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Fire Hazard Analysis of Technical Area 53 Building 1



By: Brett Noakes

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Abstract

This is an analysis of a 1970's vintage building as it is compared to current building codes and standards. The purpose of this document is to assess if the current, as found construction of an existing building could achieve the sometimes more restrictive modern building codes. Both a prescriptive analysis and a performance-based analysis were completed to verify life-safety concerns and criteria as well as construction criteria. The prescriptive analysis compared existing, as found construction to current codes and standards while the prescriptive analysis used modern fire modeling techniques to see how likely fire scenarios would challenge the structure, if at all.

Key Words: Life Safety Code, RSET, ASET, Performance Based Design, Fire Dynamics Simulator (FDS), PyroSim, Pathfinder

Contents

Abstract.....	3
List of Tables	7
List of Figures	8
Construction.....	9
Fire Areas.....	9
Egress Evaluation.....	10
Egress evacuation.....	14
Evacuation Time	15
Findings.....	15
Fire Protection Alarm System Analysis of Technical Area 53 Building 1	16
Fire Detection and Alarm System.....	16
Type of Detectors.....	16
Compliance with NFPA® 72.....	16
Detector Response	17
Fire Alarm System.....	18
Notification Devices	18
Compliance with NFPA® 72.....	18
Mass Notification Systems	19
Inspection Testing and Maintenance.....	21
Fire Protection System Analysis of Technical Area 53 Building 1	21
Fire Protection System.....	21
Calculations.....	23
Fire Pumps	24
Inspection Testing and Maintenance (ITM).....	24
Fire Protection Structural Analysis of Technical Area 53 Building 1	25
Construction.....	25
Occupancy Classification.....	26
IBC 2012 Construction Requirements	26
Structural Fire Protection Requirements.....	27
Code Compliance.....	27
Fire Safety Plan for Technical Area 53 Building 1	27

Procedure for Reporting Fires and Evacuation of Building.....	27
Reporting Fires.....	27
Building Evacuation.....	27
Site Plan	31
Emergency Evacuation Routes	32
Fire Hazards	36
Performance-Based Analysis	37
Defining Project Scope	37
Identifying Goals and Defining Stakeholder Objectives	37
Developing Performance Criteria	38
Developing Design Fire Scenarios.....	39
Design Fires	40
Basement Fire	40
Wing “D” Fire.....	41
Wing “C” Fire.....	41
Wing “B” Fire.....	41
Wing A/B Fire.....	41
Analysis	42
Models	42
Egress Model	42
Fire Analysis	44
Basement Fire Scenario	44
Wing “D” Fire Scenario.....	49
Wing “C” Fire Scenario	52
Wing “B” Fire Scenario	55
Wing “A/B” Fire Scenario	58
Conclusion	62
References	63
Drawings	64
Suppression System Drawings.....	73
Fire Alarm Drawings	79
DETECT Models.....	114

Alarm Device Cut Sheets	116
Floor Plans with Exits	139
“D” Wing	140
“A” WING	141
“B” WING	141
“C” WING	141
Occupancy Identification Maps	144
Hydraulic Calculations.....	148

List of Tables

Table 1 Facility Area Designations.....	9
Table 2 Occupancy Classification.....	10
Table 3 Occupancy Load	11
Table 4 Egress Capacity.....	12
Table 5 Means of Egress Features	14
Table 6 Battery Calculations.....	20
Table 7 Fire Protection Features Automatic Fire Sprinkler Systems.....	22
Table 8 Sprinkler Head Location(s) and Type(s).....	23
Table 9 ITM	25
Table 10 Common Causes for Business Fires	39
Table 11 Model HRR Inputs for Fire Growth.....	46
Table 12 HRR Inputs for the Wing C Fire.....	53
Table 13 HRR Inputs for the Wing B Fire.....	56
Table 14 HRR Inputs for Wing A/B Fire.....	59

List of Figures

Figure 1 Site Plan.....	31
Figure 2 Basement Egress.....	32
Figure 3 "D" Wing Egress 1st Floor	33
Figure 4 First Floor Egress	34
Figure 5 Second Floor Egress	35
Figure 6 Table 2-4.2 from SFPE Handbook Third Edition.....	39
Figure 7 Pathfinder model at the beginning of egress simulation.....	43
Figure 8 Screen shot of Pathfinder model showing all three levels of Building 1.....	44
Figure 9 Pathfinder model showing all occupants have exited.....	44
Figure 10 Photo of Similar Fuel Package from Dreamstime.com	45
Figure 11 Table 3-1.5 HRR Values of Palletized and Rack Storage Commodities Tested at FMRC for SFPE Handbook Third Edition	45
Figure 12 Highest Temperatures for Basement Scenario	47
Figure 13 Basement Visual Distance at 6 feet	48
Figure 14 First Floor Visual Distance at 6 feet.....	48
Figure 15 Temperature Slice for the Wind D fire.....	51
Figure 16 Visual Slice of the D Wing Fire at 6 Feet.....	52
Figure 17 HRR Curve of Two men's Jackets from SFPE Handbook Third Edition.....	53
Figure 18 Temperature Slice of the Wing C Fire.....	54
Figure 19 Visual Slice of the Wing C Fire at 6 feet.....	54
Figure 20 Screen Shot of the HRR Curves Measured During the Experiments with Dry Powder Extinguishment (11).....	55
Figure 21 Temperature Slice File for Wing B fire.....	57
Figure 22 Visual Slice at 6 feet for Wing B Fire	57
Figure 23 HRR Curve for Trash Bags from SFPE Handbook Third Edition.	59
Figure 24 Temperature Slice for the Wing A/B Fire	60
Figure 25 Visual Slice at 6 Feet for the First Floor of wing A/B.....	60
Figure 26 Visual Slice at 6 Feet for the Second Floor of Wing A	61

Table 1 Facility Area Designations

Area	Building	Description
1.	TA-53-1	A Wing, Administrative Offices
2.		B Wing, Assembly (Auditorium), Lounge, Café, Offices
3.		C Wing, Offices, Basement Area additional work spaces and Mechanical Space(s)
4.		D Wing, Offices, and Basement Area with additional work space and Mechanical Space(s)

Construction

Building 1 is an approximately 76,600 square foot building that has a fully compliant NFPA® 13 suppression system and the following construction makeup. Construction on Building 1 was completed in 1971. It consists of cast-in place concrete, concrete tee, concrete block and steel joists. The exterior walls are concrete block with significant (30-40%) insulated spandrel glass openings. Foundation walls, tunnels, and footers are cast-in place concrete. Floor/ceiling assemblies between floors are concrete tee construction. The roof/ceiling assemblies are steel joists covered with (4 inches) lightweight concrete. If not for the unprotected steel construction, the facility would be entirely of fire resistive construction (Type I).

“A” Wing is two stories, one at grade and one above with a roughly 4’ by 4’ utility tunnel running around the perimeter and below grade. “B” Wing is one story throughout, though the Auditorium (B105) has a projector mezzanine; there is also a utility tunnel under “B” Wing. “C” Wing is one story with a full basement below grade. Access to the basement is through two interior stairwells, one exterior stair, two exterior airway (ventilation only), and through a connection to the “D” Wing basement. “D” Wing is similarly a single story with a partial basement under the North-South leg. Access to the “D” Wing basement is through one interior stairwell, two exterior airways (ventilation only), a freight elevator and a hoistway, and a connection to the “C” Wing basement.

Fire Areas

The facility was likely intended to be separated between floors, between “B” and “C” Wings, between “C” and “D” Wings and between the inactive chemical labs in “D” wing and the balance of the facility. The door labels installed between “B” and “C” Wing have been painted over and the rating is not evident; they are assumed to carry a minimum 45 minute rating based on the materials and construction. This is the same configuration for the doors between “C” and “D” wing. The doors between “D” Wing and the area intended to be a chemical laboratory are oversized fire doors. Though not specifically listed, these doors are of a very similar

construction to fire doors and are expected to provide some nominal fire resistance. In general, these separations are beneficial – if not required – and should be maintained.

With the uncertainties and known deficiencies in the fire doors, the facility will be treated as one fire area; however, any fire separations provided in the original construction should be maintained.

Egress Evaluation

The facility’s layout with respect to emergency egress was evaluated with respect to NFPA® 101, 2012 edition (1). The evaluation included, but was not limited, to travel distances, common paths of travel, dead end travel and passive fire resistance for egress enclosures. The quantitative analysis will include a comparison of compliance codes (e.g. total travel distance: actual and required maximum).

Table 2 Occupancy Classification

Area	Assembly	Business	Industrial	Storage	Special Structure	Mixed Occupancy
1.	N/A	All	N/A	N/A	N/A	N/A
2.	Lecture, Café, Lounge	Incidental Office Space	N/A	N/A	N/A	N/A
3.		Offices	N/A	Basement	N/A	N/A
4.		Offices	N/A	Basement	N/A	N/A

Table 3 Occupancy Load

Area	Net Square Footage	Occupant Load	NFPA® criteria	Actual Load	Comment(s)
1.	16959	170	100 ft ² /person	<100	Offices
2.	2358	24	100 ft ² /person	<12	Offices
	2202	156	Fixed Seating	N/A	Lecture
	2875	575	5 ft ² /person	<50	Lounge/Reception
	1364	91	15 ft ² /person (less concentrated)	<48	Café, only 48 seats available.
3.	11988 (1 st floor)	120	100 ft ² /person	<50	Offices
	11988 (basement)	120		<20	
4.	15,008 (1 st floor)	151	100 ft ² /person	<50	Offices
	8746 (basement)	88			

Table 4 Egress Capacity

Area	Exit	Capacity (NFPA® 101 Table 7.3.3.1) Stairs Capacity Factor .3, Door Capacity Factor .2
1.	SE 40 inch door (1 st) East main door (1 st) 72 inch X 2	195 720
Total Available		915
Required		170
2.	East main door 72 inch X 2 North 34 inch door of auditorium South 34 inch door of auditorium Café 72 inch door	720 170 170 360
Total Available		1420
Required		846
3.	West 72 inch door Northeast 72 inch doors X 2	360 720
Total Available		1080
Required		240
4.	West 36 inch door (1 st) South 72 inch doors (1 st) North 72 inch door (1 st) NW 72 inch door (1 st) NE 72 inch door (1 st)	180 720 360 360 360
Total Available		1980
Required		239
Basement	West 44 inch stair	146

	Center 40 inch stair	133
	Exterior 38 inch stair	126
	North 44 inch stair	146
Total Available		551
Required		208

The egress capacity in Table 4 was calculated using the most restrictive component of each particular egress system.

Based on the lay out of the facilities exits and their calculated egress capacity the egress components of this facility were found to be acceptable according to NFPA® 101 (1).

The Doors between wings “B” and “C” and the doors between wings “C” and “D” would be acceptable places for horizontal exits and may have originally been designed to be horizontal exits, however the institutional history for buildings of this vintage is that rated walls have been breached without proper penetration seals. During the walkdown of this building a full inspection of these walls was not completed and therefore cannot be verified that these would still qualify as horizontal exits.

Corridors and stairways are not required to have any rating in accordance with NFPA®, 101 39.3.6. (1) The finish requirements for exits and corridors is Class A or Class B (NFPA® 101 39.3.3.2.1) (1) with other areas allowed to be Class A, Class B, and Class C (NFPA® 101 39.3.3.2.2) (1).

Exit signs are placed as shown in the Occupancy Identification Maps located at the end of this report and are located in accordance with NFPA® 101 7.10.1.2.1 (1)

All aspects of the egress system for this building meet the prescriptive requirements of NFPA® 101 for Existing Business Occupancy.

Table 5 Means of Egress Features

Area	Exit Stairs Enclosed (Y/N)	Travel Distance To Exit	Common Path Of Travel	Dead End Corridor Length	Exit Signs Illuminated (Y/N)	Emergency Lighting
NFPA® 101 Req.		300 ft. Sprkd. Bld	100 ft.	50 ft.		
1.	(2) Stairs (1) Enclosed	<100 ft.	<20 ft.	None	Tritium	Y
2.	None	<100 ft.	<20 ft.	None	Tritium	Y
3.	(3) Stairs (2) Enclosed	<150 ft.	75 ft.	36 ft.	Tritium	Y
4.	(1) Enclosed Stair	<150 ft.	70 ft.	36 ft.	Tritium	Y

Egress evacuation

The typical occupants of this building are people in good general health with the ability to move at an appropriate pace to self-evacuate. The response to a fire will most likely be delayed for the following reasons. First, drills and maintenance are performed on the notification system at regular intervals and even though prior notification is usually communicated to occupants before maintenance begins with an approximate time of completion and a follow-up announcement that the test is over. This process lends itself to complacency with regards to immediate response to alarms resulting in additional stimulation needed to get people moving. This could be peers walking by, the smell of smoke, or someone yelling this is not a drill.

Secondly, some individuals may be working with sensitive information and feel the need to secure it before they attempt to egress. This is not required by procedure but if not done the notification process after the event could take a while motivating individuals to secure before leaving.

Thirdly, this building is located in the northern mountains of New Mexico and is susceptible to inclement weather resulting in additional delays as people gather their belongings before they leave.

The estimated delay for these pre-movement delays would be in the range of 2 to 3 minutes.

Evacuation Time

Assuming that for a worst case scenario the total allowed occupant load was in the building, and that everyone left immediately at the same time during the event and used all exits in balance, an approximate egress time could be calculated. Calculating time would be based on the time it takes the required number of occupants out the most restrictive exit.

Total Occupants = 1703

Number of Exits = 14

$1703/14 = 122$ people per door

Most restrictive door is a 36 inch door.

A 36 inch door has 6 inches of boundary layer on each side of the door (NFPA® HB 20th Edition Table 4.2.4) (2) leaving and effective width of 2 feet.

From Table 4.2.8 (NFPA® HB) the Maximum Specific Flow for doors is 24 people/minute/ft. of effective width. (2)

$24 \times 2 = 48$ people per minute through the door

$122/48 = 2.5$ minutes total egress time

When you add in the 3 minutes (worst case) for the pre-movement time you get an egress time of 5.5 minutes.

This however is unlikely because you cannot assume that all people will use every exit equally. The larger exits can accommodate more people than are usually present during normal operating times. The egress times for this building are most likely less than calculated. Occupant loads are much less than calculated.

For tenability of the occupants during a fire event it is realistically not likely for an untenable environment to happen that would prevent or block an egress path. This building is fully sprinkler protected with nonhazardous uses and a well laid out egress system. The only tenability issues would be keeping smoke above 5 feet for a smoldering fire that is not yet hot enough to activate the sprinkler system, however this scenario happening without someone being alerted quickly is unlikely during normal business hours.

Findings

During the walk-down of the facility it was noticed that the North most exit's external stairs were not properly maintained for the recent winter weather and that the steps do not lead to a proper public way. NFPA® 101 (2012) (1)

7.1.10.1* General. Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

7.7.1* Exit Termination. Exits shall terminate directly, at a public way or at an exterior exit discharge, unless otherwise provided in 7.7.1.2 through 7.7.1.4. (1)

Fire Protection Alarm System Analysis of Technical Area 53 Building 1

Fire Detection and Alarm System

The fire detection and alarm system in TA-53-1 was updated in 2004/2005. New manual pull stations, smoke detectors, individually addressable modules (IAM), booster power supplies (BPS), conduit and conductors were installed. All devices report to a new Edwards Systems Technologies (EST, GE Infrastructure) Model QS4 Fire Control Panel. This panel activates devices on two internally-driven notification appliance circuits (NAC) and two external BPS units and their associated notification appliances. This system also communicates with the fire dispatch center through two dedicated phone lines.

The HVAC controls, elevator controls, and mechanical interface devices (i.e. flow switches, tamper switches) were not upgraded or added. Where such devices previously existed – as in the case of water flow detection and valve supervision – the existing devices were connected to new IAM that report to the new panel.

Type of Detectors

There are two types of detectors located within this building. The first being the fire suppression system and the second being some strategically placed smoke detection.

The primary way of detection for this building would be the NFPA® 13 compliant sprinkler system. Each sprinkler contains a sacrificial element that when heated to 212°F will break and allow water to be discharged. This discharge of water will activate the suppression system pressure switch located at the riser. This switch is constantly monitored by the building fire alarm panel and upon receipt of the signal, will initiate the building notification appliances and report the condition to a constantly attended location for dispatch of the fire department.

The second type of detection in this facility is photoelectric area smoke detectors manufactured by General Electric, model SIGA-PS. These detectors are placed in the telecommunication room, the computer room, and above the FACP. These devices are strategically placed for asset protection.

Compliance with NFPA® 72

As stated previously the fire suppression system is fully compliant with NFPA® 13. The suppression system consists of standard response heads rated for 212°F with a spacing of 12' X 12'.

The smoke detectors are strategically placed for asset protection by way of early warning. The telecommunication room is a space of 20' X 40' and is protected by two detectors. This configuration is compliant with NFPA® 72. In the computer room there are a total of three

detectors, one ceiling mount and two under floor mounted. The ceiling mount detector is protecting an area of 16' X 30' while the two underfloor detectors protect the same area. It is assumed that the under floor area is used for routing of cabling and cooling plenum for the equipment. Without having document history it is assumed the two detectors are required based on hazard protection in accordance with NFPA® 72 (2013) 17.7.3.1.3. (3) The last location of a smoke detector is above the FACP which is a NFPA® 72 requirement.

Detector Response

Fire scenario 1: For this fire scenario there was a stack of collapsed cardboard boxes with some other incidental trash found in the basement near the stairs during my walk downs of this building. Assuming this fuel package ignites, what would be the response characteristics of the suppression system?

The input parameters for the DETACT model are as follows:

Ceiling Height = 9' = 2.7m

Room Width = 14' = 4.2m

Radial distance based on 12X12 spacing = 16.7' = 5.1 assuming worst case

Note: The actual location of the head in relation to the fuel package is directly above it.

20°C ambient

212°F head = 100°C

Sprinkler RTI of 100

“t-squared fire” with a medium growth rate as indicated by Table B.2.3.2.6.2 (a) for item 9

Note: Stack is only 3 feet tall.

With these conditions the DETACT model predicts the sprinkler will activate at approximately 380 seconds with a HRR of approximately 1600kw. This would be under worst case conditions. In actuality the sprinkler is located above the fuel package and would most likely have faster response. However with these results I think the fire would be adequately suppressed.

Fire scenario 2: In this scenario I assume there is an equipment failure in the computer room with ignition of computer components. What would be the response characteristics of the smoke detector located on the ceiling of that room?

The input parameters for the DETACT model for scenario 2 are as follows: Treating the smoke detector as a super sensitive heat detector.

Ceiling Height = 9' = 2.7m

Room Width = 30' = 9.1m

Radial distance based on detector in center of room and fire at edge = 34' = 10.3 assuming worst case

20°C ambient

Detector activation is based on a rise in temperature of 7.2°C from Table B.4.7.5.3 (NFPA® 72) for PVC (3). Assuming the PVC was the closest to the plastics contained in computer equipment.

No RTI

“t-squared fire” with a Fast growth rate as indicated by Table B.2.3.2.6.2 (a) (NFPA® 72) for item 16 (3)

The DETACT model shows the detector will activate in 41 seconds with a HRR of 79kw.

Fire Alarm System

The fire panel is Edwards Systems Technologies (EST, GE Infrastructure) Model QS4 Fire Control Panel. This panel activates devices on two internally-driven notification appliance circuits (NAC) and two external BPS units and their associated notification appliances. This system also communicates with the fire dispatch center through two dedicated phone lines through a digital alarm communicator transmitter (DACT).

All signals are transmitted off the site to a central station and then dispatched accordingly. All trouble and supervisory signals are dispatched to on call fire alarm elections to be investigated. All alarm signals are dispatched to the county from the central station and they dispatch emergency personnel.

Notification Devices

The only notification devices are the General Electric Field Configurable Horns and Strobes-Genesis Series. These are used both as horns and strobes and as strobe only devices. They are field configurable for both horns and strobe candela rating. The strobe ratings are 15cd, 30cd, 75cd, and 110cd rating. The horns are somewhat configurable in that they have a high output level of 99dB at 10 feet and low output level of 94dB.

Compliance with NFPA® 72

This building is mostly an office building; most of the notification appliances are located in the corridors. The spacing in the corridors is compliant with the corridor strobes being set to 15cd. All public (lobbies, restrooms, and conference rooms) areas also have appropriate notification devices for the size of their rooms.

Using the 6dBA rule of thumb the devices under the most demand are located in a mechanical room in the basement.

Room size is 60' X 60'

The horn produces 99dB at 10 feet so the dB level at 80 feet would be 81dB.

Requirements for the space are 15dB above ambient back ground noise which for mechanical rooms is 85dBA average From Table A.18.4.3. This means you need 100dB in the room.

The max dB allowed is 110 which is what the devices are set to, therefore sounds levels for this room have reached the max.

Table 18.5.5.4.1 (a) stated a room of this size can be covered by one 135cd strobe or four 30cd strobes.

This area is cover by two 110 cd strobes which is in excess of the code requirement.

Mass Notification Systems

This building does not have a mass notification system, however the laboratory as a whole uses emergency text message and emergency email notification to notify the population of an emergency.

Table 6 Battery Calculations

Number	Device	Current			Total
		Stand by	Total	Alarm	
	NAC #1				
11	HS 15cd			.081	.891
4	S 15cd			.059	.224
1	75cd			.152	.152
NAC #1					1.279 amps
	NAC#2				
9	HS 15cd			.081	.729
2	S 15cd			.059	.118
NAC #2					.847 amps
Control Panel					
1	Quick-Start CPU	.117	.117	.135	.135
1	PS6	.072	.072	.096	.096
1	SLIC controller	.033	.033	.057	.057
1	DACT	.013	.013	.026	.026
Initiating Devices					
8	Smoke Detectors	.000045	.0004	.000045	.00036
21	Pull Stations	.000396	.0083	.00068	.01428
10	Single Input Module	.00025	.0025	.0004	.004
1	Dual Input Module	.000396	.0004	.00068	.00068
Output Devices					
2	Single Channel Riser Module	.000223	.0004	.0001	.0002
1	Output Relay Module	.0001	.0001	.0001	.0001
NAC #1					1.279 amps
NAC #2					.847 amps
Total			.2507		2.46 amps

Laboratory requires 24 hours of standby power $.2507 \times 24 \text{ hours} = 6 \text{ AH}$ required

Laboratory requires 10 minutes of alarm $10/60 = .16667 \times 2.46 = .410 \text{ AH}$ required

$6 + .410 = 6.410 \text{ AH}$ (derate by 20%) $\times 1.2 = 7.692 \text{ amp hours}$ required.

This System is supplied by two 12 AH batteries.

Inspection Testing and Maintenance

All alarms system components shall be inspected, tested, and maintained in accordance with NFPA® 72 chapter 14.

At initial acceptance 100% of the alarm system shall be tested and shall work with all interconnected building systems. These controls shall function as designed in the design documents matrix.

Where the alarm system interacts with the fire suppressions system, these components shall be inspected, tested, and maintained by the requirements and intervals set forth in NFPA® 25 Water Based Fire Suppression Systems.

Fire Protection System Analysis of Technical Area 53 Building 1

Fire Protection System

The facility is protected throughout by two distinct automatic fire sprinkler systems with an additional wet chemical extinguishing system to protect the cooking equipment in the café. System SPW-001 covers Wings “A”, “B”, “C”. The 6 inch cast-iron fire water supply enters in the basement Room C18 where a pressure switch with a retard chamber and attached to an alarm check valve detects flow at the riser. There is also a redundant set of flow switches that divide the system by zone (e.g. wing and floor). System SPW-002 provides coverage to “D” Wing, enters Room D3 Room C18 where a pressure switch with a retard chamber and attached to an alarm check valve detects flow at the riser.

The system design density is nominally compliant with the code of record (NFPA® 13, 1980 Edition); that is, it provides 0.19 gpm/ft^2 over 1500 ft^2 . The current standard, NFPA® 13, would require a slightly higher density (0.20 gpm/ft^2) (4). The water supply has changed little through the years.

The fire sprinkler heads are standard spray upright, pendant, and extended coverage sidewall (in some offices and laboratories), 212°F , standard response and spaced to cover $<130 \text{ ft}^2/\text{head}$.

The “D” wing sprinkler system did not have a riser tag with flow data. After further research of available sprinkler system drawings it is believed that this portion of the building is protected using a pipe schedule system.

Spare sprinkler cabinets were observed during the site visit as not having minimum spare sprinklers in the cabinets. These cabinets are required by NFPA® 13 and should be installed with no less than 12 heads, one cabinet near each riser with each having no less than 6 spare heads would be appropriate (4). All sprinkler types in the facility should be represented with spare stock in such a cabinet (e.g. extended coverage sidewall, standard spray upright and pendant, special temperature ratings). The cabinet would normally be mounted on the wall nearest the riser. A sprinkler wrench should also be provided.

In Hallway C1, outside of Room C5, there is a duct greater than 48 in. in width with no sprinkler coverage beneath. Sprinkler coverage is required by NFPA® 13 underneath any horizontal obstruction that is greater than 48 in. in width (4).

Table 7 Fire Protection Features Automatic Fire Sprinkler Systems

Area	Suppression System Type		Design	Spacing	System Design	FD Hose	H ₂ O Testing Results	
	(Wet/Dry/Preaction/Deluge)		gpm/ft ²	ft ² /head	BoR Req't.	Allowance	Static –	Flow – Residual
1, 2, 3	Wet		0.19 gpm/ft ² 1500 ft ²	<130 ft ²	65 psi @ 663 gpm	250 gpm	75psi (S) 63 psi @ 954gpm	Hyd. 53-805 ₂ (2012)
4.	Wet				No Design Info On File		70psi(S) 68psi@915gpm	Hyd. 53-806 (2013)
						Central Station Supervision of:		
Area	Std Response	Quick Response	HD Activation	UV/IR Activation	Manual Actuation	Waterflow	Detection	Valves
1.	All	N/A	N/A	N/A	N/A	Pressure	N/A	Yes ₁
2.		-	-	-	-	& Paddle by Zone	-	-
3.								
4.	All	N/A	N/A	N/A	N/A	Pressure & Paddle	N/A	Yes ₁

by Zone

1. Control valves are supervised; alarm valves as part of the alarm check valve and retard chamber assembly are not supervised as required.
2. Test date: September 9, 2012 and August 12, 2013

The Hydrant Flow data is provided to us by the Los Alamos County Fire Department. Every hydrant is exercised once a year with hydrant flow calculations done every two years on each hydrant. The Fire Protection Division Office believes that this hydrant flow date is not accurate for new construction or design purposes and therefore only uses this LAFD information as a way to check system health. When a new project is in the works FP-DO will conduct a test with calibrated equipment at a site nearest the point of connection.

Table 8 Sprinkler Head Location(s) and Type(s)

Area	Qty.	Manufacturer	Year	Model	Type
1,2,3	140	Star	1969	Model D	SSU (“C” Wing Basement)
	30	Reliable	1981	Model G	SSU
	340	Reliable	1981	Model G	SSP
	40	Central	1981	HF-17/32	Extended Coverage Sidewall (“A” Wing Corridors)
4.	~100	Star	1969	Model D	SSU (“D” Wing Basement)
	~100	Reliable	1981	Model G	SSP

Note: There are some Grinnell F950 sprinkler heads in the facility (circa 1979). These sprinkler heads are prone to unwanted activations, but none of these heads were observed near critical electronics equipment.

Calculations

For this project a hand calculation of the auditorium was completed. The calculation was completed using the new NFPA® 13 and DOE requirements which are .2 gpm per square foot with an area of 1500 square feet (Ordinary group 2 demands) and a DOE required hose allowance of 500gpm.

A problem I had with the calculation was finding good drawings of the system. The drawings I could find were dated 1981 and had too much information on one sheet. I did my best to highlight the system and made my best guess on pipe lengths and elevation changes and fittings.

The calculation showed a system demand of 341.5gpm at 141.5 psi which is undoubtedly greater demand than the system was originally designed and is well above the available supply. The high pressures needed as a result of the hand calculation show that my guess on elevation changes, pipe lengths, and fittings were most likely wrong, resulting in the inflated pressure demand. However the site is provided with a tank and pump configuration that can serve this inflated demand.

Fire Pumps

The area that Building 1 is located in is protected by two site wide fire pumps. An electric fire booster pump, taking suction from the water storage tank, is located in the MPF-54 pump house. The fire booster pump is a PATTERSON Pump Model 8X6 MIH, single-stage horizontal fire pump (13.281-in impeller diameter), with a pump rating of 1,250 gpm @ 70 net psi at 1780 RPM. It has a nameplate net pressure of 58 psi @ 150% rated flow (82.3 maximum BHP) when driven by an WEG Type DP electric motor rated at 150 HP @ 1785 RPM (460 V, 60 Hz, 3-phase electric supply at 167 A). The motor has a service factor = 1.15. The electric fire pump is activated when the TA-53 water supply system pressure drops below 11 psi. The fire pump is either manual or automatic start but only manual shut-off.

A second fire water storage tank with diesel-driven fire booster pump was originally provided for TA-53 to improve the TA-53 fire water supply reliability. The tank has a capacity of 750,000-gal. The pump is a Patterson Pump Model 8X6ML, single-stage horizontal fire pump (13.531-in impeller diameter) rated at 1250 gpm @ 70 net psi at 1750 RPM. The pump driver is a Clarke Model JU4H-UF58 diesel engine rated at 110 HP @ 1750 RPM, derated to 79 HP @ 1470 RPM at 7,300 ft. elevation.

It is recommended that a computer based calculation be ran on the system once better as-builds have been found or created.

Inspection Testing and Maintenance (ITM)

Table 9 ITM

Sprinklers	At 50 years and every 10 years thereafter Shall be inspected for Leakage, Corrosion, Physical damage, Loss of fluid in the glass bulb heat responsive element, Loading, Painting unless painted by the sprinkler manufacturer and correct orientation annually
Control Valves	Shall be inspected for proper position In the normal open or closed position, Sealed, locked, or supervised, Accessible, Provided with correct wrenches, Free from external leaks, Provided with applicable identification Monthly Annually each valve shall be operated
Piping	Obstruction, internal inspection of piping shall be done every 5 years Piping shall be free of mechanical damage and no additional external loads shall be place on the piping. Monthly
Signs	Shall be legible to indicate what each valve controls. The Riser Tag should also be clear and legible.

The previous is just a small sampling of typical ITM activities. For a more complete list of requirements you can go NFPA® 25 *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. (5)

Fire Protection Structural Analysis of Technical Area 53 Building 1

Construction

Building 1 is an approximately 81,000 square foot building that has a fully compliant NFPA® 13 suppression system and the following construction makeup. Construction on Building 1 was completed in 1971. It consists of cast-in place concrete, concrete tee, concrete block and steel joists. The exterior walls are concrete block with significant (30-40%) insulated spandrel glass openings. Foundation walls, tunnels, and footers are cast-in place concrete. Floor/ceiling assemblies between floors are concrete tee construction. The roof/ceiling assemblies are steel joists covered with (4 inches) lightweight concrete. If not for the unprotected steel construction, the facility would be entirely of fire resistive construction (Type I) with the unprotected steel construction in mind Building 1 is of Type II B construction.

“A” Wing is two stories, one at grade and one above with a roughly 4’ by 4’ utility tunnel running around the perimeter and below grade. “B” Wing is one story throughout, though the Auditorium (B105) has a projector mezzanine; there is also a utility tunnel under “B” Wing. “C” Wing is one story with a full basement below grade. Access to the basement is through two interior stairwells, one exterior stair, two exterior airway (ventilation only), and through a connection to the “D” Wing basement. “D” Wing is similarly a single story with a partial basement under the North-South leg. Access to the “D” Wing basement is through one interior stairwell, two exterior airways (ventilation only), a freight elevator and a hoistway, and a connection to the “C” Wing basement.

Occupancy Classification

The occupancy of Building 1 is mixed with the majority of the structure being classified as business (Group B) and houses mostly office space. Building 1 does have two assembly areas a lecture hall classified as an A-3 occupancy with an occupant load of 156 and a small cafeteria that would be classified as an A-2 occupancy with an occupant load of 91. Using Table 508.4 *Required Separation of Occupancies (IBC 2012)* (6) the required separation between a group B and group A for a sprinklered building is 1 hour.

The height of Building 1 is 22 feet above grade with one level below grade (14’) these heights do not qualify Building 1 as a high rise building. (6)

IBC 2012 Construction Requirements

Using Table 503 *Allowable Building Heights and Areas (IBC 2012)* (6) to assess the required construction of the Group B building. The total area of the building is 81,000 square feet with two stories above grade. The first floor has square footage of 47,680 with the second floor having a square footage of 10,345 and the basement with a square footage of 23,221. The area of the first floor exceeds the allowable limits of all construction types except Type 1 construction, which as stated earlier Building 1 is not this type. So a building area modification has to be done in accordance with Section 506 of the IBC. (6)

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

$$A_t = 23,000 \text{ Type II B}$$

$$I_f = [F/P - .25] W/30$$

$$F = 1321$$

$$P = 1768$$

$W = 30$ the frontage width varies along the perimeter but all widths are over 30 feet.

$$I_f = .5$$

$I_s = 2$ (Section 506.3 IBC states a two story building fully sprinklered gets an increase of 2)

$A_a = 23,000 + (23,000 \times .5) + (23,000 \times 2) = 80,500 > 47,680$ feet of the first floor.

All construction types could be used but Type V B is eliminated based on allowable area.

Structural Fire Protection Requirements

Due to the un-protected steel joist in the floor/ceiling assemblies this building is of Type II B construction. The requirements for this type of construction can be found in table 601 of the IBC (6). Type IIB has no fire resistance ratings that need to be achieved by the IBC. Plus with the lack of exposures to Building 1 there are no exterior wall fire resistance ratings that need to be applied.

Code Compliance

Although Building 1 was built in the 1970s it is my opinion that from a structural stand point it still meets 2012 building code and could easily have its construction type upgraded if there were ever the need.

In regards to the 1 hour separation required between the assembly areas and the business areas, it is believed that the original construction meets this requirement with the use of cinderblock walls and rated doors. However it has been an institutional issue that rated walls like these have often been breached as building components have been upgraded or decommissioned. One would have to assume this is the case for these rated separations until a proper inspection has been completed which is beyond the limits of this analysis.

Fire Safety Plan for Technical Area 53 Building 1

Procedure for Reporting Fires and Evacuation of Building

Reporting Fires

(From LANL Emergency Procedures and Protective Actions) (7)

Initial emergency reporting must be made promptly, accurately, and effectively by any on-scene observer/worker who is knowledgeable of the event. The worker must call:

- 911 for life threatening events such as a person needing medical attention or a fire,
 - Workers should provide a description of the emergency, location, and protective actions taken (evacuation/sheltering).
- if applicable, response teams in the facility, and
- line/facility management and/or local Operations Center, where applicable.

Building Evacuation

(From LANL Emergency Procedures and Protective Actions)

The purpose of evacuating a building is to remove oneself from danger such as a chemical spill, fire, suspicious package, bomb threat, or other emergency event that is within the building. It is important that all LANL workers be familiar with the evacuation procedure and posted emergency evacuation diagrams for the building that is their primary place of employment as well as other areas that they frequent.

Once a worker has received a notification to take protective actions, under no circumstances should he or she return to a hazardous area or building to perform sweeps, make notifications, or collect belongings. Building-specific emergency/facility plans may provide additional information.

If it is unsafe to go outside (e.g., due to lightning), evacuees will make a safe, secure, and responsible decision. The best course of action may be to evacuate to another building, or to personal vehicles in the parking lot.

Upon hearing the notification to evacuate, all occupants will evacuate the building immediately, if safe to do so, and perform the following with minimal delay:

1. Evacuate the building

- If accessible and safe to do so, take coats, hand bags/briefcases, and car keys in the event re-entry to the building is not allowed, or there is inclement weather.
- DO NOT carry food, drinks, or items that, if dropped, could inhibit safe egress and cause slips, trips, or falls.
- If the route is blocked by unsafe conditions, take the nearest safe path out of the building.
- DO NOT deviate from the exit route to sweep an area.
- DO NOT use the elevator.

2. Sweep while evacuating

Sweeping is the action of paying attention while evacuating. The steps for sweeping are the following:

- Conduct a visual sweep along the route between the work location and the building exit.
- Knock on office doors that are closed or locked, shout loudly to evacuate.
- If safe, open doors and shout “evacuate” in areas such as restrooms, locker rooms, conference rooms, etc., or anywhere a facility occupant could be unaware of an emergency condition.
- Pay attention to anything that may assist with the timely rescue of personnel or identify the source of the emergency event.
- Notify the AAL of any person needing assistance to evacuate.

3. Assemble at the designated Assembly Area (AA) for accountability.

Accounting for all persons after emergency evacuation is essential. When gathering at the AA, workers must:

- Be aware of and give the right-of-way to responding emergency vehicles and personnel.

- Provide the Assembly Area Leader (AAL), applicable local Operations Center, or IC with any information (e.g., smoke, pool of water, person-down, strange odor, hazardous conditions) obtained during the sweep.
- Provide information regarding any resident who is absent or missing from the AA to the AAL, applicable local Operations Center, or IC.
- Remain at the designated AA for further instructions or until the “All Clear” signal is given by the IC or designee.
- NOT re-enter the building until instructed to do so by the AAL or applicable local Operations Center (who will be instructed by the IC).

Note: Some emergency events may deteriorate rather than improve. If this is the case, the IC or building residents will determine the need to move a population from their initial AA or shelter location to a relocation center, or move uphill or upwind of the event. The AAL or applicable local Operations Center will report accountability and status of personnel back to the IC.

4. Report the event to the IC or EOC via the AAL, runner, radio, or phone call. The following should be conveyed in the report:

- Why evacuated, accountability, and changes in AA
- Observed hazards or unusual conditions
- Any known injuries
- Status of critical equipment/operations

5. Additional information from the IC will be relayed to the AAL such as all clear, etc.

6. Return to normal operations

Returning to normal operations is the point at which the IC turns the facility back over to the facility personnel (typically the FOD or designee). Facility personnel must participate in a face-to-face briefing with the IC to determine if recovery tasks must be completed. The IC or the facility personnel will then direct workers to return to the building so operations may resume. Workers must not return to the building until they have received the “All Clear” from the IC. The IC may provide the facility personnel/AAL the “All Clear” to provide to building residents.

Any worker having a permanent or temporary special need that may hinder his or her evacuation must notify his or her line manager. The line manager will assign a co-worker(s) to assist the worker during all emergency events including, but not limited to, drills and real events requiring evacuation or sheltering.

Workers assisting others should:

- Always ask someone with a disability how they can be of help before attempting any rescue technique or giving assistance.
- Assist special needs individuals out of the building using the nearest exit.
- If unable to exit the building, and if safe to do so, assist the individual to the nearest exit stairwell or safe area of refuge, and inform emergency personnel of the situation.
- Notify the AAL/IC.

All guests, visitors, and outside personnel (including subcontract and crafts workers, maintenance workers, delivery personnel, or persons attending a meeting) conducting business in a building are responsible to ask for evacuation information or to follow a resident during an evacuation. If an emergency evacuation occurs, building residents should consider escorting visitors and ensuring visitors know they can follow the resident out of the building.


Site Plan




Figure 1 Site Plan

AA = Assembly Area

IAA = Inclement Weather Assembly Area

 = Fire Hydrant

 = FDC

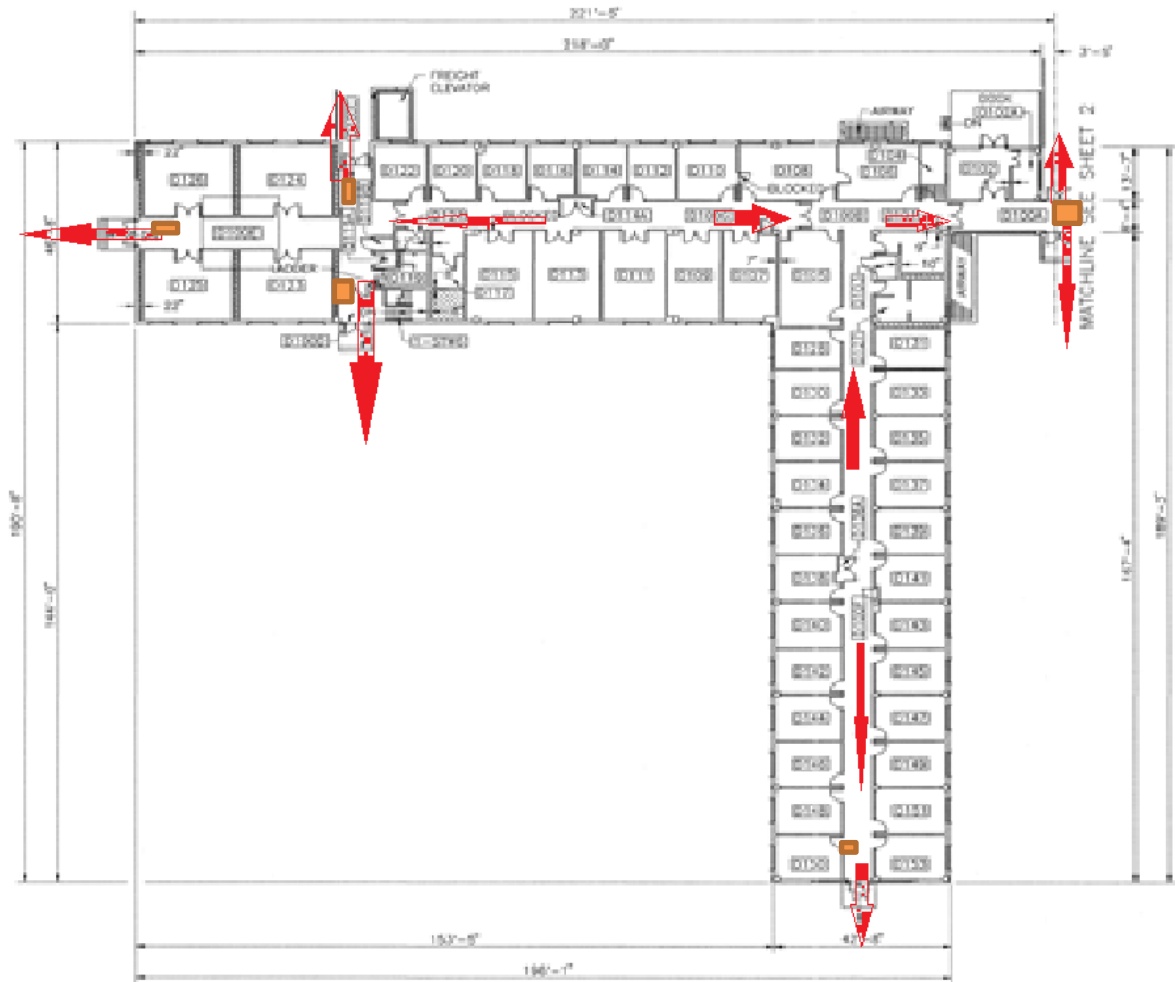


Figure 3 "D" Wing Egress 1st Floor

 = Pull Station



Figure 4 First Floor Egress

 = Pull Station

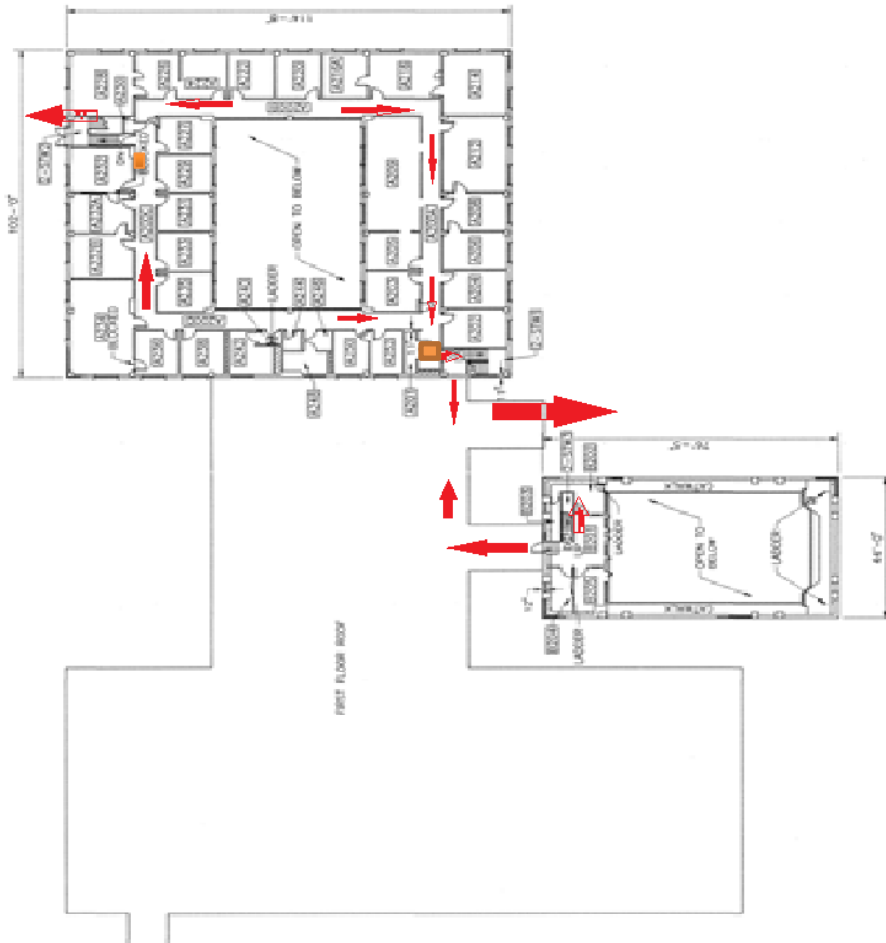


Figure 5 Second Floor Egress

 = Pull Station

Fire Hazards

The fire hazards in the facility are generally consistent with business occupancies and those in physical laboratories with the possible exceptions of those outlined in this section.

Some building areas have accumulated a considerable number of combustible and flammable liquids containers with relatively small quantities of liquids. The vast majority of these containers are stored in flammable liquids cabinets. All uses of the combustible and flammable liquids appear to be incidental to the primary function of the areas located.

Because the liquids are properly stored, their use is incidental, and their quantities are relatively low, the hazard is expected to be controlled by the fire sprinkler system, as installed.

Lasers are used within the facility and do add an additional ignition hazard, however the configurations of the lasers and laser use procedures reduce these risks to an acceptable level.

The commercial kitchen is a hazard to the building and occupants as it contains deep fryer and gas fire grills and ovens. These hazards have been properly addressed with a compliant suppression system designed specifically for these hazards.

Utility hazards associated with this facility are electrical and natural gas.

Natural gas enters the facility on the eastern side, directly adjacent to Room D104 and enters the "C" wing through the basement level of the C-Wing stairwell. It is metered, pressure regulated, and then dispersed to the boilers, hot water heaters, and four areas in "D" Wing. The "C" Wing gas line feeds the boilers, hot water heaters and areas in the "C" Wing.

The facility receives power from the LANL grid at 13.2kV. There is a large transformer in the basement, Room C10 that steps this power down to 480V (3 Phase) for distribution throughout the facility. There are small electrical control closets dispersed throughout the facility and easily accessible to the main corridors.

The large transformer in the basement could pose a significant threat to the fire safety of the building. Oil-cooled transformer fires are relatively common and occasionally catastrophic. For this reason oil-cooled transformers are seldom installed inside buildings. On the positive, the oil (PCB Contaminated) originally used for cooling has been replaced by a less flammable fluid.

Performance-Based Analysis

The performance based guide by SFPE was used for the analysis of Building 1. The process is as follows:

Defining Project Scope

Identifying Goals

Defining Stakeholder Objectives

Developing Performance Criteria

Developing Design Fire Scenarios

Developing Trial Designs (Not completed. Evaluating an existing Structure)

Evaluating Existing Design against Performance Criteria. (7)

Defining Project Scope

The scope of this project is to evaluate the tenability and structural response of Building 1 during likely fire scenarios. Two types of modeling software will be used for this analysis. The first model will analyze the egress system of Building 1 to help determine the available safe egress time for Building 1, with the second model analyzing the effects of fire on Building 1 structural components and the egress system.

The hope of this analysis is to show that Building 1 in its current configuration will meet the goals of the Department of Energy (DOE) with regards to life safety and structural fire resistance. If all goals are achieved for this business occupancy with the use of the aforementioned modeling software then DOE can be relatively assured that the operations housed in Building 1 for Los Alamos National Laboratory will not be greatly affected.

Identifying Goals and Defining Stakeholder Objectives

Building 1 is predominately a business occupancy with some incidental assembly occupancy space. Building 1 does not house any mission critical processes, hazardous materials, or high value equipment that require extra protection from fire that would require special analysis to evaluate the effectiveness of current fire protection features. The effect of a fire in Building 1 is

believed to only impact personnel who currently have office space inside Building 1, as well as some incidental lab space and meeting space.

Building 1 is divided into 4 wings and it is further believed that a fire in one wing is not likely to have an effect on all four wings. A single fire would at most damage two adjacent wings. The configuration of Building 1 in effect reduces the likelihood of a total loss fire. Using these assumptions it is reasonable to assume that wings not close to a fire would be able to be operational with limited interruption. The wings that are affected by the fire would likely have limited damage and not be a total loss.

With the previous assumptions and the configuration of Building 1 it is likely that the down time for mission operations would be limited to personnel relocations or small lab space until the damaged portions of Building 1 could be repaired barring any structural fire damage. This limits the goals of this analysis to life safety and the prevention of structural damage to Building 1.

The life safety goal will be as found in Chapter 5 of NFPA® 101 Life Safety Code®.

“5.2.2 Performance Criterion. Any occupant who is no intimate with the ignition shall not be exposed to instantaneous or cumulative untenable conditions.” (1)

The goal for Structural damage is to prevent flashover conditions for the likely fire scenarios that can be found in Building 1.

The SFPE Handbook of Fire Protection Engineering states that flashover is associated with compartment temperatures of 500°C to 600°C (8).

Developing Performance Criteria

The performance criteria for preventing structural damage is preventing temperatures from reaching 600°C. At these temperatures the light weight concrete used in the construction of Building 1 loses roughly about 50% of its strength (8). Likewise the steel joists used in Building 1 also lose 50% of their strength at around 600°C (8).

The performance criteria for Life Safety will be based on occupant’s ability to find their way to an exit. The limit for this has been determined for a large enclosure where the occupants may not be familiar with the building at a visibility of at least 13 meters (8).

Table 2-4.2 Allowable Smoke Densities and Visibility That Permits Safe Escape

Degree of Familiarity with Inside Building	Smoke Density (extinction coefficient)	Visibility
Unfamiliar	0.15 1/m	13 m
Familiar	0.5 1/m	4 m

Figure 6 Table 2-4.2 from SFPE Handbook Third Edition

A quick internet search of average height of males in the United States showed several sites that indicate that height to be 5 feet 9 inches. With this height in mind a 6 foot height or 2 meters above the finished floor seems like a reasonable distance at which to hold the 13 meter visibility distance.

Building 1’s construction and current configuration will be found acceptable if during all of the likely fire scenarios modeled, the visibility within the egress system stays at or above 13 meters at a height of 2 meters above the finished floor for the required amount of time needed for safe egress as determined by the egress model and if flashover conditions are never attained during the fire event.

Developing Design Fire Scenarios

A survey of approximately 10 websites for the most common causes of fire in business occupancies resulted in the following list.

Table 10 Common Causes for Business Fires

Cause	Number of times found in search
Open Flames	1
Electrical	5
Cooking	1
Spontaneous Ignition	1
Flammable and Combustible Materials	1
Human Error	3
Arson	5
Smoking	2
Hot Work	1

Open flames does not seem like a likely cause for a fire in Building 1 due to the restriction of the use of candles by the laboratory. One might assume that because Building 1 houses some lab space that open flames might be a factor, however Building 1’s labs our electronics labs with no need for open flames plus most of the labs in Building 1 are no longer routinely used.

Electrical fires were one of the most mentioned and seem like a likely cause for ignition in Building 1. One of the design fires will incorporate this cause into its scenario.

Cooking as a cause did not have huge support from the websites visited, but Building 1 does have a small commercial kitchen and although the hazards within the cafeteria are properly addressed a kitchen fire is not out of the realm of possibility. For this reason a scenario will be developed with cooking as the cause of ignition.

Spontaneous ignition such as oily rags not properly disposed of is not a likely fire scenario for Building 1 and will not be evaluated. This type of fire lends itself more to an industrial occupancy as opposed to the office space that is Building 1.

Flammable and combustible materials are a plausible fire cause for Building 1 and will be a part of a design fire scenario.

Human error is a plausible fire cause for Building 1 and will be a part of a design fire scenario.

Arson was one of the most popular causes of fire in businesses, however Building 1 is located behind a guarded perimeter where access is only available by way of badge access or security guard. There is no business competition that would drive arson for hire. The likelihood of a disgruntled employee starting a fire is less due to the access restrictions. For these reasons arson will not be evaluated in a design fire scenario.

Smoking as a cause seems like a plausible fire cause but due to it being heavily restricted and enforced on laboratory property it most likely is less of an issue than in other areas.

Hot work does seem as though it would have a high likelihood as a cause for fire in Building 1, but due to the age of the building and its components it is likely that some refurbishment may need to be done in the mechanical areas of the basement resulting in hot work. Hot work will be a component of a design fire scenario.

Design Fires

Because the assumption is that a fire in one wing of Building 1 will not involve all of the wings of Building 1. One design fire for each wing and one for the basement were developed using the common causes of fire for businesses discussed earlier. Another assumption made was that all fires happen in occupied areas, therefore it is assumed that notification is made by pull station almost immediately upon the onset of the fire.

Basement Fire

The design fire that was developed for the basement is based on inspection and the potential for such a scenario to happen. In the basement of "C" wing by the west stairway there is a small room created with low walls approximately 7 feet high. Within this space a 3 foot high stack of flattened corrugated cardboard was found. Also above this space is duct work for the HVAC system for Building 1.

The scenario developed is that due to the age of the building and nature of the basement being a mechanical area an upgrade to the duct work is needed in the area defined above. This work will require some hot work and while procedures and inspections of the area are required before work begins human error gets involved and not all the hot work precautions are followed which can lead to the ignition of the 3 foot high stack of corrugated cardboard.

The location of this fire will challenge the egress system from the basement as well as have the potential to challenge the egress from the first floor. Additional assumptions for this scenario are that the normally closed door at the top of the stairs is open throughout the duration of the fire making this a true worst case incident.

Wing “D” Fire

The wing “D” fire scenario involves the use of flammable liquids in a laboratory setting. This fire will have a liter of ethanol pool fire. This is the likely scenario that a wash bottle of ethanol with an unsecured lid is knocked over on a lab bench and the contents come in contact with hot equipment in the area igniting the pool of ethanol. This fire will be located in an area that will challenge a major intersection in the Wing “D” egress system and will assume a worst case of the doors to the fire room being open and staying open throughout the fire.

Wing “C” Fire

The wing “C” fire scenario involves the careless placement of a winter coat in close proximity to a space heater. This fire will represent the more human error but this time in an office setting. This fire will be located in an area that will challenge an intersection in the Wing “C” egress system and will assume a worst case of the doors to the fire room being open and staying open throughout the fire.

Wing “B” Fire

The wing “B” fire will be a kitchen fire located in the cafeteria. This scenario encompasses the largest hazard associated with Wing “B”. This fire will have both the sprinkler system operational and the wet chemical suppression system operational to show if the hazards are properly addressed. The fire will be a deep fat fryer fire.

Wing A/B Fire

The Wing “A/B” fire will be a wastebasket fire in an office setting. The office will be located on the first floor near the east exit and east stairwell. Again all doors will be open to represent the worst case conditions. A fire in this area has the potential to completely render half the egress system for Wing “A/B”.

This fire will represent an overloaded electrical outlet located next to a small recycle waste paper basket.

Analysis

Models

FDS is the fire and smoke modeling software that will be used for the following analysis. FDS was developed at the National Institute of Standards and Technology (NIST) (9). “FDS simulates fire scenarios using computational fluid dynamics (CFD) optimized for low-speed, thermally driven flow” (9). For this analysis PyroSim was used as an interface with FDS to build the models and fire scenarios. PyroSim is a graphical user interface for FDS (9). This interface provides immediate input feedback and ensures that the FDS input file used is correct (9).

PyroSim was used to build and run the fire scenarios described above. This software allowed quick feedback on the developed scenario to make sure that the model was set up correctly based on the inputs through PyroSim. This function was very helpful in identifying areas within the model that needed attention.

Pathfinder was used for the calculation of total amount of time it takes all of the occupants of Building 1 to exit the building, also known as the required safe egress time. “Pathfinder is an agent passed egress and human movement simulator” (10) . Pathfinder was very helpful in showing visually what the previous egress calculations showed. Pathfinder shows a visual representation of the egress process during an egress event based on the imported parameters, both human and building.

Egress Model

A Pathfinder model was developed for Building 1 using drawing files. Each floor was drawn per its floor arrangement with all egress components built to connect the floors and exterior exits from Building 1. The Pathfinder model will show a visual representation of occupants before and during the building evacuation event. The only parameters were that occupants were to use the nearest available exit and were to start the exit process immediately. After the total time for all the occupants to exit had been calculated the pre-movement time discussed earlier was added to the model’s time to make the total required safe egress time (RSET). This time will determine the length of time needed to run each fire scenario.

As stated before the likely occupant load for Building 1 with the lecture hall full is 1703 occupants. This was the number of occupants placed in the Pathfinder model with the aforementioned parameters. The Pathfinder model showed a total egress time of 144.3 seconds or roughly 2.5 minutes. The pre-movement time stated earlier as worst case was 3 minutes, when the 3 minute pre-movement time is added to the model’s 2.5 minute required egress time the total RSET for Building 1 is 5.5 minutes. This 5.5 minutes will be the bounding time each of the fire scenarios will be evaluated against to determine if there is enough available safe egress time (ASET).



Figure 7 Pathfinder model at the beginning of egress simulation.

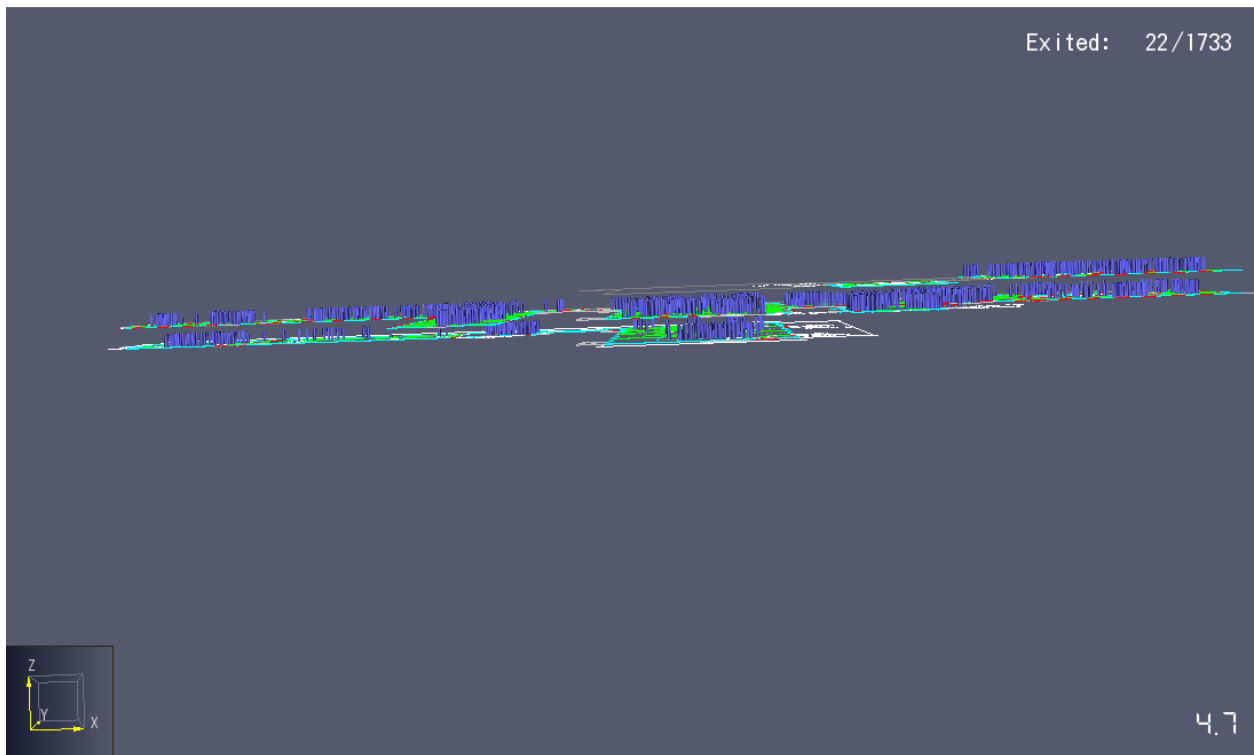


Figure 8 Screen shot of Pathfinder model showing all three levels of Building 1.

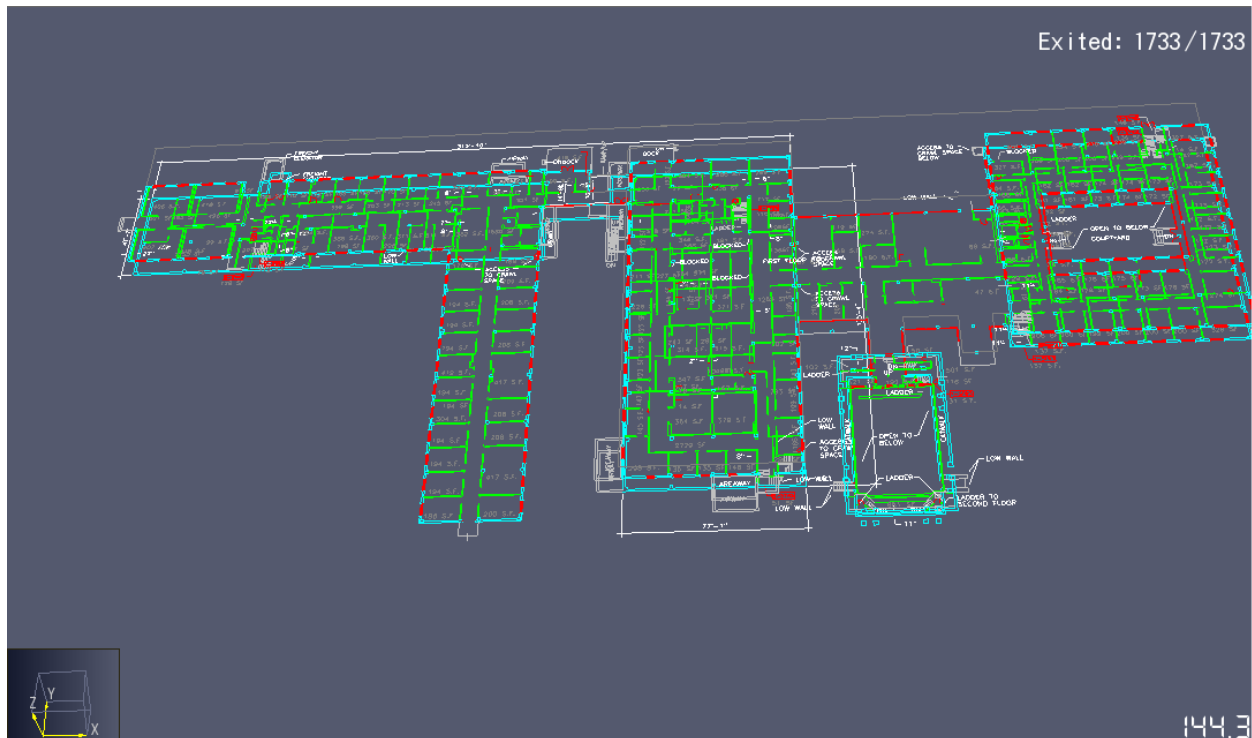


Figure 9 Pathfinder model showing all occupants have exited.

Fire Analysis

Basement Fire Scenario

The FDS model was built using PyroSim software with imported floor plans. The general layout of the fire area was constructed using the imported floor plan. All model meshes were set at .5 meters cubed. The use of smaller meshes was not feasible as using them made two computers crash.

Model parameters:

Room heights for this scenario were set at 14 feet for the basement area and 10 feet for the first floor corridor. Only the corridor for the first floor was constructed while the basement was constructed as a large open area aside from the room of origin. The majority of the basement area is partitioned with low walls; because of this construction, the smoke movement is assumed to accumulate undeterred like an open room.

The fire parameters for this model were developed using information found in the SFPA Handbook. The fuel package for this model will be a stack of corrugated cardboard boxes. The

fuel package for this fire was at a height of 1 meter or about three feet in height; however the only data that could be found in the SFPA Handbook was for whole pallets or large stacks of like materials, for this reason some assumptions were made based on the data that was found in the SFPA Handbook.



Figure 10 Photo of Similar Fuel Package from Dreamstime.com

SFPE Data:

Test	Commodity	Storage Height (m)	Peak HRR (kW·m ⁻²)	Time of Peak (s)
SP-4	PS jars in compartmented CB cartons	4.11	16,600	439
SP-13	PS foam meat trays, wrapped in PVC film, in CB cartons	4.88	10,900	103
SP-23	PS foam meat trays, wrapped in paper, in CB cartons	4.90	11,700	113
SP-30A	PS toy parts in CB cartons	4.48	5,210	120
SP-35	PS foam Insulation	4.21	26,000	373
SP-44	PS tubs in CB cartons	4.17	6,440	447
SP-15	PE bottles in compartmented CB cartons	4.20	5,330	434
SP-22	PE trash barrels in CB cartons	4.51	28,900	578
SP-43	PE bottles in CB cartons	4.41	4,810	190
SP-6	PVC bottles in compartmented CB cartons	4.63	8,510	488
SP-19	PP tubs in compartmented CB cartons	4.26	5,870	314
SP-24	PS high foam insulation	4.27	1,822	33
SP-41	Compartmented CB cartons, empty	4.51	2,470	144
RS-1	CB cartons, double triwall, metal liner	2.95	1,680	180
RS-2	**	2.95	1,490	89
RS-3	**	2.95	1,680	180
RS-4	**	4.47	2,520	120
RS-5	**	4.47	2,250	240
RS-6	**	5.99	3,260	210
RS-7	PS cups in compartmented CB cartons	2.90	4,420	95
RS-8	**	2.90	4,420	100
RS-9	**	2.90	4,420	120
RS-10	**	4.42	6,580	100
RS-11	**	5.94	8,030	148

CB, cardboard; PE, polyethylene; PP, polypropylene; PS, polystyrene; PU, polyurethane

Figure 11 Table 3-1.5 HRR Values of Palletized and Rack Storage Commodities Tested at FMRC for SFPE Handbook Third Edition

The data shows a peak Heat Release Rate (HRR) of 2,470 kw/m² for a 4.5 meter high stack of empty cardboard. The fuel package in this scenario is 1 meter as found, so dividing the peak

HRR by four reduces the HRR to 617 kW/m^2 which is what was used in the model. It is understood that a linear relationship between height and HRR does not exist but it is safe to assume that less fuel will produce a smaller peak HRR.

The next step was to find a HRR curve that for a similar type of fuel. One was found in Figure 3.1.42 of the SFPE Handbook Fourth edition. Using the SCEA std, Curve which had a peak of about the same 2400 kW all that was needed was to adjust the curve to the time constraints set by the scenario. The SCEA curve reached its peak at 600 seconds however its HRR was at 0 at the 500 second mark so the model started basically at the 500 second mark.

Table 11 Model HRR Inputs for Fire Growth

Time (seconds)	Fraction of Peak HRR
25	10%
50	20%
100	100%
150	70%
200	50%
250	20%
300	10%

The room of origin is protected by two 212°F (100°C) sprinkler heads. These were placed as appropriate in the model.

The use of the model is to show the tenability of the area and the temperature of the room of origin so slice files were used to see the effects of the fire on the area. One temperature slice file was used in the middle of the room of origin to see if the 600°C threshold was exceeded. Two visual slice files were used to evaluate the distance one would expect to be able to see during the fire event for the duration of the RSET time of 5.5 minutes. These were placed 6 feet above the floor on both the basement level and the first floor.

The figure below shows the highest temperatures attained in the room were at 270°C , well below the 600 degree threshold. The highest temperatures were achieved during the peak HRR.

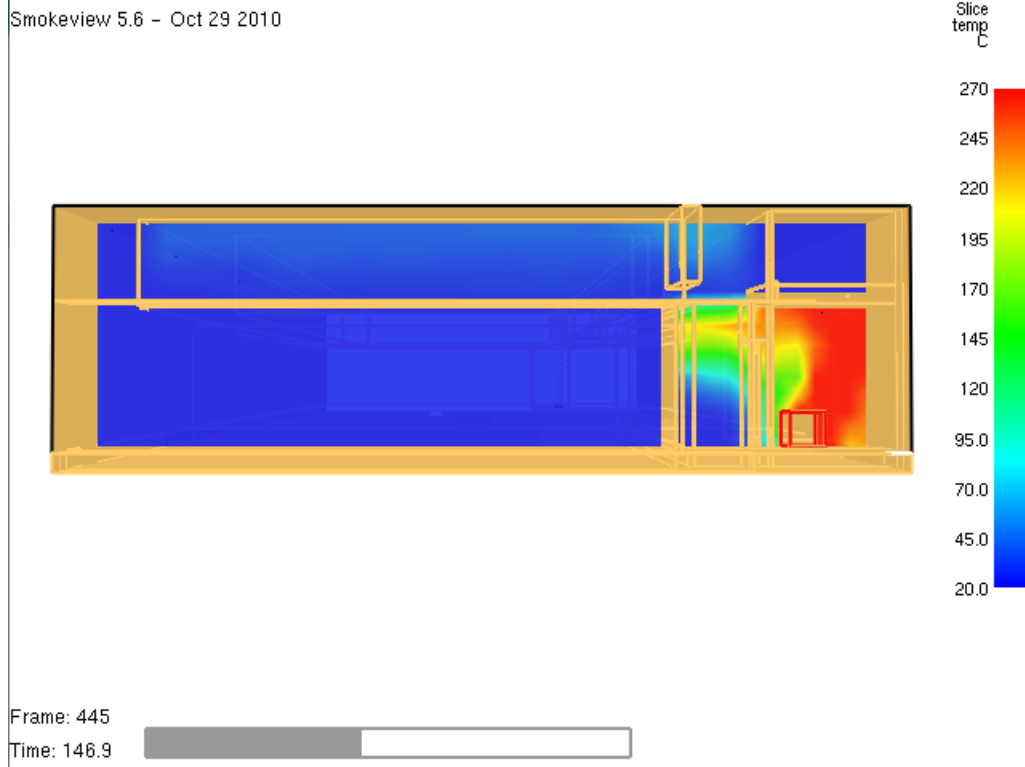


Figure 12 Highest Temperatures for Basement Scenario

The output files for this model show a sprinkler activation time of 54 seconds for the first sprinkler and 60 a second activation time for the second sprinkler in the room.

The visual distance one could be expected to see is demonstrated in the following figures. As one can see the basement did not meet the criteria of maintaining the 13 meters of visual distance as the visual distance of the basement dropped below 13 meters at around 240 seconds. The first floor corridor however never dropped below 15 meters throughout the analysis.

It could be argued that it is not likely for guests to be in the basement area of Building 1 and therefore the criteria of a 4 meter visual distance could be the threshold to consider. If this criterion were applied the basement level would have passed this analysis. For the purposes of this report it was determined that the basement level fire did not meet the performance criteria set by the stake holders and therefore additional steps need to be taken to remedy this scenario. Those steps would be to remove the fuel package from the basement to limit the fuel load in this area.

Smokeview 5.6 - Oct 29 2010

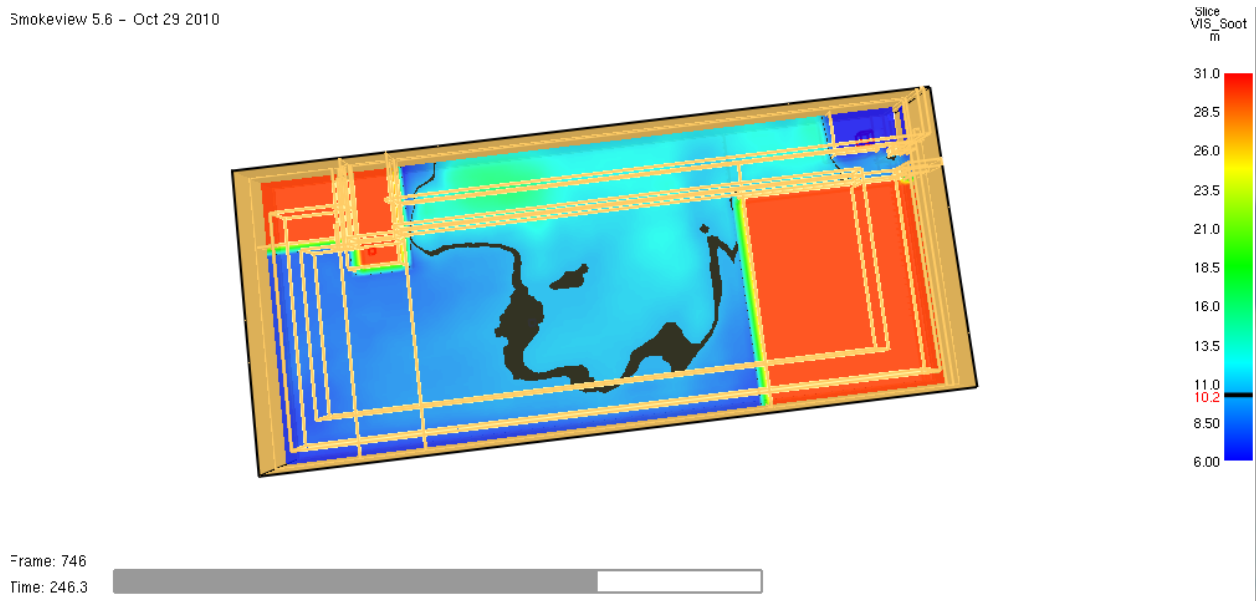


Figure 13 Basement Visual Distance at 6 feet

Smokeview 5.6 - Oct 29 2010

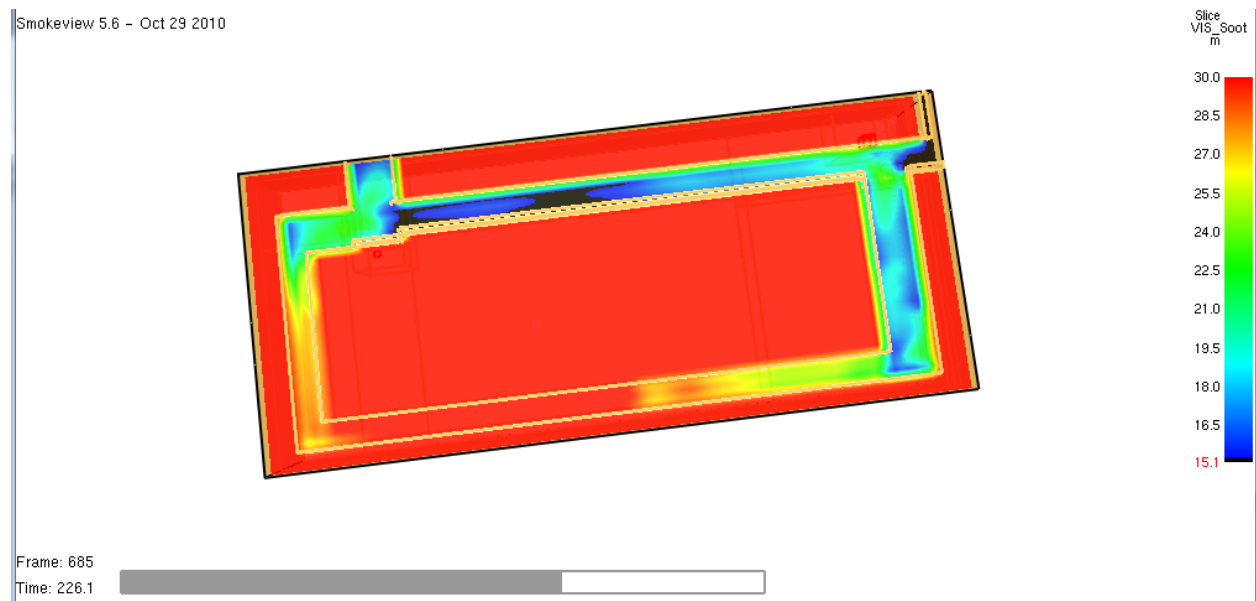


Figure 14 First Floor Visual Distance at 6 feet

Wing “D” Fire Scenario

The FDS model was built using PyroSim software with imported floor plans. The general layout of the fire area was constructed using the imported floor plan.

Model Parameters:

Room heights for this scenario were set at 9 feet for the whole area. Only the corridor for the first floor was constructed and the room of origin. As stated in the scenario doors to the room are open throughout the fire.

The fire parameters were developed using a series of calculations found in the SFPE Handbook on flammable liquid spill fires.

First estimate the size of the spill.

$$A_s = (1.4m^2 / L)V$$

$$V = 1L$$

$$A_s = 1.4m^2$$

Second estimate the maximum possible fire size.

$$A = 1.55 * A_s$$

$$A_s = 1.4$$

$$A = 2.17m^2$$

Third calculate the heat release rate of Ethanol.

$$\dot{Q} = \dot{m}'' * A * \Delta hc$$

$\dot{m}'' = .022kg/m^2 s$ from page 3-38 of the SFPE Handbook (8) for Diameters of greater than .6m but less than 3.0m

$$D = 1$$

$$A = 2.17m^2$$

$\Delta hc = 26.8MJ/kg$ from table 3-1.21 in the SFPE Handbook (8) for Ethanol

$$\dot{Q} = 1.27 MW$$

Fourth calculate the total burn time of the fire.

$$t_b = (V * \rho) / (\dot{m} * A)$$

$$V = 1L \quad (1L = .001m^3)$$

$\rho = 794kg/m^3$ from table 3-1.21 in the SFPE Handbook (8) for Ethanol

$$A = 2.17m^2$$

$$t_b = 17 \text{ seconds total burn time}$$

From the above calculations the fire designed in the PyroSim has a peak HRR of $1270kw/m^2$. It is also assumed that once ignited the pool fire will be at peak HRR for the duration of the fire with no ramp up. The fire will burn for 17 seconds and then extinguish once the fuel is consumed.

The room of origin is protected by six $100^\circ C$ heads that were placed in the model appropriately. The room selected in the structure is located at the intersection of the two main corridors for Wing "D".

The use of the model is to show the tenability of the area and the temperature of the room of origin so slice files were used to see the effects of the fire on the area. One temperature slice file was used in the middle of the room of origin to see if the $600^\circ C$ threshold was exceeded. One visual slice file was used to evaluate the distance one would expect to be able to see during the fire event for the duration of the RSET time of 5.5 minutes, it was placed 6 feet above the floor.

The rendering seen below shows that the highest temperature in the room was $111^\circ C$ far below the $600^\circ C$ threshold.

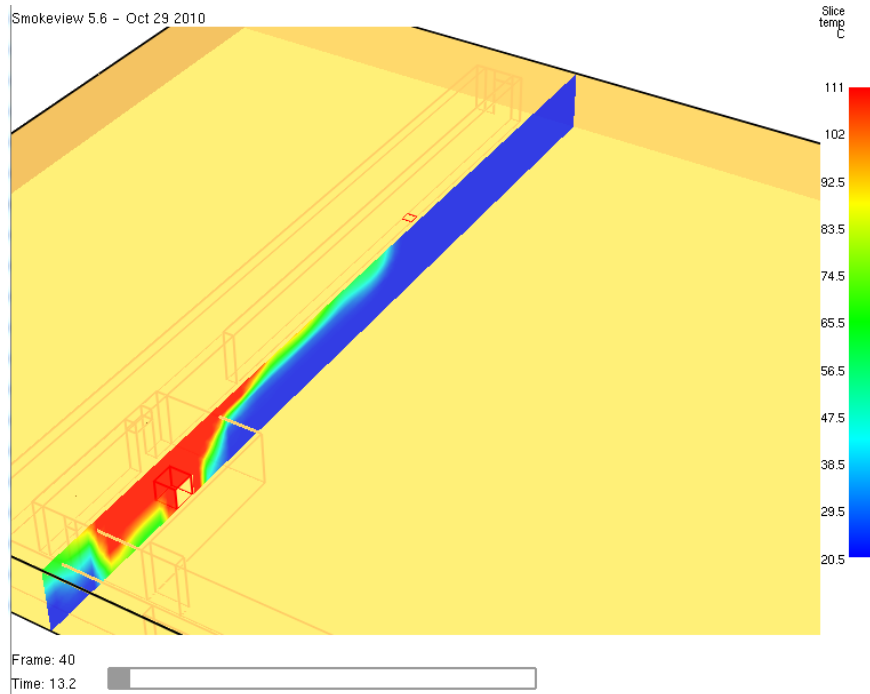


Figure 15 Temperature Slice for the Wind D fire

The rendering below shows that the visibility at 6 feet above the finished floor was only limited to 22.5 meters which is above the 13 meter threshold.

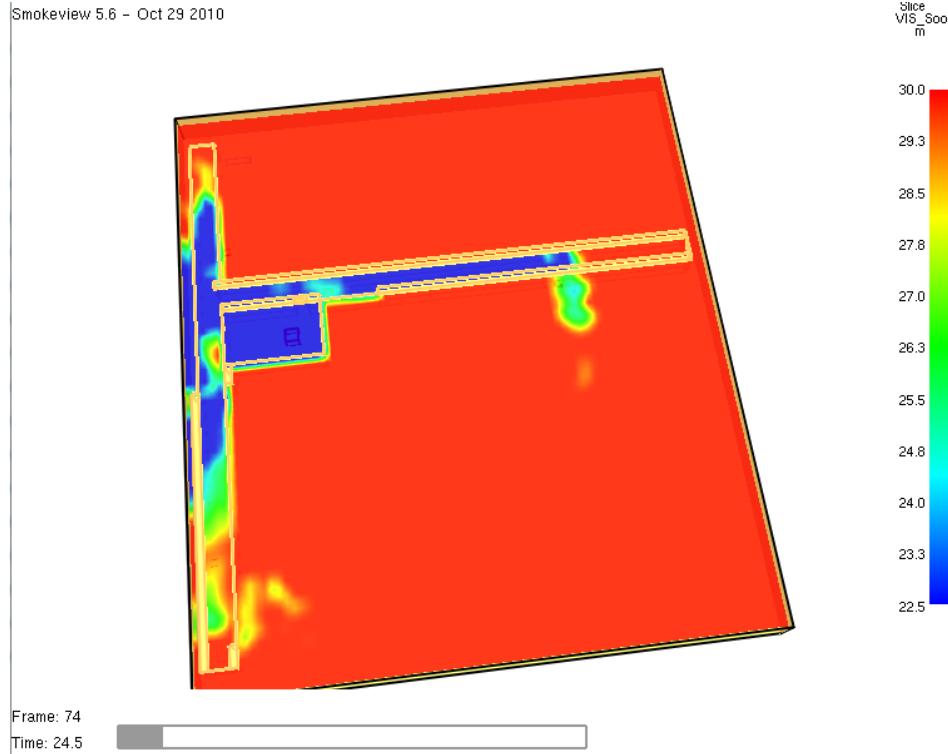


Figure 16 Visual Slice of the D Wing Fire at 6 Feet

The output files of the model show the first sprinkler discharge was 2 seconds into the event ultimately all sprinklers in the room activated.

The model shows that for this type of fire scenario Building 1's current configuration is acceptable.

Wing "C" Fire Scenario

The FDS model was built using PyroSim software with imported floor plans. The general layout of the fire area was constructed using the imported floor plan.

Model Parameters

Room heights for this scenario were set at 9 feet for the whole area. Only the corridor for the first floor was constructed and the room of origin. As stated in the scenario doors to the room are open throughout the fire.

The HRR curve that was used for this model simulated two jackets that have ignited by a nearby space heater is an office located in Wing "C". The office like the previous scenario is located at a major corridor junction in Wing "C".

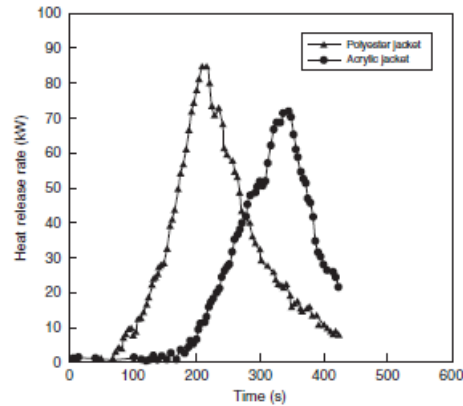


Figure 3-1.19. Two men's jackets.

Figure 17 HRR Curve of Two men's Jackets from SFPE Handbook Third Edition

The curve modeled was for the Polyester Jackets to show a worst case scenario. Below is the data that was input in the model to control the fire growth.

Table 12 HRR Inputs for the Wing C Fire

Time (seconds)	Fraction of Peak HRR
0	0%
100	10%
175	75%
200	100%
250	60%
300	40%
350	10%

The rendering below shows that the room temperature of the Wing “C” fire only reached a temperature of 85°C again far below the 600°C threshold. The model output files show sprinkler activation at 173 seconds. Only one of the two sprinkler heads located in the room activated.

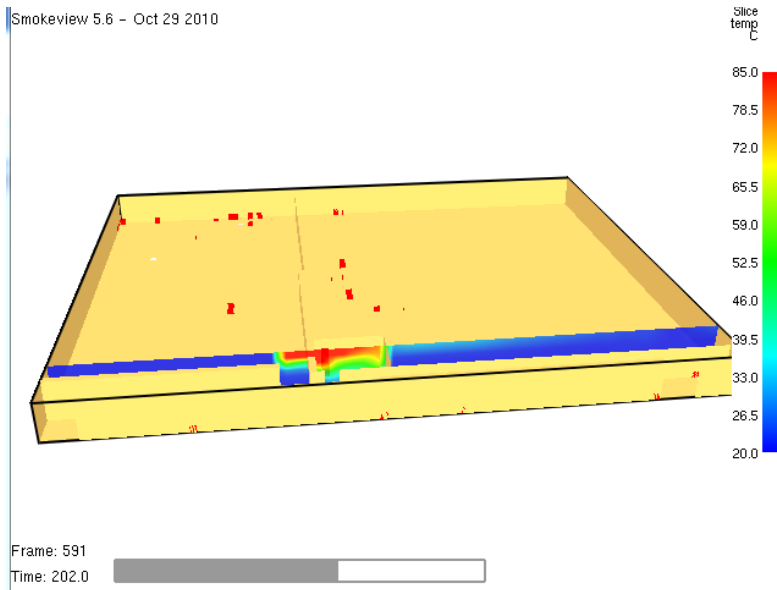


Figure 18 Temperature Slice of the Wing C Fire

The rendering below shows the visibility at 6 feet above the floor. As shown the visibility drops to 11.5 meters which is below the threshold set for this analysis. The argument can be made that if the 13 meter requirement is not maintained that it would cause persons unfamiliar with the building to turn and go another way. The way the egress system is set up in Building 1 it would allow individuals safe egress away or around the high concentration of smoke for the area located at the end of the corridor.

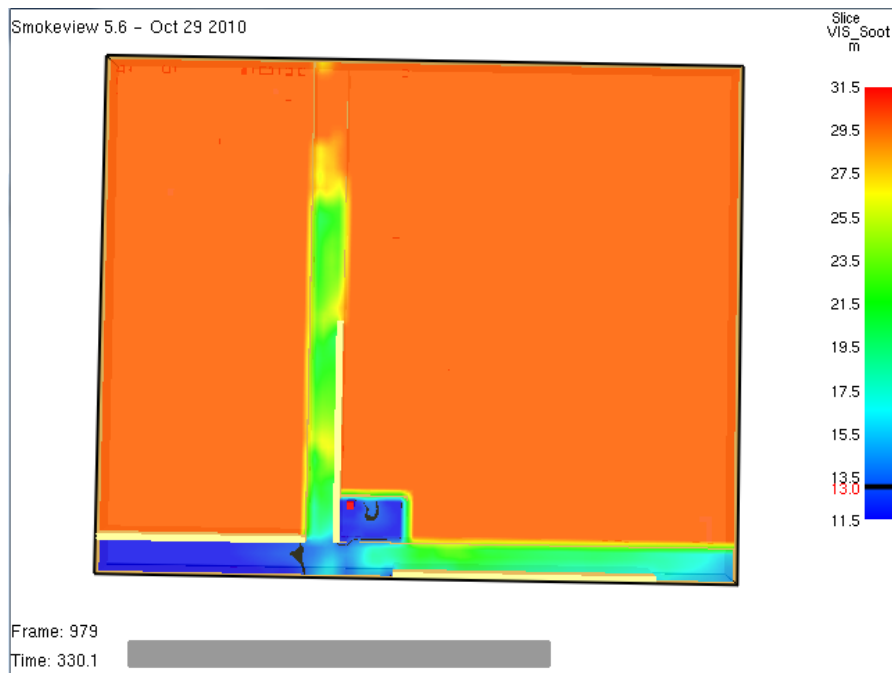


Figure 19 Visual Slice of the Wing C Fire at 6 feet.

For the purposes of the analysis based on the limited experience of the evaluator with this modeling software this scenario should have additional modeling completed to further eliminate any errors that may have reduced the visibility.

Wing “B” Fire Scenario

The FDS model was built using PyroSim software with imported floor plans. The general layout of the fire area was constructed using the imported floor plan.

Model Parameters

Room heights for this scenario were set at 9 feet for the whole area. Only the corridor for the first floor was constructed and the room of origin and the main entrance area. As stated in the scenario doors to the room are open throughout the fire.

Online research was conducted to find appropriate data to import into the model for the design fire. During this research a draft paper was found by W.K Chow and Xiaomin Ni of China titled Experimental Evaluation of Performance of Open Kitchen Fire Suppression Systems (11). The report explains a series of experiments using a 25 cm pan with cooking oil heated electrically to its autoignition temperature. In some tests the oil was allowed to free burn and in others the effect of extinguishment were evaluated. One such experiment showed the effect of a dry chemical extinguishing agent being applied to the cooking oil fire. Below is the graph of those tests.

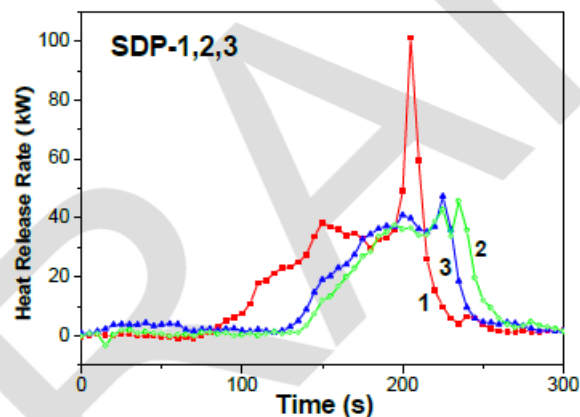


Fig. 13. Heat release rate measured for tests SDP-1 to SDP-3.

Figure 20 Screen Shot of the HRR Curves Measured During the Experiments with Dry Powder Extinguishment (11)

The report stated that after the initial extinguisher discharge there was a brief flare up and rise in the HRR after the discharge of the extinguishing agent but then the fire quickly extinguished (11). The SDP-1 curve is the one used to design the fire for this scenario.

The SDP-1 test shows a peak HRR of 100 kW for a 25cm pan. The fryer that is located in the kitchen of Wing “B” is approximately 14” X 14” (35.5 cm X 35.5cm) and has a larger surface area than the pan used in the experiments noted in the report. The surface area of the experimental pan was calculated to be 491 cm² while the surface area of the fryer is 1260 cm² roughly 2.5 times larger. Using the equation $\dot{Q} = \dot{m} \cdot A \cdot \Delta h_c$ with all other things being equal the only change between the experiment and the scenario application are the surface areas of the oil. For this reason the average HRR of 33.2kW was multiplied by 2.5 to arrive at a new HRR for the scenario of 83 kW. After the discharge of the extinguisher in the experiment the HRR rose to 100 kW or 300% increase before extinguishment. For this reason the 83kW was multiplied by three to arrive at a new peak HRR of 249 kW.

The curves with the adjustment of increased surface area include the extinguishment by way of dry chemical which is similar to the extinguishment installed in the hood of kitchen of Wing “B”. By using this curve I am also modeling the application of the installed extinguishment system. The model will however have the installed sprinklers for the area around the hood system.

The table below shows the inputs in the model for the fire in the Wing “B” café.

Table 13 HRR Inputs for the Wing B Fire

Time (seconds)	Fraction of Peak HRR
10	10%
100	20%
150	40%
175	30%
200	100%
220	10%
300	0%

The rendering below shows that the room temperature of the Wing “B” fire only reached a temperature of 55°C again far below the 600°C threshold. The model output files show sprinkler activation at 198 seconds. Only one sprinkler in the room activated.

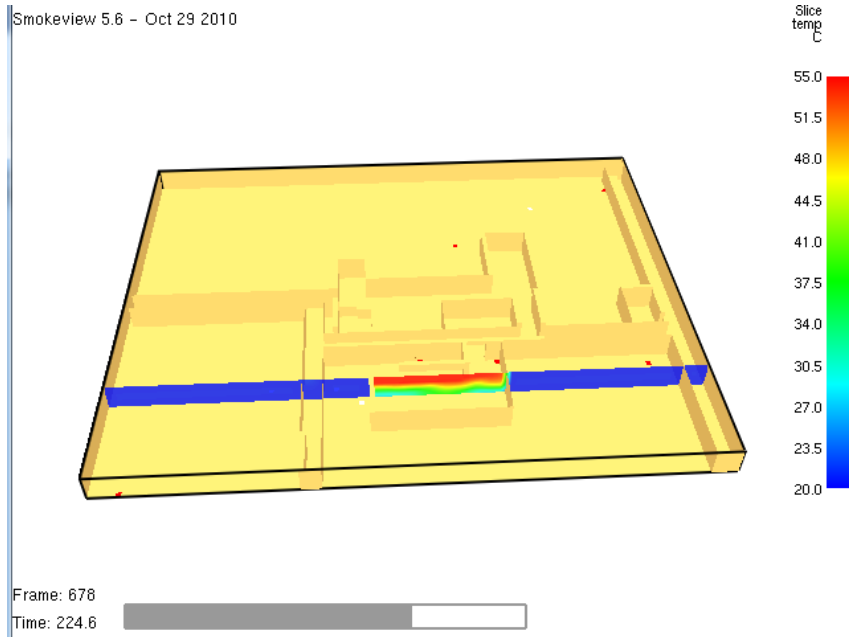


Figure 21 Temperature Slice File for Wing B fire

The rendering below shows the visibility at 6 feet above the floor. As shown the visibility drops to 15 meters which is above the threshold set for this analysis and therefore this scenario is found to be properly addressed with Building 1's current configuration.

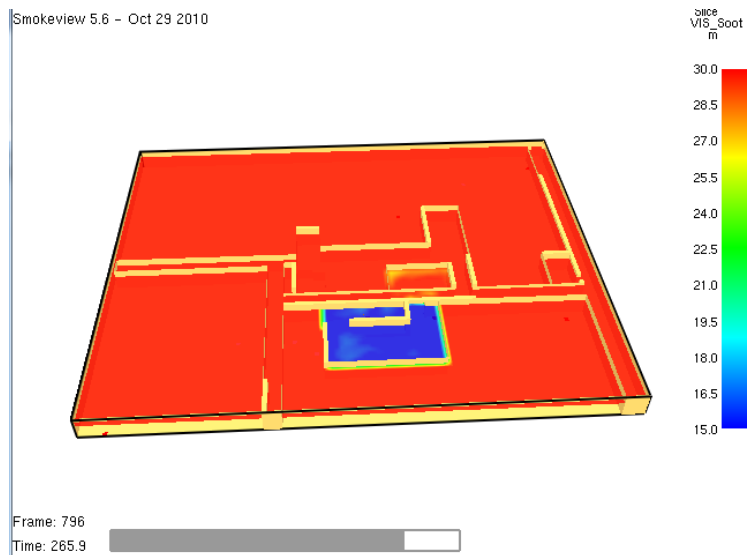


Figure 22 Visual Slice at 6 feet for Wing B Fire

Wing “A/B” Fire Scenario

The FDS model was built using PyroSim software with imported floor plans. The general layout of the fire area was constructed using the imported floor plan.

Model Parameters

Room heights for this scenario were set at 9 feet for the whole area. Only the corridor for the first floor was constructed and the room of origin and the main entrance area. The stairwell to the second floor of Wing “A” was included as well as the second floor corridors to evaluate the visibility at the 6 foot levels on both floors. As stated in the scenario doors to the room are open throughout the fire.

The HRR curve was used for this model to simulate a trash fire that was ignited by an overloaded electrical outlet in the reception area of the main entrance of Wings “B” and “A”. The purpose of this fire was to see how a likely fire scenario at a junction of two adjacent wings would affect occupants on two floors as well as in the area of the auditorium.

The below HRR curve from the SFPE Handbook was used for the design of the fire for this scenario. The curve input into the model is the Three Sacks curve that has a peak of 350 kW at 75 seconds. This was the peak HRR used during this scenario.

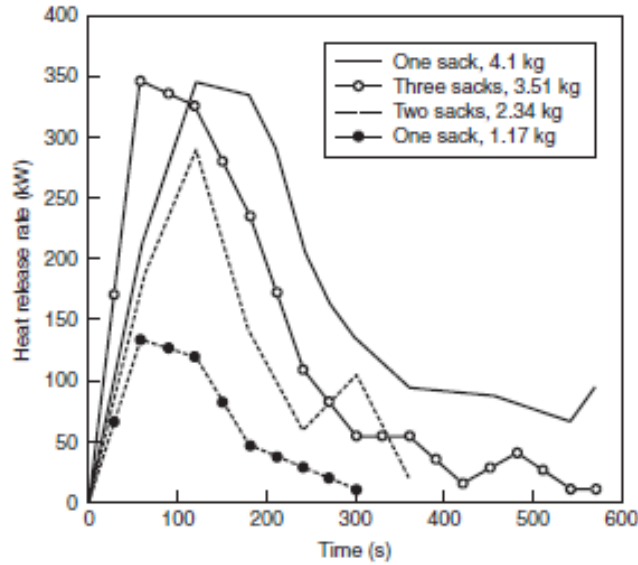


Figure 3-1.49. Trash bags.

Figure 23 HRR Curve for Trash Bags from SFPE Handbook Third Edition.

Below is the model inputs used to build the fire growth for this scenario.

Table 14 HRR Inputs for Wing A/B Fire

Time (seconds)	Fraction of Peak HRR
0	0%
25	20%
50	70%
100	100%
125	90%
150	75%
200	50%
250	30%
300	10%

The rendering below shows that the room temperature of the Wing “A/B” fire only reached a temperature of 120°C again far below the 600°C threshold. The model output files show sprinkler activation at 56 seconds. Only two sprinklers activated during this scenario fire model.

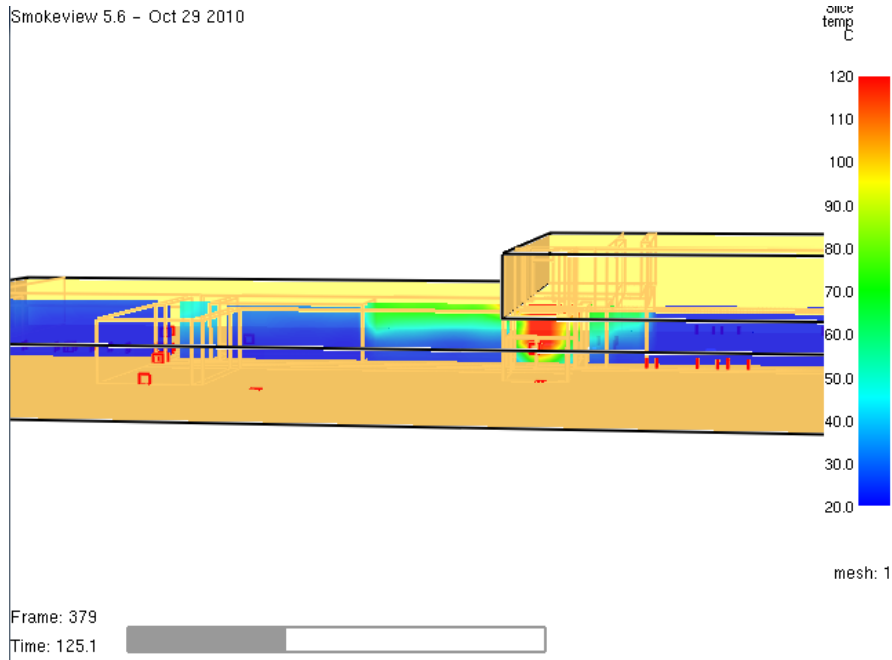


Figure 24 Temperature Slice for the Wing A/B Fire

The rendering below shows the visibility at 6 feet above the floor for the first floor. As shown the visibility drops to 11 meters which is below the threshold set for this analysis and therefore this scenario is found to be improperly addressed with Building 1's current configuration.

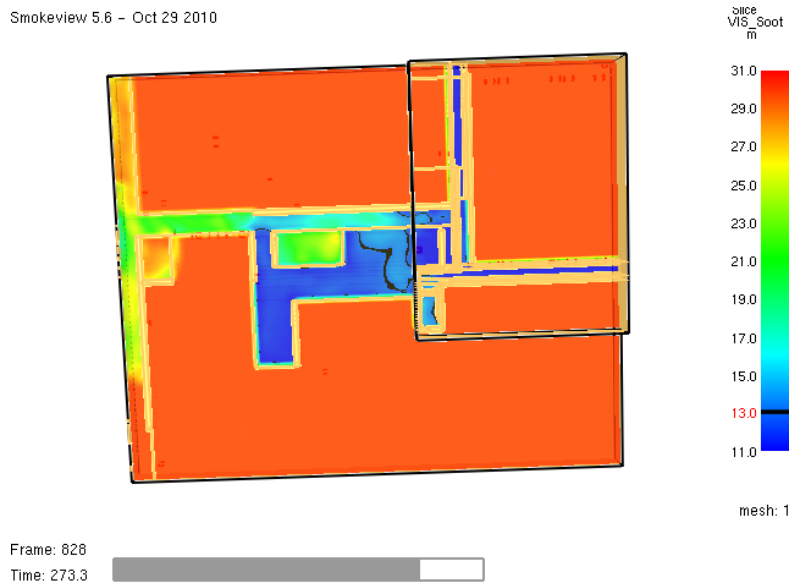


Figure 25 Visual Slice at 6 Feet for the First Floor of wing A/B

The rendering below shows the visibility at 6 feet above the floor for the second floor of Wing “A”. As shown the visibility drops to 11.5 meters which is below the threshold set for this analysis and therefore this scenario is found to be improperly addressed with Building 1’s current configuration.

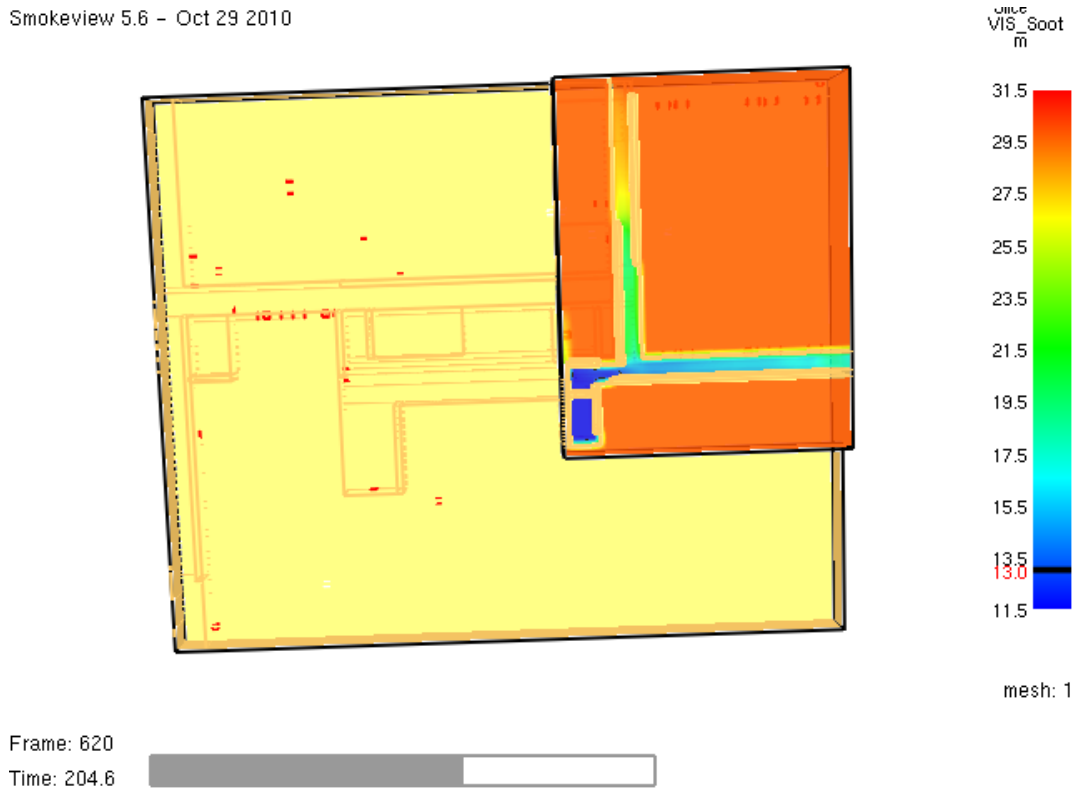


Figure 26 Visual Slice at 6 Feet for the Second Floor of Wing A

The visibility for this scenario is still well above the threshold for those occupants that are familiar with the building but this scenario is in the area where Building 1 is most likely to have guests. In fact guests are instructed to report to the very reception area in this scenario. For this reason combustibles in this area should be kept to a minimum. Again this scenario is using a worst case scenario of three bags of trash which could be argued the likelihood of which is small but if janitorial services are not available the three bags of trash could happen. More modeling could be done by a more experienced evaluator to better create the area for this scenario. The more simple solution could be to remove the reception area from this area or add more restrictive administrative controls.

Conclusion

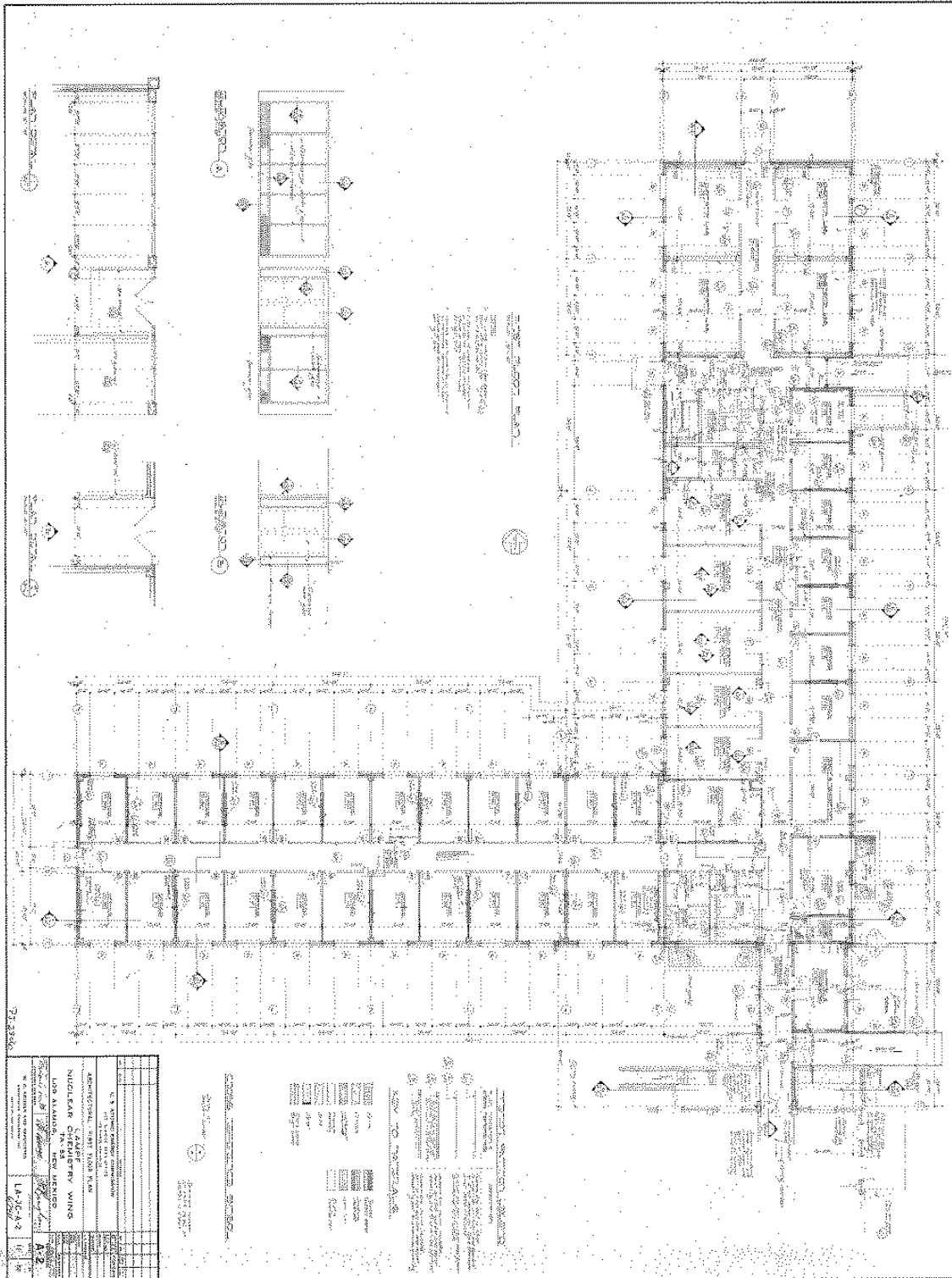
This analysis of Building 1 has shown that the 1971 vintage building does meet current building codes. This analysis also used modern fire modeling techniques to model likely fire scenarios for each wing to see if Building 1's current configuration could perform to the stated criteria. The models showed that Building 1's current configuration is acceptable on the basis of structural fire protection as temperatures during the fire models stayed well below flashpoint which was one part of the criteria. The models also showed, however, that the smoke visibility levels could not be maintained to the more restrictive unfamiliar occupant distance of 13 meters. In a few of the models the visual distance dropped below the criteria; however all models would have passed the less restrictive familiar occupant distance of 4 meters. Additional modeling could be completed by a more experienced evaluator to determine the relevancy of this analysis.

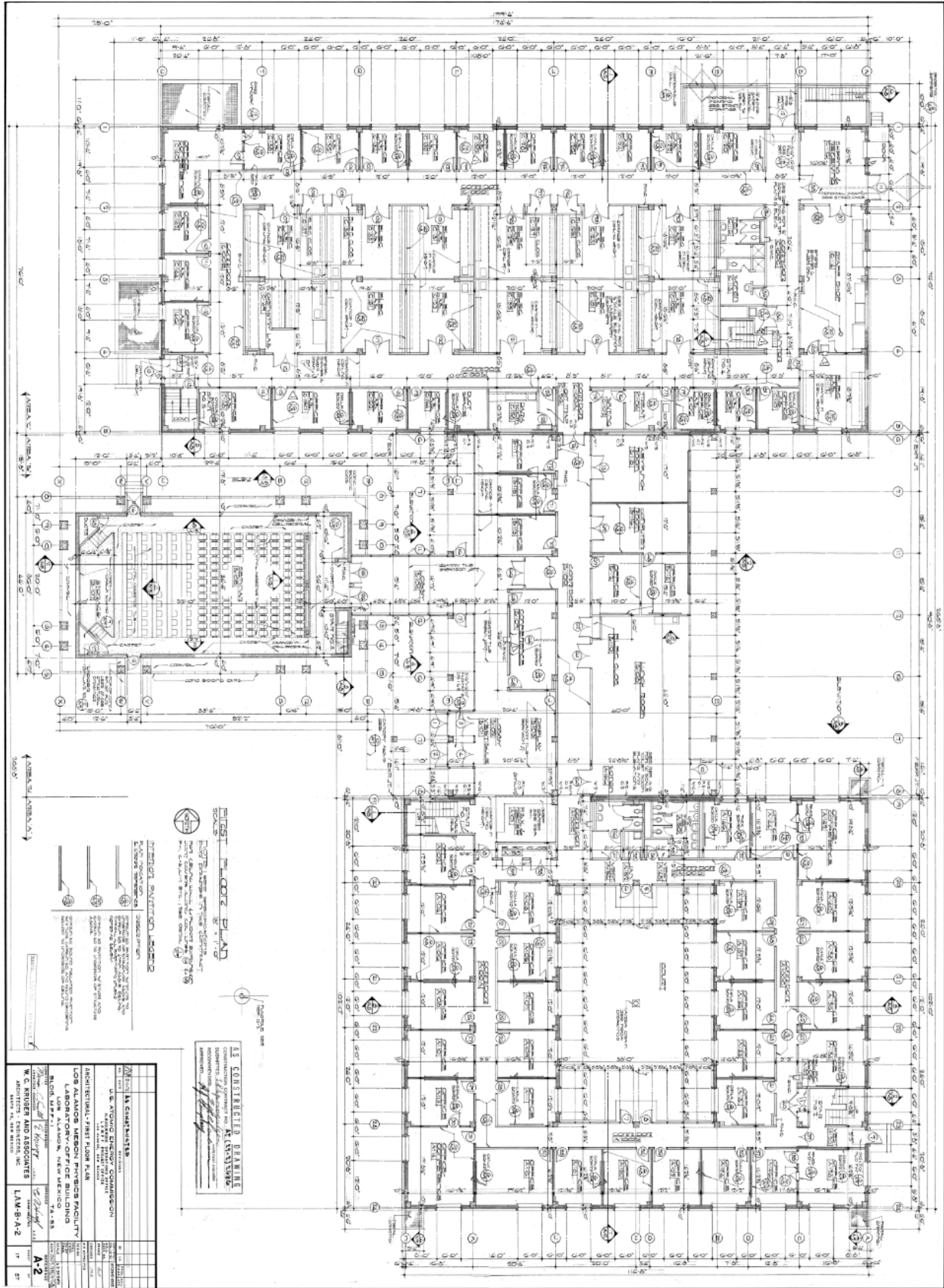
References

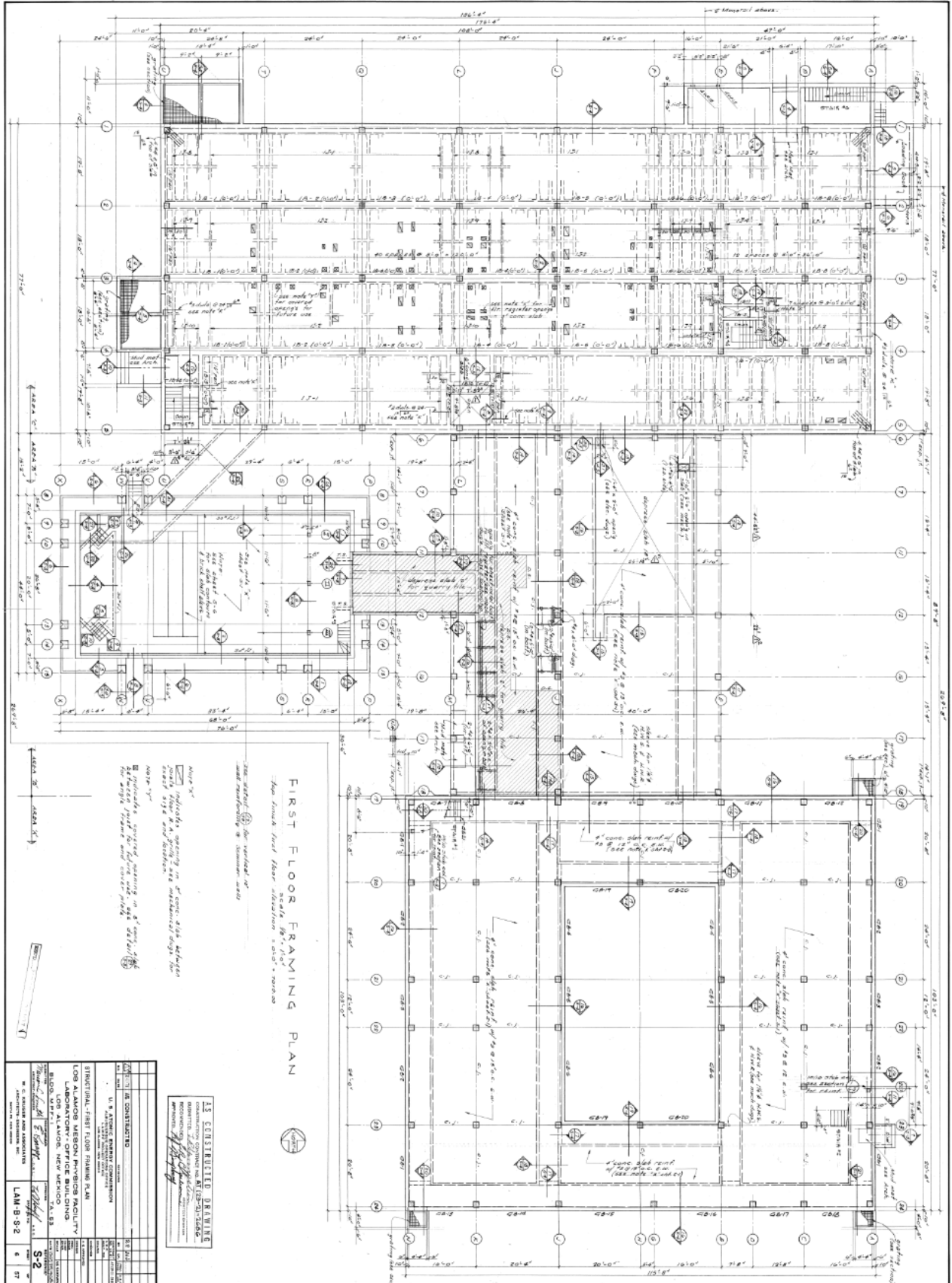
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12. **Ni, W.K. Chow and Xiaomin.** *Experimental Evaluation on Performance of Open Kitche Fire Duppresion Systems*. Hong Kong, China : Fire Safety Science-Draft Proceedings of the Eleventh International Symposium, 2014.

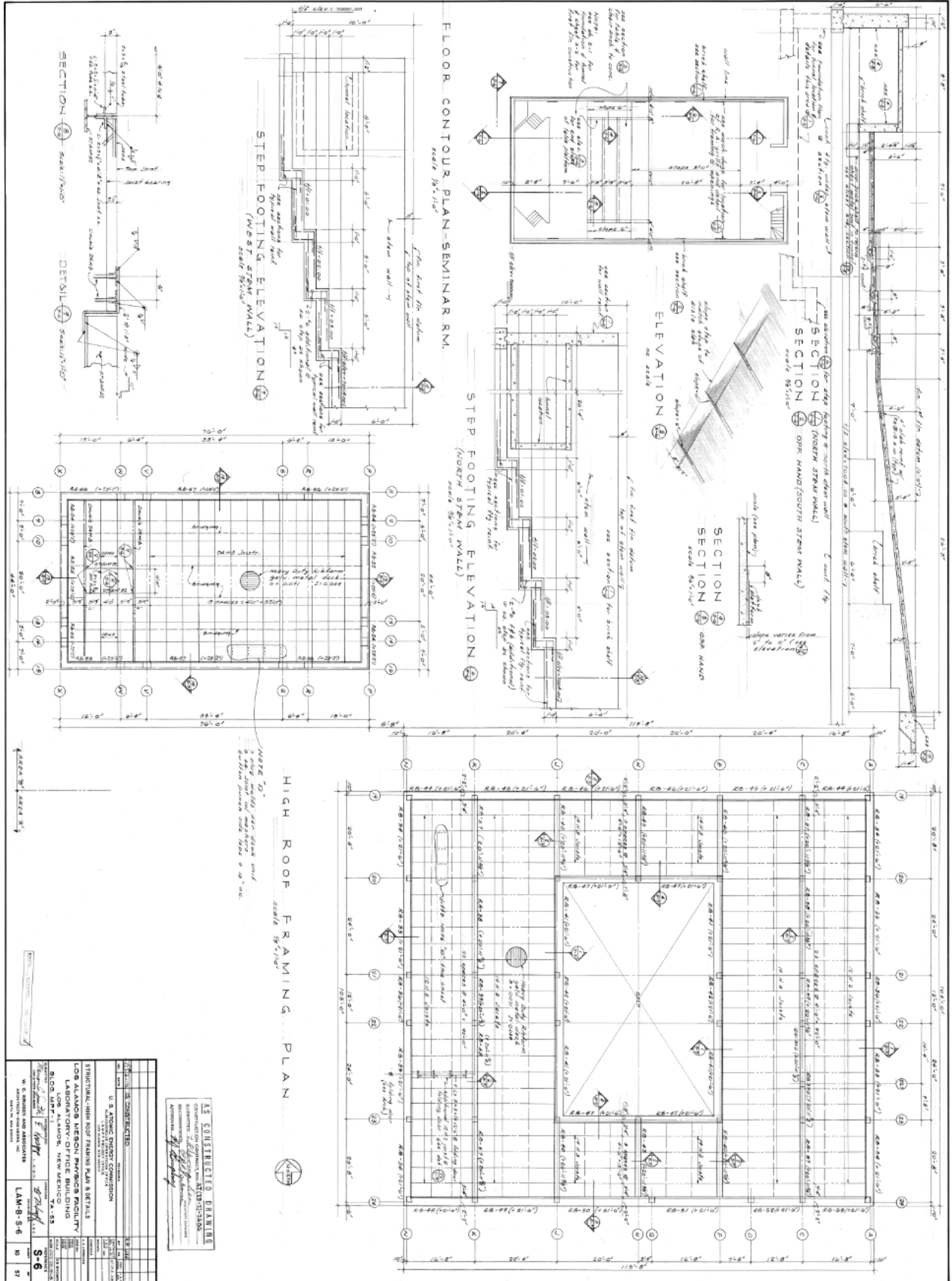
Drawings

(A complete drawing set could not be found)



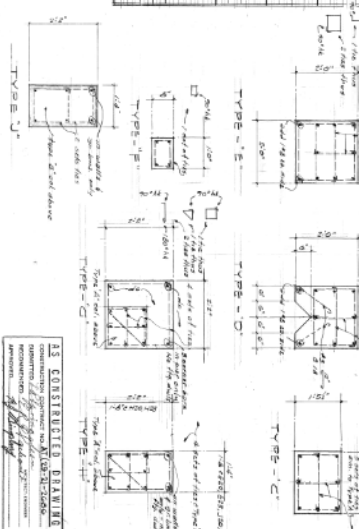






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PROJECT INFORMATION PROJECT: LOS ALAMOS PERSONNEL SERVICE LABORATORY OFFICE BUILDING LOCATION: LOS ALAMOS, NEW MEXICO 87545	
CLIENT: W. C. MURPHY AND ASSOCIATES	DATE: 3-6
PROJECT NO.: LAW-B-5-6	SCALE: 1/8" = 1'-0"

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33 CONCRETE DRAWING

CONCRETE REINFORCEMENT DRAWING

DATE: 10/15/15

BY: [Signature]

CHECKED: [Signature]

PROJECT: MASON PHYSICS BUILDING

LOCATION: 1000 NEW YORK AVENUE, NEW YORK, NY 10003

SCALE: AS SHOWN

REVISIONS:

NO.	DESCRIPTION
1	ISSUED FOR PERMIT
2	REVISED PER COMMENTS

LABORATORY: [Name]

DATE: [Date]

PROJECT: MASON PHYSICS BUILDING

LOCATION: 1000 NEW YORK AVENUE, NEW YORK, NY 10003

SCALE: AS SHOWN

REVISIONS:

NO.	DESCRIPTION
1	ISSUED FOR PERMIT
2	REVISED PER COMMENTS

LABORATORY: [Name]

DATE: [Date]

WALL SECTIONS & DETAILS

SECTION 1
 Typical wall section showing exterior finish, insulation, and structural framing.

SECTION 2
 Section through a window or door opening, showing framing, glazing, and weatherstripping.

SECTION 3
 Section through a roof structure, showing rafters, sheathing, and waterproofing.

SECTION 4
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 5
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 6
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 7
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 8
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 9
 Section through a wall and roof junction, showing structural support and insulation.

SECTION 10
 Section through a wall and roof junction, showing structural support and insulation.

ROOF DRAIN
 Detail of a roof drain assembly, showing the drain pan, membrane, and flashing.

CASCA DETAIL
 Detail of a casca (curtain wall) assembly, showing the glass panel, mullion, and support structure.

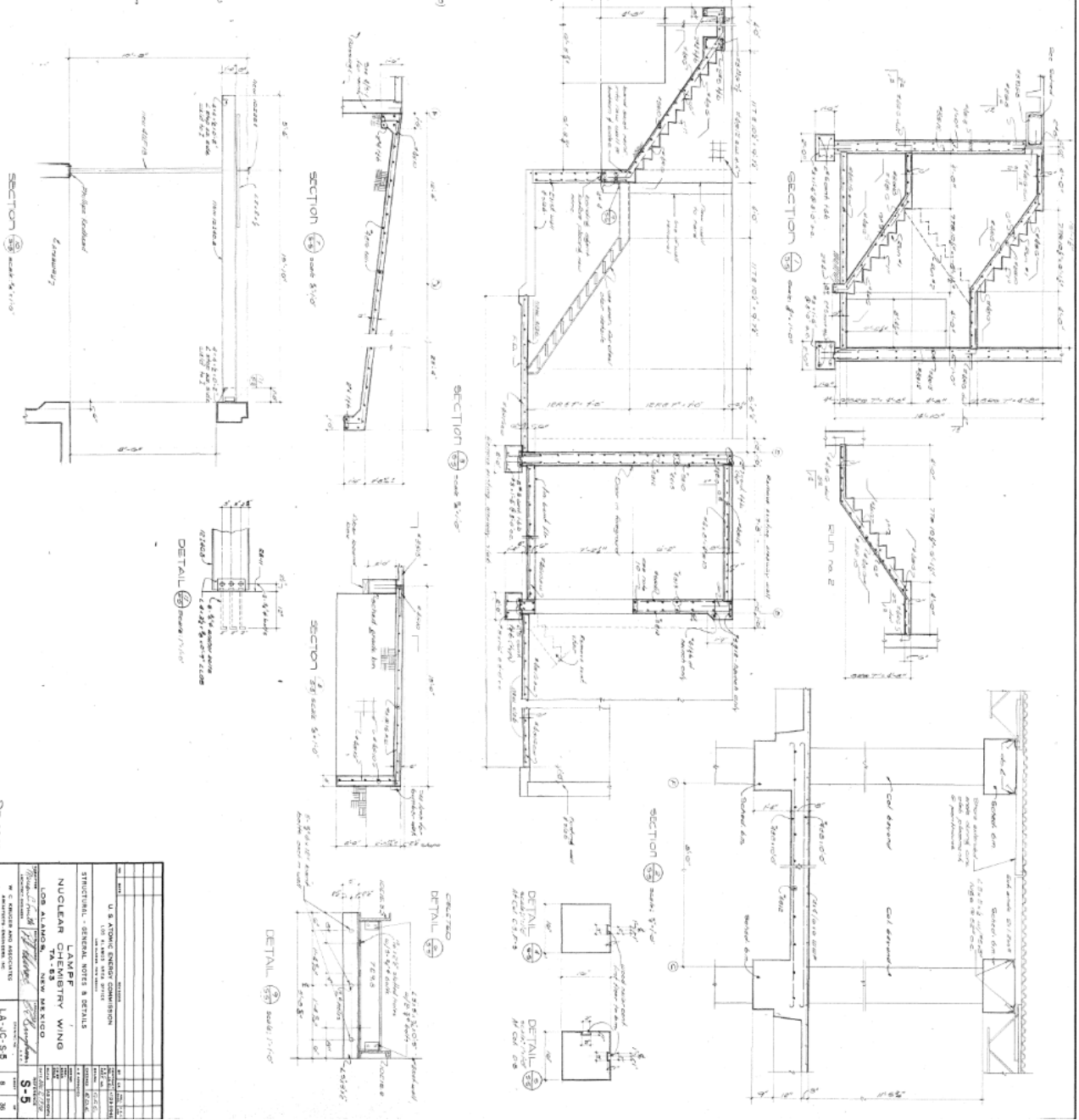
**1.5\"/>
 Detail of a 1.5\"/>**

PROJECT INFORMATION:

ARCHITECT	U. S. ARCHITECTURAL COMPANY
PROJECT	LOS ALAMOS NEURON PHYSICS FACILITY
DATE	NOVEMBER 2014
LOCATION	LOS ALAMOS, NEW MEXICO
SCALE	AS SHOWN
DATE	NOVEMBER 2014
BY	BRETT NOAKES
CHECKED BY	U. S. ARCHITECTURAL COMPANY
DATE	NOVEMBER 2014
PROJECT NO.	LA-NB-1.7
DATE	NOVEMBER 2014
BY	BRETT NOAKES
CHECKED BY	U. S. ARCHITECTURAL COMPANY
DATE	NOVEMBER 2014

GENERAL NOTES

1. General: Read entire set of drawings carefully for a full understanding of the project. All dimensions are in feet and inches unless otherwise noted. All work shall be in accordance with the applicable codes and standards.
2. MATERIALS
 - a. All materials shall be of the highest quality and shall be approved by the architect.
 - b. All materials shall be installed in accordance with the manufacturer's instructions.
 - c. All materials shall be installed in accordance with the applicable codes and standards.
3. CONSTRUCTION
 - a. All construction shall be in accordance with the applicable codes and standards.
 - b. All construction shall be installed in accordance with the manufacturer's instructions.
 - c. All construction shall be installed in accordance with the applicable codes and standards.
4. FINISHES
 - a. All finishes shall be in accordance with the applicable codes and standards.
 - b. All finishes shall be installed in accordance with the manufacturer's instructions.
 - c. All finishes shall be installed in accordance with the applicable codes and standards.
5. ELECTRICAL
 - a. All electrical work shall be in accordance with the applicable codes and standards.
 - b. All electrical work shall be installed in accordance with the manufacturer's instructions.
 - c. All electrical work shall be installed in accordance with the applicable codes and standards.
6. MECHANICAL
 - a. All mechanical work shall be in accordance with the applicable codes and standards.
 - b. All mechanical work shall be installed in accordance with the manufacturer's instructions.
 - c. All mechanical work shall be installed in accordance with the applicable codes and standards.
7. PLUMBING
 - a. All plumbing work shall be in accordance with the applicable codes and standards.
 - b. All plumbing work shall be installed in accordance with the manufacturer's instructions.
 - c. All plumbing work shall be installed in accordance with the applicable codes and standards.
8. PAINTS AND COATINGS
 - a. All paints and coatings shall be in accordance with the applicable codes and standards.
 - b. All paints and coatings shall be installed in accordance with the manufacturer's instructions.
 - c. All paints and coatings shall be installed in accordance with the applicable codes and standards.
9. SCHEDULES
 - a. All schedules shall be in accordance with the applicable codes and standards.
 - b. All schedules shall be installed in accordance with the manufacturer's instructions.
 - c. All schedules shall be installed in accordance with the applicable codes and standards.

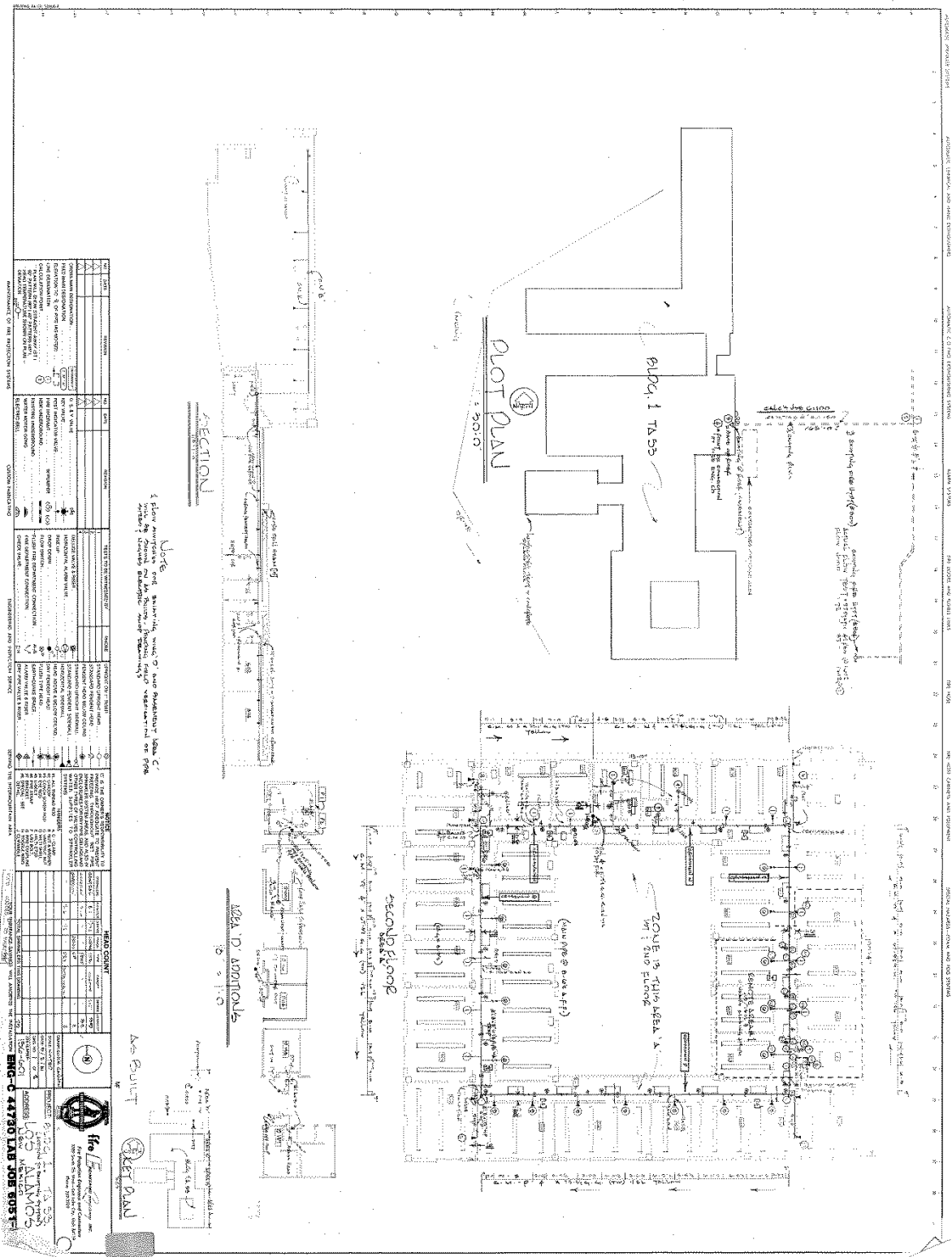


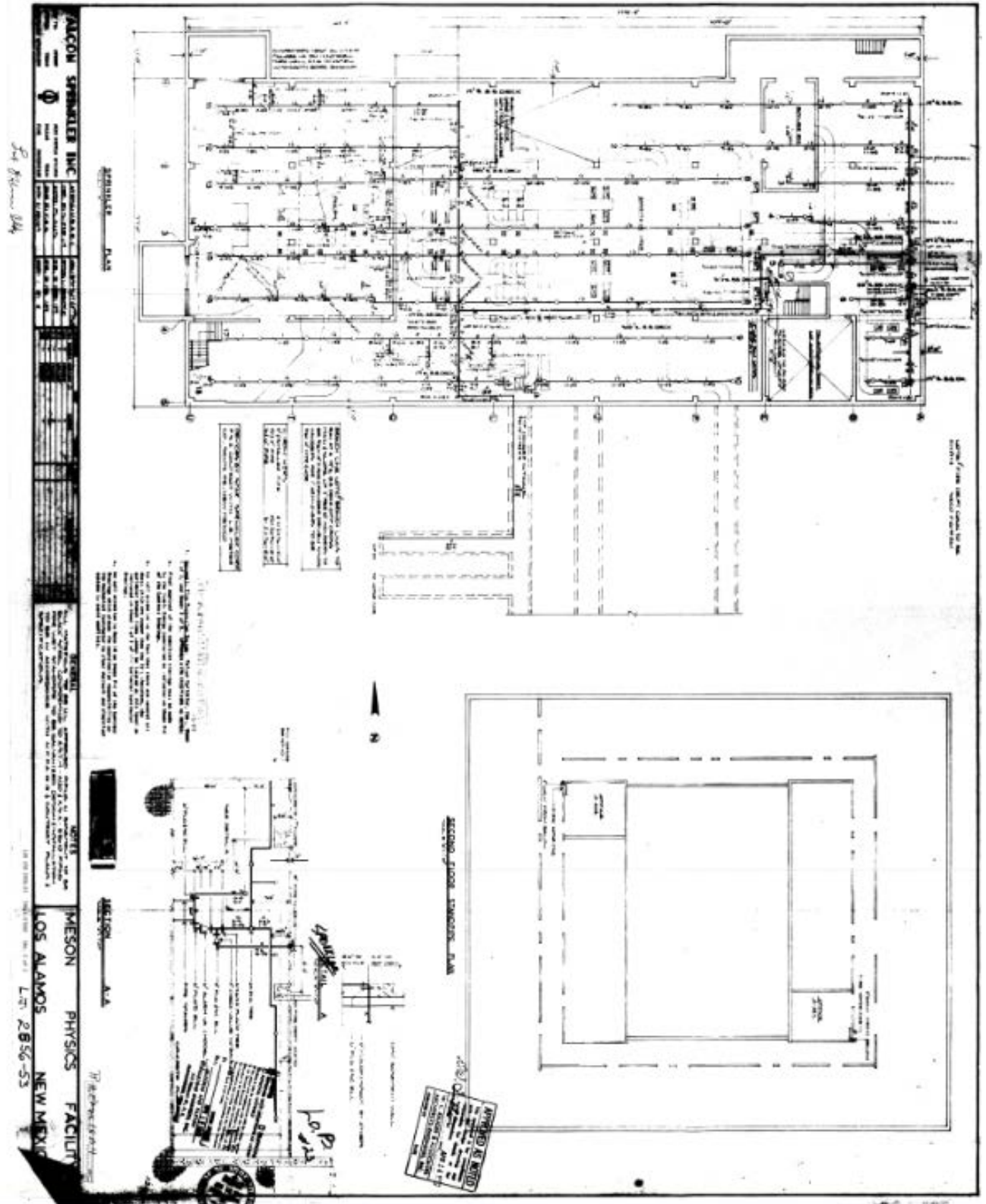
U.S. & TERRAZZO ENGINEERING ARCHITECTS
STRUCTURAL - SERVICE NOTES & DETAILS
NUCLEAR CHEMISTRY WING
LOS ALAMOS, NEW MEXICO
S-5

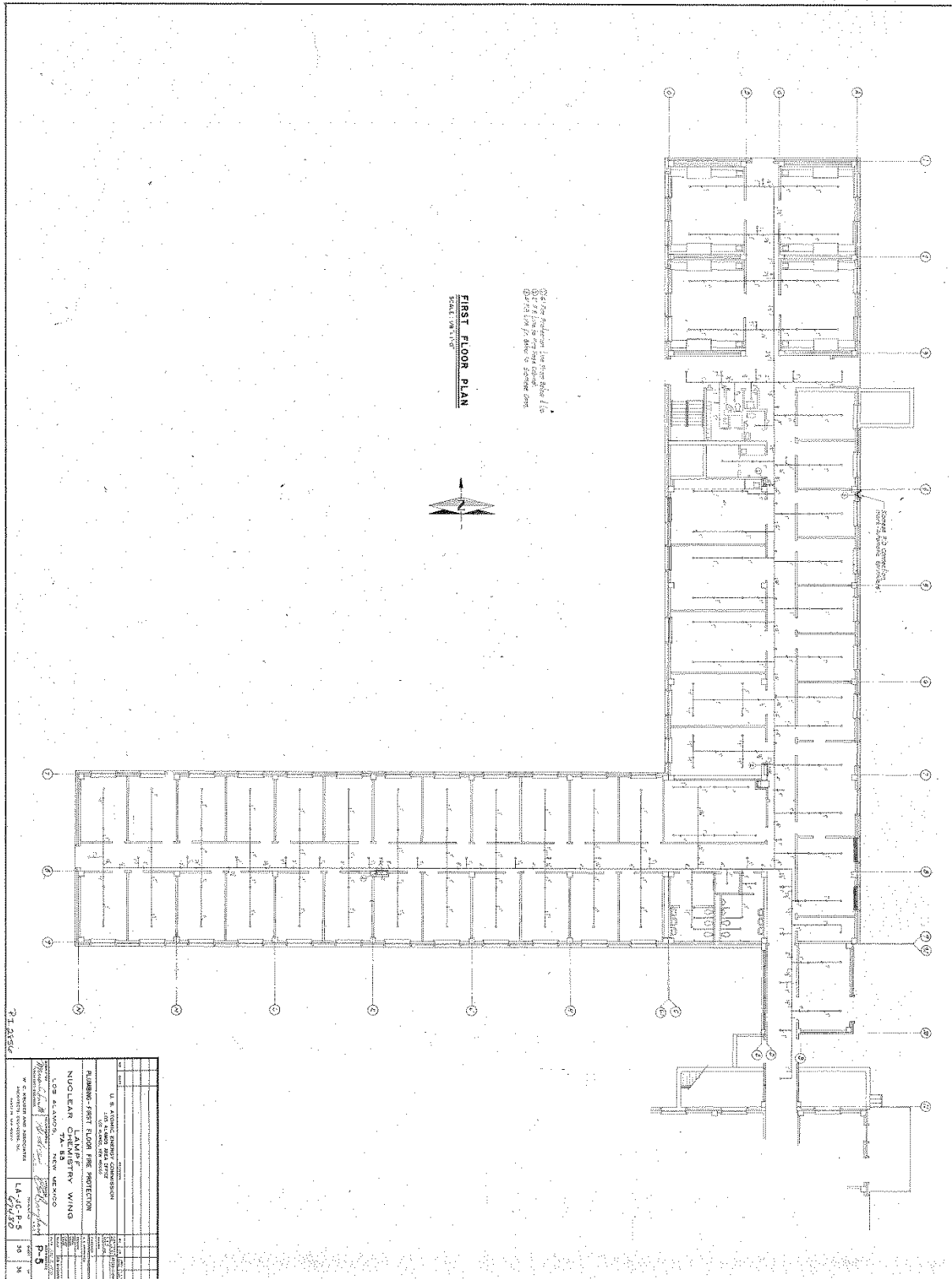
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2	11/10/14	ISSUED FOR CONSTRUCTION
3	01/15/15	ISSUED FOR CONSTRUCTION
4	03/10/15	ISSUED FOR CONSTRUCTION
5	05/10/15	ISSUED FOR CONSTRUCTION
6	07/10/15	ISSUED FOR CONSTRUCTION
7	09/10/15	ISSUED FOR CONSTRUCTION
8	11/10/15	ISSUED FOR CONSTRUCTION
9	01/10/16	ISSUED FOR CONSTRUCTION
10	03/10/16	ISSUED FOR CONSTRUCTION
11	05/10/16	ISSUED FOR CONSTRUCTION
12	07/10/16	ISSUED FOR CONSTRUCTION
13	09/10/16	ISSUED FOR CONSTRUCTION
14	11/10/16	ISSUED FOR CONSTRUCTION
15	01/10/17	ISSUED FOR CONSTRUCTION
16	03/10/17	ISSUED FOR CONSTRUCTION
17	05/10/17	ISSUED FOR CONSTRUCTION
18	07/10/17	ISSUED FOR CONSTRUCTION
19	09/10/17	ISSUED FOR CONSTRUCTION
20	11/10/17	ISSUED FOR CONSTRUCTION

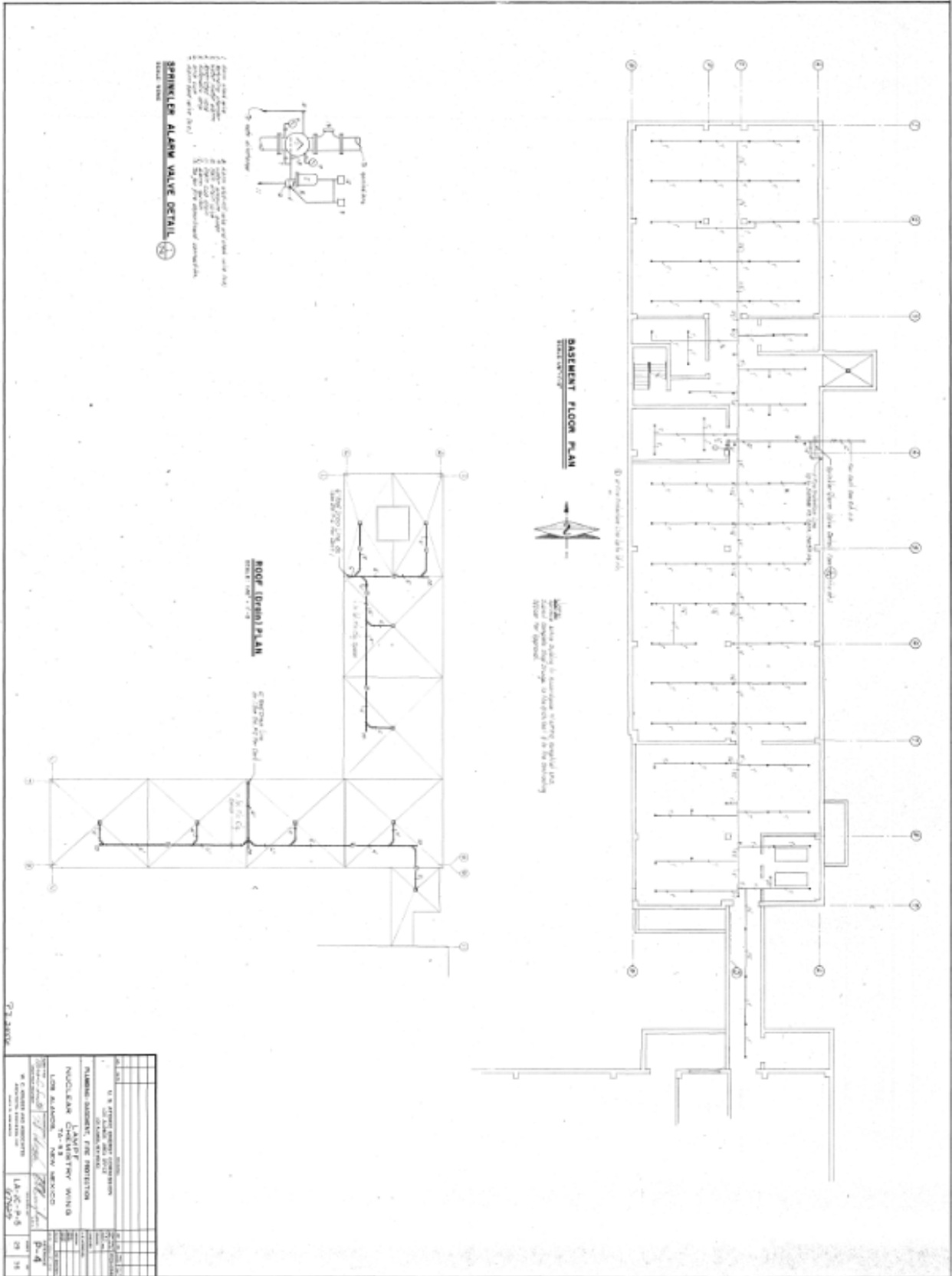
M. C. KERRICK AND ASSOCIATES
LA 100 S 8
2708

Suppression System Drawings









Fire Alarm Drawings

PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT

BLDG 01 TA-53

PROJECT DESIGN DATA

OWNER AND DESIGNER TO ADVISE THE ARCHITECT OF ANY CHANGES TO THE PROJECT DESIGN.

LIST OF DRAWINGS

NO.	DESCRIPTION	DATE	BY	CHKD.
01	PROJECT DESIGN DATA	06/15/15	BN	BN
02	PROTECTION TITLE SHEET & LIST OF DRAWINGS	06/15/15	BN	BN
03	PROTECTION SCHEDULES & NOTES	06/15/15	BN	BN
04	PROTECTION SITE PLAN	06/15/15	BN	BN
05	PROTECTION GENERAL NOTES	06/15/15	BN	BN
06	PROTECTION FIRST FLOOR PLAN	06/15/15	BN	BN
07	PROTECTION SECOND FLOOR PLAN	06/15/15	BN	BN
08	PROTECTION THIRD FLOOR PLAN	06/15/15	BN	BN
09	PROTECTION MECHANICAL ROOM PLAN	06/15/15	BN	BN
10	PROTECTION ELECTRICAL ROOM PLAN	06/15/15	BN	BN
11	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
12	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
13	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
14	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
15	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
16	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
17	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
18	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
19	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
20	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
21	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
22	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
23	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
24	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN



LOCATION PLAN
SCALE: AS SHOWN

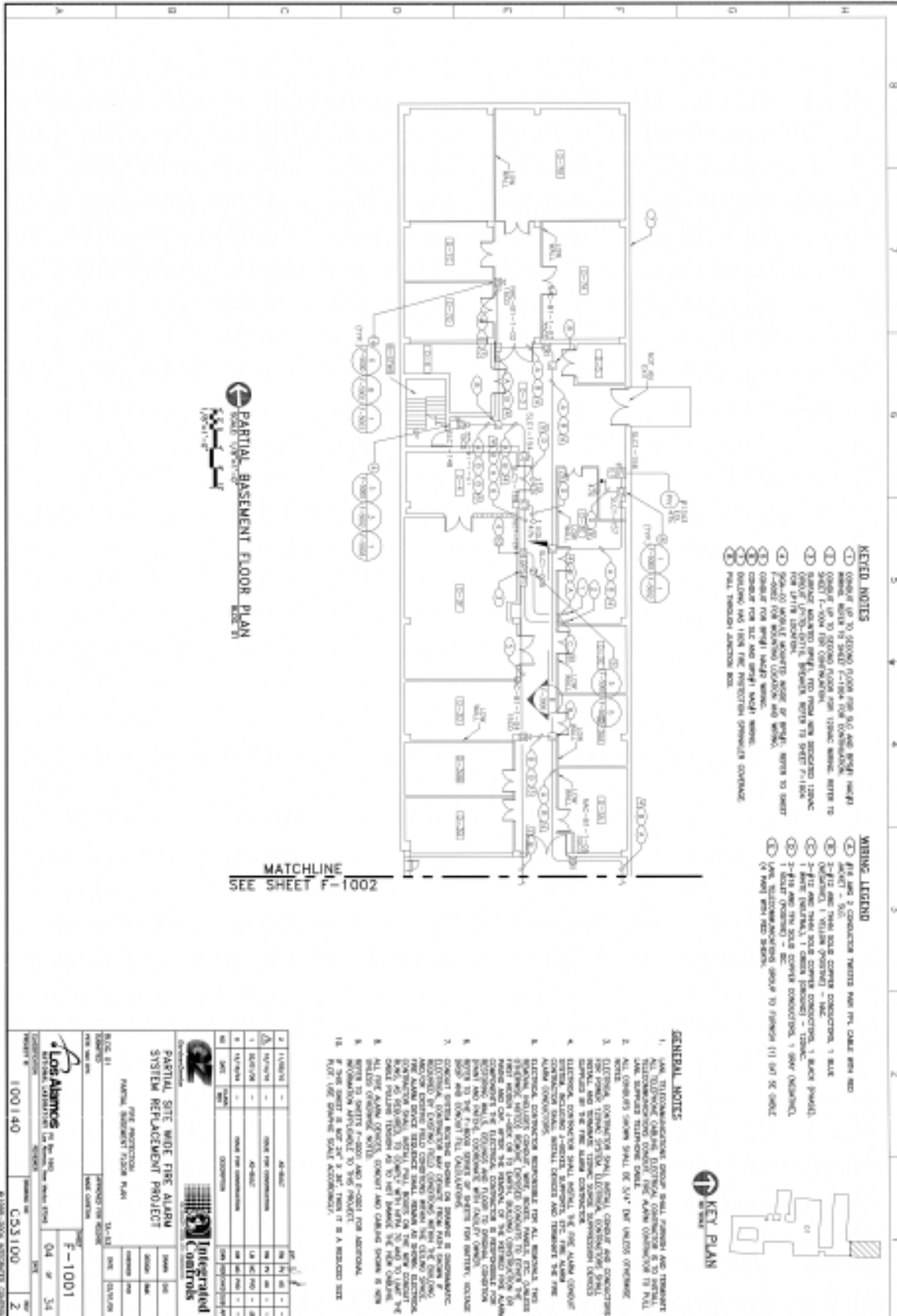
THE APPROVED COLOR IS ALWAYS APPLIED AFTER A SHING NAME, FINISHES, PRODUCTS OR COLORS HAVE BEEN DETERMINED AND APPROVED BY THE ARCHITECT. THE ARCHITECT SHALL BE RESPONSIBLE FOR THE PROVISION OF THE ONLY EXISTING & WORKING "AS SHOWN" SUBSTITUTIONS TO BE USED. THE ARCHITECT SHALL BE RESPONSIBLE FOR THE PROVISION OF THE ONLY EXISTING & WORKING "AS SHOWN" SUBSTITUTIONS TO BE USED.

NO.	DESCRIPTION	DATE	BY	CHKD.
1	PROTECTION TITLE SHEET & LIST OF DRAWINGS	06/15/15	BN	BN
2	PROTECTION SCHEDULES & NOTES	06/15/15	BN	BN
3	PROTECTION SITE PLAN	06/15/15	BN	BN
4	PROTECTION GENERAL NOTES	06/15/15	BN	BN
5	PROTECTION FIRST FLOOR PLAN	06/15/15	BN	BN
6	PROTECTION SECOND FLOOR PLAN	06/15/15	BN	BN
7	PROTECTION THIRD FLOOR PLAN	06/15/15	BN	BN
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9	PROTECTION ELECTRICAL ROOM PLAN	06/15/15	BN	BN
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12	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
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16	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
17	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
18	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
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20	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
21	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
22	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
23	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN
24	PROTECTION BATTERY & VOLTAGE DROP CALCULATIONS	06/15/15	BN	BN

Los Alamos National Laboratory
100140
C53100
2

Integrated Controls

PROJECT NO: 100140
SHEET NO: 01 OF 34
DATE: 06/15/15



- KEYED NOTES**
- 1. CONDUIT RUN TO SECOND FLOOR FOR RISE AND RISE HEIGHT
 - 2. CONDUIT UP TO SECOND FLOOR FOR 120VAC SERVICE, REFER TO SHEET F-1004 FOR CONNECTIONS
 - 3. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 4. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 5. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 6. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 7. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 8. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 9. RISE AND RISE HEIGHT FOR SECOND FLOOR
 - 10. RISE AND RISE HEIGHT FOR SECOND FLOOR

- MARKING LEGEND**
- 1. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 2. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 3. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 4. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 5. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 6. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 7. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 8. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 9. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE
 - 10. 1/2" DIA. CONDUCTOR TRACES FOR 120VAC SERVICE

PARTIAL BASEMENT FLOOR PLAN

MATCHLINE
SEE SHEET F-1002

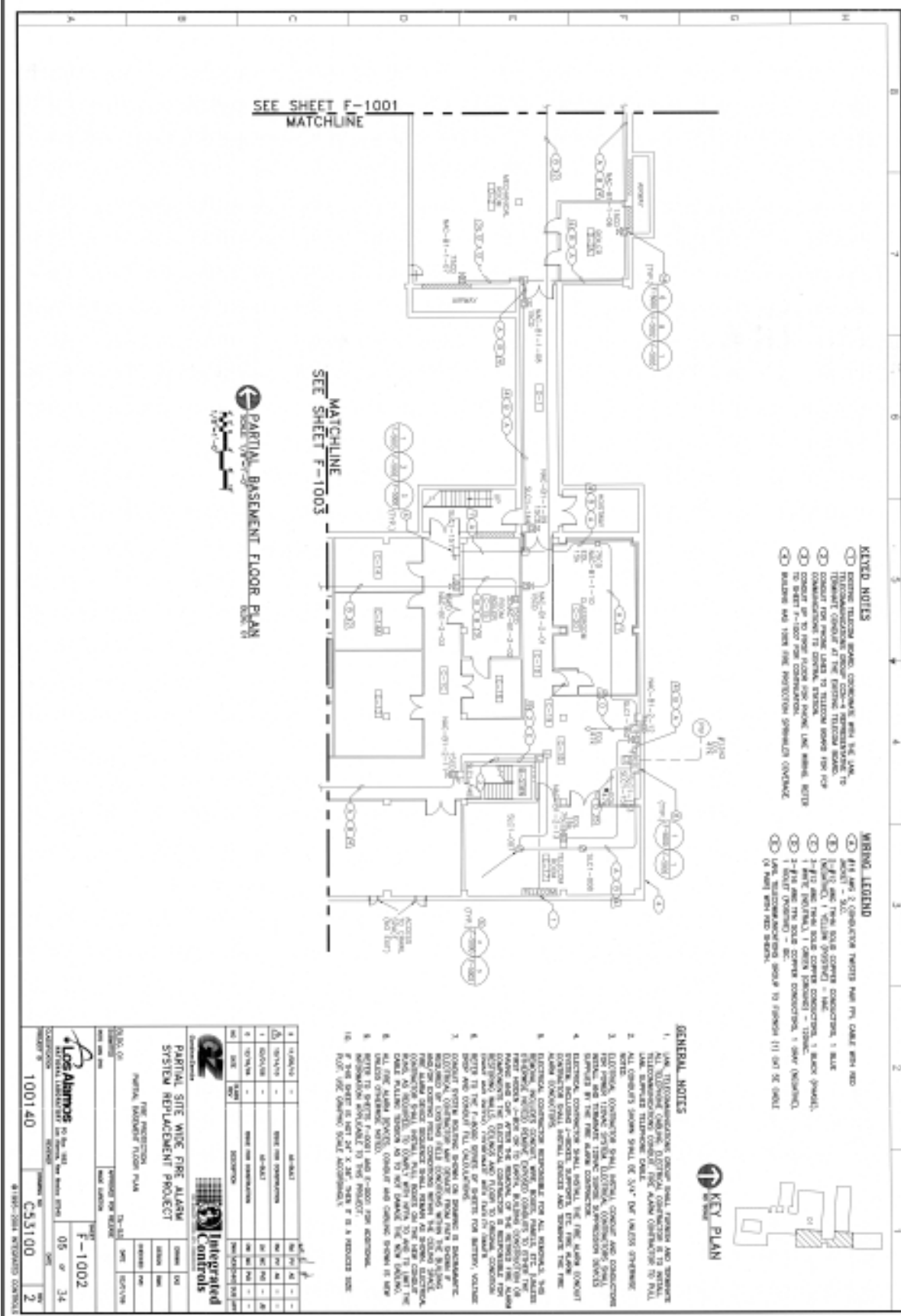


GENERAL NOTES

1. ALL UTILITIES SHOWN ARE TO BE MAINTAINED AND PROTECTED. ALL UTILITIES SHALL BE DEEPER THAN SHOWN UNLESS OTHERWISE NOTED. ALL UTILITIES SHALL BE MAINTAINED AND PROTECTED.
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17. ALL UTILITIES SHALL BE MAINTAINED AND PROTECTED.
18. ALL UTILITIES SHALL BE MAINTAINED AND PROTECTED.

NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL
1	CONDUIT	100	FT	1.50	150.00
2	TRAY	50	FT	2.00	100.00
3	WIRE	1000	FT	0.10	100.00
4	BOX	10	EA	10.00	100.00
5	VALVE	5	EA	20.00	100.00
6	PIPE	100	FT	1.00	100.00
7	FLANGE	10	EA	10.00	100.00
8	WELD	100	HR	1.00	100.00
9	PAINT	100	GA	1.00	100.00
10	LABOR	1000	HR	1.00	1000.00
11	MATERIAL	1000	EA	1.00	1000.00
12	PERMIT	1	EA	100.00	100.00
13	INSURANCE	1	EA	100.00	100.00
14	TESTING	1	EA	100.00	100.00
15	TRAINING	1	EA	100.00	100.00
16	CONSTRUCTION	1	EA	100.00	100.00
17	OPERATION	1	EA	100.00	100.00
18	MAINTENANCE	1	EA	100.00	100.00
19	REPAIR	1	EA	100.00	100.00
20	REPLACE	1	EA	100.00	100.00
21	REMOVE	1	EA	100.00	100.00
22	INSTALL	1	EA	100.00	100.00
23	REMOVE	1	EA	100.00	100.00
24	INSTALL	1	EA	100.00	100.00
25	REMOVE	1	EA	100.00	100.00
26	INSTALL	1	EA	100.00	100.00
27	REMOVE	1	EA	100.00	100.00
28	INSTALL	1	EA	100.00	100.00
29	REMOVE	1	EA	100.00	100.00
30	INSTALL	1	EA	100.00	100.00

Log Alliance
1001 440
033100
2



- KEYED NOTES**
- 1 EXTING TITANIUM BOND, CONDUIT AND 1/2" I.M.C. TO TITANIUM CONDUIT AT THE EXTING TITANIUM BOND.
 - 2 CONDUIT FOR PULL LINES TO TITANIUM BOND FOR THE CONNECTION TO CONTROL STATION.
 - 3 CONDUIT FOR 1" PULL FROM THE PULLING LINE WITH NOTES TO THE CONTRACTOR.
 - 4 BONDING AND TIGHTEN THE PROTECTION SHEATHS CONDUIT.

- WIRING LEGEND**
- 1 1/2" I.M.C. CONDUIT WITH PULL CHASE WITH ADS
 - 2 1/2" I.M.C. CONDUIT WITH ADS
 - 3 1/2" I.M.C. CONDUIT WITH ADS
 - 4 1/2" I.M.C. CONDUIT WITH ADS
 - 5 1/2" I.M.C. CONDUIT WITH ADS
 - 6 1/2" I.M.C. CONDUIT WITH ADS
 - 7 1/2" I.M.C. CONDUIT WITH ADS
 - 8 1/2" I.M.C. CONDUIT WITH ADS
 - 9 1/2" I.M.C. CONDUIT WITH ADS
 - 10 1/2" I.M.C. CONDUIT WITH ADS

SEE SHEET F-1001
MATCHLINE

SEE SHEET F-1003
MATCHLINE

PARTIAL BASEMENT FLOOR PLAN

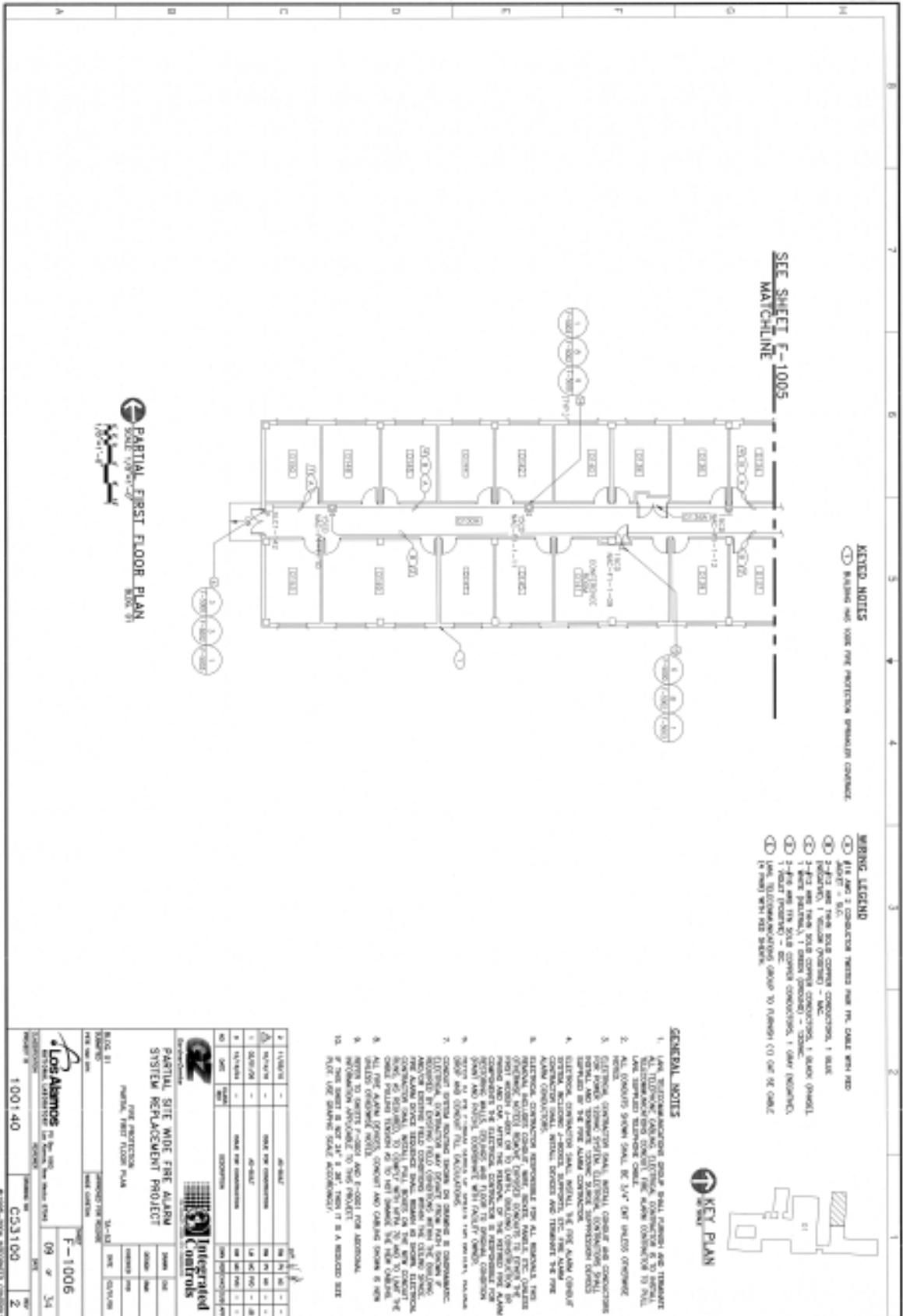


KEY PLAN

- GENERAL NOTES**
1. I.M.C. CONDUIT SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE AND SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE AND SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE.
 2. ALL CONDUITS SHALL BE 1/2" I.M.C. UNLESS OTHERWISE NOTED.
 3. CONDUITS SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE AND SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE.
 4. CONDUITS SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE AND SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE.
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 14. CONDUITS SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE AND SHALL BE INSTALLED IN ACCORDANCE WITH THE I.M.C. CODE.

NO.	SYMBOL	DESCRIPTION	QUANTITY	UNIT
1	□	EXTING TITANIUM BOND	1	FT
2	○	CONDUIT FOR PULL LINES	1	FT
3	○	CONDUIT FOR PULL LINES	1	FT
4	○	CONDUIT FOR PULL LINES	1	FT
5	○	CONDUIT FOR PULL LINES	1	FT
6	○	CONDUIT FOR PULL LINES	1	FT
7	○	CONDUIT FOR PULL LINES	1	FT
8	○	CONDUIT FOR PULL LINES	1	FT
9	○	CONDUIT FOR PULL LINES	1	FT
10	○	CONDUIT FOR PULL LINES	1	FT
11	○	CONDUIT FOR PULL LINES	1	FT
12	○	CONDUIT FOR PULL LINES	1	FT
13	○	CONDUIT FOR PULL LINES	1	FT
14	○	CONDUIT FOR PULL LINES	1	FT

Los Alamitos
FIRE PROTECTION
PARTIAL BASEMENT FLOOR PLAN
F-1002
05 of 34
C53100
2



KEYED NOTES
 1. RALING AND SOLE FIRE PROTECTION SYMBOL CHANGE.

WIRING LEGEND
 1. 1/2" x 1/2" CONDUCTOR TRACES FROM THE PANEL WITH RED INSULATION.
 2. 2-#12 and TRIN SOLID COPPER CONDUCTORS, 1 BULKY (SIGNAL), 1 EARTH (GROUND) - WAC.
 3. 2-#12 and TRIN SOLID COPPER CONDUCTORS, 1 BULKY (SIGNAL), 1 EARTH (GROUND) - WAC.
 4. 2-#12 and TRIN SOLID COPPER CONDUCTORS, 1 BULKY (SIGNAL), 1 EARTH (GROUND) - WAC.
 5. 1/2" x 1/2" CONDUCTOR TRACES FROM THE PANEL WITH RED INSULATION.
 6. 1/2" x 1/2" CONDUCTOR TRACES FROM THE PANEL WITH RED INSULATION.



GENERAL NOTES

1. ALL WIRING AND CONNECTIONS SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARM CODE (NFPA 72).
2. ALL CONDUITS SHALL BE 1/2" OR 3/4" O.D. RIGID CONDUIT.
3. ALL WIRING SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARM CODE (NFPA 72).
4. ALL WIRING SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARM CODE (NFPA 72).
5. ALL WIRING SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARM CODE (NFPA 72).
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13. ALL WIRING SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE NATIONAL FIRE ALARM CODE (NFPA 72).

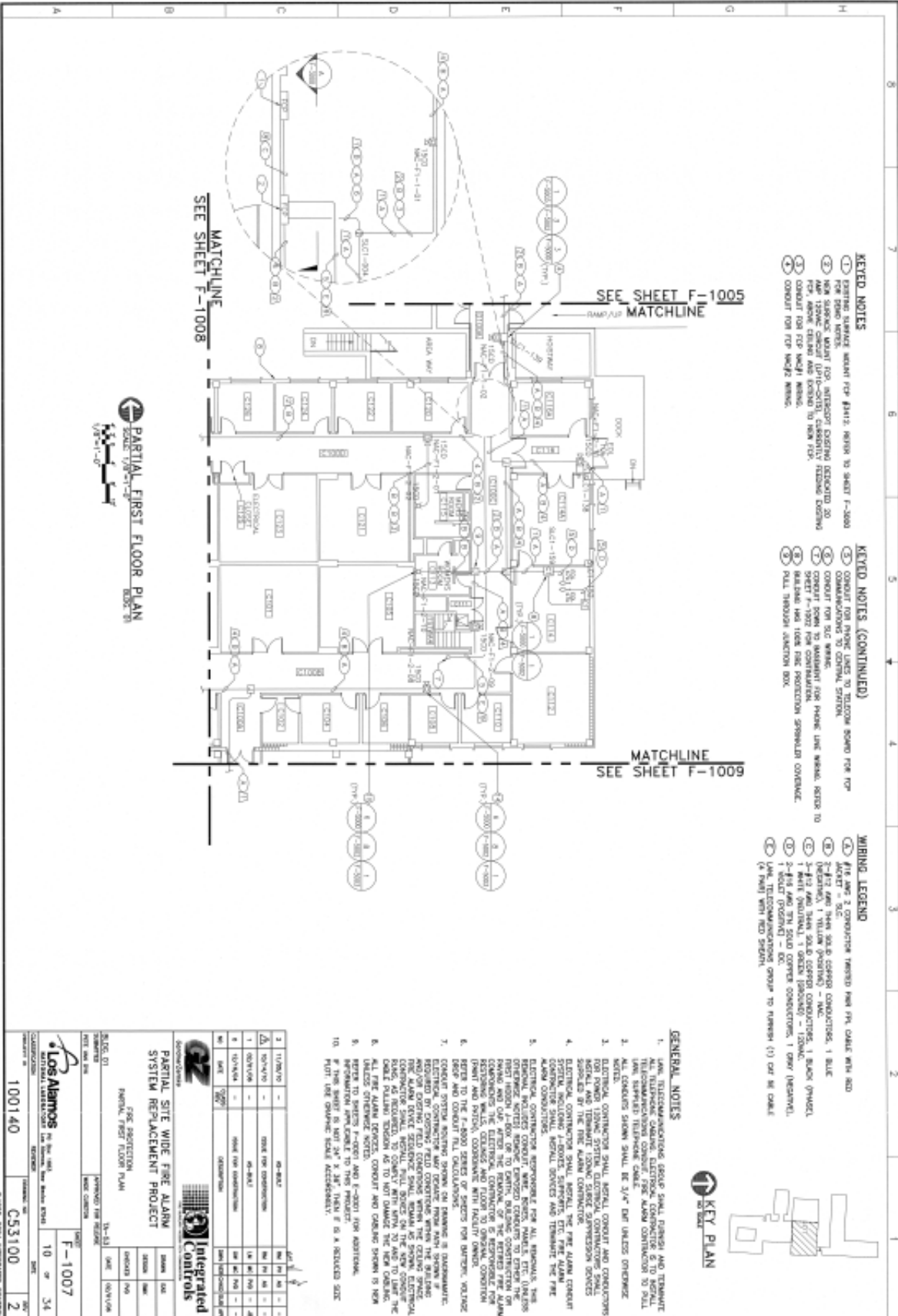
NO.	DESCRIPTION	QTY	UNIT	PRICE	TOTAL
1	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
2	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
3	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
4	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
5	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
6	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
7	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
8	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
9	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
10	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
11	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
12	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
13	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
14	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
15	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
16	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
17	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
18	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00
19	1/2" x 1/2" CONDUCTOR	100	FT	0.10	10.00
20	2-#12 COPPER CONDUCTOR	100	FT	0.20	20.00

Integrated Controls

PASTRAL SITE MIRE FIRE ALARM SYSTEM REPLACEMENT PROJECT
 PARTIAL FIRST FLOOR PLAN

NO. 01
 DATE: 09/09/15
 DRAWN BY: [Name]
 CHECKED BY: [Name]

100140
 09 of 34
 03/31/09
 2



- KEYED NOTES**
- 1 EXISTING SURFACE MOUNT FCP 8412; REFER TO SHEET F-1008
 - 2 FIVE (5) NEW NOTES
 - 3 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 4 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 5 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 6 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 7 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 8 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 9 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008
 - 10 NEW 120VAC MOUNT FCP 4000; REFER TO SHEET F-1008

- KEYED NOTES (CONTINUED)**
- 11 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 12 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 13 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 14 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 15 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 16 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 17 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 18 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 19 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP
 - 20 CONSULT FOR WIRE LUNCH TO FOLLOW BOARD FOR FCP

- WIRING LEGEND**
- 1 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 2 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 3 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 4 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 5 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 6 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 7 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 8 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 9 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80
 - 10 #16 AWG 2 CONDUCTOR TWISTED PAIR P/N CABLE WITH 80

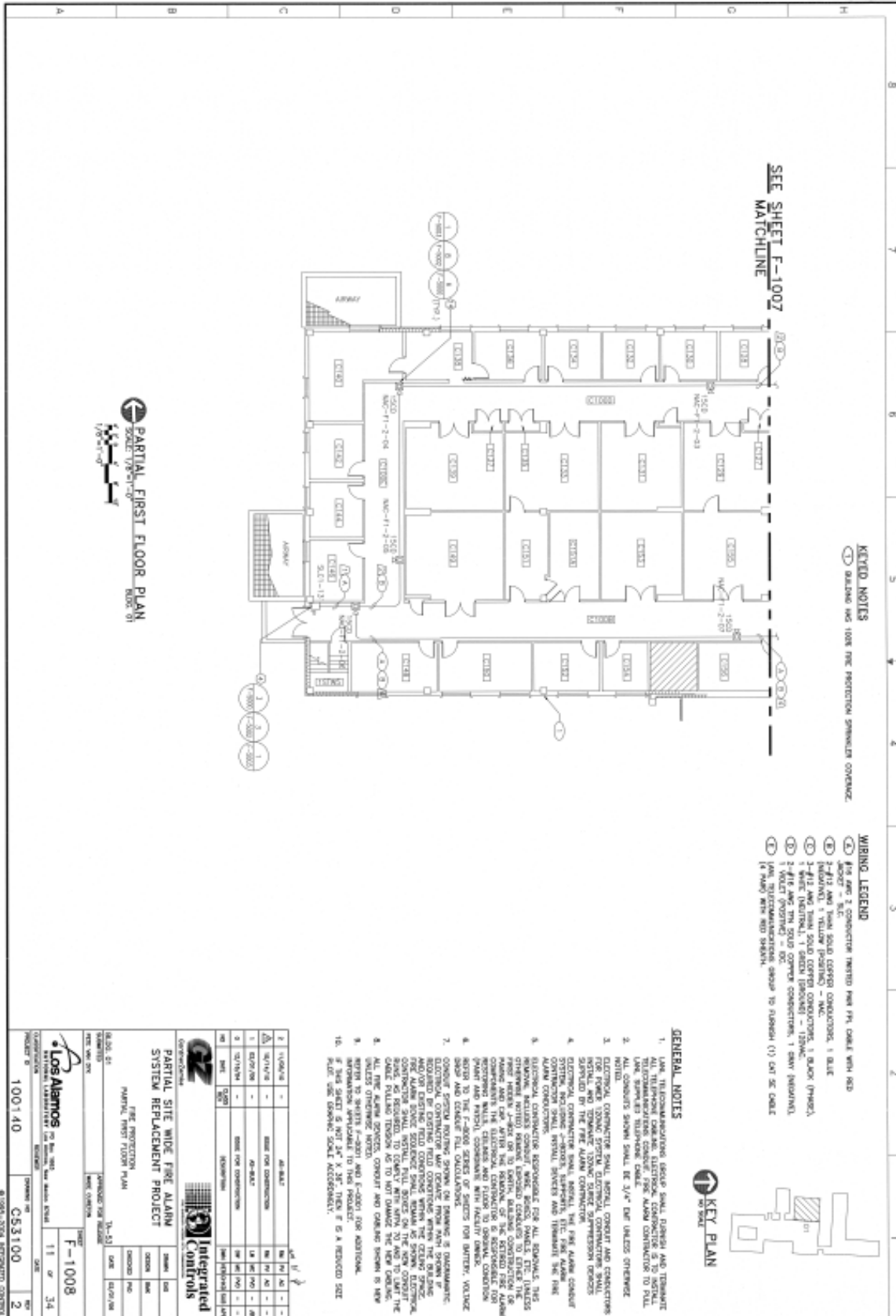
GENERAL NOTES

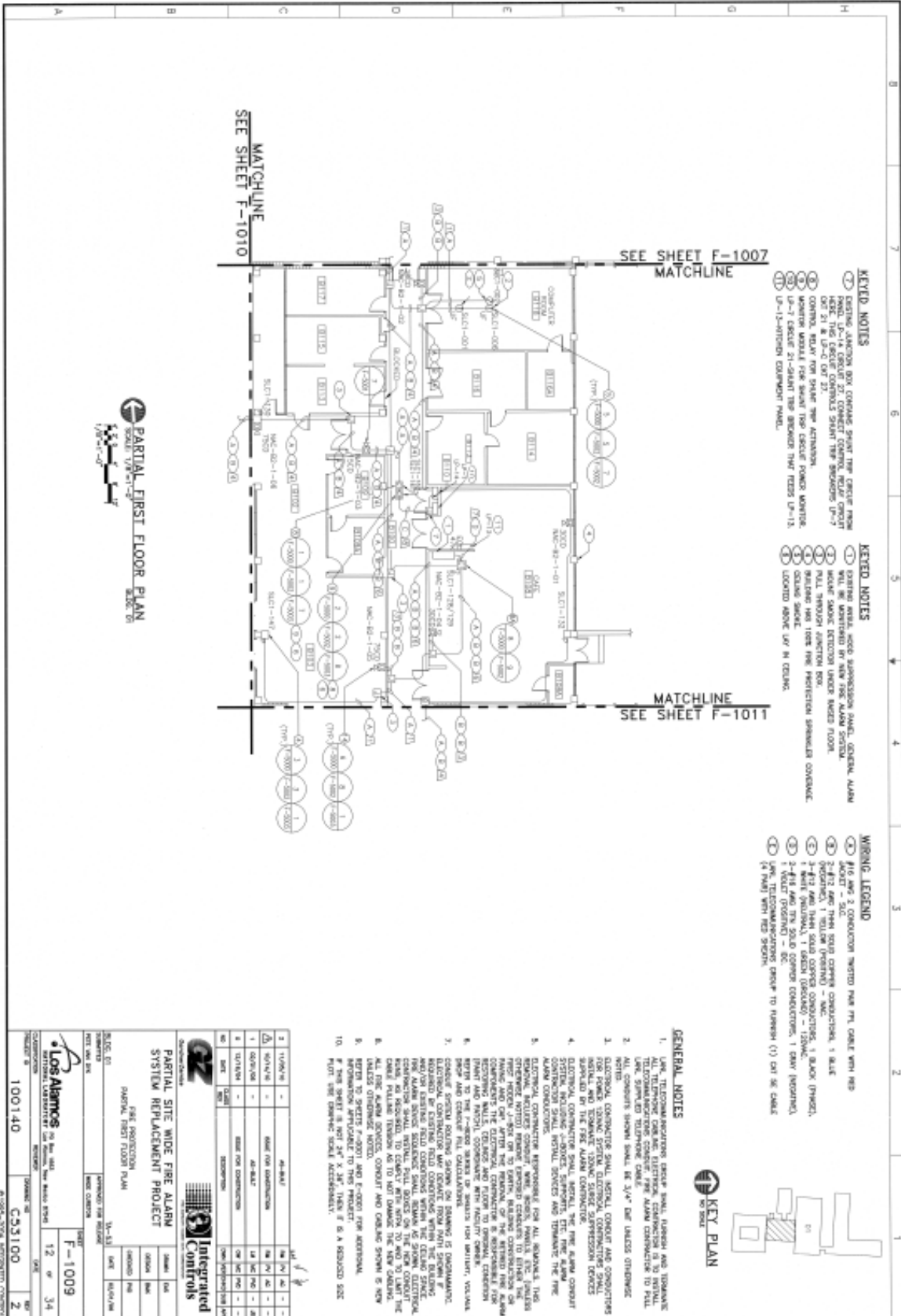
1. LVA, TELECOMMUNICATIONS (EQUIP SHALL FINISH AND TERMINATE ALL TELEPHONE CABLES, ELECTRIC CONDUCTOR & TO METALLIC LINES, SHIELDS TELEPHONE CABLES)
2. ALL CONDUITS SHOWN SHALL BE 1/2" DIA UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
4. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
5. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
6. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
7. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
8. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
9. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.
10. ELECTRICAL CONTRACTOR SHALL INSTALL CONDUIT AND CONDUITORS FOR DOWN 120VAC SYSTEM, ELECTRICAL CONDUCTORS SHALL BE 12 AWG UNLESS OTHERWISE NOTED.

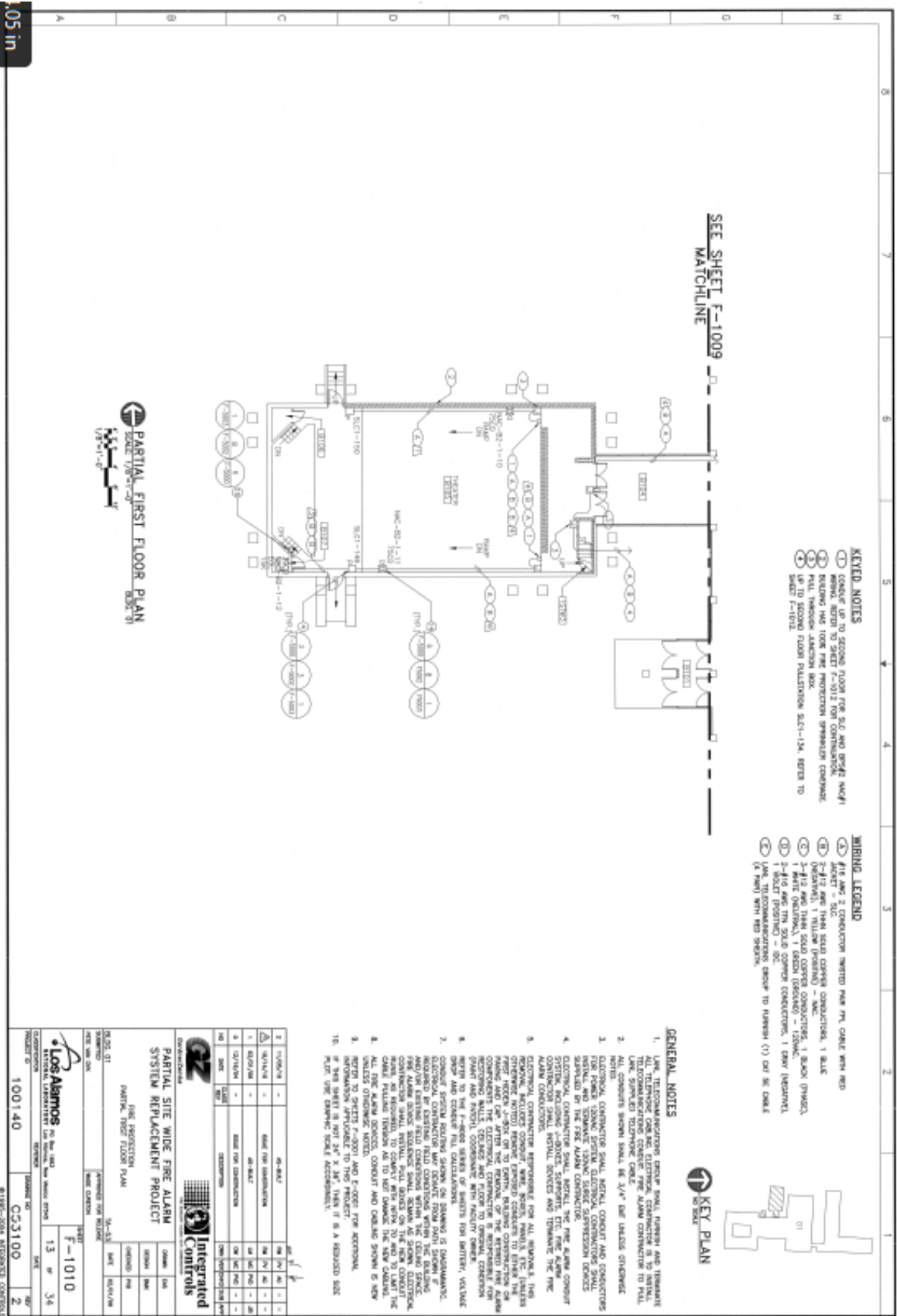


NO	DATE	DESCRIPTION	BY	CHECKED
1	10/10/15	ISSUE FOR PERMITTING	BN	BN
2	10/10/15	ISSUE FOR PERMITTING	BN	BN
3	10/10/15	ISSUE FOR PERMITTING	BN	BN
4	10/10/15	ISSUE FOR PERMITTING	BN	BN
5	10/10/15	ISSUE FOR PERMITTING	BN	BN
6	10/10/15	ISSUE FOR PERMITTING	BN	BN
7	10/10/15	ISSUE FOR PERMITTING	BN	BN
8	10/10/15	ISSUE FOR PERMITTING	BN	BN
9	10/10/15	ISSUE FOR PERMITTING	BN	BN
10	10/10/15	ISSUE FOR PERMITTING	BN	BN

Los Alamos National Laboratory
Integrated Controls
 PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT
 PARTIAL FIRST FLOOR PLAN
 SHEET NO: F-1007
 DATE: 10/10/15
 DRAWN BY: BN
 CHECKED BY: BN
 PROJECT NO: 100140
 SHEET NO: 10 OF 34
 CONTRACT NO: CS3100
 DRAWING NO: 2







SEE SHEET F-1009
MATCHLINE

- KEYED NOTES**
- ① CONDUIT UP TO SECOND FLOOR FOR SLC AND BRIDGE (SUCH AS SLC-1-100)
 - ② BUILDING FIRE ALARM CONTROL PANEL
 - ③ PULL STATION
 - ④ UP TO SECOND FLOOR PULLSTATION SLC-1-124, REFER TO SHEET F-1010

- WIRING LEGEND**
- ① #16 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ② #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ③ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ④ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑤ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑥ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑦ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑧ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑨ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑩ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑪ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑫ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑬ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑭ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION
 - ⑮ #12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION

KEY PLAN

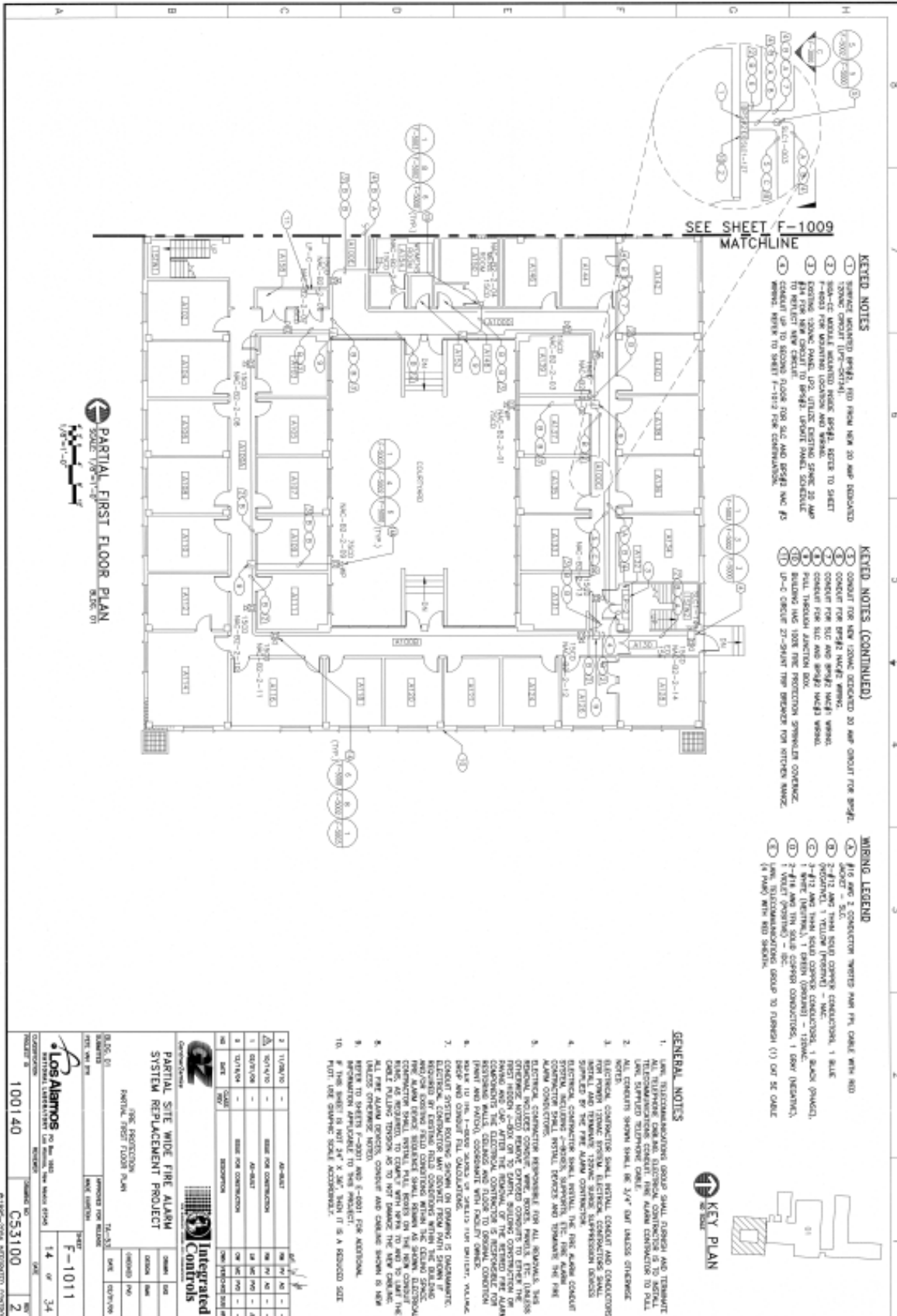
- GENERAL NOTES**
1. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 2. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 3. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 4. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 5. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 6. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 7. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 8. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 9. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 10. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 11. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 12. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 13. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 14. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.
 15. THE FIRE ALARM SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72), LATEST EDITION, AND ALL APPLICABLE LOCAL AND STATE CODES.

NO. 1	TYPE	DESCRIPTION	QTY	UNIT	PRICE	TOTAL
1	WIRE	#16 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	1.50	150.00
2	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
3	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
4	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
5	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
6	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
7	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
8	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
9	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
10	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
11	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
12	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
13	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
14	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00
15	WIRE	#12 AWG, 2 CONDUCTOR INSTALLED PER PPL. CABLE WITH RED INSULATION	100	FT.	2.50	250.00

Los Alamos
FIRE PROTECTION
PARTIAL FIRE FLOOR PLAN

Integrated Controls

PROJECT NO: 100140
DATE: 06/15/15
DRAWING NO: CS3100
SHEET NO: 2



- KEYED NOTES**
- 1) SMOKER MOUNTED PULL STATION FROM NEW TO NEW DISCONNECT
 - 2) NON-DC MOUNTED MOUNTING BRACKET FROM EXISTING TO SHEET
 - 3) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 4) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 5) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 6) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 7) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 8) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 9) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT
 - 10) EXISTING SIGNAL PANEL, USE EXISTING SIGNAL PANEL TO NEW DISCONNECT

- KEYED NOTES (CONTINUED)**
- 11) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 12) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 13) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 14) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 15) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 16) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 17) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 18) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 19) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL
 - 20) CONDUIT FOR NEW SIGNAL DISCONNECT TO NEW CIRCUIT FOR SIGNAL

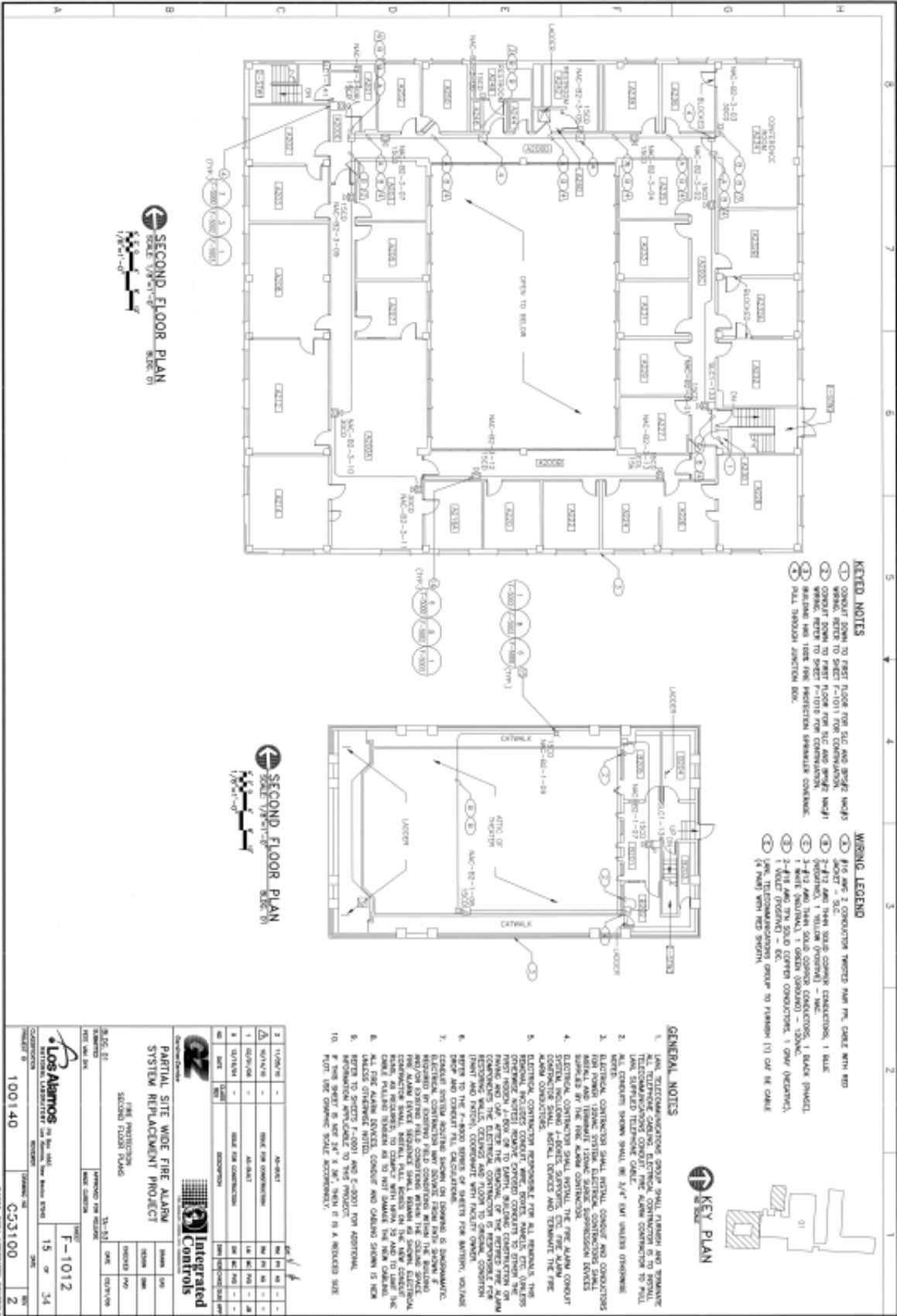
- WIRING LEGEND**
- 1) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 2) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 3) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 4) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 5) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 6) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 7) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 8) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 9) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)
 - 10) 1/2" RIGID CONDUIT (NOTED FROM THE CABLE WITH AND FROM THE CABLE)



- GENERAL NOTES**
1. ALL TELECOMMUNICATIONS GROUP SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP. ALL TELECOMMUNICATIONS GROUP SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP. ALL TELECOMMUNICATIONS GROUP SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 2. ALL CONDUIT SHALL BE 1/2" RIGID UNLESS OTHERWISE NOTED.
 3. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 4. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 5. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 6. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 7. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 8. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 9. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.
 10. ALL ELECTRICAL CONDUIT SHALL BE INSTALLED AND TREATED AS TELECOMMUNICATIONS GROUP.

NO.	DATE	BY	DESCRIPTION	REVISED BY	DATE
1	10/20/15	BN	AS-BUILT		
2	10/20/15	BN	ADD FOR CONSTRUCTION		
3	10/20/15	BN	AS-BUILT		
4	10/20/15	BN	ADD FOR CONSTRUCTION		
5	10/20/15	BN	AS-BUILT		
6	10/20/15	BN	ADD FOR CONSTRUCTION		
7	10/20/15	BN	AS-BUILT		
8	10/20/15	BN	ADD FOR CONSTRUCTION		
9	10/20/15	BN	AS-BUILT		
10	10/20/15	BN	ADD FOR CONSTRUCTION		

PROJECT NO.	100140	DATE	10/20/15
PROJECT NAME	Los Alamos Partial Site Wide Fire Alarm System Replacement Project	PROJECT NO.	CS3100
PROJECT LOCATION	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT OWNER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT MANAGER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT ENGINEER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT ARCHITECT	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT CONTRACTOR	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT SUBCONTRACTOR	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT CONSULTANT	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT SPECIALIST	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT DESIGNER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT CHECKER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT APPROVER	Los Alamos National Laboratory	PROJECT NO.	CS3100
PROJECT DATE	10/20/15	PROJECT NO.	CS3100
PROJECT SHEET	F-1011	PROJECT NO.	CS3100
PROJECT TOTAL SHEETS	14 of 34	PROJECT NO.	CS3100
PROJECT SHEET NO.	14 of 34	PROJECT NO.	CS3100
PROJECT SHEET TOTAL	14 of 34	PROJECT NO.	CS3100
PROJECT SHEET NO.	14 of 34	PROJECT NO.	CS3100
PROJECT SHEET TOTAL	14 of 34	PROJECT NO.	CS3100



KEYED NOTES

1. PULL STATION TO FIRST FLOOR FOR SIG AND GROUP W/CP
2. GROUP NOTED TO SHEET F-1011 FOR CONNECTION
3. GROUP NOTED TO SHEET F-1012 FOR CONNECTION
4. PULL THROUGH CONNECTION BOX

WIRING LEGEND

1. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
2. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
3. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
4. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
5. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
6. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
7. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
8. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
9. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG
10. 1/2" DIA. 1/2" CONDUIT THROUGH WALL PER CODE WITH RED IDENT. TAG

GENERAL NOTES

1. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL CODES.
2. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
3. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
4. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
5. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
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8. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
9. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.
10. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE NATIONAL FIRE ALARM CODE (NFPA 72) AND ALL APPLICABLE LOCAL CODES.

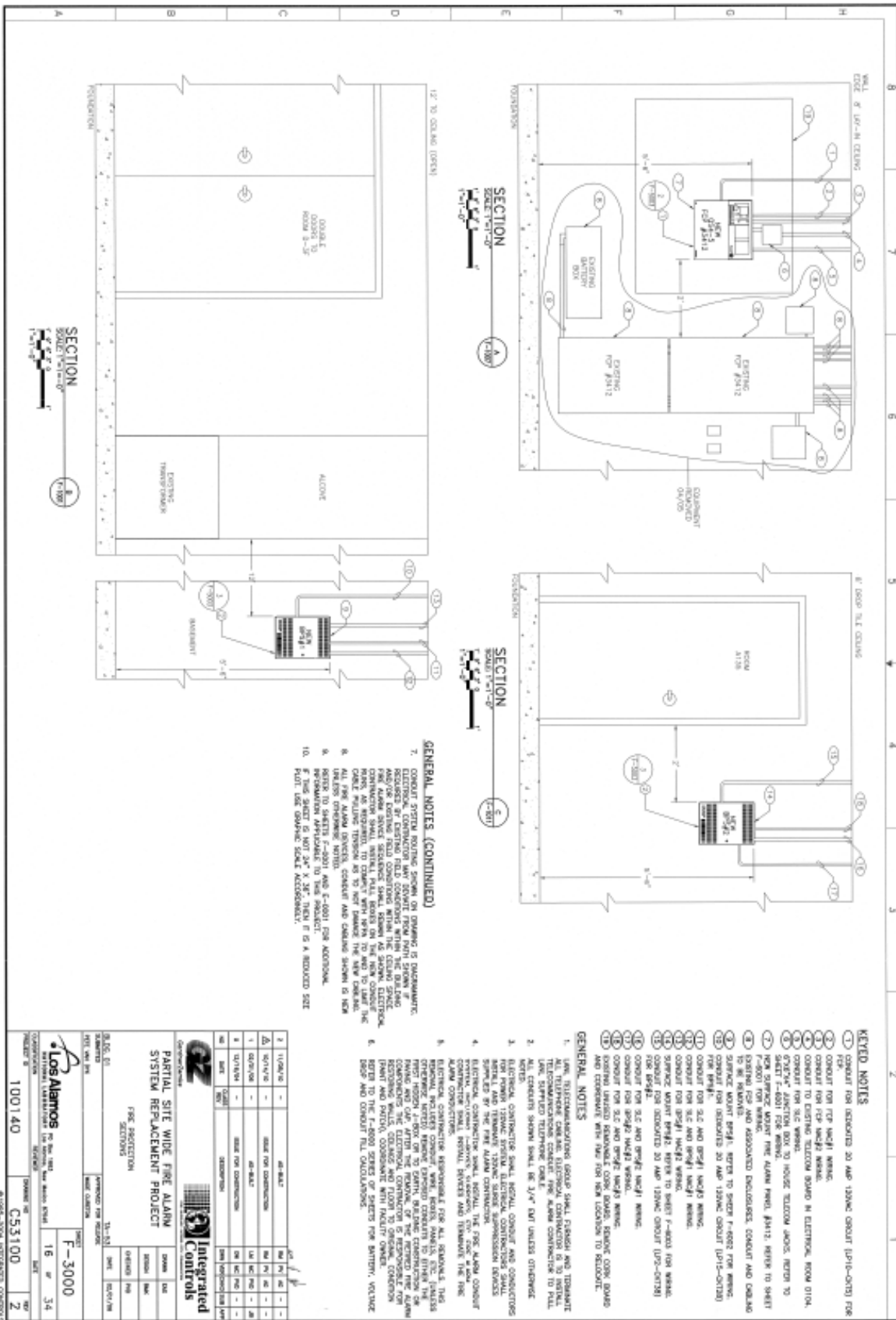


SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

NO.	DATE	REVISION	BY	CHKD.
1	10/15/15	ISSUE FOR PERMIT	BN	BN
2	11/13/15	ISSUE FOR PERMIT	BN	BN
3	11/13/15	ISSUE FOR PERMIT	BN	BN
4	11/13/15	ISSUE FOR PERMIT	BN	BN
5	11/13/15	ISSUE FOR PERMIT	BN	BN
6	11/13/15	ISSUE FOR PERMIT	BN	BN
7	11/13/15	ISSUE FOR PERMIT	BN	BN
8	11/13/15	ISSUE FOR PERMIT	BN	BN
9	11/13/15	ISSUE FOR PERMIT	BN	BN
10	11/13/15	ISSUE FOR PERMIT	BN	BN

PROJECT NO.	100140	DATE	11/13/15
CLIENT	Los Altos	PROJECT	F-1012
PROJECT NAME	PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT	SHEET	15 OF 34
PROJECT ADDRESS	100140	DATE	11/13/15
PROJECT CITY	Los Altos	PROJECT	F-1012
PROJECT STATE	CA	SHEET	15 OF 34
PROJECT ZIP	94024	DATE	11/13/15
PROJECT PHONE	415-947-1000	PROJECT	F-1012
PROJECT FAX	415-947-1000	SHEET	15 OF 34
PROJECT EMAIL	info@losaltos.com	DATE	11/13/15
PROJECT WEBSITE	www.losaltos.com	PROJECT	F-1012
PROJECT URL	www.losaltos.com	SHEET	15 OF 34
PROJECT ADDRESS	100140	DATE	11/13/15
PROJECT CITY	Los Altos	PROJECT	F-1012
PROJECT STATE	CA	SHEET	15 OF 34
PROJECT ZIP	94024	DATE	11/13/15
PROJECT PHONE	415-947-1000	PROJECT	F-1012
PROJECT FAX	415-947-1000	SHEET	15 OF 34
PROJECT EMAIL	info@losaltos.com	DATE	11/13/15
PROJECT WEBSITE	www.losaltos.com	PROJECT	F-1012
PROJECT URL	www.losaltos.com	SHEET	15 OF 34



<p>UNPROTECTED/FIELD SIDE EDO WIRES, 795-1-31T MULTI-STRAND TINE PAIR STEEL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>	<p>EDO WIRES, 795-1-10A/C LOCAL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>	<p>EDO WIRES, 795-1-10A/C DATA PAIR BICO LOCAL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>
<p>FIELD SIDE EDO WIRES, 795-1-31T MULTI-STRAND TINE PAIR STEEL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>	<p>FIELD SIDE EDO WIRES, 795-1-10A/C LOCAL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>	<p>TERMINAL STRIP EDO WIRES, 795-1-10A/C LOCAL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>
<p>TERMINAL STRIP EDO WIRES, 795-1-31T MULTI-STRAND TINE PAIR STEEL SUSPENSION WIRELASS SYSTEM DETAIL SCALE: NONE</p>	<p>HEAT DETECTOR SERIES 400 STEEL LAMINATED WOUNDING SYSTEM DETAIL SCALE: NONE</p>	<p>HEAT DETECTOR SERIES 400 STEEL LAMINATED WOUNDING SYSTEM DETAIL SCALE: NONE</p>

GENERAL NOTES

1. THIS IS A TYPICAL TOWNHIP SPEC. SHEET. SOME AMENDMENTS MAY APPEAR ON THE DRAWINGS AND SHALL NOT BE OBSERVED ON THE DRAWING PLAN.

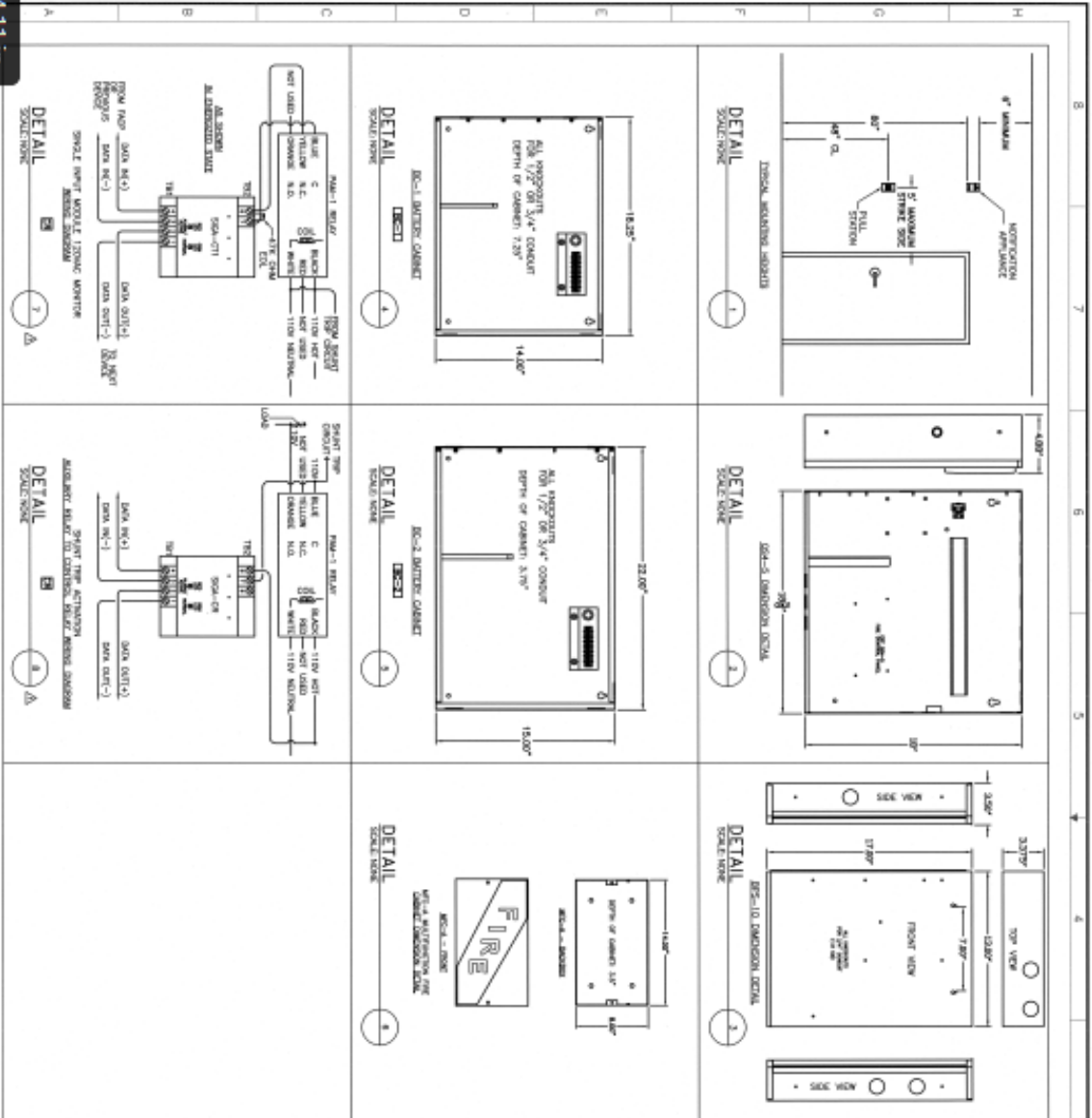
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2	10/24/13	ISSUE FOR CONSTRUCTION	BN	BN
3	10/24/13	REVISED	BN	BN
4	12/16/14	ISSUE FOR CONSTRUCTION	BN	BN
5	01/02/15	REVISED	BN	BN

Integrated Controls

Los Alamos
PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT
FIRE PROTECTION
FIRE DETAILS

PROJECT NO: 100140
SHEET NO: 18 OF 34
DATE: 1/2/15

4.11 in



GENERAL NOTES
1. THIS IS A TYPICAL TEMPLATES ONLY SHEET. THE EXACT DETAILS AND DIMENSIONS SHALL BE DETERMINED BY THE PROJECT TEAM AND SHALL NOT BE REVERSED ON THE FLOOR PLAN.

NO.	DESCRIPTION	DATE	BY	CHKD.
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3	ISSUED FOR CONSTRUCTION	10/14/15	BN	BN
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7	ISSUED FOR CONSTRUCTION	10/14/15	BN	BN
8	ISSUED FOR CONSTRUCTION	10/14/15	BN	BN
9	ISSUED FOR CONSTRUCTION	10/14/15	BN	BN
10	ISSUED FOR CONSTRUCTION	10/14/15	BN	BN

Los Alamos
100140

Integrated Controls

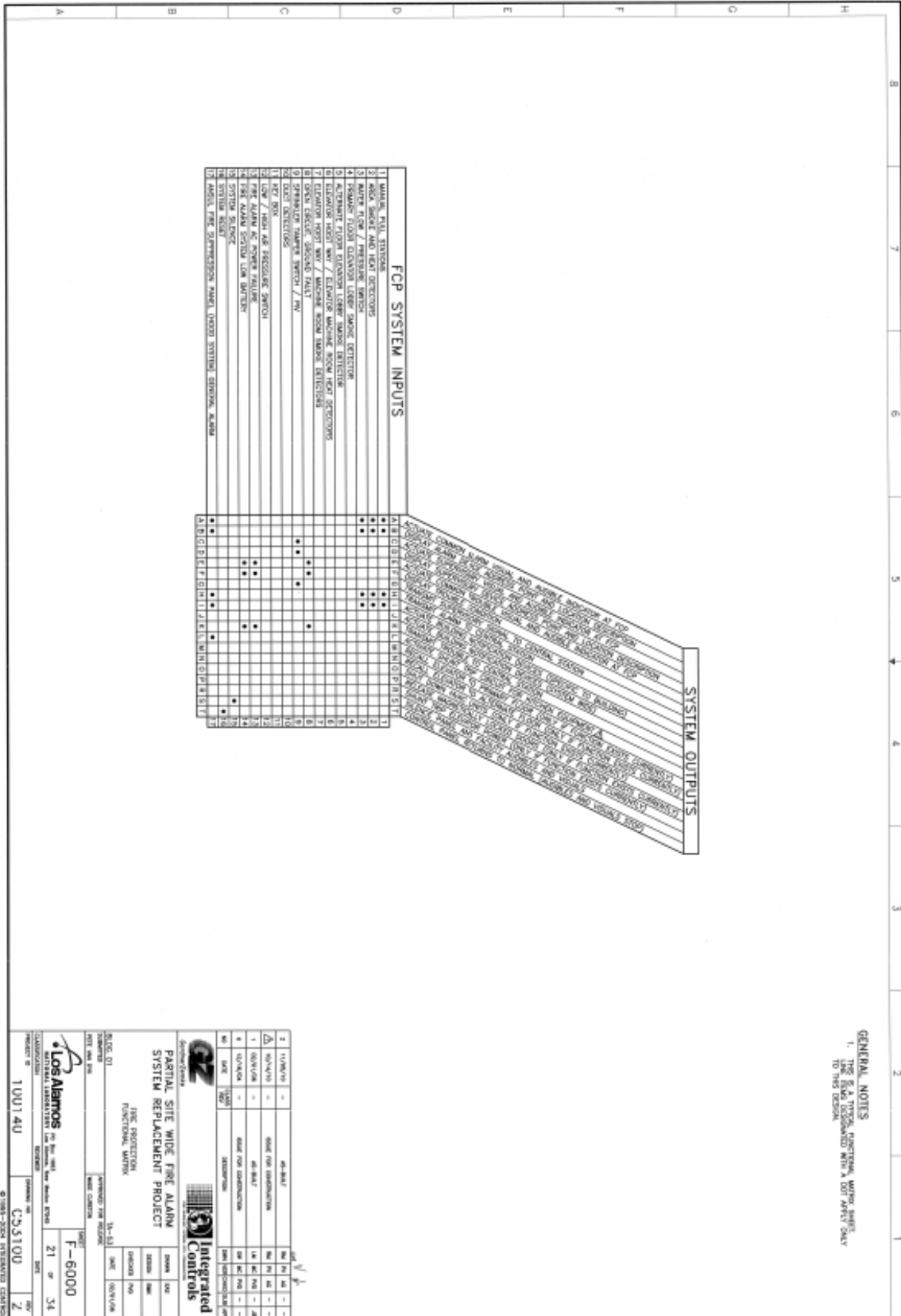
PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT

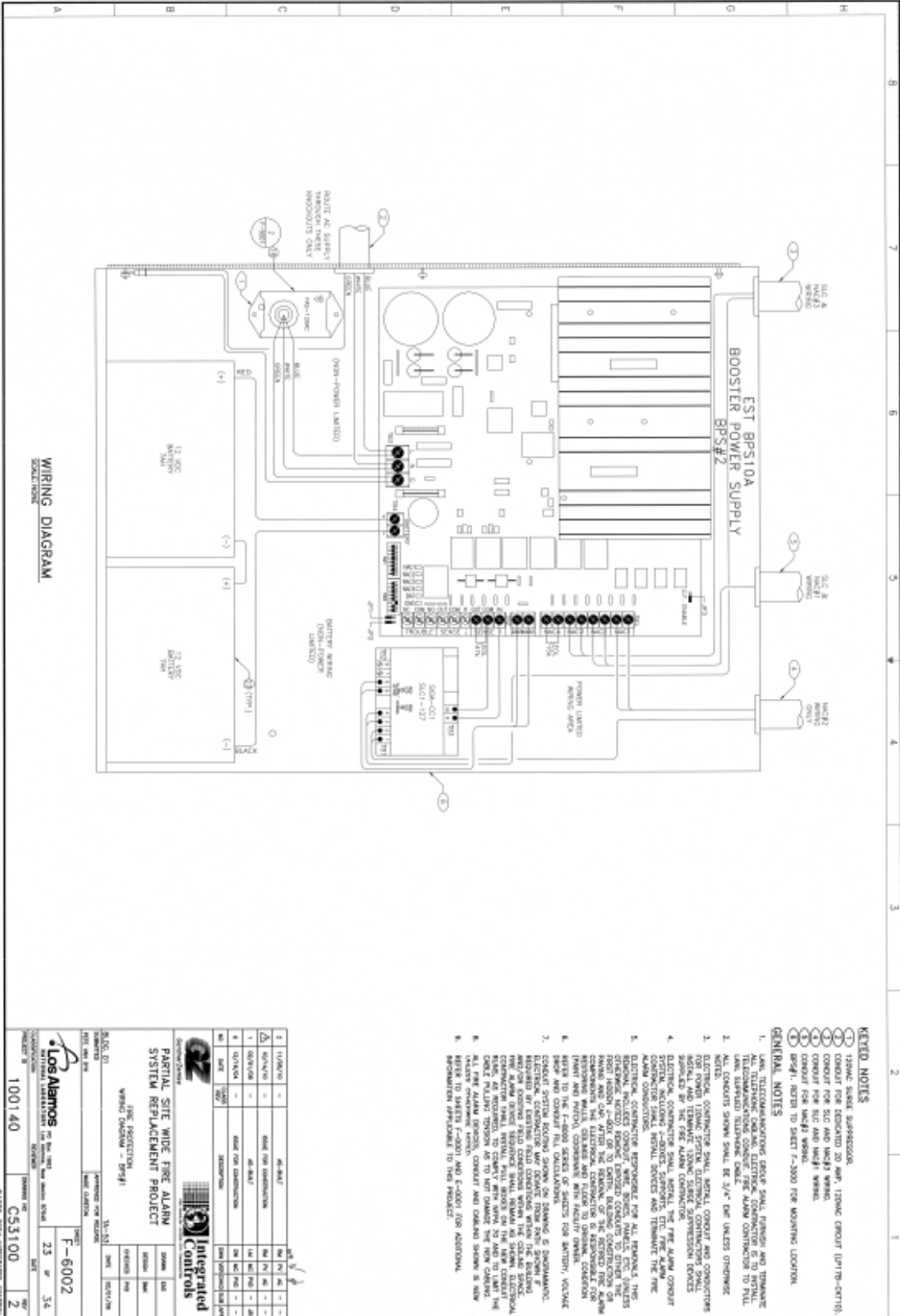
F-5003

DATE: 10/14/15

PROJECT NO: CS3100

2





WIRING DIAGRAM
SCALE: 1/8" = 1'-0"

KEYED NOTES

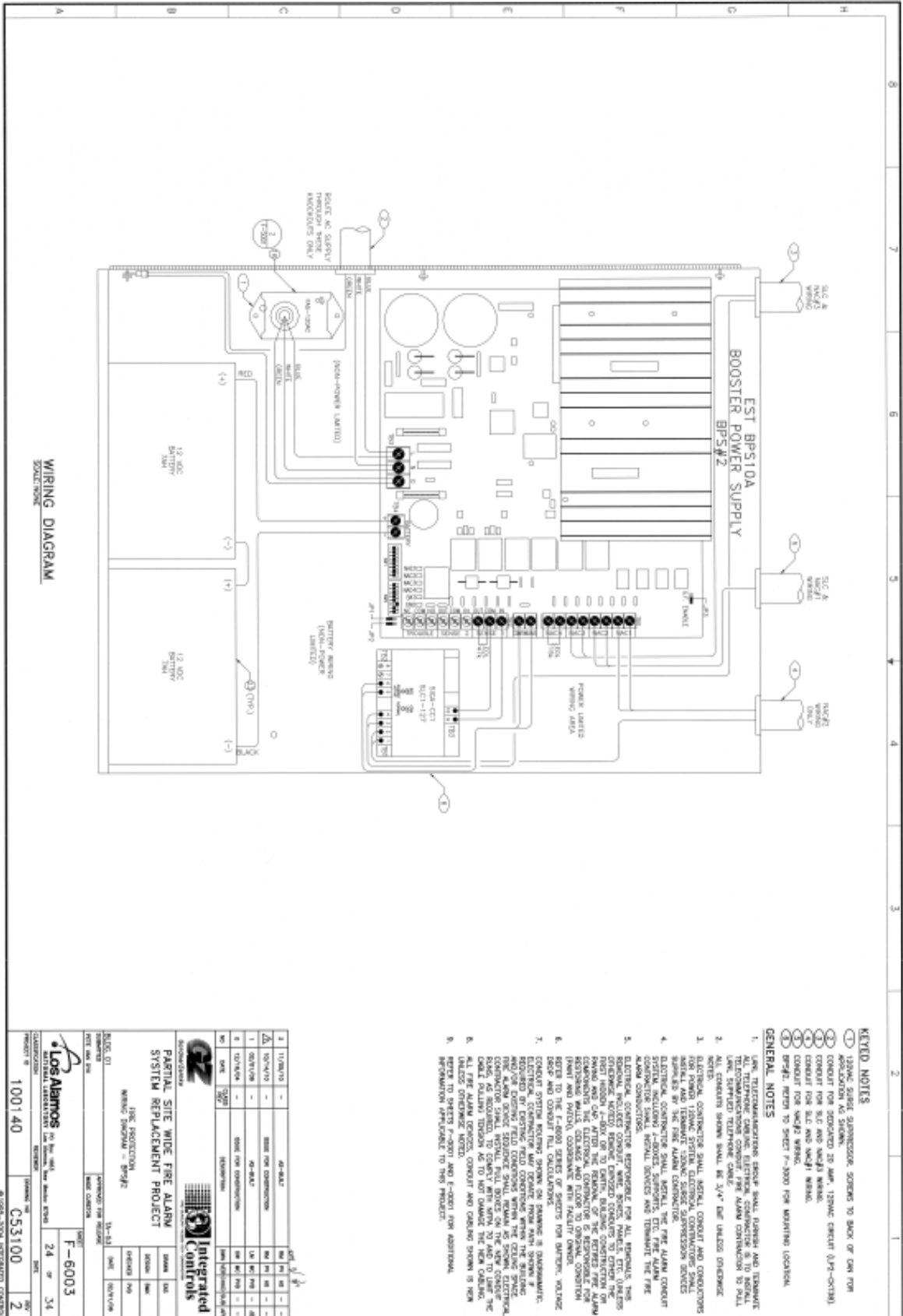
1. 15WAC SILENCE SUPPRESSOR.
2. CONDUIT FOR SOG AND WELD3 WIRING.
3. CONDUIT FOR SOG AND WELD3 WIRING.
4. CONDUIT FOR WELD3 WIRING.
5. CONDUIT FOR WELD3 WIRING.

GENERAL NOTES

1. ALL TELECOMMUNICATIONS GROUP SHALL TERMINATE AND TERMINATE ALL TELECOMMUNICATIONS CABLES TO THE BUILDING TELECOMMUNICATIONS CENTER. FIRE ALARM CONDUIT TO FILL LANE, SHIPPED TELEPHONE CABLE, BE 3/4" EMT UNLESS OTHERWISE NOTED.
2. ELECTRICAL CONDUIT SHALL BE 1/2" EMT UNLESS OTHERWISE NOTED.
3. ELECTRICAL CONDUIT SHALL BE 1/2" EMT UNLESS OTHERWISE NOTED.
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100	01/10/23	BR	ISSUE FOR CONSTRUCTION

Los Alamos
PROJECT NO. 100140
DRAWING NO. CS3100
SHEET NO. 2



WIRING DIAGRAM
SECTION

- KEYED NOTES**
- 1. LINES, TELECOMMUNICATIONS SHEET SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLES. ELECTRICAL CONNECTOR 8 TO METAL LINE SHIPPED TELEPHONE CABLE.
 - 2. ALL CABLES SHOWN SHALL BE 1/4" DIA. UNLESS OTHERWISE NOTED.
 - 3. ELECTRICAL CONNECTOR SHALL BE METAL, CONDUIT AND CONDUITORS SHALL BE 1/2" DIA. UNLESS OTHERWISE NOTED.
 - 4. ELECTRICAL CONNECTOR SHALL BE METAL, CONDUIT AND CONDUITORS SHALL BE 1/2" DIA. UNLESS OTHERWISE NOTED.
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 - 7. ELECTRICAL CONNECTOR SHALL BE METAL, CONDUIT AND CONDUITORS SHALL BE 1/2" DIA. UNLESS OTHERWISE NOTED.
 - 8. ALL FIRE ALARM DEVICES, CONDUIT AND CABLES SHOWN IS NEW UNLESS OTHERWISE NOTED.
 - 9. REFER TO OTHER SHEETS AND F-6003 FOR APPROVAL.

GENERAL NOTES

1. LINES, TELECOMMUNICATIONS SHEET SHALL FURNISH AND TERMINATE ALL TELEPHONE CABLES. ELECTRICAL CONNECTOR 8 TO METAL LINE SHIPPED TELEPHONE CABLE.
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REVISIONS

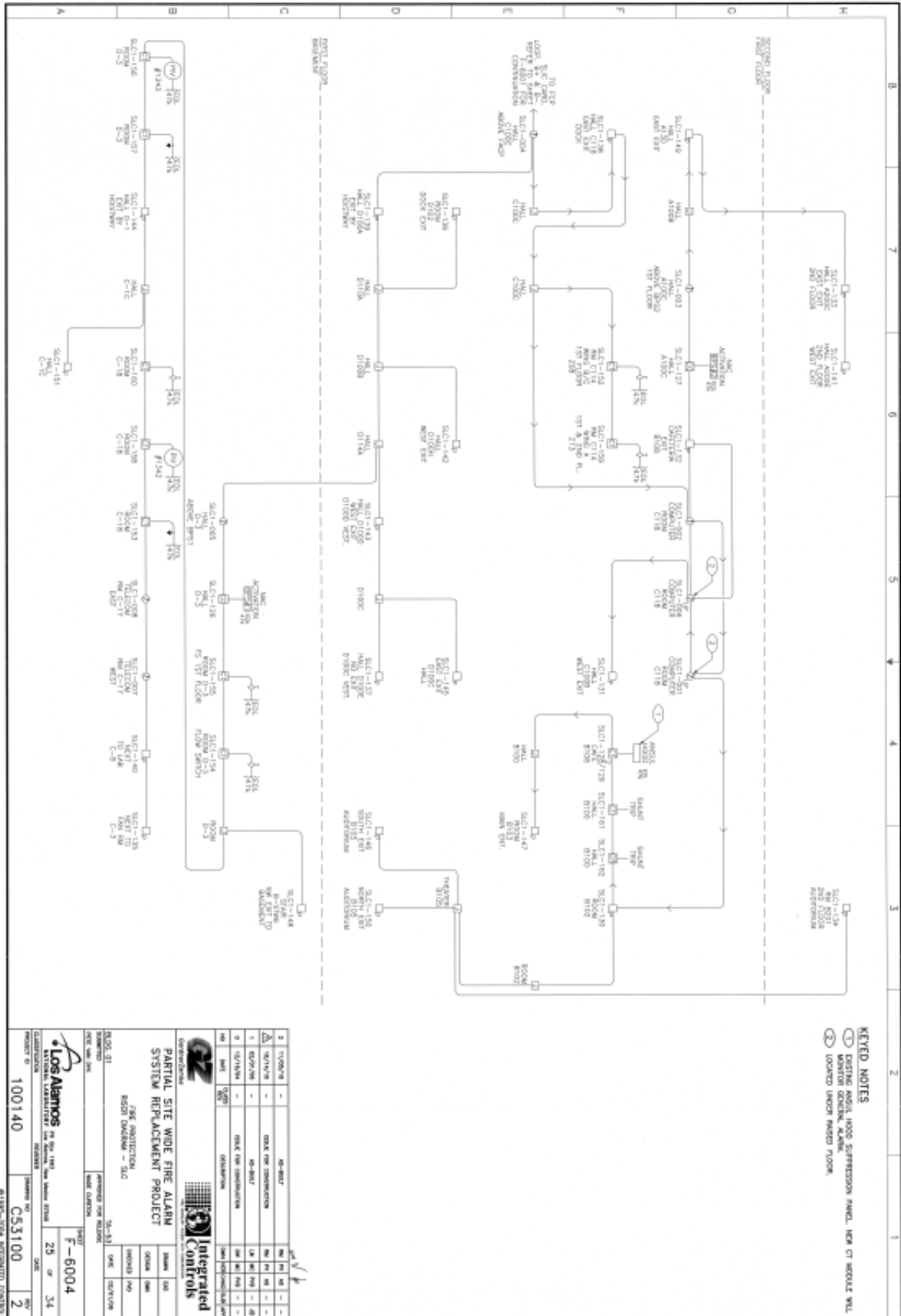
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6	10/24/10	-	REV. 06
7	10/24/10	-	REV. 07
8	10/24/10	-	REV. 08
9	10/24/10	-	REV. 09
10	10/24/10	-	REV. 10

Los Alamos National Laboratory
Integrated Controls

PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT
 FIRE PROTECTION
 WIRING DIAGRAM - BPS#2

REVISED BY: [Signature]
 APPROVED FOR ISSUANCE: [Signature]
 DATE: 10/24/10

PROJECT NO: 100140
 DRAWING NO: CS3100
 SHEET NO: 2



KEYED NOTES
 ① FIRE ALARM CONTROL PANEL, NEAR CT BOWELL WALL
 ② FIRE ALARM CONTROL PANEL, NEAR CT BOWELL WALL
 ③ LOCATED UNDER WAREHOUSE FLOOR

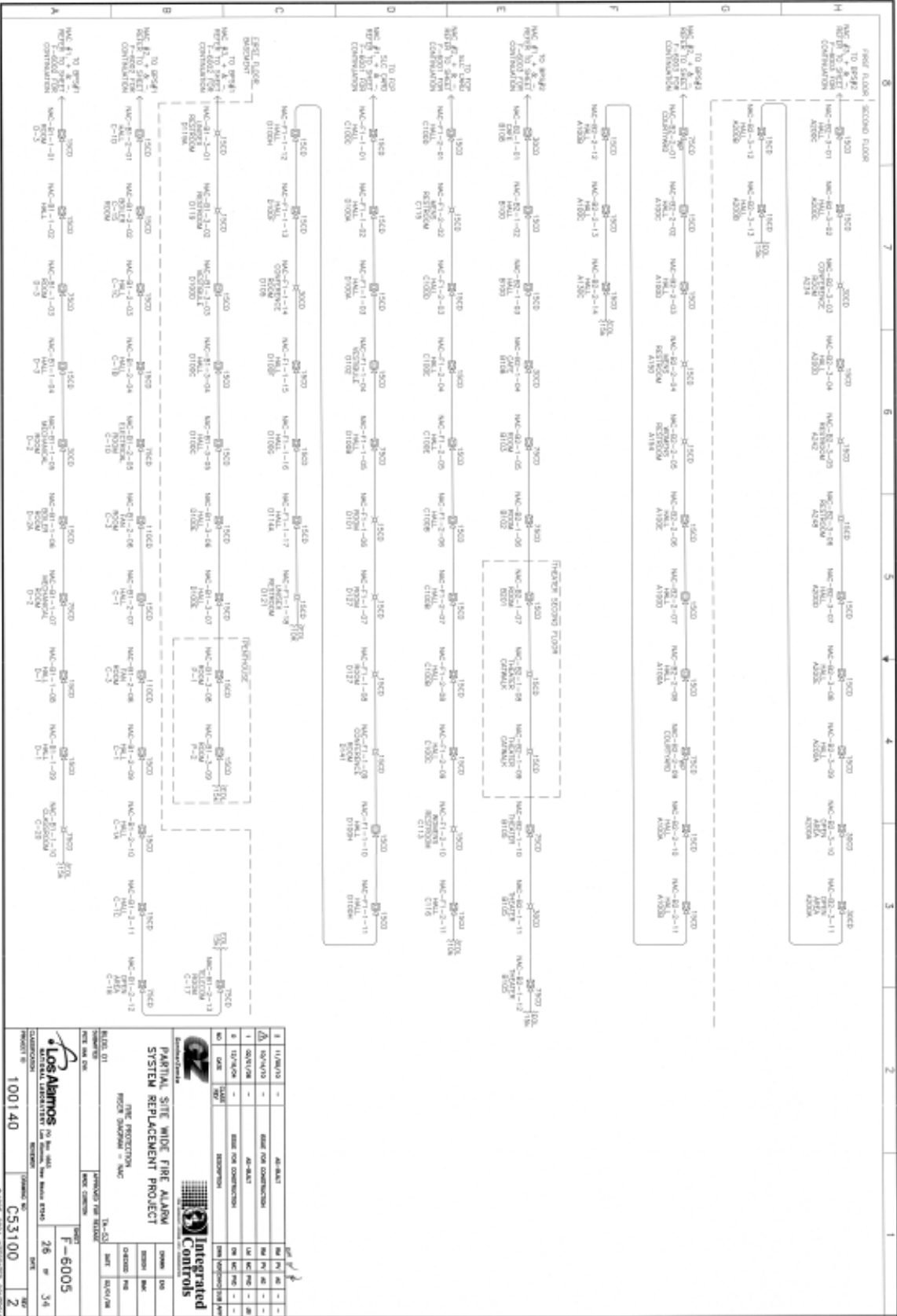
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CLASSIFICATION		PROJECT NO.	100140	ISSUED TO	CS3100
PROJECT NO.	100140	ISSUED TO	CS3100	DATE	2

Los Alamos National Laboratory
 4800 UNIVERSITY AVENUE, LOS ALAMOS, NM 87545

Integrated Controls

PARTIAL SITE WIDE FIRE ALARM SYSTEM REPLACEMENT PROJECT

DATE: 01/15/15
 DRAWING NO: F-6004
 SHEET NO: 25 OF 34



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ																																															
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DATE	DESCRIPTION	BY	REV
11/20/10	AS-BUILT		1
03/17/10	FIELD FOR CONSTRUCTION		2
03/17/08	AS-BUILT		3
12/17/04	FIELD FOR CONSTRUCTION		4
03/07	REVISION		5

<p>Los Alamos FIRE PROTECTION CONDUIT FILL CALCULATIONS</p> <p>PROJECT: F-8005</p> <p>DRAWING NO: 33 OF 34</p> <p>DATE: 05/31/10</p> <p>SCALE: 2</p> <p>PROJECT NO: 100140</p> <p>DRAWING NO: C53100</p> <p>DATE: 2</p>	<p>Integrated Controls</p> <p>1500-2004 ANTISEMITO 02/03/2</p>
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DETECT Models

Smoke Detectors

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

INPUT PARAMETERS			CALCULATED PARAMETERS		
Calculation reset	1	0 or 1	R/H	3.8148	-
Ceiling height (H)	2.7	m	W/H	3.3704	-
Room width (W)	9.1	m	Temperature factor	0.1229	-
Radial distance (R)	10.3	m	Velocity factor	0.1734	-
Ambient temperature (To)	20	C	Calculation time (t)	101	s
Actuation temperature (Ta)	27.2	C	Fire HRR (Q)	479.45	kW
Rate of rise rating (ROR)	0	C/min	Gas temperature (Tg)	44.299	C
Response time index (RTI)	1	(m-s) ^{1/2}	Gas velocity (Ug)	0.9747	m/s
Fire growth power (n)	2	-	ROR at detector	19.278	C/min
Fire growth coefficient (k)	0.047	kW/s ⁿ	Detector temp (Td)	44.294	C
Fire location factor (kLF)	1	-	Detection trigger	61	100

Representative t2 coeff.	k
Slow	0.003
Medium	0.012
Fast	0.047
Ultrafast	0.400

CALCULATION RESULTS	FT	ROR	
Transport lag time (tl)	46	46	s
Detection time (td)	41	2	s
HRR at detection (Qd)	79	0	kW
HRR w/transport lag (Ql+d)	358	109	kW

< Press PgDn key for additional results >

Sprinklers

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

INPUT PARAMETERS			CALCULATED PARAMETERS		
Calculation reset	1	0 or 1	R/H	1.8889	-
Ceiling height (H)	2.7	m	W/H	1.5556	-
Room width (W)	4.2	m	Temperature factor	0.225	-
Radial distance (R)	5.1	m	Velocity factor	0.2244	-
Ambient temperature (To)	20	C	Calculation time (t)	501	s
Actuation temperature (Ta)	100	C	Fire HRR (Q)	3012	kW
Rate of rise rating (ROR)	0	C/min	Gas temperature (Tg)	171.48	C
Response time index (RTI)	100	(m-s) ^{1/2}	Gas velocity (Ug)	2.3272	m/s
Fire growth power (n)	2	-	ROR at detector	24.122	C/min
Fire growth coefficient (k)	0.012	kW/s ⁿ	Detector temp (Td)	145.53	C
Fire location factor (kLF)	1	-	Detection trigger	119	500

Representative t2 coeff.	k
Slow	0.003
Medium	0.012
Fast	0.047
Ultrafast	0.400

CALCULATION RESULTS	FT	ROR	
Transport lag time (tl)	31	31	s
Detection time (td)	383	2	s
HRR at detection (Qd)	1760	0	kW
HRR w/transport lag (Ql+d)	2059	13	kW

< Press PgDn key for additional results >

Alarm Device Cut Sheets



Integrity Synchronized Temporal Horn-Strobe Installation Sheet

Description

The Integrity Synchronized Temporal Horn-Strobe is a fire alarm notification appliance designed for indoor or outdoor walls and ceilings. (The 15 cd strobe is for indoor use only.) For model numbers, see Table 1; for accessories see Table 2.

Table 1: Models

Description	Numbers	
15 cd horn-strobe, red [1]	757-5A-T	INT-5AT
	XLS757-5A-	2452THS-15-R
15 cd horn-strobe, white [1]	757-5A-TW	INT-5ATW
	XLS757-5A-TW	2452THS-15-W
30 cd horn-strobe, red	757-3A-T	INT-3AT
	XLS757-3A-T	2452THS-30-R
30 cd horn-strobe, white	757-3A-TW	INT-3ATW
	XLS757-3A-TW	2452THS-30-W
75 cd horn-strobe, red [2]	757-4A-T	INT-4AT
	XLS757-4A-T	2452THS-75-R
75 cd horn-strobe, white [2]	757-4A-TW	INT-4ATW
	XLS757-4A-TW	2452THS-75-W
15/75 cd horn-strobe, red	757-7A-T	INT-7AT
	XLS757-7A-T	2452THS-15/75-R
15/75 cd horn-strobe, white	757-7A-TW	INT-7ATW
	XLS757-7A-TW	2452THS-15/75-W
110 cd horn-strobe, red	757-8A-T	INT-8AT
	XLS757-8A-T	2452THS-110-R
110 cd horn-strobe, white	757-8A-TW	INT-8ATW
	XLS757-8A-TW	2452THS-110-W

[1] For indoor use only
[2] Not ULC Listed

Table 2: Accessories

Description	Numbers	
Surface box, red, indoor	757A-SB	INT-SB
	XLS757A-SB	2459-SMB-R
Surface box, white, indoor	757A-SBW	INT-SBW
	XLS757A-SBW	2459-SMB-W
Weatherproof box, red, outdoor	757A-WB	INT-WB
	XLS757A-WB	2459-WPB-R
Weatherproof box, white, outdoor	757A-WBW	INT-WBW
	XLS757A-WBW	2459-WPB-W
Bidirectional mounting frame, red, indoor	757A-BDF	INT-BDF
	XLS757A-BDF	2459-BDF-R
Bidirectional mounting frame, white, indoor	757A-BDFW	INT-BDFW
	XLS757A-BDFW	2459-BDF-W

The strobe operates on any existing two-wire signal circuit. There are jumpers for selecting either a temporal or steady tone, and high or low volume. See Figure 4 for the jumper locations.

The strobe features an enhanced synchronization circuit to comply with the latest requirements of UL 1971 *Signaling Devices for the Hearing Impaired* and CAN/ULC-S526 *Visible Signal Devices for Fire Alarm Systems, Including Accessories*. Synchronized operation requires a separately installed synchronization control module. See Table 3 for a list of compatible synchronization modules.

Table 3: Compatible synchronized models

Description	Numbers	
Auto-Sync Output Module	SIGA-CC1S	SIGA-MCC1S
Genesis Signal Master - Remote Mount	ADTG1M-RM	MG1M-RM
	XLSG1M-RM	EG1M-RM
	G1M-RM	ZG1M-RM
	BPS-6(10)A	APS-6(10)A

Installation

WARNING: Electrocutation hazard. To avoid personal injury or death from electrocution, remove all sources of power and allow stored energy to discharge before installing or removing equipment.

Notes

- Electrical supervision requires the wire run to be broken at each terminal. Do not loop the signaling circuit field wires around the terminals.
- To ensure flash synchronization, do not install this enhanced strobe (identified by a red cd rating on the front of the unit) in the same field of view as older models (identified by a black cd rating on the front of the unit).

Install this product in accordance with applicable requirements in the latest editions of NFPA 72, *National Fire Alarm and Signaling Code*, and CSA C22.1 the *Canadian Electrical Code, Part 1, Section 32, CAN/ULC-S524 Installation of Fire Alarm Systems* and in accordance with the local authority having jurisdiction.

GE Security

EST Fire & Life Safety Notification Appliances

Overview

The Genesis line of signals are among the smallest, most compact audible-visible emergency signaling devices in the world. About the size of a deck of playing cards, these devices are designed to blend with any decor.

Thanks to patented breakthrough technology, GE Security Genesis strobes do not require bulky specular reflectors and lenses. Instead, an exclusive cavity design conditions light to produce a highly controlled distribution pattern. Significant development efforts employing this new technology have given rise to a new benchmark in strobe performance - FullLight technology.

FullLight strobe technology produces a smooth light distribution pattern without the spikes and voids characteristic of specular reflectors. This ensures the entire coverage area receives consistent illumination from the strobe flash. As a result, Genesis strobes with FullLight technology go well beyond the minimum UL-required "I" pattern, significantly exceeding UL-1971 and ULC-5526 light distribution requirements.

Genesis strobes and horn-strobes offer 15 to 110 candela output, which is selectable with a conveniently-located switch on the side of the device. Models are also available that offer fixed 15/75 cd output. The candela output setting remains clearly visible even after final installation, yet it stays locked in place to prevent unauthorized tampering.

Genesis signals feature textured housings in architecturally neutral white or traditional fire red. An ingenious iconographic symbol indicates the purpose of the device. This universal symbol is code-compliant and is easily recognized by all building occupants regardless of what language they speak. Models with "FIRE" markings are also available.

Standard Features

- **Unique low-profile design**
 - The most compact UL-1971/ULC-5526 listed strobe available
 - Ultra-slim - protrudes less than one inch
 - Attractive appearance
 - No visible mounting screws
- **Four field-configurable options in one device**
 - Select 15, 30, 75, or 110 cd strobe output
 - Select high (default) or low dB horn output
 - Select temporal (default) or steady horn output
 - Select public mode flash rate (default) or private mode temporal flash
- **Fixed 15/75 cd model available**
- **Easy to install**
 - Fits standard 1-gang electrical boxes - no trim plate needed
 - Optional trim plate accommodates oversized openings
 - Pre-assembled with captive hardware
 - #12 AWG terminals - ideal for long runs or existing wiring
- **Unparalleled performance**
 - Industry's most even light distribution
 - Meets tough synchronizing standards for strobes
 - Single microprocessor controls both horn and strobe
 - Low current draw minimizes system overhead
 - Independent horn control over a single pair of wires
 - Highly regulated in-rush current
 - Multiple frequency tone improves sound penetration
 - Industry's first temporal strobe output

Field Configurable Horns and Strobes Genesis Series



Data Sheet #5001-0573 Issue 8
Not to be used for installation purposes. Page 1 of 6

Installation

Genesis horns and strobes mount to any standard one-gang surface or flush electrical box. Matching optional trim plates are used to cover oversized openings and can accommodate one-gang, two-gang, four-inch square, or octagonal boxes, and European 100 mm square.



Genesis Horn/Strobe with optional trim plate

All Genesis signals come pre-assembled with captive mounting screws for easy installation. Two tabs at the top of the signal unlock the cover to reveal the mounting hardware. The shallow depth of Genesis devices leaves ample room behind the signal for extra wiring. Once installed with the cover in place, no mounting screws are visible.

Field Configuration

Temporal horn and horn-strobe models are factory set to sound in a **three-pulse temporal pattern**. Units may be config-

ured for use with coded systems by cutting a jumper on the circuit board. This results in a **steady output** that can be turned on and off (coded) as the system applies and removes power to the signal circuit. A Genesis Signal Master is required when horn-strobe models are configured for coded systems. Non-temporal, horn-only models sound a **steady tone**.

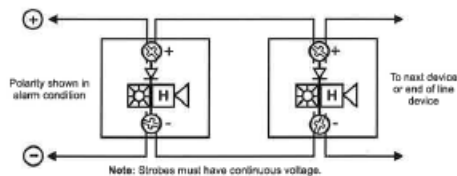
Genesis strobes and horn-strobes are shipped from the factory ready for use as **UL 1971 compliant** signals for public mode operation. These signals may be configured for **temporal flash** by cutting a jumper on the circuit board. This battery-saving feature is intended for private mode signaling only.

Genesis strobes and horn-strobes may be set for **15, 30, 75, or 110 candela output**. The output setting is changed by simply opening the device and sliding the switch to the desired setting. The device does not have to be removed to change the output setting. The setting remains visible through a small window on the side of the device after the cover is closed.

Horns and horn-strobes are factory set for **high dB output**. **Low dB output** may be selected by cutting a jumper on the circuit board. This reduces the output by about 5 dB.

Wiring

Field wiring terminals accommodate #18 to #12 AWG (0.75 mm² to 2.5 mm²) wiring. Horns, strobes, and combination horn-strobes are interconnected with a single pair of wires as shown below.



WARNING: These devices will not operate without electrical power. As fires frequently cause power interruptions, we suggest you discuss further safeguards with your local fire protection specialist.

These visual signal appliances' flash intensity may not be adequate to alert or awaken occupants in the protected area. Research indicates that the intensity of strobe needed to awaken 90% of sleeping persons is approximately 100 cd. GE Security recommends that strobes in sleeping rooms be 110 cd minimum.



U.S.
T 888-378-2529
F 866-503-3996

Canada
T 519 376 2430
F 519 376 7258

Asia
T 852 2907 8108
F 852 2142 5063

Australia
T 61 3 9259 4700
F 61 3 9259 4799

Europe
T 32 2 725 11 20
F 32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

www.gesecurity.com

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Ordering Information

Catalog Number		Description	Ship Wt. lbs (kg)
White Finish	Red Finish		
G1-HDVM	G1R-HDVM	Genesis Horn-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output)	0.25 (0.11)
G1-VM	G1R-VM	Genesis Strobe (selectable 15, 30, 75, or 110 cd output)	
G1-HD	G1R-HD	Genesis Temporal Horn (selectable high/low dB output)	
G1-P	G1R-P	Genesis Steady Horn (not compatible with Genesis Signal Master)	
G1F-HDVM	G1RF-HDVM	Genesis Horn-Strobe (selectable 15, 30, 75, or 110 cd output, selectable high/low dB output) - with "FIRE" marking	
G1F-VM	G1RF-VM	Genesis Strobe (selectable 15, 30, 75, or 110 cd output) - with "FIRE" marking	
G1F-HD	G1RF-HD	Genesis Temporal Horn (selectable high/low dB output) - with "FIRE" marking	
G1F-P	G1RF-P	Genesis Steady Horn with "FIRE" marking (not compatible with Genesis Signal Master)	
G1F-HDV1575	G1RF-HDV1575	15/75 cd temporal horn-strobe, hi/lo dB-24V - with "FIRE" marking (see note 1)	
G1F-V1575	G1RF-V1575	15/75 cd strobe - with "FIRE" marking (see note 1)	

Mounting Accessories

G1T	G1RT	Genesis Trim Plate (for two-gang or 4" square boxes)	0.15 (0.7)
G1T-FIRE	G1RT-FIRE	Genesis Trim Plate (for two-gang or 4" square boxes) with "FIRE" markings	0.15 (0.7)
27193-16	27193-11	One-gang surface mount box	1 (0.4)

Synchronization Modules

G1M	Genesis Signal Master - Snap-on Mount		0.2 (0.1)
G1M-RM	Genesis Signal Master - Remote Mount (1-gang)		
SIGA-CC1S	Intelligent Synchronization Output Module (2-gang)		0.5 (0.23)
SIGA-MCC1S	Intelligent Synchronization Output Module (Plug-in UIOI)		0.18 (0.08)

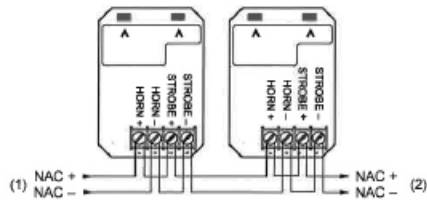
Note 1: These 15/75 cd models provide fixed output and are not multi-candela devices. The 15 cd output component complies with UL1971, while the 75 cd output component complies with UL 1638.



Genesis Horn-Strobes may be ordered in red or white, with or without "FIRE" marking. Order matching trim plates separately.



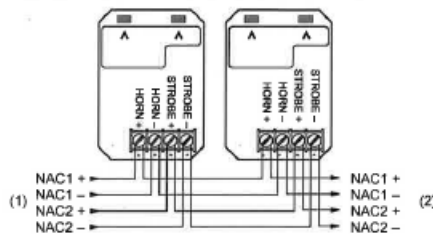
Figure 2: Typical one-circuit wiring diagram



Polarity is shown in the active state.

- (1) From UL/ULC Listed fire alarm control panel signal circuit.
- (2) To next device or end of line resistor for Class B. Return to control panel for Class A connection.

Figure 3: Typical two-circuit wiring diagram



Polarity is shown in the active state.

- (1) From UL/ULC Listed fire alarm control panel signal circuit.
- (2) To next device or end of line resistor for Class B. Return to control panel for Class A connection.

Mounting the electrical box

Figure 1 shows mounting details for:

- Standard box. When using a 4 in. square box, use an extension ring for additional wiring space, if needed. If using a double-gang electrical box that is 2-1/2 in. (64 mm) deep, locate the conduit only at the rear of the box.
- Weatherproof box. Peel off the adhesive backing from the gasket and adhere to the box.
- Surface mount box.

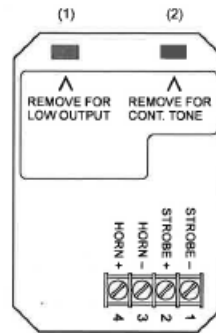
Selecting the volume and tone

The horn has a jumper for selecting a high or low volume output level. The default is high volume. To set the output to low volume, remove the output jumper from the circuit board on the rear of the unit. See Figure 4 below.

The horn has a jumper for selecting either a temporal or steady tone. The default is temporal tone. To set the output to steady tone, remove the tone jumper from the circuit board on the rear of the unit.

Tip: Save the jumper by sliding it onto a single pin.

Figure 4: Jumper setup and terminal block



Item	In	Out
(1)	High output	Low output
(2)	Temporal tone	Steady (continuous) tone

Maintenance

Note: Do not change the factory-applied finishes.

This unit is shipped from the factory as an assembled unit; it contains no user-serviceable parts and should not be disassembled.

Perform a visual inspection and an operational test twice a year or as directed by the local authority having jurisdiction.

Specifications

Operating voltage	16 to 33 VDC, 16 to 33 VFWR
Strobe operating current	See Table 4
Horn operating current	See Table 5
Sound output	See Table 6 and Table 7
Light output	See Table 10
Horn temporal pattern	0.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 0.5 s on, 1.5 s off, repeat cycle
Wire size	12 to 18 AWG (0.75 to 2.50 mm ²)
Compatible electrical boxes	2-1/2 in. (64 mm) deep double-gang, 4 in. square box 2-1/8 in. (54 mm) deep, Surface or bidirectional mounting box per Table 2
Operating temperature	
Indoor	32 to 120°F (0 to 49°C)
UL outdoor	-35 to 150°F (-37 to 66°C)
ULC outdoor	-40 to 150°F (-40 to 66°C)
Relative humidity	
Indoor	93% noncondensing
Outdoor	98% noncondensing

Regulatory information

Manufacturer	Edwards, A Division of UTC Fire & Security Americas Corporation, Inc. 8985 Town Center Parkway, Bradenton, FL 34202, USA
Year of manufacture	The first two digits of the date code (located on the product identification label) are the year of manufacture.
UL rating	Regulated 24 DC, regulated 24 FWR [1]
Environmental class	indoor, outdoor
Synchronization	Meets UL 1971 requirements. Maximum allowed resistance between any two devices is 20 Ω . Refer to specifications for the synchronization control module, this strobe, and the control panel to determine allowed wire resistance.
North American standards	Meets: CAN/ULC-S525-07, CAN/ULC-S526-07, UL 464, UL 1638 and UL 1971 Follow: NFPA 72 and CAN/ULC-S524
FCC compliance	This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules and regulations.

[1] This device was tested to the regulated 24 DC/FWR operating voltage limits of 16 V and 33 V.

Contact information

For contact information, see www.utcfireandsecurity.com.

Overview

The Control Relay Module and the Polarity Reversal Relay Module are part of the Signature Series system. They are intelligent analog addressable devices available in either plug-in (UIO) versions, or standard 1-gang mount versions.

The SIGA-CR/MCR Control Relay Module provides a Form "C" dry relay contact to control external appliances such as door closers, fans, dampers etc. This device does not provide supervision of the state of the relay contact. Instead, the on-board microprocessor ensures that the relay is in the proper ON/OFF state. Upon command from the loop controller, the SIGA-CR/MCR relay activates the normally open or normally-closed contact.

The SIGA-CRR/MCRR Polarity Reversal Relay Module provides a Form "C" dry relay contact to power and activate a series of SIGA-AB4G Audible Sounder Bases. Upon command from the Signature loop controller, the SIGA-CRR reverses the polarity of its 24 Vdc output, thus activating all Sounder Bases on the data loop.

Standard-mount versions (SIGA-CR and SIGA-CRR) are installed to standard North American 1-gang electrical boxes, making them ideal for locations where only one module is required. Separate I/O and data loop connections are made to each module.

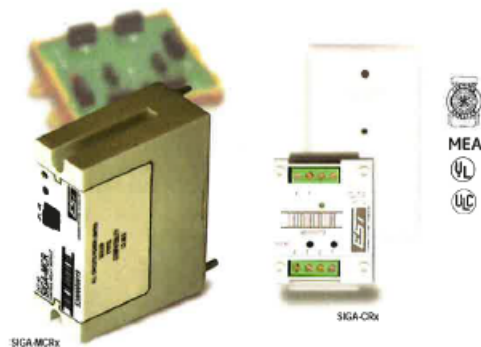
Plug-in UIO versions (SIGA-MCR and SIGA-MCRR) are part of the UIO family of plug-in Signature Series modules. They function identically to the standard mount versions, but take advantage of the modular flexibility and easy installation that characterizes all UIO modules. Two- and six-module UIO motherboards are available. All wiring connections are made to terminal blocks on the motherboard. UIO assemblies may be mounted in GE Security enclosures.

Standard Features

- **Provides one no/nc contact (SIGA-CR/MCR)**
Form "C" dry relay contact can be used to control external appliances such as door closers, fans, dampers etc.
- **Allows group operation of sounder bases**
The SIGA-CRR/MCRR reverses the polarity of its 24 Vdc output, thus activating all Sounder Bases on the data loop.
- **Plug-in (UIO) or standard 1-gang mount**
UIO versions allow quick installation where multiple modules are required. The 1-gang mount version is ideal for remote locations that require a single module.
- **Automatic device mapping**
Signature modules transmit information to the loop controller regarding their circuit locations with respect to other Signature devices on the wire loop.
- **Electronic addressing**
Programmable addresses are downloaded from the loop controller, a PC, or the SIGA-PRO Signature Program/Service Tool; there are no switches or dials to set.
- **Intelligent device with microprocessor**
 - All decisions are made at the module to allow lower communication speed with substantially improved control panel response time and less sensitivity to line noise and loop wiring properties; twisted or shielded wire is not required.
- **Ground fault detection by address**
Detects ground faults right down to the device level.

Control Relay Modules

SIGA-CR, SIGA-MCR, SIGA-CRR,
SIGA-MCRR

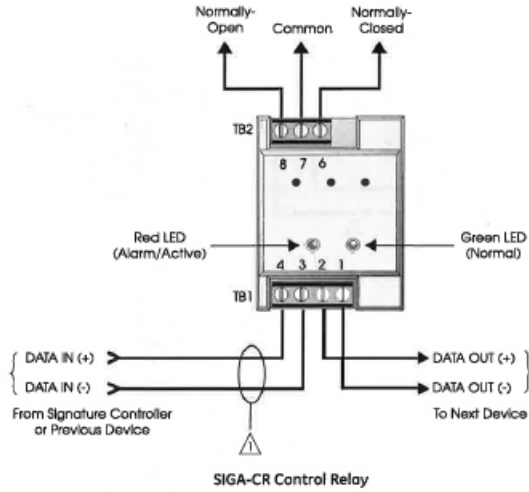


Data Sheet #5001-0239 Issue 7
Not to be used for installation purposes. Page 1 of 6

Typical Wiring

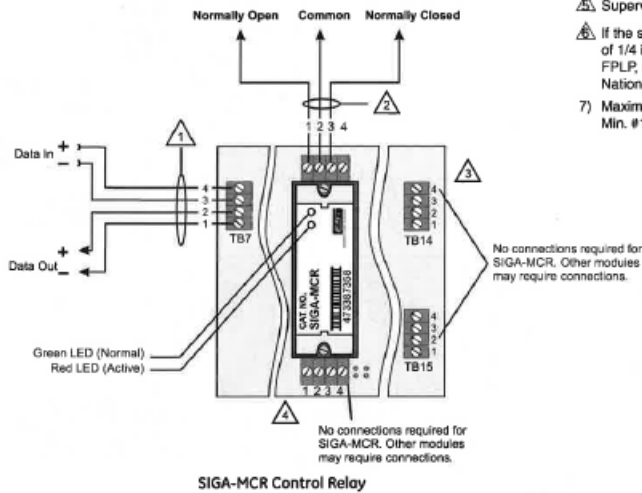
Modules will accept #18 AWG (0.75mm²), #16 (1.0mm²), #14 AWG (1.50mm²) and #12 AWG (2.5mm²) wire sizes.

Note: Sizes #16 AWG (1.0mm²) and #18 AWG (0.75mm²) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.



Notes

- ⚠ Refer to Signature Loop Controller Installation Sheet for wiring specifications.
- ⚠ NFPA 72 requires that the SIGA-CR/SIGA-MCR be installed in the same room as the device it is controlling. This requirement may not apply in all markets. Check with your local AHJ for details.
- ⚠ The SIGA-UIC6R and the SIGA-UIC2R do not come with TB14.
- ⚠ The SIGA-UIC6 does not come with TB8 through TB13.
- ⚠ Supervised and power-limited.
- ⚠ If the source is nonpower-limited, maintain a space of 1/4 inch from power-limited wiring or use FPL, FPLP, FPLR, or an equivalent in accordance with the National Electrical Code.
- 7) Maximum #12 AWG (2.5mm²) wire.
Min. #18 (0.75mm²).



Specifications

Catalog Number	SIGA-CR	SIGA-MCR	SIGA-CRR	SIGA-MCRR
Description	Control Relay		Polarity Reversal Relay	
Type Code	Personality Code B (Factory Set)		Personality Code B (Factory Set)	
Address Requirements	Uses 1 Module Address			
Operating Current	Standby = 100µA Activated = 100µA			
Operating Voltage	15.2 to 19.95 Vdc (19 Vdc nominal)			
Relay Type and Rating	Form "C" 24 VDC = 2 amps (pilot duty) 120 Vac = 0.5 amps 220 Vac (non-UL) = 0.5 amps			
Mounting	North American 2½ inch (64 mm) deep 1-gang boxes and 1½ inch (38 mm) deep 4 inch square boxes with 1-gang covers and SIGA-MP mounting plates	Plugs into UIO2R, UIO6R or UIO6 Motherboards	North American 2½ inch (64 mm) deep 1-gang boxes and 1½ inch (38 mm) deep 4 inch square boxes with 1-gang covers and SIGA-MP mounting plates	Plugs into UIO2R, UIO6R or UIO6 Motherboards
Construction & Finish	High Impact Engineering Polymer			
Storage and Operating Environment	Operating Temperature: 32°F to 120°F (0°C to 49°C) Storage Temperature: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH			
LED Operation	On-board Green LED - Flashes when polled On-board Red LED - Flashes when in alarm/active			
Compatibility	Use With: Signature Loop Controller			
Agency Listings	UL, ULC, CSFM, MEA			

Ordering Information

Catalog Number	Description	Ship Weight - lbs (kg)
SIGA-CR	Control Relay Module (Standard Mount) - UL/ULC Listed	0.4 (0.15)
SIGA-MCR	Control Relay Module (UIO Mount) - UL Listed	0.18 (0.08)
SIGA-CRR	Polarity Reversal Relay Module (Standard Mount) - UL/ULC Listed	0.4 (0.15)
SIGA-MCRR	Polarity Reversal Relay Module (UIO Mount) - UL Listed	0.18 (0.08)

Related Equipment

27193-11	Surface Mount Box - Red, 1-gang	1 (0.6)
27193-16	Surface Mount Box - White, 1-gang	1 (0.6)
SIGA-UIO2R	Universal Input-Output Module Board w/Riser Inputs - Two Module Positions	0.32 (0.15)
SIGA-UIO6R	Universal Input-Output Module Board w/Riser Inputs - Six Module Positions	0.62 (0.28)
SIGA-UIO6	Universal Input-Output Module Board - Six Module Positions	0.56 (0.25)
SIGA-AB4G	Audible (Sounder) Detector Base	0.3 (0.15)

Accessories

MFC-A	Multifunction Fire Cabinet - Red, supports Signature Module Mounting Plates	7.0 (3.1)
SIGA-MP1	Signature Module Mounting Plate, 1 footprint	1.5 (0.70)
SIGA-MP2	Signature Module Mounting Plate, 1/2 footprint	0.5 (0.23)
SIGA-MP2L	Signature Module Mounting Plate, 1/2 extended footprint	1.02 (0.46)

Overview

SIGA-CC1/MCC1 Single Input Signal Modules and SIGA-CC2/MCC2 Dual Input Signal Modules are part of GE Security's Signature Series system. They are intelligent analog addressable devices used for connecting, upon command from the loop controller, supervised Class B signal or telephone circuits to their respective power inputs. The power inputs may be polarized 24 Vdc to operate audible and visible signal appliances or 25 and 70 VRMS to operate audio evacuation speakers and firefighter's telephones.

The actual operation of the SIGA-CC1/MCC1 and SIGA-CC2/MCC2 is determined by the "personality code" selected by the installer. It is downloaded to the module from the Signature loop controller during system configuration.

The SIGA-CC1 and SIGA-CC2 mount to standard North American two-gang electrical boxes, making them ideal for locations where only one module is required. Separate I/O and data loop connections are made to each module.

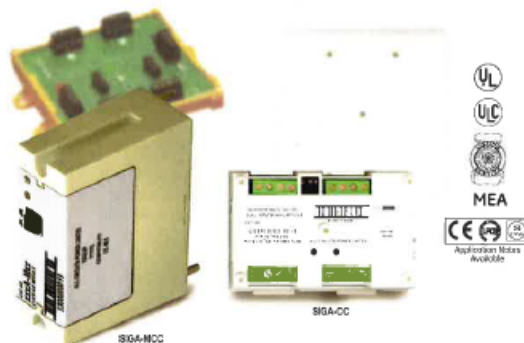
The SIGA-MCC1 and SIGA-MCC2 are part of the UIO family of plug-in Signature Series modules. They function identically to the SIGA-CC1 and SIGA-CC2, but take advantage of the modular flexibility and easy installation that characterize all UIO modules. Two- and six-module UIO motherboards are available. These can accommodate individual risers for each on-board module, or risers that are shared by any combination of its UIO modules. All wiring connections are made to terminal blocks on the motherboard. UIO assemblies may be mounted in GE Security enclosures.

Standard Features

- **Single and Dual input (riser) select**
Use for connecting supervised 24 Vdc Audible/Visible signal circuits, or 25 and 70 VRMS Audio Evacuation and Telephone circuits to their power inputs.
- **Ring-tone generator**
When configured for telephone circuits, the SIGA-CC1 generates its own ring-tone signal eliminating the need for a separate ring-tone circuit.
- **Plug-in (UIO) or standard 2-gang mount**
UIO versions allow quick installation where multiple modules are required. The 2-gang mount version is ideal for remote locations that require a single module.
- **Automatic device mapping**
Signature modules transmit information to the loop controller regarding their circuit locations with respect to other Signature devices on the wire loop.
- **Electronic addressing**
Programmable addresses are downloaded from the loop controller, a PC, or the SIGA-PRO Signature Program/Service Tool; there are no switches or dials to set.
- **Intelligent device with microprocessor**
All decisions are made at the module to allow lower communication speed with substantially improved control panel response time and less sensitivity to line noise and loop wiring properties; twisted or shielded wire is not required.
- **Ground fault detection by address**
Detects ground faults right down to the device level.

Signal Modules

SIGA-CC1, SIGA-MCC1,
SIGA-CC2 & SIGA-MCC2

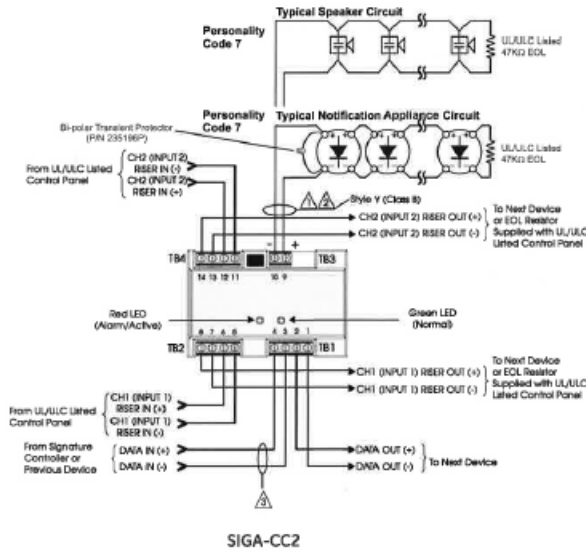


Data Sheet 85001-0237 Issue 9
Not to be used for installation purposes. Page 1 of 6

Typical Wiring (SIGA-CC2/MCC2)

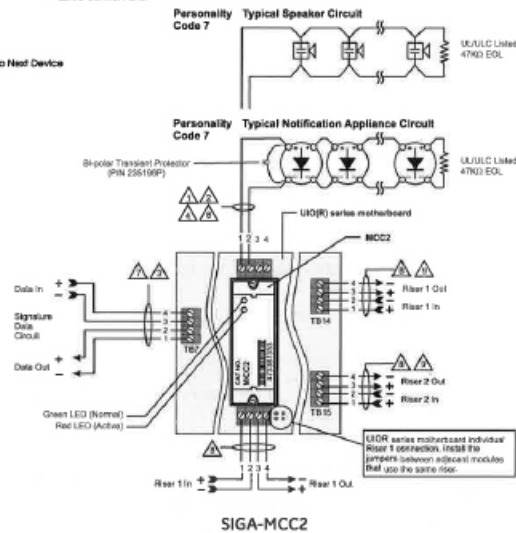
Modules will accept #18 AWG (0.75mm²), #16 (1.0mm²), #14 AWG (1.50mm²) and #12 AWG (2.5mm²) wire sizes.

Note: Sizes #16 AWG (1.0mm²) and #18 AWG (0.75mm²) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.



Notes

- ⚠ For maximum wire resistance and maximum wire distances, refer to IOMC Manual (P/N 270144).
- ⚠ Maximum #12 AWG (2.5mm²) wire. Min. #18 (0.75mm²).
- ⚠ Refer to Signature Loop Controller Installation Sheet for wiring specifications.
- ⚠ These modules will NOT support two-wire smoke detectors.
- ⚠ All wiring power limited and supervised. If the input source is non-power limited, then maintain spacing of 1/4 inch or use FPL, FPLP, FPLR or equivalent in accordance with NEC.
- ⚠ The SIGA-UIO6 does not come with TB8 through TB13.
- ⚠ Supervised and power-limited.
- ⚠ Supervised and power-limited when connected to a power-limited source. If the source is nonpower-limited, maintain a space of 1/4 inch from power-limited wiring or use FPL, FPLP, FPLR, or an equivalent in accordance with the National Electrical Code.
- ⚠ The input for this riser is common to all modules.



Maximum Output Load		
24Vdc	25V	70V
Signals	Audio	Audio
2A	50W	35W

Data Sheet 85001-0237 Issue 9
Not to be used for installation purposes. Page 3 of 6

Signature Series Overview

The Signature Series intelligent analog-addressable system from GE Security is an entire family of multi-sensor detectors and mounting bases, multiple-function input and output modules, network and non-network control panels, and user-friendly maintenance and service tools. Analog information from equipment connected to Signature devices is gathered and converted into digital signals. An onboard microprocessor in each Signature device measures and analyzes the signal and decides whether or not to input an alarm. The microprocessor in each Signature device provides four additional benefits – Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

Self-diagnostics and History Log – Each Signature Series device constantly runs self-checks to provide important maintenance information. The results of the self-check are automatically updated and permanently stored in its non-volatile memory. This information is accessible for review any time at the control panel, PC, or using the SIGA-PRO Signature Program/Service Tool. The information stored in device memory includes:

- Device serial number, address, and type
- Time and date of last alarm (EST3 V 2 only.)
- Most recent trouble code logged by the detector – 32 possible trouble codes may be used to diagnose faults.

Automatic Device Mapping –The Signature Data Controller (SDC) learns where each device's serial number address is installed relative to other devices on the circuit. The SDC keeps a map of all Signature Series devices connected to it. The Signature Series Data Entry Program also uses the mapping feature. With interactive menus and graphic support, the wired circuits between each device can be examined. Layout or "as-built" drawing information showing branch wiring (T-taps), device types and their address are stored on disk for printing hard copy. This takes the mystery out of the installation. The preparation of as-built drawings is fast and efficient.

Device mapping allows the Signature Data Controller to discover:

- Unexpected additional device addresses
- Missing device addresses
- Changes to the wiring in the circuit.

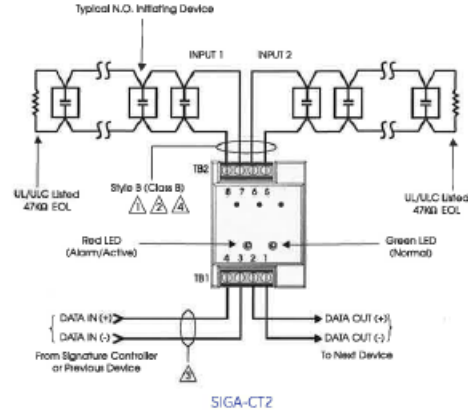
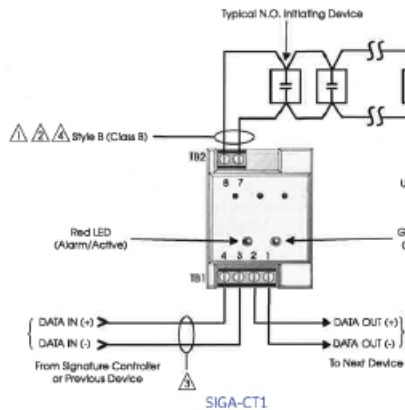
Most Signature modules use a personality code selected by the installer to determine their actual function. Personality codes are downloaded from the SDC during system configuration and are indicated during device mapping.

Typical Wiring

Modules will accept #18 AWG (0.75mm²), #16 (1.0mm²), and #14AWG (1.50mm²), and #12 AWG (2.50mm²) wire sizes.

Note: Sizes #16 AWG (1.0mm²) and #18 AWG (0.75mm²) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

Initiating (Slave) Device Circuit Wire Specifications		
Maximum Allowable Wire Resistance	50 ohms (25 ohms per wire) per Circuit	
Maximum Allowable Wire Capacitance	0.1µF per Circuit	
For Design Reference:	Wire Size	Maximum Distance to EOLR
	#18 AWG (0.75 mm ²)	4,000 ft (1,219 m)
	#16 AWG (1.00 mm ²)	
	#14 AWG (1.50 mm ²)	
	#12 AWG (2.50 mm ²)	



NOTES

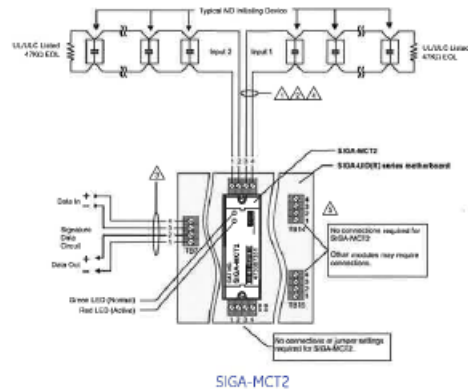
- ⚠ Maximum 25 Ohm resistance per wire.
- ⚠ Maximum #12 AWG (2.5 mm²) wire; Minimum #18 AWG (0.75 mm²).
- ⚠ Refer to Signature controller installation sheet for wiring specifications.
- ⚠ Maximum 10 Vdc @ 350 µA
- ⚠ The SIGA-UI06R and the SIGA-UI02R do not come with TB1A.
- 6 All wiring is supervised and power-limited.
- 7 These modules will not support 2-wire smoke detectors.

Warnings & Cautions

This module will not operate without electrical power. As fires frequently cause power interruption, we suggest you discuss further safeguards with your local fire protection specialist.

Compatibility

The Signature Series modules are compatible only with GE Security's Signature Loop Controller.





Manual Pull Stations

SIGA-270, SIGA-270P,
SIGA-278



Overview

The SIGA-270 and SIGA-278 series Manual Pull Stations are part of EST's Signature Series system. The SIGA-270 Fire Alarm Manual Pull Stations feature our very familiar teardrop shape. They are made from die-cast zinc and finished with red epoxy powder-coat paint complemented by aluminum colored stripes and markings. With positive pull-lever operation, one pull on the station handle breaks the glass rod and turns in a positive alarm, ensuring protection plus fool-proof operation. Presignal models (SIGA-270P) are equipped with a general alarm (GA) keyswitch for applications where two stage operation is required. The up-front highly visible glass rod discourages tampering, but is not required for proper operation.

EST's double action single stage SIGA-278 station is a contemporary style manual station made from durable red colored lexan. To initiate an alarm, first lift the upper door marked "LIFT THEN PULL HANDLE", then pull the alarm handle.

Standard Features

Note: Some features described here may not be supported by all control systems. Check your control panel's Installation and Operation Guide for details.

- **Traditional familiar appearance**
SIGA-270 models feature our familiar teardrop design with simple positive pull action and sturdy die-cast metal body.
- **One stage (GA), two stage (pre-signal), and double action models**
SIGA-270 models are available for one or two stage alarm systems. The single stage double action SIGA-278 features a rugged Lexan housing with keyed reset mechanism.

• Break glass operation

An up-front visible glass rod on the SIGA-270 discourages tampering.

• Intelligent device with integral microprocessor

All decisions are made at the station allowing lower communication speed while substantially improving control panel response time. Less sensitive to line noise and loop wiring properties; twisted or shielded wire is not required.

• ADA Compliant

Meets ADA requirements for manual pull stations.

• Electronic Addressing with Non-volatile memory

Permanently stores programmable address, serial number, type of device, and job number. Automatically updates historic information including hours of operation, last maintenance date, number of alarms and troubles, and time and date of last alarm.

• Automatic device mapping

Each station transmits wiring information to the loop controller regarding its location with respect to other devices on the circuit.

• Stand-alone operation

The station inputs an alarm even if the loop controller's polling interrogation stops.

• Diagnostic LEDs

Status LEDs; flashing GREEN shows normal polling; flashing RED shows alarm state.

• Designed for high ambient temperature operation

Install in ambient temperatures up to 120 °F (49 °C).

Installation

Single-stage Signature Series fire alarm manual pull stations mount to North American 2½ inch (64 mm) deep 1-gang boxes.

Two stage presignal (270P) models require 1½ inch (38 mm) deep 4-inch square boxes with 1-gang, ½-inch raised covers. Openings must be angular. *Rounded openings are not acceptable.* Recommended box: Steel City Model 52-C-13; in Canada, use Iberville Model CI-52-C-49-1/2.

All models include terminals are suited for #12 to #18 AWG (2.5 mm² to 0.75 mm²) wire size. Edwards recommends that these fire alarm stations be installed according to latest recognized edition of national and local fire alarm codes.

Electronic Addressing: The loop controller electronically addresses each manual station, saving valuable time during system commissioning. Setting complicated switches or dials is not required. Each station has its own unique serial number stored in its on-board memory. The loop controller identifies each device on the loop and assigns a "soft" address to each serial number. If desired, the stations can be addressed using the SIGA-PRO Signature Program/Service Tool.

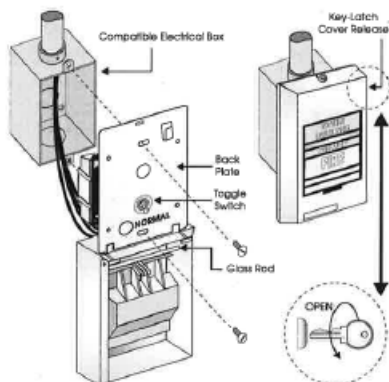


Figure 1. SIGA-278 installation

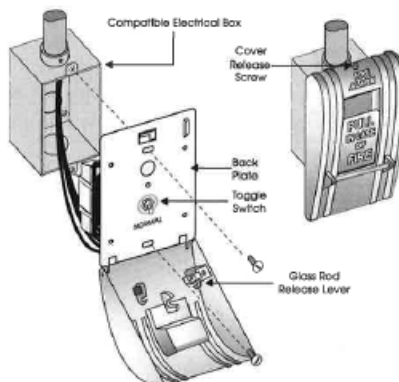


Figure 2. SIGA-270, SIGC-270F, SIGC-270B installation

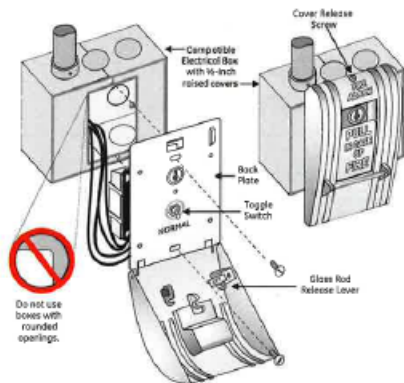


Figure 3. SIGA-270P, SIGC-270PB installation



Part of GE
Security

CONTROL PANELS

Compatibility → QuickStart

QS4 Multi-loop Intelligent/ Conventional Life Safety Control Panel

Features

- One to four Signature loops – each with a capacity of 250 intelligent devices – PLUS up to 48 conventional circuits
- Compatible with two- and four-wire smoke detectors
- Combines the Signature intelligent releasing module with Signature multisensor detectors for reliable suppression
- Failsafe mode ensures uncompromised reliability
- Class A (Style 7) or Class B (Style 4) wiring options
- Capacity for eight remote annunciators
- Four built-in system relays
- Optional dual line dialer supports Contact ID and 4/2 formats
- Three methods of programming: QuickStart "auto-learn," front panel and personal computer (PC)
- Supports optional barcode scanner for direct device data entry
- Two optional banks of 30 front panel switches with dual LEDs
- Up to 20 adjustable pre-alarm settings for Signature smoke detectors
- Red or grey cabinets in two sizes for surface or semi-flush mounting
- Large 14-line (224 character) backlit LCD display
- Four password levels, plus priority access keyswitch
- Message routing by event type or by individual message
- Alarm sensitivity by time of day or manual selection
- 1,000 event history buffer, plus alarm history counter
- 6 amp Power Supply, 4.75 amps available for external use
- ULC-S527-99 compliant
- Compare utility identifies system changes and simplifies testing

Description

EST's QS4 QuickStart life safety control panel provides conventional and intelligent addressable circuits in a single intelligent control panel. Designed for easy setup and simple installation, QuickStart lives up to its name in every respect. QS4's exclusive QuickStart auto-learn function, and the option of configuring the panel using convenient front panel



programming or from a PC, makes short work of system setup. Devices come on-line in no time as well, thanks to QS4's built-in barcode scanner port. A simple pass of the optional scanner is all it takes to store device information in the QuickStart database. The scanner can also be used for quick and easy text entry when assembling custom messages.

QS4's setup routine is deceptively simple, considering this system's robust features and broad capacity. Supporting up to 1,000 intelligent detectors and modules, QS4 takes full advantage of EST's exclusive Signature Series technology, which provides electronic addressing, automatic device mapping, environmental compensation, and true multisensor detection.

As a hybrid system, QS4 combines Signature Series support along with up to 48 conventional Class B or a combination of 40 Class A and Class B initiating circuits. Compatible with either two- or four-wire detectors, these circuits also provide built-in support for EST's EC family of conventional detectors.

QuickStart's design leaves plenty of room for system expansion. Option cards snap onto QS4's easily-accessible DIN mounting rails. These cards include a dialer, auxiliary relays, and additional system capacity. The QS4 also supports as many as eight remote annunciators and up to 60 programmable front panel switches with dual LEDs for system control and display.

QS4 is as simple to operate as it is to set up. Its large 14-line backlit LCD display provides easy-to-understand details concerning up to 1,000 system events, while bright system status LEDs and large, tactile control buttons present the user with a clean, crystal clear interface. Four password levels limit control and information retrieval to authorized personnel. A priority access keyswitch gives Level 2 access, without a password, to management and emergency personnel.



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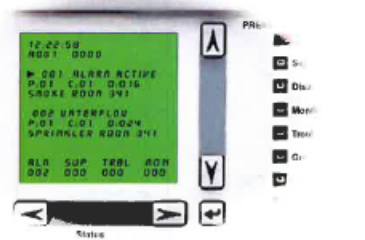
Literature Sheet #65005-0114 Issue 5

Not to be used for installation purposes. Page 1 of 8

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CPU / LCD Display

The QS4 front panel display provides 14 lines by 16 characters of text detailing event, device, diagnostic, and programming information. Its large backlit LCD screen is easy to read and always provides at-a-glance indication of the system's state of operation. The CPU/Display Unit houses the CPU card and mounting space for two optional LED/Switch cards.



Display with two alarms shown

Specifications

Operating environment	Temperature: 32–120 °F (0–49 °C) Humidity: 93 %RH, non-condensing
Current requirements	Standby: 117 mA when connected to PS6; 105 mA when connected as a remote annunciator Alarm: 135 mA when connected to PS6; 123 mA when connected as a remote annunciator

Failsafe Mode

If the CPU loses communication with other circuit cards, the power supply card continues to monitor the system for any alarm events. If an alarm occurs on any device or circuit during a communications failure, the power supply activates all alarm outputs and instructs the dialer to transmit a default alarm message to the monitoring station.

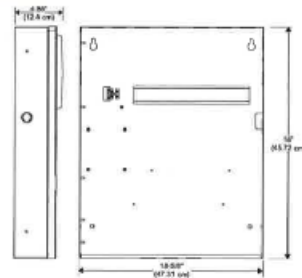
Remote Annunciator Dimensions

Model	Height	Width	Depth
QSA-1-S	7.6" (19.46 cm)	14.25" (36.20 cm)	2.9" (7.3 cm)
QSA-1-F (rough in)	6.56" (16.66 cm)	13.25" (33.66 cm)	2.1" (5.33 cm)
QSA-1-F (finished)	7.8" (19.81 cm)	14.42" (36.63 cm)	1.39" (3.49 cm)
QSA-2-S	7.6" (19.46 cm)	18.56" (47.14 cm)	2.9" (7.3 cm)
QSA-2-F (rough in)	6.56" (16.66 cm)	17.56" (44.60 cm)	2.1" (5.33 cm)
QSA-2-F (finished)	7.8" (19.81 cm)	18.76" (47.63 cm)	1.39" (3.49 cm)

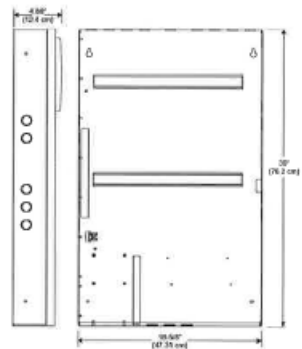
*Rough-in dimensions reflect the size of the cabinet where it enters the wall.
Finished dimensions reflect the size of the cabinet that protrudes from the wall.*

Cabinet Dimensions

5-Option Cabinet
QS4-5-R-1 (red)
QS4-5-G-1 (grey)

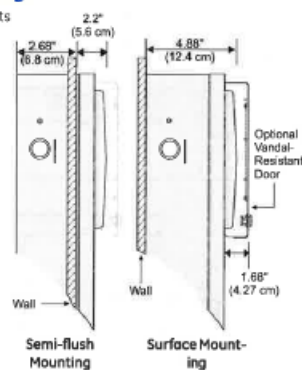


12-Option Cabinet
QS4-12-R-1 (red)
QS4-12-G-1 (grey)



Cabinet Mounting

12 and 5-Option Cabinets



Semi-flush mounting requires an optional trim ring, which adds 1/4" to all sides of the panel.

NOT TO BE USED FOR INSTALLATION PURPOSES.

Standard Components and Option Cards

All QS4 panels come standard with a CPU/Display Unit, and a PS6 Power Supply (see ordering information for details).

QuickStart option cards provide a wide range of features and extra system capacity. Thanks to the convenient Quick-Lok mounting system, option cards snap onto the DIN mounting rails easily and securely. Wallboxes are available in two sizes with room for either five or 12 single-space option cards. Both sizes of wallbox feature easily-accessible mounting rails and plenty of room for cabling.

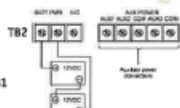
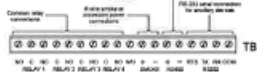
12-option card cabinet with option cards and batteries installed.



Power Supply Card PS6

The PS6 provides primary dc power to all the circuit cards installed in the cabinet. There are four 24 Vdc power output circuits – three for powering auxiliary applications, and one for powering four-wire smoke detectors – and a charging circuit for standby batteries. The PS6 also provides common alarm, supervisory, and trouble relays, as well as a fourth relay that is user programmable.

Wiring



- Relay 1:** Form C. Contacts change position when the control panel processes an alarm signal and remain changed until all active alarm inputs restore and the control panel resets.
 - Relay 2:** Form A. Contacts change position when the panel processes a supervisory signal and remain changed until all active supervisory inputs restore.
 - Relay 3:** Form A. Contacts change position when the panel loses power or processes a trouble signal and remain changed until power returns or the trouble clears.
 - Relay 4:** Form A. Relay closes and opens according to panel programming.
- Smoke/Accessory Power:** Jumper setting determines if the 24 Vdc is constant or resettable.

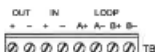
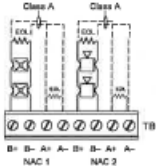
Specifications

Main supply circuit	AC input: 115 or 230 Vac, 50/60 Hertz DC input: 24 Vdc batteries
Battery charging circuit	Charge current: 2 amps Charge capacity: 40 amp hours (UL) 30 amp hours (ULC)
Smoke/Accessory power output circuit	Voltage: 24 Vdc, regulated Current: 250 mA Wire size: 12 to 18 AWG (0.75 to 2.5 mm ²)
Auxiliary power output circuits	Quantity: 3 Voltage: 24 vdc full wave rectified Current: 1.5 amps each
Common alarm relay	Style: Form C Contact rating: 1 amp Wire size: 12 to 18 AWG (0.75 to 2.5 mm ²)
Trouble, Supervisory and programmable relays	Style: Form A (N/O) Contact rating: 1 amp Wire size: 12 to 18 AWG (0.75 to 2.5 mm ²)
Operating environment	Temperature: 32 - 120° F (0 - 49° C) Humidity: 93 %RH, non-condensing
Current requirements	Standby current: 72 mA Alarm current: 96 mA

Signature Loop Intelligent Controller SLIC

The SLIC provides one Class A or Class B data circuit (loop) for connecting Signature Series detectors and modules. The SLIC also provides two programmable Class A or Class B notification appliance circuits (NACs) for connecting polarized 24 Vdc notification appliances such as horns and strobes. Both the QS4-5 and the QS4-12 support one to four SLICs.

Wiring



Signaling Line Circuit and NACs are supervised and power-limited.

Specifications

Signaling line circuit	Configuration: Class B (Style 4) or Class A (Style 7) Capacity: 125 Signature detectors 125 Signature modules Wire size: 12 to 18 AWG (0.75 to 2.5 mm ²) Circuit resistance: 65 ohms Circuit capacitance: 0.3 μf
Notification appliance circuits #1 and #2	Configuration: Class B or Class A Output voltage: 24 Vdc, nominal Output current: 2.0 A at 24 Vdc for #1 and 1.0 A at 24 Vdc for #2 Wire size: 18 to 12 AWG (0.75 to 2.5 mm ²) End of line resistor: 10k ohms, ½ W
NAC power input circuit	Voltage: 24 Vdc, nominal Wire size: 18 to 12 AWG (0.75 to 2.5 mm ²)
Operating environment	Temperature: 32 - 120° F (0 - 49° C) Humidity: 93 %RH, non-condensing
Current requirements	Standby current: 33 mA Alarm current: 57 mA (Both NACs on)
Card spaces	Requires one card space.

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OPTION CARD **LED/Switch Cards** SL30, SL30-1, SL20L5S, SL30L

The SL30 and SL30-1 provide thirty circuits for zone annunciation. Each circuit comprises two LEDs and a push button switch. The **SL30** push button switches are numbered from 1 to 30 and the **SL30-1** push button switches are numbered from 31 to 60. The **SL20L5S** provides 20 circuits for point annunciation and five circuits for custom control functions. The **SL30L** provides 30 circuits for point annunciation. SL20L5S and SL30L circuits are labeled using inserts provided with the cards.

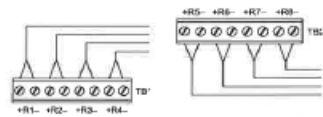


Specifications	
Operating environment	Temperature: 32 - 120° F (0 - 49° C) Humidity: 93% RH, non-condensing
Current requirements	Standby: 1mA Alarm: 0.75 mA per active LED

OPTION CARD **Relay Card** ZR8

The ZR8 provides eight dry-contact relays that can be independently configured as Form A or Form B relays. It occupies one card space on the chassis rail.

Wiring

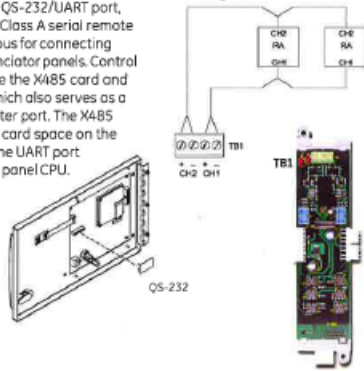


Specifications	
Output relays	Style: Form A (N/O) or Form B (N/C) (jumper configurable) Contact rating: 1 amp @ 30 Vdc resistive. Wire size: 18 to 12 AWG (0.75 to 2.5 mm ²)
Operating environment	Temperature: 32 - 120° F (0 - 49° C) Humidity: 93%RH, non-condensing
Current requirements	Standby current: 7 mA Alarm current: 18 ma per active relay
Card spaces	Requires one card space.

OPTION CARD **Class A RS-485 Card and QS-232 Port** X485

The NT-A, which includes the X485/RS-485 card and QS-232/UART port, provides one Class A serial remote annunciator bus for connecting remote annunciator panels. Control panels require the X485 card and UART port, which also serves as a laptop or printer port. The X485 occupies one card space on the chassis rail. The UART port plugs into the panel CPU.

Wiring



Specifications	
Wire size	12 to 18 AWG (0.75 to 2.5 mm ²) twisted pair (6 twists per foot minimum)
Circuit resistance	100 Ohms
Circuit capacitance	0.4 μF
Operating environment	Temperature: 32 - 120° F (0 - 49° C) Humidity: 93%RH, noncondensing
Current requirements	Standby: 75 mA Alarm: 75 mA
Card Spaces	Requires one space for the NT-A

Overview

The Signature Series Model SIGA-PS Intelligent Photoelectric Smoke Detector gathers analog information from its smoke sensing element and converts it into digital signals. The detector's on-board microprocessor measures and analyzes these signals. It compares the information to historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires. Unwanted alarms are virtually eliminated.

The microprocessor in each detector provides four additional benefits - Self-diagnostics and History Log, Automatic Device Mapping, Stand-alone Operation and Fast, Stable Communication.

Self-diagnostics and History Log - Each Signature Series detector constantly runs self-checks to provide important maintenance information. The results of the self-check are automatically updated and permanently stored in the detector's non-volatile memory.

Automatic Device Mapping - The loop controller learns where each device's serial number address is installed relative to other devices on the circuit. The mapping feature provides supervision of each device's installed location to prevent a detector from being re-installed (after cleaning etc.) in a different location from where it was originally.

Stand-alone Operation - A decentralized alarm decision by the detector is guaranteed. On-board intelligence permits the detector to operate in stand-alone mode. If loop controller CPU communications fail for more than four seconds, all devices on that circuit go into stand-alone mode. The circuit acts like a conventional alarm receiving circuit.

Fast Stable Communication - On-board intelligence means less information needs to be sent between the detector and the loop controller. Other than regular supervisory polling response, the detector only needs to communicate with the loop controller when it has something new to report.

Standard Features

- Integral microprocessor
- Non-volatile memory
- Automatic mapping device
- Electronic addressing
- Environmental compensation
- Intelligent detector
- Wide 0.67% to 3.77%/ft. sensitivity range
- Twenty pre-alarm sensitivity values, set in 5% increments
- Identification of dirty or defective detectors
- Automatic day/night sensitivity adjustment
- Twin RED/GREEN status LEDs
- Standard, relay, fault isolator, and audible mounting bases
- Designed and manufactured to ISO 9001 standards

Intelligent Photoelectric Smoke Detector

SIGA-PS



Data Sheet 85001-0269 Issue 6
Not to be used for installation purposes. Page 1 of 4

Application

Although photoelectric detectors have a wide range of fire sensing capabilities they are best suited for detecting slow, smoldering fires. The table below shows six standard test fires used to rate the sensitivity of smoke and heat detectors. The table indicates that no single sensing element is suited for all test fires.

GE Security recommends that this detector be installed according to latest recognized edition of national and local fire alarm codes.

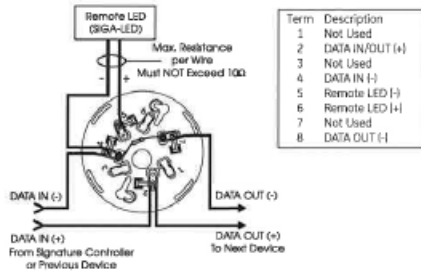
Test Fire	SIGA-IS Ion	SIGA-PS Photo	SIGA-HRS and SIGA-HFS Rate-of-Rise/ Fixed Temp.	SIGA-PHS Photo Heat 3D	SIGA-IPHS Ion/Photo/Heat 4D
Open Wood	optimum	unsuitable	optimum	very suitable	optimum
Wood Pyrolysis	suitable	optimum	unsuitable	optimum	optimum
Smoldering Cotton	very suitable	optimum	unsuitable	optimum	optimum
Poly Urethane Foam	very suitable	very suitable	suitable	very suitable	optimum
n-Heptane	optimum	very suitable	very suitable	optimum	optimum
Liquid Fire without Smoke	unsuitable	unsuitable	optimum	very suitable	very suitable

Typical Wiring

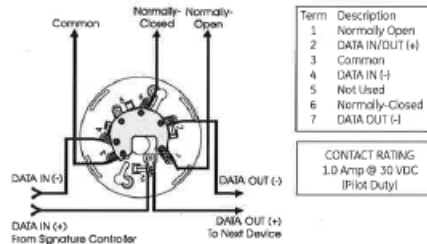
The detector mounting bases accept #18 AWG (0.75mm²), #16 (1.0mm²), #14 AWG (1.5mm²), and #12 AWG (2.5mm²) wire sizes.

Note: Sizes #16 AWG (1.0mm²) and #18 AWG (0.75mm²) are preferred for ease of installation. See Signature Loop Controller catalog sheet for detailed wiring requirement specifications.

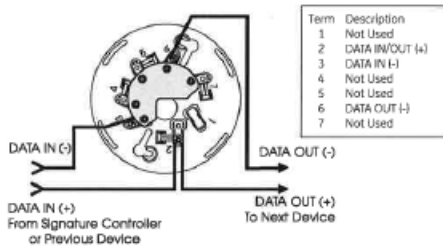
Standard Detector Base, SIGA-SB, SIGA-SB4



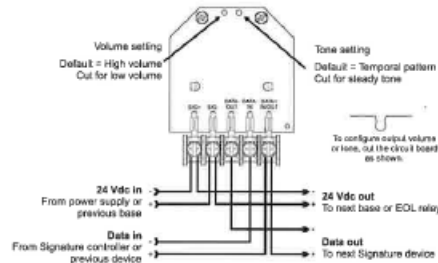
Relay Detector Base, SIGA-RB, SIGA-RB4



Isolator Detector Base, SIGA-IB, SIGA-IB4



Audible Detector Base, SIGA-AB4G



Overview

The SIGA-CT1 Single Input Module and SIGA-CT2/SIGA-MCT2 Dual Input Modules are intelligent analog addressable devices used to connect one or two Class B normally-open Alarm, Supervisory, or Monitor type dry contact Initiating Device Circuits (IDC).

The actual function of these modules is determined by the "personality code" selected by the installer. This code is downloaded to the module from the Signature loop controller during system configuration.

The input modules gather analog information from the initiating devices connected to them and convert it into digital signals. The module's on-board microprocessor analyzes the signal and decides whether or not to input an alarm.

The SIGA-CT1 and SIGA-CT2 mount to standard North American 1-gang electrical boxes, making them ideal for locations where only one module is required. Separate I/O and data loop connections are made to each module.

The SIGA-MCT2 is part of the UIO family of plug-in Signature Series modules. It functions identically to the SIGA-CT2, but takes advantage of the modular flexibility and easy installation that characterizes all UIO modules. Two- and six-module UIO motherboards are available. All wiring connections are made to terminal blocks on the motherboard. UIO assemblies may be mounted in GE Security enclosures.

Standard Features

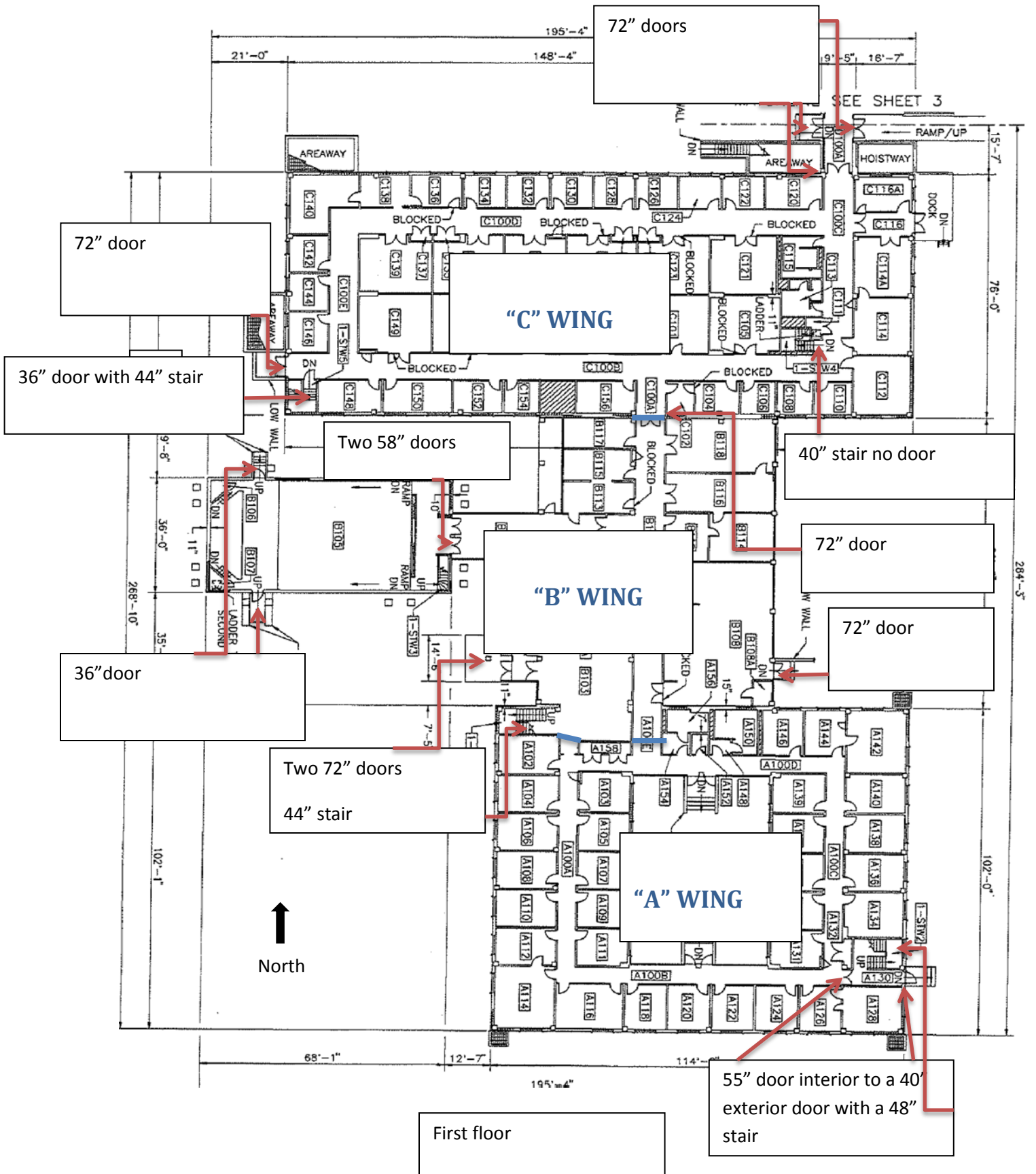
- **Multiple applications**
Including Alarm, Alarm with delayed latching (retard) for water-flow applications, Supervisory, and Monitor. The installer selects one of four "personality codes" to be downloaded to the module through the loop controller.
- **Plug-in (UIO) or standard 1-gang mount**
UIO versions allow quick installation where multiple modules are required. The 1-gang mount version is ideal for remote locations that require a single module.
- **Automatic device mapping**
Signature modules transmit information to the loop controller regarding their circuit locations with respect to other Signature devices on the wire loop.
- **Electronic addressing**
Programmable addresses are downloaded from the loop controller, a PC, or the SIGA-PRO Signature Program/Service Tool. There are no switches or dials to set.
- **Non-volatile memory**
Permanently stores serial number, type of device, and job number.
- **Stand-alone operation**
The module makes decisions and inputs an alarm from initiating devices connected to it even if the loop controller's polling interrogation stops. (Function availability dependent upon control panel.)
- **Ground fault detection by address**
Detects ground faults right down to the device level.

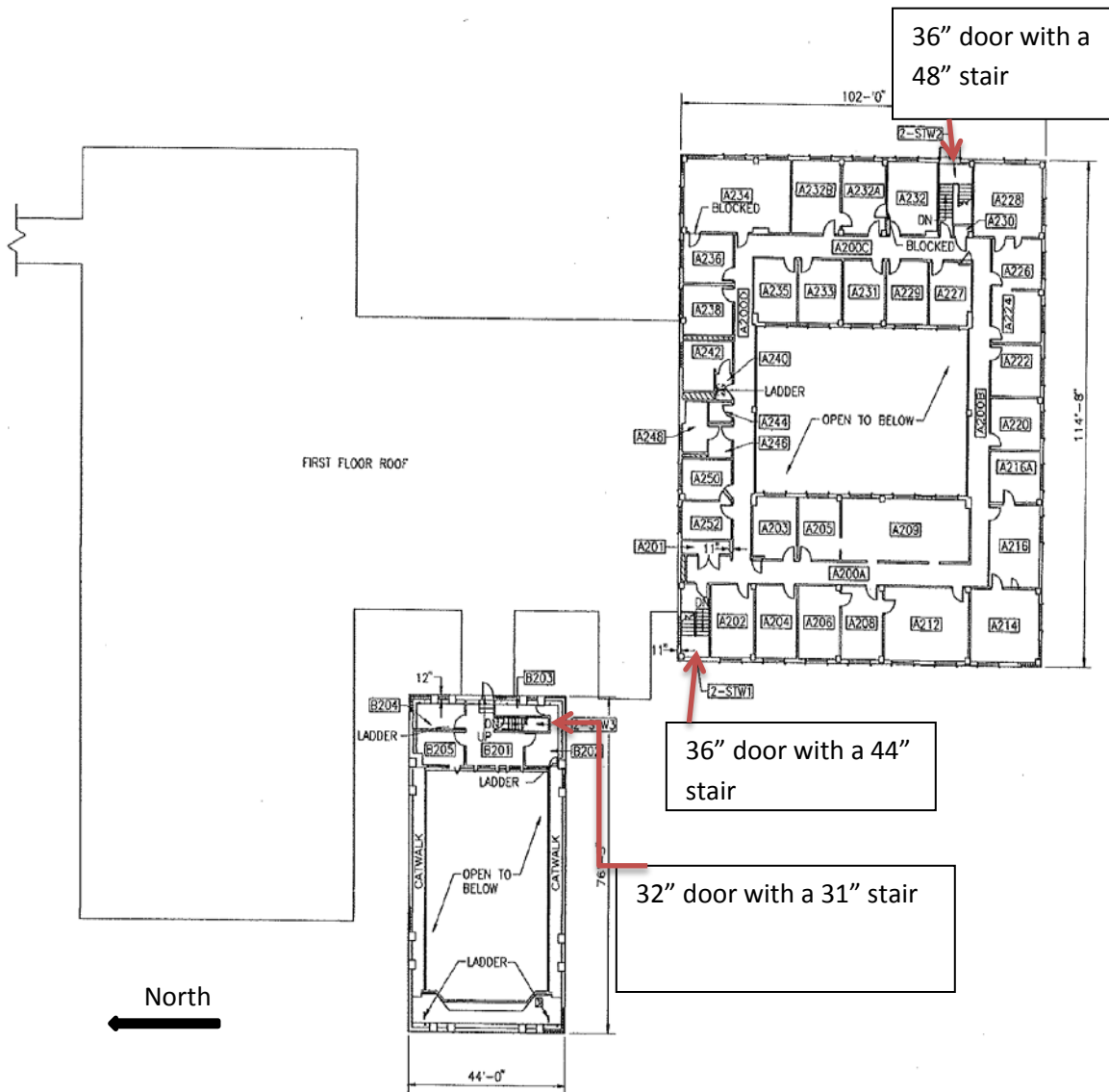
Input Modules SIGA-CT1, SIGA-CT2 & SIGA-MCT2



Data Sheet 85001-0241 Issue 6
Not to be used for installation purposes. Page 1 of 4

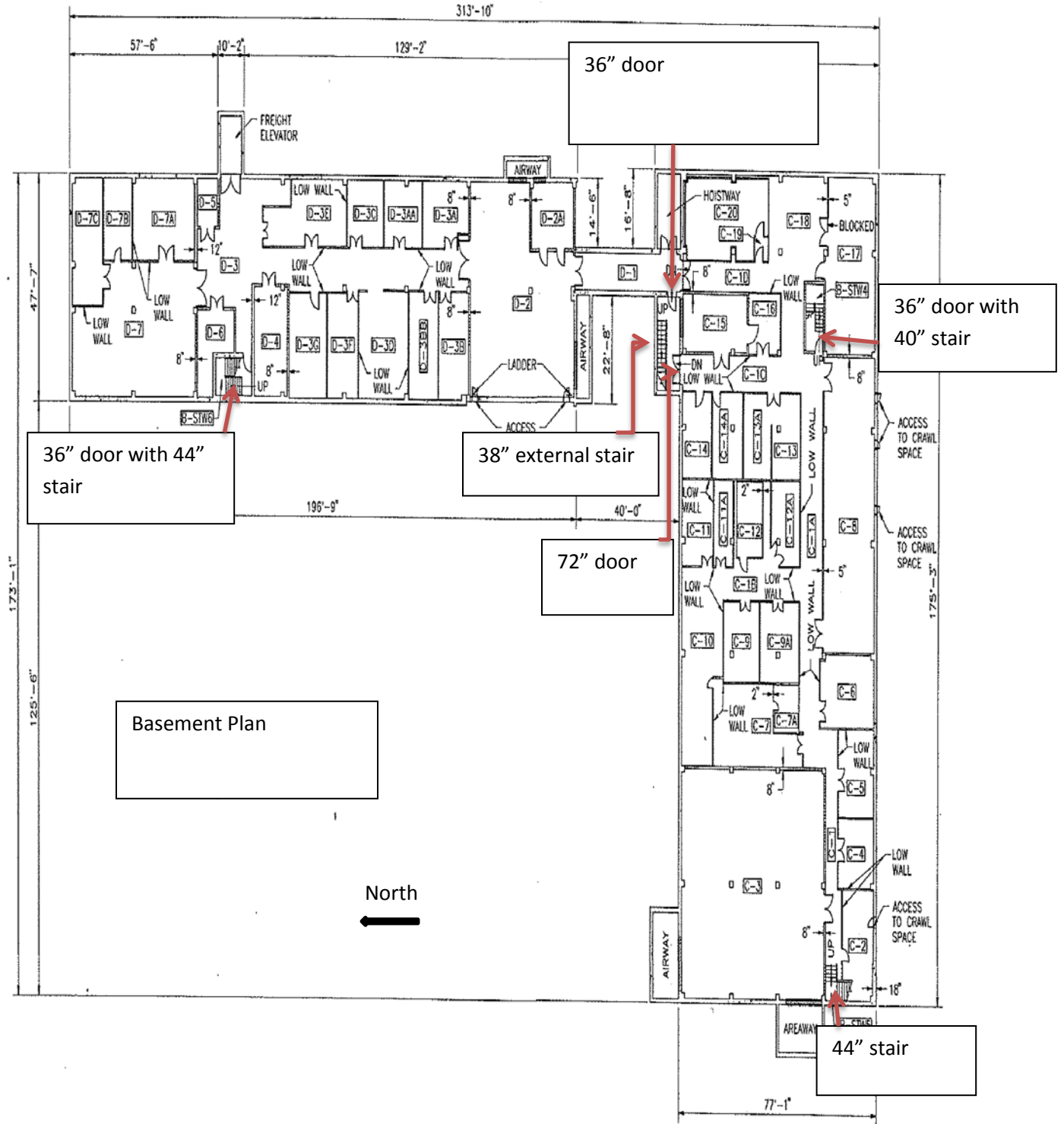
Floor Plans with Exits



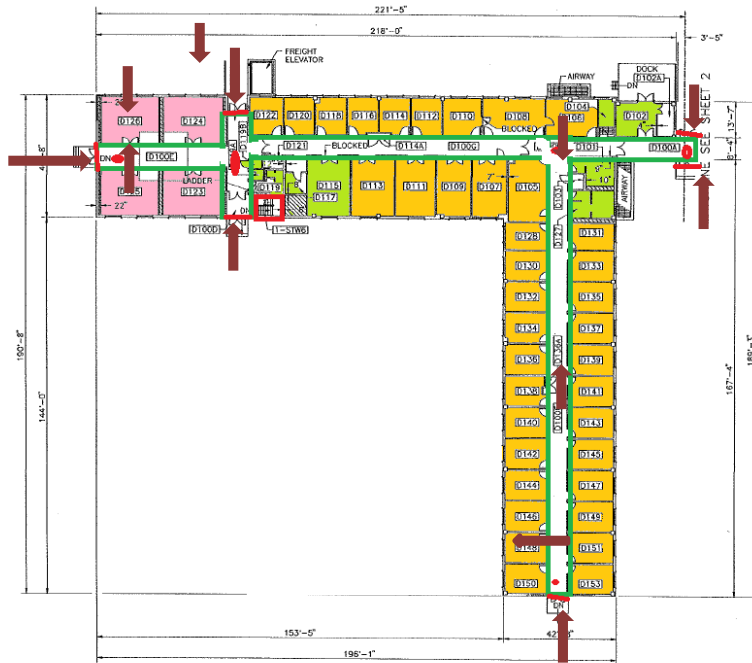


SECOND FLOOR PLAN

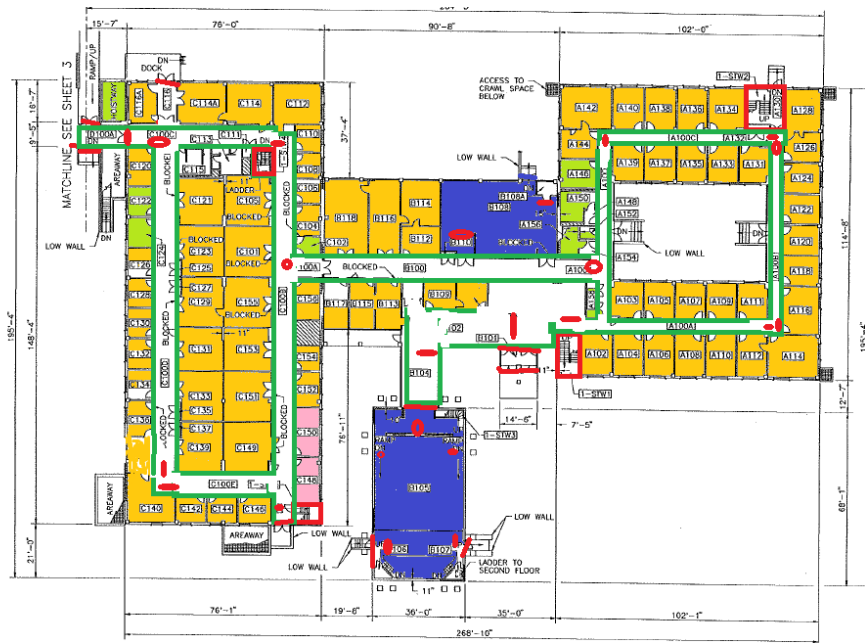
SCALE: 1/16" = 1'-0"

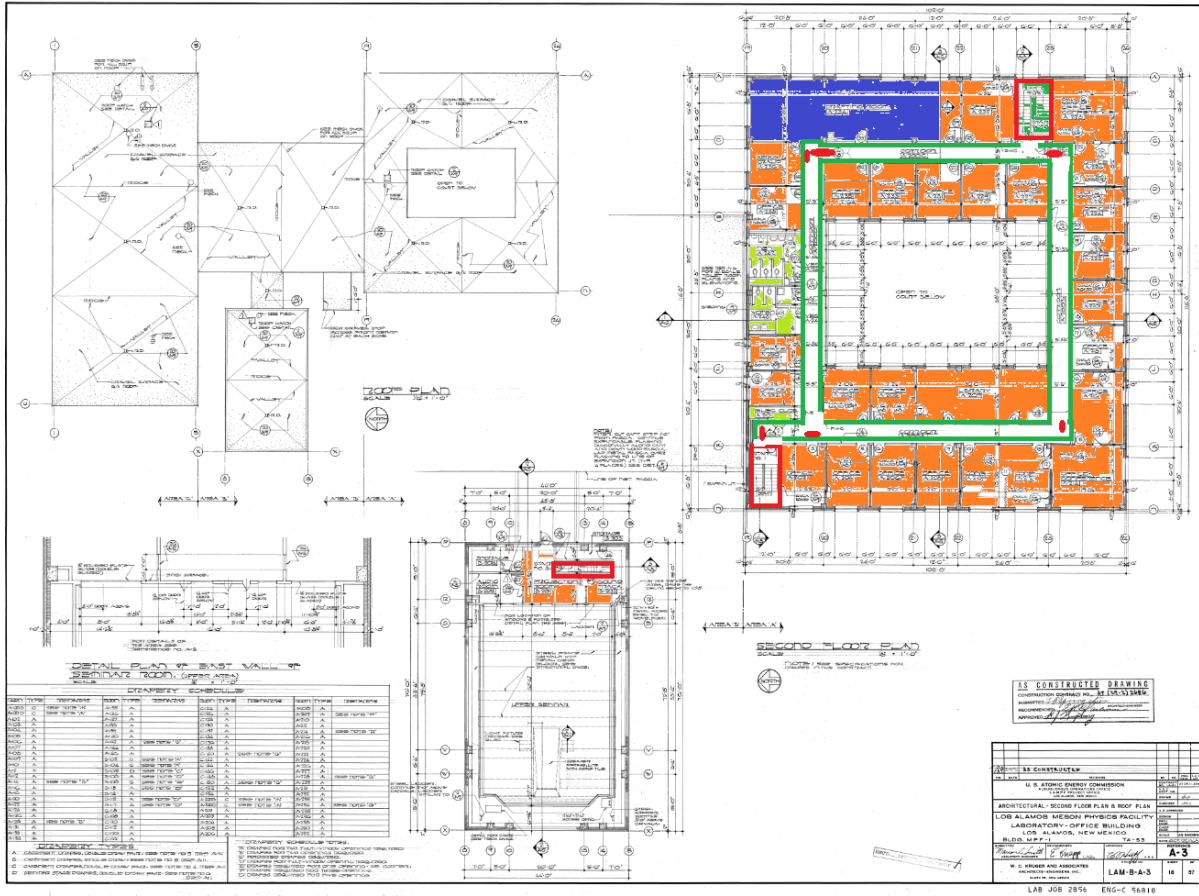











Occupancy Identification Maps



FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"





	Assembly Occupancy
	Business Occupancy
	Business Occupancy
	Mechanical Space
	Corridor
	Stair
	Lab Space
	Exit Sign
	Exit door

Hydraulic Calculations

Noakes

HYDRAULIC CALCULATIONS

CONTRACT NAME FPE 523 Project Call.

SHEET 1 OF 3

NOZZLE IDENT. AND LOCATION	FLOW IN GPM	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS PSI/FT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES
	q			L		Pt	Pt	Density = .29 lbm area = 1500 sq ft 10x12 = 120 $\frac{1500 \times .25}{120}$
	q			F		Pe	Pv	
	q			T		Pf	Pn	
	q			L	Hazard with 0.5	Pt	Pt	13 sprinklers K factor = 5.6
	q			F		Pe	Pv	
	q			T		Pf	Pn	
1 SP1 BL1	q 24	5/8" 40		L 9	.18	Pt 19.4	Pt	g = .2 x 120 P = (Q/K) ² (24/5.6)
	q	(1.019)		F 0		Pe 0	Pv	
	q			T 9		Pf 1.64	Pn	
2 SP2 BL1	q 25.1	1/2"		L 10	.18	Pt 20.4	Pt	$Q = K \sqrt{\frac{P}{S.L \sqrt{2000}}}$
	q 49.1	(6.38)		F 0		Pe 0	Pv	
	q			T 10		Pf 1.8	Pn	
3 SP3 BL1	q 26.2	1/4"		L 8.6	.4	Pt 21.24	Pt	$Q = 5.6 \sqrt{21.54}$
	q 75.2	(6.38)		F 0		Pe 0	Pv	
	q			T 8.6		Pf 3.44	Pn	
4 SP4 BL1	q 28.2	1.5"	1 Tee	L 2.6	.34	Pt 25.29	Pt	$Q = 5.6 \sqrt{25.29}$
	q 103.4	(6.6)		F 8		Pe 0	Pv	
	q			T 10.6		Pf 3.6	Pn	
5 SP5 BL1	q 30.1	1.5"	1 Tee	L 2.5	.03	Pt 28.8	Pt	$Q = 5.6 \sqrt{28.8}$
	q 133.4	(6.6)		F 8		Pe 0	Pv	
	q			T 15.5		Pf 4.65	Pn	
6 BL1	q			L		Pt 29.3	Pt	BL1 Total
	q			F		Pe	Pv	
	q 133.4			T		Pf	Pn	
7 BL1 TO BL2	q 133.4	3"		L 12	.23	Pt 29.3	Pt	
	q	(6.068)		F 0		Pe 0	Pv	
	q			T 12		Pf .3	Pn	
	q			L		Pt 29.6	Pt	
	q			F		Pe	Pv	
	q			T		Pf	Pn	
	q			L		Pt	Pt	
	q			F		Pe	Pv	
	q			T		Pf	Pn	
						Pt		



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HYDRAULIC CALCULATIONS

CONTRACT NAME

FPE S23 Project Calc

SHEET 2 OF 3

NOZZLE IDENT. AND LOCATION	FLOW IN GPM	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS PSI/FT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES
8 SP6 BL2	q 24	1 (1.04)		L 9	.18	Pt 18.4	Pt	
	q			F 0		Pe 0	Pv	
				T 9		Pf 1.64	Pn	
9 SP7 BL2	q 28.1	1 1/4 (6.38)		L 10	.18	Pt 20.04	Pt	q = 5.6 √20.04
	q 49.1			F 0		Pe 0	Pv	
				T 10		Pf 1.8	Pn	
10 SP8 BL2	q 26.2	1 1/4 (1.38)	(2) EC15	L 8.6	.4	Pt 21.84	Pt	q = 5.6 √21.84
	q 5.27			F 6		Pe 0	Pv	
				T 14		Pf 5.6	Pn	
11 SP9 BL2	q 29.3	1 1/2 (1.61)	(1) Tee	L 2.6	.35	Pt 27.44	Pt	q = 5.1 √27.44
	q 104.6			F 8		Pe 0	Pv	
				T 10.6		Pf 3.71	Pn	
BL2 Totals	q			L		Pt 31.15	Pt	BL2 Total
	q 104.6			F		Pe	Pv	
				T		Pf	Pn	
BL2 BL3	q 133.4			L		Pt 29.6	Pt	q from BL1 = 133.4 Pt from BL1 = 29.6
	q 238			F		Pe	Pv	
				T		Pf	Pn	
12 BL2 TO BL3	q 238	3 (5.068)	(1) ELB	L 12	.07	Pt 60.75	Pt	
	q			F 7		Pe 0	Pv	
				T 19		Pf 1.33	Pn	
BL3	q			L		Pt 62.08	Pt	
	q 238			F		Pe	Pv	
				T		Pf	Pn	
13 SP10 BL3	q 24	1 (1.04)		L 9	.18	Pt 18.4	Pt	
	q			F 0		Pe 0	Pv	
				T 9		Pf 1.64	Pn	
14 SP11 BL3	q 28.1	1 1/4 (6.38)		L 10	.18	Pt 20.04	Pt	q = 5.6 √20.04
	q 49.1			F 0		Pe 0	Pv	
				T 10		Pf 1.8	Pn	
15 SP12 BL3	q 26.2	1 1/2 (1.38)		L 8.6	.4	Pt 21.84	Pt	q = 5.6 √21.84
	q 75.27			F 0		Pe 0	Pv	
				T 8.6		Pf 3.44	Pn	
						Pt 25.28		



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HYDRAULIC CALCULATIONS

CONTRACT NAME

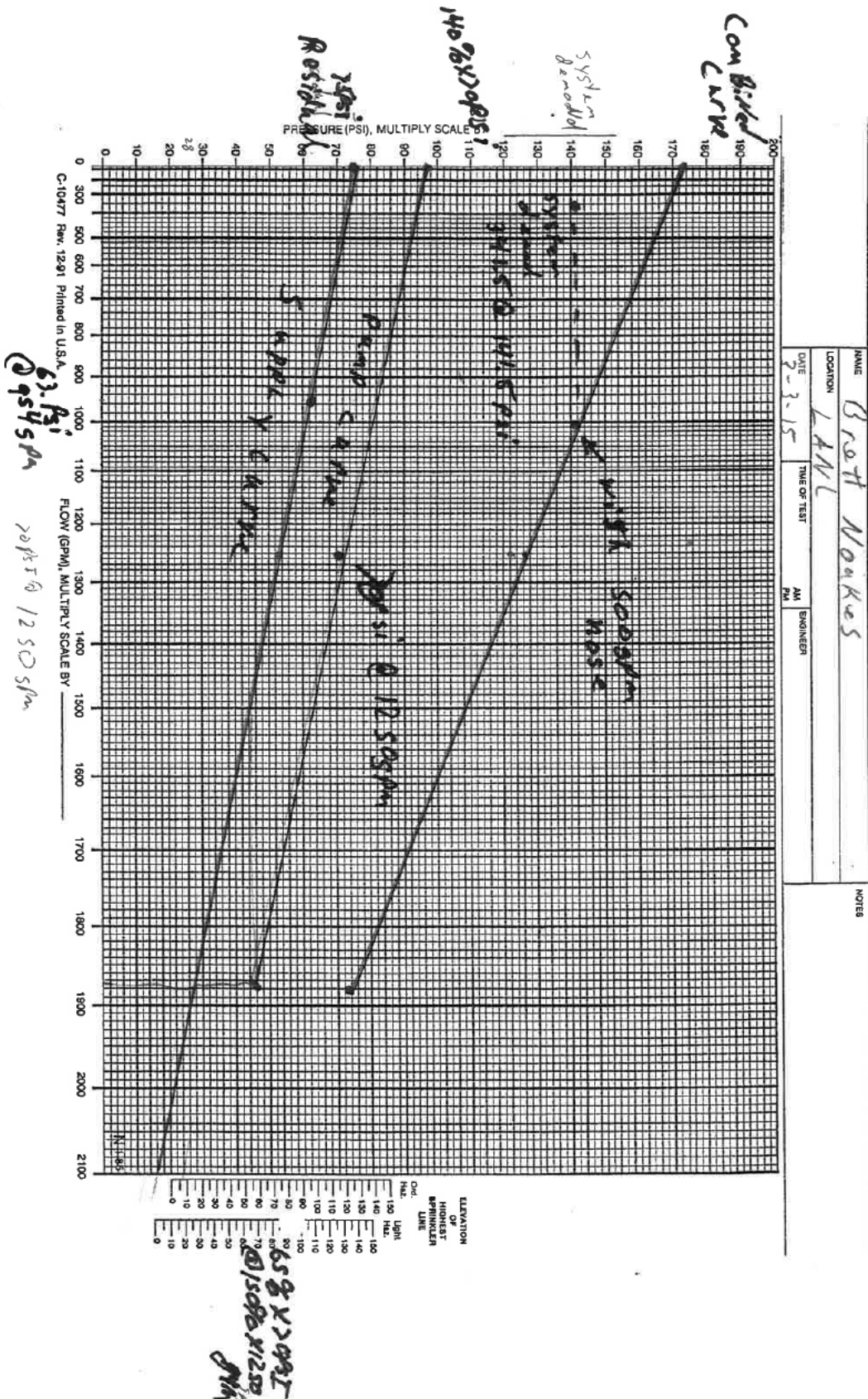
FPE 523 Project Calc.

SHEET 3 OF 3

NOZZLE IDENT. AND LOCATION	FLOW IN GPM	PIPE SIZE	PIPE FITTINGS AND DEVICES	EQUIV. PIPE LENGTH	FRICTION LOSS PSI/FT	PRESSURE SUMMARY	NORMAL PRESSURE	NOTES
16 5 P13 BL3	q 28.15	1 1/2 (1.33)	1 Tee	L 4	.8	Pt 25.29	Pt	$q = 5.6 \times \sqrt{25.28}$
	q 103.4			F 8		Pe 0	Pv	
				T 12		Pf 9.6	Pn	
	q		L			Pt 34.88	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
17 BL3 TO 4" main	q 238			L		Pt 62.88	Pt	From BL1 + 2 = 238 Pt from BL1 + 2 = 62.88
	q 341.4			F		Pe	Pv	
				T		Pf	Pn	
18 BL3 TO 4" main	q 341.4	3" (3.068)	4 EUB (P)	L 122	.13	Pt 92.68	Pt	1433 x 13 = Pe
	q		1 Tee (P)	F 43		Pe 5.629	Pv	
				T 165		Pf 21.45	Pn	
19 4" main TO HOR	q	4" (4.026)	3 EUB (P)	L 105	.04	Pt 124.75	Pt	Pe = 432 x 24 =
	q 341.4		1 5/8" V2	F 54		Pe 10.39	Pv	
				T 159		Pf 6.36	Pn	
	q		L			Pt 141.5	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	System demand is 341.5 gpm @ 146.5 psi
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	
	q		L			Pt	Pt	
	q		F			Pe	Pv	
	q		T			Pf	Pn	



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NAME	Brett Noakes
LOCATION	LAV
DATE	2-3-15
TIME OF TEST	
AM	
ENGINEER	

NOTES