Alarm and Signaling Code* – (CA Amended) 2010 Edition
- NFPA 92B – *Standard for Smoke Management Systems in Malls, Atria, and Large Spaces* – 2005 Edition
- NFPA 101 – *Life Safety Code* (LSC) – 2006 Edition
    - The AHJ required this analysis be conducted in accordance with the 2009 Edition

1.2.3 References

- NFPA Handbook – 20th Edition
- SPFE Handbook – 4th Edition
- See Appendix S

2 Egress Analysis and Design

The AHJ required that the egress system comply with the 2009 Edition of the Life Safety Code (LSC). Sections and tables in Chapter 2 of this report will be in reference to the LSC, unless otherwise stated.

2.1 Occupancy Classification

Section 2.1 of this report includes a narrative summarizing occupant load factors, exit access corridors, exit passageways, and vertical exits conforming to the Life Safety code.

2.1.1 Occupant Load Factor

CHP is a multi-occupancy building including assembly, business, and storage. Although there is a detention use within CHP, the detained occupants will be guided by correctional officers trained in emergency protocol, and escorting will occur through separate exits for this specific use. The detained occupants will be kept separate from the general population so not to create an obstacle or obstruction to the general population of the building. Table 7.3.1.2 of the LSC has been implemented in area-based calculation of all rooms as tabulated in Table 1 of this report.

Table 1: Occupancy Classification

Room	Use	ft^2 per person
Courtroom	Assembly	15 net
Office	Business	100
Storage, MEP	Storage	300
Locker	Exercise room without equipment	50

2.1.2 Exit Access Corridors

Corridors along the north and south of CHP shall meet the following requirements per the 2009 LSC, Section 7.1.3.1:

- Corridor wall will have 1-hour fire resistance rating

- Doors connected to the exit access corridor shall be 20-minute rated doors

Locations of fire resistant walls are found in Appendix C.

2.1.3 Exit Passageways

An exit passageway is a horizontal means of exit travel that shall be constructed of 2-hour fire resistant material per the LSC, Section 7.2.6. In the Basement, there is an exit passageway connecting Officer Waiting to Exit SW. Locations of fire resistant walls are found in Appendix C.

2.1.4 Vertical Exits

Stairways in CHP shall be smokeproof enclosures per LSC, Section 7.2.3. All stairways adjacent to the atrium will be constructed of 2-hour fire resistance material per the LSC, Section 7.2.3.3. Vestibules will not be provided as CHP is not a high-rise building.

2.2 Occupant Load

Life safety analysis includes calculation of occupants inhabiting the building and the egress path to the public way. This path includes corridors, exit passageways, and stairways leading to exit discharge. Section 2.2 of this report includes information pertaining to occupant load, exit capacity per floor, number of exits per floor and arrangement of exits. Occupant loads can be found in the Life Safety Plans in Appendix B. The Occupant Classification Plans in Appendix C depict areas of the building with differentiating occupancies.

2.2.1 Capacity and Use

Capacity and use of CHP are summarized in Table 2. Detailed designations and calculations pertaining to capacity and use are tabulated in Appendix A.

Table 2: Capacity and Use

Floor	Exit Capacity (people)	Actual Usage (people)
Basement	1060	34
First	2140	418
Second	700	585
Third	700	449
Fourth	700	525

2.2.2 Occupant Load

Section 3.3.153.2 of the Life Safety Code defines occupant load as the total number of persons that might occupy a building or portion thereof at any one time. Calculations are in Appendix A. The total occupant load of CHP is 2011 persons. Occupant load conforms to Section 7.3.1.1.1 of the Life Safety Code.

2.2.3 Exit Capacity

The exit capacity of CHP is compliant with the LSC on a per floor basis as seen in Table 2. The exit capacity is greater than the usage as calculated in accordance with LSC.

2.2.4 Number of Exits

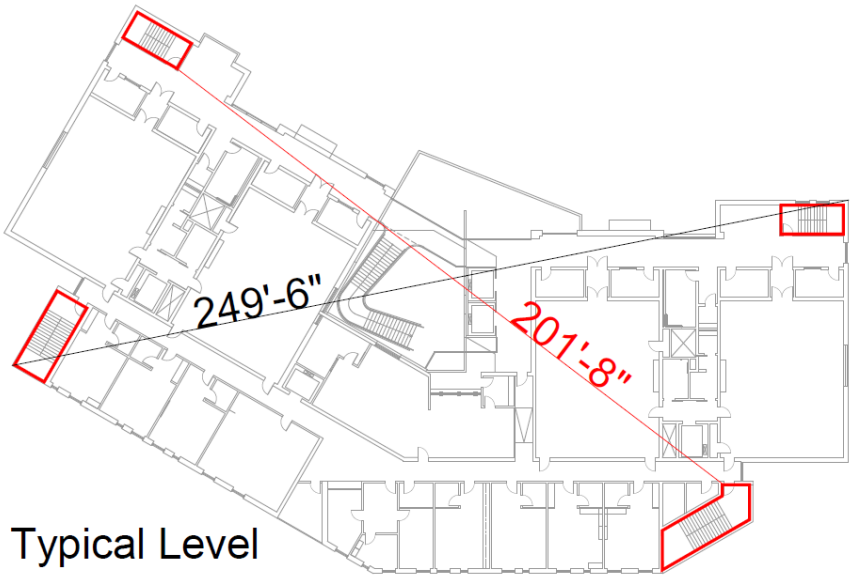
The required number of separate means of egress in accordance with the LSC, Section 7.4.1.2 for an occupant load of more than 500 and less than 1000 persons shall not be less than three. Although not required, CHP has 4 stairways with entrances on Levels 1 – 4 in compliance with Section 12.2.4 of the Life Safety Code for new assembly occupancies.

2.2.5 Arrangement of Exits

The arrangement of exits in CHP conforms to the requirements in Section 7.5.1.3.3 of the LSC. Section 7.5.1.3.3 requires exits and exit accesses within a sprinklered building to be located at a distance not less than one-third the length

of the maximum overall diagonal dimension of the building area to be served. The maximum diagonal dimension of CHP is approximately 249 feet 6 inches. One-third the maximum diagonal dimension is 83 feet 2 inches. Exit access is located as depicted in Figure 1; 201 feet 8 inches is not less than 83 feet 2 inches (one-third the maximum diagonal distance).

Figure 1: Exit Separation Diagonal



2.3 Safety

Occupant safety is the principle criterion of evacuation. Section 2.3 discusses key portions of the life safety system in CHP.

2.3.1 Atrium

A 1-hour fire-resistance-rated accordion style door assembly connected to the fire alarm system separates Levels 3 and 4 from the atrium space. This not only creates a void in the atrium for smoke filling, but separates hot gasses and smoke from occupants on L3 and L4. Locations of fire resistant walls are found in Appendix C.

2.3.2 Exit Signage

Exits, other than the main exterior exit doors that obviously and clearly are identifiable as exits, shall be marked by an approved sign that is readily visible from any direction of exit access per Section 7.10.1.2.1 of the LSC. These exits

shall have illumination and tactile signage per Section 7.10.5 and 7.10.1.3. Floor proximity exit signage shall be installed per Section 7.10.1.6. Direction indicators shall comply with Section 7.10.6.2.

2.3.3 Interior Finish

Chapter 10 of the Life Safety Code mandates requirements for interior finish. Interior wall and ceiling finish is required to be Class A, Class B, or Class C by Section 10.2.3 of the LSC as classified by ASTM E 84.

2.4 STEPS – Egress Modeling

STEPS is a computer egress modeling program. Section 2.4 of this report focuses on the parameters and criteria used while modeling occupant egress of CHP.

2.4.1 Occupant Walking Speeds

Characteristics of occupants used in STEPS are tabulated in Table 3.

Table 3: Occupant Characteristics

Occupant Type	Walking Speeds	
	Horizontal Speed	Vertical Speed
Young	4.27 ft/sec (1.3 m/s)	2.62 ft/sec (0.8 m/s)
Middle	3.94 ft/sec (1.2 m/s)	2.3 ft/sec (0.7 m/s)
Old	3.28 ft/sec (1.0 m/s)	1.96 ft/sec (0.6 m/s)
Disabled	1.64 ft/sec (0.5 m/s)	0.89 ft/sec (0.27 m/s)

References

- Fruin, John J., Pedestrian Planning and Design, Revised Edition, Elevator World, Inc., Mobile, Alabama, 1987. - Public Spaces.
- Fahy, Rita F. and Proulx, Guylene, Toward Creating a Database on Delay Times to Start Evacuation and Walking Speeds for Use in Evacuation Modeling, Human Behavior in Fire-Proceedings of the 2nd International Symposium, MIT, March 2001. Drill in Mid-Rise.
- Boyce, Shields, and Silcock, Towards the Characterization of Building Occupancy for Fire Safety Engineering: Capabilities of Disabled People Moving Horizontally and on an Incline, Fire Technology, 35, 1, 1999.

2.4.2 Assumptions

Analysis using STEPS is dependent on assumptions about the size and interaction of moving persons; the speed at which people move through different building features, assumptions about the travel speeds of different individuals, and the location of occupants within a building. Grid size used in this STEPS model is of 0.5m which accounts for an average representative size of one human including bounding space. Occupants' characteristics are based on the walking speeds in Table 3. Four groups are used in the simulation: Young,

Middle, Old, and Disabled. The population is split into three character groups equally between Young, Middle, and Old. The Disabled character group is based on a ratio of 1 Disabled to 200 of total population.

Basement level has been left out of the STEPS model as the occupants are correctional officers, police officers, and detained individuals. As stated previously, these occupants will use a separate set of exits than the occupants on Levels 1 through 4. The occupant load in the Basement is 34 excluding detained individuals. Officers will be trained to deal with fire situations as the Basement is a detention facility and will escort detainees per the Fire Safety Management Plan (see Chapter 7).

Hand calculation methods utilize research about walking speeds horizontally and diagonally that have been validated by SFPE.

2.4.3 Limitations

Hand calculations, based on methods outlined in Chapter 4 of the 2009 NFPA Handbook are employed, but are limited as flow rates may not inherently include human behavior. This is where computer modeling has an opportunity to predict RSET times with greater precision by including human behavior.

The computer based evacuation model has been analyzed using STEPS 4.0. Limitations are further developed based on questions in the SFPE Handbook chapter on emergency movement by Nelson and Mowrer found in Appendix E of this report.

2.4.4 Evacuation Hand Calculation Results

Total egress time of 14.92 minutes has been calculated in accordance with the 2009 NFPA Handbook for complete egress in CHP.

Stair and door widths were measured from the architectural floor plans. Effective width is calculated by subtracting 12 inches from the actual witdh in accordance with Chapter 2, Section 4, of the NFPA Handbook. The effective width is then converted to feet. Maximum specific flow is limited per Table 4.2.8 for stairways and doors to 18.5 and 24 persons/minute/feet of effective width, respectively. The calculated flow in persons/minute is the product of effective width and maximum specific flow. “People through exit” is based on the Life Safety Plans (Appendix B). Exit time for each level is the quotient of “people through exit” and

calculated flow. Time for entire building to egress is the product of the number of stories and the time it take to evacuate one level. The limiting time is the maximum time per exit between the stairway and door calculations. See Appendix D of this report for tabulated calculation results.

2.4.5 STEPS Computer Based Egress Results

Results from computer egress modeling using the STEPS program produced an evacuation time of 17 minutes. Figure 2, Figure 3 and Figure 4 are selected screenshots from STEPS depicting the layout of CHP to compare the precise congruence between the STEPS model and the architectural floor plans in Appendix B and Appendix C.

Figure 2: STEPS Model – Level 1 though 4 with Occupants

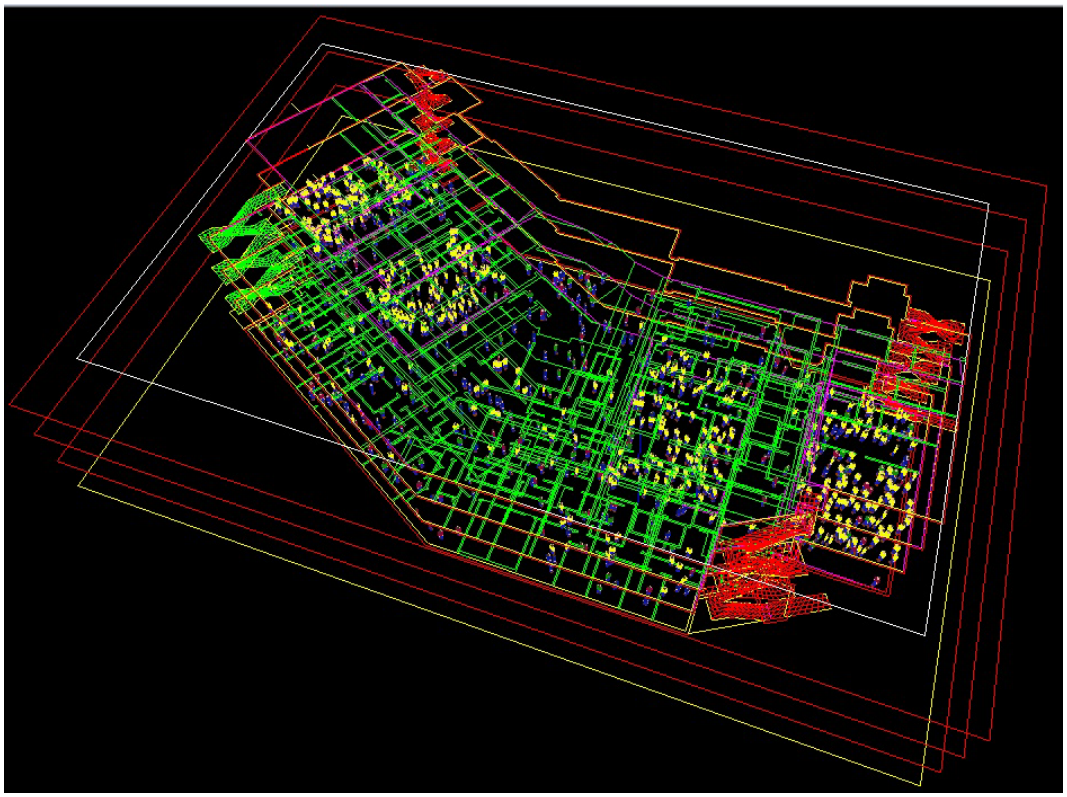


Figure 3: STEPS, Level 1, t=0

Figure 4: STEPS, Level 1, Queuing

2.5 Tenability Performance Criteria

The temperature and visibility tenability limits are proposed to serve as design criteria on which to base the level of safety for the atrium. These tenability limits will be evaluated at a height of 6 feet above the finished floor level. Upper bounds used for temperature and visibility are 140°F and 42 feet, respectively. More detailed information on research and validation of these criteria are developed in Section 6.5 of this report. Chapter 6 discusses the design of the smoke management system that will be installed to keep occupants safe during evacuation.

2.5.1 Methodology

A performance-based option shall meet the goals and objectives of the LSC in accordance with Sections 4.1, 4.2 and 5.2.2. CHP is a structure designed, constructed, and maintained to protect occupants who are not intimate with the initial fire development for the time needed to evacuate, relocate, or defend in place. Design is compliant with Chapters 1 through 5 of the Life Safety Code. The design of CHP endeavors to protect any occupant who is not intimate with ignition to not be exposed to instantaneous or cumulative untenable conditions.

2.6 Summary

Approximate evacuation time is calculated by hand and by computer-based modeling to be 14.92 and 17 minutes, respectively. These values for RSET have been justified throughout Chapter 2. Chapter 6 of this report further develops and validates the design of the smoke management system and provides that ASET is greater than RSET.

3 Fire Alarm and Signaling Systems

Chapter 3 provides the requirements and design of the fire alarm and signaling system for the Court House Project.

3.1 System Description

Although not strictly required by NFPA 72, an in-building fire emergency / voice alarm communication system (EVACS) will be installed in CHP. This system will allow trained staff and emergency personnel to aid in an evacuation whether due to a fire emergency or other issue that may arise in a court building. The authority having jurisdiction over the CHP is not requiring a mass notification system as it has not been adopted due to the lack of knowledge by the AHJ. The ceilings in CHP are all smooth in texture. Detection appliances will not be reduced per Table 17.6.3.5.1 as the listed spacing multiplier is 1.00, begetting a standard coverage area per the manufacturer. For manufacturer data sheets see Appendix J.

3.1.1 Fire Alarm Control Panel

Simplex 4100ES Fire control panel will be installed; model 4100-9111. The initial setup includes:

- 250 addressable points and support TrueAlarm analog
- three 3 amp SLC outputs
- two batteries up to 50 amp-hrs
- 9 amp system power supply/battery charger
- Three NACs

An additional power supply (SPS) has been selected to add:

- 9 amp power supply
- 250 addressable points and support TrueAlarm analog
- Three class A/B NACs

The addition of the SPS provides a total of six NACs while only five NACs are required to handle the amount of devices in CHP.

3.1.2 Initiating Devices

Simplex TrueAlarm Analog Sensors – Photoelectric, Ionization, and Heat has been selected as the addressable initiating device to be used with the 4100ES fire alarm control panel. Heat Sensor 4098-9733 has a fixed temperature setting of 135°F, RTI = quick, and the UL listed spacing is 60 feet by 60 feet. An accompanying sensor base (4098-9791) will be installed with a supervised remote relay (2098-9737). Supervisory current is 270 µA while alarm current is 28 mA, both from 24 VDC supply. The 4098-9733 will be wired with 14 AWG.

It should be noted that the selection of a heat detector is an educational exercise and the most likely design in a professional setting would consist of smoke detectors in the place of heat detectors specified in this report.

Calculation of detector activation requires a numerical value for RTI. Table B.3.2.5 in NFPA 72 notes for heat detectors with a temperature setting of 135°F the RTI values based on a UL listed spacing of 50 feet is 44 and 70 feet is 24. Using interpolation, the RTI value for spacing of 60 feet is 34.

Although the listing is 60 feet by 60 foot, the AHJ wants to stay conservative and follow NFPA 72 for the spacing of Heat detectors at 30 feet by 30 feet leading to approximately 69 devices per floor and a total of 345 heat detectors installed in CHP; totals to be confirmed with shop drawings from the chosen licensed Simplex dealer and licensed fire alarm contractor. See Appendix F for typical floor layout of initiating devices.

The AHJ has also required one manual pull station to be installed near the main entrance. The Simplex addressable manual station (4099-9003) will be installed as directed. This double action, push operation manual pull station will read FIRE ALARM on the housing and read PULL DOWN on the pull lever. This device has been approved and listed with UL, ULC, FM, CSFM, and MEA.

In the atrium, at the Level 4 slab, a horizontal array of reflective beam smoke detectors will be installed (manufacturer: Fire Fight Enterprises Model 50RU). Supervisory current is 4 mA at 24 VDC and alarm current is 15 mA at 24 VDC. Obscuration sensitivity is set to 35% with an operating distance of 15 feet to 150 feet. The maximum horizontal dimension of the atrium is less than 50 feet wide; Model 50RU has the capacity to operate properly in this space.

Fire Dynamics Simulations provided a beam detector activation time of 72 seconds. The beam detector simulated is located at the floor elevation of Level 4 with a line of sight through the smoke plume. The intent of the design to be installed in the building is to provide a horizontal array of 4 beam detectors enabling detection of smoke from a fire initiating at the base of the atrium.

3.1.3 Alarm Notification Devices

Simplex TrueAlert Multi-candela Notification Appliances (4906-9154) will be installed for visual and audio notification including a speaker. This ceiling mounted notification device is white with “FIRE” in red lettering. All speaker wattage tap for the 4906-9154 will be connected via 1 W, outputting 82 dBA at 10 feet. The strobe intensity of model 4906-9154 is selectable as: 15, 30, 75, or 110 candela. Spacing for this speaker/strobe (see Appendix F) follows Table 18.5.4.3.1(b) in NFPA 72:

- 15 cd is spaced with 20 feet by 20 feet coverage
    - Current on alarm is 50 mA on 24 VDC
- 30 cd is spaced with 30 feet by 30 feet coverage
    - Current on alarm is 83 mA on 24 VDC
- 75 cd is spaced with 44 feet by 44 feet coverage
    - Current on alarm is 155 mA on 24 VDC
- 110 cd is spaced with 53 feet by 53 feet coverage, however not used in this building
    - Current on alarm is 211 mA on 24 VDC

It is necessary to install additional speaker appliances between speaker/strobes dependant on spacing. Simplex Multi-application peripherals will be installed, model 4209-9721(CD). These speakers are ceiling mounted in most cases, however some wall mounted speakers may be required in the atrium space. All speaker wattage tap for the 4209-9717(CD) will be connected via 1 W, outputting 85 dBA at 10 feet. Initial spacing will be 25 feet; however, the acoustical consultant will model the audibility and intelligibility of CHP for final spacing requirements.

Notification devices will not be installed in institutional occupancies (I-3 holding areas).

3.2 Fire Alarm Design Fire Scenarios

Three fire scenarios were investigated for detector activation; (1) activation of beam detector from a fire initiating in the base of the atrium, (2) activation of a heat detector in a typical courtroom, and (3) activation of a heat detector on Level 2 adjacent to the atrium.

Beam detector activation is based on data compiled from Fire Dynamics Simulator using a beam detector device that activates at 35% obscuration. Heat detector activation is based on DETACT calculations (tabulated in Appendix G) with an RTI value of 34 aforementioned in Section 3.1.2 of this report. Inputs for DETACT calculations included 70°F ambient temperature, 12 foot ceilings, a response time index of 34, and detector activation of 135°F for both the "typical courtroom" and "Level 2, adjacent to atrium" calculations. The maximum horizontal radius between heat detector and fire location is based on the detector spacing in each scenario.

3.2.1 Base of Atrium

The atrium is four stories tall, slab to slab height is 16 feet (10 feet floor to ceiling and 4 feet of interstitial space for structural and MEP systems). Smoke in the atrium will be detected by the beam detector at the Level 4 slab, 48 feet above the fire surface. Beam detector activation was found to occur at 72 seconds after ignition of Design Fire 1. Further investigation with Fire Dynamics Simulator is developed in Chapter 6 of this report.

3.2.2 Typical Courtroom

The courtrooms in CHP have two heat detectors, where a maximum radius to a detector is approximately 14 feet. Heat detector calculation using DETACT computes detector activation time of 143.8 seconds with a fire size of 970 kW. See Appendix G for tabulated calculation.

3.2.3 Level 2, Adjacent to Atrium

Adjacent to the Atrium on Level 2 the maximum radius to a heat detector is 15 feet. Heat detector calculation using DETACT computes detector activation time of 149.7 seconds with a fire size of 1052 kW. See Appendix G for tabulated calculation.

3.3 Power Requirements

Voltage drop and battery calculations have been performed using Level 1 as a typical floor plan to project the total power requirements in CHP. The battery capacity required (based on NFPA 72, Sections 10.5.6 and 10.5.6.3) is 21.87 amp-hours (tabulated in Appendix H). The 4100ES has 50 amp-hrs of capacity which is adequate and appropriate for the CHP.

The voltage drop calculated for Level 1, as a representative level begets one NAC per floor with three circuits used per NAC for a total current drop of 3.745 V (tabulated in Appendix H).

NAC1-Circuit1

- Total current = 1.459 amps
- Voltage percent = 9.532%
- Voltage drop = 2.288 V
- Voltage at last device = 21.712 V

NAC1-Circuit2

- Total current = 1.271 amps
- Voltage percent = 9.880%
- Voltage drop = 2.371 V
- Voltage at last device = 21.629 V

NAC1-Circuit3

- Total current = 1.015 amps
- Voltage percent = 5.987%
- Voltage drop = 1.437 V
- Voltage at last device = 22.563 V

3.4 Inspection, Testing, and Maintenance

Inspection, testing, and maintenance (ITM) is the responsibility of the property/building/system owner or designated representative per Section 14.2.2, delegation of responsibility must be in writing and to a qualified person in accordance with Section 10.4.3. Prior to system maintenance or testing, the record of completion and any other information required must be provided by the

owner or owner’s representative to the service personnel upon request (per Section 14.2.4).

Once the construction of the CHP has been completed, a Fire Alarm and Emergency Communication System Record must be obtained from the installer. This Record must be completed at the time of system acceptance and approval.

Subsequently per annum, a Fire Alarm and Emergency Communication System Inspection and Testing Form must be completed by the system inspector or tester at the time of the inspection or test.

See Appendix I for Fire Alarm and Emergency Communication System Record Form and Fire Alarm and Emergency Communication System Inspection and Testing Form.

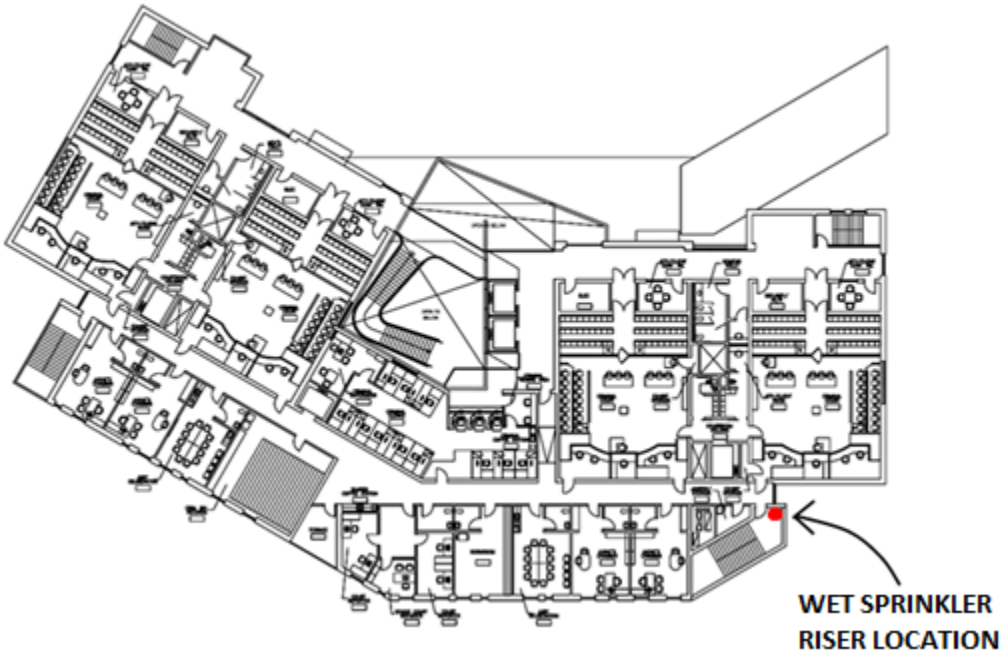
4 Water-based Fire Suppression Systems

Chapter 4 describes the water-based fire suppression approach utilized in the Court House Project.

4.1 System Description

The Court House Project will be a fully sprinklered building with a standard wet automatic fire suppression system including wet sprinklers and standpipes as per NFPA 13 and NFPA 14, respectively. The maximum zone for one sprinkler riser is 52,000 square feet; each level is defined as a separate zone of less than 30,000 square feet. The sprinkler riser location is depicted in Figure 5.

Figure 5: Sprinkler Riser Location



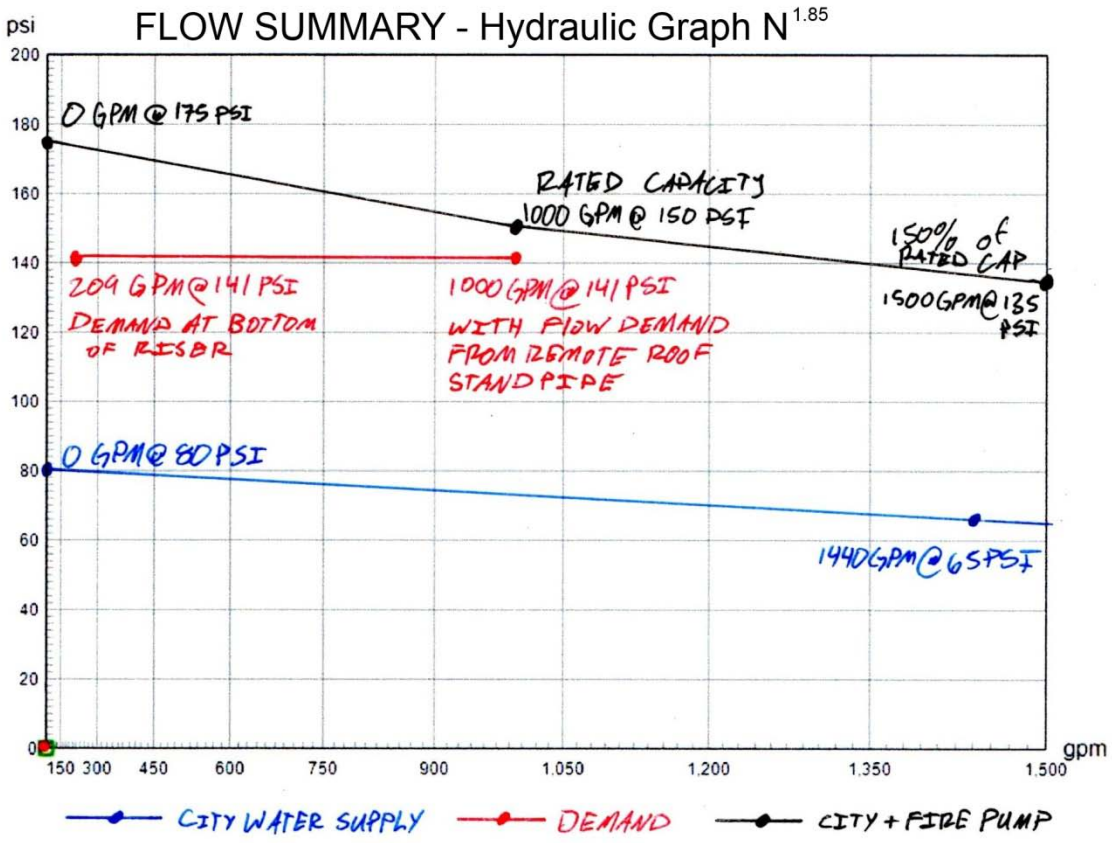
4.2 Water Supply

A flow test adjacent to the CHP has been conducted. The static pressure is 80 psi and the residual pressure is 65 psi at 1,440 GPM. The automatic sprinkler system in the CHP requires a minimum pressure of 140.7 psi at 208.7 GPM. Hydraulic calculations have been preformed for the most remote area on Level 4, see Appendix K.

Each standpipe adds 250 GPM to the demand. There are four standpipes in CHP; one in each of the four smokeproof enclosures. NFPA 14, Section 7.10.1.1.3 states that the total minimum flow shall not exceed 1000 GPM for buildings sprinklered throughout.

The city water pressure will not be sufficient to provide high enough pressures to supply the water suppression system in CHP. A fire pump will be required. The fire pump curve including the city water supply pressure is plotted in Figure 6.

Figure 6: Flow Summary



The fire pump specified for CHP is a diesel-powered motor driven horizontal split-case AC Fire Pump Series 8100. It will provide 1000 GPM by an 8.8 inch impeller. This fire pump is UL and FM approved. Manufacturer's data is in Appendix R. The pump selected is shown by flow line C on the Performance Curve sheet.

4.3 Occupancy Classification

The Court House Project is defined as light hazard occupancy with a minimum coverage area of 1500 square feet and flow density of 0.10 GPM/ft2 when calculating the hydraulically most remote area. Per NFPA 13 Table 8.6.2.2.1(a), the maximum protection area of one sprinkler for a hydraulically calculated noncombustible obstructed and unobstructed building is 225 ft2 (maximum spacing 15 feet x 15 feet). The design area per sprinkler used in the hydraulically remote area is 168 ft2 with dimensions of 12 feet x 14 feet.

The hydraulically most remote area is calculated with 1656 square feet, including 12 fire sprinklers with a design coverage area of 168 square feet per head. Although the required flow density for a design area of 1656 square feet would be less than 0.10 GPM/ft2, this value was used as a more conservative required density to allow for an extra factor of safety.

4.4 System Components

4.4.1 Piping

There will be a 4 inch wet sprinkler riser. Each level will have a riser assembly to facilitate separate sprinkler zones on each level.

See Appendix M for detailed layout and information on the riser, cross mains, and branch lines used to calculate the hydraulically most remote area.

4.4.2 Sprinkler Types

The Reliable Model G4 Concealed Automatic Sprinkler will be installed in spaces with drop ceilings. Further details for this fire sprinkler are located in Section L1 of Appendix L.

The Reliable Model F1FR556 Series Quick Response Standard Spray (upright) sprinkler will be installed in stairwells within CHP. Further details for this fire sprinkler are located in Section L2 of Appendix L.

The Reliable Model XL Quick Response Institutional Sprinkler (INST Pendent) will be installed in all institutional spaces within the basement of the CHP. Further details for this fire sprinkler are located in Section L3 of Appendix L.

4.4.3 Valves

The Reliable Model E3 High Pressure Alarm Check Valve will be installed at each level's riser assembly in the southeast stair of CHP. Further details for this valve are located in Section L4 of Appendix L.

The Croker angle valve will be installed for all standpipe connections in the CHP. Further details on this Class I standpipe connection are located in Section L5 of Appendix L.

4.4.4 Standpipe

The Court House Project is 4 stories above grade. The highest level of occupancy is above 30 feet. The 2010 CBC requires that buildings having a level of occupancy greater than 30 feet or above 3 floors to have a standpipes at the roof. Class I standpipe connections at level landings and standpipes at the roof will be installed using a Crocker Angle Valve as specified in Section L5 of Appendix L.

Standpipes are located in Stair NW, SW, NE, and SE. In accordance with CBC 905.4 Class I standpipes have been allowed to be placed at the level landing.

4.5 Standard of Care

The standard of care for the fire suppression system installed in the CHP will be in accordance with 2011 NFPA 25.

4.5.1 Sprinkler System

The requirements of NFPA 25 shall be explicitly followed as listed below:

- All sprinklers are to be inspected from the floor level annually.
- Sprinkler pipe and fittings shall be inspected annually at each floor level.
- Sprinkler pipe hangers and seismic braces shall be inspected annually at each floor level.
- Gauges on wet pipe sprinkler systems shall be inspected monthly to ensure that they are in good condition and that normal water supply pressure is being maintained.
- Annually, prior to the onset of freezing weather, buildings with wet pipe systems shall be inspected to verify that windows, skylights, doors, ventilators, other openings and closures, blind spaces, unused attics, stair

towers, roof houses, and low spaces under buildings do not expose water-filled sprinkler piping to freezing and to verify that adequate heat [minimum40°F] is available.

- Alarm devices shall be inspected quarterly to verify that they are free of physical damage. The hydraulic nameplate for hydraulically designed systems shall be inspected quarterly to verify that it is attached securely to the sprinkler riser and remains legible.

4.5.2 Standpipe and Hose Systems

The requirements of NFPA 25 shall be explicitly followed as listed below:

- Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.
- Table 6.2.2 shall be used for the inspection, testing, and maintenance of all classes of standpipe and hose systems.
- Where water damage is a possibility, an air test shall be conducted on the system at 25 psi prior to introducing water to the system.
- A flow test shall be conducted every 5 years at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify the water supply still provides the design pressure at the required flow.
- A main drain test shall be performed on all standpipe systems with automatic water supplies in accordance with the requirements of Chapter 13.

4.5.3 Valves, Valve Components, and Trim

The requirements of NFPA 25 shall be explicitly followed as listed below:

- The property owner shall have the manufacturers' literature available to provide specific instructions for inspecting, testing, and maintaining the valves and associated equipment.
- All pertinent personnel, departments, authorities having jurisdiction, or agencies shall be notified that testing or maintenance of the valve and associated alarms is to be conducted.
- Before opening a test or drain valve, it shall be verified that adequate provisions have been made for drainage.
- A main drain test shall be conducted annually at each water-based fire protection system riser to determine whether there has been a change in the condition of the water supply piping and control valves.

- Systems where the sole water supply is through a backflow preventer and/or pressure reducing valves, the main drain test of at least one system downstream of the device shall be conducted on a quarterly basis.
- When there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected if necessary.
- Mechanical water flow devices, including but not limited to water motor gongs, shall be tested quarterly.
- Gauges shall be inspected monthly to verify that they are in good condition and that normal pressure is being maintained.
- Gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge.
- Each control valve shall be operated annually through its full range and returned to its normal position.
- Post indicator valves shall be opened until spring or torsion is felt in the rod, indicating that the rod has not become detached from the valve.
- Valve supervisory switches shall be tested semiannually.
- The operating stems of outside screw and yoke valves shall be lubricated annually.
- The valve then shall be completely closed and reopened to test its operation and distribute the lubricant.
- Alarm valves and system riser check valves shall be externally inspected monthly and shall verify the following:
    - The gauges indicate normal supply water pressure is being maintained.
    - The valve is free of physical damage.
    - All valves are in the appropriate open or closed position.
    - The retarding chamber or alarm drains are not leaking.
- Valves shall be inspected internally every 5 years to verify that all components operate correctly, move freely, and are in good condition.
- Internal components shall be cleaned, repaired, or replaced as necessary in accordance with the manufacturer's instructions.

4.6 Inspection

Inspection for the fire suppression system installed in the CHP will be in accordance with 2011 NFPA 25.

4.6.1 Sprinkler System

Routine inspection will follow these requirements as per NFPA 25 Section 5.2:

Gauges	monthly
Control valves	monthly
Water flow devices	quarterly
Valve supervisory devices	quarterly
Supervisory signal devices	quarterly
Hydraulic nameplate	quarterly
Buildings	annually
Hanger/seismic bracing	annually
Pipe and fittings	annually
Sprinklers	annually
Spare sprinklers	annually
Valves	annually
Obstructions	5 years

4.6.2 Standpipe and Hose Systems

Routine inspection will follow these requirements as per NFPA 25 Section 6.2:

Control valves	monthly
Pressure regulating devices	quarterly
Piping	annually
Hose connections	annually
Cabinet	annually
Hose connections	annually
Hose storage device	annually
Hose nozzle	annually (and after each use)
Also follow NFPA 25 Table 6.2.2	

4.6.3 Valves, Valve Components, and Trim

Routine inspection will follow these requirements as per NFPA 25 Chapter 13:

Control Valves	
Sealed	weekly
Locked	monthly
Tamper switches	monthly
Alarm Valves	
Exterior	monthly

Interior	5 years
Strainers, filters, orifices	5 years
Check Valves	
Interior	5 years
Pressure Reducing and Relief Valves	
Sprinkler systems	annually
Hose connections	annually
Hose racks	annually
Fire Department Connections	
FDC	quarterly

4.7 Testing

Testing for the fire suppression system installed in the CHP will be in accordance with 2011 NFPA 25.

4.7.1 Sprinkler System

Routine testing will follow these requirements as per NFPA 25 Section 5.3:

Water flow devices	quarterly
Valve supervisory devices	semiannually
Supervisory signal devices	semiannually
Main drain	annually
Antifreeze solution	annually
Gauges	5 years
Sprinklers - fast response	20 yrs and every 10 thereafter

4.7.2 Standpipe and Hose Systems

Routine testing will follow these requirements as per NFPA 25 Section 6.3:

Water flow devices	quarterly
Valve supervisory devices	semiannually
Supervisory signal devices	semiannually
Hose storage device	annually
Hose storage device	5 years
Pressure control valve	5 years
Hydrostatic test	5 years
Flow test	5 years
Main drain test	annually

4.7.3 Valves, Valve Components, and Trim

Routine testing will follow these requirements as per NFPA 25 Chapter 13:

Main drains	annually
Water flow alarms	quarterly
Backflow prevention assembly	annually
Control Valves	
Position	annually
Operation	annually
Supervisory	semiannually
Pressure Reducing and Relief Valves	
Sprinkler systems	5 years
Circulation relief	annually
Pressure relief valves	annually
Hose connection	5 years
Hose racks	5 years

4.8 Maintenance

The maintenance requirements for the fire suppression system installed in the CHP will be in accordance with 2011 NFPA 25.

4.8.1 Sprinkler System

Maintenance will follow these requirements as per NFPA 25 Section 5.4:

Valves	annually or as needed
Obstruction investigation	5 years of as needed

4.8.2 Standpipe and Hose Systems

Maintenance will follow these requirements as per NFPA 25 Section 6.4:

Hose connections	annually
Valves	annually
Also follow NFPA 25 Table 6.5.1	

4.8.3 Valves, Valve Components, and Trim

Maintenance will follow this requirement as per NFPA 25 Chapter 13:

Control valves	annually

5 Structural Fire Protection

Chapter 5 discusses requirements pertaining to structural fire protection including fire-resistance-ratings of buildings elements, construction type, and allowable height and area provisions for the Court House Building as required by 2010 CBC.

5.1 Construction Classification

The grade plane, which is the baseline for building height, is at the same elevation as the finished floor of Level 1. Each level in CHP has a slab to slab height of 16 feet; the total building height to the roof is 64 feet. The non-combustible roof structure extends less than 20 feet above the allowable building height in accordance with Section 504.3. CHP is equipped with an approved automatic fire sprinkler, fire alarm and smoke control system in accordance with the CBC. Type IIA construction will be provided in accordance with Table 503.

5.1.1 Occupancy

In accordance with Section 303, the main occupancy of CHP is Assembly Group A-3. The basement level will comply with Section 408 Group I-3, however, Section 408.2 allows that portions of the building with occupancies other than I-3 will meet the applicable requirements associated with that occupancy.

5.1.2 Fire Protection Systems

Fire suppression and life safety systems will be installed in accordance with the CBC and appropriate NFPA standards (see appropriate sections of this report for more detail).

5.1.3 Building Height and Area

CHP has been designed with the following vertical specifications:

- Building height: 64 feet
- Stories above grade plan: 4

The story areas of CHP are approximately as follows:

- Basement: 17,800 square feet
- Level 1: 26,600 square feet
- Level 2: 24,300 square feet
- Level 3: 24,900 square feet
- Level 4: 24,500 square feet
- Total Area: 118,100 square feet

5.1.3.1 Initial Tabular Provisions

Table 503 provides for occupancy Group A-3 in Type IIA construction with the following requirements:

- Maximum height: 55 feet
- Maximum stories: 3
- Maximum story area: 15,500 square feet

CHP will be constructed of noncombustible materials and have an approved automatic fire sprinkler system as required for the forthcoming modifications. The design of the CHP does not fit under the tabulated requirements of Table 503; however, footnote A1, A2 and A3 allow for height and story increases due to frontage and installation of an approved automatic fire sprinkler system.

5.1.3.2 Frontage Increase

Section 506.2 provides requirements and calculations procedure for a frontage increase.

$I_f = [F/P - 0.25]W/30$		Frontage increase equation
F	= 747 feet	Building perimeter fronting public way
P	= 747 feet	Perimeter of entire building
W	= 30 feet	Width of public way
I_f	= 0.75	Area increase due to frontage

5.1.3.3 Building Area Modification

$A_a = \{A_t + [A_t * I_f] + [A_t * I_s]\}$ Area increase equation

A_t = 15,500 square feet Tabular building area (Table 503)

I_f = 0.75 Area increase due to frontage

I_s = 2 Increase factor due to sprinklers

A_a = 58,125 square feet Allowable building area per story

5.1.3.4 Automatic Fire Sprinkler Increase

Section 506.2 provides for an increase of one story and 20 feet in height to the maximum values of Table 503. Increases are permitted in addition to the building area increase in accordance with Section 506.2. Section 506.3 provides a 200% (Is=2) area increase for use in building area modification of buildings with an approved automatic fire sprinkler system.

5.1.3.5 Modified Height and Area

Modifications to Table 503 provide for occupancy Group A-3 in Type IIA to be constructed with the following requirements:

- Maximum height: 75 feet
- Maximum stories: 4
- Maximum story area: 58,125 square feet
- Maximum allowable total area: 174,375 square feet

These provisions allow for a greater height and area for Type IIA than tabulated in Table 503; CHP will be constructed in accordance with Type IIA construction.

5.2 Fire Resistance Requirements

Chapter 6 of the CBC provides the fire resistance requirements associated with types of construction. Specifically, the requirements pertaining to Type IIA construction for CHP are as follows in Table 4:

Table 4: Reference to CBC Table 601

Type IIA Fire-Resistance Rating Requirements for Building Elements	
Primary structural frame	1 hour
Bearing walls (exterior & interior)	1 hour
Nonbearing wall and partitions (exterior)	0 hour[1]
Nonbearing walls and partitions (interior)	0 hour
Floor construction and secondary members	1 hour
Floor constructions and secondary members	1 hour

1. Based on the provisions in Table 602 for a separation distance greater than or equal to 30 feet in Occupancy Group A.

The fire separation distance required for CHP is 30 feet.

5.2.1 Atrium

A four story atrium spans all four levels, however, communicates with Levels 1 and 2, yet is separated from Levels 3 and 4. In accordance with Section 404.6 the extent of the atrium will be separated from adjacent spaces by a 1-hour fire barrier.

5.2.2 Shafts

In accordance with Section 708.4, shaft enclosures will have a fire-resistance-rating of not less than 2-hours where connecting four stories or more, and not less than 1-hour where connecting three or less stories. Where 2-hour fire-resistance-ratings are required they shall be self supporting elements down to the ground. The Level 1 slab will be constructed of 2-hour fire-resistance-rated materials enabling 2-hour shafts to be supported by the Level 1 slab.

Elevators in CHP travel at least four stories, each elevator will be constructed of 2-hour fire-resistance-rated materials and be provided with a roll down smokeguard device in place of an elevator lobby.

5.2.3 Floor/Roof Assemblies

As stated in Section 712.3 the fire-resistance-rating of floor and roof assemblies will not be less than that required by the building type construction as listed in the table above based on the constructions type and Tables 601 and 602. All slabs in the CHP will be minimally constructed of 1-hour fire-resistance-rated reinforced concrete.

As mentioned in Section 5.2.2 of this report, the Level 1 Slab will be constructed of 2-hour fire-resistance-rated materials.

5.2.4 Exterior Walls

In accordance with Section 705, the rating of exterior walls will be rated for exposure to fire from both sides. Opening protections are not required for the CHP per Table 705.8 with a fire separation distance of 30 feet or greater for an unprotected/sprinklered or a protected degree of opening protection. All exterior bearing walls in the CHP will be minimally constructed of 1-hour fire-resistance-rated reinforced concrete.

5.2.5 Penetrations

Penetrations will be constructed in accordance with Section 713 to protect the continuity of membranes, horizontal assemblies and fire-resistance-rated wall assemblies. Through penetrations shall be protected by an approved penetration firestop system, with a minimum positive pressure differential of 0.01 inch of water and shall have an F rating of not less than the required fire-resistance rating of the wall penetrated in accordance with Section 713.3.1.2.

5.2.6 Joints

Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which it is installed as stated in Section 714 for fire-resistant joint systems. All joints in the CHP will be minimally constructed of 1-hour fire-resistance-rated reinforced concrete.

5.2.7 Columns/Beams

Primary and secondary members will be constructed using 1-hour fire-resistance-rated materials as noted in the Type IIA Building Elements Table 4 in this report. The steel in reinforced concrete columns, beams, girders, and trusses will have a minimum insulating thickness of 1½ inches for 1-hour fire-resistance-rated construction. Steel in reinforced concrete joists and tie rods in floor and roof slabs will have a minimum insulating thickness of ¾ inches for 1-hour fire resistance.

The columns and beams supporting the Level 1 slab will be constructed of 2-hour fire-resistance-rated materials so that 2-hour shafts can be supported by the Level 1 slab.

5.2.8 Interior Walls and Partitions

Nonbearing interior walls and partitions not used as part of the atrium enclosure separation discussed previously do not require a fire-resistive-rating as provided in CBC Table 602. Corridors in Group A occupancies with an approved fire sprinkler system may be constructed without a fire-resistance-rating in accordance with Table 1018.1. CHP is not required to have rated interior walls and partitions unless otherwise specified in this report. The majority of the interior walls will be constructed of gypsum wallboard which is inherently fire resistive in nature, however not required.

5.3 Summary

Chapter 5 of this Report discusses the building height and area requirements as modified by the code specifically for the Court House Project. Height and area calculated to a maximum of 75 feet and 58,125 square feet per floor, respectively. The occupancy type and building construction type have been specified as Group A-3 and Type IIA. Fire resistance ratings materials and constructions have been discussed at length. Generally, 1-hour fire-resistance-rating is required.

Special considerations have been made for the Level 1 slab and supporting members of 2-hour fire-resistance-rated materials to provide proper support for 2-hour shafts within the Court House Project building.

6 Rational Analysis

6.1 Introduction

Chapter 6 documents the performance-based fire and life safety engineering analysis that has been conducted for CHP to provide the rational analysis of the smoke control system. This project involves the construction of a new courthouse containing a four story atrium. The building will incorporate a smoke control system that complies with Section 909 of the 2010 CBC. This document describes key assumptions, design criteria, and analysis methodology associated with the performance-based design of the smoke management system serving the facility.

The unique geometry of the atrium creates opportunities and challenges with respect to the implementation of a smoke control system. From a design standpoint, the placement and space allocation for outside supply air will likely present the greatest challenge to the design. Inlet flow velocities will be required to be limited so that air velocity does not produce negative affects to the fire plume dynamics.

This design utilizes the exhaust method in accordance with CBC 909.8. As the CBC has been updated through the triennial adoption cycle, certain prohibited conditions may have changed. Some may confuse the air-flow method with the exhaust method while reviewing the code. The air-flow method prohibits airflow toward the fire not to exceed 200 feet per minute; the exhaust method does not have this prohibition written into code. The airflow will be carefully monitored throughout this analysis however there are not any restriction codified for the exhaust method. Location of natural make-up air sources will take into account the effects of air velocity pertaining to plume dynamics.

6.1.1 Alternate Design

CBC Section 1.8.7 discusses provisions for alternative materials, design and method of construction and equipment. It states:

> The provisions of this code, as adopted by the Department of Housing and Community Development are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, design or method of construction not specifically prescribed by this code. Consideration and approval of alternates shall comply with Section 1.8.7.2 for local building departments and

Section 1.8.7.3 for the Department of Housing and Community Development.

Approval of alternates. The consideration and approval of alternates by a local building department shall comply with the following procedures and limitations:

1. The approval shall be granted on a case-by-case basis.
2. Evidence shall be submitted to substantiate claims that the proposed alternate, in performance, safety and protection of life and health, conforms to, or is at least equivalent to, the standards contained in this code and other rules and regulations promulgated by the Department of Housing and Community Development.
3. The local building department may require tests performed by an approved testing agency at the expense of the owner or owner's agent as proof of compliance.
4. If the proposed alternate is related to accessibility in covered multifamily dwellings or in facilities serving "Covered multifamily dwellings" as defined in Chapter l1A, the proposed alternate must also meet the threshold set for "Equivalent facilitation" as defined in Chapter llA.

This is this provision that permits a performance-based design to be conducted and subsequently reviewed by the Authority Having Jurisdiction for compliance with the intent of the California Building Code.

6.2 Initial calculations

Initial calculations were performed using the methods outlined in NFPA 92B. For the exhaust method, both axisymmetric and balcony spill plume fires were studied. The smoke layer interface is designed to be 32 feet above the finished floor of Level 1, keeping smoke and hot gasses above Level 2.

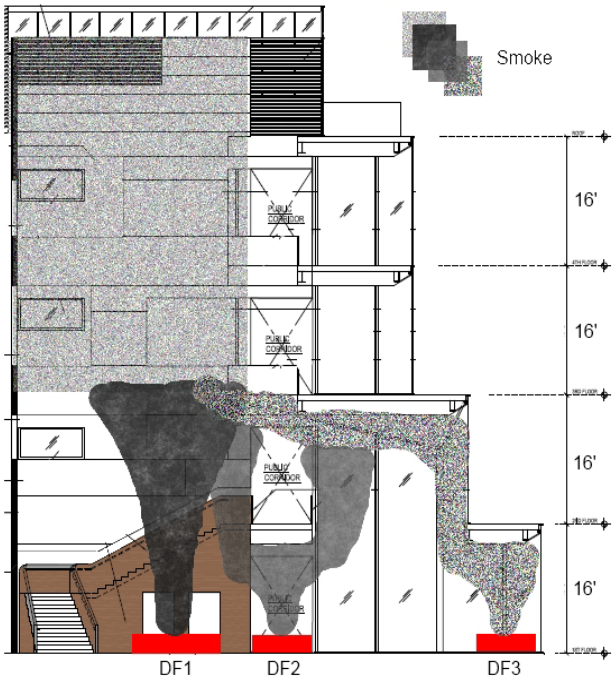
Table 5 details the inputs and results (in bold) from calculations performed in accordance with the exhaust method on NFPA 92B.

Table 5: NFPA 92B Calculation

Axisymmetric	Balcony Spill
Q = 5,000 kW	Q = 1,200 kW
Z = 32 ft	H = 12 ft
Z_L = 13.65 ft	W = 30 ft
	Z_B = 20 ft
Elevation = 0 ft	Elevation = 0 ft
Smoke Temp = 165°F	**Smoke Temp = 80°F**
Exhaust = 114,000 CFM	**Exhaust = 227,000 CFM**

In Figure 7; design fire 1, 2 and 3 are depicted with a cross sectional view of the atrium showing probable smoke growth for each scenario.

Figure 7: Theoretical Smoke Production



6.3 Modeling Approach

The four-story atrium has a beam detector positioned across the opening of the Level 4 slab. Detection of smoke by beam detector, heat by heat sensor, and water flow activates the smoke control system through the fire alarm panel. Upon activation, the horizontal sliding doors separating Levels 3 and 4 from the atrium along with the exhaust fans and modulated natural ventilation openings will begin sequencing.

The beam detector is set to actuate at 35% obscuration. The exhaust fan rate is 100,000 CFM. Modulated natural ventilation occurs at windows on Levels 1 and 2 and the main entrance doors in Level 1.

Sprinkler activation will occur once a frangible bulb (rated at 165°F) has collected enough heat to break. After sprinkler activation, the water flow alarm will activate.

6.3.1 Design Objectives

The fire and life safety strategy promulgated in Chapter 6 of this report is intended to safeguard life, health, property and public welfare for building occupants and fire fighters alike. In the design of CHP, several objectives are directly or indirectly considered with regard to the fire/life safety of the system:

- Fire Prevention - to identify fire risks and to implement policies that will lead to the reduction of these risks.
- Fire Protection - to install suitable systems for the detection and suppression of fires, incorporating active and passive measures to separate smoke and fire from people.
- Fire Planning - to recommend that procedures are developed and enforced to provide for safe evacuation of people and facilitation of fire department operations.
- Fire Fighting - to provide suitable systems to assist the fire department, as well as protect the lives of emergency personnel.

6.3.2 Design Methodology

Where performance-based approaches are used, they follow the guidelines set out in the Society of Fire Protection Engineers document SFPE Engineering Guide to Performance-based Fire Protection Analysis and Design of Buildings.

Except as specifically identified herein, applicable building and fire codes are being followed.

6.4 Design Fire Definition

6.4.1 General

The design fires form the basis upon which the proposed fire strategy and mitigation features were evaluated. The process to develop these scenarios is outlined below:

6.4.2 Fire Sizes

To account for the range of possible design fire scenarios, four design fire locations were identified based upon a review of the architectural floor plans. Please note that The Basement Floor was not considered in the design fire analysis owing to its separation from the First Floor, which serves as the entry floor. The design fires have been identified as follows:

6.4.2.1 Design Fire 1 – First Floor Lobby Adjacent to Stair (Growth and Decay)

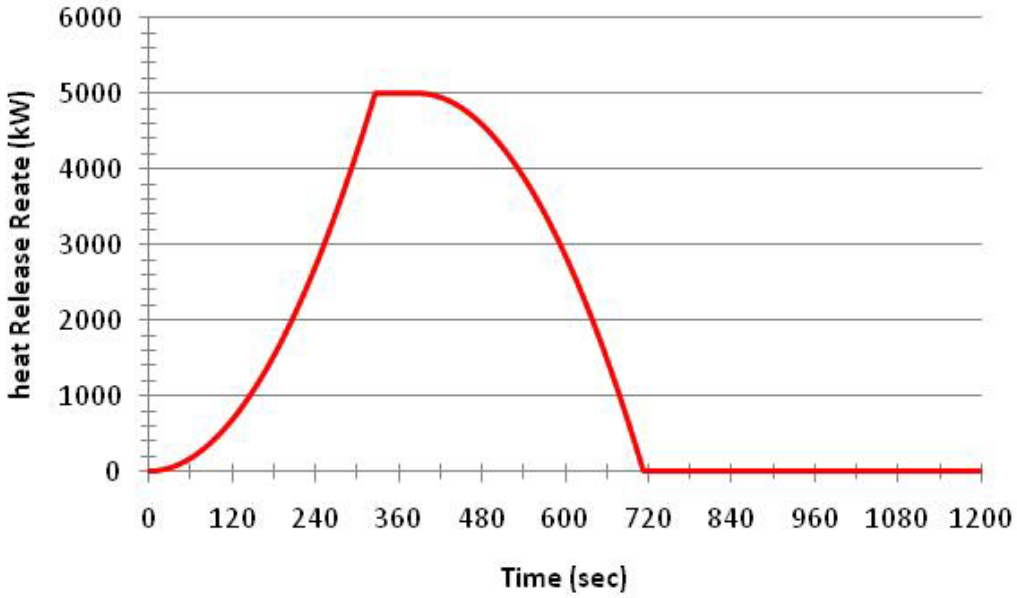
The First Floor is open to the Second Floor at one principal location. As a result of this opening, there is the potential for a balcony spill plume condition to be created from a fire on the First Floor. Design Fire 1 looks at the potential hazard associated with a fire originating on the First Floor in the high-bay. In this area, the maximum floor-to-ceiling height is approximately 79.5 feet, which would result in a fire that would not likely be controlled by automatic fire suppression systems. Alternatively, a fuel-controlled fire of approximately 5,000 kW could result from the light to moderate fuel load located in these spaces. Such a fire would be representative of boxes, several full trash bags, miscellaneous light furniture, or cleaning materials and similar items. This fire size correlates well with peak and sustained heat releases for miscellaneous items documented in sources such as the Appendix to NFPA 92B.

Based on the fact that the spaces are predominantly used for circulation, the assumption of a maximum HRR of 5,000 kW is conservative. To best represent the true behavior of a fuel-controlled lobby fire within the FDS model, this fire will grow in accordance with a fast-growth t^2 fire, until it reaches its maximum, then

remains constant at 5,000 KW for 60 seconds, and then begins to decay over the next 300 seconds.

Figure 8 provides a heat release rate curve for the scenario. The decay condition is considered given that a sustained 5,000 KW would require a significant fuel load that is unlikely to be present in the lobby of a court building.

Figure 8 Heat Release Curve for a Decaying Fire



6.4.2.2 Design Fire 2 – First Floor Below Bridge

Design Fire 2 examines the potential for a sizable fire to develop within the atrium below the bridge located within the center of the space. The fire examined is assumed to be a sprinkler controlled fire, the maximum heat release rate of approximately 1,040 kW being governed by an approximate 12 foot ceiling height below the atrium bridge. Fuel loads would be transient in nature, but are assumed to be a mixture of cellulosic and hydrocarbon materials of a generally non-hazardous and non-toxic nature. Within the FDS model, this fire will grow in accordance with a fast-growth t^2 fire, until it reaches its maximum, at which point the heat release rate would remain constant at the maximum value as a result of sprinkler control. Sprinkler control calculations were performed using the DETACT algorithm and are provided in Appendix P.

6.4.2.3 Design Fire 3 – First Floor Security Screening Queuing

This is a sprinkler-controlled fire on the First Floor near the entrance, connected with the atrium. In consideration of the potential for a high and uncontrolled combustible fuel load within the Security Screening Queuing, a sprinkler controlled transient fire having a maximum HRR of approximately 1040 kW has been studied.

Within the FDS model, this fire will grow in accordance with a fast-growth t^2 fire, until it reaches its maximum, then the heat release rate will remain constant at the maximum value. Sprinkler control calculations were performed using the DETACT algorithm and are provided in Appendix P.

6.4.2.4 Design Fire 4 – Second Floor Elevator Lobby

This fire is located at the elevator lobby connected to the atrium on the Second Floor. Smoke and heat generated as a result of this fire would spill in to the atrium, and spread throughout the adjacent space on the Second Floor. Due to its location below a 12 foot ceiling above, the maximum HRR is controlled via the automatic sprinkler system, reaching approximately 1,040 kW prior to sprinkler activation and subsequent control.

Within the FDS model, this fire will grow in accordance with a fast-growth t^2 fire, until it reaches its maximum, then the heat release rate will remain constant at the maximum value. Sprinkler control calculations were performed using the DETACT algorithm and are provided in Appendix P.

6.4.3 Summary of Design Fire Scenarios

Table 6 provides a summary of the design fire details including fire sizes calculated using DETACT, fire sizes modeled in FDS, and the location of each design fire.

Table 6 Summary of Design Fires

ID	Location	Calculated Fire[1]	FDS Fire
DF1	First Floor Lobby Adjacent to Stair	5,000 kW	5,000 kW
DF2	First Floor Below Bridge	1040 kW[2]	1,200 kW
DF3	First Floor Security Screening/Queuing	1040 kW[2]	1,200 kW
DF4	Second Floor Elevator Lobby	1040 kW[2]	1,200 kW

[1] Fire size at sprinkler activation was based on calculation developed by Heskestad and Delichastios.

[2] The FDS fire size is slightly higher due to the manner in which the fire parameters were entered into the model; which adds an additional factor of safety to the design fires to account for limitations in calculation methods.

Design fire schematics and building sections are provided in Appendix Q.

6.5 Tenability Criteria

The temperature, visibility, radiant flux and CO toxicity tenability limits are proposed to serve as design criteria on which to base the level of safety for an atrium using the performance-based approach. These tenability limits should be evaluated at a height of 6 feet above the finished floor level in accordance with CBC Section 909.8.1 for the smoke layer interface. This height of 6 feet is useful for all criteria as most occupants can keep their head below 6 feet during an emergency situation. Temperature, visibility, and radiant flux are considered, and the life safety strategy is intended to provide tenable conditions for a duration that enables safe evacuation of building occupants. The design criteria are discussed in detail in the following sections.

6.5.1 Temperature

It is necessary to provide evacuating occupants with tenable conditions during the evacuation period. Therefore, a maximum layer temperature must be identified. NFPA 130 – Standard for Fixed Guideway and Passenger Rail Systems suggests thermal burns to the respiratory tract can occur upon inhalation of air above 140ºF (60ºC) that is saturated with water vapor. Therefore, the maximum tenable design temperature is 140ºF (60ºC).

6.5.2 Visibility

Occupants attempting to exit the facility must also be provided with sufficient visibility in order to evacuate. Since most occupants of the building will likely be

only moderately familiar with the building layout and exact location of emergency exits, it is necessary for the smoke management system to provide suitable visibility levels.

As stated in the FDS User's Manual, estimates of visibility through smoke can be made using the equation: S=C/K where C is a non-dimensional constant, K is the light extinct coefficient, and S is the visibility through the smoke. K varies with the density of smoke particulate and a mass specific extinction coefficient. However, C is specified according to the object being viewed through the smoke. For these analyses C is specified as 8 since the exit signs in the building will be the light-emitting type.

As discussed by Jin, in Visibility and Human Behavior in Fire Smoke, proposed allowable smoke visibility that permits safe escape ranges from approximately 4 feet to 66 feet, depending on the nature of the space and the awareness level of the occupants.

Jin's work suggests that an allowable visibility for occupants unfamiliar with their surroundings is 13 meters (42 feet) . However, consideration will be given to areas with less than 42 feet of visibility if the travel distance to an exit in that area is less than 42 feet.

6.5.3 Radiant Flux

In situations where a sustained hot smoke layer has been developed, it is possible that the hot smoke layer can radiate heat down to the evacuating occupants. Consideration is given to this possibility by calculating the upper layer temperature required to impart a critical radiant heat flux upon the occupants.

The CIBSE Guide E – Fire Engineering indicates that a 2.5 kW/m² incident radiant flux upon the skin of an occupant would result in burns with a short exposure and recommends using a lower flux. Another reference, the SFPE Engineering Guide, "Predicting 1st and 2nd Degree Skin Burns from Thermal Radiation" indicates that an incident radiant flux greater than 1.7 kW/m² would cause pain on the exposed skin of an occupant with a prolonged exposure. Based upon these two references, a thermal flux of 2.0 kW/m² was chosen as the design criteria. To provide perspective for this, intense incident radiant flux originating from the sun are approximately 0.6 to 1.0 kW/m².

If smoke temperatures are maintained below (350ºF) 180ºC, the thermal radiation from the hot upper layer to the occupants below will not exceed the tenability criteria.

6.5.4 Carbon Monoxide Dosing

CO concentrations will not specifically be measured for this analysis because previous analyses of similar spaces have shown that visibility is a far more restrictive tenability criterion.

6.6 Results

In order to predict the effect of a fire scenario on the interior environment of CHP, each of the design fire scenarios was simulated using FDS. Of primary interest are the effects of the fire growth and smoke development on the visibility and temperature within the space.

Ventilation conditions were the same for all scenarios and included the following provisions:

- 100,000 cfm of mechanical exhaust located at high level in the atrium.
- 26.5 sf of natural ventilation make-up air opening at the east and west ends of the Second Floor corridor (total of 53 sf).
- 26.5 sf of natural ventilation make-up air opening at the west end of the First Floor corridor.
- 110.9 sf of natural ventilation make-up opening at the main entry doors (two doors @ 7’ 2” wide by 7’ 10” high each)

Inlet air velocities were measured through the natural make-up openings at velocities up to 525 feet per minute. Engineering analysis of the plume dynamics was conducted. Utilizing SmokeView, fire plume dynamics were shown to develop in the same fashion as a naturally growing plume. The openings for make-up air are smaller orifices than the cross sectional area of corridors and open areas in CHP. Incoming velocity subsides as the remainder of the building acts as a much larger orifice reducing velocity as cross sectional area increases.

The walking surfaces of levels 3 and 4 have been separated from the atrium by fire rated construction and fire rated horizontal sliding doors that close upon activation of the fire alarm due to actuation of the beam detector. Actuation of

heat detectors and water flow devices will also activate the fire alarm system subsequently closing the fire rated horizontal sliding doors.

6.6.1 Design Fire 1

The AHJ initially required modeling of a fast-growth t^2 fire with a peak heat release rate of 5,000 kW followed by a steady heat release rate after the peak rate was reached. Given the nature of the building, it is unlikely that a fire load of this magnitude would exist.

Noting that a 5,000 kW fast-growth t^2 fire will have consumed approximately 57.5 pounds of douglas fir wood by the time that it reaches its maximum size then would require approximately 0.5 pounds of wood per second to sustain a steady heat release rate of 5,000 kW.

In order to sustain a 5,000 kW fire, significant amounts of fuel would be required. After discussion about limited fuel in the atrium and the significant amounts of fuel that would be required to sustain the AHJ's initial request, the AHJ agreed that a growth and decay fire would be a more likely fire to represent the fuel load. As agreed upon, this simulation considers the growth of a fire to 5,000 kW, a 60 second steady-state maximum heat release rate and an ensuing decay of the fire due to the consumable fuel within the atrium.

Temperatures and Visibilities remain tenable at egress walking surfaces for the First and Second Floors for the duration of the simulation (evacuation period). The highest temperatures and lowest visibilities were recorded at 463 seconds into the simulation. A rendering of the temperature slice rendered from the FDS simulation at 6 feet above the walking surface on Level 2 is depicted in Figure 9; temperature remains within a tenable range for the extent of the simulation (20 minutes). A rendering of the visibility slice rendered from the FDS simulation at 6 feet above the walking surface on Level 2 is depicted in Figure 10; visibility remains more than 13 meters for the extent of the simulation (20 minutes).

Figure 9: DF1, Level 2 Temperature Slice Rendering

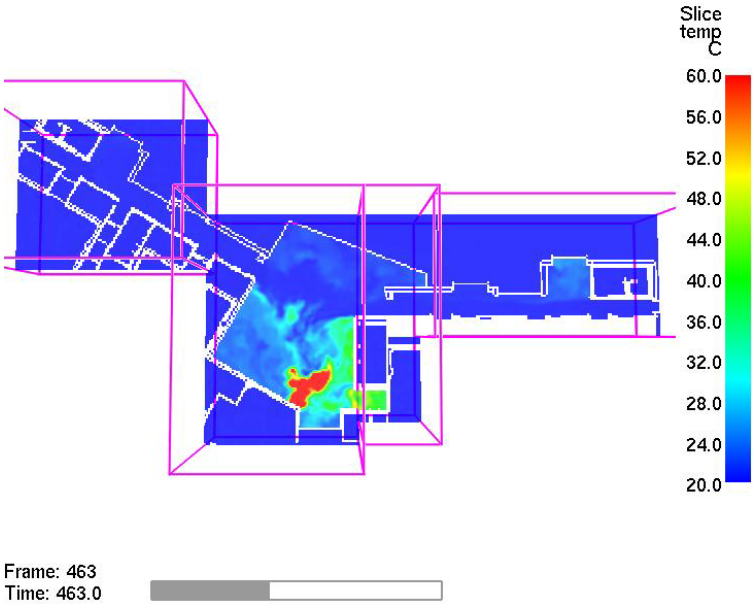


Figure 9 depicts that the walking surfaces on Level 2 remain free and clear from high untenable temperatures. The area colored red is at or above 60°C but is within the atrium opening. The fire plume rises up the through the atrium opening in this location for DF1.

Figure 10: DF1, Level 2 Visibility Slice Rendering

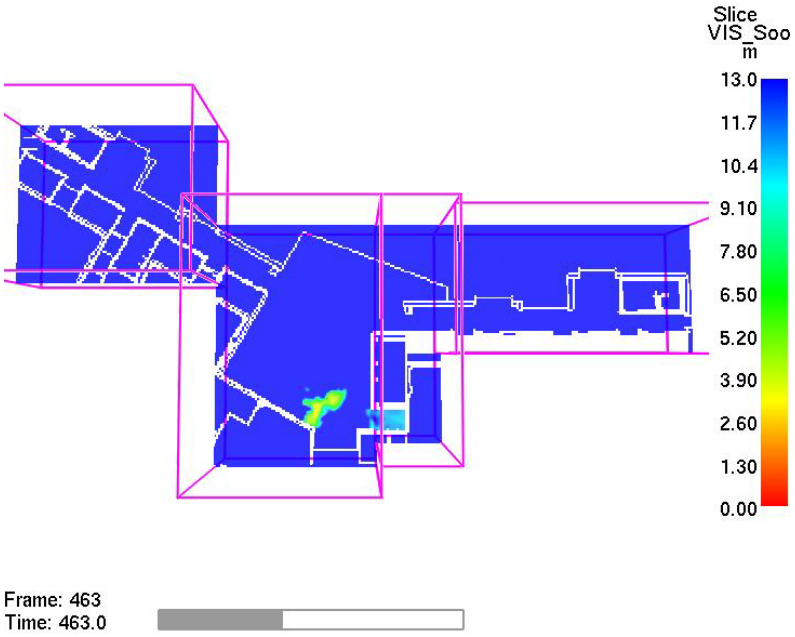
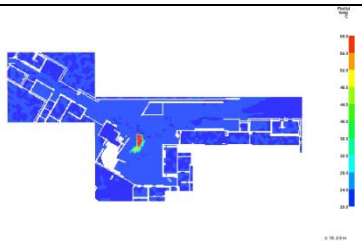
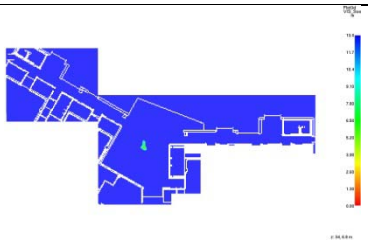
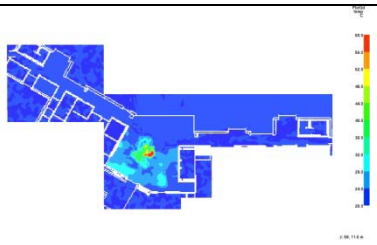
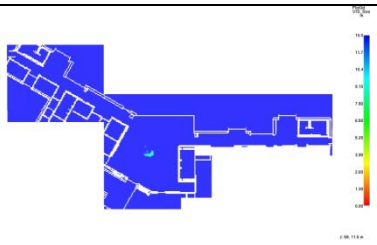
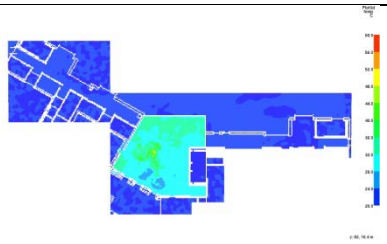
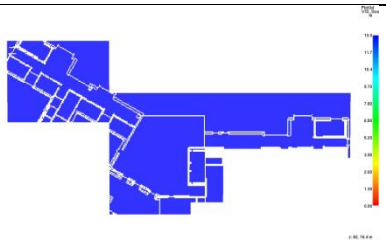


Figure 10 depicts that the walking surfaces on Level 2 remain free and clear from smoke that would stop occupants from seeing at least 13 meters.

6.6.2 Design Fire 2

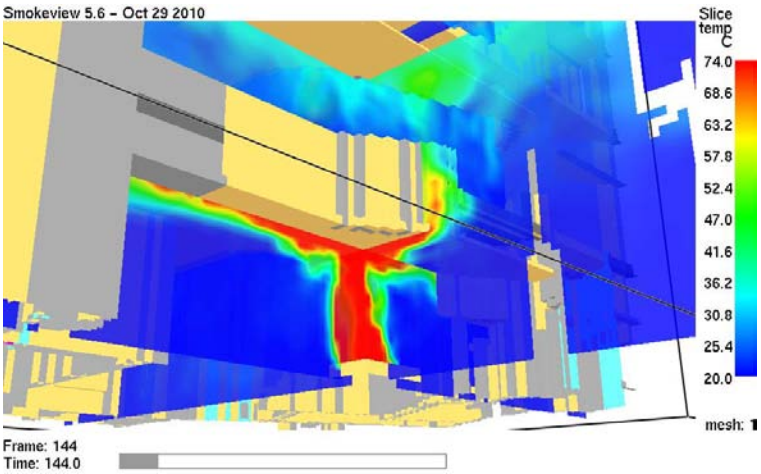
Design Fire 2 was modeled as a 1,200 kW sprinkler-controlled fire on the first floor below the bridge. Figure 11 provides a summary of the results. Both temperature and visibility levels are maintained with tenable limits for the duration of the simulation.

Figure 11 Design Fire 2 Results @ 1200 Seconds

Floor	Temperature	Visibility
First Floor		
Second Floor		
Third Floor		
Fourth Floor		

As the balcony is a much smaller area than a full ceiling, Figure 12 depicts heat collection under the balcony. The balcony provides enough collection area for sprinkler activation to occur (sprinklers rated at 74°C).

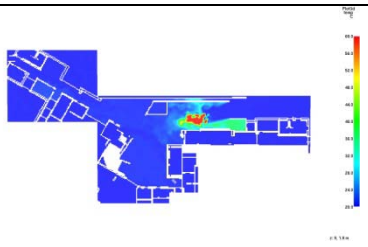
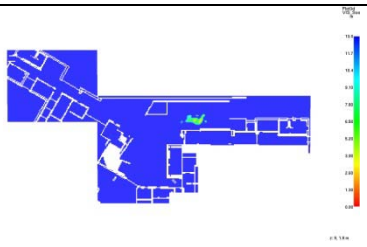
Figure 12: DF2 Temperature Rendering



6.6.3 Design Fire 3

Design Fire 3 was modeled as a 1,200 kW sprinkler-controlled fire on the first floor at the security area. Figure 13 provides a summary of the results. Both temperature and visibility levels are maintained with tenable limits for the duration of the simulation.

Figure 13 Design Fire 3 Results @ 1200 Seconds

Floor	Temperature	Visibility
First Floor		

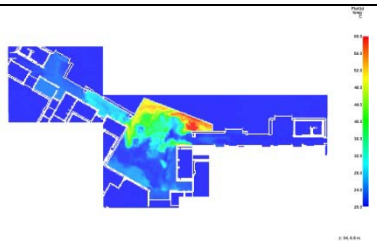
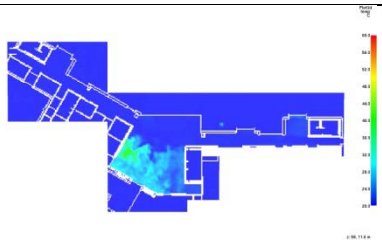
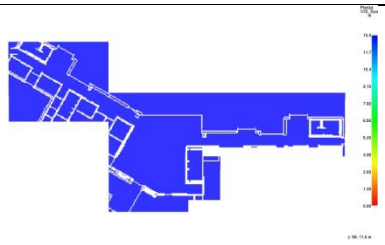
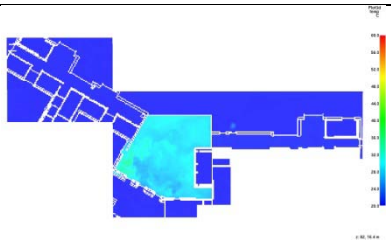
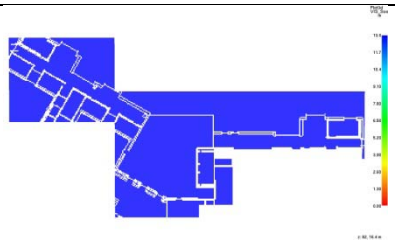
Second Floor		
Third Floor		
Fourth Floor		

Figure 14 depicts the temperatures at 6 feet above each level's walking surface. All areas in the atrium not intimate with the ignition source remain free and clear from high untenable temperatures. The red coloration on Level 1 is the fire source and on Level 2, the red coloration is the plume spilling through the floor opening and into the atrium; these areas are not expected to remain below 60°C.

Figure 14: DF3 Temperature Rendering

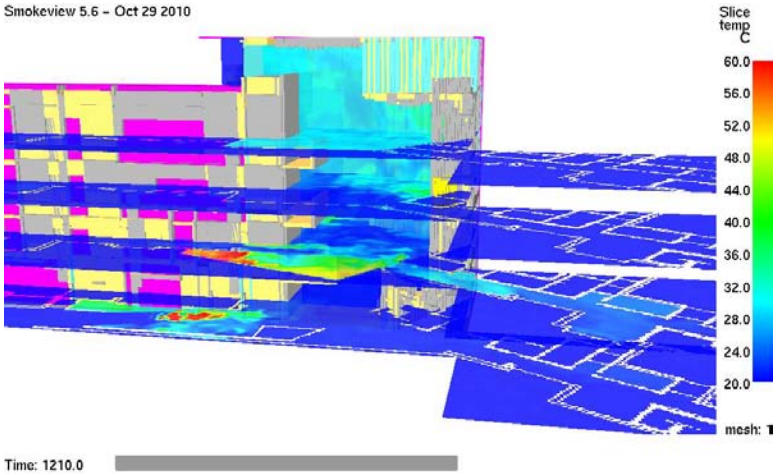
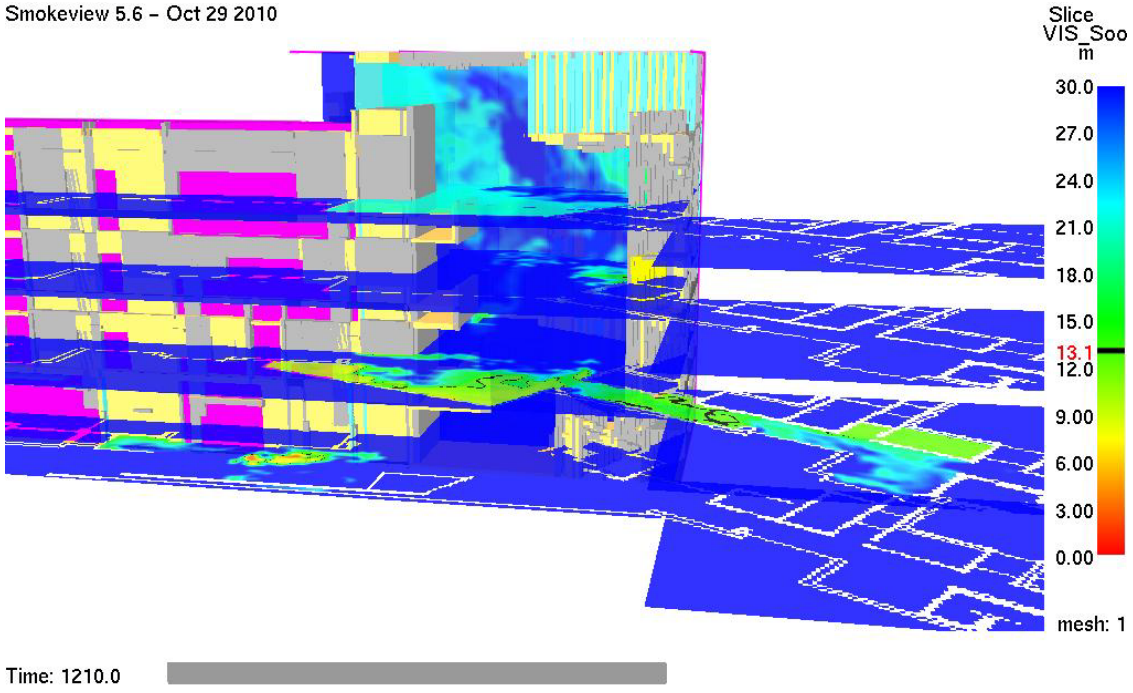


Figure 15 depicts the visibility at 6 feet above each level's walking surface and vertically through the fire surface. Areas in the atrium used for egress are depicted to have smoke densities that provide at least 13 meters of visibility.

It should be noted that the right corridor (as depicted in Figure 15) has a neon green coloration that denotes approximately 15 meters of visibility and a cyan coloration that denotes approximately 22 meters of visibility. Between the neon green and cyan colorations there exists a small pocket of light green coloration bounded by a black outline. This area is 6 feet above the Level 2 walking surface and approximately 4 square feet in area which has degraded to approximately 12 meters of visibility 20 minutes after the fire ignition. This small infringement of the tenability criteria will not decrease the ability of occupants to exit Level 2, by this time; all occupants should have exited the building as the RSET is 17 minutes.

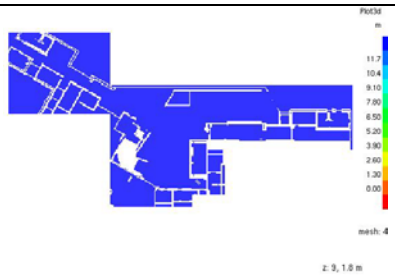
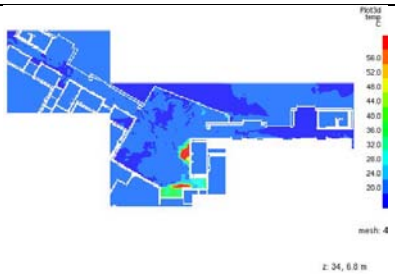
Figure 15: DF3 Visibility Rendering

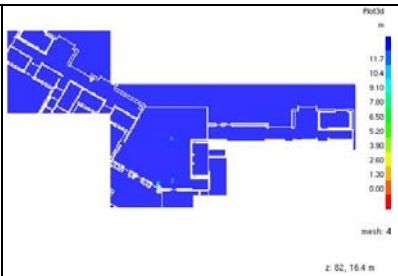


6.6.4 Design Fire 4

Design Fire 4 was modeled as a 1,200 kW sprinkler-controlled fire at the second floor elevator lobby. Figure 16 provides a summary of the results. Both temperature and visibility levels are maintained with tenable limits for the duration of the simulation.

Figure 16 Design Fire 4 Results @ 1200 Seconds

Floor	Temperature	Visibility
First Floor		
Second Floor		
Third Floor		

Fourth Floor		

6.7 Summary

Chapter 6 documents the approach, methodology, key input parameters, tenability criteria and results associated with the Rational Analysis conducted for CHP. The analysis results discussed demonstrate that the proposed smoke control system maintains the level of safety that is intended by the California Building Code as enforced by the Authorities Having Jurisdiction. Fires in the atrium such as 5MW axisymmetric and 1.2MW balcony spill plumes have been simulated. The results conclude that with an exhaust rate of 100,000 cubic feet per minute and automatic natural openings providing make-up air, tenability is maintained for 20 minutes.

7 Fire Safety Management Plan

Chapter 7 provides information pertaining to the fire safety management plan for CHP.

7.1 Fire Safety and Evacuation Plan

Chapter 7 of this report will serve as a fire safety and evacuation plan to be approved by the authority having jurisdiction. The AHJ requested that the 2012 International Fire Code (IFC) be used in place of the 2010 CFC.

7.1.1 Fire Evacuation Plan

In accordance with Section 404.3.1 of the IFC, the following nine points will be included in the Fire Evacuation Plan:

7.1.1.1 Emergency egress or escape routes and whether evacuation of the building is to be complete or, where approved, by selected floors or areas only.

Escape routes for all unrestrained occupants will include a path through rated corridors to one of the four exit stairs which leads to a common way outside the building. Occupants will then meet on the north side of the building.

Restrained occupants will be escorted by police to the holding block in the basement then transported out of the building through Exit B2 and B3 while being kept separate from the general population.

7.1.1.2 Procedure for employees who must remain to operate critical equipment before evacuating.

Trained employees that must remain in the building will ensure that all levels have been cleared of occupants so long as they are not endangering their own lives. These employees will aid the general population toward safe egress directing them to rendezvous on the north side of the building so that the building staff can account for all occupants. Employees will take direction from the local fire department upon arrival.

Police will ensure all restrained occupants not intimate with the fire are kept safe from harm.

7.1.1.3 Procedure for assisted rescue for persons unable to use the general means of egress unassisted.

Stair SE and NW have space on the level landing for use as an area of refuge. The fire department will check all stairs for occupants that are unable to use stairs or have been injured in the event and have found refuge in an exit stair.

Police will lead restrained occupants as noted in Section 7.1.1.1.

7.1.1.4 Procedure for accounting for employees and occupants after evacuation has been completed.

The security check in keeps record of all occupants entering and exiting the building, this list will be used to account for employees and occupants after evacuation on the north side of the building.

7.1.1.5 Identification and assignment of personnel responsible for rescue or emergency medical aid.

Personnel responsible for rescue and emergency medical aid will be identified as first responders and be trained as such by a qualified trainers. These first responders will communicate with the local fire department and paramedics what the situation is and where the emergency has taken place within the building along with injuries and known occupants that need rescue assistance.

7.1.1.6 The preferred and any alternative means of notifying occupants of a fire or emergency.

The fire alarm system installed in CHP is an in-building fire emergency / voice alarm communication system (EVACS). The temporal three alarm will sound followed by voice communication to occupants on each floor with instructions for escape. The EVACS allows trained staff and emergency personnel to communicate different messages to separate floors.

7.1.1.7 The preferred and any alternative means of reporting fires and other emergencies to the fire department or designated emergency response organization.

The fire alarm control panel (FACP) will automatically alert the fire department when the system goes into alarm and supervisory signals will not be transmitted to the fire department.

7.1.1.8 Identification and assignment of personnel who can be contacted for further information or explanation of duties under the plan.

The building engineer and their staff will be trained and knowledgeable of the duties of this plan as well as trained building first responders.

7.1.1.9 A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where provided.

The alert tone for fire will be the temporal three, emitting a whoop-whoop-whoop sound. A message for fire emergencies will be preprogrammed and recorded for each floor as, “there is a fire on floor 1 (2, 3 or 4), please stay calm and proceed to the nearest exit stair, located at the end of each corridor on each of the four corners of the building. Please follow directions given by building staff.” Trained staff and the fire department may choose to override this message at the fire alarm control panel with specific instruction.

Once staff reaches the FACP they may choose to override the preprogrammed message should the building loose structural integrity due to explosions or other events that reduce the strength of the structure.

7.1.2 Fire Safety Plan

Fires and other emergencies will be reported to local fire department and law enforcement officers from the FACP as well as back up notification from the building engineer. All occupants will be evacuated based on the aforementioned Fire Evacuation Plan. There are no major fire hazards associated with normal use and occupancy of the premises. The building engineer will be responsible for maintenance of systems and equipment installed to control and prevent fire. Additionally, the building engineer is responsible for proper maintenance,

housekeeping and controlling fuel hazard sources in the building and outside of the building for a perimeter that is not less than 50 feet perpendicular to all exterior walls.

A site plan including the occupant assembly point, the location of fire hydrants, and the normal route for fire department vehicle access can be found in Appendix N of this report. Floor plans of each floor Basement – Level 4 can be found in Appendix O that identify the locations of exits, primary and secondary evacuation routes, areas of refuge, manual fire alarm boxes, portable fire extinguishers, occupant-use hose stations, and the fire alarm control panel.

7.1.3 Lockdown Plan

In the holding cell portion of the Basement lockdown will occur when the fire alarm control panel goes into alarm. Once initiated, the operator in the Sheriff Central Control Room will be notified and shall be accountable for the procedures of the lockdown followed by delayed evacuation. If emergency event is a false alarm or has been contained before egress has begun the operator will notify law enforcement officer of the end of lockdown and can commence normal operations. The communication between the Sheriff Central Control room and the FACP will have two-hour fire-resistance-rated cabling enabling two-way communication to continue normal operations during an emergency event.

Lockdown will not occur for the general population of un-restrained occupants within the building.

7.1.3.1 Training

Training will occur once every three months for employees that work in the Basement holding area (training will occur during each shift). Lockdown and evacuation drills cannot be substituted for regular training.

Employees shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment. Training of new staff shall be provided promptly upon entrance on duty. Refresher training shall be provided at least annually.

Group I-3 occupancies shall be provided with 24-hour staffing. Staff shall be within three floors or 300 feet (91 440 mm) horizontal distance of the access door

of each resident area. All locks are unlocked remotely and automatically in accordance with Section 408.4 of the International Fire Code.

Keys necessary for unlocking doors installed in the means of egress shall be individually identifiable by both touch and sight.

7.1.4 Availability

A copy of Chapter 7 from this report shall be kept in the FACP cabinet and in the building engineer's office.

7.2 Emergency Evacuation Drills

Emergency evacuation drills will be completed quarterly for all employees in the building that are normally working in Group A occupancies (the IFC requires that Group B occupancies are drilled annually, however this Fire Safety Management Plan include a more rigorous schedule). It is the responsibility of the building engineer to coordinate and initiate emergency evacuation drills.

7.2.1 Evacuation Records

Records shall be maintained of required emergency evacuation drills and include the following information:

- Identity of the person conducting the drill
- Date and time of the drill
- Notification method used
- Staff members on duty and participating
- Number of occupants evacuated
- Special conditions simulated
- Problems encountered
- Weather conditions when occupants were evacuated
- Time required to accomplish complete evacuation

7.2.2 Notification, Initiation , and Accountability

The fire code official will be notified prior to all scheduled drills and given an official copy of the evacuation records. Once building occupants have arrived the occupant assembly point, the building engineer will use the security check-in/out record supplied by building security to account for all employees. The building

engineer will announce when the drill has been completed and occupants will be allowed to return to their offices.

Should an evacuation drill be cancelled before occupants reach the occupant assembly point, the EVACS system will be used to announce, “This has been a test of the emergency evacuation system. You are not in danger. Please return to your offices. There is no need to evacuate.”

7.3 Employee Training and Response Procedures

Employees will be trained in fire prevention, evacuation, and fire safety as required by this report, focusing on the following key points:

- Employees shall be apprised of the fire hazards of the materials and processes to which they are exposed. Each employee shall be instructed in the proper procedures for preventing fires in the conduct of their assigned duties.
- Employees shall be familiarized with the fire alarm and evacuation signals, their assigned duties in the event of an alarm or emergency, evacuation routes, areas of refuge, exterior assembly areas, and procedures for evacuation.
- Where a facility has a lockdown plan, employees shall be trained on their assigned duties and procedures in the event of an emergency lockdown.
- Employees assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers or other manual fire-fighting equipment and the protective clothing or equipment required for its safe and proper use.

Conclusion

This Fire Protection Report has documented the prescriptive and performance-based design solutions utilized for code compliant fire protection and life safety systems in the Court House Project. Occupants will be able to safely exit the building in the event of fire with a greater ASET than REST, ASET 20 minutes, RSET 17 minutes. To assist occupants in safe egress from the building an in-building fire emergency / voice alarm communication system has been specified in accordance with NFPA 72.

The Court House Project will be a fully sprinklered building with a standard wet automatic fire suppression system including wet sprinklers and standpipes in accordance with NFPA 13 and NFPA 14, respectively. This system will be interconnected with the fire alarm system.

The occupancy type and building construction type have been specified as Group A-3 and Type IIA. Fire resistance ratings materials and constructions are generally 1-hour fire-resistance-rating, however, special considerations have been made to support members of 2-hour fire-resistance-rated materials in the Court House Project building.

Furthermore, this report demonstrates that the proposed smoke control system maintains the level of safety that is intended by the California Building Code as enforced by the Authorities Having Jurisdiction. This system will be connected to the other life safety and fire protection systems through the fire alarm control panel and smoke control panel.

A fire safety and evacuation plan have been provided to assist in the overall protection of occupants by educating staff with set reactions during an emergency event

The Court House Project is designed in accordance with the 2010 California Building Code and industry accepted best practices in fire protection engineering and life safety methodologies.

Appendix A

Occupant Load and Capacity

A1 Occupant Load

Basment Occupant Loads				
Room Name	**Use**	**Area (ft^2)**	**OLF (ft^2)**	**Occ Load**
RECORDS SUPERVISOR	OFFICE	160	100	2
RECORDS DIVISION	STORAGE	955	300	4
BUILDING STORAGE	STORAGE	186	300	1
BUILDING MAINT / AGS	STORAGE	231	300	1
ATTORNEY CLIENT RM	OFFICE	32	100	1
ATTORNEY CLIENT RM	OFFICE	32	100	1
SHERIFF SERGEANT	OFFICE	120	100	2
SHERIFF DEPUTIES	OFFICE	601	100	7
MENS LOCKER RM	LOCKER	117	50	3
WOMENS LOCKER RM	LOCKER	97	50	2
ARMORY / WPNS STORAGE	STORAGE	102	300	1
SHERIFF CENTAL CONTROL	OFFICE	255	100	3
ELECTRICAL ROOM	MEP	352	300	2
MDF	MEP	234	300	1
OFFICER WAITING	OFFICE	182	100	2
AOC MAINTENANCE	MEP	288	300	1
				34

Level 1 Occupant Loads				
Room Name	**Use**	**Area (ft^2)**	**OLF (ft^2)**	**Occ Load**
SECURITY/AV/IT	MEP	122	300	1
TRAFFIC COURT	Assembly-unconcentrated	1656	15	111
SCREENING ROOM	Office	36	100	1
JUDGES CHAMFBER	Office	348	100	4
JURY DELIBERATION	Assembly-unconcentrated	348	15	24
ELECTRICAL	MEP	79	300	1
RECORD STORAGE	Storage	220	300	1
TRAFFIC FILE/VIEWING	Office	81	100	1
TRAFFIC DIVISON	Office	1332	100	14
TRAFFIC SUPERVISOR	Office	173	100	2
IT STAGING	MEP	105	300	1
SERVER ROOM	MEP	154	300	1
ADMIN-EXEC IT DIRECTOR	Office	145	100	2
CENTRAL STORAGE/RECEIVING	Storage	499	300	2
MAILROOM	Office	326	100	4
EMPLOYEE ENT/EXIT	Office	459	100	5
JANITOR STORAGE	Storage	27	300	1
SELF-HELP	Office	951	100	10
RUNNING BOXES	Storage	88	300	1
PARALEGAL COPY AREA	Office	99	100	1
HR DIRECTOR	Office	204	100	3
HR WAITING ROOM	Office	112	100	2
HR ANALYST	Office	160	100	2
HR WORK AREA	Office	120	100	2
ELECTRICAL	MEP	80	300	1
JURY MAGMT WORKROOM	Office	114	100	2
CLERKS	Office	993	100	10
FAMILY CT WAITING AREA	Office	93	100	1
FAMILY CT WAITING AREA	Office	290	100	3
WORKROOM	Office	153	100	2
FAMILY COURT DIRECTOR	Office	237	100	3
FAMILY COURT MEDIATOR	Office	152	100	2
FAMILY COURT MEDIATOR	Office	153	100	2
FAMILY COURT MEDIATOR	Office	153	100	2
FAMILY COURT MEDIATOR	Office	153	100	2
PROB COURT INVESTIGATOR	Office	120	100	2
CHILDRENS WAITING	Assembly-unconcentrated	209	15	14
JURY MGMT FILE STORAGE	Storage	156	300	1
JURY MGMT SUPERVISOR	Office	160	100	2
JURY STORAGE/SUPPLY	Storage	24	300	1
JUROR ASSEMBLY SEATING	Assembly-unconcentrated	2532	15	169
GUN LOCKER	Storage	43	300	1
SECURITY/AV/IT	MEP	146	300	1
				418

Level 2 Occupant Loads				
Room Name	**Use**	**Area (ft^2)**	**OLF (ft^2)**	**Occ Load**
ATTY/CLIENT CONF ROOM	Assembly-unconcentrated	104	15	7
SECURITY/AV/IT	MEP	112	300	1
CRIMINAL COURT	Assembly-unconcentrated	1656	15	111
VIEWING	OFFICE	36	100	1
ELEC	MEP	112	300	1
ATTY/CLIENT CONF ROOM	Assembly-unconcentrated	112	15	8
CRIMINAL COURT	Assembly-unconcentrated	1656	15	111
CRIMINAL SUPERVISOR	OFFICE	198	100	2
CRIMINAL CLERKS	OFFICE	1133	100	12
CRIMINAL VIEWING AREA	OFFICE	81	100	1
ELEC	MEP	112	300	1
ATTY/CLIENT CONF ROOM	Assembly-unconcentrated	112	15	8
CRIMINAL COURT	Assembly-unconcentrated	1656	15	111
VIEWING	OFFICE	36	100	1
SECURITY/AV/IT	MEP	112	300	1
ATTY/CLIENT CONF ROOM	Assembly-unconcentrated	112	15	8
CRIMINAL COURT	Assembly-unconcentrated	1656	15	111
JUDGES CHAMBER	OFFICE	348	100	4
JUDGES CHAMBER	OFFICE	348	100	4
JURY DELIBERATION	Assembly-unconcentrated	348	15	24
CRIM. DIV. RECORDS	STORAGE	680	300	3
TERRACE	Assembly-unconcentrated	152	15	11
COURT REPORTER	OFFICE	167	100	2
SENIOR COURT REPORTER	OFFICE	116	100	2
COURT REPORTER	OFFICE	178	100	2
WORKROOM	OFFICE	348	100	4
JURY DELIBERATION	Assembly-unconcentrated	348	15	24
JUDGES CHAMBER	OFFICE	348	100	4
JUDGES CHAMBER	OFFICE	349	100	4
JANITOR / STORAGE	STORAGE	56	300	1
				585

Level 3 Occupant Loads				
Room Name	**Use**	**Area (ft^2)**	**OLF (ft^2)**	**Occ Load**
ATTY / CLIENT CONF RM	Assembly-unconcentrated	104	15	7
SECURITY / AV / IT	MEP	112	300	1
SHARED COURT	Assembly-unconcentrated	1656	15	111
VIEWING	OFFICE	36	100	1
ELEC	MEP	84	300	1
INTERPRETERS	OFFICE	489	100	5
INTERPRETER COORD.	OFFICE	150	100	2
ADMIN-EXEC	OFFICE	108	100	2
ADMIN-EXEC	OFFICE	108	100	2
ADMIN-FINANCE	OFFICE	121	100	2
ADMIN-FINANCE	OFFICE	121	100	2
ADMIN FINANCE CFO	OFFICE	154	100	2
FINANCIAL FILES	STORAGE	193	300	1
LOWER TERRACE	Assembly-unconcentrated	522	15	35
MULTI-PURPOSE CONF RM	Assembly-unconcentrated	995	15	67
ELEC	MEP	75	300	1
JURY DIV CLERKS	OFFICE	1268	100	13
JUV DIV VIEWING AREA	OFFICE	100	100	1
VIEWING	OFFICE	36	100	1
JUV DIV SUPERVISER	OFFICE	173	100	2
JUV DIV WORK ROOM	OFFICE	144	100	2
SECURITY / AV / IT	MEP	112	300	1
ATTY / CLIENT CONF RM	Assembly-unconcentrated	112	15	8
JUVENILE COURT	Assembly-unconcentrated	1656	15	111
JUDGES CHAMBER	OFFICE	348	100	4
WORKROOM	OFFICE	348	100	4
JUDGES LIB / CONF RM	Assembly-unconcentrated	412	15	28
ADMIN-EXEC CEO	OFFICE	312	100	4
RECEPTION / WORK AREA	OFFICE	405	100	5
COPY / FILE	OFFICE	155	100	2
ADMIN-EXEC ASST CEO	OFFICE	229	100	3
FILE AREA	STORAGE	388	300	2
CT REPORTER SUPER	OFFICE	154	100	2
COURT REPORTER	OFFICE	143	100	2
COURT REPORTER	OFFICE	143	100	2
COURT REPORTER	OFFICE	141	100	2
JUV DIV FILE STORAGE	STORAGE	744	300	3
JUDGES CHAMBER	OFFICE	348	100	4
JANITOR STORAGE	STORAGE	56	300	1
				449

Level 4 Occupant Loads				
Room Name	**Use**	**Area (ft^2)**	**OLF (ft^2)**	**Occ Load**
ATTY / CLIENT CONF RM	Assembly-unconcentrated	104	15	7
SECURITY / AV / IT	MEP	112	300	1
FAMILY COURT	Assembly-unconcentrated	1656	15	111
VIEWING	OFFICE	36	100	1
ELEC	MEP	112	300	1
ATTY / CLIENT CONF RM	Assembly-unconcentrated	112	15	8
CIVIL COURT	Assembly-unconcentrated	1656	15	111
TERRACE	Assembly-unconcentrated	436	15	30
BREAK ROOM	Assembly-unconcentrated	433	15	29
WORKROOM	OFFICE	120	100	2
CIVIL VIEWING AREA	OFFICE	80	100	1
ELEC	MEP	80	300	1
CIVIL CLERKS	OFFICE	1556	100	16
CIVIL SUPERVISOR	OFFICE	201	100	3
VIEWING	OFFICE	36	100	1
SECURITY / AV / IT	MEP	112	300	1
ATTY / CLIENT CONF RM	Assembly-unconcentrated	112	15	8
CIVIL COURT	Assembly-unconcentrated	1656	15	111
JUDGES CHAMBER	OFFICE	348	100	4
JUDGES CHAMBER	OFFICE	348	100	4
JURY DELIBERATION	Assembly-unconcentrated	348	15	24
LACTATION ROOM	OFFICE	80	100	1
COURT SVCS SUPPLY / FILE	STORAGE	117	300	1
COURT SVCS CLERKS	OFFICE	1057	100	11
COURT SVCS VAULT	STORAGE	169	300	1
COURT SVCS SUPERVISER	OFFICE	193	100	2
RESEATCH ATTORNEY	OFFICE	230	100	3
CIVIL DIV FILE STORAGE	STORAGE	474	300	2
JURY DELIBERATION	Assembly-unconcentrated	348	15	24
JUDGES CHAMBER	OFFICE	349	100	4
JANITOR / STORAGE	STORAGE	56	300	1
				525

A2 Capacities

BASEMENT	Stair			Door				
ID	Width (in.)	Factor	Capacity	Width (in.)	Factor	Capacity	Limit Capacity	Actual Usage
EXIT SW	60	0.3	200	36	0.2	180	180	2
EXIT BSE	60	0.3	200	36	0.2	180	180	0
EXIT B1	NA	0.3	NA	36	0.2	180	180	4
EXIT B2	NA	0.3	NA	36	0.2	180	180	0
EXIT B3	NA	0.3	NA	36	0.2	180	180	0
EXIT B5	48	0.3	160	36	0.2	180	160	28
TOTAL							1060	34

FIRST FLOOR	Stair			Door				
ID	Width (in.)	Factor	Capacity	Width (in.)	Factor	Capacity	Limit Capacity	Actual Usage
EXIT NW	51	0.3	170	36	0.2	180	170	60
EXIT SW	60	0.3	200	36	0.2	180	180	103
EXIT 3	NA	0.3	NA	72	0.2	360	360	83
EXIT 4	NA	0.3	NA	36	0.2	180	180	0
EXIT SE	60	0.3	200	36	0.2	180	180	84
EXIT BSE	60	0.3	200	36	0.2	180	180	0
EXIT NE	51	0.3	170	36	0.2	180	170	0
EXIT 7	NA	0.3	NA	144	0.2	720	720	88
TOTAL							2140	418

SECOND FLOOR	Stair			Door				
ID	Width (in.)	Factor	Capacity	Width (in.)	Factor	Capacity	Limit Capacity	Actual Usage
EXIT NW	51	0.3	170	36	0.2	180	170	129
EXIT SW	60	0.3	200	36	0.2	180	180	146
EXIT NE	51	0.3	170	36	0.2	180	170	131
EXIT SE	60	0.3	200	36	0.2	180	180	179
TOTAL							700	585

THIRD FLOOR	Stair			Door				
ID	Width (in.)	Factor	Capacity	Width (in.)	Factor	Capacity	Limit Capacity	Actual Usage
EXIT NW	51	0.3	170	36	0.2	180	170	77
EXIT SW	60	0.3	200	36	0.2	180	180	180
EXIT NE	51	0.3	170	36	0.2	180	170	68
EXIT SE	60	0.3	200	36	0.2	180	180	124
TOTAL							700	449

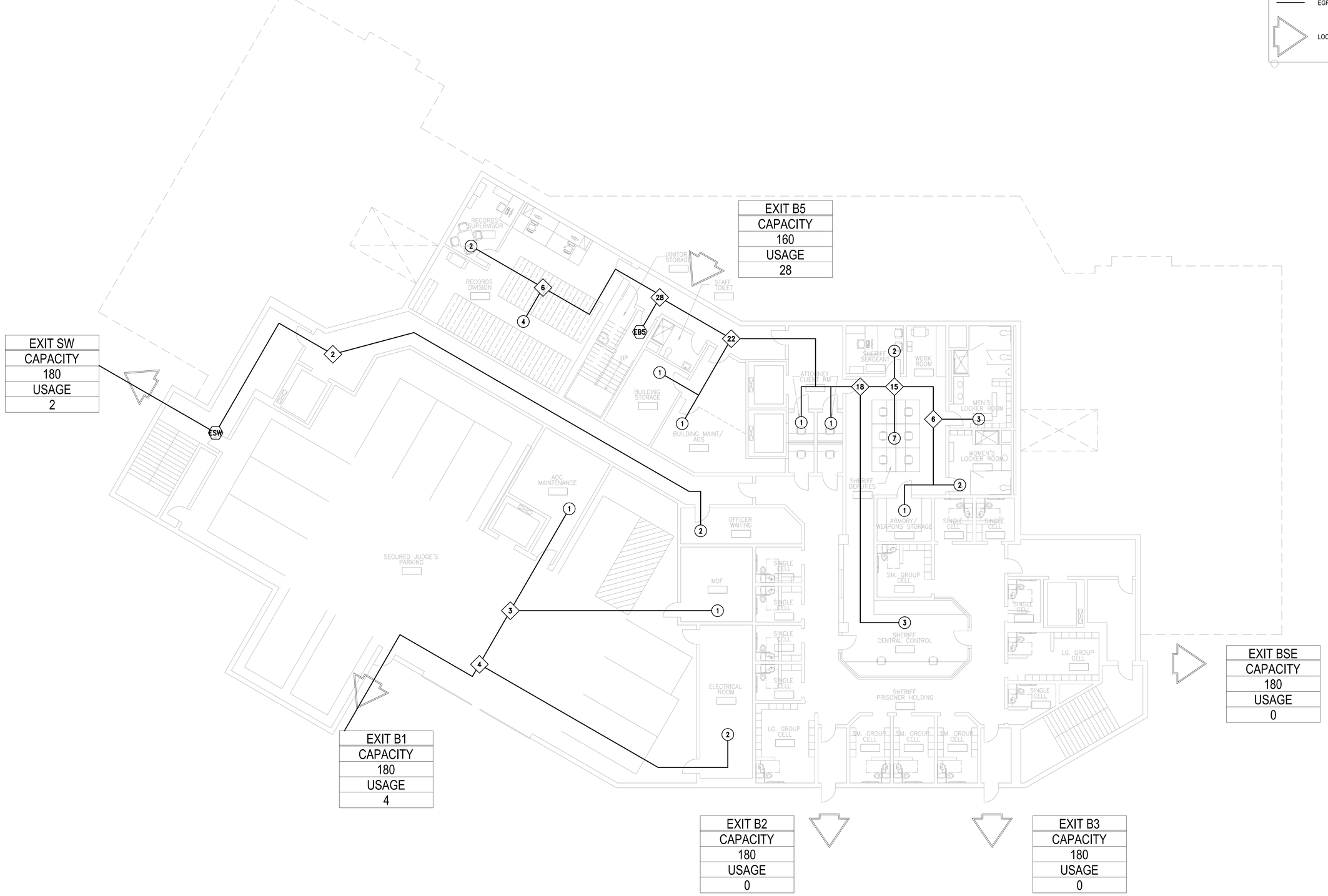
FORTH FLOOR	Stair			Door				
ID	Width (in.)	Factor	Capacity	Width (in.)	Factor	Capacity	Limit Capacity	Actual Usage
EXIT NW	51	0.3	170	36	0.2	180	170	130
EXIT SW	60	0.3	200	36	0.2	180	180	173
EXIT NE	51	0.3	170	36	0.2	180	170	68
EXIT SE	60	0.3	200	36	0.2	180	180	154
TOTAL							700	525

Appendix B

Life Safety Plans

B1 Life Safety Plans

LEGEND	
1	OCCUPANT LOAD PER ROOM
88	CONVERGING OR DIVERGING OCCUPANTS
ESE	EXIT DESIGNATION
	EGRESS PATH
	LOCATION OF EXIT



1/8" = 1'-0"
0 4 8 20

Basement Plan

Submittal Date: 12-11-2011

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 521 - COURSE PROJECT

LS100

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LEGEND	
1	OCCUPANT LOAD PER ROOM
88	CONVERGING OR DIVERGING OCCUPANTS
ESE	EXIT DESIGNATION
	EGRESS PATH
	LOCATION OF EXIT

EXIT NW
CAPACITY
170
USAGE
60

EXIT 7
CAPACITY
720
USAGE
88 (+ 24)

EXIT NE
CAPACITY
170
USAGE
0

EXIT SW
CAPACITY
180
USAGE
103

EXIT SE
CAPACITY
180
USAGE
84

EXIT BSE
CAPACITY
180
USAGE
0

EXIT 3
CAPACITY
360
USAGE
83

EXIT 4
CAPACITY
180
USAGE
0

1/8" =1'-0"
0 4 8 20

First Floor Plan

Submittal Date: 12-11-2011

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Court House Project

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LS101

LEGEND	
1	OCCUPANT LOAD PER ROOM
88	CONVERGING OR DIVERGING OCCUPANTS
ESE	EXIT DESIGNATION
	EGRESS PATH
	LOCATION OF EXIT

EXIT NW
CAPACITY
170
USAGE
129

EXIT NE
CAPACITY
170
USAGE
131

EXIT SW
CAPACITY
180
USAGE
146

EXIT SE
CAPACITY
180
USAGE
179

1/8" =1'-0"

0 4 8 20

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Second Floor Plan

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EXIT NW
CAPACITY
170
USAGE
77

EXIT NE
CAPACITY
170
USAGE
68

EXIT SW
CAPACITY
180
USAGE
180

EXIT SE
CAPACITY
180
USAGE
124

LEGEND

- (1) OCCUPANT LOAD PER ROOM
- (88) CONVERGING OR DIVERGING OCCUPANTS
- (ESE) EXIT DESIGNATION
- EGRESS PATH
- LOCATION OF EXIT

1/8" =1'-0"

0 4 8 20

Third Floor Plan

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LS103

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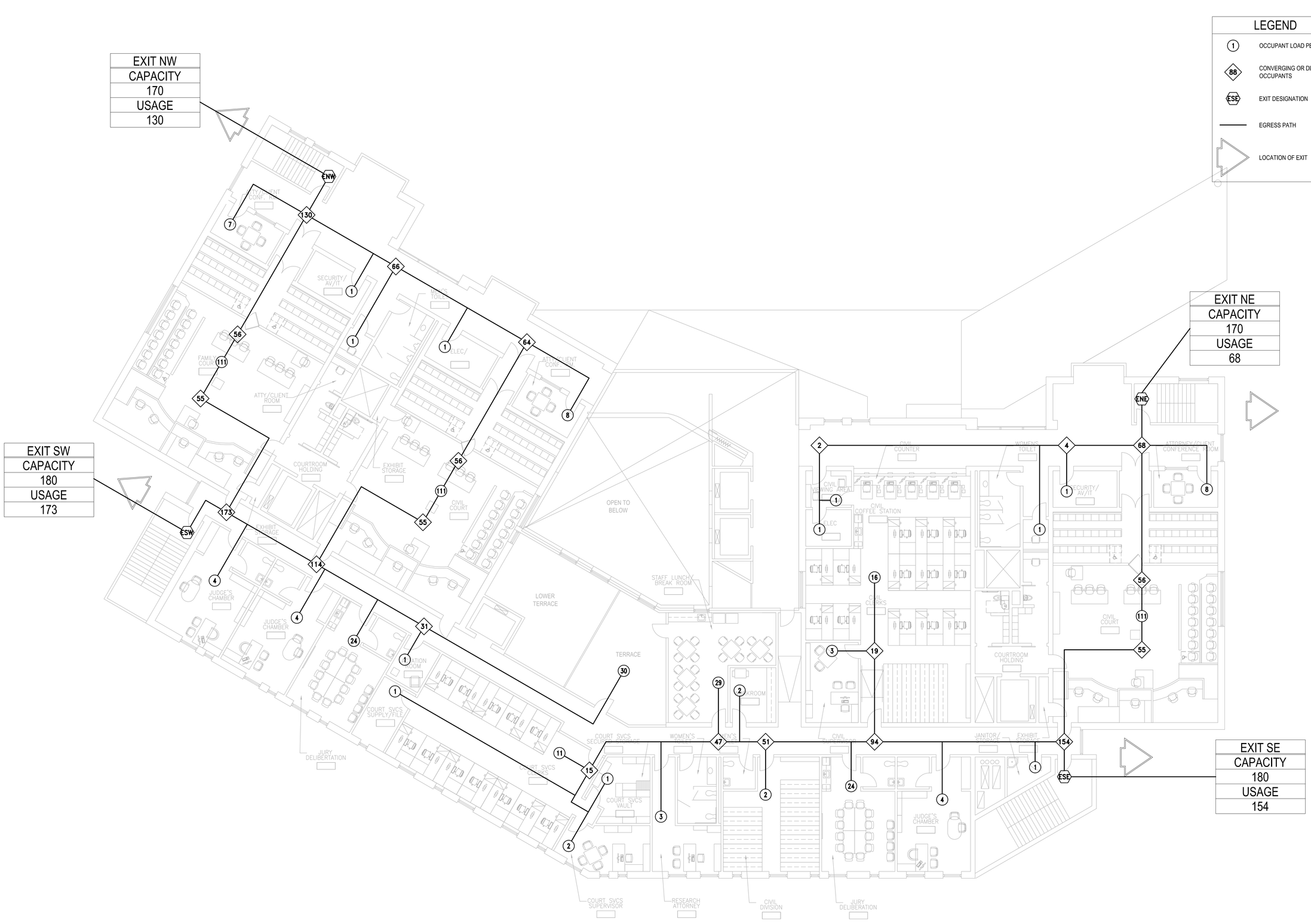

Fourth Floor Plan

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LS104

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Appendix C

Occupancy Classification Plans

C1 Occupancy Classification Plans

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LEGEND

ASSEMBLY	RESTROOM (NONSIMULTANEOUS)
CIRCULATION (NONSIMULTANEOUS)	STORAGE
MECHANICAL, ELECTRICAL, AV, IT, SECURITY	VERTICAL EXIT (OR HOISTWAY)
BUSINESS	1-HOUR WALL
	2-HOUR WALL

1/8" =1'-0"
0 4 8 20

Basement Plan

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LEGEND

- ASSEMBLY
- CIRCULATION (NONSIMULTANEOUS)
- MECHANICAL, ELECTRICAL, AV, IT, SECURITY
- BUSINESS
- RESTROOM (NONSIMULTANEOUS)
- STORAGE
- VERTICAL EXIT (OR HOISTWAY)
- 1-HOUR WALL
- 2-HOUR WALL

1/8" =1'-0"
0 4 8 20

First Floor Plan

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Project

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LEGEND

- ASSEMBLY
- CIRCULATION (NONSIMULTANEOUS)
- MECHANICAL, ELECTRICAL, AV, IT, SECURITY
- BUSINESS
- RESTROOM (NONSIMULTANEOUS)
- STORAGE
- VERTICAL EXIT (OR HOISTWAY)
- 1-HOUR WALL
- 2-HOUR WALL

1/8" =1'-0"

0 4 8 20

Second Floor Plan

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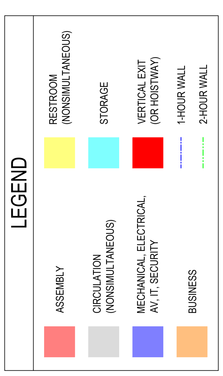
	OC103	CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 521 - COURSE PROJECT	RYAN RIGSBEE	Submittal Date: 12-11-2011
		Court House Project Somewhere, California	**Third Floor Plan**	



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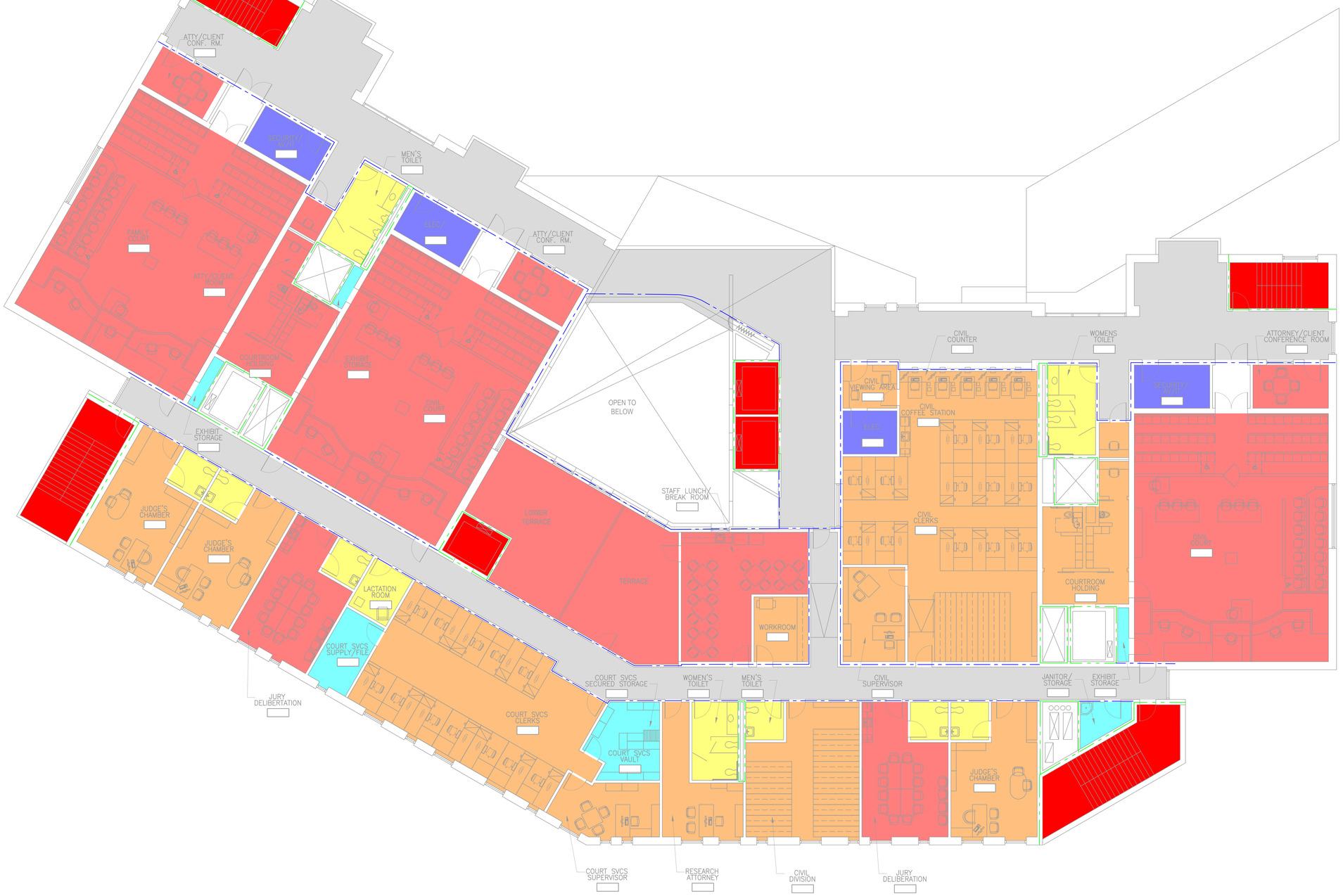

Fourth Floor Plan

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Court House Project

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CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 521 - COURSE PROJECT

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Appendix D

Egress Time

D1 2009 NFPA Handbook Egress Time

Flow capability of a stairway								
	population/floor=		~585		stories=	4		
Stair Label	stair (inches)	effective width (We) inches	effective width (We) feet	persons/min/ft effective width (F,sm)	calculated flow (F,c) persons/min	people through exit	time for one level (minutes)	time for entire building (minutes)
EXIT NW	51	39	3.3	18.5	60.1	129	2.15	8.58
EXIT SW	60	48	4.0	18.5	74.0	146	1.97	7.89
EXIT NE	51	39	3.3	18.5	60.1	131	2.18	8.72
EXIT SE	60	48	4.0	18.5	74.0	179	2.42	9.68

Flow capacity through a door									
	population/floor=		~585		stories=	4			
Stair Label	Door (inches)	effective width (We) inches	effective width (We) feet	maximum specific flow (F,sm) persons/ min/ft	calculated flow (F,c) persons/min	people through exit	time for one level (minutes)	time for entire building (minutes)	limiting time (minutes)
EXIT NW	36	24	2.0	24	48	129	2.69	10.75	10.75
EXIT SW	36	24	2.0	24	48	146	3.04	12.17	12.17
EXIT NE	36	24	2.0	24	48	131	2.73	10.92	10.92
EXIT SE	36	24	2.0	24	48	179	3.73	14.92	**14.92**

Appendix E

STEPS Limitations

E1 Emergency Movement Questions (SFPE)

Evacuation Model Type

1. Is the model based on optimization, simulation, or risk assessment?

The decision process is divided into two main stages: (1) Finding which Target (Exit or Checkpoint) to aim for, (2) finding how to move to the chosen Target.

2. Is the type of model suitable for the application?

When running in Evacuation mode, people's priority is to get out of the model as quickly as they can and therefore they are only looking for exits.

3. What are the limitations of the model with respect to the application?

The only limitation is processing time, which with today's computers is almost non-existent.

Enclosure Representation

1. Is the model based on a fine or a course network?

The grid size can be adjusted to user specifications.

2. How are different spaces and areas represented?

Spaces and areas are user defined by plans, items and blockages.

3. How are connections between spaces represented?

Connections are user defined by transfers.

4. How are obstructions within a space represented?

Obstructions are user defined by blockages.

5. How do these representations influence model results?

Occupants must find a path to exits on their own accord; they are "aware" of impending danger.

6. How many nodes, connections, and obstructions can the model handle?

This is dependent on the computer STEPS is run on, not on the program.

7. How are the data entered to represent spaces, connections, and obstructions?

Geometric data may be imported from CAD programs, and then the STEPS GUI can be used to define the imported lines.

Population Perspective

1. Does the model use a global or an individual perspective?

Occupants in the model use individual perspective based on people group definitions.

2. If the perspective is global, what general characteristics of the population are represented?

N/A

3. If the perspective is individual, what individual characteristics of the population are represented?

Characteristics are user defined in people groups. The user must build the population.

4. How are the individual or global characteristics of the population entered in the model?

Through a dialog box that contains parameters such as speed, size, etc.

Behavioral Perspective

1. What type of behavioral perspective does the model employ?
    a. none, implicit, rule-based, functional analogy-based, or artificial intelligence-based

Occupants have patience and association, how likely to stand in queue and whether they search for others before exiting the building.

2. How does the model treat interaction effects on behavior?
    a. people-people interactions
    b. people-enclosure interactions
    c. people-environment interactions

People can occupy empty cells; cells that do not have obstructions or other people.

3. How does the model address decision making factors?
    a. physiological
    b. psychological
    c. sociological

Decisions are made by grid cell score at each time step. Cells are scored low, based on; target, queue and patience.

Model Validation

1. Has the model been validated?
    a. If so, how and to what extent?

STEPS simulations have been validated by comparison to actual events and analytics. It is accepted internationally.

2. How has the model validation been reported?

In a report, Uncertainty in Egress Models and Data: Investigation of Dominant Parameters and Extent of Their Impact on Predicted Outcomes. And by NIST.

Model Implementation

1. Has the model been implemented on a computer?

Yes.

2. What computer platforms does the model support?

Windows 32- and 64-bit platforms.

Model Support

1. Is the model currently supported by the author(s)?

Yes, by Mott MacDonald.

2. Is the model supported by another agency?

No.

3. Is the model still being developed?
    a. If so, how are users notified of upgrades?

Steps is continuously undergoing development. Upgrade notification through email.

Model Costs

1. What is the initial cost of the model?

Approximately $5000 USD.

2. What are the ongoing costs for upgrades, support, and maintenance

Maintenance charge of 15% annually.

Appropriateness to Task

1. What inputs does the model require of the user?
    a. Are these available?

DXF files. These are available to anyone competent in CAD.

2. Does the model consider elements needed for the task at hand?
    a. speed of movement
    b. impact of density on speed
    c. queuing or other congestion
    d. merging of flows
    e. pre-movement decisions
    f. decisions/actions during movement

Yes to all.

3. Does the model produce an output meeting the needs of the task at hand?

Yes.

Appendix F

Level 1 Fire Alarm and Signaling Plans

LEGEND
Simplex TrueAlarm Analog Sensors – Heat

First Floor Plan

Initiating Device Plan

Submittal Date: June 2012

RYAN RIGSBEE

Court House Project

Somewhere, California

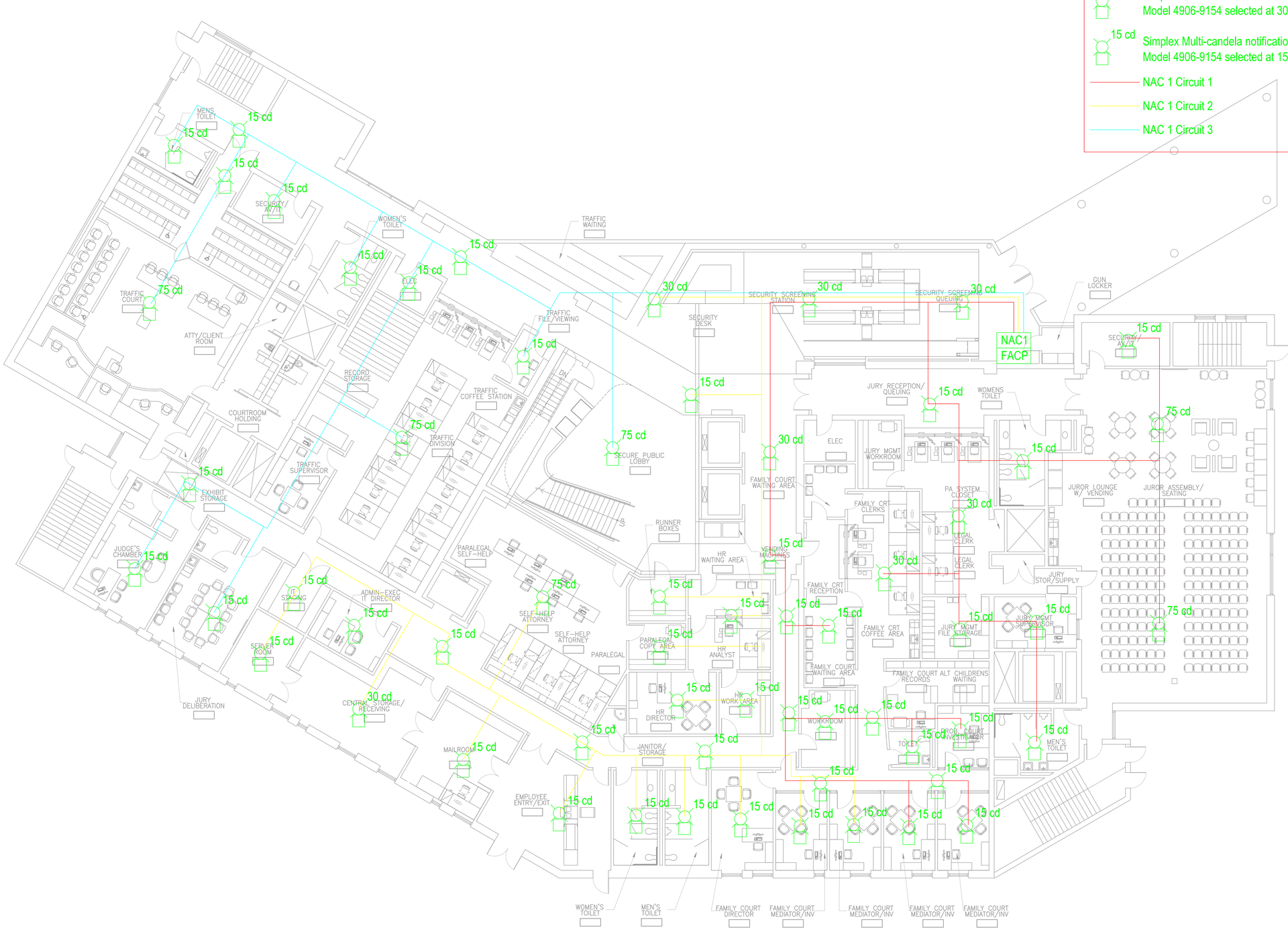
CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 522 - COURSE PROJECT

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

LEGEND

- 75 cd — Simplex Multi-candela notification appliance horn/strobe Model 4906-9154 selected at 75 candela ceiling mount
- 30 cd — Simplex Multi-candela notification appliance horn/strobe Model 4906-9154 selected at 30 candela ceiling mount
- 15 cd — Simplex Multi-candela notification appliance horn/strobe Model 4906-9154 selected at 15 candela ceiling mount
- NAC 1 Circuit 1
- NAC 1 Circuit 2
- NAC 1 Circuit 3



First Floor Plan

Notification Device Plan

Submittal Date: June 2012

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 522 - COURSE PROJECT

FA101

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Appendix G

Initiating Fire Scenario Calculations

Typical Courtroom

This sheet predicts sprinkler/heat detector activation based on the method of Heskestad and Delichatsios(updated)
Input in the green areas.

alpha [kW/s^2]	0.0469
r [m]	4.27
g [m/s^2]	9.81
Ceiling Height [ft]	12
Convective Fraction	0.7
Tamb [F]	70
Cp	1
RTI (m-s)^(1/2)	34
Tact [F]	135
Tact [K]	330.37222
Tamb [K]	294.26111
Ceiling Height [m]	3.6585366
Q [kW]	969.77368
Q [Btu/sec]	920.08888
t [sec]	143.79665
rho [lb/ft^3]	0.074717
rho [kg/m^3]	1.1959446
A	0.0278757
t2*	13.501513
t2*f	1.8659018
dT2*	81.631377
u2*/(dT2*^(1/2))	0.5352616
U2*	4.8360933
D	0.4284463
U [m/s]	1.6612529
u/u2*	0.3435113
dT [K]	78.976106
T [K]	373.23722
Y	3.5233497
Td [K]	330.3723
delta	-7.52E-05

Detector Activation Time [s]
143.8

Fire Size @ Activation [kW]
970

Level 2, Adjacent to Atrium

This sheet predicts sprinkler/heat detector activation based on the method of Heskestad and Delichatsios(updated)
Input in the green areas.

alpha [kW/s^2]	0.0469
r [m]	4.57
g [m/s^2]	9.81
Ceiling Height [ft]	12
Convective Fraction	0.7
Tamb [F]	70
Cp	1
RTI (m-s)^(1/2)	34
Tact [F]	135
Tact [K]	330.37222
Tamb [K]	294.26111
Ceiling Height [m]	3.6585366
Q [kW]	1051.65
Q [Btu/sec]	997.77041
t [sec]	149.74392
rho [lb/ft^3]	0.074717
rho [kg/m^3]	1.1959446
A	0.0278757
t2*	14.05992
t2*f	1.9369745
dT2*	81.138619
u2*/(dT2*^(1/2))	0.5127064
U2*	4.6183045
D	0.4484226
U [m/s]	1.5864399
u/u2*	0.3435113
dT [K]	78.499377
T [K]	372.76049
Y	3.587308
Td [K]	330.3724
delta	-0.000173

Detector Activation Time [s]
149.7

Fire Size @ Activation [kW]
1052

Appendix H

Voltage Drop and Battery Calculations

Typical NAC / Level Voltage Drop Calculations

NAC 1 / CIRCUIT 1	INDICATING DEVICE MODEL NUMBER	DESCRIPTION (1)	QTY	DEVICE CURRENT (amp)	EXT CURRENT (amp)
Simplex	4906-9154	75cd Horn/Strobe	2	0.155	0.310
	4906-9154	30cd Horn/Strobe	3	0.083	0.249
	4906-9154	15cd Horn/Strobe	18	0.050	0.900
				CURRENT TOTAL	**1.459**

CURRENT TOTAL (I)	WIRE LENGTH (FT)	WIRE RESISTIVITY CONSTANT	CIRCULAR MILLS (CM)	VOLTAGE PERCENT	VOLTAGE DROP	VOLTAGE AT LAST DEVICE
1.459	474	21.6	6530	9.532	2.288	21.712

NAC 1 / CIRCUIT 2	INDICATING DEVICE MODEL NUMBER	DESCRIPTION (1)	QTY	DEVICE CURRENT (amp)	EXT CURRENT (amp)
Simplex	4906-9154	75cd Horn/Strobe	1	0.155	0.155
	4906-9154	30cd Horn/Strobe	2	0.083	0.166
	4906-9154	15cd Horn/Strobe	19	0.050	0.950
				CURRENT TOTAL	**1.271**

CURRENT TOTAL (I)	WIRE LENGTH (FT)	WIRE RESISTIVITY CONSTANT	CIRCULAR MILLS (CM)	VOLTAGE PERCENT	VOLTAGE DROP	VOLTAGE AT LAST DEVICE
1.271	564	21.6	6530	9.880	2.371	21.629

NAC 1 / CIRCUIT 3	INDICATING DEVICE MODEL NUMBER	DESCRIPTION (1)	QTY	DEVICE CURRENT (amp)	EXT CURRENT (amp)
Simplex	4906-9154	75cd Horn/Strobe	3	0.155	0.465
	4906-9154	30cd Horn/Strobe	0	0.083	0.000
	4906-9154	15cd Horn/Strobe	11	0.050	0.550
				CURRENT TOTAL	**1.015**

CURRENT TOTAL (I)	WIRE LENGTH (FT)	WIRE RESISTIVITY CONSTANT	CIRCULAR MILLS (CM)	VOLTAGE PERCENT	VOLTAGE DROP	VOLTAGE AT LAST DEVICE
1.015	428	21.6	6530	5.987	1.437	22.563

CALCULATIONS (I x FT x 21.6) / C.M = VOLTAGE DROP
(VOLTAGE DROP / 24) * 100 = PERCENT VOLTAGE DROP
24 - VOLTAGE DROP = VOLTAGE AT LAST DEVICE

21.6 = RESISTIVITY OF COPPER WIRE PAIR PER 1000' (10.8 FOR SINGLE CONDUCTOR)
WIRE LENGTH = DISTANCE IN FEET FROM POWER CIRCUIT SOURCE TO LAST DEVICE
CM = CIRCULAR MILLS / CROSS SECTIONAL AREA OF CONDUCTOR
AWG# 12 = 6530 CM
AWG# 14 = 4110 CM
AWG# 18 = 1620 CM

Total Current for NAC 1	**3.745**

Standby and Alarm Battery Calculation All Levels

Model	Description	Quantity	Standby current (amps)	Alarm Current (amps)	Total Standby Current (amps)	Total Alarm Current (amps)
4100-9111	FACP	1	0.373	0.470	0.373	0.47
4100-5111	SPS	1	0.175	0.185	0.175	0.185
4906-9154	75cd Horn/Strobe	30	0	0.309	0	9.27
4906-9154	30cd Horn/Strobe	25	0	0.050	0	1.25
4906-9154	15cd Horn/Strobe	240	0	0.050	0	12
0206.02-50RU	Beam Detector	1	0.004	0.015	0.004	0.015
4098-9733	Heat Detector	345	0.00027	0.028	0.09315	9.66

Subtotal Current (amps)	0.64515	32.85
Secondary Power Source (hours)	24	0.083333333
Subtotal (amp-hours)	15.4836	2.7375
Total Current (amp-hours)	18.2211	
Required Battery Capacity (amp-hours)	21.86532	

Notes:

Battery calculations shal include a 20% safety margin per Section 10.5.6, NFPA 72

Required opperating time of secondary power source per Section 10.5.6.3, NFPA 72

Standby: 24 hours

Alarm: 5 minutes

Appendix I

NFPA 72 Inspection Testing and Maintenance Form

FIRE ALARM AND EMERGENCY COMMUNICATION SYSTEM RECORD OF COMPLETION

To be completed by the system installation contractor at the time of system acceptance and approval.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.
Attach additional sheets, data, or calculations as necessary to provide a complete record.

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

Description of property: _____

Occupancy type: _____

Name of property representative: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Authority having jurisdiction over this property: _____

Phone: _____ Fax: _____ E-mail: _____

2. INSTALLATION, SERVICE, AND TESTING CONTRACTOR INFORMATION

Installation contractor for this equipment: _____

Address: _____

License or certification number: _____

Phone: _____ Fax: _____ E-mail: _____

Service organization for this equipment: _____

Address: _____

License or certification number: _____

Phone: _____ Fax: _____ E-mail: _____

A contract for test and inspection in accordance with NFPA standards is in effect as of: _____

Contracted testing company: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Contract expires: _____ Contract number: _____ Frequency of routine inspections: _____

3. DESCRIPTION OF SYSTEM OR SERVICE

☐ Fire alarm system (nonvoice)

☐ Fire alarm with in-building fire emergency voice alarm communication system (EVACS)

☐ Mass notification system (MNS)

☐ Combination system, with the following components:

☐ Fire alarm ☐ EVACS ☐ MNS ☐ Two-way, in-building, emergency communication system

☐ Other (specify): _____

3. DESCRIPTION OF SYSTEM OR SERVICE *(continued)*

NFPA 72 edition: _____ Additional description of system(s): _____

3.1 Control Unit

Manufacturer: _____ Model number: _____

3.2 Mass Notification System ☐ This system does not incorporate an MNS

3.2.1 System Type:

☐ In-building MNS—combination

☐ In-building MNS—stand-alone ☐ Wide-area MNS ☐ Distributed recipient MNS

☐ Other (specify): _____

3.2.2 System Features:

☐ Combination fire alarm/MNS ☐ MNS autonomous control unit ☐ Wide-area MNS to regional national alerting interface

☐ Local operating console (LOC) ☐ Direct recipient MNS (DRMNS) ☐ Wide-area MNS to DRMNS interface

☐ Wide-area MNS to high-power speaker array (HPSA) interface ☐ In-building MNS to wide-area MNS interface

☐ Other (specify): _____

3.3 System Documentation

☐ An owner's manual, a copy of the manufacturer's instructions, a written sequence of operation, and a copy of the numbered record drawings are stored on site. Location: _____

3.4 System Software ☐ This system does not have alterable site-specific software.

Operating system (executive) software revision level: _____

Site-specific software revision date: _____ Revision completed by: _____

☐ A copy of the site-specific software is stored on site. Location: _____

3.5 Off-Premises Signal Transmission ☐ This system does not have off-premises transmission.

Name of organization receiving alarm signals with phone numbers:

Alarm: _____ Phone: _____

Supervisory: _____ Phone: _____

Trouble: _____ Phone: _____

Entity to which alarms are retransmitted: _____ Phone: _____

Method of retransmission: _____

If Chapter 26, specify the means of transmission from the protected premises to the supervising station:

_____

If Chapter 27, specify the type of auxiliary alarm system: ☐ Local energy ☐ Shunt ☐ Wired ☐ Wireless

4. CIRCUITS AND PATHWAYS

4.1 Signaling Line Pathways

4.1.1 Pathways Class Designations and Survivability

Pathways class: _____ Survivability level: _____ Quantity: _____
(See NFPA 72, Sections 12.3 and 12.4)

4.1.2 Pathways Utilizing Two or More Media

Quantity: _____ Description: _____

4.1.3 Device Power Pathways

☐ No separate power pathways from the signaling line pathway

☐ Power pathways are separate but of the same pathway classification as the signaling line pathway

☐ Power pathways are separate and different classification from the signaling line pathway

4.1.4 Isolation Modules

Quantity: _____

4.2 Alarm Initiating Device Pathways

4.2.1 Pathways Class Designations and Survivability

Pathways class: _____ Survivability level: _____ Quantity: _____
(See NFPA 72, Sections 12.3 and 12.4)

4.2.2 Pathways Utilizing Two or More Media

Quantity: _____ Description: _____

4.2.3 Device Power Pathways

☐ No separate power pathways from the initiating device pathway

☐ Power pathways are separate but of the same pathway classification as the initiating device pathway

☐ Power pathways are separate and different classification from the initiating device pathway

4.3 Non-Voice Audible System Pathways

4.3.1 Pathways Class Designations and Survivability

Pathways class: _____ Survivability level: _____ Quantity: _____
(See NFPA 72, Sections 12.3 and 12.4)

4.3.2 Pathways Utilizing Two or More Media

Quantity: _____ Description: _____

4.3.3 Device Power Pathways

☐ No separate power pathways from the notification appliance pathway

☐ Power pathways are separate but of the same pathway classification as the notification appliance pathway

☐ Power pathways are separate and different classification from the notification appliance pathway

5. ALARM INITIATING DEVICES

5.1 Manual Initiating Devices

5.1.1 Manual Fire Alarm Boxes ☐ This system does not have manual fire alarm boxes.

Type and number of devices: Addressable: _____ Conventional: _____ Coded: _____ Transmitter: _____

Other (specify): _____

5.1.2 Other Alarm Boxes ☐ This system does not have other alarm boxes.

Description: _____

Type and number of devices: Addressable: _____ Conventional: _____ Coded: _____ Transmitter: _____

Other (specify): _____

5.2 Automatic Initiating Devices

5.2.1 Smoke Detectors ☐ This system does not have smoke detectors.

Type and number of devices: Addressable: _____ Conventional: _____

Other (specify): _____

Type of coverage: ☐ Complete area ☐ Partial area ☐ Nonrequired partial area

Other (specify): _____

Type of smoke detector sensing technology: ☐ Ionization ☐ Photoelectric ☐ Multicriteria ☐ Aspirating ☐ Beam

Other (specify): _____

5.2.2 Duct Smoke Detectors ☐ This system does not have alarm-causing duct smoke detectors.

Type and number of devices: Addressable: _____ Conventional: _____

Other (specify): _____

Type of coverage: _____

Type of smoke detector sensing technology: ☐ Ionization ☐ Photoelectric ☐ Aspirating ☐ Beam

5.2.3 Radiant Energy (Flame) Detectors ☐ This system does not have radiant energy detectors.

Type and number of devices: Addressable: _____ Conventional: _____

Other (specify): _____

Type of coverage: _____

5.2.4 Gas Detectors ☐ This system does not have gas detectors.

Type of detector(s): _____

Number of devices: Addressable: _____ Conventional: _____

Type of coverage: _____

5.2.5 Heat Detectors ☐ This system does not have heat detectors.

Type and number of devices: Addressable: _____ Conventional: _____

Type of coverage: ☐ Complete area ☐ Partial area ☐ Nonrequired partial area ☐ Linear ☐ Spot

Type of heat detector sensing technology: ☐ Fixed temperature ☐ Rate-of-rise ☐ Rate compensated

5. ALARM INITIATING DEVICES *(continued)*

5.2.6 Addressable Monitoring Modules ☐ This system does not have monitoring modules.

Number of devices: _____

5.2.7 Waterflow Alarm Devices ☐ This system does not have waterflow alarm devices.

Type and number of devices: Addressable: _____ Conventional: _____ Coded: _____ Transmitter: _____

5.2.8 Alarm Verification ☐ This system does not incorporate alarm verification.

Number of devices subject to alarm verification: _____ Alarm verification set for: _____ seconds

5.2.9 Presignal ☐ This system does not incorporate pre-signal.

Number of devices subject to presignal: _____

Describe presignal functions: _____

5.2.10 Positive Alarm Sequence (PAS) ☐ This system does not incorporate PAS.

Describe PAS: _____

5.2.11 Other Initiating Devices ☐ This system does not have other initiating devices.

Describe: _____

6. SUPERVISORY SIGNAL-INITIATING DEVICES

6.1 Sprinkler System Supervisory Devices ☐ This system does not have sprinkler supervisory devices.

Type and number of devices: Addressable: _____ Conventional: _____ Coded: _____ Transmitter: _____

Other (specify): _____

6.2 Fire Pump Description and Supervisory Devices ☐ This system does not have a fire pump.

Type fire pump: ☐ Electric pump ☐ Engine

Type and number of devices: Addressable: _____ Conventional: _____ Coded: _____ Transmitter: _____

Other (specify): _____

6.2.1 Fire Pump Functions Supervised

☐ Power ☐ Running ☐ Phase reversal ☐ Selector switch not in auto ☐ Engine or control panel trouble ☐ Low fuel

Other (specify): _____

6.3 Duct Smoke Detectors (DSDs) ☐ This system does not have DSDs causing supervisory signals.

Type and number of devices: Addressable: _____ Conventional: _____

Other (specify): _____

Type of coverage: _____

Type of smoke detector sensing technology: ☐ Ionization ☐ Photoelectric ☐ Aspirating ☐ Beam

6.4 Other Supervisory Devices ☐ This system does not have other supervisory devices.

Describe: _____

7. MONITORED SYSTEMS

7.1 Engine-Driven Generator ☐ This system does not have a generator.

7.1.1 Generator Functions Supervised

☐ Engine or control panel trouble ☐ Generator running ☐ Selector switch not in auto ☐ Low fuel

☐ Other (specify): _____

7.2 Special Hazard Suppression Systems ☐ This system does not monitor special hazard systems.

Description of special hazard system(s): _____

7.3 Other Monitoring Systems ☐ This system does not monitor other systems.

Description of special hazard system(s): _____

8. ANNUNCIATORS ☐ This system does not have annunciators.

8.1 Location and Description of Annunciators

Location 1: _____

Location 2: _____

Location 3: _____

9. ALARM NOTIFICATION APPLIANCES

9.1 In-Building Fire Emergency Voice Alarm Communication System ☐ This system does not have an EVACS.

Number of single voice alarm channels: _____ Number of multiple voice alarm channels: _____

Number of speakers: _____ Number of speaker circuits: _____

Location of amplification and sound-processing equipment: _____

Location of paging microphone stations:

Location 1: _____

Location 2: _____

Location 3: _____

9.2 Nonvoice Notification Appliances ☐ This system does not have nonvoice notification appliances.

Horns: _____ With visible: _____ Bells: _____ With visible: _____

Chimes: _____ With visible: _____

Visible only: _____ Other (describe): _____

9.3 Notification Appliance Power Extender Panels ☐ This system does not have power extender panels.

Quantity: _____

Locations: _____

10. MASS NOTIFICATION CONTROLS, APPLIANCES, AND CIRCUITS ☐ This system does not have an MNS.

10.1 MNS Local Operating Consoles

Location 1: _____

Location 2: _____

Location 3: _____

10.2 High-Power Speaker Arrays

Number of HPSA speaker initiation zones: _____

Location 1: _____

Location 2: _____

Location 3: _____

10.3 Mass Notification Devices

Combination fire alarm/MNS visible appliances: _____ MNS-only visible appliances: _____

Textual signs: _____ Other (describe): _____

Supervision class: _____

10.3.1 Special Hazard Notification

☐ This system does not have special suppression predischarge notification.

☐ MNS systems DO NOT override notification appliances required to provide special suppression predischarge notification.

11. TWO-WAY EMERGENCY COMMUNICATION SYSTEMS

11.1 Telephone System ☐ This system does not have a two-way telephone system.

Number of telephone jacks installed: _____ Number of warden stations installed: _____

Number of telephone handsets stored on site: _____

Type of telephone system installed: ☐ Electrically powered ☐ Sound powered

11.2 Two-Way Radio Communications Enhancement System

☐ This system does not have a two-way radio communications enhancement system.

Percentage of area covered by two-way radio service: Critical areas: _____ % General building areas: _____ %

Amplification component locations: _____

Inbound signal strength: _____ dBm Outbound signal strength: _____ dBm

Donor antenna isolation is: _____ dB above the signal booster gain

Radio frequencies covered: _____

Radio system monitor panel location: _____

11. TWO-WAY EMERGENCY COMMUNICATION SYSTEMS *(continued)*

11.3 Area of Refuge (Area of Rescue Assistance) Emergency Communications Systems

☐ This system does not have an area of refuge (area of rescue assistance) emergency communications system.

Number of stations: _____ Location of central control point: _____

Days and hours when central control point is attended: _____

Location of alternate control point: _____

Days and hours when alternate control point is attended: _____

11.4 Elevator Emergency Communications Systems

☐ This system does not have an elevator emergency communications system.

Number of elevators with stations: _____ Location of central control point: _____

Days and hours when central control point is attended: _____

Location of alternate control point: _____

Days and hours when alternate control point is attended: _____

11.5 Other Two-Way Communication Systems

Describe: _____

12. CONTROL FUNCTIONS

This system activates the following control fuctions:

☐ Hold-open door releasing devices ☐ Smoke management ☐ HVAC shutdown ☐ F/S dampers

☐ Door unlocking ☐ Elevator recall ☐ Fuel source shutdown ☐ Extinguishing agent release

☐ Elevator shunt trip ☐ Mass notification system override of fire alarm notification appliances

Other (specify): _____

12.1 Addressable Control Modules

☐ This system does not have control modules.

Number of devices: _____

Other (specify): _____

13. SYSTEM POWER

13.1 Control Unit

13.1.1 Primary Power

Input voltage of control panel: _____ Control panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panel board): _____

Disconnecting means location: _____

13.1.2 Engine-Driven Generator

☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

13. SYSTEM POWER *(continued)*

13.1.3 Uninterruptible Power System ☐ This system does not have a UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

13.1.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture ☐ Battery calculations are attached

13.2 In-Building Fire Emergency Voice Alarm Communication System or Mass Notification System

☐ This system does not have an EVACS or MNS system.

13.2.1 Primary Power

Input voltage of EVACS or MNS panel: _____ EVACS or MNS panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panel board): _____

Disconnecting means location: _____

13.2.2 Engine-Driven Generator ☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

13.2.3 Uninterruptible Power System ☐ This system does not have a UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

13.2.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture ☐ Battery calculations are attached

13. SYSTEM POWER *(continued)*

13.3 Notification Appliance Power Extender Panels ☐ This system does not have power extender panels.

13.3.1 Primary Power

Input voltage of power extender panel(s): _____ Power extender panel amps: _____

Overcurrent protection: Type: _____ Amps: _____

Location (of primary supply panel board): _____

Disconnecting means location: _____

13.3.2 Engine-Driven Generator ☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

13.3.3 Uninterruptible Power System ☐ This system does not have a UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

13.3.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture ☐ Battery calculations are attached

14. RECORD OF SYSTEM INSTALLATION

Fill out after all installation is complete and wiring has been checked for opens, shorts, ground faults, and improper branching, but before confucting operational acceptance tests.

This is a: ☐ New system ☐ Modification to an existing system Permit number: _____

The system has been installed in accordance with the following requirements: (Note any or all that apply.)

☐ *NFPA 72,* Edition: _____

☐ *NFPA 70, National Electrical Code,* Article 760, Edition: _____

☐ Manufacturer's published instructions

Other (specify): _____

System deviations from referenced NFPA standards: _____

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

15. RECORD OF SYSTEM OPERATIONAL ACCEPTANCE TEST

☐ New system

All operational features and functions of this system were tested by, or in the presence of, the signer shown below, on the date shown below, and were found to be operating properly in accordance with the requirements for the following:

☐ Modifications to an existing system

All newly modified operational features and functions of the system were tested by, or in the presence of, the signer shown below, on the date shown below, and were found to be operating properly in accordance with the requirements of the following:

☐ *NFPA 72*, Edition: _____

☐ *NFPA 70, National Electrical Code,* Article 760, Edition: _____

☐ Manufacturer's published instructions

Other (specify): _____

☐ Individual device testing documentation [Inspection and Testing Form (Figure 14.6.2.4) is attached]

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

16. CERTIFICATIONS AND APPROVALS

16.1 System Installation Contractor:

This system, as specified herein, has been installed and tested according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

16.2 System Service Contractor:

The undersigned has a service contract for this system in effect as of the date shown below.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

16.3 Supervising Station:

This system, as specified herein, will be monitored according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

16. CERTIFICATIONS AND APPROVALS *(continued)*

16.4 Property or Owner Representative:

This system, as specified herein, will be monitored according to all NFPA standards cited herein.

Signed:		Printed name:		Date:	
Organization:		Title:		Phone:	

16.5 Authority Having Jurisdiction:

I have witnessed a satisfactory acceptance test of this system and find it to be installed and operating properly in accordance with its approved plans and specifications, with its approved sequence of operations, and with all NFPA standards cited herein.

Signed:		Printed name:		Date:	
Organization:		Title:		Phone:	

FIRE ALARM AND EMERGENCY COMMUNICATION SYSTEM INSPECTION AND TESTING FORM

To be completed by the system inspector or tester at the time of the inspection or test.
It shall be permitted to modify this form as needed to provide a more complete and/or clear record.
Insert N/A in all unused lines.
Attach additional sheets, data, or calculations as necessary to provide a complete record.

Date of this inspection or test: _____ Time of inspection or test: _____

1. PROPERTY INFORMATION

Name of property: _____

Address: _____

Description of property: _____

Occupancy type: _____

Name of property representative: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Authority having jurisdiction over this property: _____

Phone: _____ Fax: _____ E-mail: _____

2. INSTALLATION, SERVICE, AND TESTING CONTRACTOR INFORMATION

Service and/or testing organization for this equipment: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Service technician or tester: _____

Qualifications of technician or tester: _____

A contract for test and inspection in accordance with NFPA standards is in effect as of: _____

The contract expires: _____ Contract number: _____ Frequency of tests and inspections: _____

Monitoring organization for this equipment: _____

A contract for test and inspection in accordance with NFPA standards is in effect as of: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Entity to which alarms are retransmitted: _____ Phone: _____

3. TYPE OF SYSTEM OR SERVICE

☐ Fire alarm system (nonvoice)

☐ Fire alarm with in-building fire emergency voice alarm communication system (EVACS)

☐ Mass notification system (MNS)

☐ Combination system, with the following components:

☐ Fire alarm ☐ EVACS ☐ MNS ☐ Two-way, in-building, emergency communication system

☐ Other (specify): _____

3. TYPE OF SYSTEM OR SERVICE *(continued)*

NFPA 72 edition: _____ Additional description of system(s): _____

3.1 Control Unit

Manufacturer: _____ Model number: _____

3.2 Mass Notification System ☐ This system does not incorporate an MNS

3.2.1 System Type:

☐ In-building MNS—combination

☐ In-building MNS—stand-alone ☐ Wide-area MNS ☐ Distributed recipient MNS

☐ Other (specify): _____

3.2.2 System Features:

☐ Combination fire alarm/MNS ☐ MNS ACU only ☐ Wide-area MNS to regional national alerting interface

☐ Local operating console (LOC) ☐ Direct recipient MNS (DRMNS) ☐ Wide-area MNS to DRMNS interface

☐ Wide-area MNS to high-power speaker array (HPSA) interface ☐ In-building MNS to wide-area MNS interface

☐ Other (specify): _____

3.3 System Documentation

☐ An owner's manual, a copy of the manufacturer's instructions, a written sequence of operation, and a copy of the record record drawings are stored on site. Location: _____

3.4 System Software ☐ This system does not have alterable site-specific software.

Software revision number: _____ Software last updated on: _____

☐ A copy of the site-specific software is stored on site. Location: _____

4. SYSTEM POWER

4.1 Control Unit

4.1.1 Primary Power

Input voltage of control panel: _____ Control panel amps: _____

4.1.2 Engine-Driven Generator ☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

4.1.3 Uninterruptible Power System ☐ This system does not have UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

4. SYSTEM POWER *(continued)*

4.1.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture.

4.2 In-Building Fire Emergency Voice Alarm Communication System or Mass Notification System

☐ This system does not have an EVACS or MNS.

4.2.1 Primary Power

Input voltage of EVACS or MNS panel: _____ EVACS or MNS panel amps: _____

4.2.2 Engine-Driven Generator

☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

4.2.3 Uninterruptible Power System

☐ This system does not have a UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

4.2.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture.

4.3 Notification Appliance Power Extender Panels

☐ This system does not have power extender panels.

4.3.1 Primary Power

Input voltage of power extender panel(s): _____ Power extender panel amps: _____

4.3.2 Engine-Driven Generator

☐ This system does not have a generator.

Location of generator: _____

Location of fuel storage: _____ Type of fuel: _____

4.3.3 Uninterruptible Power System

☐ This system does not have a UPS.

Equipment powered by a UPS system: _____

Location of UPS system: _____

Calculated capacity of UPS batteries to drive the system components connected to it:

In standby mode (hours): _____ In alarm mode (minutes): _____

4. SYSTEM POWER *(continued)*

4.3.4 Batteries

Location: _____ Type: _____ Nominal voltage: _____ Amp/hour rating: _____

Calculated capacity of batteries to drive the system:

In standby mode (hours): _____ In alarm mode (minutes): _____

☐ Batteries are marked with date of manufacture.

5. ANNUNCIATORS

☐ This system does not have annunciators.

5.1 Location and Description of Annunciators

Annunciator 1: _____

Annunciator 2: _____

Annunciator 3: _____

6. NOTIFICATIONS MADE PRIOR TO TESTING

Monitoring organization	Contact:	_____	Time:	_____
Building management	Contact:	_____	Time:	_____
Building occupants	Contact:	_____	Time:	_____
Authority having jurisdiction	Contact:	_____	Time:	_____
Other, if required	Contact:	_____	Time:	_____

7. TESTING RESULTS

7.1 Control Unit and Related Equipment

Description	Visual Inspection	Functional Test	Comments
Control unit	☐	☐	
Lamps/LEDs/LCDs	☐	☐	
Fuses	☐	☐	
Trouble signals	☐	☐	
Disconnect switches	☐	☐	
Ground-fault monitoring	☐	☐	
Supervision	☐	☐	
Local annunciator	☐	☐	
Remote annunciators	☐	☐	
Power extender panels	☐	☐	
Isolation modules	☐	☐	
Other (specify) _____	☐	☐	

7. TESTING RESULTS *(continued)*

7.2 Control Unit Power Supplies

Description	Visual Inspection	Functional Test	Comments
120-volt power	☐	☐	
Generator or UPS	☐	☐	
Battery condition	☐	☐	
Load voltage	☐	☐	
Discharge test	☐	☐	
Charger test	☐	☐	
Other (specify) _____	☐	☐	

7.3 In-Building Fire Emergency Voice Alarm Communications Equipment

Description	Visual Inspection	Functional Test	Comments
Control unit	☐	☐	
Lamps/LEDs/LCDs	☐	☐	
Fuses	☐	☐	
Primary power supply	☐	☐	
Secondary power supply	☐	☐	
Trouble signals	☐	☐	
Disconnect switches	☐	☐	
Ground-fault monitoring	☐	☐	
Panel supervision	☐	☐	
System performance	☐	☐	
Sound pressure levels Occupied ☐ Yes ☐ No Ambient _____ dBA Alarm _____ dBA (attach report with locations, values, and weather conditions)	☐	☐	
System intelligibility ☐ CSI ☐ STI (attach report with locations, values, and weather conditions)	☐	☐	
Other (specify) _____	☐	☐	

7. TESTING RESULTS *(continued)*

7.4 Notification Appliance Power Extender Panels

Description	Visual Inspection	Functional Test	Comments
Lamps/LEDs/LCDs	☐	☐	
Fuses	☐	☐	
Primary power supply	☐	☐	
Secondary power supply	☐	☐	
Trouble signals	☐	☐	
Ground-fault monitoring	☐	☐	
Panel supervision	☐	☐	
Other (specify)	☐	☐	

7.5 Mass Notification Equipment

Description	Visual Inspection	Functional Test	Comments
Functional test	☐	☐	
Reset/power down test	☐	☐	
Fuses	☐	☐	
Primary power supply	☐	☐	
UPS power test	☐	☐	
Trouble signals	☐	☐	
Disconnect switches	☐	☐	
Ground-fault monitoring	☐	☐	
CCU security mechanism	☐	☐	
Prerecorded message content	☐	☐	
Prerecorded message activation	☐	☐	
Software backup performed	☐	☐	
Test backup software	☐	☐	
Fire alarm to MNS interface	☐	☐	
MNS to fire alarm interface	☐	☐	
In-building MNS to wide-area MNS	☐	☐	

7. TESTING RESULTS *(continued)*

7.5 Mass Notification Equipment *(continued)*

Description	Visual Inspection	Functional Test	Comments
MNS to direct recipient MNS	☐	☐	
Sound pressure levels Occupied ☐ Yes ☐ No Ambient _____ dBA Alarm _____ dBA (attach report with locations, values, and weather conditions)	☐	☐	
System intelligibility ☐ CSI ☐ STI (attach report with locations, values, and weather conditions)	☐	☐	
Other (specify)	☐	☐	

7.6 Two-Way Communications Equipment

Description	Visual Inspection	Functional Test	Comments
Phone handsets	☐	☐	
Phone jacks	☐	☐	
Off-hook indicator	☐	☐	
Call-in signal	☐	☐	
System performance	☐	☐	
System audibility	☐	☐	
System intelligibility	☐	☐	
Radio communications enhancement system	☐	☐	
Area of refuge communication system	☐	☐	
Elevator emergency communications system	☐	☐	
Other (specify)	☐	☐	

7. TESTING RESULTS *(continued)*

7.7 Combination Systems

Description	Visual Inspection	Functional Test	Comments
Fire extinguishing monitoring devices/system	☐	☐	
Carbon monoxide detector/system	☐	☐	
Combination fire/security system	☐	☐	
Other (specify)	☐	☐	

7.8 Special Hazard Systems

Description (specify)	Visual Inspection	Functional Test	Comments
	☐	☐	
	☐	☐	
	☐	☐	

7.9 Emergency Communications System

☐ Visual

☐ Functional

☐ Simulated operation

☐ Ensure predischarge notification appliances of special hazard systems are not overridden by the MNS. See *NFPA 72*, 24.4.1.7.1.

7.10 Monitored Systems

Description (specify)	Visual Inspection	Functional Test	Comments
Engine-driven generator	☐	☐	
Fire pump	☐	☐	
Special suppression systems	☐	☐	
Other (specify)	☐	☐	

7. TESTING RESULTS *(continued)*

7.11 Auxiliary Functions

Description	Visual Inspection	Functional Test	Comments
Door-releasing devices	☐	☐	
Fan shutdown	☐	☐	
Smoke management/smoke control	☐	☐	
Smoke damper operation	☐	☐	
Smoke shutter release	☐	☐	
Door unlocking	☐	☐	
Elevator recall	☐	☐	
Elevator shunt trip	☐	☐	
MNS override of FA signals	☐	☐	
Other (specify)	☐	☐	

7.12 Alarm Initiating Device

☐ Device test results sheet attached listing all devices tested and the results of the testing

7.13 Supervisory Alarm Initiating Device

☐ Device test results sheet attached listing all devices tested and the results of the testing

7.14 Alarm Notification Appliances

☐ Appliance test results sheet attached listing all appliances tested and the results of the testing

7.15 Supervisory Station Monitoring

Description	Visual Inspection	Functional Test	Time	Comments
Alarm signal	☐	☐		
Alarm restoration	☐	☐		
Trouble signal	☐	☐		
Trouble restoration	☐	☐		
Supervisory signal	☐	☐		
Supervisory restoration	☐	☐		

8. NOTIFICATIONS THAT TESTING IS COMPLETE

Monitoring organization	Contact:		Time:	
Building management	Contact:		Time:	
Building occupants	Contact:		Time:	
Authority having jurisdiction	Contact:		Time:	
Other, if required	Contact:		Time:	

9. SYSTEM RESTORED TO NORMAL OPERATION

Date: _____ Time: _____

10. CERTIFICATION

10.1 Inspector Certification:

This system, as specified herein, has been inspected and tested according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

10.2 Acceptance by Owner or Owner's Representative:

The undersigned has a service contract for this system in effect as of the date shown below.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

DEVICE TEST RESULTS

(Attach additional sheets if required)

Device Type	Address	Location	Test Results

Appendix J

Fire Alarm System Manufacturer Data Sheets

4100 - 9111

Simplex

4100ES Fire Control Panels

UL, ULC, CSFM Listed; FM Approved;
*MEA (NYC) Acceptance**

Addressable Fire Detection and Control
Basic Panel Modules and Accessories

Features

Master Controller (top) bay:

- Master controller with color-coded operator interface including raised switches for high confidence feedback
- Dual configuration program CPU, convenient service port access, and capacity for up to 2000 addressable points
- CPU assembly includes dedicated compact flash memory for on-site system information storage
- System power supply (SPS) and charger (9 A total) with on-board: NACs, IDNet addressable device interface, programmable auxiliary output and alarm relay
- Available with InfoAlarm Command Center expanded content user interface (see data sheet S4100-0045)
- Upgrade kits are available for existing control panels

Standard addressable interfaces include:

- IDNet addressable device interface with 250 points that support TrueAlarm analog sensing and operate with *either shielded or unshielded* twisted pair wiring
- Remote annunciator module support via RUI (remote unit interface) communications port

Optional modules include:

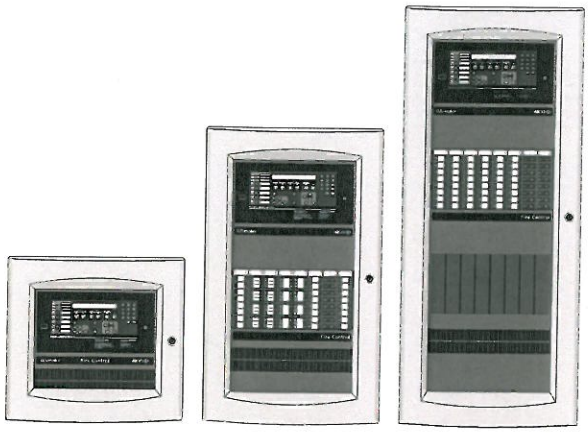
- Building Network Interface Module (BNIC) for Ethernet connectivity options (see data sheet S4100-0061)
- TrueAlert addressable notification appliance power supplies with three, 3 A SLC outputs
- Additional IDNet and MAPNET II addressable device modules and IDNet/MAPNET II quad isolator modules
- IDNet+ output module with built-in quad isolator and enhanced operation for better retrofit to existing wiring (see data sheet S4100-0046)
- Fire Alarm Network Interfaces, DACTs, city connections, and up to five (5) RS-232 ports for printers and terminals
- IP communicator compatibility
- Alarm relays, auxiliary relays, additional power supplies, IDC modules, NAC expansion modules
- Service modems, VESDA Air Aspiration Systems interface, ASHRAE BACnet Interface, TCP/IP Bridges
- LED/switch modules and panel mount printers
- Emergency communications systems (ECS) equipment; 8 channel digital audio or 2 channel analog audio
- Battery brackets for seismic area protection (see page 2)

Compatible with Simplex® remotely located:

- 4009 IDNet NAC Extenders, up to ten per IDNet SLC
- TrueAlert Addressable Controllers

4100ES and upgrade kits are UL Listed to:

- UL Std. 864, Fire Detection and Control (UOJZ), and Smoke Control Service (UUKL)
- UL Std. 2017, Process Management Equipment (QVAX)
- UL Std. 1076, Proprietary Alarm Units-Burglar (APOU)
- UL Std. 1730, Smoke Detector Monitor (UULH)
- ULC Std. S527-99



4100ES Cabinets are Available with
One, Two or Three Bays

Software Feature Summary

CPU provides dual configuration programs:

- Two programs allow for optimal system protection and commissioning efficiency with one active program and one reserve
- Downtime is reduced because the system stays running during download

PC based programmer features:

- Convenient front panel accessed Ethernet port for quick and easy ***download*** of site-specific programming
- Modifications can be ***uploaded*** as well as downloaded for greater service flexibility
- ***AND***, firmware enhancements are made via software downloads to the on-board flash memory

Introduction

4100ES Series Fire Detection and Control Panels provide extensive installation, operator, and service features with point and module capacities suitable for a wide range of system applications. An on-board Ethernet port provides fast external system communications to expedite installation and service activity. Dedicated compact flash memory archiving provides secure on-site system information storage of electronic job configuration files to meet NFPA 72 (*National Fire Alarm and Signaling Code*) requirements.

Modular design. A wide variety of functional modules are available to meet specific system requirements. Selections allow panels to be configured for either Stand-Alone or Networked fire control operation. InfoAlarm Command Center options provide convenient expanded display content (detailed on data sheet S4100-0045).

* See pages 5 and 6 for product that is UL or ULC listed and additional listing information. This product has been listed by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7165-0026:251(4100ES) and 7300-0026:0368 (4009 TPS) for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use – City of New York Department of Buildings – MEA35-93E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Fire Protection Products.

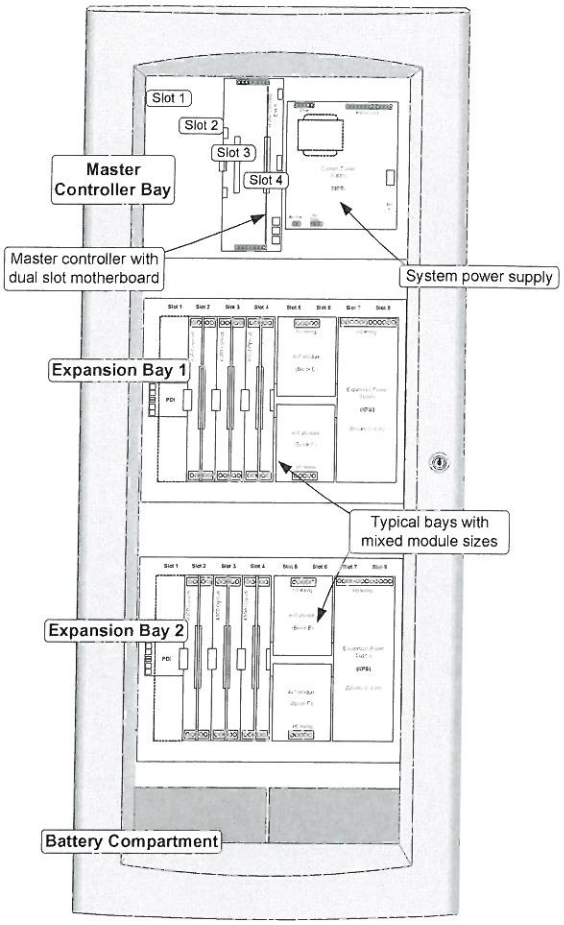
Module Bay Description

The Master Controller Bay (top) includes a standard multi-featured system power supply, the master controller board, and operator interface equipment.

The Expansion Bays include a Power Distribution Interface (PDI) for new 4" x 5" flat design option modules and also accommodate 4100-style modules.

The Battery Compartment (bottom) accepts two batteries, up to 50 Ah, to be mounted within the cabinet without interfering with module space.

The following illustration identifies bay locations using a three bay cabinet for reference.



4100ES Module Bay Reference

Mechanical Description

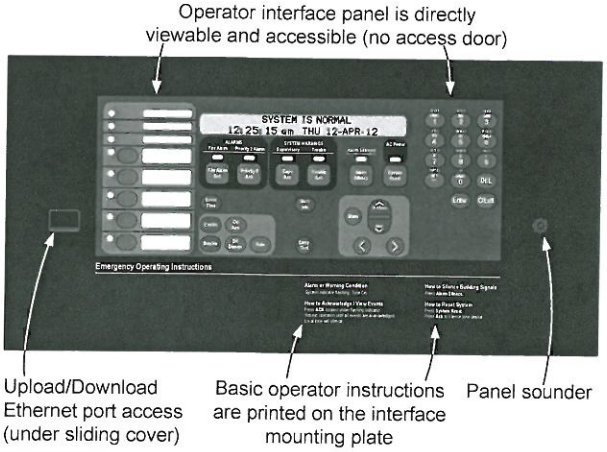
- Boxes can be close-nippled; each box provides convenient stud markers for drywall thickness and nail-hole knockouts for quicker mounting
- Smooth box surfaces are provided for locally cutting conduit entrance holes exactly where required
- Cabinet assembly design has been seismic tested and is certified to IBC and CBC standards as well as to ASCE 7-05 category D, requires 33 Ah or 50 Ah batteries with battery brackets as detailed on data sheet S2081-0019

Mechanical Description *(Continued)*

- The latching dress panel (retainer) assembly easily lifts off for internal access
- NACs are mounted directly on power supply assemblies providing minimized wiring loss, compact size, and readily accessible terminations
- Packaging supports traditional 4100-style motherboard with daughter cards
- Modules are power-limited (except as noted, such as relay modules)
- The NEMA 1 box is ordered separately and available for early installation
- Doors are available with tempered glass inserts or solid; boxes and doors are available in platinum or red
- Boxes and door/retainer assemblies are ordered separately per system requirements; refer to data sheet S4100-0037 for details

Operator Interface Detail Reference

The following illustration identifies the primary functions of the operator interface.



Software Feature Summary

- TrueAlarm individual analog sensing with front panel information and selection access
- "Dirty" TrueAlarm sensor maintenance alerts, service and status reports including "almost dirty"
- TrueAlarm magnet test indication appears as distinct "test abnormal" message on display when in test mode
- TrueAlarm sensor peak value performance report
- ***"Install Mode"*** allows grouping of multiple troubles for uninstalled modules and devices into a single trouble condition (typical with future phased expansion); with future equipment and devices grouped into a single trouble, operators can more clearly identify events from the commissioned and occupied areas
- Module level ground fault searching assists installation and service by locating and isolating modules with grounded wiring
- ***"Recurring Trouble Filtering"*** allows the panel to recognize, process, and log recurring intermittent troubles (such as external wiring ground faults), but only sends a single outbound system trouble to avoid nuisance communications
- WALKTEST silent or audible system test performs an automatic self-resetting test cycle

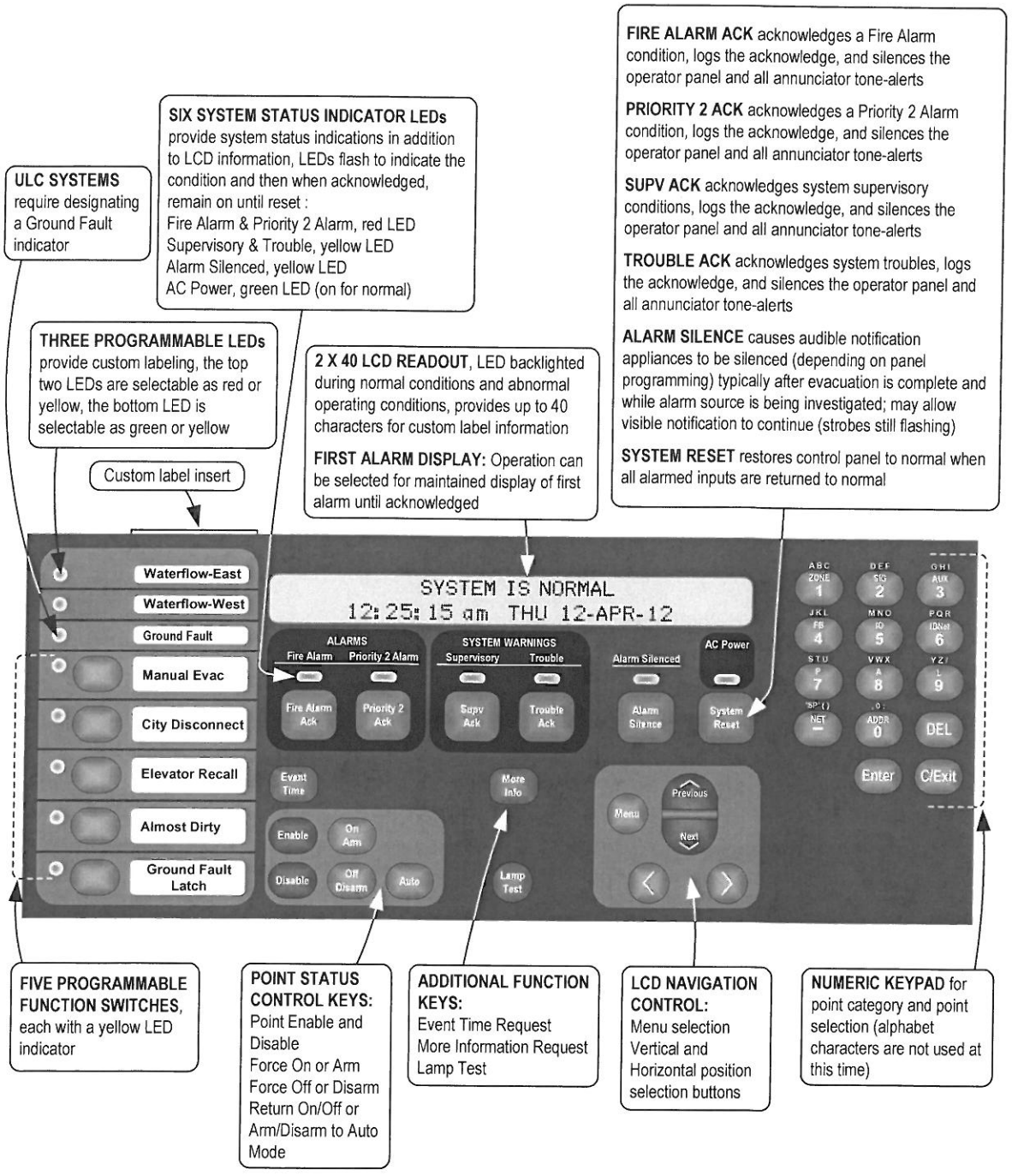
Operator Interface

Convenient Status Information. With the locking door closed, the glass window allows viewing of the display, status LEDs, and available operator switches. Features include a two-line by 40-character, wide viewing angle (super-twist) LCD with status LEDs and switches as shown in the illustration below.

LED indicators describe the general category of activity being displayed with the LCD providing more detail. For the authorized user, unlocking the door provides access to the control switches and allows further inquiry by scrolling the display for additional detail.

Operator Interface Features

- Convenient and extensive operator information is provided using a logical, menu-driven display
- Multiple automatic and manual diagnostics for maintenance reduction
- Alarm and Trouble History Logs (up to 1300 total events) are available for viewing from the LCD, or capable of being printed to a connected printer, or downloaded to a service computer
- Convenient PC programmer label editing
- Password access control



Compatible Peripheral Devices

The 4100ES is compatible with an extensive list of remote peripheral devices including printers, CRT/keyboards (up to five total), and both conventional and addressable devices including TrueAlarm analog sensors.

Addressable Device Control

Overview. The 4100ES provides standard addressable device communications for IDNet compatible devices and accepts optional modules for communications with MAPNET II compatible devices. Using a two wire communications circuit, individual devices such as manual fire alarm stations, TrueAlarm sensors, conventional IDC zones, and sprinkler waterflow switches can be interfaced to the addressable controller to communicate their identity and status.

Addressability allows the location and condition of the connected device to be displayed on the operator interface LCD and on remote system annunciators. Additionally, control circuits (fans, dampers, etc.) may be individually controlled and monitored with addressable devices.

Addressable Operation. Each addressable device on the communication channel is continuously interrogated for status condition such as: normal, off-normal, alarm, supervisory, or trouble. Both Class B and Class A operation are available. Sophisticated poll and response communication techniques ensure supervision integrity and allow for "T-tapping" of the circuit for Class B operation. Devices with LEDs pulse the LED to indicate receipt of a communications poll and can be turned on steady from the panel.

IDNet Channel Capacity. The CPU bay system power supply (SPS) provides an IDNet signaling line circuit (SLC) that supports up to 250 addressable monitor and control points intermixed on the same pair of wires. Additional IDNet circuit modules are available for 64, 127, or 250 addressable devices.

IDNet/MAPNET II Communications wiring specifications. Distances are for shielded or unshielded wire. Shielded wire may provide protection from unexpected sources of interference.

Wiring Specifications

Size		18 AWG (0.82 mm^2)
Type	Preferred	Shielded twisted pair (STP)
	Acceptable*	Unshielded twisted pair (UTP)
Farthest Distance from Control Panel per Device load	126-250	Up to 2500 feet (762 m)
	up to 125	Up to 4000 ft (1219 m)
Total Wire Length Allowed With "T" Taps for Class B Wiring		Up to 10,000 ft (3 km); 0.58 µF

* Some applications may require shielded wiring. Review your system with your local Simplex product supplier.

TrueAlert Addressable Notification

TrueAlert Power Supplies provides three, 3 A Signaling Line Circuits (SLCs) for controlling and powering addressable notification appliances. With addressable appliances, Class B wiring can be "T-tapped" for easier wiring and reduced wire run lengths. Appliances include horns, strobes, and combination units. For more detail, refer to data sheet S4009-0003.

TrueAlarm System Operation

Addressable device communications include operation of TrueAlarm smoke and temperature sensors. Smoke sensors transmit an output value based on their smoke chamber condition and the CPU maintains a current value, peak value, and an average value for each sensor. Status is determined by comparing the current sensor value to its average value. Tracking this average value as a continuously shifting reference point filters out environmental factors that cause shifts in sensitivity.

Programmable sensitivity of each sensor can be selected at the control panel for different levels of smoke obscuration (shown directly in percent) or for specific heat detection levels. To evaluate whether the sensitivity should be revised, the peak value is stored in memory and can be easily read and compared to the alarm threshold directly in percent.

CO sensor bases combine an electrolytic CO sensing module with a TrueAlarm analog sensor to provide a single multiple sensing assembly using one system address. The CO sensor can be enabled/disabled, used in LED/Switch modes and custom control, and can be made public for communication across a fire alarm Network. (refer to data sheet S4098-0041 for details)

TrueAlarm heat sensors can be selected for fixed temperature detection, with or without rate-of-rise detection. Utility temperature sensing is also available, typically to provide freeze warnings or alert to HVAC system problems. Readings can selected as either Fahrenheit or Celsius.

TrueSense Early Fire Detection. Multi-sensor 4098-9754 provides photoelectric and heat sensor data using a single 4100ES IDNet address. The panel evaluates smoke activity, heat activity, ***and their combination***, to provide TrueSense early detection. For more details on this operation, refer to data sheet S4098-0024.

Diagnostics and Default Device Type

Sensor Status. TrueAlarm operation allows the control panel to automatically indicate when a sensor is almost dirty, dirty, and excessively dirty. The NFPA 72 requirement for a test of the sensitivity range of the sensors is fulfilled by the ability of TrueAlarm operation to maintain the sensitivity level of each sensor. CO Sensors track their 5 year active life status providing indicators to assist with service planning. Indicators occur at: 1 year, 6 months, and when end of life is reached.

Modular TrueAlarm sensors use the same base and different sensor types (smoke or heat sensor) and can be easily interchanged to meet specific location requirements. This allows intentional sensor substitution during building construction when conditions are temporarily dusty. Instead of covering smoke sensors (causing them to be disabled), heat sensors may be installed without reprogramming the control panel. The control panel will indicate an incorrect sensor type, but the heat sensor will operate at a default sensitivity to provide heat detection for building protection at that location.

CPU Bay Module Details

Master Controller and Motherboard:

- Mounts in Slot 4 of a two slot motherboard (Slots 3 and 4 of the Master Controller Bay) and provides one Style 4 or Style 7, RUI communications channel, available at Slot 4
- RUI communications controls up to 31 devices per master controller (on one or multiple RUI channels); devices include: MINIPLEX transponders, 4603-9101 LCD Annunciators, 4602-9101 Status Command Units (SCU), 4602-9102 Remote Command Units (RCU), 4602 Series LED Annunciator Panels, 4100 Series 24 I/O and LED/Switch modules, and remote mount 4009 TPS units
- Up to four RUI channels are supported; use up to three 4100-1291 RUI expansion modules as required
- Optional Service Modem 4100-6030 mounts onto the master controller board with its own on-board connections
- Slot 3 of the motherboard is primarily for the 4100-6078 Network Interface Board with media modules, and secondarily for the 4100-6038 Dual RS-232 Board (4100-6038 is required for 2120 System connections)

System Power Supply: (see page 8 for more detail)

- Rating is 9 A total with "Special Application" appliances; 4 A total for "Regulated 24 DC" appliance power
- Outputs are power-limited, except for the battery charger
- Provides system power, battery charging, auxiliary power, auxiliary relay, earth detection, on-board IDNet communications channel for 250 points, three on-board NACs, and provisions for either an optional City Connect Module or an optional Alarm Relay Module
- **IDNet SLC Output** provides Class B or Class A communications for up to 250 addressable devices (as described on page 4)

System Power Supply *(Continued)*:

- **Three, 3 A On-Board NACs**, conventional reverse polarity operation; rated 3 A for Special Application appliances and 2 A for Regulated 24 DC power, with electronic control and overcurrent protection; selectable as Class B or Class A, and for synchronized strobe or SmartSync horn/strobe operation over two wires
- **NACs can be selected** as auxiliary power outputs derated to 2 A for continuous duty; the total auxiliary power output per SPS is limited to 5 A
- **Battery Charger** is dual rate, temperature compensated, and charges up to 50 Ah sealed lead-acid batteries mounted in the battery compartment (33 Ah for single bay cabinets); also is UL listed for charging up to 110 Ah batteries mounted in an external cabinet (see data sheet S2081-0012 for details)
- **Battery and Charger Monitoring** includes battery charger status and low or depleted battery conditions; status information provided to the master controller includes analog values for: battery voltage, charger voltage and current, actual system voltage and current, and individual NAC currents
- **2 A Auxiliary Power Output** is selectable for detector reset, door holder, or coded output operation
- **Auxiliary Relay** is selectable as N.O. or N.C., rated 2 A @ 32 VDC, and is programmable as a trouble relay, either normally energized or normally de-energized, or as an auxiliary control
- **Optional City Connect Module** (4100-6031, with disconnect switches, or 4100-6032, without disconnect switches) can be selected for conventional dual circuit city connections
- **Optional Alarm Relay Module** (4100-6033) provides three Form C relays that are used for Alarm, Trouble, and Supervisory, rated 2 A resistive @ 32 VDC

Master Controller Selection Information

Master Controller and Expansion Bay Selection* (Canadian models have low battery cutout)

Model	Model Type and Listing			Description	Supv.	Alarm
4100-9111	120 VAC Input		UL	4100ES Master Controller Assembly **with LCD and operator interface**, 9 A system power supply/battery charger (SPS), 250 point IDNet interface, 3 NACs, auxiliary relay, and external RUI communications interface	373 mA	470 mA
4100-9112	English	120 VAC, Canadian	ULC			
4100-9113	French					
4100-9211	220-240 VAC Input		UL			
4100-9131	120 VAC Input		UL	4100ES Master Controller Assembly, **no display, no operator interface**, 9 A system power supply/battery charger (SPS), 250 point IDNet interface, 3 NACs, auxiliary relay, and external RUI communications interface	363 mA	425 mA
4100-9132	English	120 VAC, Canadian	ULC			
4100-9133	French					
4100-9230	220-240 VAC Input		UL			
4100-9121 (not ULC listed)	Redundant Master Controller, two bay assembly; top bay contains LCD and operator interface, CPU card assembly, and 4100ES, 9 A system power supply/battery charger (SPS); second bay contains CPU card in Slot 2, and LCD and operator interface; 120 VAC, 60 Hz input; **NOTE: RUI connections require use of 4100-1291 RUI expansion modules**				718 mA	937 mA
4100-2300	Expansion Bay Assembly; **order for each required expansion bay** (not required for 4100-9121)					
4100-2303	Legacy Module Stabilizer Bracket, used when expansion bays have legacy slot style modules					

Master Controller Upgrades for Existing 4100 Series Fire Alarm Control Panels*

Model	Panel Type	Includes
4100-7150	1000 pt 4100 (4100+)	New Master Controller and 4100ES user interface door assembly with Ethernet connection
4100-7152	512 pt 4100	Same as 4100-7150 plus includes a Universal Power Supply
4100-7158	1000 pt 4100 (4100+) or 4100U	New Master Controller with Ethernet Connection Upgrade Kit; for 4100+ **without** LCD and operator interface, or 4100U **with or without** LCD and operator interface
4100-2301	Expansion Bay Upgrade Kit for mounting 4100ES style (4" x 5" modules) in existing 4100 style panels; **Note:** When using this kit to upgrade a 4100+ transponder, a **4100-0620 Transponder Interface Card (TIC)** is also required for communications to the 4100ES module	

* For InfoAlarm Command Center expanded content display products, refer to data sheet S4100-0045. *(Continued on next page)*

Module Selection Information

Master Controller Upgrades for Existing 4020 Series Fire Alarm Control Panel

Model	Description
4100-9833	4020 Master Controller Upgrade to 4100ES; Includes New Master Controller with LCD & operator interface assembly, 8 VDC Converter and RUI Interface in a single bay cabinet with locking glass door and retainer; mounts as an adjunct panel close-nippled to existing 4020 cabinet; also includes 8 VDC box-to-box power and communications harness and solid filler panel for the existing 4020 Master Controller bay

Communication Modules

Model	Description			Size	Supv.	Alarm
4100-6078	For Master Controller; mounts in Slot 3	Modular Network Interface; each requires two media modules (below)		1 Slot	46 mA	46 mA
4100-6061	For Redundant Master Controller			1 Slot	46 mA	46 mA
4100-6056	Wired Media Module	Select two media cards as required; mounts on 4100-6078 or 4100-6061		N.A.	55 mA	55 mA
4100-6057	Fiber Optic Media Module			N.A.	25 mA	25 mA
4100-6047	Building Network Interface Card (BNIC), refer to data sheet S4100-0061 for details			2 Blocks	291 mA	291 mA
4100-6055	Network Access Dial-in Service Modem, mounts to 4100-6078 or 4100-6061 Network Interface Card, requires telephone line connection			N.A.	60 mA	60 mA
4100-1291	Remote Unit Interface Module (RUI); up to three maximum per control panel			1 Slot	85 mA	85 mA
4100-6030	Service Port Modem, local panel access only, mounts to Master Controller Module, requires telephone line connection, accesses same information as front panel port			N.A.	70 mA	70 mA
4100-6031	**Select one per SPS** (fits on SPS)	City Circuit, with disconnect switches	For use with SPS only, not RPS	N.A.	20 mA	36 mA
4100-6032		City Circuit, w/o disconnect switches		N.A.	20 mA	36 mA
4100-6033		Alarm Relay, 3 Form C relays, 2 A @ 32 VDC; for SPS or RPS		N.A.	15 mA	37 mA
4100-6101	Physical Bridge, Class B, includes 1 modem module and 2 wired modules			1 Slot	210 mA	210 mA
4100-6102	Physical Bridge, Class X, includes 2 modem and 2 wired modules			2 Slots	300 mA	300 mA
4100-6038	Dual Port RS-232 with 2120 interface (slot module)		3 maximum of RS-232 type modules per panel	1 Slot	132 mA	132 mA
4100-6046	Dual Port RS-232 standard interface (4 x 5 module)			1 Block	60 mA	60 mA
4100-6045	Decoder Module			3 Slots	85 mA	163 mA
4100-6048	VESDA Aspiration System Interface			1 Slot	132 mA	132 mA
4100-6052	DACT, Point or Event Reporting; 1 shipped unless 4100-7908 is selected; 2 max. per system; includes 2, 2080-9047 cables, 14 ft (4.3 m) long, RJ45 plug and spade lugs			1 Slot	30 mA	40 mA

Expansion, System, Remote, and TrueAlert Power Supplies and Accessories (Canadian models have low battery cutout)

Model	Voltage/Listing		Description	Size	Supv.	Alarm
4100-5101	120 VAC	UL	**Expansion Power Supply (XPS)**; 9 A output, 3 built-in Class A/B NACs; NAC operation is same as SPS, see page 5 for details	2 Blocks	50 mA	50 mA
4100-5103	120 VAC, Canadian	ULC				
4100-5102	220-240 VAC	UL				
4100-5115	NAC Expansion Module, 3 NACs, Class A/B, **mounts on XPS only**			N.A.	25 mA	25 mA
4100-5111	120 VAC	UL	**Additional System Power Supply (SPS)**; 9 A power supply/charger with 250 point IDNet channel, 3 Class A/B NACs, add IDNet device currents separately	4 Blocks	175 mA	185 mA
4100-5112	120 VAC, Canadian	ULC				
4100-5113	220-240 VAC	UL				
4100-5125	120 VAC	UL	**Remote Power Supply (RPS)**; 9 A power supply/charger similar to SPS except no IDNet channel or City Circuits; will accept one 4100-6033	4 Blocks	150 mA	185 mA
4100-5126	120 VAC, Canadian	ULC				
4100-5127	220-240 VAC	UL				
4100-5120	120 VAC	UL	**TrueAlert Power Supply (TPS)**; 3 Class B SLCs rated 3 A each for up to 63 TrueAlert addressable (special application) appliances per channel, 189 per TPS; built-in battery charger; 2 A aux. power output; add device current separately (see S4009-0003 for details)	4 Blocks	88 mA	100 mA
4100-5121	120 VAC, Canadian	ULC				
4100-5122	220-240 VAC	UL				
4100-5124	TrueAlert SLC Class A Adapter for all 3 SLCs, **mounts on TPS only**			N.A.	10 mA	10 mA
4100-5152	12 VDC Power Option, 2 A maximum			1 Block	1.5 A maximum	
4100-0156	8 VDC Converter, required for multiple Physical Bridge Modules, 3 A maximum			1 Block	included w/loads	
4009-9813	4009 TPS Transponder Interface Card (TIC), mounts in a remote cabinet with TPS; order card, TPS, and batteries separately, and select a 2975-9229 (red) or 2975-9230 (beige) cabinet (field installed); refer to data sheet S4100-0037 for cabinet detail; Supervisory and Alarm current = 87 mA; (CSFM listed under 7300-0026:0368)					
4100-0636	Box Interconnection Harness Kit (non-audio); **order one for each close-nippled cabinet**					
4100-0638	4100 Slot Module Additional 24 VDC Harness; **need when 4100 Slot module requirements exceed 2 A from SPS**					

8 Zone Initiating Device Circuits*

Model	Type	Supv.	Alarm
4100-5005	Class B	75 mA	195 mA
4100-5015	Class A	75 mA	195 mA

* IDC Modules are 1 Slot size

Expansion Signal Module and Options (1.5 A Class B except as noted)

Model	Description		Supv.	Alarm
4100-5116	Converts 1 NAC in to 3 NACs out; 1 Block size		18 mA	80 mA
4100-1266	Expands 3 NACs to 6	select one; mounts on 4100-5116	0.6 mA	60 mA
4100-1267	Converts 3 NACs to Class A		0.6 mA	30 mA

Continued on next page

Module Selection Information *(Continued)*

Miscellaneous Accessories

Model	Description
4100-1279	Single blank 2" display cover; **4100-2302** provides a single plate for a full bay
4100-9856*	4100ES Canadian French Appliqué Kit; Simplex, 4100ES, Controle Incendie
4100-9857*	4100ES English Appliqué Kit; Simplex, 4100ES, Fire Control
4100-9858*	4100ES InfoAlarm Remote Display English Appliqué Kit; Simplex, Operator Interface, 4100ES
4100-9859*	4100ES InfoAlarm Remote Display Canadian French Appliqué Kit; Simplex, Interface de l'operateur, 4100ES
4100-9835	Termination and Address Label Kit (for module marking); provides additional labels for field installed modules
4100-6029	Smoke Management Application Guide; **required for UUKL listing**
4100-6034	Tamper Switch, one per cabinet assembly if required; monitors solid door for panels with solid door; monitors the internal retainer panel for panels with glass door (not the glass door); has a built-in addressable IDNet IAM
2081-9031	Series resistor for WSO, IDCs (N.O. water flow and tamper on same circuit, wires after water flow and before tamper) 470 Ω, 1 W, encapsulated, two 18 AWG leads (0.82 mm^2), 2-1/2" L x 1-3/8" W x 1" H (64 mm x 35 mm x 25 mm)

* **Note:** 4100ES **English** Appliqués are included with 4100ES Upgrade and Retrofit Kits for mounting 4100ES in 4100, 2120, 2001, and Autocall back boxes so that upgrades can be easily identified as 4100ES. 4100ES Appliqué Kits are available for applications such as to update Remote InfoAlarm Displays connected to a panel that was upgraded to 4100ES or for an existing 4100U when the New Master Controller is upgraded to 4100ES and only a software upgrade is required. **When required, French appliqués are ordered separately.**

Addressable Interface Modules (refer to location reference on pages 9 and 10)

Model	Description		Supv.	Alarm
4100-3101	IDNet Module, 250 point capacity	With 250 IDNet devices, add	200 mA	250 mA
4100-3104	IDNet Module, 127 point capacity	With 127 IDNet devices, add	102 mA	127 mA
4100-3105	IDNet Module, 64 point capacity	With 64 IDNet devices, add	51 mA	64 mA
IDNet Modules, Specifications for each capacity; Module size = 1 Block		Module without devices	75 mA	115 mA
		Loading per IDNet device	0.8 mA	1 mA

Model	Description		Supv.	Alarm
4100-3102	MAPNET II Module, 127 point capacity, add devices separately; Module size = 2 Slots; Loading per MAPNET II device = 1.7 mA	Module without devices	255 mA	275 mA
		Fully loaded module, total	471 mA	491 mA
4100-3103	Isolator Module **for MAPNET II or IDNet**; converts a single connected SLC into four isolated outputs selectable as Class A or Class B; up to two Isolator Modules can be connected to one SLC; Module size = 1 Slot; **NOTE:** Compatible with MAPNET II Remote Isolators only; for quad isolation with IDNet Remote Isolators, use 4100-3107 IDNet+ Module (see data sheet S4100-0046 for details)		50 mA	50 mA

Relay Modules; Nonpower-limited (for mounting in expansion bay only, refer to location reference on pages 9 and 10)

Model	Description	Resistive Ratings		Inductive Ratings		Size	Supv.	Alarm
4100-3202	4 DPDT w/feedback	10 A	250 VAC	10 A	250 VAC	2 Slots	15 mA	175 mA
4100-3204	4 DPDT w/feedback	2 A	30 VDC/VAC	1/2 A	30 VDC/120 VAC	1 Block	15 mA	60 mA
4100-3206	8 SPDT	3 A	30 VDC/120 VAC	1-1/2 A	30 VDC/120 VAC	1 Block	15 mA	190 mA

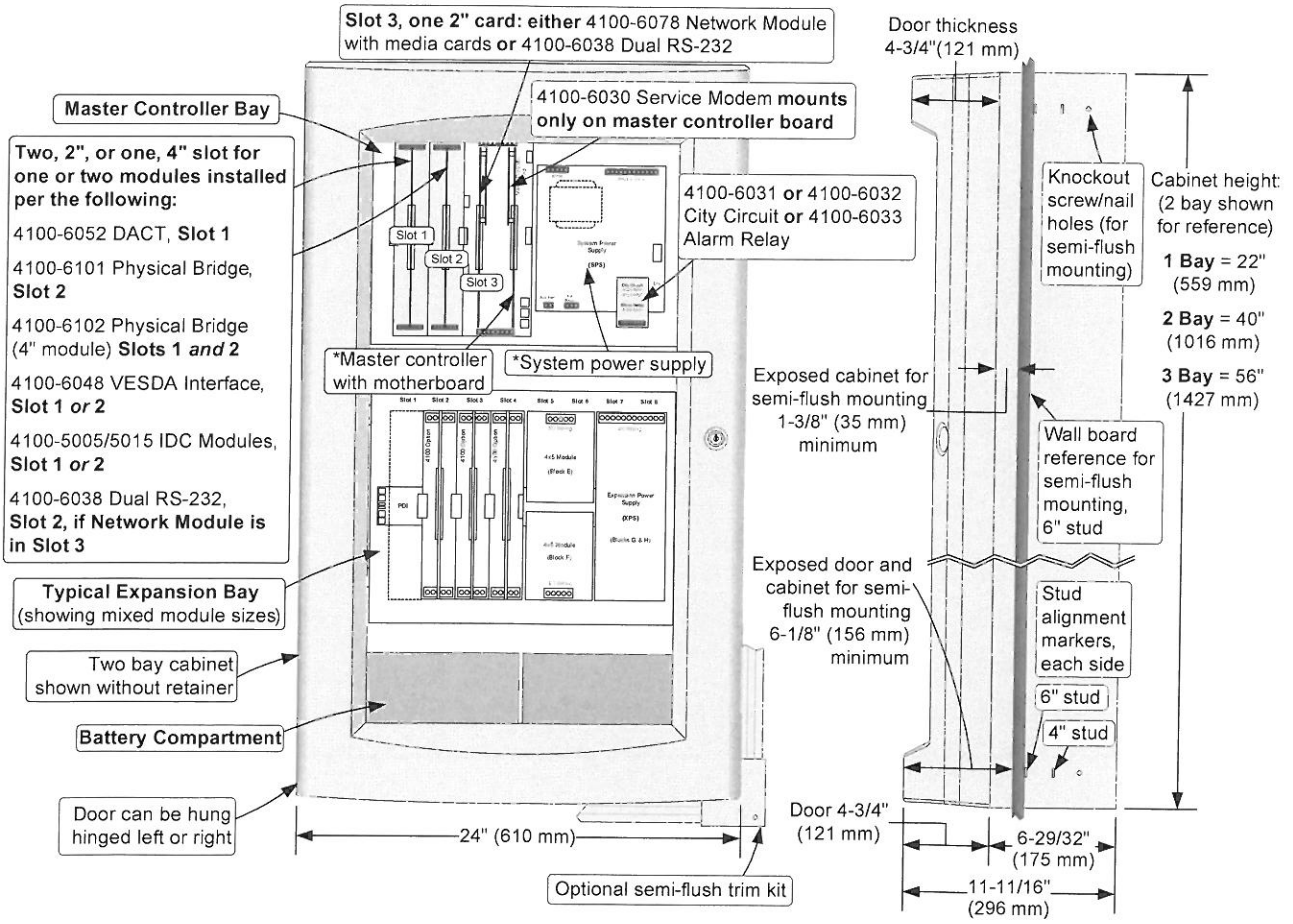
Current Calculation Notes:

1. To determine total supervisory current, add currents of modules in panel to base system value **and** all external loads powered by panel power supplies.
2. To determine total alarm current, add currents of modules in panel to base system alarm current **and** add all panel NAC loads **and** all external loads powered from panel power supplies.

General Specifications

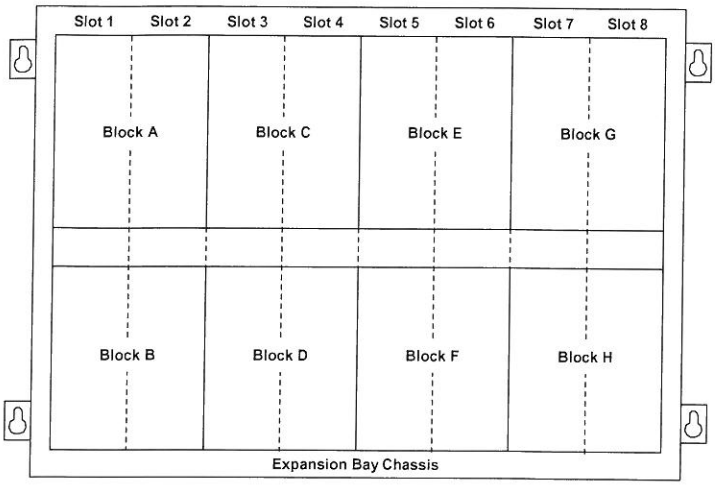
Input Power	System Power Supplies (SPS) Expansion Power Supplies (XPS) Remote Power Supplies (RPS) TrueAlert Power Supplies (TPS)	120 VAC Models	4 A maximum @ 102 to 132 VAC, 60 Hz	
		220-240 VAC Models	2 A maximum @ 204 to 264 VAC, 50/60 Hz; separate taps for 220/230/240 VAC	
Power Supply Output Ratings for SPS, XPS, and RPS (nominal 28 VDC on AC; 24 VDC on battery backup)	Total Power Supply Output Rating	**Including module currents and auxiliary power outputs;** 9 A total for "Special Application" appliances; 4 A total for "Regulated 24 DC" power (see below for details)		Output switches to battery backup during mains AC failure or brownout conditions
	Auxiliary Power Tap	2 A maximum	Rated 19.1 to 31.1 VDC	
	NACs Programmed for Auxiliary Power	2 A maximum per NAC; 5 A maximum total		
Special Application Appliances	Simplex 4901, 4903, 4904, and 4906 Series horns, strobes, and combination horn/strobes and speaker/strobes (contact your Simplex product representative for compatible appliances)			
Regulated 24 DC Appliances	Power for other UL listed appliances; use associated external synchronization modules where required			
Battery Charger Ratings for SPS, RPS and TPS (sealed lead-acid batteries)	Battery capacity range	UL listed for battery charging of 6.2 Ah up to 110 Ah (110 Ah batteries require a remote battery cabinet); ULC listed for charging up to 50 Ah batteries		
	Charger characteristics and performance	Temperature compensated, dual rate, recharges depleted batteries within 48 hours per UL Standard 864; to 70% capacity in 12 hours per ULC Standard S527		
Environmental	Operating Temperature	32° to 120°F (0° to 49° C)		
	Operating Humidity	Up to 93% RH, non-condensing @ 90° F (32° C) maximum		
Additional Technical Reference	Installation Instructions	574-848		
	Operating Instructions	579-197		

Mounting and CPU Bay Module Reference (* indicates supplied modules)



NOTE: A system ground must be provided for Earth Detection and transient protection devices. This connection shall be made to an approved, dedicated Earth connection per NFPA 70, Article 250, and NFPA 780.

Expansion Bay Module Loading Reference



Size Definitions: Block = 4" W x 5" H (102 mm x 127 mm) card area
Slot = 2" W x 8" H (51 mm x 203 mm) motherboard with daughter card

Description		Mounting
IDNet Modules		1 Block
4, 2 A Relays	**NON Power-limited**	1 block
4, 10 A Relays		4", 2 slots
8, 3 A Relays		1 block
VESDA Interface		2", 1 Slot
Class B IDC		2", 1 Slot
Class A IDC		2", 1 Slot
MAPNET II Module		4", 2 Slots
MAPNET II/IDNet Isolator		2", 1 Slot
Class B Physical Bridge		2", 1 Slot
Class X Physical Bridge		4", 2 Slots
Decoder Module		6", 3 Slots
System, Remote, or TrueAlert Power Supply		Blocks E, F, G & H ONLY
Expansion Power Supply		Blocks G & H ONLY
NAC Expansion Module		On XPS ONLY

Additional 4100ES Data Sheet Reference

Subject	Data Sheet	Subject	Data Sheet
Introducing the 4100ES	*S4100-0060*	Agent Release Applications	S4100-0040
4100ES Enclosures	S4100-0037	Fire Alarm Network Overview	S4100-0055
4100ES Audio and Firefighter Phone Modules	S4100-0034	Network Communications	S4100-0056
LED/Switch Modules & Printer	S4100-0032	Network Display Unit (NDU)	S4100-0036
Remote Annunciators	S4100-0038	Addressable Device Compatibility	S4090-0011
MINIPLEX Transponders	S4100-0035	TrueAlert Addressable Products	S4009-0003
Building Network Interface (BNIC)	S4100-0061	IDNet+ Module w/Quad Isolator	S4100-0046
InfoAlarm Command Center	S4100-0045	Remote Battery Charger	S4081-0002
Graphic I/O Modules	S4100-0005	TFX Interface Module	S4100-0042
SafeLINC Internet Interface	S4100-0028	Master Clock Interface	S4100-0033
TrueInsight Remote Service	S4100-0063	2120 BMUX Module	S4100-0048

Simplex

TrueAlarm Analog Sensing

*UL, ULC, CSFM Listed; FM Approved; MEA (NYC) Acceptance**

TrueAlarm Analog Sensors – Photoelectric, Ionization, and Heat; Standard Bases and Accessories

Features

TrueAlarm analog sensing provides:

- Digital transmission of analog sensor values via IDNet or MAPNET II two-wire communications

For use with the following Simplex® products:

- 4100ES, 4100U, 4010ES, and 4010 Series control panels; and 4008 Series control panels with reduced feature set (refer to data sheet S4008-0001 for details)
- 4020, 4100, and 4120 Series control panels, Universal Transponders and 2120 TrueAlarm CDTs equipped for MAPNET II operation

Fire alarm control panel provides:

- Peak value logging allowing accurate analysis of each sensor for individual sensitivity selection
- Sensitivity monitoring satisfying NFPA 72 sensitivity testing requirements; automatic individual sensor calibration check verifies sensor integrity
- Automatic environmental compensation, multi-stage alarm operation, and display of sensitivity directly in percent per foot
- Ability to display and print detailed sensor information in plain English language

Photoelectric smoke sensors provide:

- Seven levels of sensitivity from 0.2% to 3.7%

Heat sensors provide:

- Fixed temperature sensing
- Rate-of-rise temperature sensing
- Utility temperature sensing

Ionization smoke sensors provide:

- Three levels of sensitivity; 0.5%, 0.9%, and 1.3%

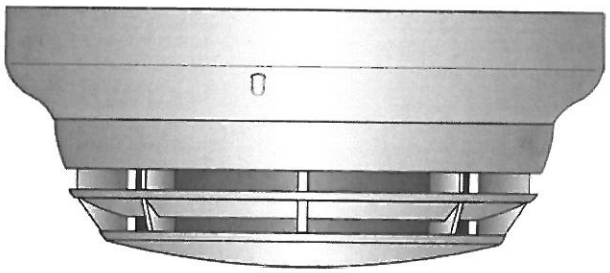
General features:

- UL listed to Standard 268
- Louvered smoke sensor design enhances smoke capture by directing flow to chamber; entrance areas are minimally visible when ceiling mounted
- Designed for EMI compatibility
- Magnetic test feature is provided
- Optional accessories include remote LED alarm indicator and output relays

Additional base reference:

- For isolator bases, refer to data sheet S4098-0025
- For sounder bases, refer to data sheet S4098-0028
- For photo/heat sensors, refer to data sheet S4098-0024 (single address) and S4098-0033 (dual address)

* These products have been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listings 7272-0026:218, 7271-0026:231, 7270-0026:216, and 7300-0026:217 for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use – City of New York Department of Buildings – MEA35-93E. Additional listings may be applicable, contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Fire Protection Products.



4098-9714 TrueAlarm Photoelectric Sensor Mounted in Base

Description

Digital Communication of Analog Sensing. TrueAlarm analog sensors provide an analog measurement digitally communicated to the host control panel using Simplex addressable communications. At the control panel, the data is analyzed and an average value is determined and stored. An alarm or other abnormal condition is determined by comparing the sensor's present value against its average value and time.

Intelligent Data Evaluation. Monitoring each sensor's average value provides a continuously shifting reference point. This software filtering process compensates for environmental factors (dust, dirt, etc.) and component aging, providing an accurate reference for evaluating new activity. With this filtering, there is a significant reduction in the probability of false or nuisance alarms caused by shifts in sensitivity, either up or down.

Control Panel Selection. Peak activity per sensor is stored to assist in evaluating specific locations. The alarm set point for each TrueAlarm sensor is determined at the host control panel, selectable as more or less sensitive as the individual application requires.

Timed/Multi-Stage Selection. Sensor alarm set points can be programmed for timed automatic sensitivity selection (such as more sensitive at night, less sensitive during day). Control panel programming can also provide multi-stage operation per sensor. For example, a 0.2% level may cause a warning to prompt investigation while a 2.5% level may initiate an alarm.

Sensor Alarm and Trouble LED Indication. Each sensor base's LED pulses to indicate communications with the panel. If the control panel determines a sensor is in alarm, or is dirty or has some other type of trouble, the details are annunciated at the control panel and that sensor base's LED will be turned on steadily. During a system alarm, the control panel will control the LEDs such that an LED indicating a trouble will return to pulsing to help identify the alarmed sensors.

True*Alarm* Sensor Bases and Accessories

Sensor Base Features

Base mounted address selection:

- Address remains with its programmed location
- Accessible from front (DIP switch under sensor)

General features:

- Automatic identification provides default sensitivity when substituting sensor types
- Integral red LED for power-on (pulsing), or alarm or trouble (steady on)
- Locking anti-tamper design mounts on standard outlet box
- Magnetically operated functional test

Sensor Bases

4098-9792, Standard sensor base

4098-9789, Sensor base with wired connections for:

- 2098-9808 Remote LED alarm indicator **or** 4098-9822 relay (unsupervised)

4098-9791, Sensor base with supervised relay driver output (not compatible with 2120 CDT):

- Relay operation is programmable and can be manually operated from control panel
- Use with remote mount 2098-9737 relay
- Also includes wired connections for remote LED alarm indicator **or** 4098-9822 relay

Sensor Base Options

2098-9737, Remote or local mount supervised relay:

- DPDT contacts for resistive/suppressed loads, power limited rating of 3 A @ 28 VDC; non-power limited rating of 3 A @ 120 VAC (requires external 24 VDC coil power)

4098-9822, LED Annunciation Relay:

- Activates when base LED is on steady, indicating local alarm or trouble
- DPDT contacts for resistive/suppressed loads, power limited rating of 2 A @ 28 VDC; non-power limited rating of 1/2 A @ 120 VAC, (requires external 24 VDC coil power)

4098-9832, Adapter plate:

- Required for surface or semi-flush mounting to 4" square electrical box and for surface mounting to 4" octagonal box
- Can be used for cosmetic retrofitting to existing 6-3/8" diameter base product

2098-9808, Remote red LED Alarm Indicator:

- Mounts on single gang box (shown in illustration to right)

Description

TrueAlarm sensor bases contain integral addressable electronics that constantly monitor the status of the detachable photoelectric, ionization, or heat sensors. Each sensor's output is digitized and transmitted to the system fire alarm control panel every four seconds.

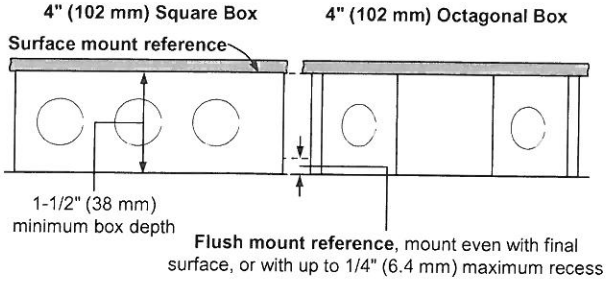
Since TrueAlarm sensors use the same base, different sensor types can be easily interchanged to meet specific location requirements. This feature also allows intentional sensor substitution during building construction. When conditions are temporarily dusty, instead of covering the smoke sensors (causing them to be disabled), heat sensors may be installed without reprogramming the control panel. Although the control panel will indicate an incorrect sensor type, the heat sensor will operate at a default sensitivity providing heat detection for building protection at that location.

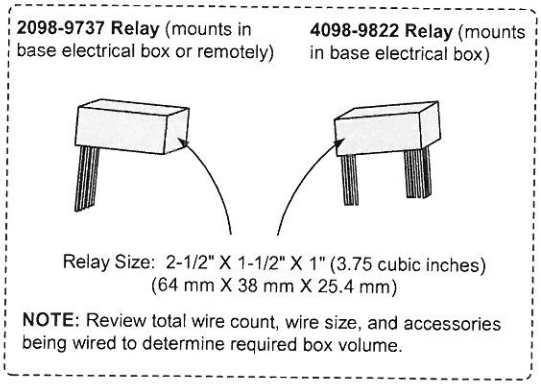
Mounting Reference

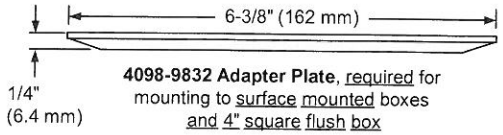
Electrical Box Requirements: (boxes are by others)

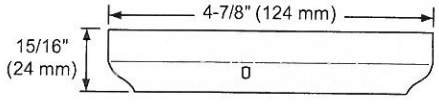
Without relay: 4" octagonal or 4" square, 1-1/2" deep; single gang, 2" deep

With relay : 4" octagonal or 4" square, 1-1/2" deep, with 1-1/2" extension ring









TrueAlarm Bases
4098-9789, -9791, & -9792

TrueAlarm Sensors

Features

Sealed against rear air flow entry

Interchangeable mounting

EMI/RFI shielded electronics

Heat sensors:

- Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation
- Rated spacing distance between sensors:

Fixed Temp. Setting	UL & ULC Spacing	FM Spacing, Either Fixed Temperature Setting
135° F (57.2° C)	60 ft x 60 ft (18.3 m)	20 ft x 20 ft (6.1 m) for fixed temperature only; **RTI = Quick**
155° F (68° C)	40 ft x 40 ft (12.2 m)	50 ft x 50 ft (15.2 m) for fixed temperature with either rate-of-rise selection; **RTI = Ultra Fast**

Smoke Sensors:

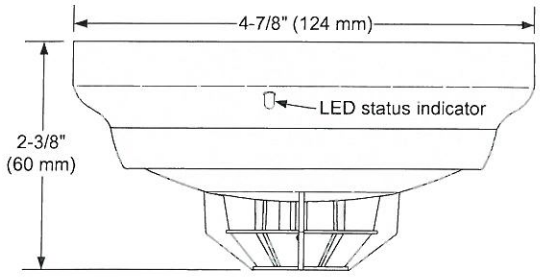
- Photoelectric or ionization technology sensing
- 360° smoke entry for optimum response
- Built-in insect screens

4098-9733 Heat Sensor

TrueAlarm heat sensors are self-restoring and provide rate compensated, fixed temperature sensing, selectable with or without rate-of-rise temperature sensing. Due to its small thermal mass, the sensor accurately and quickly measures the local temperature for analysis at the fire alarm control panel.

Rate-of-rise temperature detection is selectable at the control panel for either 15° F (8.3° C) or 20° F (11.1° C) per minute. Fixed temperature sensing is independent of rate-of-rise sensing and programmable to operate at 135° F (57.2° C) or 155° F (68° C). In a slow developing fire, the temperature may not increase rapidly enough to operate the rate-of-rise feature. However, an alarm will be initiated when the temperature reaches its rated fixed temperature setting.

TrueAlarm heat sensors can be programmed as a utility device to monitor for temperature extremes in the range from 32° F to 155° F (0° C to 68° C). This feature can provide freeze warnings or alert to HVAC system problems. *Refer to specific panels for availability.*



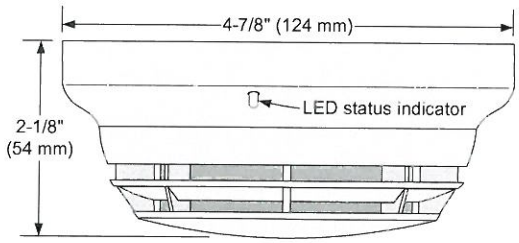
4098-9733 Heat Sensor with Base

WARNING: In most fires, hazardous levels of smoke and toxic gas can build up before a heat detection device would initiate an alarm. In cases where Life Safety is a factor, the use of smoke detection is highly recommended.

4098-9714 Photoelectric Sensor

TrueAlarm photoelectric sensors use a stable, pulsed infrared LED light source and a silicon photodiode receiver to provide consistent and accurate low power smoke sensing. Seven levels of sensitivity are available for each individual sensor, ranging from 0.2% to 3.7% per foot of smoke obscuration. Sensitivity is selected and monitored at the fire alarm control panel.

The sensor head design provides 360° smoke entry for optimum response to smoke from any direction. Due to its photoelectric operation, air velocity is not normally a factor, except for impact on area smoke flow.

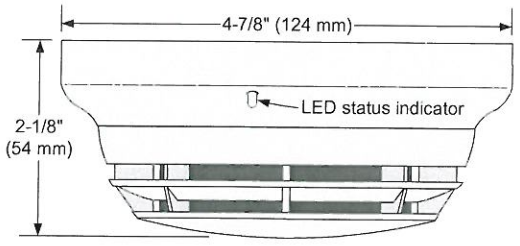


4098-9714 Photoelectric Sensor with Base

4098-9717 Ionization Sensor

TrueAlarm Ionization sensors use a single radioactive source with an outer sampling ionization chamber and an inner reference ionization chamber to provide stable operation under fluctuations in environmental conditions such as temperature and humidity. Smoke and invisible combustion gases can freely penetrate the outer chamber. With both chambers ionized by a small radioactive source [Am 241 (Americium)], a very small current flows in the circuit. The presence of particles of combustion will cause a change in the voltage ratio between chambers. This difference is measured by the electronics in the sensor base and digitally transmitted back to the control panel for processing.

Three levels of sensitivity are available for each ionization sensor: 0.5, 0.9, and 1.3% per foot of smoke obscuration.



4098-9717 Ionization Sensor with Base

Application Reference

Sensor locations should be determined only after careful consideration of the physical layout and contents of the area to be protected. Refer to NFPA 72, the *National Fire Alarm and Signaling Code*. On smooth ceilings, smoke sensor spacing of 30 ft (9.1 m) may be used as a guide. For detailed application information, refer to *4098 Detectors, Sensors, and Bases Application Manual* (574-709).

TrueAlarm Analog Sensing Product Selection Chart

TrueAlarm Sensor Bases

(Refer to Application Manual 574-709 and Installation Instructions 574-707 for additional information)

Model	Description	Compatibility	Mounting Requirements
4098-9792	Standard Sensor Base, no options	Sensors 4098-9714, -9733, & -9717	4" octagonal or 4" square box, 1-1/2" min. depth; or single gang box, 2" min. depth
4098-9789	Sensor Base with connections for Remote LED Alarm Indicator **or** Unsupervised Relay	Sensors 4098-9714, -9733, & -9717 2098-9808 remote LED alarm indicator **or** 4098-9822 relay	4" octagonal or 4" square box **Note:** Box depth requirements depend on total wire count and wire size, refer to accessories list below for reference.
4098-9791**	Sensor Base with connections for **Supervised** Remote Relay **and** connections for Remote Alarm Indicator **or** Unsupervised Relay	Sensors 4098-9714, -9733, & -9717 2098-9737 remote relay (supervised) 2098-9808 remote alarm indicator **or** 4098-9822 relay (unsupervised)	** **NOTE:** 4098-9791 is NOT compatible with the 2120 CDT

TrueAlarm Sensors

Model	Description	Compatibility	Mounting Requirements
4098-9714	Photoelectric Smoke Sensor	Bases 4098-9792, 4098-9789, and 4098-9791	Refer to base requirements
4098-9717	Ionization Smoke Sensor		
4098-9733	Heat Sensor		

TrueAlarm Sensor/Base Accessories

Model	Description	Compatibility	Mounting Requirements
2098-9737	Supervised Relay, mounts remote or in base electrical box	For use with 4098-9791 base	**Remote Mounting** requires 4" octagonal or 4" square box, 1-1/2" minimum depth **Base Mounting** requires 4" octagonal box, 2-1/8" deep with 1-1/2" extension ring
2098-9808	Remote Red LED Alarm Indicator on single gang stainless steel plate	Bases 4098-9789 and 4098-9791	Single gang box, 1-1/2" minimum depth
4098-9822	Relay, tracks base LED status (unsupervised, mounts only in base electrical box)		4" octagonal box, 2-1/8" deep with 1-1/2" extension ring
4098-9832	Adapter Plate	Bases 4098-9792, -9789, & -9791	**Required** for surface or semi-flush mounted 4" square box and for surface mounted 4" octagonal box

Specifications

General Operating Specifications		
Communications and Sensor Supervisory Power		MAPNET II or IDNet, auto-select, 24-40 VDC w/data, 400 µA typical, 1 address per base
Communications Connections		Screw terminals for in/out wiring, 18 to 14 AWG (0.82 mm^2 to 2.08 mm^2)
Remote LED Alarm Indicator Current		1 mA typical, no impact to alarm current
Remote LED Alarm Indicator and Relay Connections		Color coded wire leads, 18 AWG (0.82 mm^2)
UL Listed Temperature Range		32° to 100° F (0° to 38° C)
Operating Temperature Range	with 4098-9717 or 4098 -9733	32° to 122° F (0° to 50° C)
	with 4098-9714	15° to 122° F (-9° to 50° C)
Humidity Range		10 to 95% RH
Smoke Sensor Ambient Ratings	4098-9714, Photoelectric Sensor	Air velocity = 0-4000 ft/min (0-1220 m/min)
	4098-9717, Ionization Sensor	Air velocity = 0-200 ft/min (0-61 m/min); Altitude is up to 8000 ft (2.4 km)
Housing Color		Frost White
4098-9791 Base With Supervised Remote Relay 2098-9737 (see page 2 for contact ratings)		
Externally Supplied Relay Coil Voltage		18-32 VDC (nominal 24 VDC)
Supervisory Current		270 µA, from 24 VDC supply
Alarm Current with 2098-9737 Relay		28 mA, from 24 VDC supply
4098-9822 Unsupervised Relay, Requirements for Bases 4098-9789 and 4098-9791 (see page 2 for contact ratings)		
Externally Supplied Relay Coil Voltage		18-32 VDC (nominal 24 VDC)
Supervisory Current		Supplied from communications
Alarm Current		13 mA from separate 24 VDC supply

Simplex

UL, ULC, CSFM Listed;
*MEA (NYC) Acceptance**

Non-Addressable Initiating Peripherals

Reflective Beam Smoke Detectors
Fire Fighting Enterprises Models 50RU and 100RU

Features

Photoelectric transmitter and receiver are combined in a single, compact housing:

- An infrared beam is reflected from a matching prism with the reflected light analyzed by an on-board microprocessor providing area smoke detection
- Two models are available:
  – Model 50RU is for 15 ft to 160 ft (5 m to 50 m)
  – Model 100RU is for 160 ft to 330 ft (50 m to 100 m)
- Each model includes the matching prism reflector(s), a wall mounting bracket, and a calibrated test filter
- UL listed to Standard 268

Microprocessor controlled operation includes:

- Easy setup and alignment with three selectable alarm thresholds of 25%, 35%, or 50% beam obscuration (can be mounted horizontally or vertically)
- Operation at either 12 VDC or 24 VDC
- Alarm latching or alarm auto-reset
- Automatic gain control
- Separate alarm and trouble contacts

Applications:

- Open areas where ceiling height exceed 25ft (7.6 m) (warehouses, hotel atriums, industrial plants, and school gymnasiums)
- Public areas where cosmetics are of prime importance and detector heads need to be small and unobtrusive (shopping malls, libraries, theaters, and churches)

Benefits:

- Reduces installation costs where 6 or more spot detectors are required in a single area
- Optional remote test station mounts at ground level and reduces service time by testing without site disruption

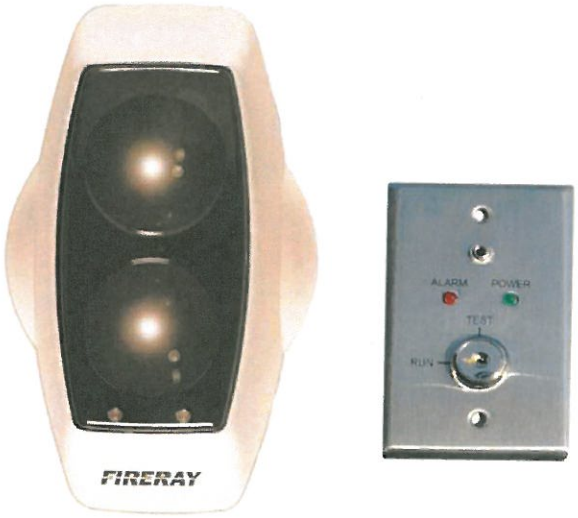
Optional Accessories:

- Surface mount matching backbox
- Extended alignment bracket
- Remote Test Station

Description

Single Unit Design. A single unit houses both an infrared transmitter and receiver. The transmitter signal is reflected by a matching prism back to the receiver where the internal microprocessor analyzes it for the presence of smoke. An alarm condition is determined when the selected sensitivity level is reached.

Mounting. Detectors are mounted with the beam projecting between 1 ft (305 mm) and 2 ft (610 mm) below, and parallel to the ceiling. Lateral detection may be up to 30 ft (9.144 m) on either side of the beam, providing a maximum total coverage area of up to 19,800 ft^2 (60 ft x 330 ft or 18.288 m x 100 m).



50RU/100RU Reflective Beam Detector (shown without wall mount bracket) and LLC Remote Test Station

Description *(Continued)*

Application Note. Reflective beam smoke detectors may not be suitable for areas with highly reflective surfaces. Separate transmitter/receiver models may be required.

Engineering Specification

The projected beam type smoke detector shall be a 4-wire 12/24 VDC device to be used with a UL Listed separately supplied 4-wire control panel. Unit shall be listed to UL 268 and shall consist of an integrated transmitter and receiver. The detector shall operate between a range of 15 ft to 330 ft (5 m to 100 m). The temperature range of the beam shall be -4° F to 131° F (-20° C to +55° C) [UL 268 listed temperature range is 32° F to 100° F (0° C to 38° C)]. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on the lenses. The unit shall include a wall mounting bracket. Testing shall be carried out by using a calibrated obscuration test filter. The Reflective beam type smoke detector shall be a Fire Fighting Enterprises 50RU (160 ft/50 m) or 100RU (330 ft/100 m).

Beam Detector Spacing

On smooth ceilings, up to 60 ft (18.288 m) between reflective beams and not more than one-half the spacing between a reflective beam and a sidewall. Other spacing may be used depending on ceiling height, airflow characteristics, and response requirements.

Refer to NFPA 72 and Installation Instructions supplied with unit for further information.

* Listings are by Fire Fighting Enterprises. Refer to CSFM 7260-1508:102; and MEA 70-02-E. This product was not approved by FM as of document revision date.

Ordering Information

Ordering Number	Model	Description
0206.02	50RU	Reflective beam smoke detector; 160 ft (50 m) maximum distance
0206.03	100RU	Reflective beam smoke detector; 330 ft (100 m) maximum distance
0400-01	LLC	Remote Test Station/Low Level Controller (0400); single gang mount; provides remote Power-on LED, Alarm LED, and remote Alarm Test
23901.01	23901	Replacement Prism; Note; Model 100RU uses 4 prisms, Model 50 RU uses 1 prism
0608.01	0608	Surface mount matching backbox
0893.01	0893	Extended Alignment Bracket, allows up to +/- 45° adjustment for either detector or prism
1000-020	NA	Optional Protective Wire Cage

Internal Ordering Note: These products can be found in Job Design under the Air Products OP category OPFFE.

Additional Product Details (not shown to scale)

Beam Detector on Surface Mount Backbox, shown with optional 1000-020 Wire Cage

Extended Alignment Bracket

Prism Reflector

Specifications

Construction Specifications

Housing	Flame Retardant ABS; IP rating = IP50
Finish	Grey/Black
Dimensions, housing only	8-1/4" H x 4-3/4" W x 4-1/2" D (210 mm x 121 mm x 114 mm)
Dimensions, with bracket	8-1/4" H x 5" W x 4-3/4" D (210 mm x 126 mm x 121 mm)
Prism Dimensions	3-15/16" square x 3/8" D (100 mm x 9.5 mm) each; one is used by the Model 50RU; four are used by the Model 100RU
Manufacturer	Fire Fighting Enterprises (A Halma Group Company); website: www.ffeuk.com/

Electrical Specifications

Input Voltage	10.2 to 30 VDC
Standby Current	4 mA @ 24 VDC
Alarm Current	15 mA @ 24 VDC
Alarm and Trouble Relays	Dedicated, separate Form C relays, rated 1 A @ 30 VDC resistive
Wiring Method	Pluggable connector with attached wire leads
Optical Wavelength	880 nm

Operating Specifications

Startup Time		10 seconds
Reset Time		5 seconds maximum
Sensitivity		25%, 35%, or 50% obscuration
Operating Distance	50RU	15 ft to 160 ft (5 m to 50 m)
	100RU	160 ft to 330 ft (50 m to 100 m)
Status Indicators		Alarm = Red LED
		Trouble = Amber LED
Alarm Types		Select latching or non-latching operation
Trouble Conditions		Improper setup alignment; 90% or more obscuration
UL Listed Temperature Range		32° F to 100° F (0° C to 38° C)
Operating Temperature Range		-4° F to 131° F (-20° C to 55° C)
Relative Humidity		10 to 93% RH, non-condensing

Simplex

*UL, ULC, CSFM Listed; FM Approved; MEA (NYC) Acceptance**

Multi-Application Peripherals

IDNet or MAPNET II Communicating Devices Addressable Manual Stations

Features

Individually addressable manual fire alarm stations with:

- Power and data supplied via IDNet or MAPNET II addressable communications using a single wire pair
- Operation that complies with ADA requirements
- The NO GRIP Single Action Station and Retrofit Kit are available with a more easily operated pull lever for applications where anticipated users may find the standard station lever difficult to activate
- Pull lever that protrudes when alarmed
- Break-rod supplied (use is optional)
- Models are available with single or double action (breakglass or push) operation
- UL listed to Standard 38

Compatible with the following Simplex® control panels:

- Model Series 4100ES, 4010ES, 4008, 4010, 4100U, 4020, 4100, and 4120 fire alarm control panels equipped with either IDNet or MAPNET II communications
- Model Series 2120 Communicating Device Transponders (CDTs) equipped with MAPNET II communications

Compact construction:

- Electronics module enclosure minimizes dust infiltration
- Allows mounting in standard electrical boxes
- Screw terminals for wiring connections

Tamper resistant reset key lock (keyed same as Simplex fire alarm cabinets)

Multiple mounting options:

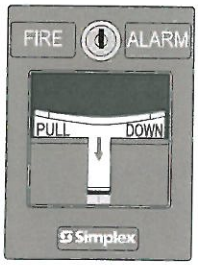
- Surface or semi-flush with standard boxes or matching Simplex boxes
- Flush mount adapter kit
- Adapters are available for retrofitting to commonly available existing boxes

Description

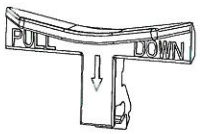
The Simplex addressable manual station combines the familiar Simplex manual station housing with a compact communication module that is easily installed to satisfy demanding applications. Its integral individual addressable module (IAM) constantly monitors status and communicates changes to the connected control panel via IDNet or MAPNET II communications wiring.

* Refer to page 2 for specific model listings. This product has been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7150-0026:224 for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use – City of New York Department of Buildings – MEA35-93E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Fire Protection Products.

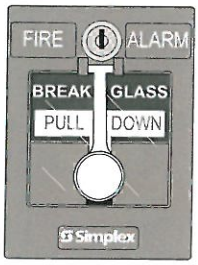
4099-9001
Single action



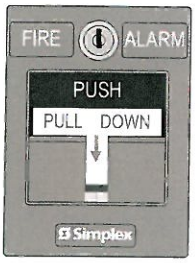
4099-9020
NO GRIP
Single action



4099-9805
NO GRIP
Retrofit kit



4099-9002
Breakglass



4099-9003
Push

With 2099-9828
Institutional
Cover kit

Operation

Activation of the 4099-9001 single action manual station requires a firm downward pull to activate the alarm switch. Completing the action breaks an internal plastic break-rod (visible below the pull lever, use is optional). The use of a break-rod can be a deterrent to vandalism without interfering with the minimum pull requirements needed for easy activation. The pull lever latches into the alarm position and remains extended out of the housing to provide a visible indication.

Single Action NO GRIP Station 4099-9020. For applications such as California Building Code, Title 24, which requires "Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist" the model 4099-9020 station provides a more easily operated pull lever compared to standard stations. Retrofit of existing stations is available using the 4099-9805 Retrofit kit.

Double Action Stations (Breakglass) require the operator to strike the front mounted hammer to break the glass and expose the recessed pull lever. The pull lever then operates as a single action station.

Double Action Stations (Push Type) require that a spring loaded interference plate (marked PUSH) be pushed back to access the pull lever of the single action station.

Station reset requires the use of a key to reset the manual station lever and deactivate the alarm switch. (If the break-rod is used, it must be replaced.)

Station testing is performed by physical activation of the pull lever. Electrical testing can be also performed by unlocking the station housing to activate the alarm switch.

Addressable Manual Station Product Selection

Addressable Manual Stations, Red Housing with White Letters and White Pull Lever

Model	Description	Housing	Pull Lever	Listings
4099-9001	Single action, English	FIRE ALARM	PULL DOWN	UL, ULC, FM, CSFM, MEA
4099-9001CB	Single action, Bilingual English and French	FEU FIRE	TIREZ PULL	ULC, FM
4099-9001CF	Single action, French	ALARME FEU	ABAISSEZ	
4099-9002	Double action, Breakglass operation, English	FIRE ALARM	PULL DOWN	UL, ULC, FM, CSFM, MEA
4099-9003	Double action, Push operation, English			
4099-9020	Single action NO GRIP operation, English	FIRE ALARM	PULL DOWN	UL, ULC, FM, CSFM

Accessories

Model	Description	
2975-9178	Surface mount steel box, red	Refer to page 3 for dimensions
2975-9022	Cast aluminum surface mount box, red	
2099-9813	Semi-flush trim plate for double gang switch box, red	Typically for retrofit, refer to page 4
2099-9814	Surface trim plate for Wiremold box V5744-2, red	
2099-9819	Flush mount adapter kit, black	Refer to page 4 for details
2099-9820	Flush mount adapter kit, beige	
2099-9803	Replacement breakglass	
2099-9804	Replacement break-rod	
2099-9828	Institutional cover kit for field installation on 4099-9001	
4099-9805	Retrofit Kit for field conversion of a single action station to a NO GRIP station; refer to Installation Instructions 579-1007 for details	

Specifications (refer to Installation Instructions 574-332 for additional information)

Power and Communications	IDNet or MAPNET II communications, 1 address per station
Address Means	DIP switch, 8 position
Wire Connections	Screw terminal for in/out wiring, for 18 to 14 AWG wire
UL Listed Temperature Range	32° to 120° F (0° to 49° C) intended for indoor operation
Humidity Range	Up to 93% RH at 100° F (38° F)
Housing Color	Red with white raised lettering
Material	Housing and pull lever are Lexan polycarbonate or equal
Pull Lever Color	White with red raised lettering
Housing Dimensions	5" H x 3-3/4" W x 1" D (127 mm x 95 mm x 25 mm)

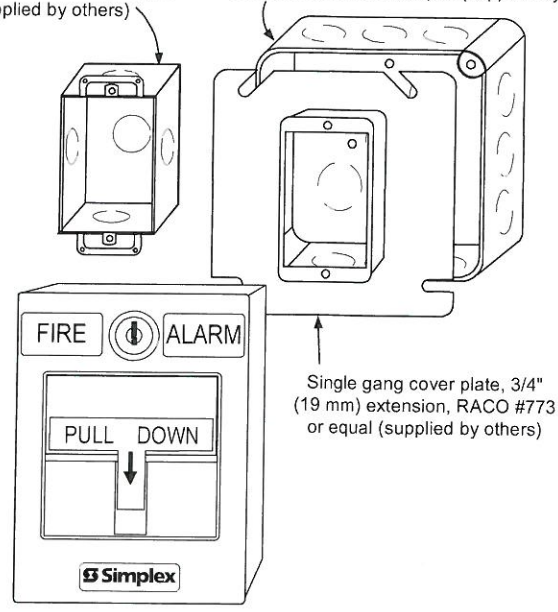
Addressable Manual Station Semi-Flush Mounting

Single Gang Box Mount

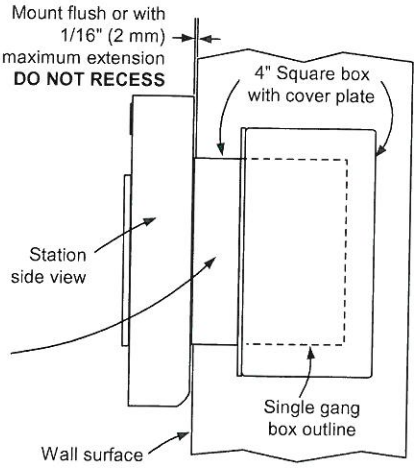
Single gang box, 2-1/2" deep (64 mm), RACO #500 or equal (supplied by others)

4" Square Box Mount

4" (102 mm) square box, 2-1/8" (54 mm) minimum depth, RACO #231 or equal (supplied by others)



Single gang cover plate, 3/4" (19 mm) extension, RACO #773 or equal (supplied by others)

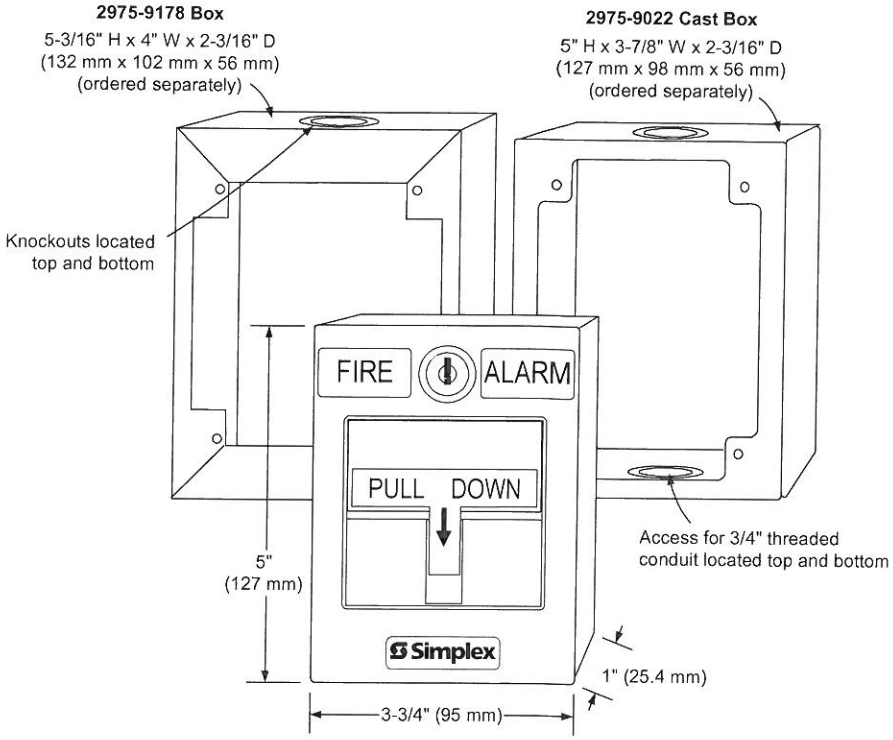


Semi-Flush Mount Side View

Addressable Manual Stations Surface Mounting

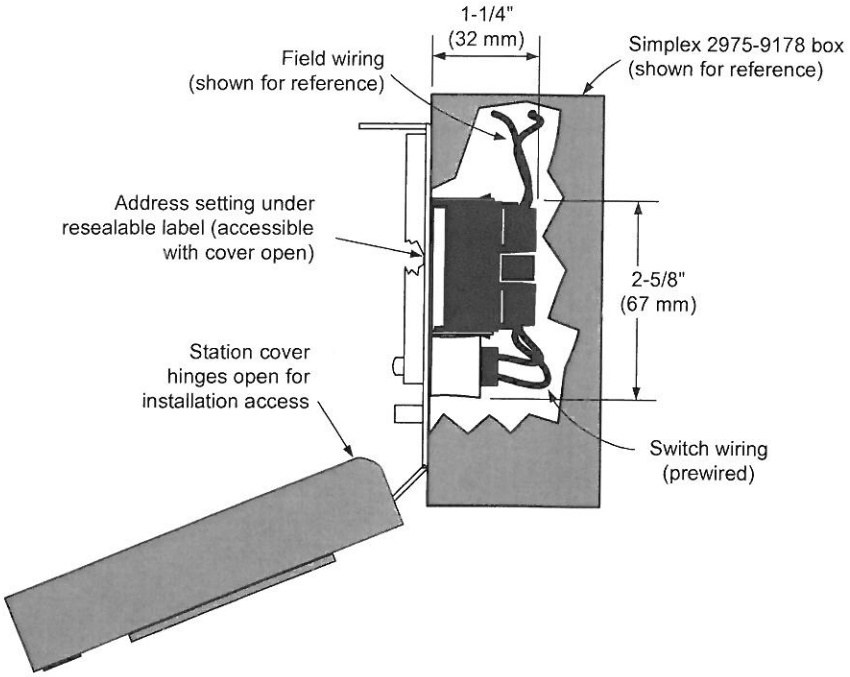
Preferred Mounting. For surface mounting of these addressable manual stations, the preferred electrical boxes are shown in the illustration to the right.

Additional Mounting Reference. Refer to page 4 for Wiremold box mounting compatibility.



4099 Series Addressable Manual Station

Surface Mount Side View with Internal Detail



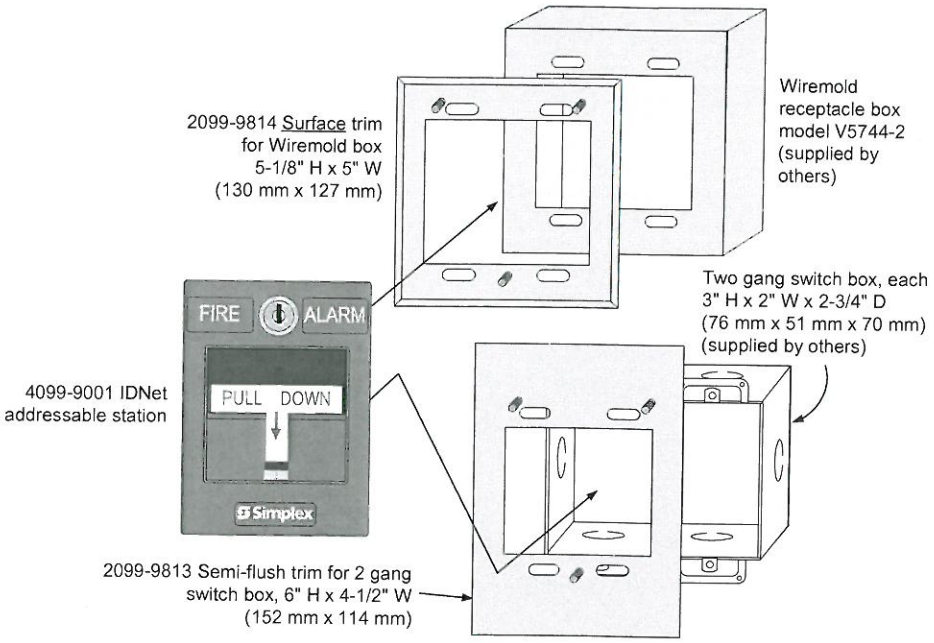
Application Reference

Refer to NFPA 72, the *National Fire Alarm and Signaling Code*, and all applicable local codes for complete requirements for manual stations. The following summarizes the basic requirements.

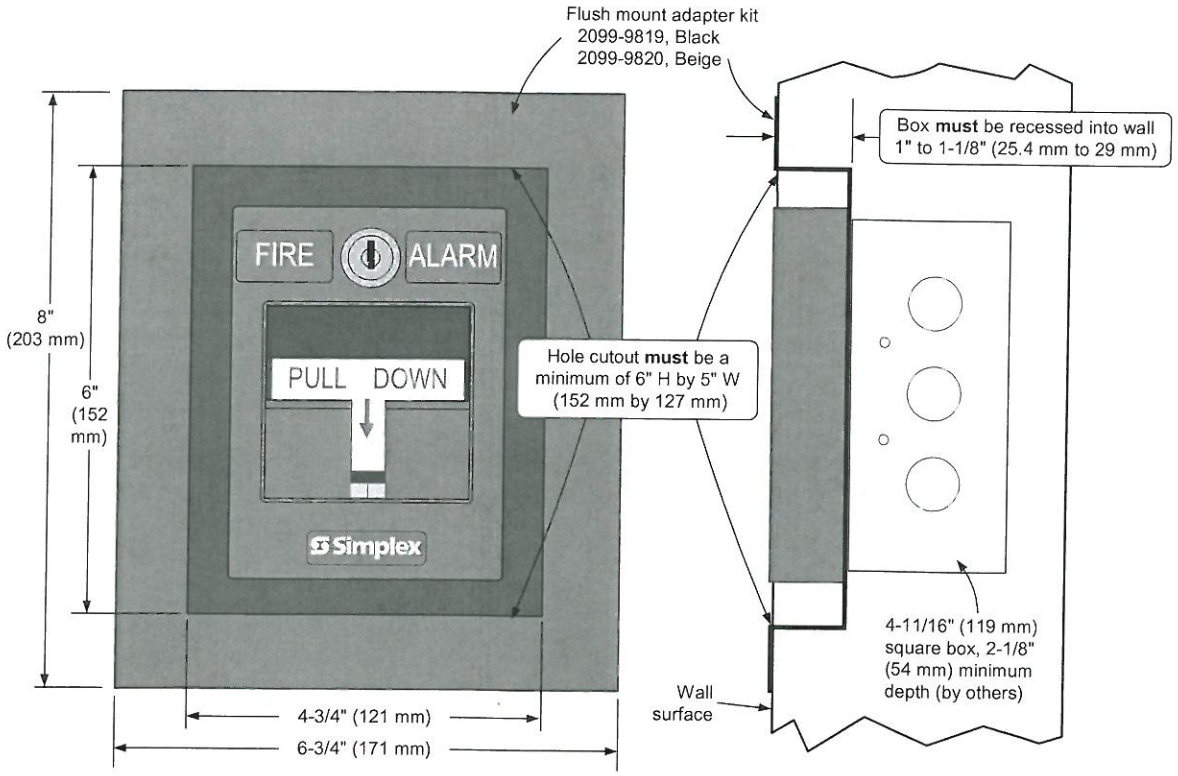
1. Stations shall be located in the normal path of exit and distributed in the protected area such that they are unobstructed and readily accessible.
2. Mounting shall be with the operable part not less than 42 in (1.07 m) and not more than 48 in (1.22 m) above floor level.
3. At least one station shall be provided on each floor. Additional stations shall be provided to obtain a travel distance not more than 200 ft (61 m) to the nearest station from any point in the building.
4. When manual station coverage appears limited in any way, additional stations should be installed.

Addressable Manual Station, Additional Mounting Information

For retrofit and new installations, additional compatible mounting boxes and the required adapter plates are shown in the illustration to the right.



Addressable Manual Station, Flush Mounting Information



4906-9154

Simplex

TrueAlert® Multi-Candela Notification Appliances

UL, ULC, CSFM Listed; FM Approved;
*MEA (NYC) Acceptance**

Visible Notification Appliances with Speaker and Multi-Candela Strobe; Non-Addressable

Features

Speaker/visible (S/V) notification appliances with multi-tapped speaker and multi-tapped high intensity xenon strobe with synchronized flash:

- Rugged, high impact, flame retardant thermoplastic housings are available for wall or ceiling mount
- Operation is compatible with ADA requirements (refer to important wall mount installation information on page 4)

Wall mount S/V features:

- Housings are available in red or white with clear lens with contrasting white or red "FIRE" lettering
- Covers are available separately to convert housing color

Ceiling mount S/V features:

- Housing is white with clear lens
- Red "FIRE" lettering is printed on two sides

Audible notification appliance (speaker):

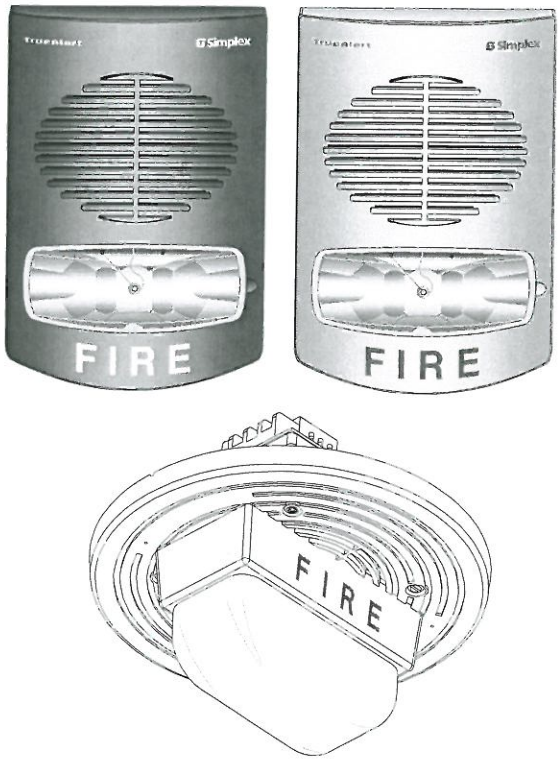
- High quality voice and tone reproduction with taps for 1/4, 1/2, 1, or 2 W, at 25 or 70.7 VRMS
- Capacitor input for connection to supervised notification appliance circuits
- Speakers are wired separately from strobe wiring
- UL listed to Standard 1480

Visible notification appliance (strobe):

- 24 VDC xenon strobe; intensity is selectable as 15, 30, 75, or 110 candela with visible selection jumper secured behind strobe housing
- Strobes are activated from NACs selected to provide Simplex® strobe synchronization signals or from separate strobe Synchronization Modules that are available for Class B or Class A operation**
- Regulated circuit design ensures consistent flash output and provides controlled inrush current
- UL listed to Standard 1971

Options for wall mounted S/Vs:

- Red or white adapters to cover surface mounted electrical boxes
- Red adapter for mounting to Simplex 2975-9145 boxes
- Red wire guard



Wall and Ceiling Mount S/Vs

Description

Multi-Candela TrueAlert S/Vs with speaker and synchronized strobe provide convenient installation to standard electrical boxes with extensions. The enclosure designs are both impact and vandal resistant and provide a convenient strobe intensity selection. Since each model can be selected for strobe intensity output, on-site model inventory is minimized and changes encountered during construction can be easily accommodated.

Wall mount S/V housings are a one-piece assembly (including lens) that mounts to a 4" square electrical box with extension (see details on page 4). The cover can be quickly removed (a tool is required) and covers are available separately for color conversion.

Ceiling mount S/Vs also install using 4" electrical boxes with an extension (see details on page 4).

Strobe Intensity Selection

During installation, a selection plug at the back of the housing determines the desired strobe intensity. An attached flag with black letters on a highly visible yellow background allows the selected intensity to be seen at the side of the strobe lens.

* Refer to page 2 for listing status of wire guards. This product has been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7320-0026:247 for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Accepted for use – City of New York Department of Buildings – MEA35-93E. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Safety Products Westminster.

** Simplex two-wire strobe synchronization operation is protected by U.S. patent Nos. 5,559,492; 5,886,620; 6,741,164; and 6,954,137.

Synchronized Strobes

Multiple Strobes. When multiple strobes and their reflections can be seen from one location, synchronized flashes reduce the probability of photo-sensitive reactions as well as the annoyance and possible distraction of random flashing. The multi-candela strobes of these S/Vs are activated by NACs that provide the Simplex synchronization format. For additional information, refer to data sheet S4905-0003.

Strobe Application Selection

Proper selection of visible notification is dependent on occupancy, location, local codes, and proper applications of: the *National Fire Alarm Code* (NFPA 72), ANSI A117.1; the appropriate model building code: BOCA, ICBO, or SBCCI; and the application guidelines of the Americans with Disabilities Act (ADA).

Product Selection

Wall Mount Multi-Candela S/Vs

Model	Housing Color	"FIRE" Lettering	Description	Housing Dimensions with Lens
4906-9151	Red	White	Multi-tapped Speaker with Multi-Candela Synchronized Strobe; strobe intensity selectable as: 15, 30, 75, or 110 candela	7-1/4" H x 5" W x 2-5/8" D (184 mm x 127 mm x 67 mm)
4906-9153	White	Red		

Ceiling Mount Multi-Candela S/V

Model	Housing Color	"FIRE" Lettering	Description	Dimensions
4906-9154	White	Red	Multi-tapped Speaker with Multi-Candela Synchronized Strobe; strobe intensity selectable as: 15, 30, 75, or 110 candela	Housing = 7-1/2" (191 mm) diameter, 1/2" (13 mm) deep Strobe lens protrusion = 2-5/8" (67 mm) above speaker housing Depth into box = 2-3/4" (70 mm)

Wall Mount S/V Adapters

Model	Description		Dimensions
4905-9946	Surface mount red adapter skirt	Required when mounting to surface mounted electrical box, 4" square, 1-1/2" deep with 1-1/2" deep extension	7-3/4" H x 5-3/8" W x 3-3/16" D (197 mm x 137 mm x 81 mm) depth with S/V = 5-7/8" (149 mm)
4905-9947	Surface mount white adapter skirt		
4905-9903	Adapter Plate, red, required to mount S/V on 2975-9145		8-5/16" H x 5-3/4" W x 0.060" Thick (211 mm x 146 mm x 1.5 mm)
2975-9145	Mounting box, red, for surface or flush mount, requires adapter plate 4905-9903 (this box may be available for retrofit applications)		7-7/8" H x 5-1/8" W x 2-3/4" D (200 mm x 130 mm x 70 mm)

Wall Mount S/V Replacement Covers

Model	Description	Dimensions
4905-9996	Red S/V cover with white "FIRE" lettering	7-1/4" H x 5" W x 1-3/8" D (184 mm x 127 mm x 35 mm)
4905-9997	White S/V cover with red "FIRE" lettering	

Synchronized Flash Control Modules

Model	Description		Dimensions
4905-9914*	Synchronized Flash Module, Class B (Style Y) operation	Epoxy encapsulated with in/out 18 AWG (0.82 mm2) wire leads, rated for 2 A NAC, requires 5 mA for power	1-3/8" W x 2-7/16" L x 13/16" H (35 mm x 62 mm x 20 mm)
4905-9922*	Synchronized Flash Module, Class A (Style Z) operation		

Wall Mount S/V Wire Guard

Model	Description	Dimensions
4905-9998	Wire guard with mounting plate, red, compatible with surface and semi-flush boxes (UL listed by Space Age Electronics Inc.)	8-3/8" H x 6-1/16" W x 3-1/4" D (213 mm x 154 mm x 79 mm)

Ceiling Mount Tile Bridge

Model	Description	Dimensions
2905-9946	Tile Bridge	See diagram on page 4

* Refer to data sheet S4905-0003 for additional flash control module information

S/V Specifications

Common Specifications

Environmental; Temperature and Humidity	32° to 122° F (0° to 50° C); 10% to 93%, non-condensing at 100° F (38° C)
Connections	Terminal blocks for 18 AWG to 12 AWG (0.82 mm^2 to 3.31 mm^2); two wires per terminal for in/out wiring

Speaker Specifications

Input Voltage		25 or 70.7 VRMS, see Note 1 below			
Power Taps		1/4, 1/2, 1, and 2 W			
Frequency Response	Fire Alarm	400 to 4000 Hz			
	General Signaling	125 to 12 kHz			
Speaker Output Ratings @ 10 ft (3 m) (see Note 1 below)	Wattage Tap	**1/4 W**	**1/2 W**	**1 W**	**2 W**
	Reverberant Chamber, UL 1480Test	76 dBA	79 dBA	82 dBA	85 dBA
	Anechoic Chamber, 1 kHz Input, On-Axis	87 dBA	90 dBA	93 dBA	96 dBA

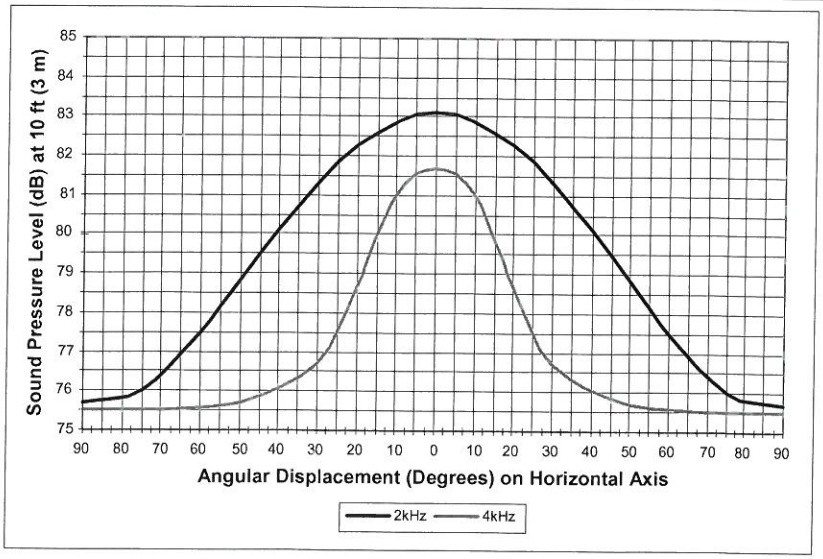
Strobe Specifications

Rated Voltage Range	UL Listed Rating	Regulated 24 VDC; see Note 2 below				
	ULC Listed Rating	20 VDC to 30 VDC per ULC S526-M878				
Flash Rate and Synchronized NAC Loading		1 Hz; with up to 35 synchronized strobes maximum per NAC				
Wall Mount	Housing Dimensions (with lens)	7-1/4" H x 5" W x 2-5/8" D (184 mm x 127 mm x 67 mm)				
	Maximum RMS Current Rating per Strobe Setting (see Note 3 below)	**15 cd**	**30 cd**	**75 cd**	**110 cd**	
		60 mA	**94 mA**	**186 mA**	**252 mA**	
	Reference RMS Currents at other voltages	18 VDC	53 mA	84 mA	165 mA	224 mA
		24 VDC	40 mA	63 mA	124 mA	168 mA
Ceiling Mount	Housing Dimensions	Speaker housing = 7-1/2" (191 mm) diameter, 1/2" deep (13 mm); lens protrusion above speaker housing = 2-5/8" (67 mm); depth into box = 2-3/4" (70 mm)				
	Maximum RMS Current Rating per Strobe Setting (see Note 3 below)	**15 cd**	**30 cd**	**75 cd**	**110 cd**	
		75 mA	**125 mA**	**233 mA**	**316 mA**	
	Reference RMS Currents at other voltages	18 VDC	67 mA	111 mA	207 mA	281 mA
		24 VDC	50 mA	83 mA	155 mA	211 mA

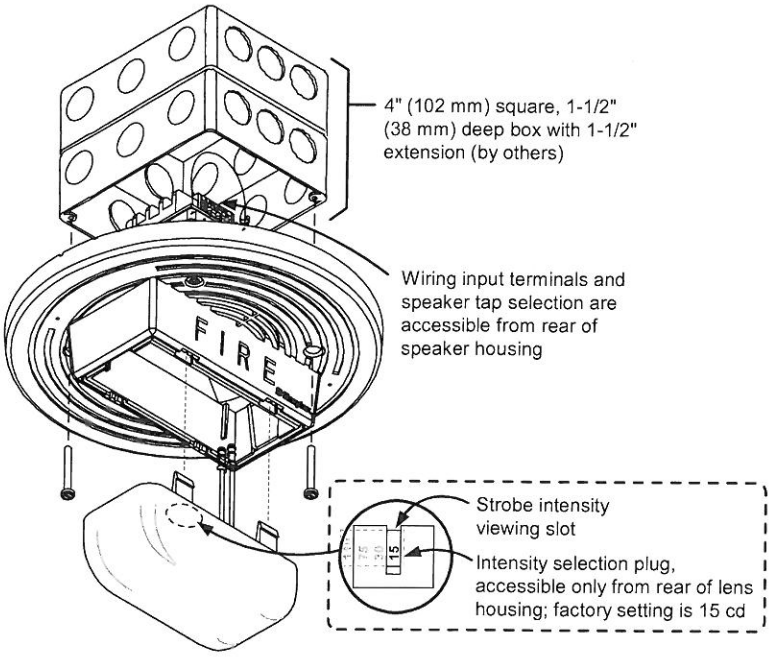
NOTES:

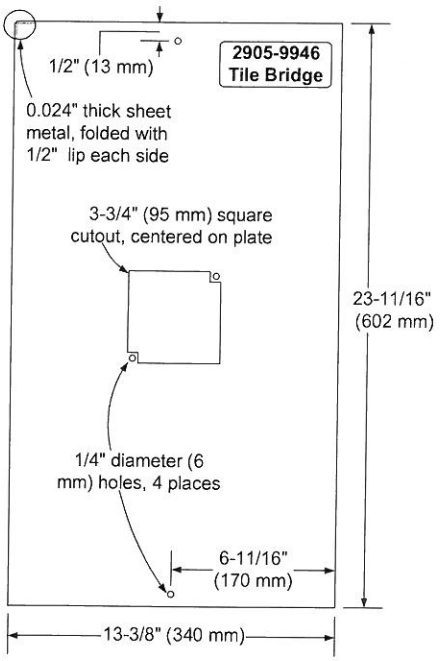
1. Speakers are for connection to conventional fire alarm audio circuits. Anechoic speaker output ratings are typically more representative of actual installed sound output.
2. "Regulated 24 VDC" refers to the voltage range of 16 to 33 VDC per UL Standard 1971, *Signaling Devices for the Hearing Impaired*, changes effective May 1, 2004. This voltage range is the absolute operating range. Operation outside of this range may cause permanent damage to the appliance. Please note that 16 VDC is the lowest operating voltage that is allowed at the last appliance on the NAC under worst case conditions.
3. The maximum RMS strobe current listed is the device nameplate rating. Strobe designs are constant wattage and the maximum RMS current rating occurs at the lowest allowable operating voltage. (RMS is root mean square and refers to the effective value of a varying current waveform.)

Speaker Directional Characteristics

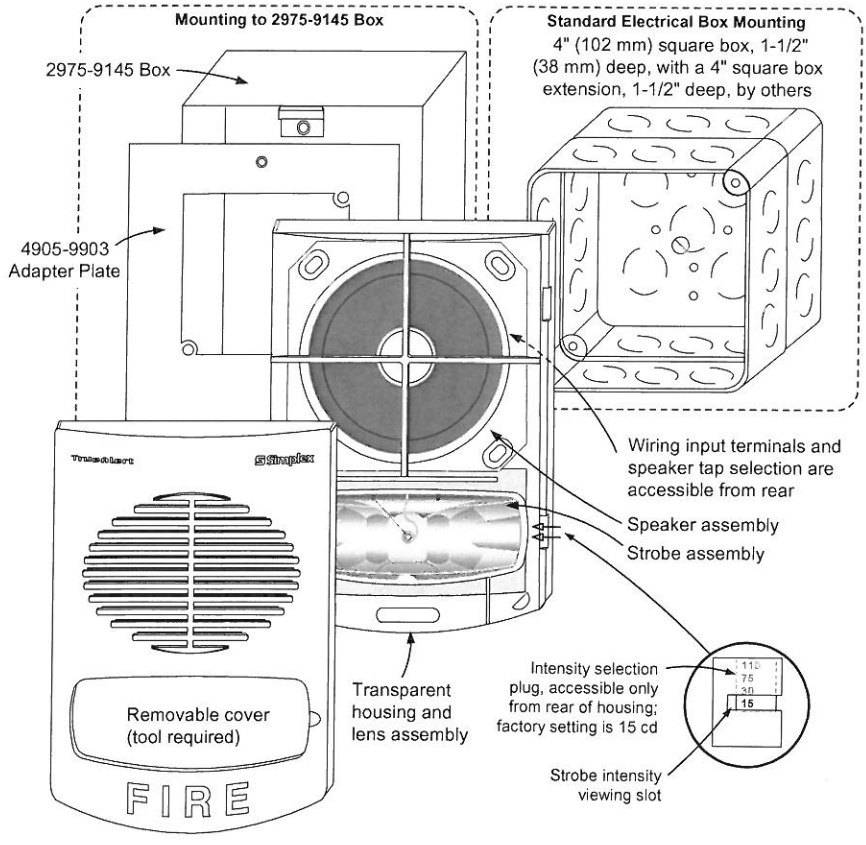


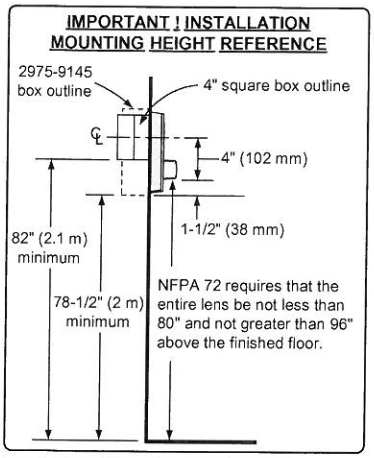
Ceiling Mount S/V Installation Reference and Tile Bridge Dimensions

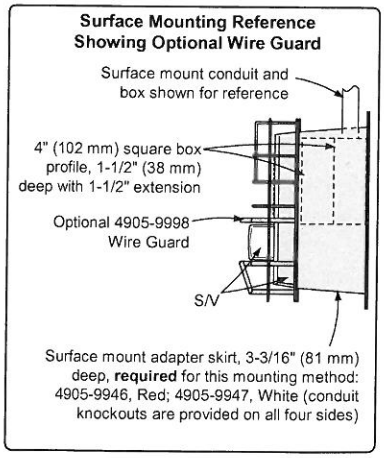




Wall Mount Installation Reference







4209-9721 (CD)

Simplex®

Multi-Application Peripherals

UL, ULC, CSFM Listed; FM Approved;
*MEA (NYC) Acceptance**

Audible Notification Appliances
Speakers, 25 or 70.7 VRMS, Wall or Ceiling Mount

Features

Fire alarm speakers with models for ceiling or wall mount:

- Four inch cone (102 mm) provides high quality tone and voice reproduction
- Multi-tapped design provides output power of 1/4, 1/2, 1, or 2 W with either 25 or 70.7 VRMS input
- In/out wiring terminals for 18 AWG to 12 AWG
- Mounts to 4" square outlet box, 1-1/2" deep with 1-1/2" deep box extension
- Capacitor input for connection to supervised notification appliance circuits
- Rugged, high impact, flame retardant thermoplastic housings
- UL listed to Standard 1480
- ULC listed to Standard S541, refer to page 4 for required minimum wattage tap per housing type

Rectangular housing models feature:

- Appearance that complements TrueAlert® strobes and speaker/strobes
- Red or white housings with "FIRE" lettering for surface or semi-flush wall mount
- Optional matching adapter skirts for covering surface mounted electrical boxes*
- Optional red wire guard

Round housing models feature:

- Off-white color (no lettering) for flush mount on ceiling or wall
- Compatible with optional tile bridge 2905-9946

Introduction

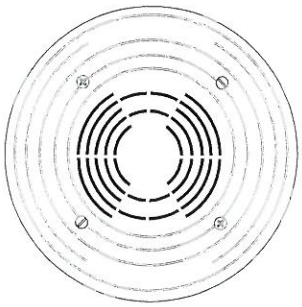
Simplex® 4902 Series speakers provide high quality sound for emergency fire alarm use as well as for background music. The moisture-repellent speaker is designed for smooth frequency response with minimal distortion.

The multi-tapped speaker transformer accommodates either 25 or 70.7 VRMS and provides an output of from 1/4 to 2 W to provide flexibility for satisfying the requirements of the installed conditions.

Rectangular housing models are for surface or semi-flush wall mount applications. Round housing models are typically for ceiling applications but can be wall mounted if desired. The rectangular housing speakers are designed to compliment the TrueAlert family of strobes and speaker/strobes, providing conventional, non-addressable speaker operation.

* Refer to page 2 for guard and adapter skirt listing. This product has been approved by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7320-0026:242 for allowable values and/or conditions concerning material presented in this document. It is subject to re-examination, revision, and possible cancellation. Additional listings may be applicable; contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Safety Products Westminster.

Rectangular Wall Mount Speakers are Available as Red with White "Fire" Lettering and White with Red "Fire" Lettering



Round Speakers are Available in Off-White (no lettering)

Specifications

Dimensions, Rectangular Wall Mount Housings		
Housing Dimensions		5-1/8" H x 5" W x 1-1/2" D (130 mm x 127 mm x 38 mm)
Depth into Box		2-3/4" (70 mm)
Dimensions, Round Housings		
Housing Dimensions		7-1/2" Diameter, 1/2" D (191 mm x 13 mm)
Depth into Box		2-3/4" (70 mm)
General Specifications		
Input Voltage		25 or 70.7 VRMS
Power Taps		1/4, 1/2, 1, and 2 W
Input Terminal Ratings		18 to 12 AWG ($0.82\ mm^2$ to $3.31\ mm^2$)
Frequency Response	Fire Alarm	400 to 4000 Hz
	General Signaling	125 to 12 kHz
Sound Output		See information on page 4
Temperature Range		32° to 100° F (0° to 38° C)
Humidity Range		10% to 95% RH from 32° to 122° F (0° to 50° C)

Product Selection

Speakers

Model*	Description		Dimensions
4902-9716 (CA)	Rectangular housing, wall mount speaker	Red with white "FIRE" lettering	5-1/8" H x 5" W x 1-1/2" D (130 mm x 127 mm x 38 mm)
4902-9717 (CA)		White with red "FIRE" lettering	
4902-9721 (CA)	Round housing speaker, ceiling or wall mount	Off-white (no lettering)	7-1/2" Diameter x 1/2" D (191 mm x 13 mm)

* ULC listed model are designated with a CA suffix (4902-9716CA). Refer to Installation Instructions 574-765 for non-suffix model numbers and to Installation Instructions 579-324 for CA suffix model numbers.

Mounting Adapters

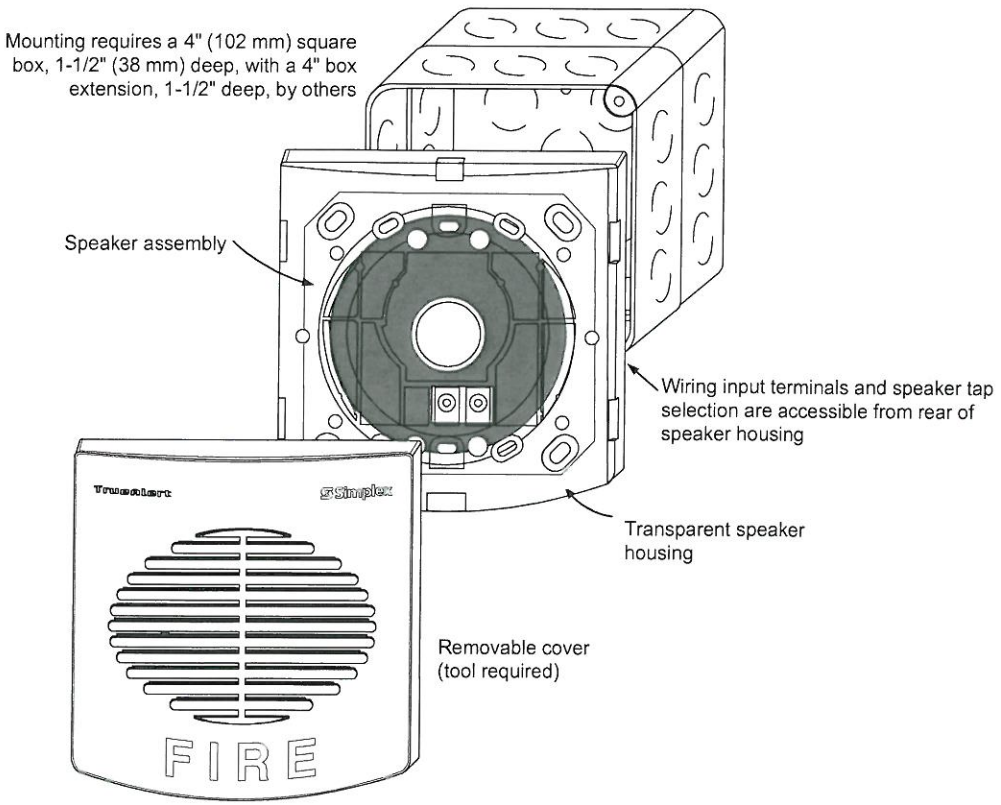
Model	Description			Dimensions
4905-9941	Red	Surface mount adapter skirt; *(not ULC listed)*	Use to cover surface mounted 1-1/2" deep box with 1-1/2" deep extension external to wall (see diagram on page 3)	5-3/8" H x 5-1/4" W x 3-3/16" D (136 mm x 133 mm x 81 mm) Total surface depth with speaker = 4-5/8" (117 mm)
4905-9942	White			
2905-9946	Tile bridge for 4902-9721 Speaker			See diagram on page 3
4905-9931	Adapter Plate, red, for mounting to 2975-9145 box (typically for retrofit, may be mounted vertical or horizontal)			8-5/16" x 5-3/4" x 0.060" Thick (211 mm x 146 mm x 1.5 mm)
2975-9145	Red mounting box, requires Adapter Plate 4905-9931			7-7/8" x 5-1/8" x 2-3/4" D (200 mm x 130 mm x 70 mm)

Covers and Guard

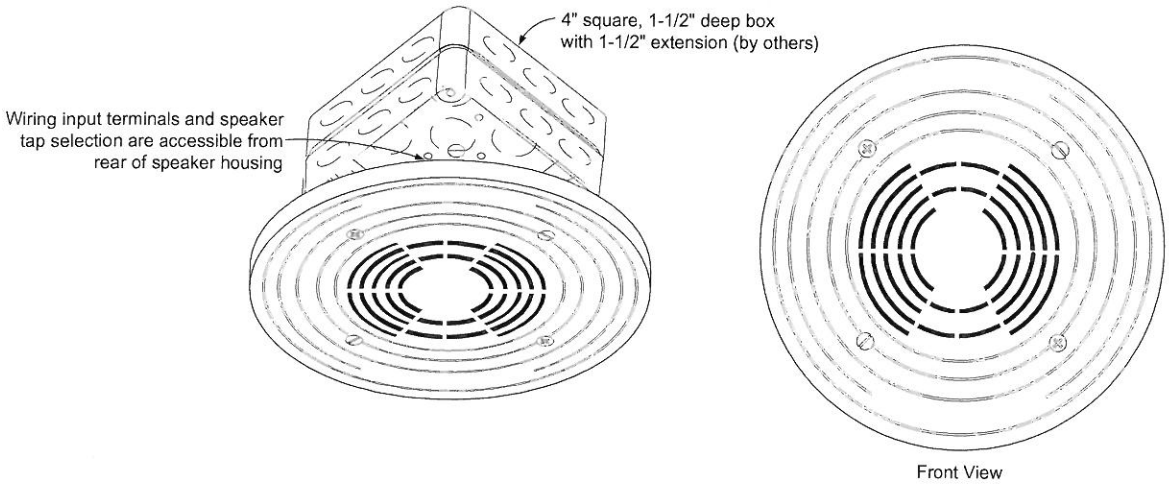
Model	Description		Dimensions
4905-9988	Red speaker cover with white "FIRE" lettering	Interchangeable with TrueAlert horns	5-1/8" H x 5" W x 1-1/2" D (130 mm x 127 mm x 38 mm)
4905-9989	White speaker cover with red "FIRE" lettering		
4905-9999	Red wire guard with mounting plate; compatible with semi-flush or surface mounted boxes; for use with 4" square electrical box mounting hole patterns only (UL listed by Space Age Electronics Inc.)		6-1/16" H x 6-1/16" W x 3-1/8" D (154 mm x 154 mm x 79 mm)

(not used)

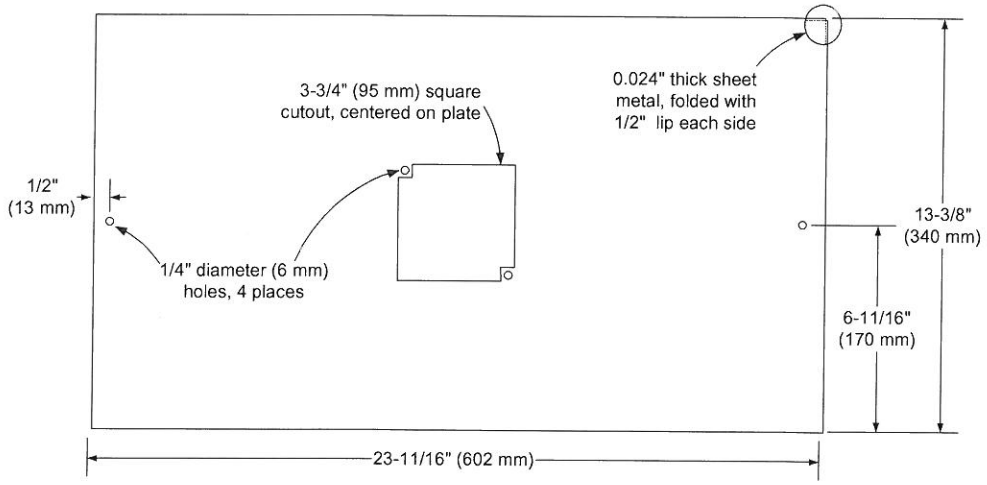
Wall Mount Speakers, Installation Reference



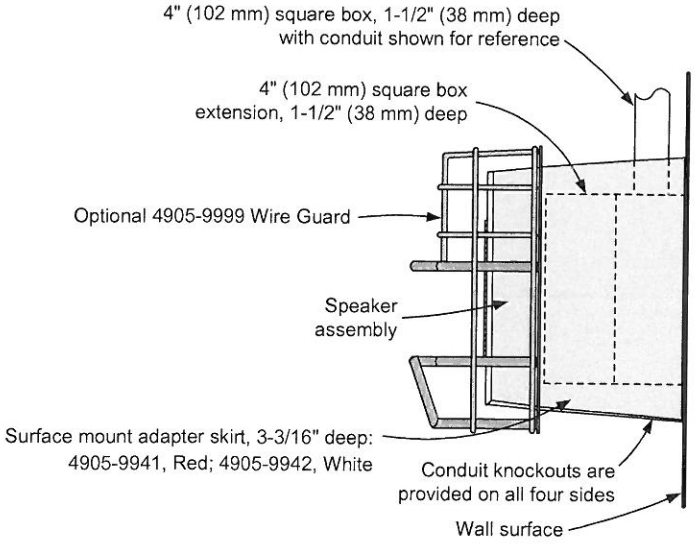
Round Speaker Installation Reference (typically ceiling mount, can be wall mounted)



2905-9946 Tile Bridge Dimensions



Surface Mounted Speaker Reference (Adapter Skirts are *Not ULC listed*)



Speaker Sound Output Specifications

Sound Output Ratings @ 10 ft (~3 m) **per UL 1480 Reverberant Chamber Testing**

Model	Type	Input Voltage	Selected Tap			
			1/4 W	1/2 W	1 W	2 W
4902-9716 4902-9717	Rectangular Housing	25 VRMS	80 dBA	83 dBA	85 dBA	88 dBA
		70.7 VRMS	79 dBA	82 dBA	85 dBA	88 dBA
4902-9721	Round Housing	25 or 70.7 VRMS	79 dBA	82 dBA	85 dBA	88 dBA

Sound Output Ratings @ 3 m (~10 ft) **per ULC S541 Anechoic Chamber Testing**

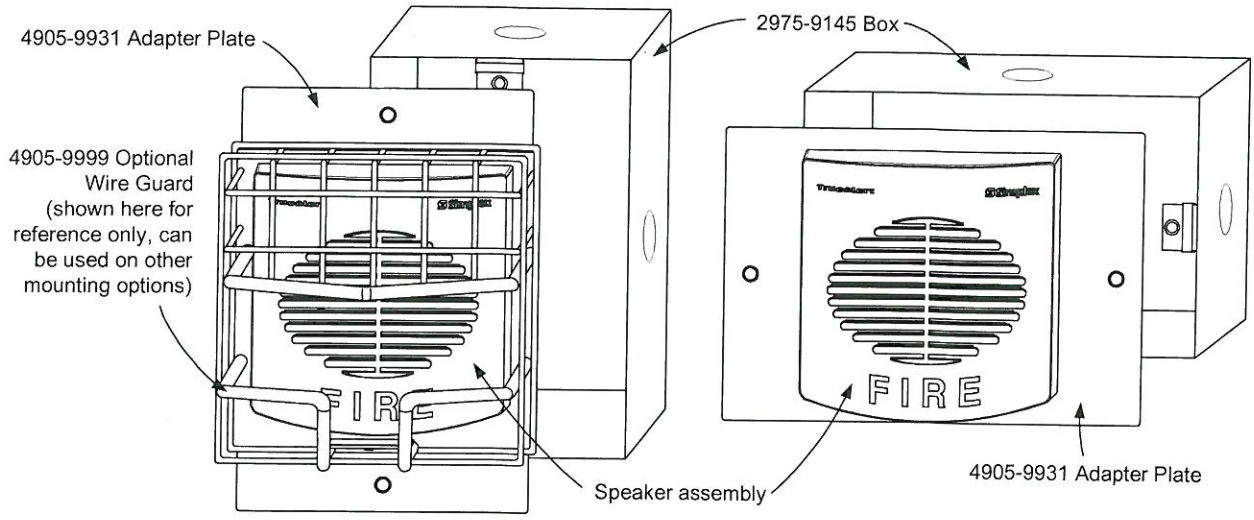
Model	Type	Input Voltage	Selected Tap			
			1/4 W	1/2 W	1 W* (see note)	2 W* (see note)
4902-9716CA 4902-9717CA	Rectangular Housing*	25 VRMS or 70.7 VRMS	77 dBA	80 dBA	83 dBA	86 dBA
4902-9721CA	Round Housing*	25 VRMS or 70.7 VRMS	79 dBA	82 dBA	85 dBA	89 dBA

* NOTE: ULC Fire Alarm applications require use of 1 W or 2 W tap for Round Housing speakers, and 2 W tap for Rectangular Housing speakers.

Speaker Polar Dispersion Reference (per ULC S541 Anechoic Chamber Testing)

Attenuation	Angle
-3 dB	30° off-axis
-6 dB	55° off-axis

4905-9931 Adapter Plate Installation Reference



Appendix K

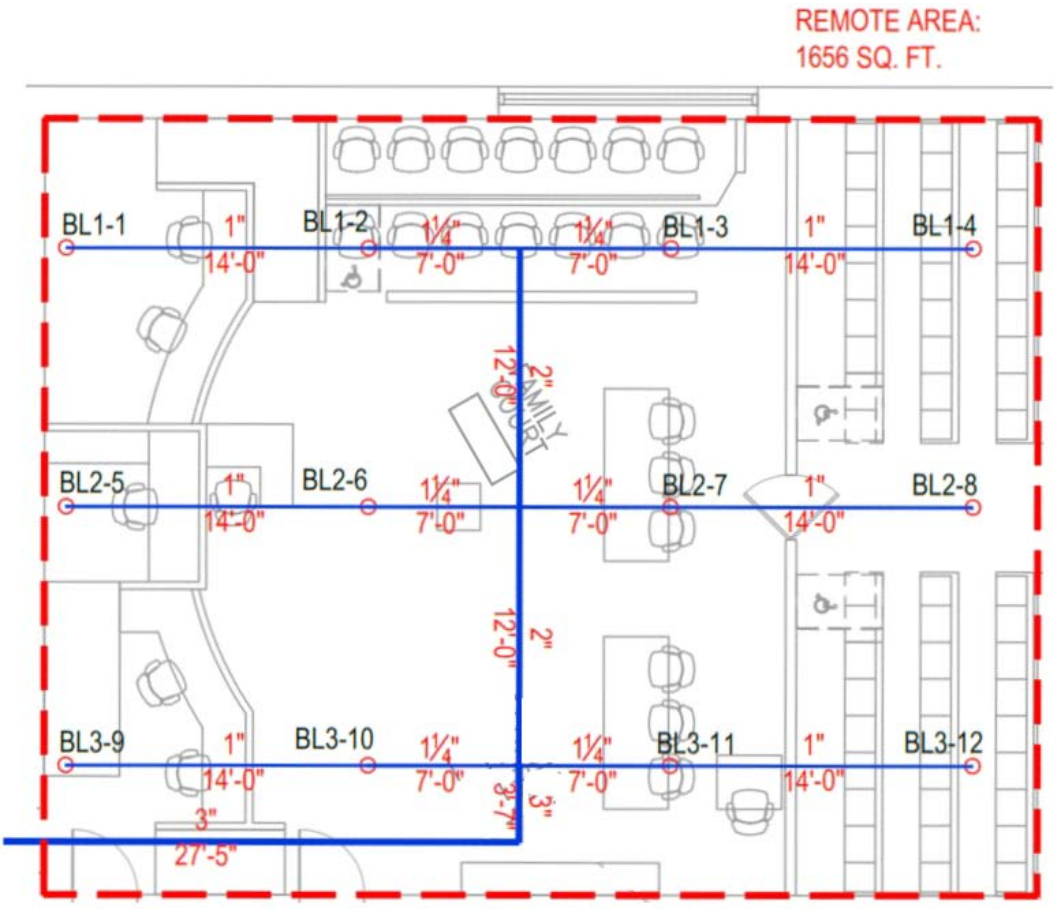
Hydraulic Calculations

K1 Level 4

Hydraulic calculations have been preformed, the west Family court room is the most demanding area (1656 square feet) resulting in a water demand of 208.7 gpm at 140.7 psi at the base of the combined sprinkler / standpipe riser. Calculations for the hydraulically remote area are tabulated on the following pages.

Short hand identification such as “BL” for Branch Line used in this appendix references the hydraulically remote area depicted in Appendix M and in Figure 17 which is a zoomed in portion of the plan found in Appendix M.

Figure 17: Remote area



Project name:	Court House Building											Date: 03/14/2012
Step No.	Nozzle Ident and Location	Flow in gpm		Pipe size (inch)	Pipe Fittings and Devices	Equivalent Pipe Length		Friction loss (psi/ft) C=120		Pressure Summary		Notes: D=0.10 gpm/ft2, K=5.6
1	BL1-1	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
2	BL1-2	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-L)=Qt/sqrt(P)=
						T	7	pf	0.095	Pf	0.7	10.4957705
										Pt	11.0	
3	BL1-4	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
4	BL1-3	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-R)=Q(4)/(P(5)^0.5)=
						T	7	pf	0.095	Pf	0.7	10.4957705
5	BL1-Main	q		1 1/4		L		C	120	Pt	11.0	Q=Q(2)+Q(4)
		Q	**69.6**	1.38	T-1 1/4"	F	6			Pe		
						T	6	pf	0.344	Pf	2.1	
6	Main-BL2	q		2		L	12	C	120	**Pt**	**24.0**	P=Pt(2)+Pt(4)+Pf(5)
		Q	69.6	2.067	E-2"	F	5			Pe		
						T	17	pf	0.048	Pf	0.8	
										Pt	24.9	
7	BL2-5	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
8	BL2-6	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-L)=Qt/sqrt(P)=
						T	7	pf	0.095	Pf	0.7	10.4957705
										Pt	11.0	
9	BL2-8	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
10	BL2-7	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-R)=Q(4)/(P(5)^0.5)=
						T	7	pf	0.095	Pf	0.7	10.4957705
11	BL2-Main	q		1 1/4		L		C	120	Pt	11.0	Q=Q(6)+Q(8)+Q(10)
		Q	**139.2**	1.38	T-1 1/4"	F	6			Pe		
						T	6	pf	1.239	Pf	7.4	
12	Main-BL3	q		2		L	12	C	120	**Pt**	**54.3**	P=Pt(6)+Pt(8)
		Q	139.2	2.067	T-2"	F	10			Pe		+Pt(11)+Pf(11)
						T	22	pf	0.173	Pf	3.8	
										Pt	58.1	

Project name:	Court House Building											Date: 03/14/2012
Step No.	Nozzle Ident and Location	Flow in gpm		Pipe size (inch)	Pipe Fittings and Devices	Equivalent Pipe Length		Friction loss (psi/ft) C=120		Pressure Summary		Notes: D=0.10 gpm/ft2, K=5.6
13	BL3-9	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
14	BL3-10	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-L)=Qt/sqrt(P)=
						T	7	pf	0.095	Pf	0.7	10.4957705
										Pt	11.0	
15	BL3-12	q		1		L	14	C	120	Pt	9.0	Q=A*D=168*0.10=16.8
		Q	16.8	1.049		F				Pe		
						T	14	pf	0.094	Pf	1.3	P=(Q/k)^2=(16.8/5.6)^2
16	BL3-11	q	18.0	1 1/4		L	7	C	120	Pt	10.3	Q=k*sqrt(P)
		Q	34.8	1.38		F				Pe		K(BL-R)=Q(4)/(P(5)^0.5)=
						T	7	pf	0.095	Pf	0.7	10.4957705
17	BL3-Main	q		1 1/4		L		C	120	Pt	11.0	Q=Q(12)+Q(14)+Q(16)
		Q	**208.7**	1.38	T-1 1/4"	F	6			Pe		
						T	6	pf	2.622	Pf	15.7	
18	Main-TOR	q		3	T-3" (1x)	L	236	C	120	**Pt**	**95.8**	P=Pt(12)+Pt(14)
		Q	208.7	3.068	E-3"(5x)	F	50			Pe		+Pt(17)+Pf(17)
						T	286	pf	0.054	Pf	15.3	
19	TOR-BOR	q		4	T-4" (3x)	L	64	C	120	Pt	111.1	
		Q	**208.7**	4.026	E-4"(1x)	F	70			Pe	27.7	Pe=h*0.433
						T	134	pf	0.014	Pf	1.9	
										Pt	**140.7**	

Appendix L

System Components

L1 Concealed Sprinkler

The Reliable Model G4 Concealed Automatic Sprinkler with the following characteristics will be installed in all spaces with drop ceilings within the CHP.

Temperature Ratings

- Ordinary sprinkler at 165°F
- White finish cover plate at 135°F
- Maximum ambient temperature of 100°F

Installation Data

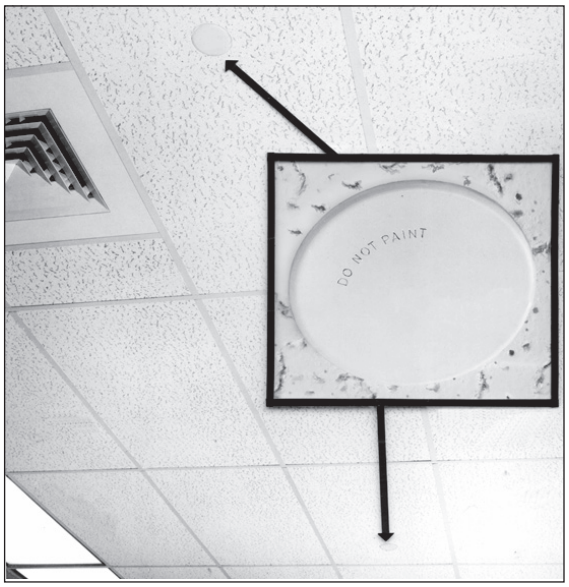
- Sprinkler inlet adjustable
- Total adjustment 1 ½”
- Normal orifice ½”
- US K-factor 5.6
- Thread 1” NPT male or female
- Sprinkler identification number (SIN) R2118

Bulletin 121 Rev. J

Reliable®

Model G4 Concealed Automatic Sprinkler

The Concealer®
A Concealed Sprinkler With ½" (13mm) or 1½" (38mm) Adjustment



Features

1. Cover plate assembly attachment with ½" (13mm) adjustment. Does not require clips or springs.
2. 1½" (38mm) Total adjustment provided by adjustable inlet versions.
3. Adjustable inlet version available with either 1" NPT male or female threads eliminating costly reducing coupling.
4. Smooth aesthetic ceiling profile.
5. Available in white or other color painted or brass, chrome, or black plated finishes.
6. Ordinary and intermediate temperature ratings.
7. Multiple orifices for design flexibility.

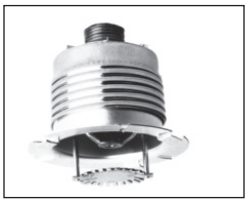
Approvals & Listings

1. Underwriters Laboratories Inc. (UL)
2. Underwriters Laboratories of Canada. (ULC)
3. N.Y.C. BS&A No. 587-75-SA.

Note: Approvals are for light and ordinary hazard, except for small orifice sprinklers which are limited to light hazard occupancies. The cup and skirt are fabricated from plated steel and are intended for interior non corrosive applications.

U.S. Patent No. 4,880,063.

Application



The Reliable Model G4 Concealer® is the most versatile concealed sprinkler available. It provides the best form of fire protection while offering an attractive appearance and ½" (13mm) of cover adjustment for ease of installation. The adjustable 1" NPT inlet versions have 1½" (38mm) of total adjustment and also eliminates the need for a reducing coupling. The small diameter cover plate assembly is easily attached and blends into the ceiling, concealing the most dependable fire protection available, an automatic sprinkler system.

The Concealer® is designed for use where aesthetic appearance is important. Offices, hospitals, motels and restaurants are but a few of the applications where it can be used. It is available in different orifice sizes allowing the designer to optimize system performance, thereby achieving a most efficient installation.

The Concealer® can eliminate the need for precise cutting of drop nipples. The cover plate assembly can be adjusted without tools so it mates accurately with the ceiling. The fire protection system need not be shut down to adjust or remove the cover plate assembly.

Product Description

The Reliable Model G4 Concealer® standard response uses the proven Model G fusible element in a standard style sprinkler frame with a drop-down deflector. This assembly is recessed into the ceiling and concealed by a flat cover plate. This threaded engagement provides ½" (13mm) of cover adjustment. The flat cover plate is attached to the skirt using an ordinary temperature classification solder. This results in a strong cover plate assembly with an ordinary temperature rating, and an intermediate temperature sprinkler which can be installed in 150°F (66°C) environments. When the ceiling temperature rises, the solder holding the cover plate to the skirt melts, the flat cover plate released thus exposing the sprinkler inside to the rising ambient temperature.

The subsequent fusing of the sprinkler element opens the waterway and causes the deflector to drop into position to distribute the discharging water. Any secure engagement of the threads between the cover plate and cup will assure that the drop–down deflector is properly located below the ceiling when a sprinkler operates.

Installation

Do not install The Concealer® in ceilings which have positive pressure in the space in the space above.

After a 2 5/8 inch diameter hole is cut in the ceiling, the sprinkler is to be installed with the Model G4 Wrench. The wrench has drive tangs which insert into cup slots. When installing a sprinkler the wrench is first positioned into the sprinkler/cup assembly until the wrench tangs engage drive slots in the top of the cup (there are two sets of mating drive slots in the cup). The sprinkler is then tightened into the pipe fitting. When inserting or removing the wrench from the sprinkler/cup assembly care should be taken to prevent damage to the sprinkler. DO NOT WRENCH ON ANY OTHER PART OF THE SPRINKLER/CUP ASSEMBLY.

The adjustable inlet versions are similar to the standard Model G4 except that an addition 1" (25mm) of adjustment is provided by means of a telescoping inlet section that threads in or out of a stationary coupling reducer (either 1 male or 1 female) as shown in Fig. 2 or Fig. 3. These sprinklers must be installed before the ceiling is in place, by wrenching on only the coupling reducer hex flats. After the ceiling has been installed with holes for the sprinkler, each telescoping inlet section is to be adjusted with the G4 Wrench. Install the cover plate assembly by hand turning it clockwise until it is tight against the ceiling.

Temperature Ratings

Classification	Sprinkler	Cover Plate	Max. Ambient Temp.
Ordinary	135°F/57°C	135°F/57°C	100°F/38°C
Ordinary	165°F/74°C	135°F/57°C	100°F/38°C
Ordinary	165°F/74°C	165°F/74°C	150°F/66°C
Intermediate	212°F/100°C	165°F/74°C	150°F/66°C

Maintenance

The Model G4 Concealer® should be inspected quarterly and the sprinkler system maintained in accordance with NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove any sprinkler that has been painted (other than factory applied) or damaged in any way. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

Ordering Information

1. Sprinkler Model
2. Temperature Rating
3. Nominal Orifice
4. Flat Cover Plate Finish
5. Inlet Type

Note: Unless otherwise specified, the 165°F (74°C) sprinkler will be provided with the 165°F (74°C) cover.

Cover Plate Finishes (1)

Standard Finishes
Bronze Chrome Plated White
Special Application Finishes
Black Plated Bright Brass Off White Black Paint

(1) Other colors and finishes are available. Consult factory for details

Note: Paint or any other coatings applied over the factory finish will void all approvals and warranties.

Installation Data

Sprinkler Inlet	Total Adjustment	Nominal Orifice	Nominal K Factor		Thread	Approvals	Sprinkler Identification Number (SIN)
			US	Metric			
Non–Adjustable	½" (13mm)	½" (15mm)	5.6	80	½" NPT (R½)	1,2,3	R2115
Non–Adjustable	½" (13mm)	7/16" (11mm)	4.2	60	½" NPT (R½)	1,2,3	R2113
Non–Adjustable	½" (13mm)	3/8" (10mm)	2.8	40	½" NPT (R½)	1,2,3	R2111
Adjustable	1½" (38mm)	½" (15mm)	5.6	80	1" NPT Male or Female	1,2,3	R2118
Adjustable	1½" (38mm)	7/16" (11mm)	4.2	60	1" NPT Male or Female	1,2,3	R2113
Adjustable	1½" (38mm)	3/8" (10mm)	2.8	40	1" NPT Male or Female	1,2,3	R2112

Installation Wrench

Model G4 Sprinkler Wrench

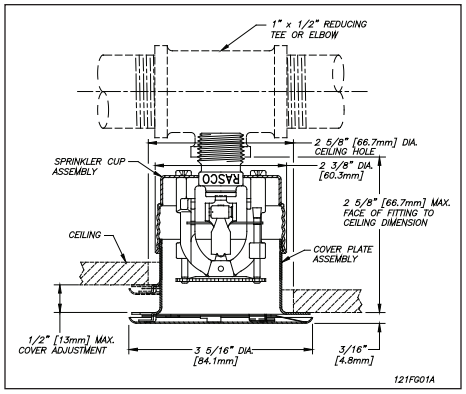


Fig. 1 - ½" NPT (R½) Non-Adjustable Inlet

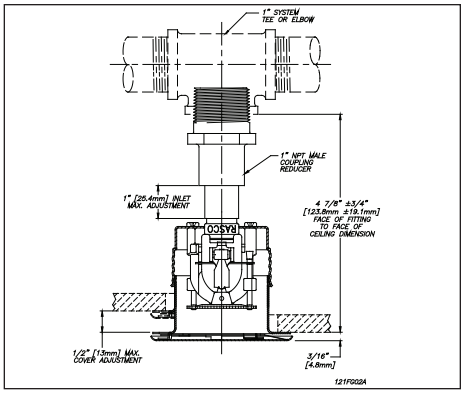


Fig. 2 - 1" NPT Male-Adjustable Inlet

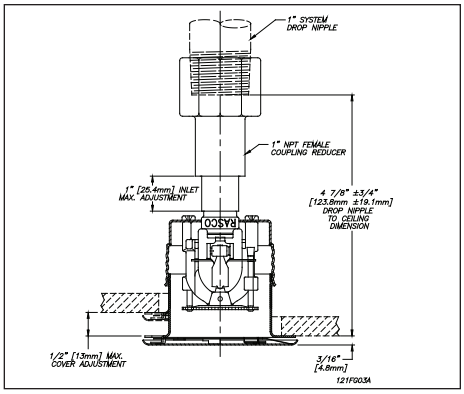


Fig. 3 - 1" NPT Female-Adjustable Inlet

The equipment presented in this bulletin is to be installed in accordance with the latest published Standards of the National Fire Protection Association, Factory Mutual Research Corporation, or other similar organizations and also with the provisions of governmental codes or ordinances whenever applicable.

Productsmanufactured and distributed by Reliable have been protecting life and property for over 90 years, and are installed and serviced by the most highly qualified and reputable sprinkler contractors located throughout the United States, Canada and foreign countries.

Manufactured by

Reliable®

The Reliable Automatic Sprinkler Co., Inc.
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(914) 829-2042 Corporate Offices
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Recycled Paper

Revision lines indicate updated or new data.

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L2 Upright Sprinkler

The Reliable Model F1FR556 Series Quick Response Standard Spray (upright) sprinkler with the following characteristics will be installed in all stairwells within the CHP.

Temperature Ratings

- Ordinary sprinkler at 155°F
- Maximum ambient temperature of 100°F

Installation Data

- Normal orifice ½”
- US K-factor 5.6
- Thread ½” NPT (R½)
- Sprinkler height 2.25”
- Sprinkler identification number (SIN) RA1475

Bulletin 014 Rev. G

Model F1FR56 Series Quick Response Standard Spray

Model F1FR56 Sprinkler Types

Standard Upright
Standard Pendent
Conventional
Vertical Sidewall
Horizontal Sidewall

Model F1FR56 Recessed Sprinkler Types

Standard Pendent/F1/F2/FP
Horizontal Sidewall

Model F1FR56 Concealed Sprinkler Types

Standard Pendent

Listing & Approvals

1. Underwriters Laboratories Inc. and Certified for Canada (cULus).
2. Factory Mutual Approvals (FM)
3. Loss Prevention Council (LPCB, UK)
4. VdS Schadenverhütung GmbH

UL Listing Category

Sprinklers, Automatic & Open (VNIV)
Quick Response Sprinkler

Product Description

Reliable Models F1FR56 Series Sprinklers are quick response sprinklers which combine the durability of a standard sprinkler with the attractive low profile of a decorative sprinkler.

The Models F1FR56 Series Recessed automatic sprinklers utilize a 3.0 mm frangible glass bulb. These sprinklers have demonstrated response times in laboratory tests which are five to ten times faster than standard response sprinklers. This quick response enables the Model F1FR56 Series sprinklers to apply water to a fire much faster than standard sprinklers of the same temperature rating.

The glass bulb consists of an accurately controlled amount of special fluid hermetically sealed inside a precisely manufactured glass capsule. This glass bulb is specially constructed to provide fast thermal response.

At normal temperatures, the glass bulb contains the fluid in both the liquid and vapor phases. The vapor phase can be seen as a small bubble. As heat is applied, the liquid expands, forcing the bubble smaller and smaller as the liquid pressure increases. Continued heating forces the liquid to push out against the bulb, causing the glass to shatter, opening the waterway and allowing the deflector to distribute the discharging water.


Upright


Pendent


Vertical Sidewall


Conventional


Horizontal Sidewall


Recessed
Pendent/F1/F2


Recessed
Horizontal Sidewall


Concealed
Pendent


Recessed
Pendent/FP

Application

Quick response sprinklers are used in fixed fire protection systems: Wet, Dry, Deluge or Preaction. Care must be exercised that the orifice size, temperature rating, deflector style and sprinkler type are in accordance with the latest published standards of the National Fire Protection Association or the approving Authority Having Jurisdiction. Quick response sprinklers are intended for installation as specified in NFPA 13. Quick response sprinklers and standard response sprinklers should not be intermixed.

Model F1FR56 Quick Response Upright, Pendent & Conventional Sprinklers

Installation Wrench: Model D Sprinkler Wrench

Installation Data:

Nominal Orifice	Thread Size	Nominal K Factor		Sprinkler Height	Approval Organization	Sprinkler Identification Number (SIN)	
		US	Metric			Upright	Pendent
Standard-Upright (SSU) and pendent Deflectors Marked to Indicate Position							
½" (15mm)	½" NPT(R½)	5.6	80	2.25" (57mm)	1, 2, 3, 4	RA1425(1)	RA1414 (1)(2)
Conventional-Install in Upright or Pendent Position							
15mm(1)	½" NPT(R½)	5.6	80	57mm	3,4	RA1475	

(1) cULus listed corrosion resistant (Polyester coated) sprinkler.
(2) Polyester coated FM approved sprinkler.

Upright

Pendent

Conventional

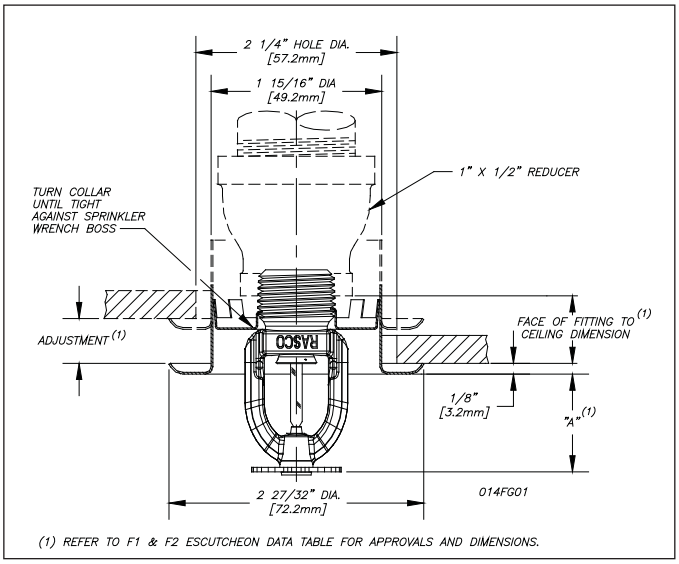
Model F1FR56 Quick Response Recessed Pendent Sprinkler

Installation Wrench: Model GFR2 Sprinkler Wrench

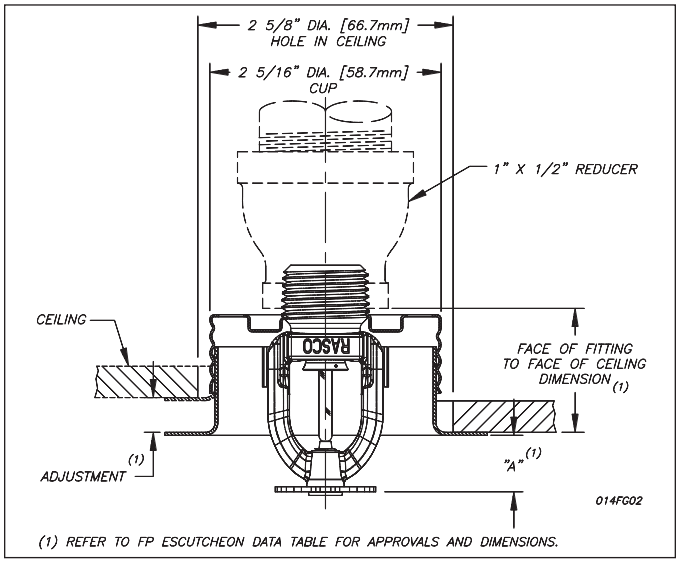
Installation Data:

Nominal Orifice	Thread Size	K Factor		Sprinkler Height	Sprinkler Identification Number (SIN)
		US	Metric		
½" (15mm)	½" NPT(R½)	5.6	80	2.25" (57mm)	RA1414

(1) Refer to escutcheon data table for approvals and dimensions.



Model F1FR56/F1 or F2



Model F1FR56/FP

L3 Institutional Sprinkler

The Reliable Model XL Quick Response Institutional Sprinkler (INST Pendent) with the following characteristics will be installed in all institutional spaces within the basement of the CHP.

Temperature Rating

- Ordinary 165°F
- Maximum ceiling temperature 100°F

Installation Data

- Sprinkler type quick response, ½" NPT thread Pendent INST
- US K-factor 5.6
- Sprinkler height 2 $^{9}/_{16}$"
- Sprinkler identification number (SIN R1344)

Maximum ecverage area

- Flow rate 26 gpm
- Pressure 21.6 psi
- Maximum coverage area 16 feet x 16 feet

Features

- Quick response performance
- Standard finish: bright chrome plated
- Sensing link releases a suspended load exceeding 50 lbs.
- Available with secure retaining flange

Bulletin 113 Rev. E

Model XL Quick Response Institutional Sprinklers

Quick Response Institutional Sprinklers Available:

Ordinary and Light Hazard Applications
Model XL INST Pendent (SIN R1314)
Model XL INST Horizontal Sidewall (SIN R1334)
Light Hazard Applications
Model XL INST Pendent EC (SIN R1344)
Model XL INST Horizontal Sidewall EC (SIN R1364)

Features

1. Quick response performance
2. Temperature rating: 165 °F (75 °C)
3. Extended coverage Listing for 16 ft. x 16 ft. (4,9 m x 4,9 m)
4. Standard finishes: bright chrome plated and white painted
5. Sensing link releases a suspended load exceeding 50 lbs.
6. Available with secure retaining flange

Listings & Approvals

1. Listed by Underwriters Laboratories, Inc. (UL)
2. Certified for Canada by Underwriters Laboratories (CUL)
3. NYC MEA 258-93-E

Note: Approvals are for light hazard occupancies.

UL Guide Number

VNIV

UL Listing Category

Sprinklers, Automatic & Open
Quick Response Sprinklers

U.S. Patent Number 6,554,077

Product Description

The Model XL INST is a quick response institutional sprinkler. It is a fusible solder link type automatic sprinkler designed for standard and extended coverage applications. These sprinklers have demonstrated response times in laboratory tests which are five to ten times faster than standard response sprinklers.

The quick response enables Model XL INST Sprinklers to apply water to a fire much more quickly than standard response sprinklers of the same temperature rating. Only when the solder link melts does the operating mechanism release from the sprinkler allowing the deflector to be extended for distributing the discharging water.

Modern architectural designs require sprinklers that provide not only the best fire protection, but also an attractive appearance. The Model XL INST meets both criteria. The flush style of this sprinkler provides for an aesthetically pleasing installation by concealing the entire sprinkler's operating parts with the exception of the heat sensing link.

Model XL INST Pendent

Model XL INST Horizontal Sidewall

The Model XL INST has been designed for use in correctional and mental health facilities and in any other type of institution where attempts by an occupant at self-injury might involve the use of a fire sprinkler. The heat sensor is designed to release a suspended load that exceeds 50 lbs. when dropped from a 1-inch height. The conical escutcheon assembly is firmly attached to the sprinkler body with tamper resistant fasteners. The horizontal sidewall model uses an escutcheon with an integral deflector shelf.

Application and Installation

All Model XL INST sprinklers are UL Listed for use with the following types of fire protection systems: wet, dry, deluge or preaction. Care must be exercised that orifice size, temperature rating, and sprinkler spacing are in accordance with this bulletin and the latest published standards of the National Fire Protection Association or the approving Authority Having Jurisdiction.

These sprinklers must be installed with a Reliable Model ZX Sprinkler Wrench. Any other type of wrench may damage the sprinkler which is designed to allow wrenching with the shipping cap installed, thereby providing further protection to the sprinkler. Shipping caps should be removed only after walls are finished and when escutcheons are being installed. When Model XL sprinklers are ordered, escutcheons both with and without retaining flanges are sold separately. The

Model XL Institutional Escutcheon is the only escutcheon that can be used with this sprinkler. The back of the Institutional HSW extended coverage escutcheon is marked "INST EC". Only escutcheons marked this way are approved for this sprinkler. The use of any other escutcheon will void all approvals and negate all warranties. Also, each installed sprinkler must include an escutcheon. It is recommended that a pick-proof caulk be applied around the circumference of each escutcheon to close any gaps with the wall or ceiling (see illustrations on page 3).

Provision must be made to prevent any axial movement of each sprinkler away from the ceiling or wall. Reliable provides a retainer flange which is highly recommended for this purpose. Reliable accepts no liability for property damage or personal injury when the retainer assembly is not used or is not installed correctly on institutional sprinklers.

Use care to avoid damaging the sprinklers before, during and after installation. Install them according to Caution Sheet CA-132, and inspect all installed sprinklers to insure that they have not been damaged. Replace all sprinklers which have any sign of damage.

When replacing Model ZX HSW with Model XL HSW, an escutcheon extender P/N 6814000001 is required.

Misuse of or tampering with Reliable Institutional Sprinklers which leads to property damage or personal injury, including death, as a result of dismantling or modifying this product for use unrelated to the intended use, shall not become the responsibility of The Reliable Automatic Sprinkler Co., Inc.

Technical Data:

Coverage Area - Pendent and Horizontal Sidewall - Standard Coverage
Refer to minimum flow and pressure requirements as specified in NFPA 13

Coverage Area - Pendent EC		
Flow Rate [1] gpm (Lpm)	**Pressure [1] psi (bar)**	**Max. Coverage Area Width x Length ft. (m)**
26 (98,4)	21.6 (1,48)	16 x 16 (4,9 x 4,9)

Coverage Area - Horizontal Sidewall EC			
Flow Rate [1] gpm (Lpm)	**Pressure [1] psi (bar)**	**Max. Coverage Area Width x Length ft. (m)**	**Deflector to Ceiling Distance Min. - Max. in. (mm)**
26 (98,4)	21.6 (1,48)	16 x 16 (4,9 x 4,9)	4 - 6 (100-to-150)
27 (102,2)	23.2 (1,60)	16 x 16 (4,9 x 4,9)	6 - 12 (150-to-300)

[1] Minimum flow rate and pressure for any spacing smaller than 16 ft. x 16 ft. (4,9 m x 4,9 m).

Model XL INST Sprinklers Temperature Data:

Temperature Rating	Sprinkler Rating		Maximum Ceiling Temp.	
	°F	°C	°F	°C
Ordinary	165	74	100	38

Installation Data:

Sprinkler Type Quick Response, ½" NPT Thread	K Factor		Deflector to Ceiling Distance Min. - Max. in. (mm)	Sprinkler Height	Sprinkler Identification Number (SIN)
	US	Metric			
Pendent INST	5.6	80	---------	$2^{9}/_{16}$	R1314
Pendent INST EC	5.6	80	---------	$2^{9}/_{16}$	R1344
HSW INST	5.6	80	4 - 12 (100-to-150)	$2^{9}/_{16}$	R1334
HSW INST EC	5.6	80	4 - 12 (100-to-300)	$2^{9}/_{16}$	R1364

Finishes:

Finishes [1]	
Sprinkler	**Escutcheon**
Bright Chrome Plated	Zinc or Aluminum
	White Painted

[1] Other finishes and colors available on special order. Consult factory for details.

Installation Tools

- Model ZX Sidewall Sprinkler Wrench
- Model ZX Tamper Resistant Escutcheon Screw Tool
- Model ZX Pendent Installation wrench

Note: When replacing Model ZX HSW with Model XL HSW, an escutcheon extender P/N 6814000001 is required.

Sprinkler Markings

- RASCO XL INST QR Pend R1314
- RASCO XL INST QR Pend EC R1344
- RASCO XL INST QR HSW R1334
- RASCO XL INST QR HSW EC R1364

Escutcheon Markings

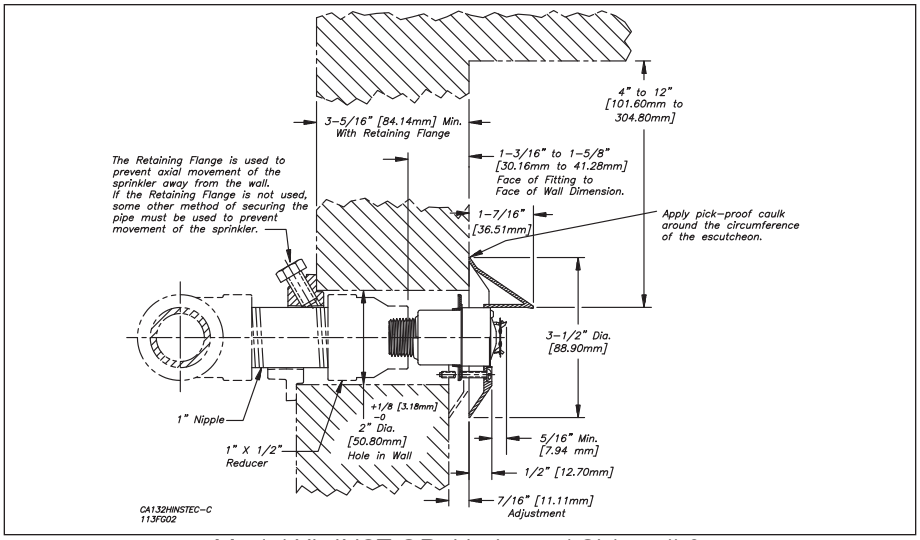
- For Model XL INST Horizontal Sidewall :
  - INST XL
- For Model XL INST Horizontal Sidewall EC :
  - INST EC

Maintenance

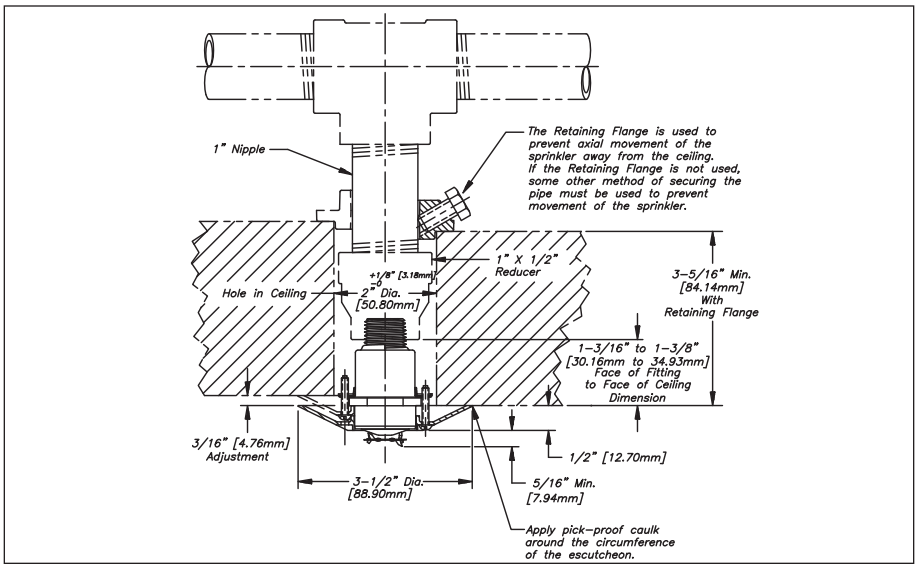
Model XL INST Sprinklers should be inspected quarterly, and the sprinkler system maintained in accordance with NFPA 25. Do not clean the sprinklers with soap and water, ammonia or other cleaning fluids. Remove any sprinkler which has been painted (other than factory applied) or damaged in any way. To install or remove the tamper resistant escutcheon screws, use the special tool supplied with the escutcheons. A stock of spare sprinklers must be maintained to allow quick replacement of damaged or operated sprinklers, in accordance with NFPA requirements.

Model XL Institutional Sprinkler Specification

Institutional sprinklers shall be [UL Listed] [NYC MEA Approved] quick response, [pendent, standard coverage sprinklers approved for light and ordinary hazard] [horizontal sidewall sprinklers, standard coverage, approved for light and ordinary hazard] [pendent, extended coverage sprinklers approved for light hazard] [horizontal sidewall, extended coverage sprinklers approved for light hazard]. Sprinkler and deflector to be of bronze construction, with ½" NPT thread. Levered fusible solder link shall consist of an approved black-painted beryllium-nickel link assembly. Fusible link shall be designed to release a suspended load that exceeds 50 lbs. (22.7 kg) when dropped from a 1-inch (25.4 mm) height. Water seal shall consist of a Teflon-coated Bellville spring washer and bronze diffuser sub-assembly containing no plastic parts. Institutional escutcheons shall be of zinc or aluminum construction with zinc ring plate and tamper resistant screws. Sprinkler K-factor shall be nominal 5.6 (81.0) . Sprinkler temperature rating shall be Ordinary 165 °F (74 °C). Standard cover finish: [Bright chrome plated] [Specialty – specify]. Quick response institutional sprinklers shall be Reliable Model XL Institutional [Pendent, Standard Coverage (SIN R1314)] [Pendent, Extended Coverage (SIN R1344)] [Horizontal Sidewall, Standard Coverage (SIN R1334)] [Horizontal Sidewall, Extended Coverage (SIN R1364)] Bulletin 113.



Model XL INST QR, Horizontal Sidewall &
Horizontal Sidewall EC Sprinkler



Model XL INST QR,
Pendent & EC Pendent Sprinkler

L4 Alarm Check Valve

The Reliable Model E3 High Pressure Alarm Check Valve with the following characteristics will be installed at each level landing of the plan southeast stair in the CHP.

Valve Description

- Rated working pressure 300 psi.
- Factory hydrostatic test pressure 600 psi.
- End and trim connections:
    - Groove dimensions per ANSI/AWWA C606.
    - Threaded openings per ANSI B 2.1. or ISO 7/1R
    - Reliable standard trim set is compatible with all 4” valve size.
- Color: Black
- Face to Face Dimension: 4” valve – 11¾”.
- Friction Loss – Expressed in equivalent length of pipe, based on Hazen-Williams formula with C=120 and a flowing velocity of 15 ft/s: Equivalent Length for the 4” valve is 17 feet.

Bulletin 409 Rev. C

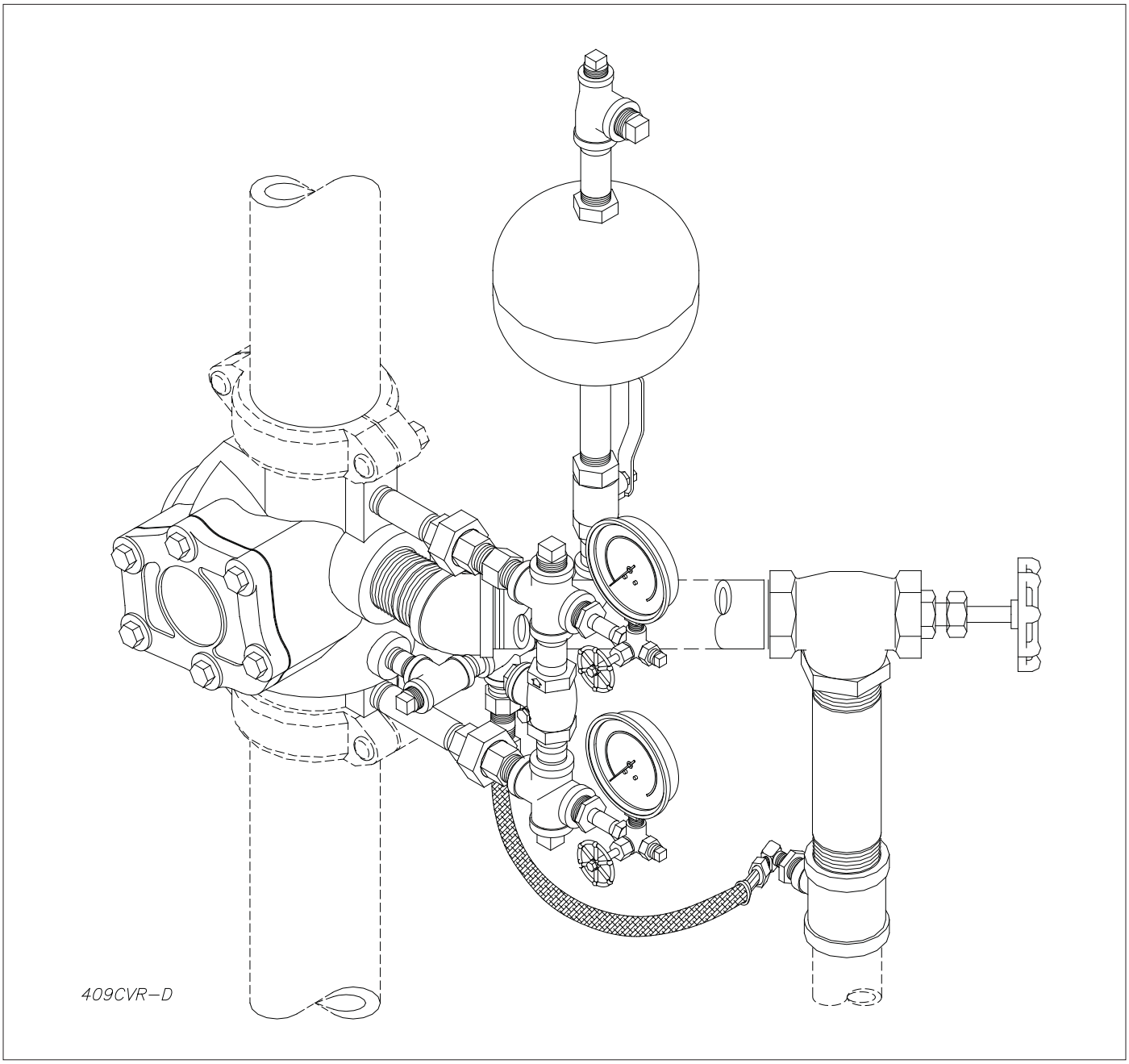
Reliable®

Model E3 High Pressure Alarm Check Valve

Instructions for Installation, Operation, Care and Maintenance

4" (100mm), 6" (150mm) and 165mm and 8" (200mm) Sizes With Model E3 Trim

Listed by Underwriters Laboratories, Inc. Approved by Factory Mutual Research Corporation, and other fire insurance and government agencies in the United States and foreign countries.



The Reliable Automatic Sprinkler Co., Inc., 103 Fairview Park Drive, Elmsford, New York 10523

General

The Reliable Model E3 High Pressure Alarm Valves are available in two easy to install closed drain trims, Standard and Optional (Variable pressure, open drain and pressure relief kits are available). The Optional trim provides a "Test" and "Drain" feature that allows the valve and in certain cases the system alarm devices, to be tested with flow through a calibrated 1/2" orifice. This method of test simulates a fire scenario where one head has opened. It also has the added benefit of exercising the clapper and flushing the alarm porting. (Note: for FM insured applications the placement of a test and drain valve in the trim does not replace the need for an inspector test connection at the outer reaches of the system. See "Test" section for details.) The Standard trim is a low cost alternative to the Optional trim and where as it does not provide the calibrated orifice like the Optional trim its method of testing the alarm devices is similar and provides the same benefits. Both trims are available in vertical or horizontal configurations. Variable pressure water supply requires the use of Model E3 trim and a Reliable E1 Retard Chamber. Constant pressure water supply requires the use of a Model E3 trim set only. Model E3 High Pressure Alarm Valves are shipped with the designated trim set, i.e. variable or constant pressure. All trim sets are closed drain.

The E3 trim is also approved for use in the vertical and horizontal position with the Reliable Model E Alarm Valve which is rated for 175 psi (12 bar) applications.

Valve Description

1. Rated working pressure 300 psi (20,7 bar).
2. Factory hydrostatic test pressure 600 psi (41,4 bar).
3. End and trim connections:
   - Groove dimensions per ANSI/AWWA C606.
   - Threaded openings per ANSI B 2.1. or ISO 7/1R
   - Reliable's standard trim sets are compatible with all 4" (100mm), 6" (150mm) and 8" (200mm) valve sizes.
4. Color – Black
   – Red (E3A *)
   – Blue (Metric)

Groove Dimensions in Inches (mm)					
Valve Size	Inlet and Outlet Dia.	Groove Dia.	Groove Width	Face To Groove Dim.	Valve Type
4 (100)	4.500 (114)	4.334 (110.1)	3/8 (9.5)	5/8 (16)	E3 & E3A*
6 (150)	6.625 (168)	6.455 (164.0)	3/8 (9.5)	5/8 (16)	E3
6 (165)	6.500 (165)	6.330 (160.8)	3/8 (9.5)	5/8 (16)	E3A
8 (200)	8.625 (219)	8.441 (214.0)	3/4 (11.11)	3/4 (19)	E3 & E3A*

*"A" Designates valves made for Australia.

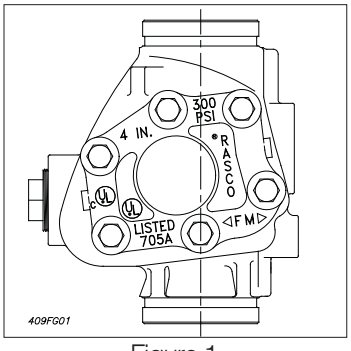


Figure 1

5. Face to Face Dimension:
   - For the 4" (100mm) valve – 11¾" (299mm).
   - For the 6" (150mm) valve – 13½" (343mm).
   - For the 8" (200mm) valve – 14½" (368mm).
6. Friction Loss – Expressed in equivalent length of pipe, based on Hazen-Williams formula with C=120 and a flowing velocity of 15 ft/s (4.6 m/s):

	Equiv. Length
• For the 4" (100mm) valve	17' (5.18m)
• For the 6" (150mm) valve	27' (8.23m)
• For the 8" (200mm) valve	29' (8.84m)

Trim Description

The basic trims of the Reliable Model E3 High Pressure Alarm Valve (Figure 2) are arranged for rapid, easy and compact attachment. They serve as a connecting point to Reliable alarm and other devices. The trims also serve as a means for testing the operation of the alarm devices while exercising the alarm valve clapper. Two Model E3 High Pressure trim sets are available for use with the Model E3 High Pressure Alarm Valve. These trims come standard with 0 to 300 psi gauges for 175 psi applications. For 300 psi applications the 0 - 600 psi gauge kit must be ordered. Note: Due to changing Approval agency requirements, the gauges supplied with the 300 psi kit may not be listed at time of ordering.

- **Variable Pressure with Closed Retard Drain**
  Model E1 Retard Chamber is required.

This trim set is used where water supply pressures vary. The retard chamber and the mechanical sprinkler alarm line are drained through a closed connection to the 2" (50mm) drain line. Only one drain connection is required.

Alarm valves are listed and approved by Underwriters Laboratories, Inc. and Factory Mutual Research Corporation only when used with the valve manufacturer's trim sets.

- **Constant Pressure**
  Retard Chamber is not required.

This trim set is used where water supply pressure does not vary. Automatic draining is provided to drain the mechanical sprinkler alarm line. This drain connection is piped into the 2" (50mm) main drain line.

Assembly of Model E3 Trim

- **Variable Pressure Vertical Installation (Figure 2)**

The following description is the recommended sequence for installing the trim as illustrated in this bulletin.

1. After the alarm check valve has been installed in the riser, attach Segment "A" in the orientation shown and in a leak tight condition.
2. Insert Segment "B" leak tight. **Note:** Segment "B" is the larger of the two union connections.
3. Install Segment "C" leak tight and orientate as shown by wrenching on the 45 degree elbow.
4. Install Segment "D" leak tight.
5. Attach Segment "E" at the unions. Verify that the arrow on the check valve is pointing to system.
6. Install the gauges.
7. Install Segment "F" leak tight by wrenching on the 2" (50mm) tee. Orientate the tube fitting towards the back of the alarm valve. Connect Item 26 (alarm line drain port) to Item 27 in the drain line using the flex tubing provided (Item 11).

Note: the tubing should be free of kinks. **Note**: An open line drain segment is optional, to be purchased separetly, as a replacement to seg. F.

8. Install ¾" x 5" (20mm x 127mm) long galvanized nipple, Model E1 Retard Chamber and Segment "G" in the orientation shown and in a leak tight condition.
9. Connect appropriate water flow alarm devices.

• **Constant Pressure Vertical Installation (Figure 2)**

Trimmings for this installation follow the same sequence given in Steps 1 through 9 above. The only exception is step 8 where Segment "G" is installed directly into the ¾" (20mm) shut-off valve in Segment "A".

Note: In all cases, carefully install the check valve in the position shown with the flow arrow pointing in the direction shown.

• **Horizontal Installation (Fig. 5, Fig. 6 Fig. 8)**

Follow a sequence similar to that given above for vertical installation, and refer to Figs. 5 & 6 for illustration.

Variable Pressure Equipment

The normal position of the alarm valve parts is shown in Fig. 9. Flow of water in the system piping resulting from the discharge through one or more fused automatic sprinklers causes the Clapper (4) to rise off the Grooved Seat (3) and permits water from the supply piping to enter the system.

The movement of Clapper (4) on Hinge Pin (8) uncovers the groove in Seat (3) and allows water to flow through the groove into the Alarm Line Outlet and to the Alarm Line, Fig 5.

Continual flow of water fills the retard chamber and flows to mechanical and/or electric alarms. (For details on mechanical and electric alarms, refer to their individual instruction sheets.) A small amount of water will simultaneously flow into the drain line.

When the water ceases to flow through the Alarm Valve, the Clapper (4) returns to its seat thus stopping the flow of water to the retard chamber. Drain Orifices (Item 9, Fig. 4 &6) allow the retard chamber and alarm line to empty through the drain line (Item 11, Fig. 4 & 6).

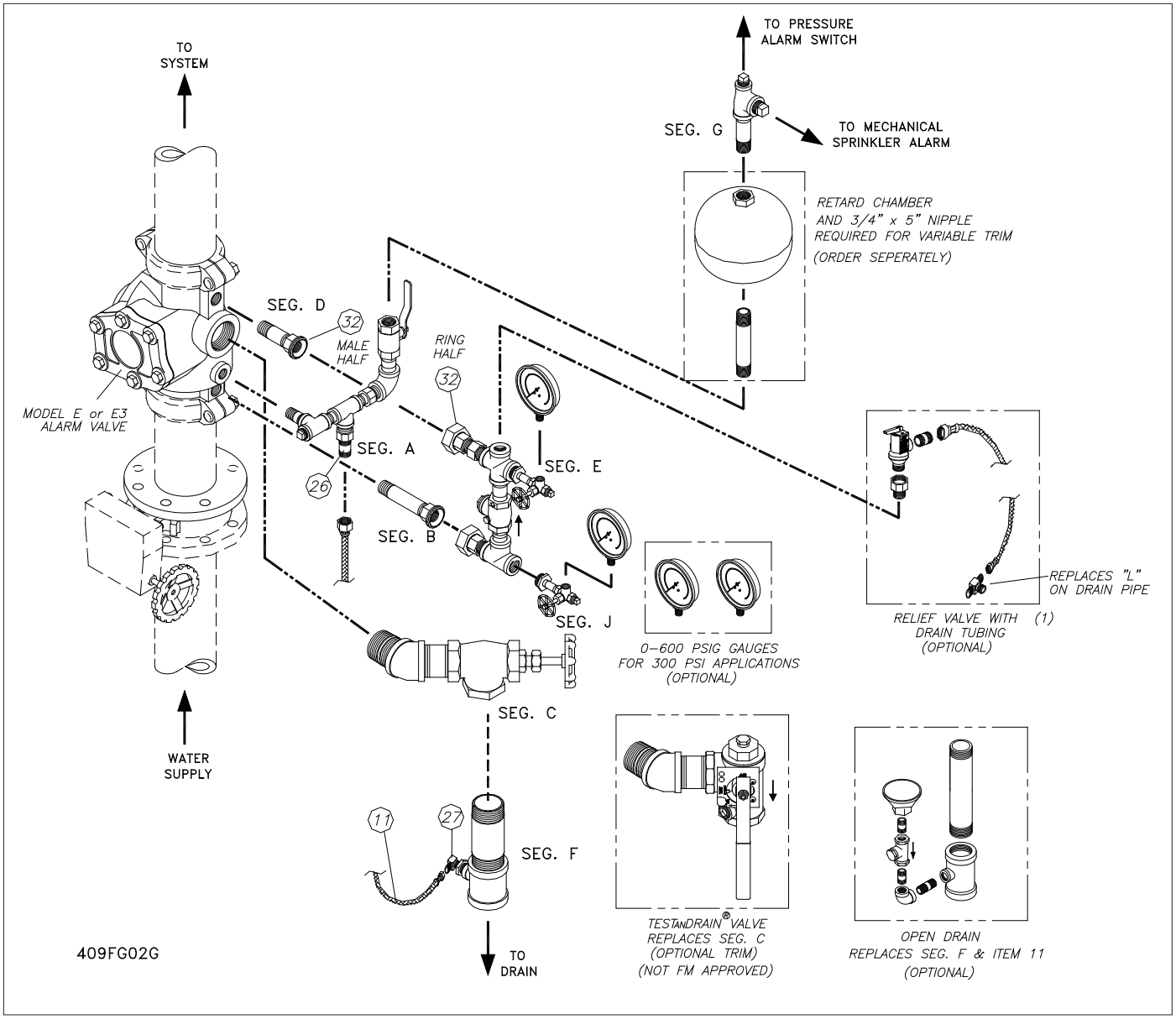


Figure 2 - Model E3 Alarm Valves with Variable Pressure Trim

Variable Pressure (Figures 3 & 5)

Item No.	Part No.		Description	Remarks	No. Req'd
1	6502141415	Vertical	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141414	Vertical, Optional	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141418	Horizontal	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141413	Horizontal, Optional	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
2	6502141436	Vertical	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141432	Vertical, Optional	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141438	Horizontal	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141434	Horizontal, Optional	Trim, Model E3 Closed Drain, Seg., 8"		1
3	6501200115		Retard Chamber		1

Constant Pressure (Figures 4 & 6)

Item No.	Part No.		Description	Remarks	No. Req'd
	6502141415	Vertical	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141414	Vertical, Optional	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	650214118	Horizontal	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141413	Horizontal, Optional	Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm		1
	6502141436	Vertical	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141432	Vertical, Optional	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141438	Horizontal	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141434	Horizontal, Optional	Trim, Model E3 Closed Drain, Seg., 8"		1
	6502141414		Trim, Model E3 Closed Drain, Seg., 4" & 6" & 165mm	Items 1 - 36	
1 *	98248001		Gauge, Water Pressure (0 - 300 psi)		2
2	98840180		Valve, Hor. Check, ¾"		1
3	98840108		Valve, Butterfly, ¾"		1
4	98840131		Valve, TESTANDRAIN™, 2" Optional		1
	98840100		Valve, Angle, 2"		1
5	98840160		Valve, Gauge, 3-Way, ¼"		2
6	98614401		Plug, ¾"		2
7	98614403		Plug, ¼"		2
8	98604406		Plug, ½"		2
9	98580002		Orifice, Drain, 3/16" Orif., ¾" NPT x ½" NPT		2
10	98580006		Orifice, Retard, 3/8" Orif., ¾" NPT	4" & 6" & 165mm	1
	98580007		Orifice, Retard, 7/16" Orif., ¾" NPT	8"	1
11	96909925		Flex Line, Steel Braided 3/8" x 9" - Vertical		1
	96920925		Flex Line, Steel Braided 20" LNG - Horizontal		1
12	98761651		Tee, ½"		1
13	96606603		Tee, ½" x ½" x ¾"		1
14	96606610		Tee, ¾" x ½" x ¾"		1
15	96606623		Tee, 2" x 2" x ½"		1
16	98543238		Nipple, 2" x Close		1
17	98543208		Nipple, 2" x 3" LG.		1
18	98543273		Nipple, 2" x 5½" LG.		1
19	98543212		Nipple, ½" x Close		3
20	98543209		Nipple, ½" x 2" LG.		1
21	98543226		Nipple, ¼" x 1½" LG.		2
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23	98543233		Nipple, ¾" x 2½" LG.		1
24	98543231		Nipple, ¾" x 3" LG.		2
25	98543279		Nipple, ¾" x Close		2
26	92056702	Horizontal	Connector, Male, 3/8" Tubing x ¼" NPT	See Fig. 6	1
27	92056703	Vertical	Elbow, Male, 3/8" Tubing x ¼" NPT	See Fig. 4	1
	6502141420	Optional	Open Drain Optional / Kit	See Fig. 2	
28	98048025		Reducer, Bushing, ½" x ¼"		2
29	98048075		Reducer, Bushing, ¾" x ¼"		2
30	98174402		Elbow, ¾"		1
31	98174411	Vertical	Elbow, 2" , 45°	See Fig. 4	1
	98174405	Horizontal	Elbow, 2"	See Fig. 6	
32	98815202		Union, ¾"		2
33	98543282		Nipple ¾" x 4" LG.		1
34	98543242		Nipple ¾" x 5" LG.		2
35	96606601		Tee, ¾"		1
36	98750005		Cross, ¾"		1

* For Optional 0 - 600 psi Gauges Specify P/N 98248005

Virtually all sprinkler system piping contains confined air. If a water hammer or pressure surge occurs in the supply line, the increased pressure will compress the confined air and cause the alarm valve clapper to lift intermittently which may result in false alarms.

The Model E3 Alarm Valve minimizes false alarms under these conditions by two features:

1. The Bypass Line, Fig. 7, with Check Valve (B) allows surges to pass from the supply to the system side of the alarm valve clapper without lifting the clapper off its seat. Repeated surges build up an effective excess pressure in the system which steadies the clapper and prevents false alarms. Should a heavy surge force the clapper off its seat and allow water to flow into the alarm line, the Model E1 Retard Chamber comes into action.

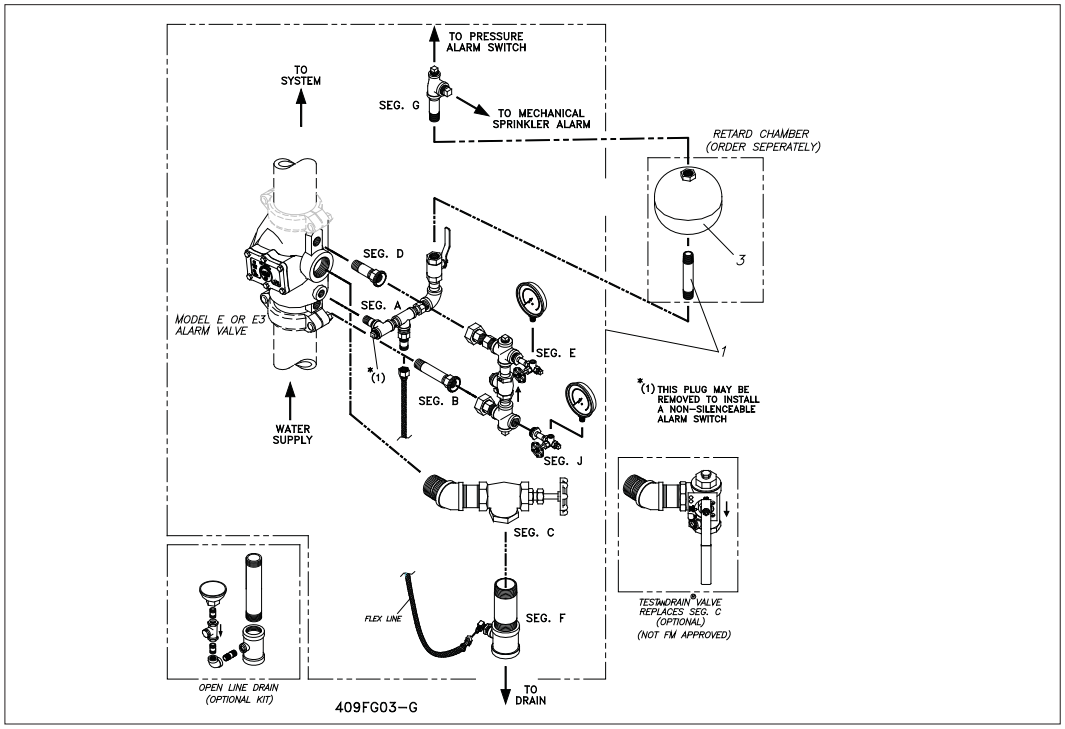


Fig. 3 Variable Pressure Vertical Installation

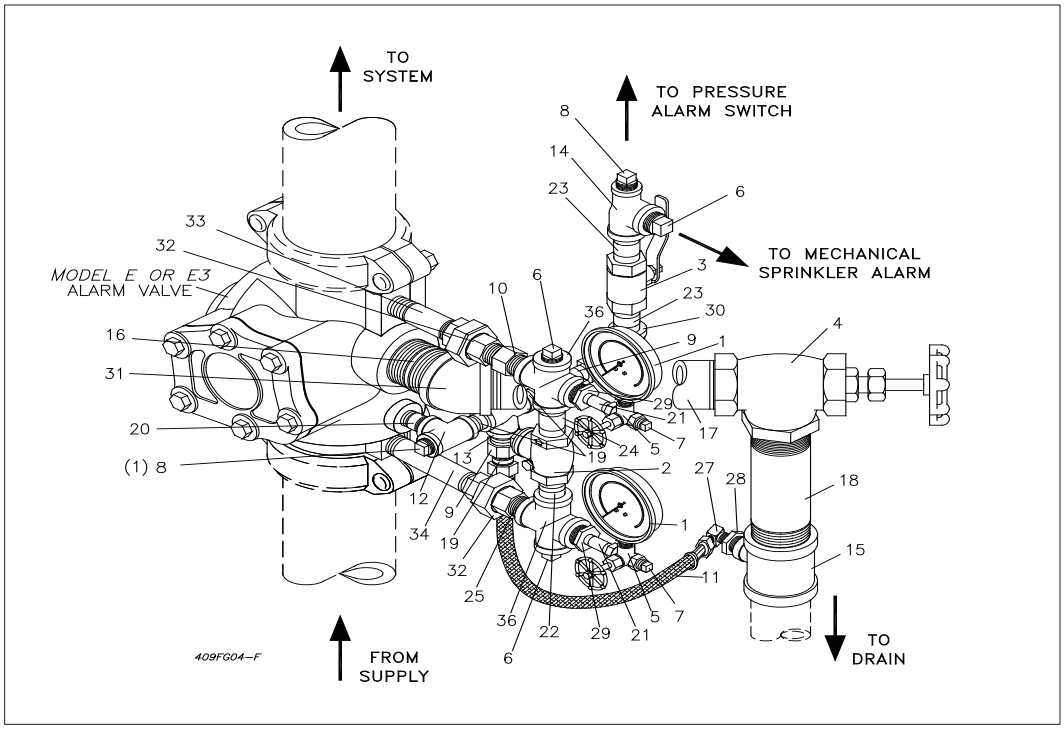


Fig. 4 Constant Pressure Vertical Installation

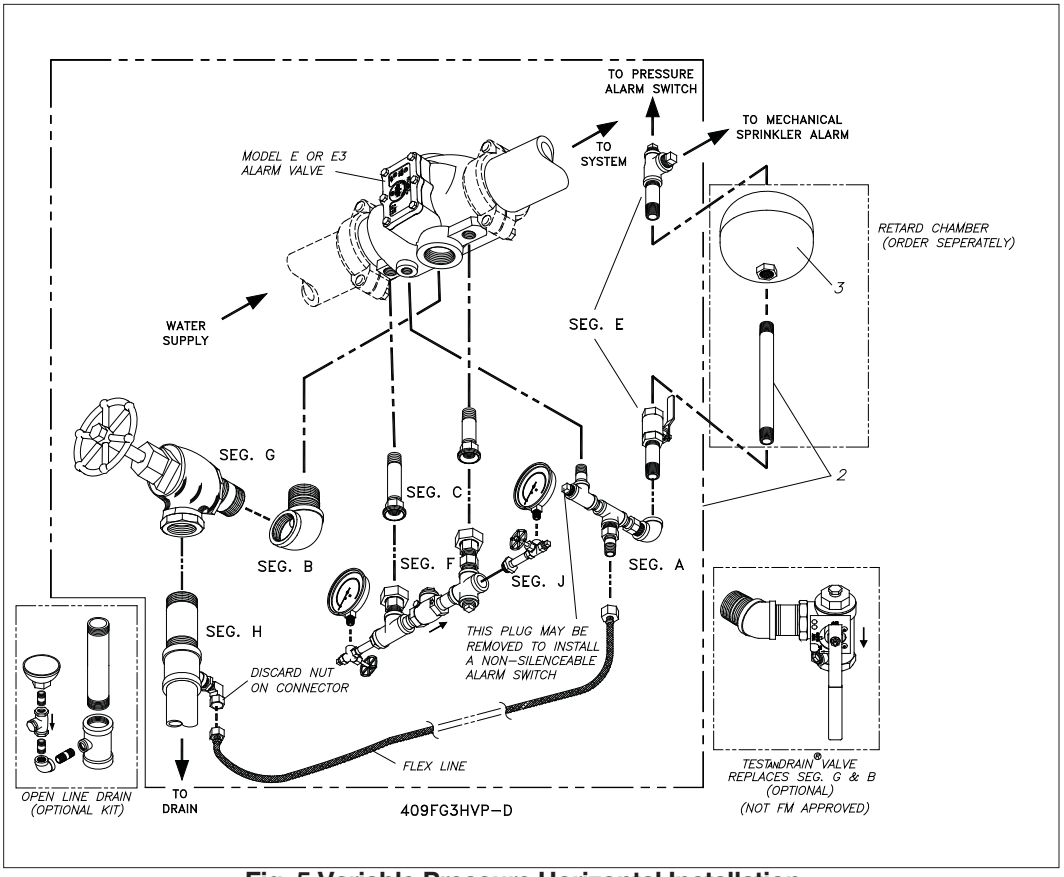


Fig. 5 Variable Pressure Horizontal Installation

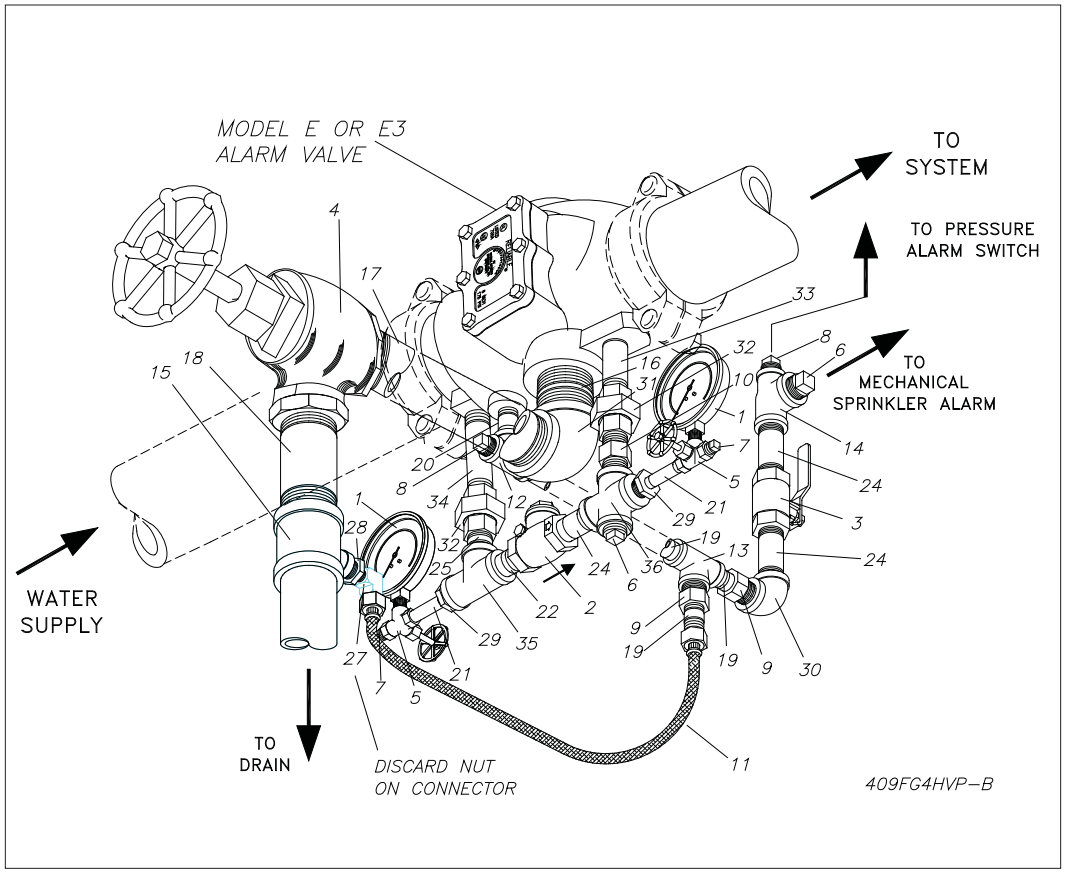


Fig. 6 Constant Pressure Horizontal Installation

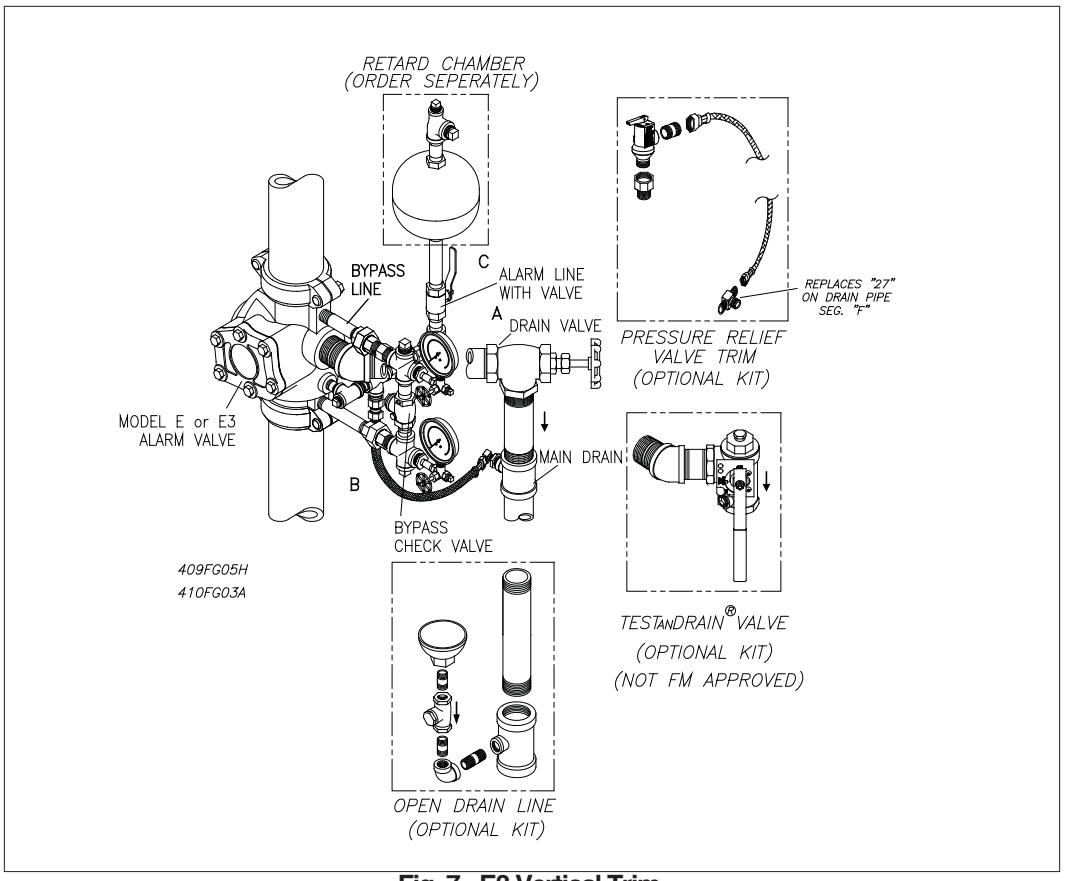


Fig. 7 - E3 Vertical Trim

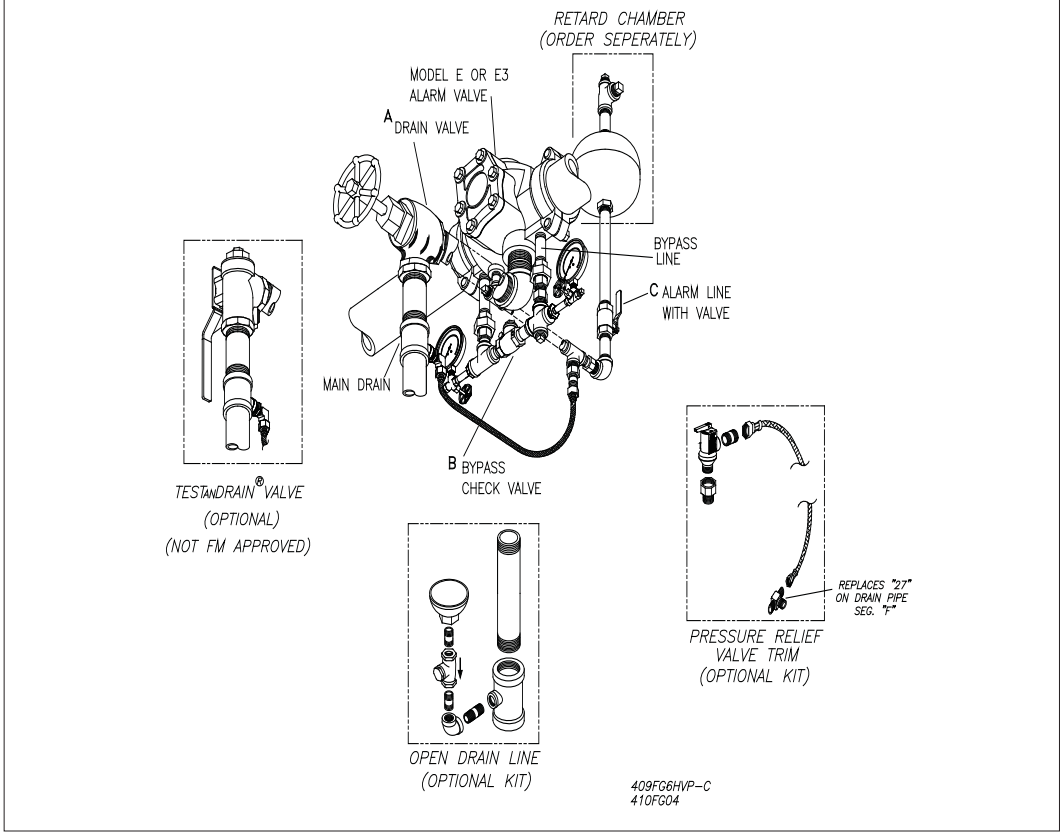


Fig. 8 - E3 Horizontal Trim

2. The retard chamber and the restriction and drain orifices allow intermittent flows to be drained before they can fill the chamber and pass on to operate the electric and mechanical alarms.

Constant Pressure Equipment

The operation of this equipment is the same as described for the variable pressure equipment, except that due to the water supply pressure being constant, the retard chamber is not required. The water, on passing through the groove in the seat of the alarm valve, flows directly to operate the electric and mechanical alarms.

Tests

To test the readiness of the entire wet pipe system, open the inspectors test connection which should cause the mechanical and the electric alarms to sound. This test connection is usually located on the end or top line of the system and its opening is the equivalent to the fusing of one automatic sprinkler.

To test the operation of the alarm equipment only, open Valve (A), Fig. 7, until alarm sounds. For the optional TestANDrainâ installation kit open the valve to the "Test" position. Testing this way has the added benefit of exercising the clapper assembly. Should the mechanical sprinkler alarm (water motor) not operate, most likely the strainer is clogged. Remove the strainer cap and filter to clean. Be sure to replace the cleaned filter and tighten cap securely. Refer to Bulletin 613 for cleaning information.

To test supply piping for unobstructed flow, close Valve (C), Fig. 5, and open Valve (A) to the drain position. When the test is completed, close Drain Valve (A) securely and open Valve (C) which must be monitored with a suitable supervising device.

For FM insured applications the placement of a Test and Drain valve (E3 Trim Option) in the 2" (50mm) drain line does not replace the need for an inspector's test connection at the outer reaches of the sprinkler system. The drain valve shall not be used in lieu of the inspector's test connection for the testing of the entire wet piping system. The drain valve shall only be used to exercise the clapper and test valve associated alarm devises. For all other applications please refer to NFPA 13 or to the authority having local jurisdiction.

Maintenance

Reliable alarm valves and associated equipment shall periodically be given a thorough inspection and test. NFPA 25 provides minimum inspection, testing and maintenance requirements. Alarm valves shall be tested, operated, cleaned, inspected and parts replaced, as required, at least annually.

Usually, any trouble will be shown by one or more of the following symptoms:

A. Mechanical Sprinkler Alarm (Water Motor) Not Operating.

See **Tests** for corrective measures.

B. Steady Water Flow Into Drain Line

Steps in the following sequence should be taken to correct steady water flow into the drain line:

1. Open Valve (A), Fig. 7, to drain which should flush any loose matter off alarm valve seat. Close valve and observe if water flow ceases.
2. Close main control valve to determine if water flow is coming from above or below alarm valve clapper.

Note: Supply pressure gauge should read zero when main control valve is closed tight and water pressure between this valve and the alarm valve is relieved. If necessary, pressure can be relieved through the lower gauge valve when the ¼" NPT plug is removed.

a. If water flow is coming from below clapper, water will stop running to drain line.

b. If water flow is coming from above clapper, water will continue to run to drain line.

Note: To minimize downtime, the following parts should be on hand before the valve is disassembled:

1) Seat installation Wrench:
   4" – Part No. 6881240000
   6" – Part No. 6881260000
2) Clapper Rubber Facing and Clamping Ring Assembly: Item 5, Figure 9.
3) Seat "O"-Rings: Items 9 and 10, Figure 9.

c. In either case (a or b), drain system by opening Valve (A), Fig. 7, to drain. Remove Cover (2), Fig. 9, Shaft Pipe Plug (14), Hinge Pin (8) and Clapper Assembly (4).

Note: Hold down Spring (13) when removing Hinge Pin (8).

d. Carefully inspect for the following:

1) Damage to clapper rubber facing – Inspect surface for imbedded foreign matter. Replace facing if found damaged (be certain that clapper and clapper clamping ring surfaces are thoroughly cleaned before assembling with new facing.)
2) Damage to seat surface – Clean seat thoroughly. Inspect for any nicks in seat or stones or other foreign matter lodged in seat groove. If seat or other parts of valve are found to be severely damaged, an authorized Reliable distributor should be contacted.

e. To replace seat "O"-Rings:

1) Using the seat wrench, unscrew the seat. Use care to avoid damage to the seat surface.
2) Remove "O"-Rings, Items 9 and 10, Fig. 9. Thoroughly clean "O"-Ring grooves and sealing surfaces. Inspect for damage or foreign material.
3) Apply a light coat of lubricant to new "O"-Rings and install in the proper grooves. Use care to avoid stretching, twisting or other damage to "O"-Rings.
4) After checking that "O"-Rings are correctly installed, carefully reinstall seat and tighten securely with the seat wrench.

f. To reassemble alarm valve:

1) Replace clapper assembly (Fig. 6) on seat alarm valve – insert Hinge Pin (8) in valve and pass it through one bearing of Clapper (4) – Press and hold Spring (13) securely in position between clapper alarm bearings and push clapper alarm shaft through spring coils and bushings to far side of valve – Replace Shaft Pipe Plug (14).

Model E3 High Pressure Alarm Valve

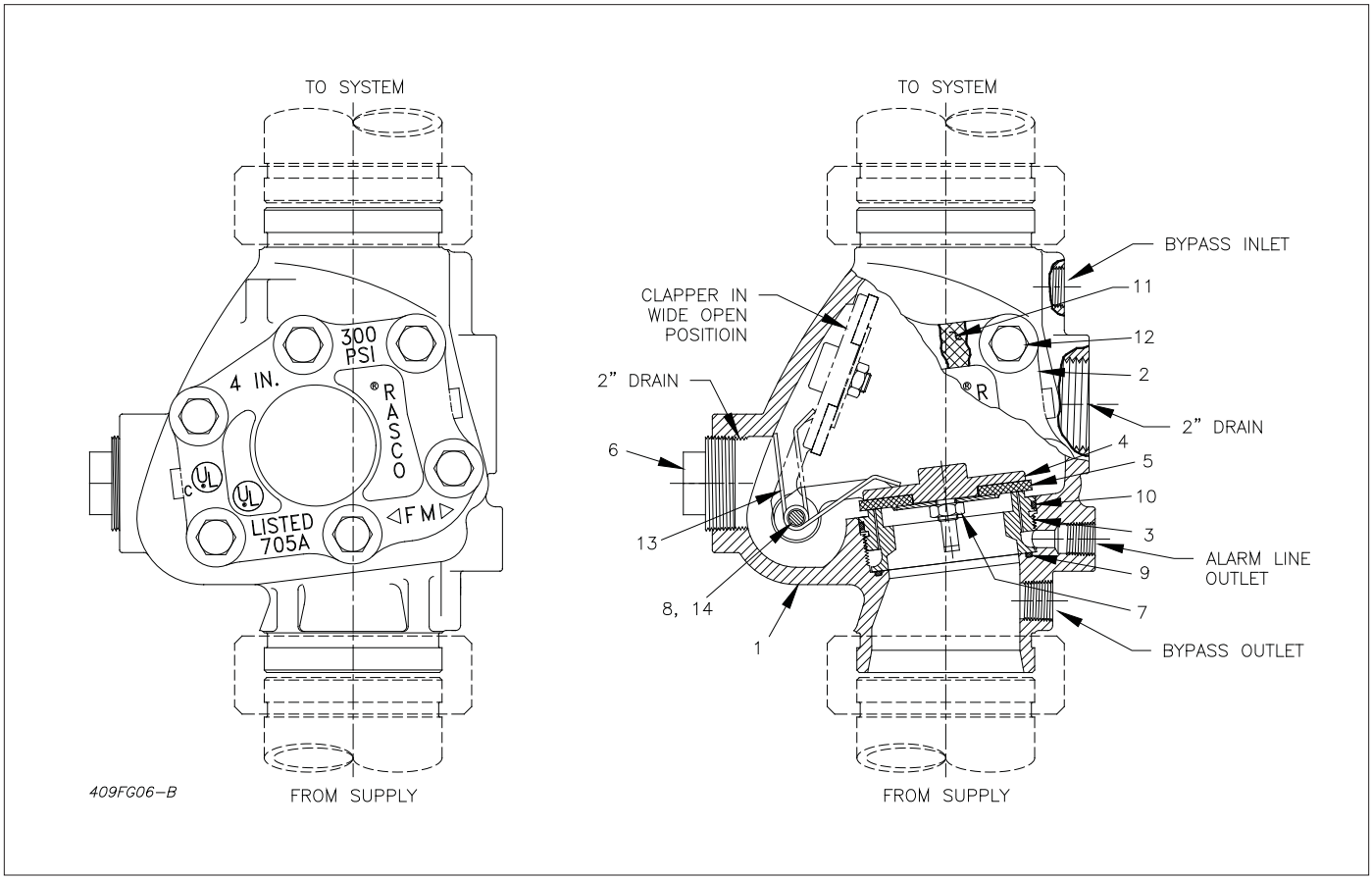


Figure 9

Model E3 Alarm Valve parts

4" (100mm) - P/N 6102040519; 6" (150mm) - P/N 6102060519
6" (165mm) - P/N 6102065518; 8" (200mm) - P/N 6102080519

Item No.	Part Name	Part Number				Quantity			
		4" (100mm)	6" (150mm)	6" (165mm)	8" (200mm)	4" (100mm)	6" (150mm)	6" (165mm)	8" (200mm)
1	Body, Grooved x Grooved	91006167	91006165	91006171	91006169	1	1	1	1
2	Cover	92116304	92116306	92116306	92116308	1	1	1	1
3	Seat	96016124	96016126	96016126	96016128	1	1	1	1
4	Clapper Bushing Assy.	71020424	71020626	71020626	71020828	1	1	1	4
5	Clapper Rubber Facing and Clamping Ring Assy.	93416104	93416106	93416106	93416108	1	1	1	
6	Drain Plug (Except Metric Valves)	95206104	95206104	95206104	95206104	1	1	1	
7	Clamping Ring Screws or Nut	94906124	95606126	95606126	95606126	1	4	4	1
8	Hinge Pin	95006124	95006126	95006126	95006128	1	1	1	1
9	Seat "O"-Ring	95436124	95436126	95436126	95436128	1	1	1	1
10	Seat "O"-Ring	95446124	95446126	95446126	95446128	1	1	1	1
11	Cover Gasket	93706124	93706126	93706126	93106128	1	1	1	1
12	Cover Bolts	91106124	91106126	91106126	91106126	6	6	6	6
13	Clapper Spring	96406124	96406124	96406124	96406124	1	1	1	1
14	Shaft Pipe Plug (not shown)	98604402	86044002	86044002	86044002	1	1	1	1
-	Retard Chamber Model E1	6303000522	6303000522	6303000522	6303000522	-	-	-	-

2) Lift toe of clapper – check for freedom of rotation and proper seating.
3) Replace Cover (2) being sure Cover Gasket (11) is in position and bolts and nuts are securely tightened.
4) Close Drain Valve (A), Fig. 7. Slowly open main control valve. Be sure Valve (C) and the main control valve are properly supervised in the OPEN position.

C. False Alarms

False alarms are generally caused by pressure surges in the water supply and can occur if the system loses its effective excess pressure (see "Operation"). Similar readings on the system and supply pressure gauges are a visual indication that the excess pressure condition has been lost. One or more of the following will contribute to this loss of pressure – Leaking system drain valves, leaking at the Alarm Valve Seat (3), Fig. 6, leaking between the Clapper (4) and the Facing (5), or leaking at the Bypass Check Valve (B), Fig. 7.

Corrective Steps:

1. Check system drain valves for tightness.
2. In order to find and correct a leak at the alarm valve seat, proceed as outlined in B.1. through 2.
3. To correct a leak between the clapper and the clapper facing, proceed as outlined in B 2.c. and B. 2.d.1.
4. In order to find and correct a leak through the bypass check valve, proceed as follows:
   a. Close the main control valve and relieve pressure between main control valve and clapper of the alarm valve through the ¼" NPT lower gauge valve. Close this valve before removing the ¼" NPT plug, and open after the plug is removed to relieve pressure. If water continues to flow from this valve, the bypass Check Valve (B) should be cleaned, repaired or replaced.
   b. If Bypass Check Valve (B) is leaking, repair after opening Valve (A) to drain and draining the system completely.
   c. Following all repairs, close Valves (A) and then slowly open the main control valve, and supervise it appropriately.
5. If the retard and mechanical sprinkler alarm line does not drain completely, false alarms may result. In this case, check both drain orifices (Item 9, Fig. 4. & 6) to ensure they are not plugged.

D. Intermittent Alarms

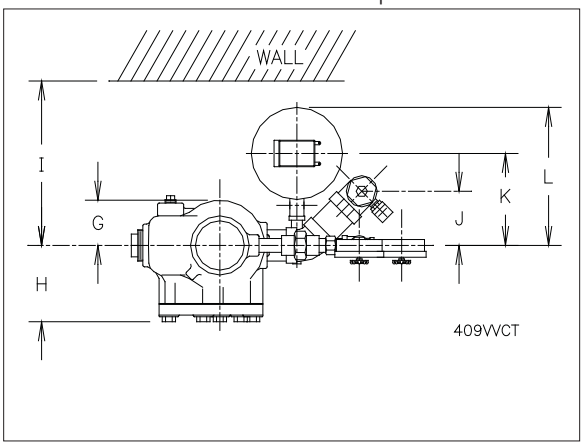
Intermittent alarms are the result of excessive confined air trapped in the sprinkler system piping. To correct this problem, fill the system slowly while venting air at all system openings. When the system is fully pressurized, vent air at all system high points including sprinkler connections if necessary.

Contact the installing contractor or Reliable if any difficulties are experienced. Should replacement parts be needed, use only genuine Reliable made parts. When ordering, specify part number, name, size, model and serial number of the unit.

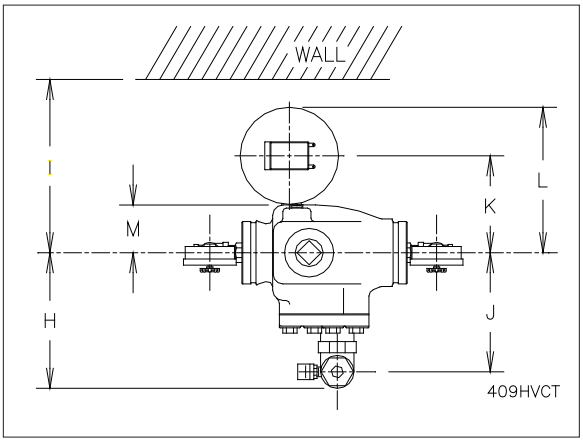
Model E3 Vertical & Horizontal Trim Illustrations
Installation Measurement in Inches (mm)

Valve	A	B	C	D	E	F	G	H	I	J	K	L	M
4 (100)	7 (178)	10½ (267)	16½ (419)	6 (152)	16¾ 426)	15 (381)	3½ (89)	5¾ (146)	12 (305)	4½ (114)	6½ (165)	10 (254)	8¼ (210)
6 (150) (165)	7 (194)	11½ (292)	17½ (445)	7 (178)	15¼ (387)	16½ (419)	4¼ (108)	7 (178)	12 (305)	4½ (114)	6½ (165)	10 (254)	6¾ (172)
8 (200)	7 (194)	11½ (292)	17½ (445)	7 (178)	15¼ (387)	16½ (419)	4¼ (108)	7 (178)	12 (305)	4½ (114)	6½ (165)	10 (254)	6¾ (172)

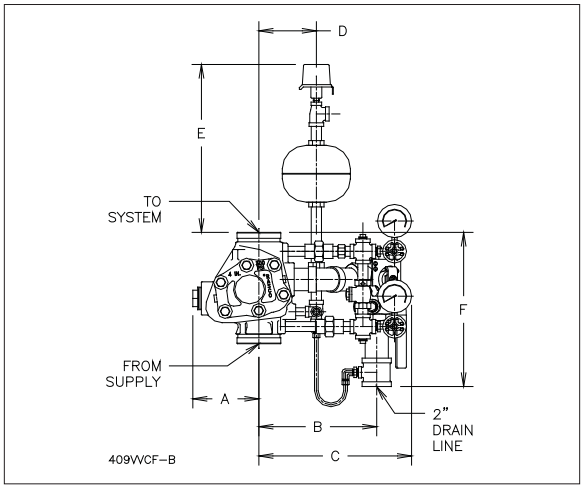
Vertical Variable Trim - Top View



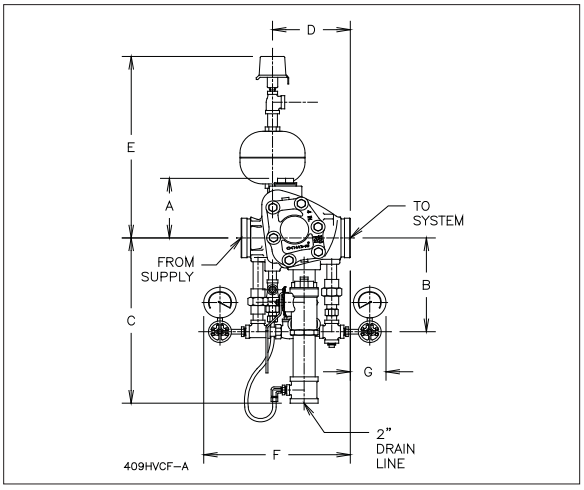
Horizontal Variable Trim - Top View



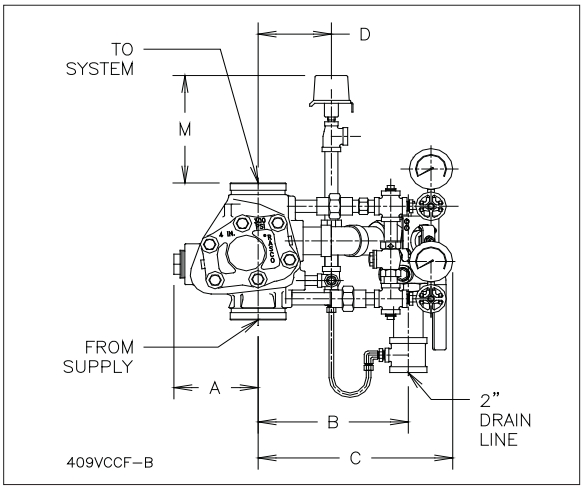
Vertical Variable Trim - Front Elevation



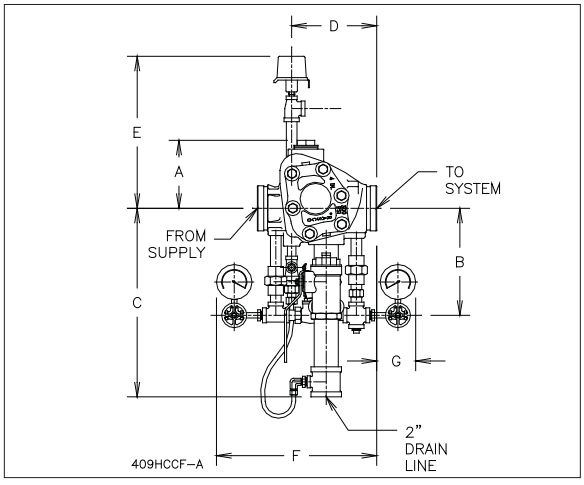
Horizontal Variable Trim - Front Elevation



Vertical Constant Trim - Front Elevation



Horizontal Constant Trim - Front Elevation



L5 Standpipe Valve

The Croker angle valve will be installed at each level on the combination standpipe sprinkler riser in the CHP.

- Angle valve 300 lb rated
- Figure Number 5015
- Standard equipment: Female NPT inlet and male hose thread outlet cast brass valve with wheel handle.
- Male hose thread is 2 ½”

ANGLE VALVES 300LB. RATED

Fire Department Valves
FEMALE X MALE

STANDARD EQUIPMENT: Female NPT inlet and male hose thread outlet cast brass valve with wheel handle.

Figure No. 5010-5015

Fire Hose Rack Assembly Valves
DOUBLE FEMALE

STANDARD EQUIPMENT: Female NPT inlet and outlet cast brass valve with wheel handle

Figure No. 5020-5025

OPTIONAL FINISHES:
PB- Polished Brass
RC- Rough Chrome Plated
PC- Polished Chrome Plated

SPECIFY THREAD

U/L LISTED
NY BSA/MEA APPROVED

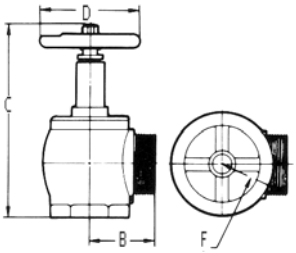
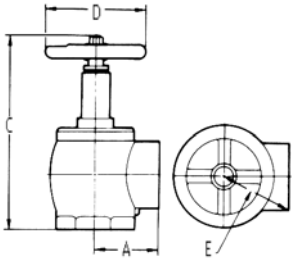


Figure No.	5010 5020	5015 5025
Size	1 1/2"	2 1/2"
A	2 11/64	3 3/16
B	2 7/32	3 3/16
C-Closed	6 5/8	9 1/4
C-Open	7 21/22	11
D	3 3/4	5
E	2 7/16	3 19/32
F	2 13/16	3 19/32
U/L Listed	Yes	Yes
FM Approved	Yes	Yes
NYC Approved	Yes	Yes
2 13/16	3 19/32	



ANGLE VALVES 300LB. RATED

Fire Department Valves
FEMALE X MALE

STANDARD EQUIPMENT: Female NPT inlet and male hose thread outlet cast brass valve with wheel handle.

Figure No. 5030-5035

Fire Hose Rack Assembly Valves
DOUBLE FEMALE

STANDARD EQUIPMENT: Female NPT inlet and outlet cast brass valve with wheel handle

Figure No. 5040-5045

OPTIONAL FINISHES:
PB- Polished Brass
RC- Rough Chrome Plated
PC- Polished Chrome Plated

SPECIFY THREAD

U/L LISTED
NY BSA/MEA APPROVED

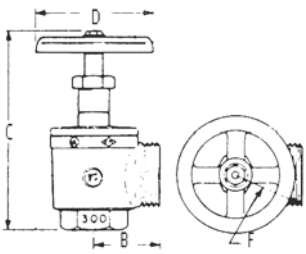
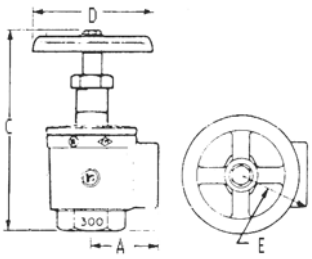


Figure No.	5030 5040	5035 5045
Size	1 1/2"	2 1/2"
A	2 9/64	3 5/32
B	2 17/64	3 3/16
C-Closed	6 1/2	8 3/4
C-Open	7 11/16	10 9/16
D	4 1/64	5 1/8
E	2 7/10	3 1/2
F	2 3/8	3 3/8
U/L Listed	Yes	Yes



Appendix M

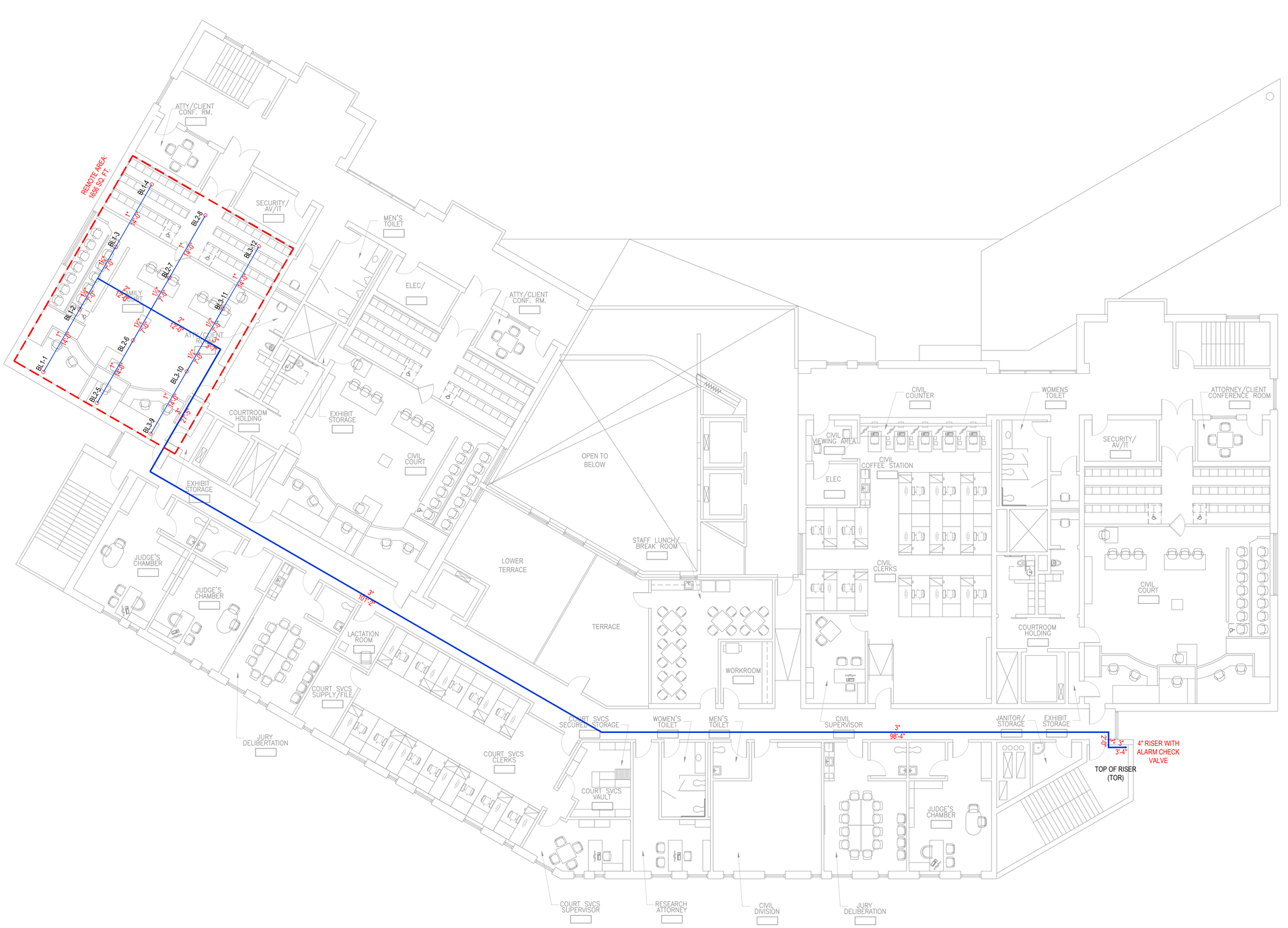
Level 4 Plan – Hydraulically Remote Area

M1 Level 4 – Hydraulically Remote Area

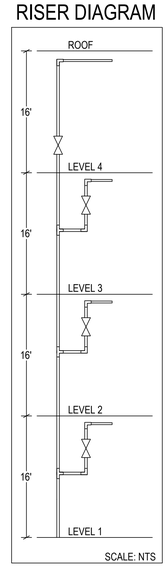
LEGEND

- RELIABLE MODEL G4 CONCEALED AUTOMATIC SPRINKLER
- SPRINKLER PIPE
- REMOTE AREA
- ALARM CHECK VALVE, TRIM, AND STANDPIPE CONNECTION

FLOOR AREA: 24,500 SQ. FT.



RISER DIAGRAM



1/8" =1'-0"
0 4 8 20

Fourth Floor Plan

Submittal Date: 03-14-2012

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 523 - COURSE PROJECT

FP104

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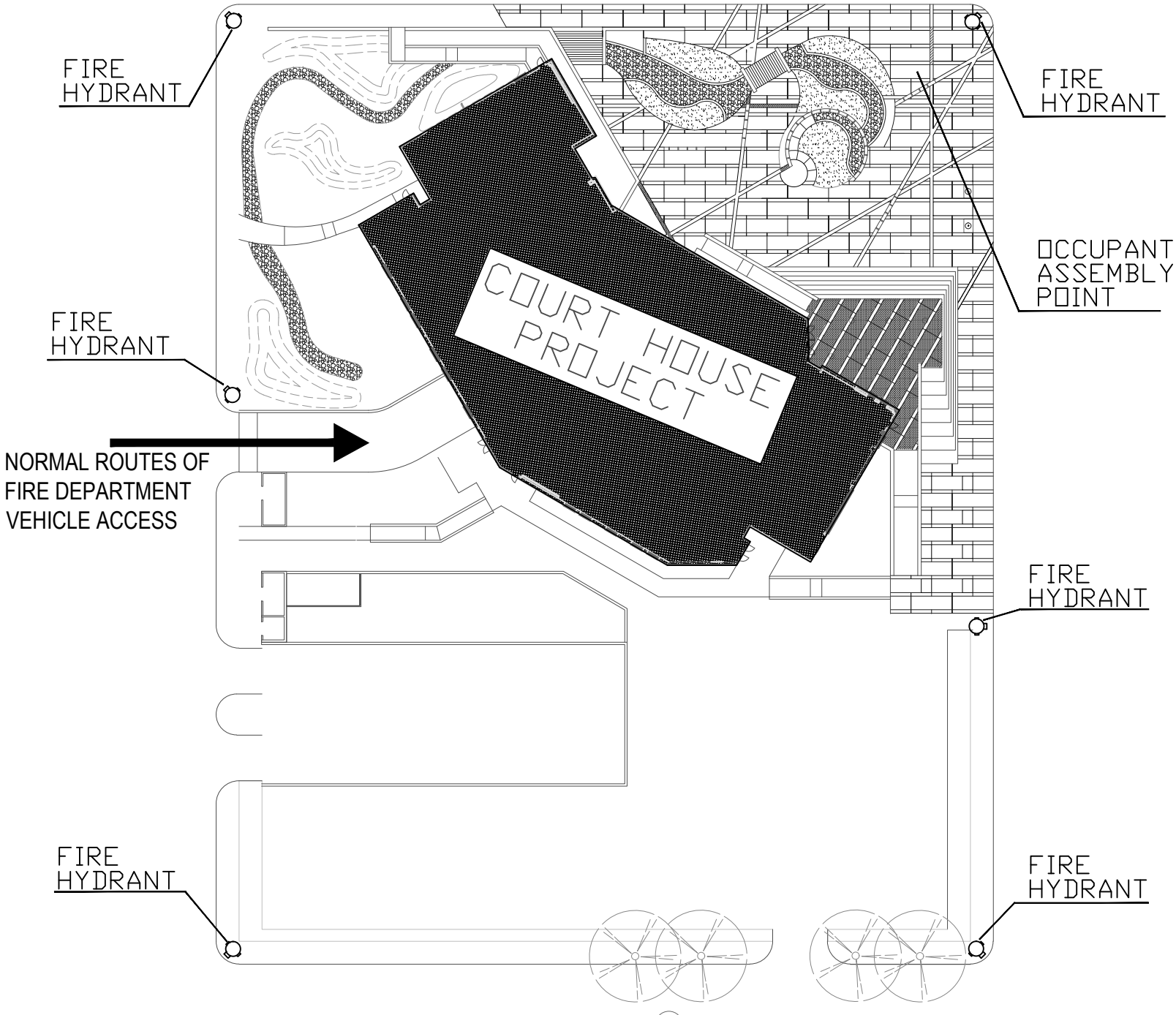
Appendix N

Fire Site Plan



SITE PLAN
SCALE: 1/16" = 1'-0"
1
ER001

Site Plan

Court House Project
Somewhere, California

Submittal Date: 12-2012

RYAN RIGSBEE

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT

ER001

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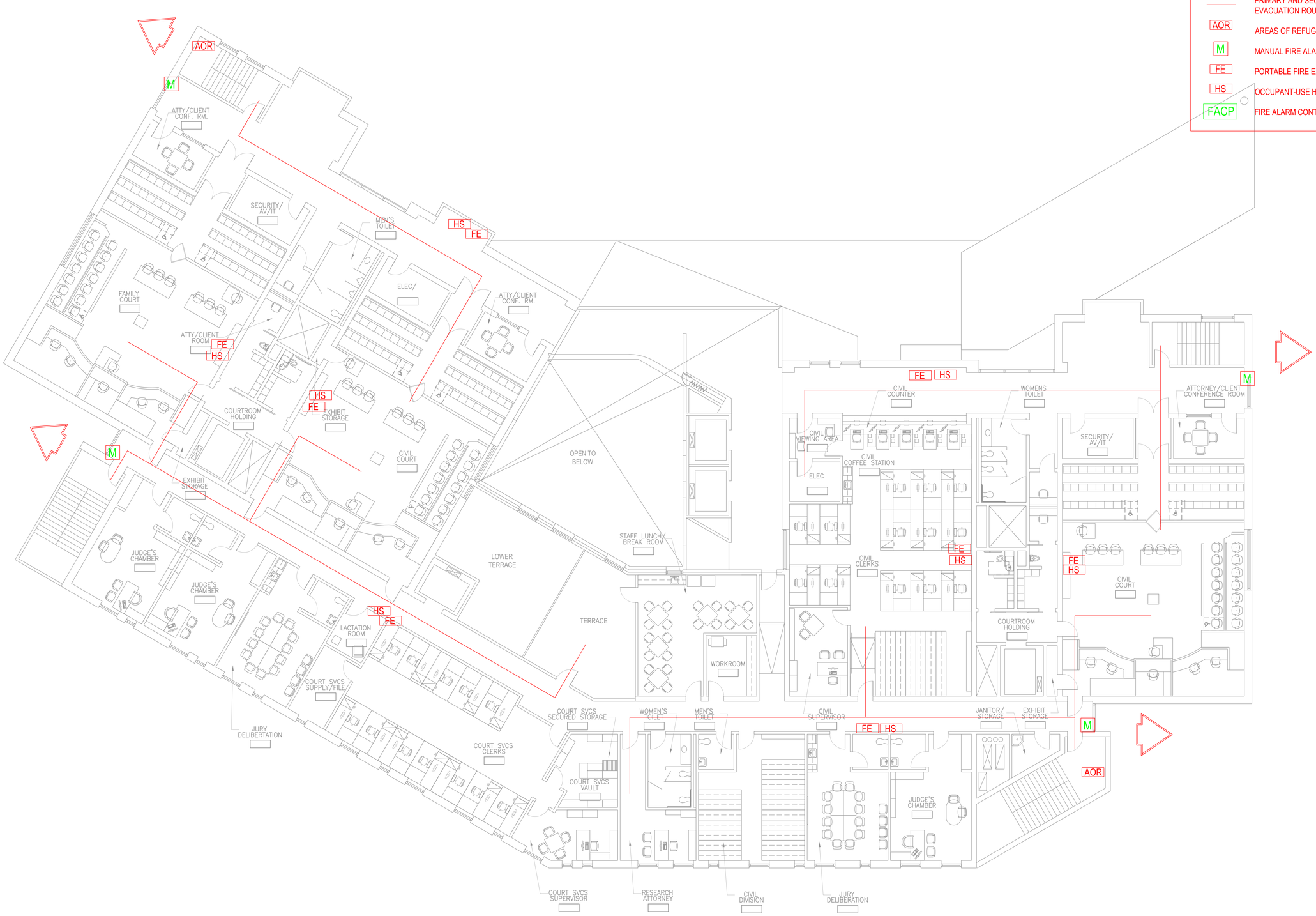
Appendix O

Emergency Route Floor Plans

LEGEND

- EXITS
- PRIMARY AND SECONDARY EVACUATION ROUTES
- AOR — AREAS OF REFUGE
- M — MANUAL FIRE ALARM BOXES
- FE — PORTABLE FIRE EXTINGUISHERS
- HS — OCCUPANT-USE HOSE STATIONS
- FACP — FIRE ALARM CONTROL PANEL



1/8" =1'-0"
0 4 8 20

N

Court House Project

Somewhere, California

Fourth Floor Plan

RYAN RIGSBEE

Submittal Date: 12-2012

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT

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LEGEND

- EXITS
- PRIMARY AND SECONDARY EVACUATION ROUTES
- AOR — AREAS OF REFUGE
- M — MANUAL FIRE ALARM BOXES
- FE — PORTABLE FIRE EXTINGUISHERS
- HS — OCCUPANT-USE HOSE STATIONS
- FACP — FIRE ALARM CONTROL PANEL

ATTY/CLIENT CONF. RM.
SECURITY/ AV/IT
MEN'S TOILET
SHARED COURT
ELEC
ADMIN–FINANCE COURT ANALYST
ATTY/CLIENT ROOM
INTERPRETERS
COURTROOM HOLDING
ADMIN–FINANCE COURT ANALYST
INTERPRETER COORDINATOR
ADMIN–FINANCE CFO
OPEN TO BELOW
EXHIBIT STORAGE
ADMIN–EXEC MGR–ADMIN SVCS
ADMIN–FINANCE FINANCIAL FILES
MULTI–PURPOSE CONFERENCE ROOM
JUDGE'S CHAMBER
ADMIN–EXEC MGR–BUS/FAC
LOWER TERRACE
WORKROOM
STAFF TOILET
JUDGE'S LIBRARY/ CONFERENCE ROOM
ADMIN–EXEC RECEPTION/WORK AREA
ADMIN–EXEC COPY/FILE
ADMIN–EXEC CEO
WORK COUNTER/ COFFEE STATION
COURT RPRTR FILE AREA
ADMIN–EXEC ADMIN SECTRY
ADMIN–EXEC JUD SECTRY
ADMIN–EXEC ASST CEO
COURT RPRTR SUPERVISOR
COURT REPORTER
COURT REPORTER
COURT REPORTER
JUVENILE DIVISION
JURY DIV COUNTER
WOMENS TOILET
ATTORNEY/CLIENT CONFERENCE ROOM
ELEC
JUV DIV VIEWING AREA
SECURITY/ AV/IT
JUV DIV SUPERVISOR
JUV DIV CLERKS
JUV DIV WORK ROOM
JUVENILE COURT
COURTROOM HOLDING
JUV DIV COFFEE STATION
WOMENS TOILET
JANITOR/ STORAGE
EXHIBIT STORAGE
JUDGE'S CHAMBER

0 4 8 20 1/8" =1'-0"

N

Third Floor Plan

Submittal Date: 12-2012

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT

ER103

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PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

LEGEND

- EXITS
- PRIMARY AND SECONDARY EVACUATION ROUTES
- AOR — AREAS OF REFUGE
- M — MANUAL FIRE ALARM BOXES
- FE — PORTABLE FIRE EXTINGUISHERS
- HS — OCCUPANT-USE HOSE STATIONS
- FACP — FIRE ALARM CONTROL PANEL

1/8" =1'-0"
0 4 8 20

Second Floor Plan

Submittal Date: 12-2012

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT

ER102

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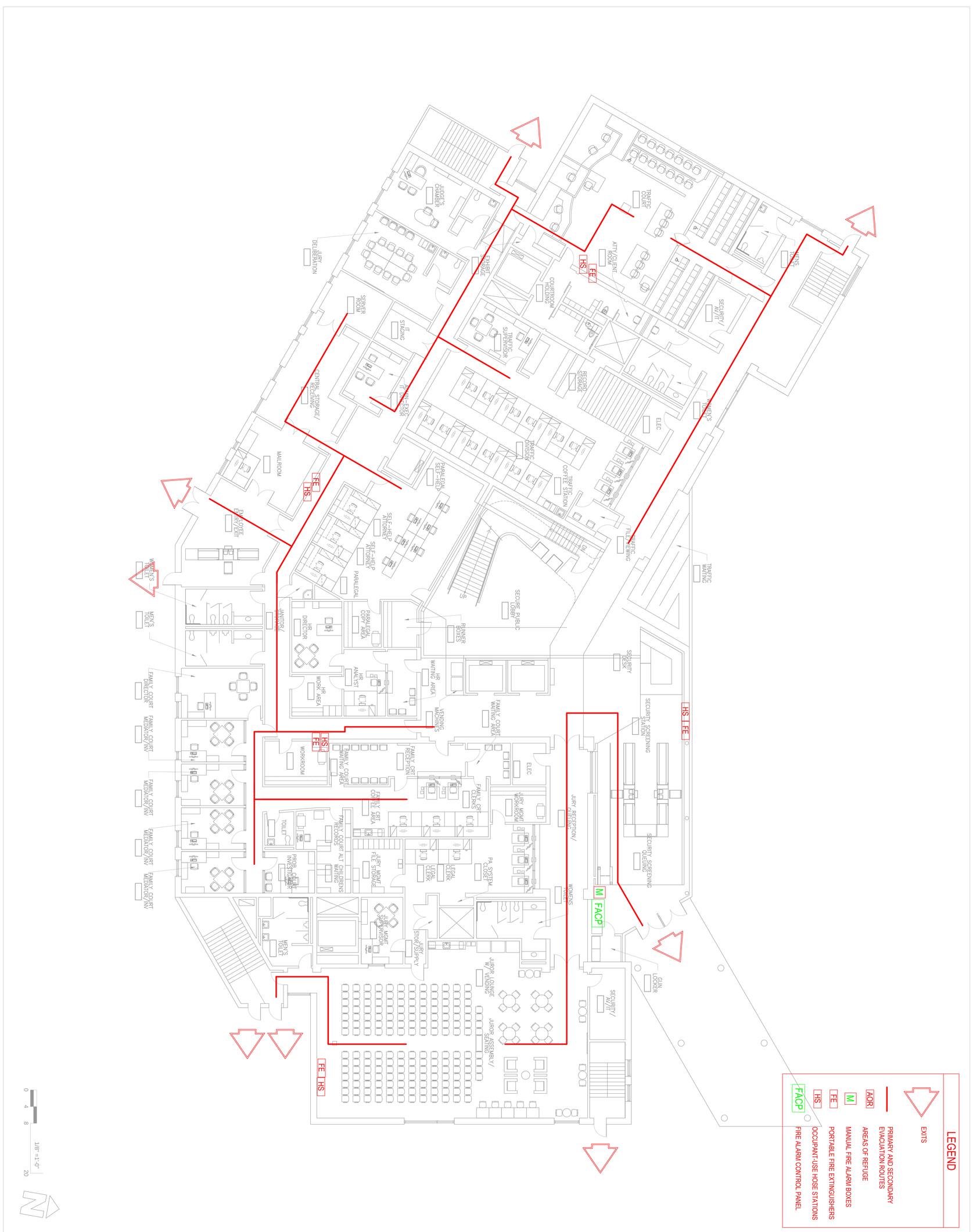
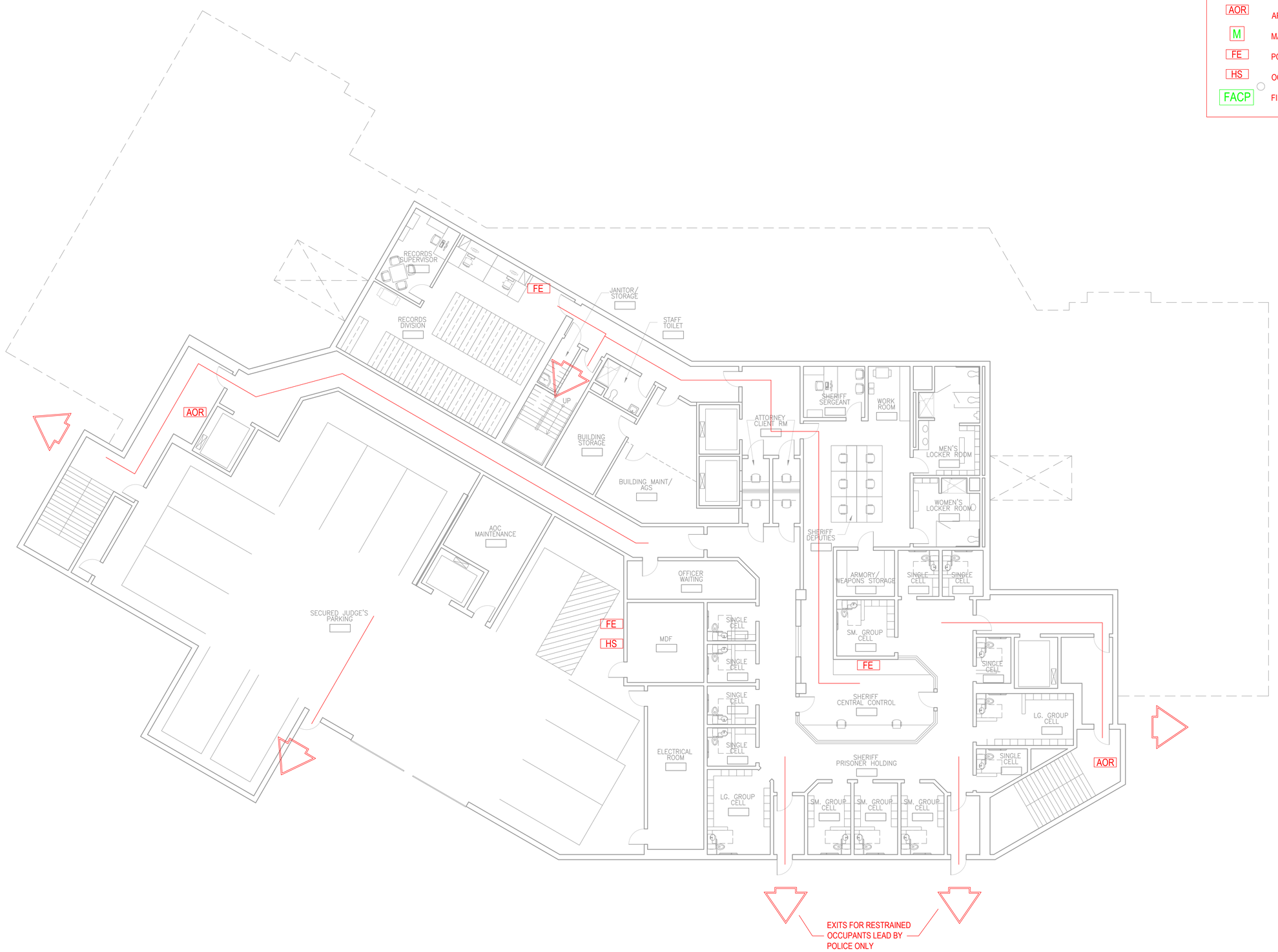


ER101		Court House Project Somewhere, California	First Floor Plan	
	CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT		RYAN RIGSBEE	Submittal Date: 12-2012

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

LEGEND

- EXITS
- PRIMARY AND SECONDARY EVACUATION ROUTES
- AOR — AREAS OF REFUGE
- M — MANUAL FIRE ALARM BOXES
- FE — PORTABLE FIRE EXTINGUISHERS
- HS — OCCUPANT-USE HOSE STATIONS
- FACP — FIRE ALARM CONTROL PANEL



1/8" =1'-0"
0 4 8 20

Basement Plan

Submittal Date: 12-2012

RYAN RIGSBEE

Court House Project

Somewhere, California

CALIFORNIA POLYTECHNIC UNIVERSITY - FPE 551 - COURSE PROJECT

ER100

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Appendix P

Sprinkler Activation Modeling
DETACT

This sheet predicts sprinkler/heat detector activation based on the method of Heskestad and Delichatsios(updated)
Input in the green areas.

green	=input in these areas
yellow	=output in these areas
blue	=titles and other messages

alpha [kW/s^2]	0.0469
r [m]	3.23
g [m/s^2]	9.81
Ceiling Height [ft]	12
Convective Fraction	0.7
Tamb [F]	70
Cp	1
RTI (m-s)^(1/2)	50
Tact [F]	165
Tact [K]	347.03889
Tamb [K]	294.26111
Ceiling Height [m]	3.6585366
Q [kW]	1039.5612
Q [Btu/sec]	986.30091
t [sec]	148.88077
rho [lb/ft^3]	0.074717
rho [kg/m^3]	1.1959446
A	0.0278757
t2*	13.978876
t2*f	1.6211482
dT2*	111.70487
u2*/(dT2*^(1/2))	0.6381725
U2*	6.7448785
D	0.3596537
U [m/s]	2.3169422
u/u2*	0.3435113
dT [K]	108.07138
T [K]	402.33249
Y	3.0050647
Td [K]	347.03975
delta	-0.000861

Detector Activation Time [s]
148.9

Fire Size @ Activation [kW]
1040

Appendix Q

Design Fire Location Schematics

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - Fisrt Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

Area affected during a fire event

RECORDS SUPERVISOR
RECORDS DIVISION
JANITOR/ STORAGE
STAFF TOILET
UP
BUILDING STORAGE
BUILDING MAINT/ AGS
AOC MAINTENANCE
SECURED JUDGE'S PARKING
OFFICER WAITING
MDF
ELECTRICAL ROOM
SINGLE CELL
LG. GROUP CELL
SM. GROUP CELL
ATTORNEY CLIENT RM
SHERIFF SERGEANT
WORK ROOM
MEN'S LOCKER ROOM
WOMEN'S LOCKER ROOM
SHERIFF DEPUTIES
ARMORY/ WEAPONS STORAGE
SHERIFF CENTRAL CONTROL
SHERIFF PRISONER HOLDING

1/8" =1'-0"
0 4 8 20

Basement Plan

A-200

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - First Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

Area affected during a fire event

First Floor Plan

A-201

1/8" = 1'-0"

0 4 8 20

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - First Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

Area affected during a fire event

ATTY/CLIENT CONF. RM.
SECURITY/ AV/IT
HOLDING/ATTY INTERVIEW
MEN'S TOILET
CRIMINAL COURT
ELEC
ATTY/CLIENT CONF. RM.
OPEN TO BELOW
COURTROOM HOLDING
CRIMINAL COURT
EXHIBIT STORAGE
JUDGE'S CHAMBER
JUDGE'S CHAMBER
CRIMINAL SUPERVISOR
CRIMINAL CLERKS
CRIMINAL VIEWING AREA
CRIMINAL COFFEE STATION
JURY DELIBERATION
CRIM. DIV. RECORDS
SHARED COFFEE STATION
TERRACE
WORKROOM
JUDGE'S CHAMBER
JUDGE'S CHAMBER
COURT REPORTER
SENIOR COURT REPORTER
COURT REPORTER
JURY DELIBERATION
ATTY/CLIENT CONF. RM.
WOMENS TOILET
HOLDING/ATTY INTERVIEW
ATTY/CLIENT CONF. RM.
ELEC
SECURITY/ AV/IT
CRIMINAL COURT
CRIMINAL COURT
COURTROOM HOLDING
JANITOR/ STORAGE
EXHIBIT STORAGE

1/8" =1'-0"
0 4 8 20

N

Second Floor Plan

A-202

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - First Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

Area affected during a fire event

ATTY/CLIENT CONF. RM.
SECURITY/ AV/IT
HOLDING/ATTY INTERVIEW
MEN'S TOILET
ELEC
SHARED COURT
ADMIN-FINANCE COURT ANALYST
INTERPRETERS
ADMIN-FINANCE COURT ANALYST
COURTROOM HOLDING
INTERPRETER COORDINATOR
ADMIN-FINANCE CFO
EXHIBIT STORAGE
ADMIN-EXEC MGR-ADMIN SVCS
ADMIN-FINANCE FINANCIAL FILES
ADMIN-EXEC MGR-BUS/FAC
JUDGE'S CHAMBER
LOWER TERRACE
STAFF TOILET
WORKROOM
OPEN TO BELOW
MULTI-PURPOSE CONFERENCE ROOM
JUDGE'S LIBRARY/ CONFERENCE ROOM
ADMIN-EXEC RECEPTION/WORK AREA
ADMIN-EXEC COPY/FILE
ADMIN-EXEC CEO
ADMIN-EXEC ADMIN SECTRY
ADMIN-EXEC JUD SECTRY
ADMIN-EXEC ASST CEO
WORK COUNTER/ COFFEE STATION
COURT RPRTR FILE AREA
COURT RPRTR SUPERVISOR
COURT REPORTER
COURT REPORTER
COURT REPORTER
JUVENILE DIVISION
JUDGE'S CHAMBER
JANITOR/ STORAGE
EXHIBIT STORAGE
2 A-302
ELEC
JUVENILE DIV COUNTER
JUV DIV VIEWING AREA
WOMENS TOILET
HOLDING/ATTY INTERVIEW
ATTORNEY/CLIENT CONFERENCE ROOM
SECURITY/ AV/IT
JUV DIV SUPERVISOR
JUV DIV CLERKS
JUV DIV WORK ROOM
JUVENILE COURT
COURTROOM HOLDING
JUV DIV COFFEE STATION
WOMENS TOILET

1/8" =1'-0"
0 4 8 20

Third Floor Plan

A-203

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - First Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

Area affected during a fire event

ATTY/CLIENT CONF. RM.
SECURITY/ AV/IT
HOLDING/ATTY INTERVIEW
MEN'S TOILET
ELEC/
ATTY/CLIENT CONF. RM.
FAMILY COURT
COURTROOM HOLDING
CIVIL COURT
EXHIBIT STORAGE
OPEN TO BELOW
STAFF LUNCH/ BREAK ROOM
LOWER TERRACE
TERRACE
JUDGE'S CHAMBER
JUDGE'S CHAMBER
LACTATION ROOM
COURT SVCS SUPPLY/FILE
JURY DELIBERTATION
COURT SVCS CLERKS
WORKROOM
COURT SVCS SECURED STORAGE
WOMEN'S TOILET
MEN'S TOILET
CIVIL SUPERVISOR
JANITOR/ STORAGE
EXHIBIT STORAGE
COURT SVCS VAULT
JUDGE'S CHAMBER
COURT SVCS SUPERVISOR
RESEARCH ATTORNEY
CIVIL DIVISION
JURY DELIBERATION
CIVIL COUNTER
WOMENS TOILET
HOLDING/ATTY INTERVIEW
ATTORNEY/CLIENT CONFERENCE ROOM
CIVIL VIEWING AREA
CIVIL COFFEE STATION
ELEC
SECURITY/ AV/IT
CIVIL CLERKS
CIVIL COURT
COURTROOM HOLDING

1/8" =1'-0"
0 4 8 20

Fourth Floor Plan

A-204

Design Fire Locations

1. DF1 - First Floor Lobby Adjacent to Stair
2. DF2 - First Floor Below Bridge
3. DF3 - First Floor Security Screening Queuing
4. DF4 - Second Floor Elevator Lobby

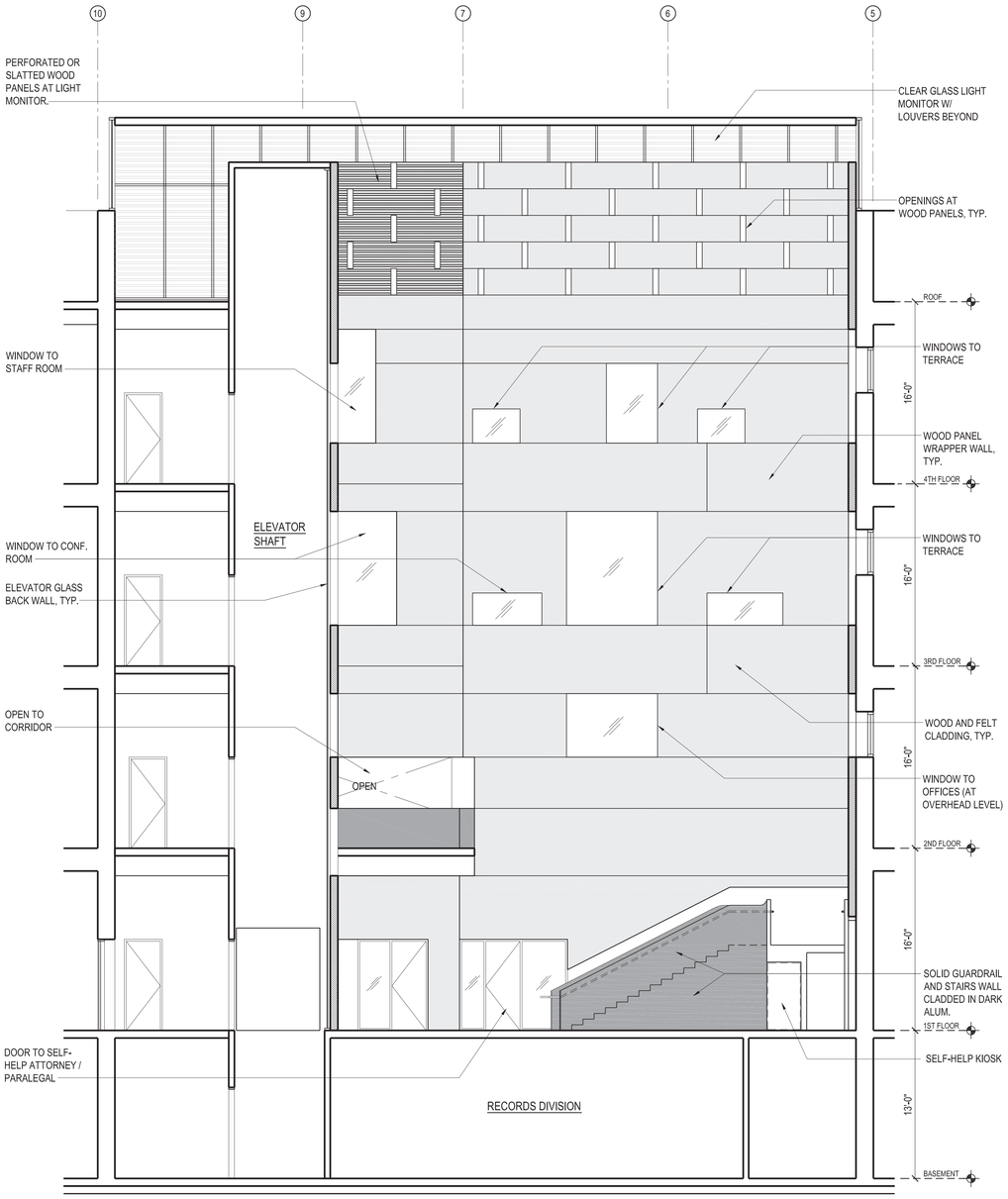
Area affected during a fire event

SINGLE-PLY THERMOPLASTIC ROOFING MEMBRANE
SLOPED STANDING SEAM ROOF, TYP.
MECHANICAL/AHU PENTHOUSE
LOW ROOF
LOW ROOF
LOW ROOF
PUBLIC ELEVATOR TOWER
OPEN TO BELOW
CANOPY BELOW
SINGLE-PLY THERMOPLASTIC ROOFING MEMBRANE
MECHANICAL/AHU PENTHOUSE
SINGLE-PLY THERMOPLASTIC ROOFING MEMBRANE
SINGLE-PLY THERMOPLASTIC ROOFING MEMBRANE
PAINTED STEEL TRELLIS
PACKAGED PUMP SKID #2
SINGLE-PLY THERMOPLASTIC ROOFING MEMBRANE
PACKAGED PUMP SKID #1
DOMESTIC HOT WATER HEATERS
HYDRONIC HOT WATER BOILERS
AIR-COOLED CHILLERS
AIR-COOLED CHILLERS
AHU FOR CHILLED BEAM SYSTEM
EXHAUST FAN FOR CHILLED BEAM SYSTEM

1/8" =1'-0"
0 4 8 20

Roof Plan

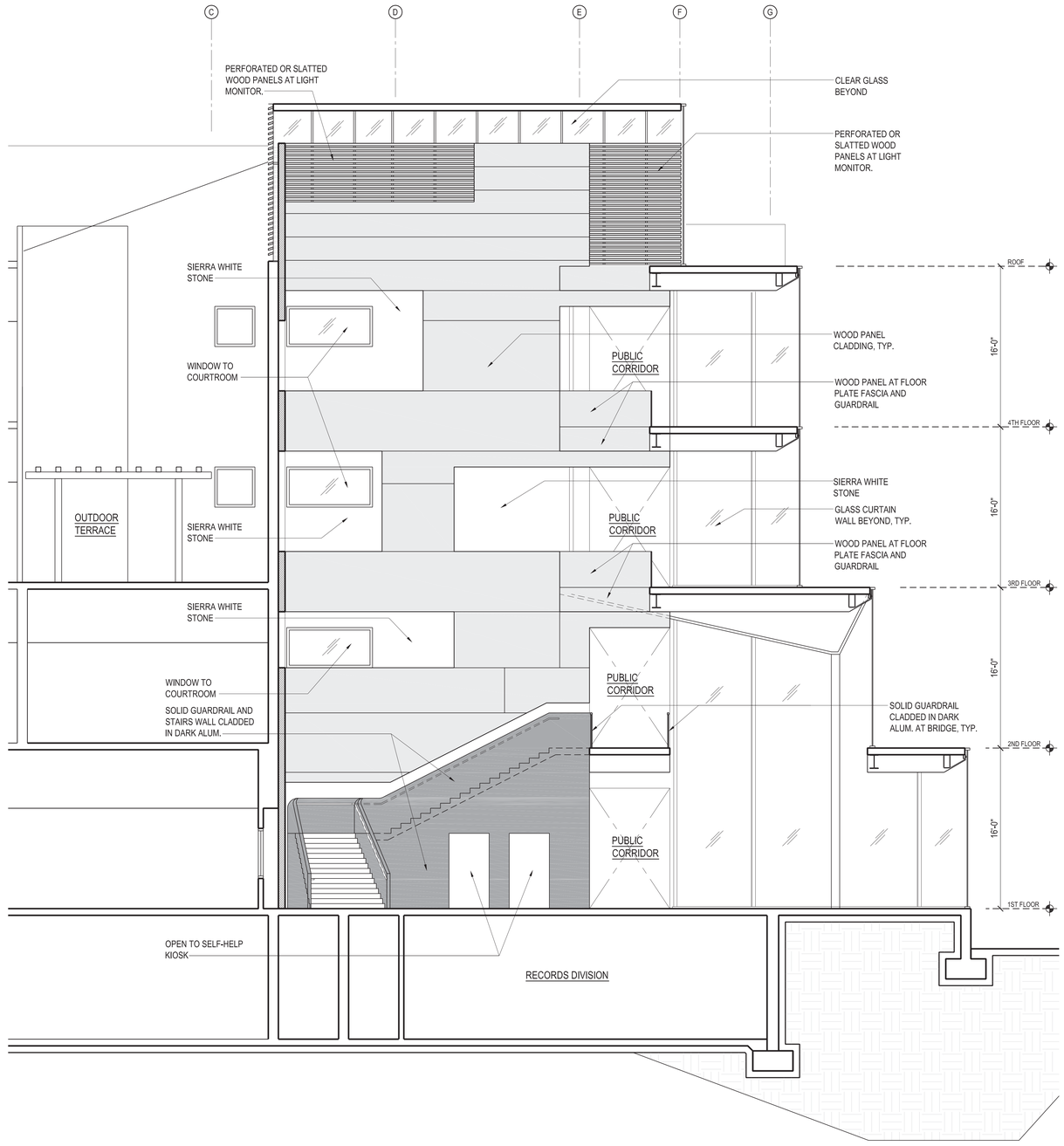
A-205



SECTION/ INTERIOR ELEVATION AT SECURE PUBLIC LOBBY

SCALE: 3/16"=1'-0"

2 A-601



SECTION/ INTERIOR ELEVATION AT SECURE PUBLIC LOBBY

SCALE: 3/16"=1'-0"

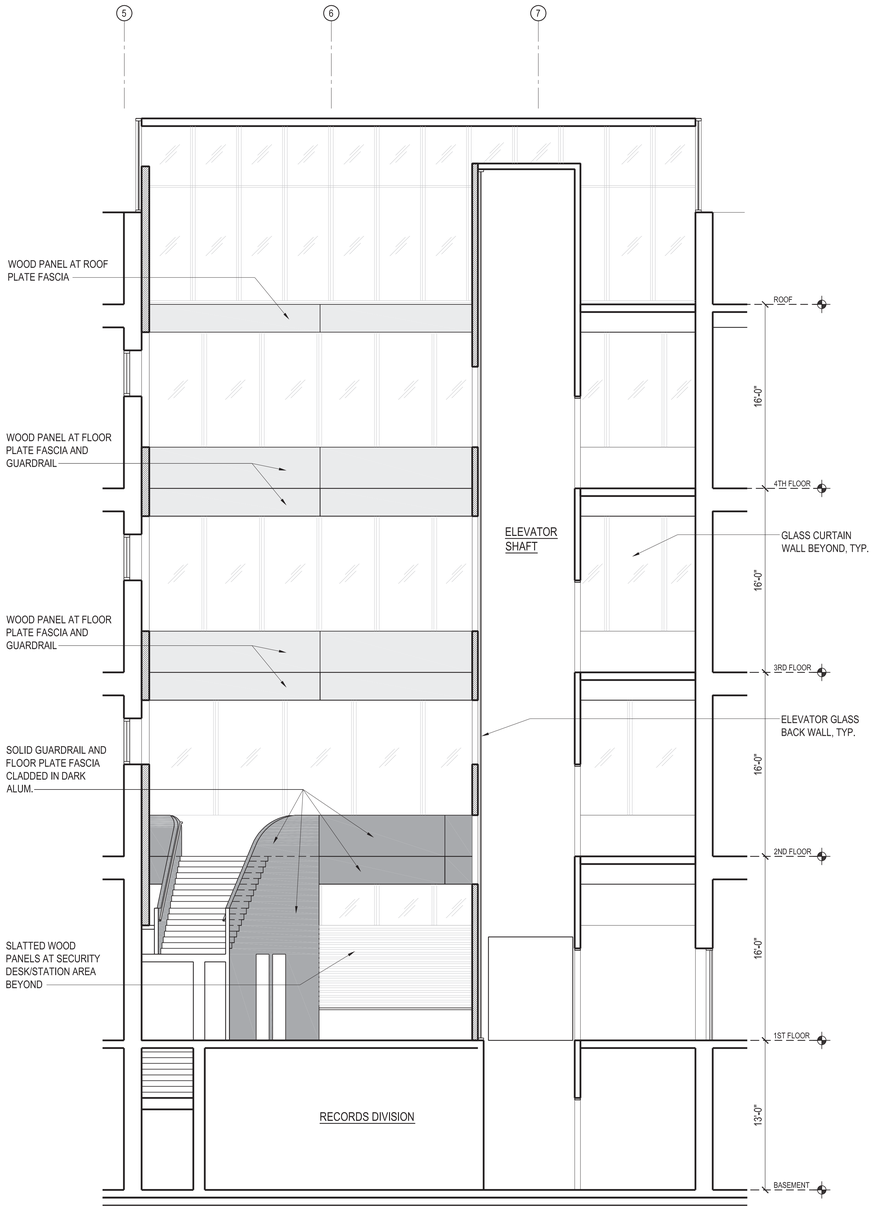
1 A-601

3/16" =1'-0"

0 4 8 16

Sections / Interior Elevations at Secure Public Lobby

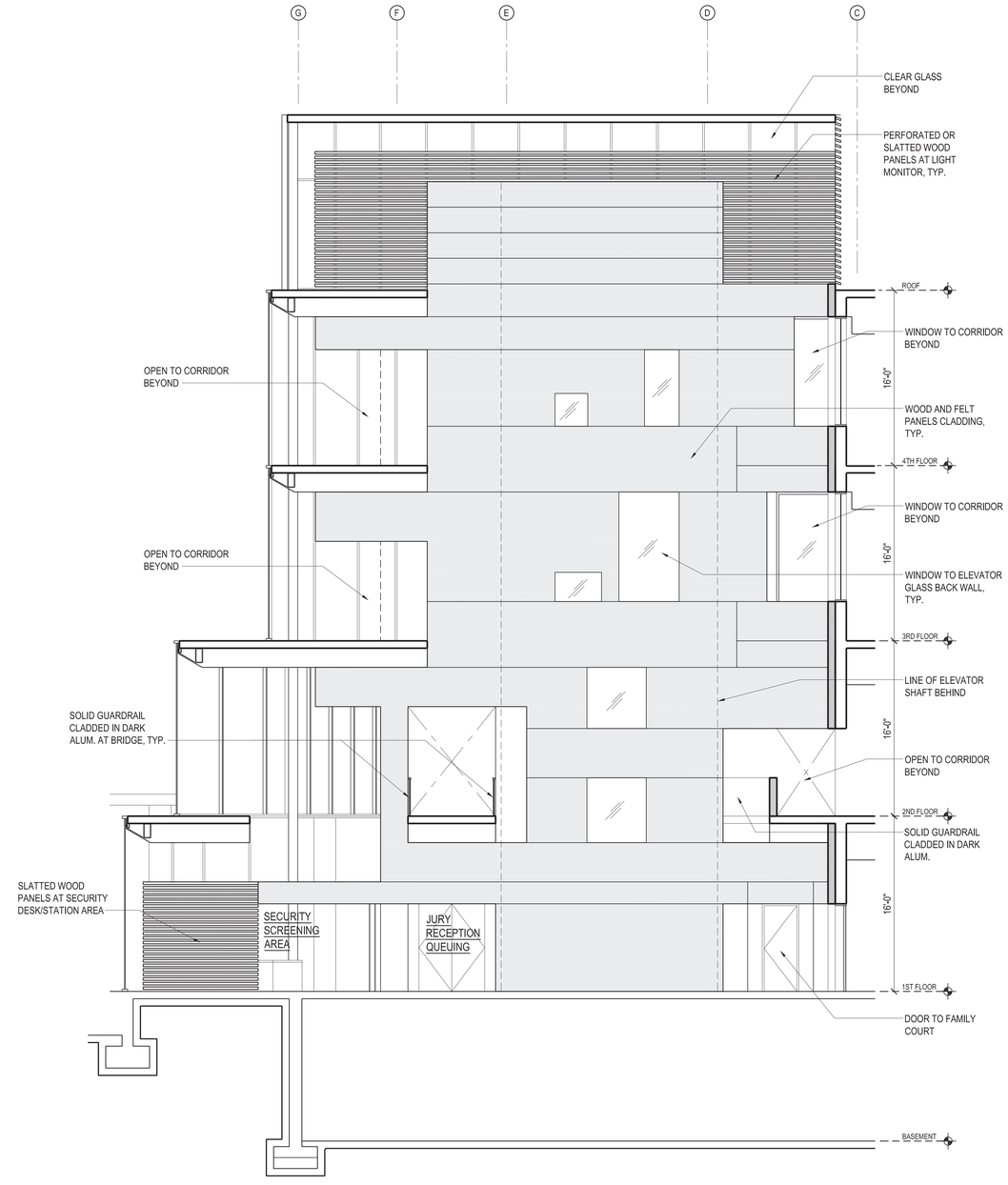
A-601



SECTION/ INTERIOR ELEVATION AT SECURE PUBLIC LOBBY

SCALE: 3/16"=1'-0"

2 A-602



SECTION/ INTERIOR ELEVATION AT SECURE PUBLIC LOBBY

SCALE: 3/16"=1'-0"

1 A-602

3/16" =1'-0"

0 4 8 16

Sections / Interior Elevations at Secure Public Lobby

A-602

Appendix R

Fire Pump Data

AC FIRE PUMP
a xylem brand

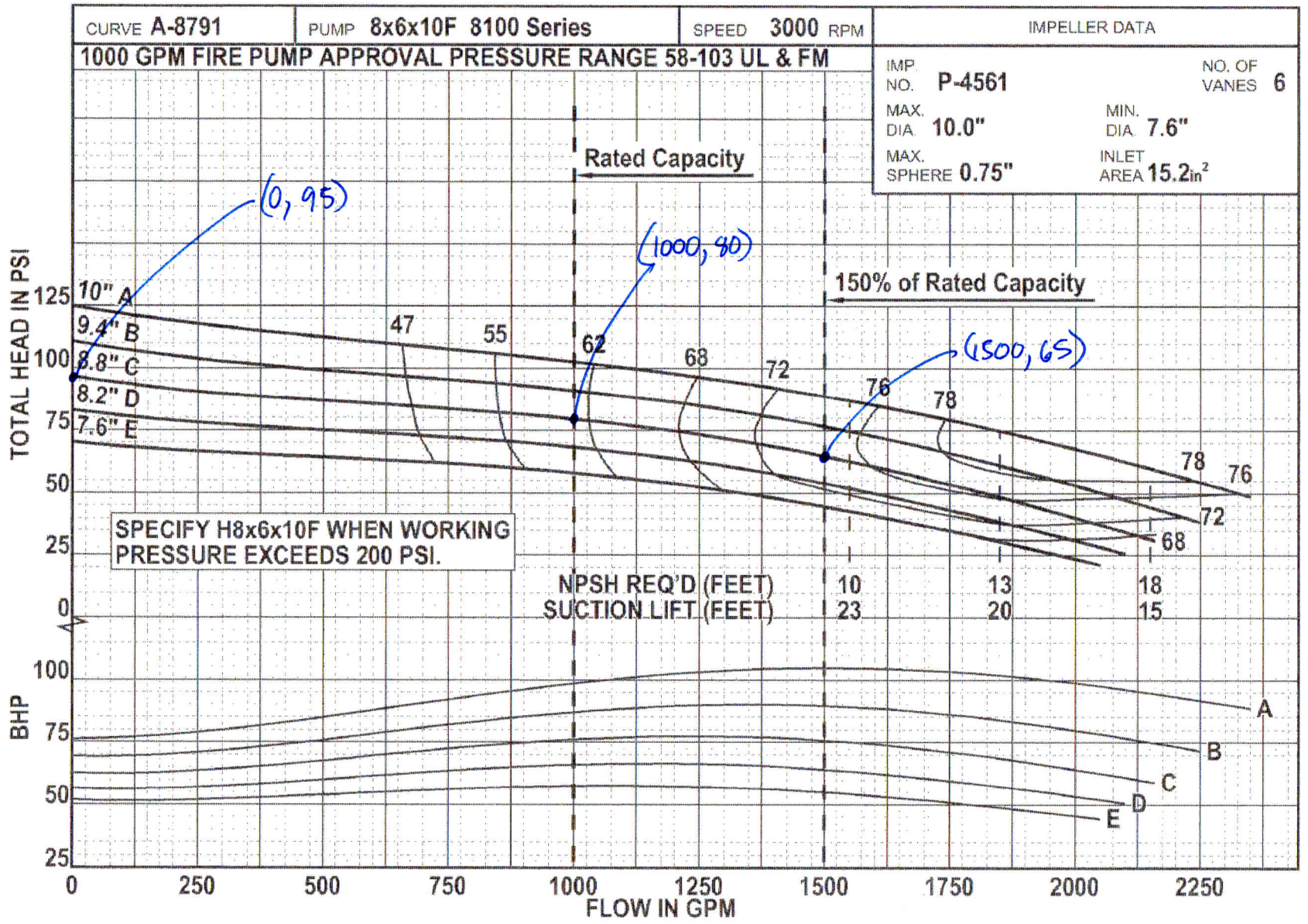
PERFORMANCE CURVES

1000 GPM

FP 2.0

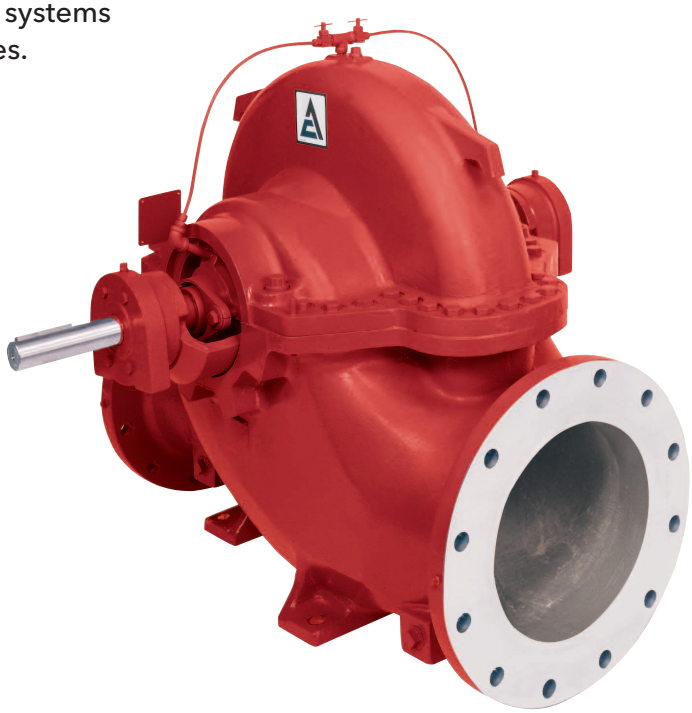
OCTOBER 2012

SUPERSEDES ALL PREVIOUS ISSUES



Curves show performance with clear water at 85°F. If specific gravity is other than 1.0, BHP must be corrected.

The 8100 Series Fire Pump is designed to provide water to stand pipe, sprinkler, chemical mitigation and hydrant systems for fire supression in industrial and commercial facilities.



Features & Benefits

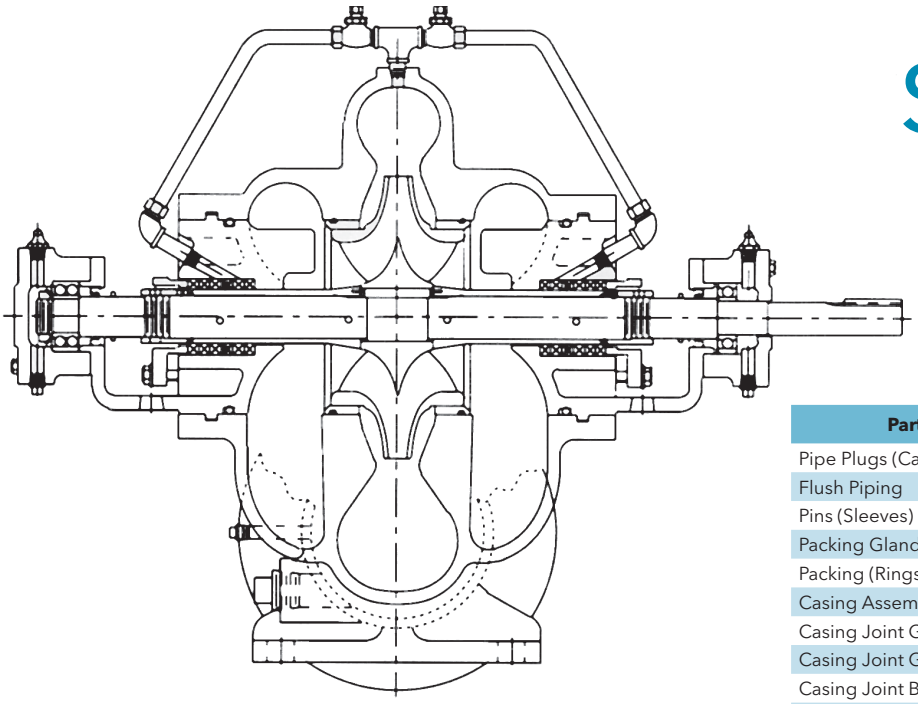
- Available in capacities up to 3,000 GPM (681 m^3/hr).
- Pressures up to 255 PSI (179 m)
- In compliance with NFPA #20, UL, ULC, FM and ANSI.
- Performance and hydrostatic tests.
- Dynamic balance impellers.
- Space saving design.
- Easy maintenance and upkeep.
- Available in electric or diesel engine driven models.
- Standard construction: cast iron, bronze fitted.
- Clockwise or counterclockwise rotation is available to simplify pump room layout.
- Packed stuff box.
- Grease lubrication.
- Available in 50 or 60 cycle.
- Suction and discharge flanges are on a common centerline.

NOTE: This product is not intended for potable water applications

Fire Pumps Series 8100

AC FIRE PUMP
a xylem brand

Series 8100



Pump Size	
3x2x11F-S	
6x4x9F	
6x4x10F-M	■
6x4x11F	● ■
6x4x12F-M	
6x6x9F	
8x6x9F	
8x6x10F	■
8x6x12F-S	
8x6x12F-M	● ■
8x6x13F	
8x6x18F	
8x8x12F	
8x8x17F	
10x8x17F-S	
10x8x17F-L	
10x8x20F-S	
10x8x20F-L	●
12x10x18F	●

● = Pumps that use Steel (SAE 4140) shafts.
■ = Pumps that use TFE Impregnated Acrylic Yarn
* = Casings for pump sizes with "H" prefix will be made from Ductile Iron (ASTM A536 Grade 65-45-12) & Casing Joint Bolts will be Steel (Grade 8).

Part Name	Basic Construction Cast Iron, Bronze Fitted
Pipe Plugs (Casing)	Brass
Flush Piping	Copper
Pins (Sleeves)	302 Stainless Steel
Packing Glands	Bronze (ASTM B584-932)
Packing (Rings)	Graphite Impregnated Acrylic Yarn
Casing Assembly	Cast Iron (ASTM a48 Class 35A)*
Casing Joint Gasket (Suction)	Paper (Vellumoid 505)
Casing Joint Gasket (Discharge)	Paper (Vellumoid 505)
Casing Joint Bolts	Steel (Grade 5)
Dowel Pins (Casing)	Steel
Casing rings	Bronze (ASTM B584-932)
Shaft	Steel (SAE 1045)
Shaft Sleeves	Bronze (ASTM B584-932)
Shaft Sleeve Nuts	Bronze (ASTM B584-932)
Bearing Housing (Inboard)	Cast Iron (ASTM a48 Class 25A)
Bearing Housing (Outboard)	Cast Iron (ASTM a48 Class 25A)
Ball Bearing (Inboard)	Steel
Ball Bearing (Outboard)	Steel
Stuffing Boxes (Packing)	Cast Iron (ASTM a48 Class 25A)
Deflectors	Rubber (Buna "N")
Lip Seals (Bearing)	Rubber (Buna "N")
Locknut (Bearing)	Steel
Lockwasher (Bearing)	Steel
Set Screws	316 Stainless Steel
Cap Screw (Bearing Housing)	Steel (Grade 2)
Cap Screw (Gland)	Steel (Grade 2)
Grease Fittings (Bearing)	Steel
Pipe Plugs (Bearing Housing)	Steel
Key (Impeller)	Steel
Key (Coupling)	Steel
O-ring (Stuffing Box)	Rubber (Buna "N")
O-ring (Casing)	Rubber (Buna "N")
O-ring (Shaft Sleeve)	Rubber (Buna "N")
Spirol Pins (Stuffing Box)	304 Stainless Steel
Spirol Pins (Casing Ring)	304 Stainless Steel
Impeller	Bronze (ASTM B584-876)
Seal Cage	PTFE

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Appendix S

References

S1 References

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