



# Woodward Willis Building

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## *Fire and Life Safety Evaluation*

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Keywords:

- Life Safety Assessment
- Egress Analysis
- Performance Based Analysis
- Fire Protection Systems
- Fire Modeling

## **Executive Summary:**

This project report is an academic exercise, completed as part of the MS Fire Protection Engineering program at California Polytechnic State University. This project is a culminating report with regards to life safety analysis of the Woodward Willis Building located in Detroit Michigan, which utilizes the fundamental and applied courses of the fire protection engineering program.

The analysis is based on a prescriptive analysis of the building and its features, and also a performance analysis which entails the life safety aspect of the building. The analysis of the building is performed in accordance with NFPA 101 Life Safety Code 2015 Edition and its references as well as being supplemented by the SFPE Handbook 5<sup>th</sup> Edition. The building is analyzed as a new structure as it is currently under construction.

The Woodward Willis building is three stories and is comprised of a technical college, storefronts, and a parking garage. These areas reveal occupancy classifications of educational, mercantile, and storage to be considered in the analysis. The building is situated on the northwest corner at the intersection of Woodward Avenue and Willis Street with frontage on each road. The north frontage of the building faces a factory and is separated by an alley. This alley is greater than 10 feet wide, which allows a separation distance fire resistance rating of 0 hours along this side of the building. The east side of the building faces a McDonalds property and is also greater than 10 feet, allowing it to have required fire resistance rating on the exterior of the building as well.

The prescriptive analysis concludes that, in general the building is in compliance with the applicable codes and standards from a fire protection standpoint. These results are based on the information available at this time and are not taking into consideration any modifications to the construction process beyond this time. A final as built scenario shall include final testing and inspection of all the systems in a typical scenario in which the building will be used. At this point, the building shall have all fire protection systems fully commissioned by a certified fire protection contractor before occupancy.

The performance based analysis addressed the life safety of the building in the event of a fire. The building was inspected during a period when the rooms within were partially furnished during construction. In this state, it was determined that the most likely fire scenario would occur via an electrical failure on a makeshift cardboard desk in a classroom on the 3<sup>rd</sup> floor. The analysis revealed that the building meets the performance criteria of the Life Safety Code in the current stage of the building. In the analyzed fire scenario, the egress capabilities are proven to exceed the potential for occupants to be harmed by the fire. This scenario would need to be confirmed compatible under normal operating conditions to remain true. If the conditions of the building are changed or altered, the scenario would need to be readdressed and analyzed to meet the status of the building.

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# 1 Introduction

This Fire and Life Safety Analysis has been conducted as a final culminating project in the Fire Protection Engineering program at California Polytechnic State University.

A prescriptive analysis as well as a performance analysis has been completed to examine the building and its fire safety features. Through the prescriptive analysis, attention was focused on the structural fire protection, egress analysis, fire detection and alarms, and fire suppression systems. These are examined per code compliancy with relevant codes that are discussed throughout. The performance analysis was conducted in a manner to simulate a likely fire scenario within the building and reveal likely tenability conditions within the building and further examine the safe egress of occupants in such a scenario.



*Figure 1: Woodward Willis Building*

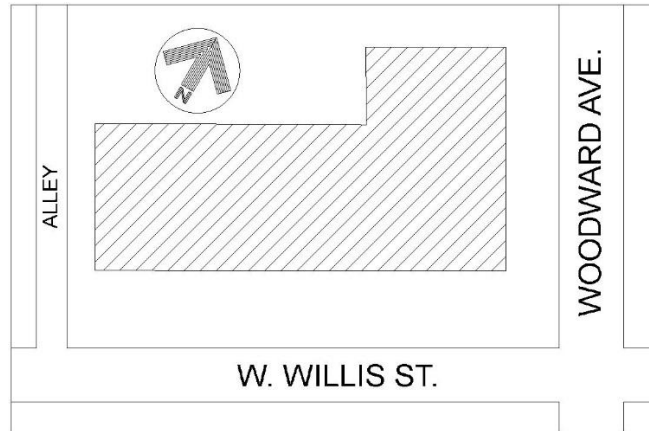
Figure 1 depicts a rendering of the Woodward Willis Building currently under construction.

The building is to be three stories, being 42ø at its highest point from ground level. It will not fall under the guidelines of a high-rise structure. The overall area of the building is 40,704 square feet as seen from Section 3.1.2. A general breakdown of the area of each floor can be seen in Table 1-1 below.

*Table 1-1 Floor Area Table*

| Level | Floor Area (Sq Ft) |
|-------|--------------------|
| 1     | 13,696             |
| 2     | 13,504             |
| 3     | 13,504             |

The building is located at the intersection of Woodward Avenue and Willis Street, giving full road access to the building from the south and east sides. The building Main entrances are along the east side towards Woodward Avenue, and also has an exit way to the west which leads directly into the alley on the west side of the building. Figure 2 depicts the layout of the building with respect to accessible roadways.



*Figure 2: Overall Bldg. Layout*

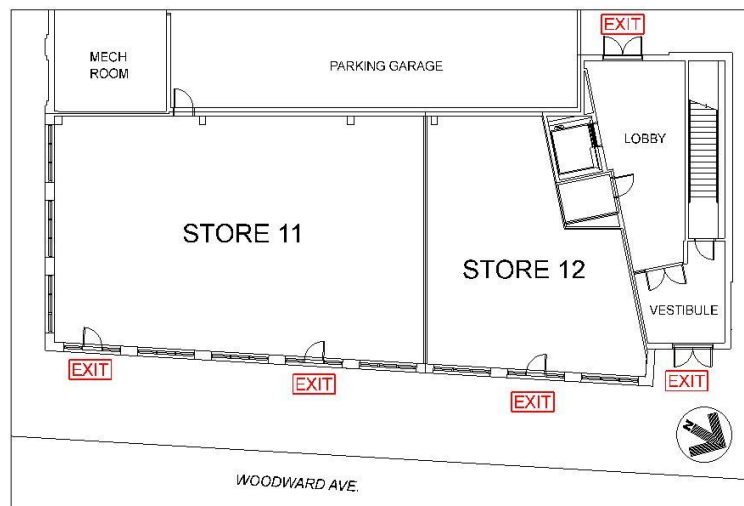
## 1.1 Building Tenants

The building consists of three main classes of occupancy. The first level consists of two storefronts along Woodward Avenue and a parking garage that is accessible from the alley. The second and third floors are solely occupied by Lawrence Tech University classrooms and labs.

### 1.1.1 Stores

The stores are located with direct access to Woodward Avenue. They are to be clothing retail in nature and will be classified as general mercantile here on out.

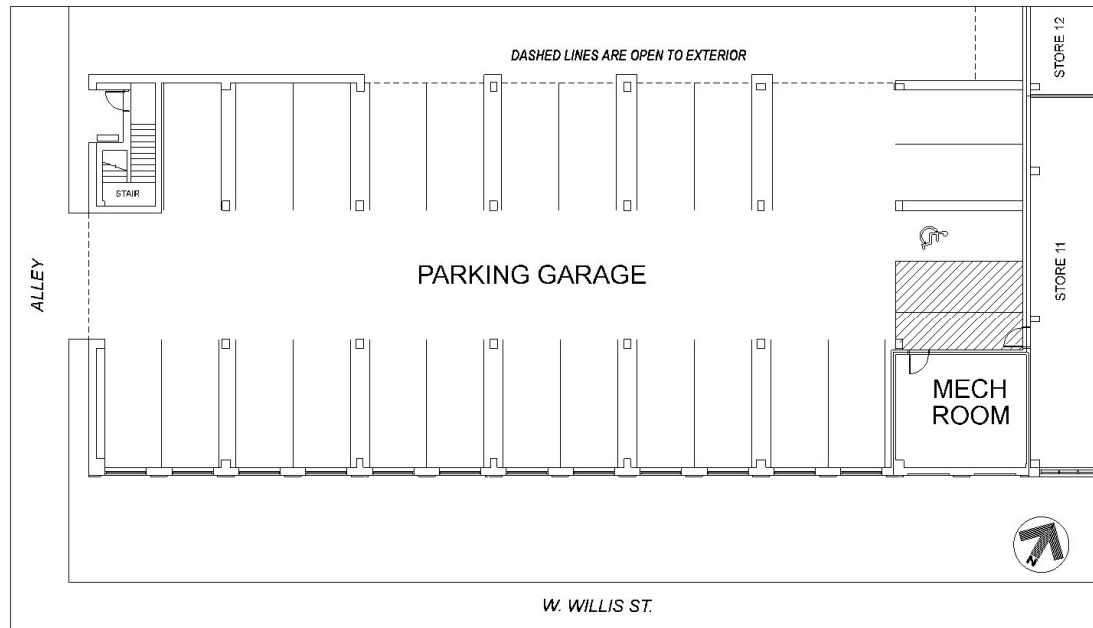
Store 12 will have one entry/exit doorway to the outside, whereas Store 11 will have two entry/exits to the exterior of the building as well as one door accessible to the parking garage. The stores can be seen represented in Figure 3 below.



*Figure 3: Storefront Layout*

### 1.1.2 Parking Garage

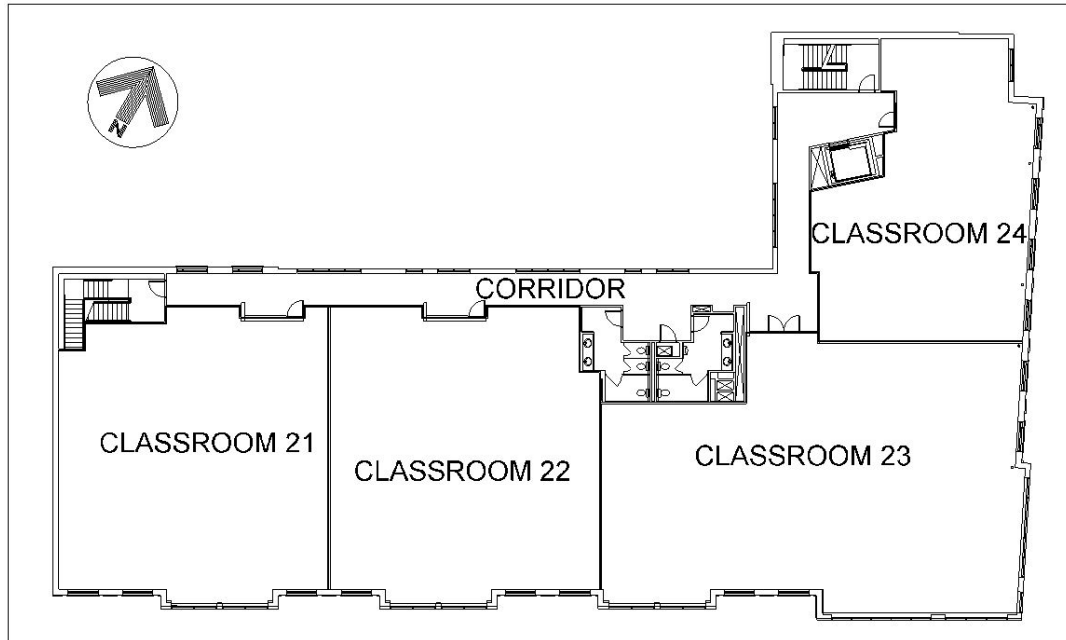
The parking garage occupies the remaining west side of the first floor. It will be open to the outside on the west, and north sides with vehicle access via the alley into the west and north sides of the garage. It will consist of 24 parking stalls within it. Figure 4 depicts the overall layout of the parking garage below.



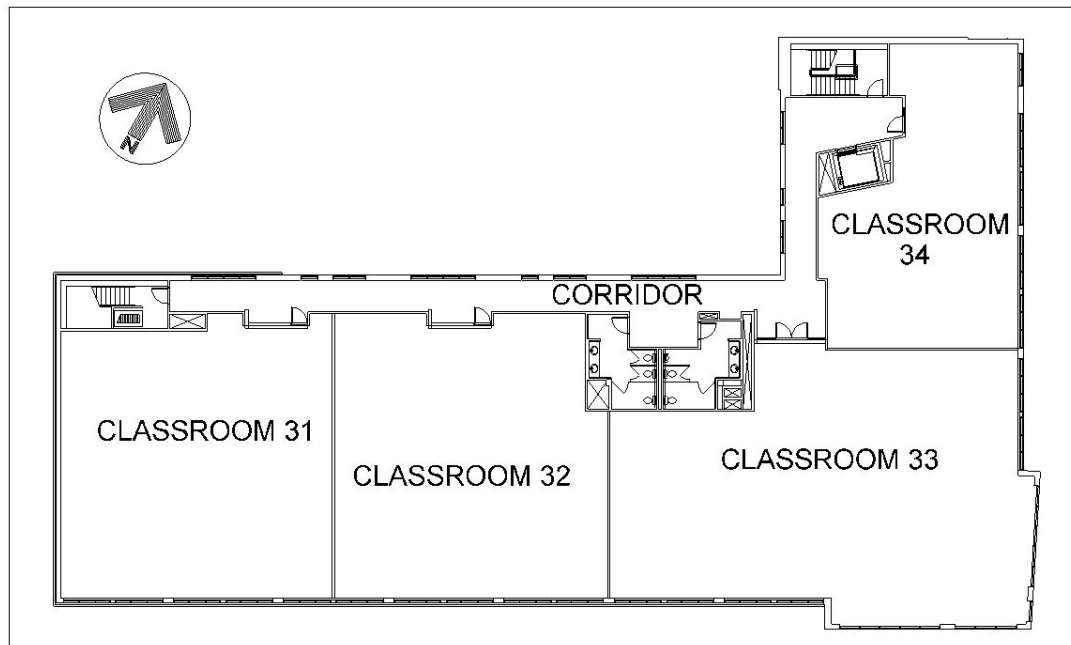
*Figure 4: Parking Garage Layout*

### 1.1.3 Technical College

The 2<sup>nd</sup> and 3<sup>rd</sup> floors consist of the technical college occupants. These are the only tenants occupying these two floors. There is an elevator in the lobby of the 1<sup>st</sup> floor serving these two levels as well as two stairways to enter/exit these levels. The stairways are located in the west and east side of the building and serve only the second and third floor from the street access below. These stairways are not accessible from any point within the stores or parking garage on the first floor. Figure 5 and Figure 6 represent the layouts for the 2<sup>nd</sup> and 3<sup>rd</sup> floor layout respectively, as seen on the next page.



*Figure 5: 2<sup>nd</sup> Floor Classroom Layout*



*Figure 6: 3<sup>rd</sup> Floor Classroom Layout*

## **2 Project Scope**

### **2.1 Life Safety**

#### **2.1.1 Life Safety Goals**

Life safety is the main goal by providing occupants of the building with adequate egress features as well as maintain the level of tenability within the building in the event of a fire. These features will ensure that the survivability in a fire scenario be at the most proficient level available to ensure all occupants can be safe and unharmed. These goals are directly derived from the NFPA 101, The Life Safety Code.

#### **2.1.2 Life Safety Objectives**

The main objective is to implement adequate construction approaches to allow occupants the safest and fastest means to evacuate the building. This objective will be subject to the structural integrity of the building, the notification systems, and fire suppression systems among others. With these objectives in place it will be possible to evaluate and ensure that the conditions within the building are maintained to a level of reliability that will prove safe for the occupants.

### **2.2 Building Documents**

The building will be assessed by the preliminary construction documents as the building is currently under construction at the time of this report. All drawings that were acquired are to be assumed representative to what will be constructed and implemented within the building. These drawings will be the basis for the entirety of this report and any construction or tenant changes will not be discussed in this evaluation.

### **2.3 Applicable Codes and Standards**

The following are a list of the Codes and Standards that are to be implemented during the design and construction of this building project:

- 2015 International Building Code
- 2015 Michigan Building Code
- NFPA 13, Standard for Installation of Sprinkler Systems, 2016 Ed.
- NFPA 72, National Fire Alarm and Signaling Code, 2016 Ed.
- NFPA 101, Life Safety Code, 2016 Ed.



### **3 Prescriptive Analysis**

The Prescriptive Analysis section of this report will focus on the code requirements that this building will be subject to conform to per the 2015 IBC and 2015 Life Safety Code. These codes will lay the groundwork for the design criteria of the building such as structural construction, occupancy and egress criteria, fire detection and alarm systems, and fire protection systems. The design criteria will then be discussed from what was actually implemented within the building.

#### **3.1 Structural Fire Protection**

The Life Safety Code and International Building Code regulates the structural components of the building based on type of construction and the overall size among others. These limitations will be further evaluated in this section of the report.

##### **3.1.1 Construction Type**

The building is being constructed as a Type II-B per the International Building Code. Under this type of construction, it allows unprotected noncombustible materials to be implemented into the building. Type II-B construction is evident in the masonry and steel construction that is incorporated within this building's structural components.

It will be seen later in Section 3.5 that the building will be fully sprinkled. Knowing sprinklers will be used throughout the building is important due to the allowance of less strict fire resistance ratings they demand as seen throughout this section. Table 3-1 reveals the required structural fire protection ratings compared to those that are to be implemented in the construction of the building.

##### **3.1.2 Building Height and Area**

Construction Type II-B allows for a maximum level of stories for Groups E & M to be 3 stories and for Group S-2 to be a maximum of 4 stories per Table 504.4 of the International Building Code. These values are obtained knowing that the building will be fully equipped throughout with a sprinkler system. This building complies for the number of floors that it will be comprised of, as it will not exceed 3 stories in any portion within.

Construction Type II-B allows for a maximum area for Group E of 43,500 square feet, Group M of 37,500 square feet, and Group S-2 of 78,000 square feet per the International Building Code Table 506.2. These area limitations take into consideration that a sprinkler system will be fully equipped throughout the entirety of the building. Each floor is less than 12,000 sq. ft. as seen from section 3.2, so this building will satisfy each individual floor for construction type.

### 3.1.3 Structural Fire Protection

A preliminary look reveals that Type II-B construction requires a 0 hour fire resistance rating throughout the building. This fire resistance rating will be further examined through this section though, as there will be certain applications where the fire resistance rating will indeed need to be implemented within the construction of the building. Table 3-1 reveals the initial fire resistance ratings for this building.

*Table 3-1 Required Fire Protection (IBC Table 601)*

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

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

Under further examination it is evident that the building will need to incorporate the following fire resistance ratings in accordance with their objective applications.

- Exit Stairwells

Per the International Building Code Section 1023.7, all interior exit stairway walls must be a minimum 1 hour fire resistance rating. This 1 hour rating will be applicable to both stairways that are implemented within this building.

- Occupancy Separation

Per the International Building Code Table 508.4, a 1 hour fire resistance rating must be maintained between Group S-2 and Groups E/M. This 1 hour rating is implemented in the building in a manner that every wall that is in contact with the parking garage has this minimum rating.

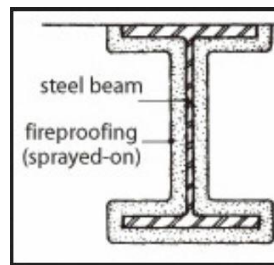
- Vertical Shaft Enclosures

Per the International Building Code Section 713.4, all vertical shaft enclosures that penetrate between floors have a minimum 1 hour fire resistance rating. This 1 hour rating is implemented within the building to accommodate all duct and pipe chases between each level of the building.

- Horizontal Separation

The International Building Code Section 707.3.10, requires that a minimum fire resistance rating of 2 hours be present as a horizontal separation between Group S-2 and any other occupancy. This 2-hour rating is implemented within the garage as a separation between the 2<sup>nd</sup> floor education classification level.

This 2-hour fire rating is met in the parking garage by means of a Spray Applied Fire Proofing. This fire proofing will be sprayed onto the underside of the deck and to all structural members in this areas in a manner to achieve the 2-hour rating. A depiction of this application can be seen in Figure 7 below.



*Figure 7: Spray Applied Fire Proofing Detail*

This 2-hour fire rating will also need to be maintained where there is a penetration. A 2-hour rating in the stairwell and mechanical room will be required to be met in the garage.

### 3.1.4 Adjacent Building Restrictions

The Woodward Willis Building is located 100' away from a Factory (Group F-1) on its west side. Per IBC Table 602, there will not be any fire resistance ratings needed to protect from the threat of fire from this building as the Woodward Willis building is of Type II-B construction. Table 3-2 shows this requirement from the IBC Table 602.

*Table 3-2: Separation Distance Fire Resistance (IBC Table 602)*

| Fire Separation<br>Distance = X (feet) | Type of<br>Construction | Occupancy Group<br>M | Occupancy Group<br>E, S-2 |
|--|-------------------------|----------------------|---------------------------|
| $X < 5$                                | II-B                    | 2                    | 1                         |
| $5 \leq X < 10$                        | II-B                    | 1                    | 1                         |
| $10 \leq X < 30$                       | II-B                    | 0                    | 0                         |
| $X \geq 30$                            | II-B                    | 0                    | 0                         |

### 3.1.5 Interior Finishes

Interior finishes are evaluated from the basis of flame spread index and smoke development. These criteria are classified within Table A.10.2.2 of the Life Safety Code and can be seen where applicable via Table 3-3.

*Table 3-3: Flame Spread and Smoke Development Table*

| Occupancy  | Exits   | Exit Access Corridors | Other Spaces                |
|--|---------|-----------------------|-----------------------------|
| Educational - New  | A       | A or B                | A or B: C on low partitions |
|  | I or II | I or II               | N/A                         |
| Mercantile - New   | A or B  | A or B                | A or B                      |
|  | I or II | -                     | N/A                         |
| Storage (Parking Garage)   | A or B  | A, B, or C            | A, B, or C                  |
|  | I or II | -                     | N/A                         |
| (1) Class A interior wall and ceiling finish - flame spread index, 0-25 (new applications); smoke developed index, 0-450   |         |                       |                             |
| (2) Class B interior wall and ceiling finish - flame spread index, 26-75 (new applications); smoke developed index, 0-450  |         |                       |                             |
| (3) Class C interior wall and ceiling finish - flame spread index, 76-200 (new applications); smoke developed index, 0-450   |         |                       |                             |
| (4) Class I interior floor finish - critical radiant flux, not less than 0.45 W/sq. cm   |         |                       |                             |
| (5) Class II interior floor finish - critical radiant flux, not more than 0.22 W/sq. cm, but less than 0.45 W/sq. cm   |         |                       |                             |
| (6) Automatic sprinklers - where a complete standard system of automatic sprinklers is installed, interior wall and ceiling finish with a flame spread rating not exceeding Class C is permitted to be used in any location where Class B is required, and Class B interior wall and ceiling finish is permitted to be used in any location where Class A is required; similarly, Class II interior floor finish is permitted to be used in any location where Class I is required, and no interior floor finish classification is required where Class II is required. These provisions do not apply to new detention and correctional occupancies. |         |                       |                             |
| (7) Exposed portions of structural members complying with the requirements for heavy timber construction are permitted.  |         |                       |                             |

In addition, where automatic sprinklers are installed Class A is allowed to be reduced to Class B and Class B is allowed to be reduced to Class C. Similarly, Class I interior finishes are allowed to be reduced to Class II and also Class II is permitted to have no interior floor classification under these provisions provided via Table A.10.2.2 of the Life Safety Code. From these reduced classes, we can see that the Woodward Willis building is compliant with these interior finish limitations per the construction documents available.

### 3.1.6 Summary of Structural Fire Protection

Structural Fire Protection has been evaluated in this section and is in accordance with both the IBC and the Life Safety Code. It is evident that the construction being of Type II-B complies with all regulations set forth from these codes. The next section of the report will begin the discussion of egress and analysis of the occupants within the building.

## 3.2 Occupancy and Egress Analysis

### 3.2.1 Mixed Occupancies

The Woodward Willis building consists of 3 main separated occupancies. These occupancies are deemed as separated due in part that they do not share exit access between each other. This separation can be seen on the second and third floors where the technical college occupies both floors and is not connected to the other occupancies on the first floor in any way. The second and third floors have their own separate stairways on each end of the building which exit directly to the outside of the building. This separation is also evident within the stores and parking garage as they directly exit into the exterior of the building without interference from the above floors or from each other.

With these separations in order, it can be seen that the lobby of the first floor is connected to the same exits as the technical colleges from above. It shall be clear that this lobby is in effect seen as an extension to the technical college area as it does not internally connect to any other portion of the building. This lobby will strictly serve as a means of egress for the stairwell in the event of a fire scenario in the building.

The occupancies and egress analysis will be performed in the next sections that follow.

### 3.2.2 1<sup>st</sup> Floor Storefronts & Parking Garage

The first floor consists of two main occupancies; the first being the two storefronts along Woodward Avenue and the second being the parking garage on the west half of the building. Figure 8 shows these occupancies and their relation to the building.

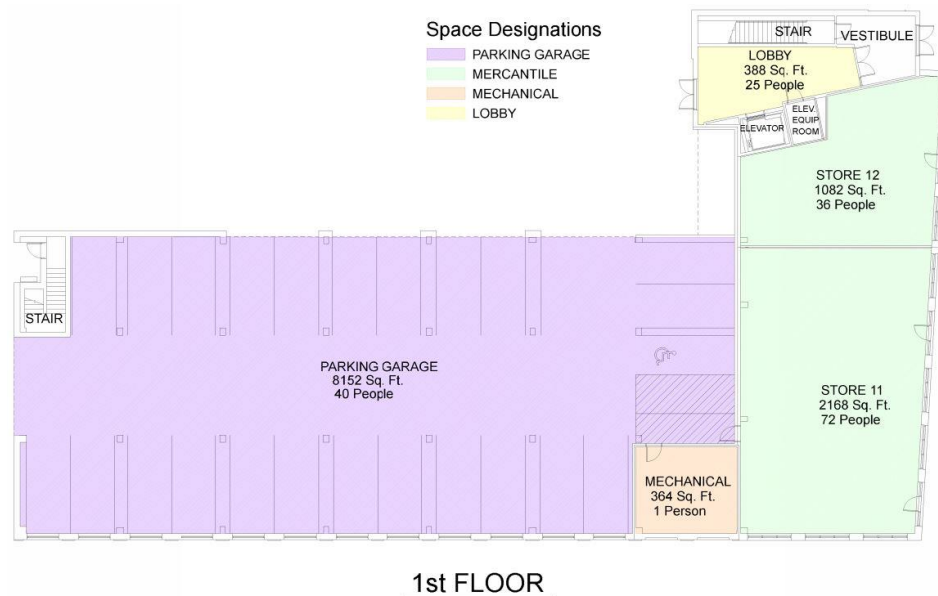


Figure 8: Storefront & Parking Garage Occupancy

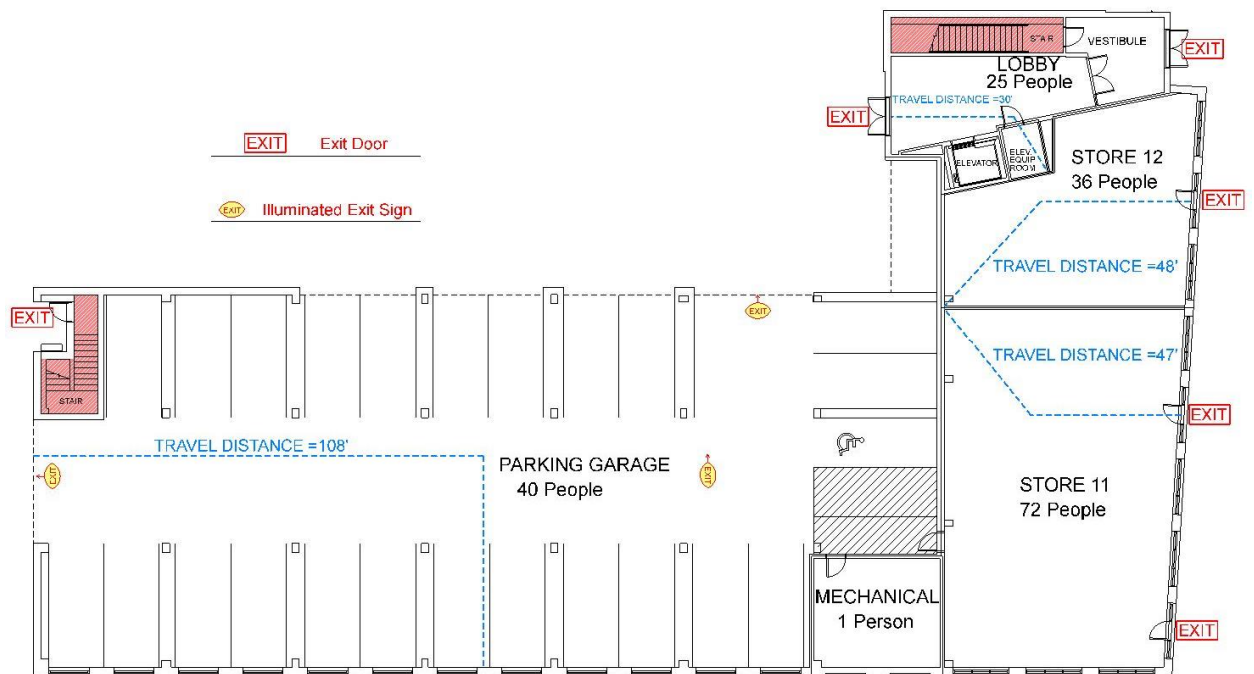
The occupant load for each area within the first floor was determined using Table 3-4 below.

*Table 3-4: 1<sup>st</sup> Floor Occupancy Load Table*

| Room           | Occupancy Classification | ft <sup>2</sup> /person | Floor Area (ft <sup>2</sup> ) | Occupant Load |
|----------------|--------------------------|-------------------------|-------------------------------|---------------|
| Lobby          | Assembly                 | 15                      | 388                           | 25            |
| Store 11       | Mercantile               | 30                      | 2,168                         | 72            |
| Store 12       | Mercantile               | 30                      | 1,082                         | 36            |
| Parking Garage | Storage (S-2)            | 200                     | 8,152                         | 40            |
|                | Total                    |                         | 11,790                        | 173           |

From this table, it can be seen that the lobby area was calculated to have an occupancy load of 25 people. It is noted again that this will be assumed as part of the overall occupancy load of the technical college, as it is separated from the rest of the building but is deemed as assembly for purposes of calculating the occupancy load. These occupancy factors used in Table 3-4 were derived from LSC Table 7.3.1.2 and IBC Table 1004.1.2.

The means of egress from the first floor is depicted in Figure 9.



*Figure 9: Means of Egress 1<sup>st</sup> Floor*

From Figure 9, it is clear to see that each store exits directly to the street and that the parking garage directly exits to the alley and exterior parking lot. Also note that the parking garage is not enclosed, meaning that the occupants will exit through the main openings on the west and north side of the garage.



Egress capacity for the first floor was determined from the guidelines of exit capacity through the doors from each area to the exterior of the building. IBC 1005.3.2 provides the guidelines that are to be used for exit factors and are represented in Table 3-5. Since there are no corridors connecting any of the occupancies they were evaluated on an individual exit capacity basis. Table 3-5 below shows the exit capacity of each occupancy.

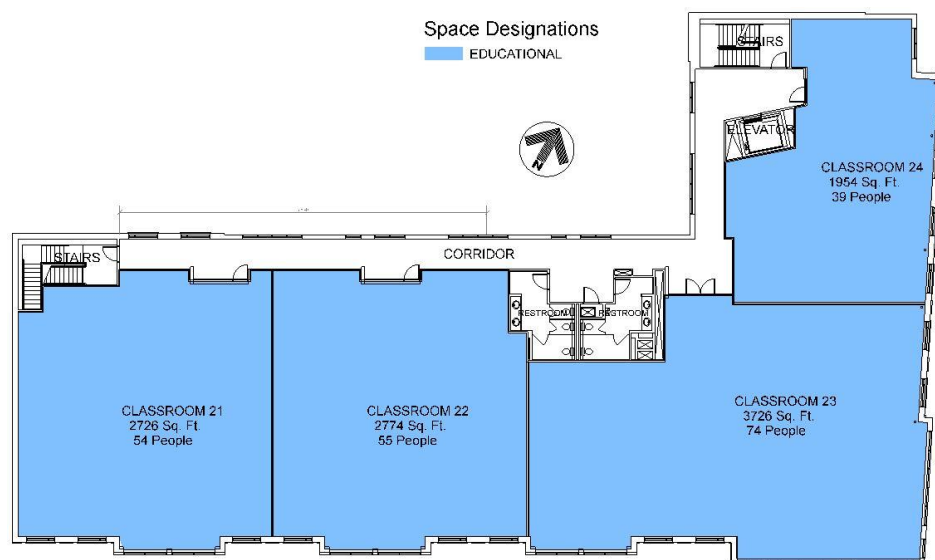
*Table 3-5: 1<sup>st</sup> floor Exit Capacity*

| Means of Egress     | Door Width (in.) | Door Factor  | Door Capacity |
|---------------------|------------------|--------------|---------------|
| Store 12 Door       | 36               | 0.2          | 180           |
|                     |                  | <b>Total</b> | <b>180</b>    |
| Store 11 South Door | 36               | 0.2          | 180           |
| Store 11 North Door | 36               | 0.2          | 180           |
|                     |                  | <b>Total</b> | <b>360</b>    |
| Lobby Door          | 72               | 0.2          | 360           |
|                     |                  | <b>Total</b> | <b>360</b>    |
| Vestibule Door      | 72               | 0.2          | 360           |
|                     |                  | <b>Total</b> | <b>360</b>    |
| Garage Door - West  | 144              | 0.2          | 720           |
| Garage Door - North | 144              | 0.2          | 720           |
|                     |                  | <b>Total</b> | <b>1440</b>   |

It can be seen from Table 3-5 that all have sufficient exit capacity to support the occupant loads of each space on the first floor.

### 3.2.3 2<sup>nd</sup> Floor Classrooms

The second floor consists of 4 classrooms, solely of an educational occupancy. Figure 10 shows these occupancies and their relation to the building.



*Figure 10: 2<sup>nd</sup> Floor Occupancy*

The occupant load for each area within the second floor was determined using Table 3-6 below.

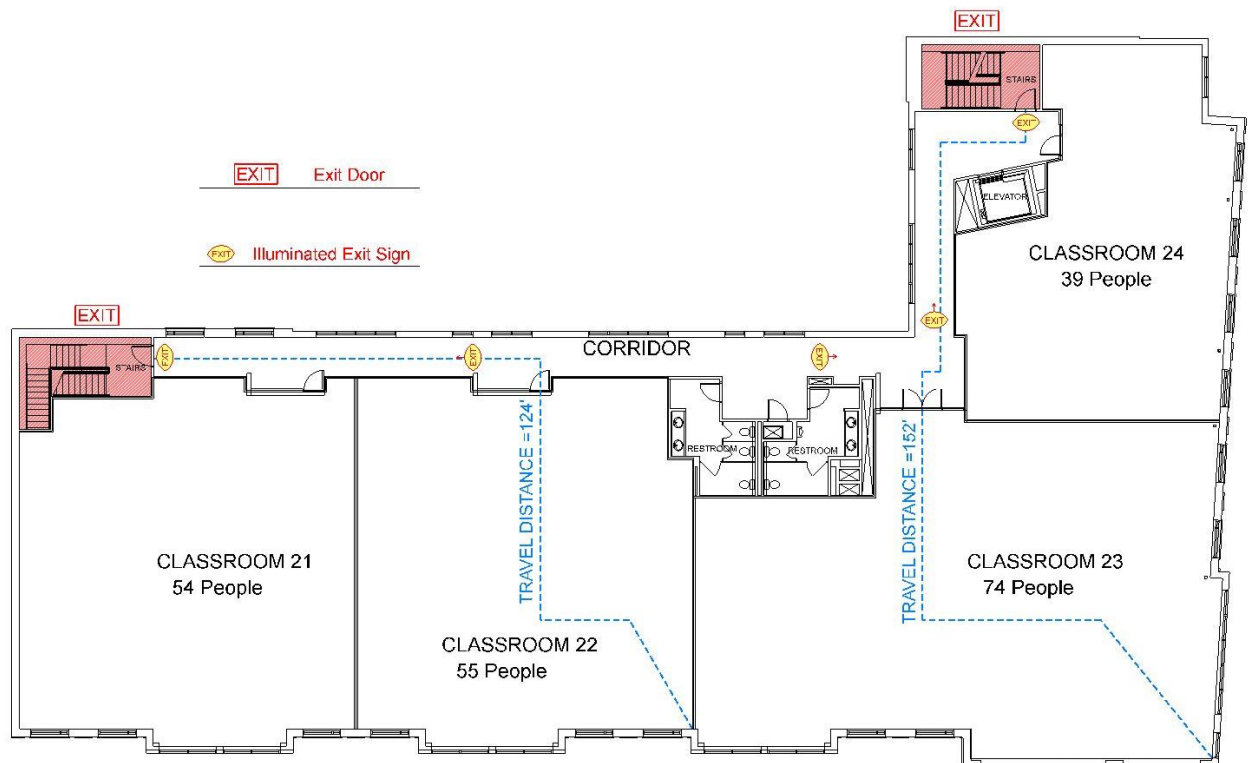
*Table 3-6: 2<sup>nd</sup> Floor Occupancy Load Table*

| Room         | Occupancy Classification | ft <sup>2</sup> /person | Floor Area (ft <sup>2</sup> ) | Occupant Load |
|--------------|--------------------------|-------------------------|-------------------------------|---------------|
| Classroom 21 | Education                | 50                      | 2,726                         | 54            |
| Classroom 22 | Education                | 50                      | 2,774                         | 55            |
| Classroom 23 | Education                | 50                      | 3,726                         | 74            |
| Classroom 24 | Education                | 50                      | 1,954                         | 39            |
| Total        |                          |                         | 11,180                        | 222           |

Based on Table 3-6, the total occupancy load for the second floor is 222 people.

The occupancy factor used in Table 3-6 was derived from LSC Table 7.3.1.2 and IBC Table 1004.1.2.

The means of egress from the second floor is depicted in Figure 11.



*Figure 11: Means of Egress 2<sup>nd</sup> Floor*

From Figure 11, it is clear to see that each classroom directly exits into the main exit corridor. The main corridor connects all rooms to an exit stairway located on each end of the corridor.



The egress capacity for the second floor was determined from the guidelines of exit capacity through the doors as well as from the stairways leading to the exterior of the building. Table 3-7 below shows the exit capacity of the 2<sup>nd</sup> floor as well as each room.

*Table 3-7: 2<sup>nd</sup> Floor Exit Capacity*

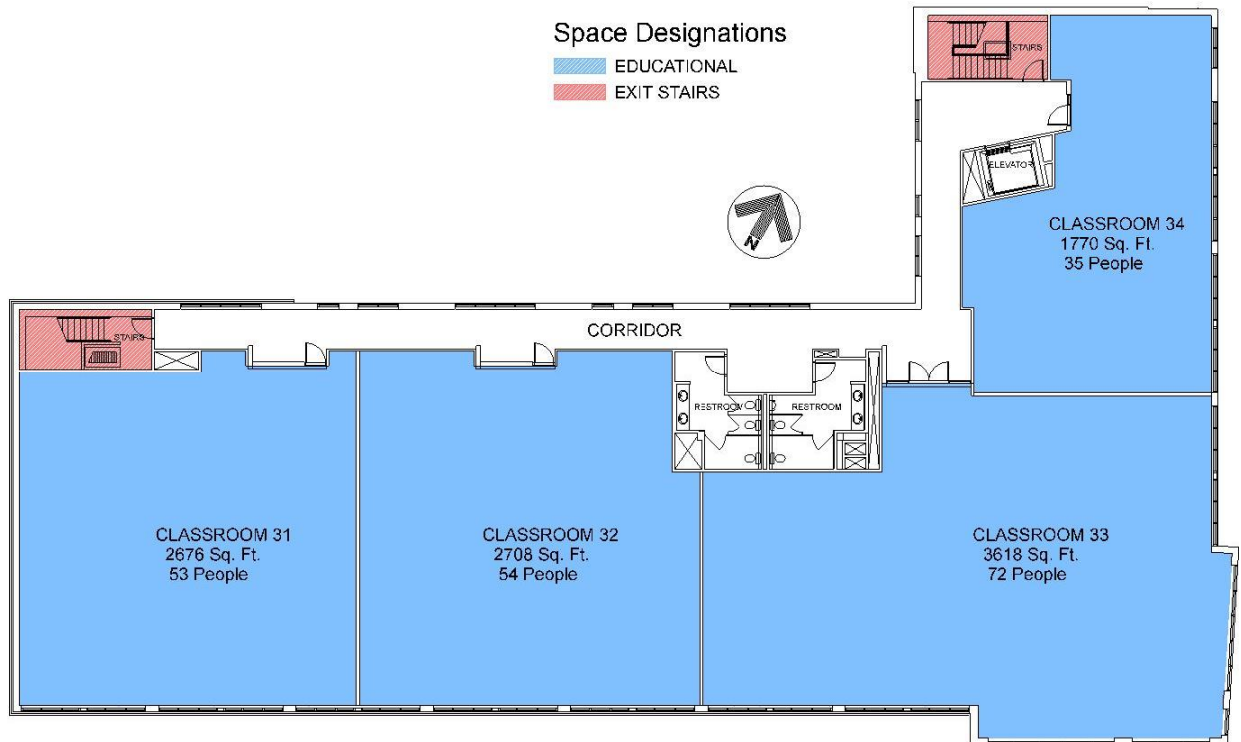
| Means of Egress    | Stair Width (in.) | Door Width (in.) | Stair Factor | Door Factor  | Stair Capacity | Door Capacity |
|--------------------|-------------------|------------------|--------------|--------------|----------------|---------------|
| Classroom 21       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <i>Total</i> | -              | 180           |
| Classroom 22       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <i>Total</i> | -              | 180           |
| Classroom 23       | -                 | 72               | -            | 0.2          | -              | 360           |
|                    |                   |                  |              | <i>Total</i> | -              | 360           |
| Classroom 24       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <i>Total</i> | -              | 180           |
| West Corridor Exit | 46                | 36               | 0.3          | 0.2          | 153            | 180           |
|                    |                   |                  |              | <i>Total</i> | 153            | -             |
| East Corridor Exit | 46                | 36               | 0.3          | 0.2          | 153            | 180           |
|                    |                   |                  |              | <i>Total</i> | 153            | -             |

It can be seen from Table 3-7 that the exit capacities to support the occupant load of the entire floor is met by both the stairways and the doors leading into the stairways.

However, the individual exit capacities of Rooms 21, 22, & 23 are not in compliance with IBC Table 1006.2.1 where it is states that rooms exceeding 49 occupants for Group E shall require 2 separate exits. These additional exit doors will need to be addressed either by reducing the maximum number occupants of these rooms to 49 people or by implementing a second exit door at least one-third the diagonal of the room away from the existing exit door.

### 3.2.4 3<sup>rd</sup> Floor Classrooms

The third floor consists of 4 classrooms, solely of an educational occupancy. Figure 12 shows these occupancies and their relation to the building.



*Figure 12: 3<sup>rd</sup> Floor Occupancy*

The occupant load for each area within the third floor was determined using Table 3-8 below.

*Table 3-8: 3<sup>rd</sup> Floor Occupancy Load Table*

| Room         | Occupancy Classification | ft <sup>2</sup> /person | Floor Area (ft <sup>2</sup> ) | Occupant Load |
|--------------|--------------------------|-------------------------|-------------------------------|---------------|
| Classroom 31 | Education                | 50                      | 2,676                         | 53            |
| Classroom 32 | Education                | 50                      | 2,708                         | 54            |
| Classroom 33 | Education                | 50                      | 3,618                         | 72            |
| Classroom 34 | Education                | 50                      | 1,770                         | 35            |
|              |                          | <b>Total</b>            | <b>10,772</b>                 | <b>214</b>    |

From Table 3-8, it can be seen that the total occupancy load for the third floor is 214 people.

The occupancy factor used in Table 3-8 was derived from LSC Table 7.3.1.2 and IBC Table 1004.1.2.

The means of egress from the third floor is depicted in Figure 13.

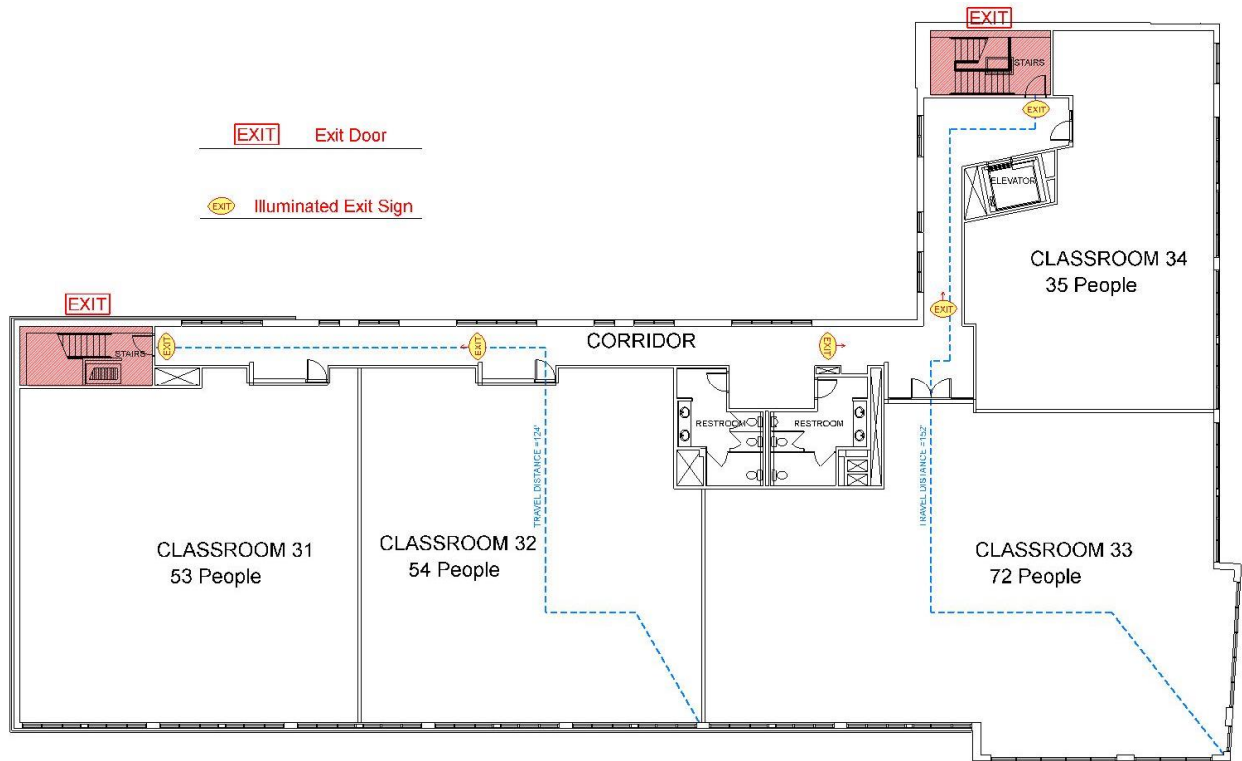


Figure 13: Means of Egress 3<sup>rd</sup> Floor

From Figure 13, it is clear to see that each classroom directly exits into the main exit corridor. The main corridor connects all rooms to an exit stairway located on each end of the corridor.

The egress capacity for the third floor was determined from the guidelines of exit capacity through the doors as well as from the stairways leading to the exterior of the building. Table 3-9 below shows the exit capacity of the 3<sup>rd</sup> Floor as well as each room.

Table 3-9: 3<sup>rd</sup> Floor Exit Capacity

| Means of Egress    | Stair Width (in.) | Door Width (in.) | Stair Factor | Door Factor  | Stair Capacity | Door Capacity |
|--------------------|-------------------|------------------|--------------|--------------|----------------|---------------|
| Classroom 31       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <b>Total</b> | -              | 180           |
| Classroom 32       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <b>Total</b> | -              | 180           |
| Classroom 33       | -                 | 72               | -            | 0.2          | -              | 360           |
|                    |                   |                  |              | <b>Total</b> | -              | 360           |
| Classroom 34       | -                 | 36               | -            | 0.2          | -              | 180           |
|                    |                   |                  |              | <b>Total</b> | -              | 180           |
| West Corridor Exit | 46                | 36               | 0.3          | 0.2          | 153            | 180           |
|                    |                   |                  |              | <b>Total</b> | 153            | -             |
| East Corridor Exit | 46                | 36               | 0.3          | 0.2          | 153            | 180           |
|                    |                   |                  |              | <b>Total</b> | 153            | -             |

It can be seen from Table 3-9 that the exit capacities to support the occupant load of each room, as well as the entire floor are met by both the stairways and the doors leading into the stairways.

However, the individual exit capacities of rooms 31, 32, & 33 are not in compliance with IBC Table 1006.2.1 where it is states that rooms exceeding 49 occupants for Group E shall require 2 separate exits. These exit arrangements will need to be addressed either by reducing the maximum number occupants of these rooms to 49 people or by implementing a second exit door at least one-third the diagonal of the room away from the existing exit door.

### **3.2.5 Exit Signage**

Exit signs will be installed throughout the building per IBC Section 1013 with exception from rooms with only one exit. These exit signs are installed throughout the building and are of the illuminated type. They are located throughout the parking garage, the large store (with two exits), and along the exit corridor to the stairwell on the second and third floors. All signage installed meets the maximum spacing distance of 100 feet.

The illuminated exit signs will aid in the event of a fire allowing occupants to follow the quickest route to a viable means of exit from the building. In the event power is lost, these signs will stay illuminated at the required 5 foot-candles for 90 minutes on a reserve battery.

### **3.2.6 Summary of Egress Analysis**

The results of the egress capabilities of the building have been compared to the requirements of the IBC and LSC, with some issues as follows,

- Rooms 21, 22, 23, 31, 32, & 33 do not have sufficient exit arrangements to support the calculated load of occupants in each room.

These deficiencies will need to be addressed by either reducing the allowable occupant load to a maximum of 49 people in each room or by adding a second exit as mentioned previously.

The rest of the features regarding egress safety on the 2<sup>nd</sup> and 3<sup>rd</sup> floors were in compliance with the applicable codes and standards. The 1<sup>st</sup> Floor is completely satisfying all applicable codes and standards as well. The next section of this report will discuss the fire alarm and notification system which will initiate the evacuation of the occupants from the building.

## **3.3 Fire Detection, Notification, and Alarm System**

A Fire Alarm system is required throughout the building to be in compliance with the Life Safety Code. This Fire Alarm System shall also be installed in accordance with NFPA 72.

### 3.3.1 Devices and Systems Description

#### Smoke Detectors:

Smoke detectors are implemented within the building per NFPA 72. These detectors are to be spaced so that, at any single point in the building a smoke detector is within 21 feet. This spacing is provided to ensure that any smoke produced from a fire can be detected.

The parking garage is exempt from requiring smoke detectors due to it being exposed to the outside and therefore smoke accumulation could be difficult. There are two smoke detectors installed in this area however. These additional smoke detectors are installed in a manner to detect a fire within the garage even though they are not spaced within the 21' spacing.

#### Duct Detectors:

Smoke detectors are to be located within the air handling system of the building. These are to be additional smoke detectors to those located within the rooms themselves. These detectors will be laid out in a fashion to be adequate for the air velocities that are unknown at this time. It can be assumed that the spacing will between detectors will be smaller as these velocities will be faster than that of the open space within the building. There are currently no final designs available for the HVAC system in the building, therefore they cannot be further analyzed to meet requirements within the building.

#### Pull Stations:

Pull stations are required to be placed at each exit door from the floor and building. The spacing between these pull stations must be a maximum of 200 feet. These are located in such a way throughout the building as to meet these requirements.

The pull stations are to be operated by occupants within the building when a fire scenario is observed. This action will trigger the fire alarm control panel to notify the rest of the building that a fire is in the building.

#### Water Flow Switch:

Water flow switches are installed in the riser room. These flow switches will detect the movement of water through risers in the event that a sprinkler has activated. Additionally, each floor control valve assembly will have a water flow switch as well. The flow switch at each floor control valve will allow for the fire alarm control panel to isolate which floor the sprinkler system has operated on since the water will only be flowing through that specific flow switch.

These forms of detection are implemented throughout the entire interior of the building. Layouts for these detectors can be seen in Appendix E.

Notification & Alarm:

Audio/Visual Device:

The audio/visual devices are spaced throughout the building in a manner to meet the minimum decibel levels as well as the minimum candela levels. The minimum decibel rating per NFPA 72 is 15 dBA over that of what is typically found in that location. Per NFPA 72 Table 18.4.3 the average ambient sound for education is 45 dBA, mercantile is 40 dBA, and for storage is 30 dBA. The decibel level of the audio device is also found to decrease by 6 dBA every 10 feet. With these limitations in place, the audio device is set to 105 dBA in a manner to cover the entire building the most efficiently. Levels over 105 dBA are found to be non-permissible to the occupants for an exposure less than one hour per NFPA 72 Table A.18.4.1.2.

The visual aspect of the device will also meet the candela requirements of NFPA 72. Table 18.5.4.3.1(a) requires a light output of 135 cd, which will be effective for a room 60'x60'. The 60'x60' area is adequate as there are no rooms exceeding this size being supplied by one device.

Visual Device:

Visual only devices will be implemented within the restrooms of the building. Visual devices are used in a manner to warn any occupants in these areas without causing harm to their ears due to reflecting sound at them in small spaces. The audio only device will comprise of a 60-cd emitting light as they are located in much smaller areas and still be in compliance with Table A.18.4.1.2.

These forms of notification are implemented throughout the entire building and are all in compliance with NFPA 72. Layouts for these devices can be seen in Appendix E.

### **3.3.2 Backup Power Requirements**

A backup power supply for the Fire Alarm Control Panel (FACP) and its devices shall be required by NFPA 72. This backup supply will be in the form of two separate batteries housed within the FACP itself. This backup power supply shall be sufficient in supplying power for at least 24 hours in the event of a primary power loss to the building as well as being capable of performing for 5 minutes with all notification and alarm devices in use. The calculation for the battery size was determined to be two batteries at 12 Volt and 18 Ah to support the current alarm setup during the construction phase. This calculation will need to be thoroughly performed upon full installation and completion of any changes that are made to ensure it will perform.

Voltage drop calculations must also be considered in the final design. Upon completion calculations must be performed to prove that the power to the devices is not compromised. For this building 24V devices will be used that have operating conditions between 16 and 33 volts. The wiring and circuitry must be proven to maintain 16V minimum at any point to the devices.

### 3.3.3 Fire Alarm Control panel

The fire alarm control panel is how all the devices and notification are tied together. This FACP is where the detection signals are sent and translated to the alarm that is output. The alarm panel is a Notifier Fire Warden-100-2(E) Addressable Control Panel. Being of the addressable type means that each detector has its own information relayed to the panel. This is beneficial when a detector goes off, as the FACP will be able to show which device activated allowing the building manager or the fire department upon arriving to know where the fire is.

The panel is set up in the event of a fire to send signal to all notification systems as well as send a signal to the local fire department to come to the building. The panel is also set up in a manner to send a signal to designated persons in the event that there is faulty equipment or a tamper switch has been activated. This will allow authorities to have personnel arrive to fix the problem and bring the fire alarm system back to full operation.

A preliminary system of operations matrix has been developed for the building as seen in Table 3-10. This matrix is a representation of how the FACP should be set up to allow proper action from the fire alarm system to take effect.

*Table 3-10: Fire Alarm System Sequence of Operation.*

| <b>FIRE ALARM SYSTEM SEQUENCE OF OPERATION</b> |                           |                           |                           |                               |                             |                               |                            |
|--|---------------------------|---------------------------|---------------------------|-------------------------------|-----------------------------|-------------------------------|----------------------------|
|  | Manual<br>Pull<br>Station | Area<br>Smoke<br>Detector | Duct<br>Smoke<br>Detector | Elevator<br>Smoke<br>Detector | Sprinkler<br>Flow<br>Switch | Sprinkler<br>Tamper<br>Switch | Loss of<br>Normal<br>Power |
| Annunciate Alarm<br>Signal at FACP             | YES                       | YES                       | YES                       | YES                           | YES                         | YES                           | NO                         |
| Annunciate Trouble<br>Signal at FACP           | YES                       | YES                       | YES                       | YES                           | YES                         | YES                           | YES                        |
| Transmit Signal to<br>Central Station          | YES                       | YES                       | YES                       | YES                           | YES                         | YES                           | YES                        |
| Initiate Bldg Audible<br>Alarm System          | YES                       | YES                       | YES                       | YES                           | YES                         | NO                            | NO                         |
| Initiate Bldg Visual<br>Alarm System           | YES                       | YES                       | YES                       | YES                           | YES                         | NO                            | NO                         |
| Shutdown Air<br>Handling Systems               | NO                        | YES                       | YES                       | YES                           | YES                         | NO                            | NO                         |
| Activate Associated<br>Fire Smoke Dampers      | NO                        | YES                       | YES                       | YES                           | YES                         | NO                            | NO                         |
| Recall Elevator to<br>Designated level         | NO                        | NO                        | NO                        | YES                           | NO                          | NO                            | NO                         |

### **3.3.4 Inspection, Testing, & Maintenance**

Inspections must be performed on an annual basis for all Fire Alarm equipment. Trouble signals on control equipment must be inspected semiannually. Lead Acid batteries need to be inspected monthly, via visually inspecting the electrolyte level. Duct and smoke detectors as well as notification appliances are also required to be inspected semiannually. These inspections are to ensure that no building modifications or changes have occurred which would affect the performance of the equipment in place.

All fire alarm equipment is to be tested annually by a certified fire alarm technician. This testing is done to provide records that the fire alarm system is completely functional. The supervisory station alarm system will need to be tested monthly and recorded by a building manager as well.

Fire Alarm system equipment shall be maintained in accordance with manufacturers published instructions at all times. Records shall be kept of any alterations to the system from the time of commissioning. These records shall be kept by the owner as well as a copy of reproducible as-built drawings of the Fire Alarm system.

### **3.3.5 Summary of Fire Detection, Notification, and Alarm System**

Based on the documents available and what has already been installed, the fire alarm system in the Woodward Willis Building is in compliance with NFPA 70 and NFPA 72. Should the state of the building be changed or renovated, a new updated review would need to be implemented to prove the system's compliance. The next section (3.4) will discuss the smoke control systems implemented within the HVAC systems throughout the building.

## **3.4 Smoke Control System**

### **3.4.1 Smoke Damper System**

A smoke control system is implemented throughout this building. It is comprised of smoke detectors mounted within the duct system and implemented throughout with smoke dampers. These dampers are installed as a means to close off all ventilation in the event of a fire to prevent the traveling of smoke through the duct system to travel to other areas of the building.

These devices are run through the fire alarm control panel. In the event a separate means of detection detects a fire, the smoke dampers will still function and close off the entire duct work system. Closing of the dampers will ensure that toxic gases and smoke are isolated to the area of the fire within the building and not spread throughout.



The smoke damper system will ensure that smoke will not travel throughout the building in the event of a fire. This will reduce the effects of smoke exposed to the occupants allowing them safer condition when exiting. Section 3.5 will now introduce the water suppression systems that are installed throughout the building.

### 3.5 Fire Protection Systems

The Woodward Willis building is fully covered by an automatic fire sprinkler system in all areas of the building. This sprinkler system is to be provided by means of a wet pipe system. In regard to the parking garage it was decided that a wet system be implemented as well. For wet piping to be possible, a heated plenum will need to be installed in the parking garage that will house the wet pipe system from the freezing elements that are present during Michigan winters.

#### 3.5.1 Wet Pipe Sprinkler System

Water supply to the building is provided via a 12" underground city water main along Woodward Avenue. To supply this building a 6" tie-in was installed and ran into the mechanical room on the south side of the building. Figure 14 below shows the water supply configuration and location into the building.

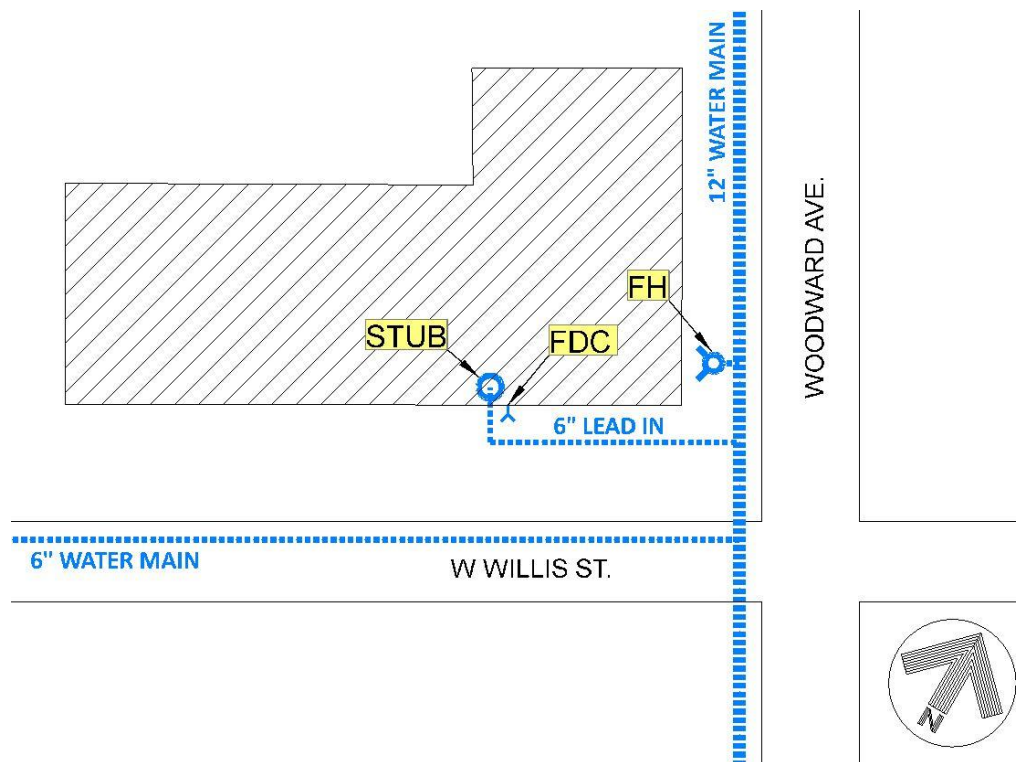


Figure 14: Underground Water Supply Layout

A water flow test was conducted from the fire hydrant along the east side of the building near the tie-in location. This test revealed a water supply as follows,

- Static Pressure: 40 PSI
- Residual Pressure: 36 PSI
- Flow: 1701 GPM

This water supply information will be the basis for sprinkler calculations later discussed.

A fire department connection (FDC) in compliance with the local Detroit fire department is installed along the south side of the mechanical room. The FDC will be used in the event of a fire as to allow the fire department to pump extra water directly into the riser. The FDC will allow additional water to be supplied to the sprinkler system to suppress the fire if necessary.

The Riser Room will consist of the main valves and risers to supply the various floors with water. It will begin from the underground stub in the floor and have a double check backflow preventer to ensure that water from the sprinkler system does not leak back into the city water supply. All control valves within the wet pipe system and riser are to be monitored by tamper switches that are to be monitored by the fire alarm control panel.

The sprinkler system will be laid out and installed per NFPA 13. Individual areas will be designed on the parameters established as follows,

#### Parking Garage

The sprinkler system for the open garage area will be Ordinary Hazard Group I. This hazard will require a density of 0.15 gpm / Sq. Ft. over an area 967.5 Sq. Ft.. This area has been reduced per 11.2.3.2.3 in NFPA 13 since the ceiling elevation is only 13' and we are using quick response heads. The heads to be used have dry barrels as the plenum above the ceiling will be heated. The following details provide the requirements for the parking garage area below,

Occupancy: Ordinary Group I

Max Coverage per Head: 130 Sq. Ft.

Density: 0.15 gpm / Sq. Ft.

Sprinkler: Reliable F3QR R5714 (Dry Barrel Pendent)

Orifice: 1/2"

K-Factor: 5.6

Area of Operation: 967.5 Sq. Ft. (Area reduction per NFPA 13 § 11.2.3.2.3)

#### Retail Space

The retail space on the 1<sup>st</sup> floor will be designated as mercantile area and be considered Ordinary Hazard Group II. This hazard will require a density of 0.20 gpm / Sq. Ft. over an area 1025.7 Sq. Ft.. This area has been reduced per 11.2.3.2.3 in NFPA 13 since the ceiling elevation is only 15'7", and we are using quick response heads. The upright heads will be placed on 1" sprigs to be within 1'-0" of the deck. The following details provide the requirements for the retail area below,

Occupancy: Ordinary Hazard Group II

Max Coverage per Head: 130 Sq. Ft.  
Density: 0.20 gpm / Sq. Ft.  
Sprinkler: Reliable F1FR RA1425 (Upright)  
Orifice: ½"ö  
K-Factor: 5.6  
Area of Operation: 1025.7 Sq. Ft. (Area reduction per NFPA 13 § 11.2.3.2.3)

#### Classroom/Labs

The labs and classrooms are on the 2<sup>nd</sup> & 3<sup>rd</sup> floors will be designated as education area and be considered Light Hazard. This hazard will require a density of 0.10 gpm / Sq. Ft. over an area 939.4 Sq. Ft.. This area has been reduced per 11.2.3.2.3 in NFPA since the ceiling elevation is only 11'0"ö, and we are using quick response heads. The upright heads will be placed on 1"ö sprigs to be within 1'0"ö of the deck. The following details provide the requirements for the classrooms and lab areas below,

Occupancy: Light Hazard  
Max Coverage per Head: 225 Sq. Ft.  
Density: 0.10 gpm / Sq. Ft.  
Sprinkler: Reliable F1FR RA1425 (Upright)  
Orifice: ½"ö  
K-Factor: 5.6  
Area of Operation: 928.2 - 939.4 Sq. Ft. (Reduced per NFPA 13 § 11.2.3.2.3)

#### Common Areas

The hallways and entry ways exist on all floors and will be designated as Light Hazard. This hazard will require a density of 0.10 gpm / Sq. Ft. over an area 939.4 Sq. Ft.. This area has been reduced per 11.2.3.2.3 in NFPA since the ceiling elevation is only 11'0"ö, and we are using quick response heads. The upright heads will be placed on 1"ö sprigs to be within 1'0"ö of the deck. The following details provide the requirements for the common areas below,

Occupancy: Light Hazard  
Max Coverage per Head: 225 Sq. Ft.  
Density: 0.10 gpm / Sq. Ft.  
Sprinkler: Reliable F1FR RA1425 (Upright)  
Orifice: ½"ö  
K-Factor: 5.6  
Area of Operation: 928.2 - 939.4 Sq. Ft. (Reduced per NFPA 13 § 11.2.3.2.3)

#### Elevator

A sprinkler will be provided in the elevator pit. This sprinkler will have a separate 1"ö control valve off of the sprinkler system. It will be an Ordinary Group I hazard in the elevator pit.

Occupancy: Ordinary Group I

Max Coverage per Head: 130 Sq. Ft.  
Density: 0.15 gpm / Sq. Ft.  
Sprinkler: Reliable F1FR RA1435 (Sidewall)  
Orifice: ½"ö  
K-Factor: 5.6  
Area of Operation: N/A

### Mechanical Room

The sprinkler system for the mechanical room will be Ordinary Hazard Group I. This hazard will require a density of 0.15 gpm / Sq. Ft. over an area 1025.7 Sq. Ft.. This area has been reduced per 11.2.3.2.3 in NFPA 13 since the ceiling elevation is only 15'7"ö and we are using quick response heads. The heads to be used are brass uprights. The following details provide the requirements for the mechanical room area below,

Occupancy: Ordinary Group I  
Max Coverage per Head: 130 Sq. Ft.  
Density: 0.15 gpm / Sq. Ft.  
Sprinkler: Reliable F1FR RA1425 (Upright)  
Orifice: ½"ö  
K-Factor: 5.6  
Area of Operation: 1025.7 Sq. Ft. (Area reduction per NFPA 13 6 11.2.3.2.3)

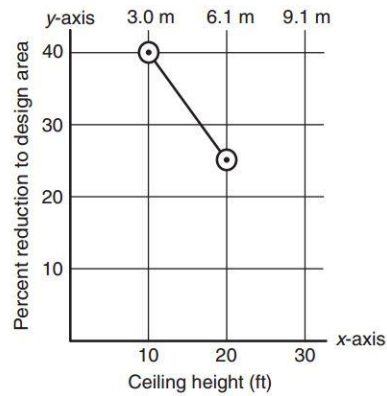
The most remote area was determined to be on the west side of the third floor. This area was determined as the farthest point from the source and has the highest elevation for the water to reach it.

The sizing of the area to be calculated was determined using NFPA 13, with the steps as follows,

- Area Reduction
  - Per NFPA 13: 11.2.3.2.3, allows the area to be reduced for rooms under 20'ö high.
  - The 3<sup>rd</sup> Floor is 11'9"ö high.

Table 3-11 reveals the calculation table used to reduce the calculation area.

Table 3-11: Area Reduction Calculation.



Note:  $y = \frac{-3x}{2} + 55$  for U.S. Customary Units

Note:  $y = -4.8x + 54.6$  for S.I. Units

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

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

For ceiling height  $> 20$ ,  $y = 0$

- For the 3<sup>rd</sup> Floor the equation reads,  $y = ((-3(11.75\phi))/2) + 55$
- Area is reduced to 939.4 Square Feet.
- Number of Heads
  - The number of heads is determined using the remote area size and the area covered by the heads within the area. Table 3-12 below shows this calculation.

Table 3-12: Number of Heads in Design Area.

|                             |  |
|-----------------------------|--|
| Design Area                 | 939.4 sq. ft.  |
| Coverage Area per Sprinkler | 145 sq. ft.  |
| # of Sprinklers to Include  | $\frac{\text{Design Area}}{\text{Coverage per Sprinkler}}$ |
|                             | $\frac{939.4 \text{ sq. ft.}}{145 \text{ sq. ft.}}$        |
|                             | 6.5 Sprinklers   |
|                             | 7 Sprinklers   |

- A minimum of number of heads is 6.5 heads which rounds up to 7 total heads.
- Minimum Heads on Branch Line
  - The minimum number of heads along a single branch line is determined as follows in Table 3-13,

*Table 3-13: Heads on a Branch lone.*

|                              |   |
|------------------------------|---|
| Design Area                  | 939.4 sq. Ft.   |
| Spacing Along Branchline     | 12 ft.  |
| # of Sprinkler on Branchline | $\frac{1.2\sqrt{\text{Design Area}}}{\text{Spacing Along Branchline}}$ $\frac{1.2\sqrt{939.4 \text{ sq. ft.}}}{12 \text{ ft.}}$ <p>3.1 sprinklers</p> <p>4 sprinklers</p> |

- The minimum number of heads on a single branch line will be 4 heads. For the purpose of this layout area, 5 heads will be used. Using 5 heads will result in a more severe calculation scenario for the remote area as more water will be flowing through the length of the branch line.

With these factors in mind, an overall layout of the Remote Area can be depicted from Figure 15 as seen below.

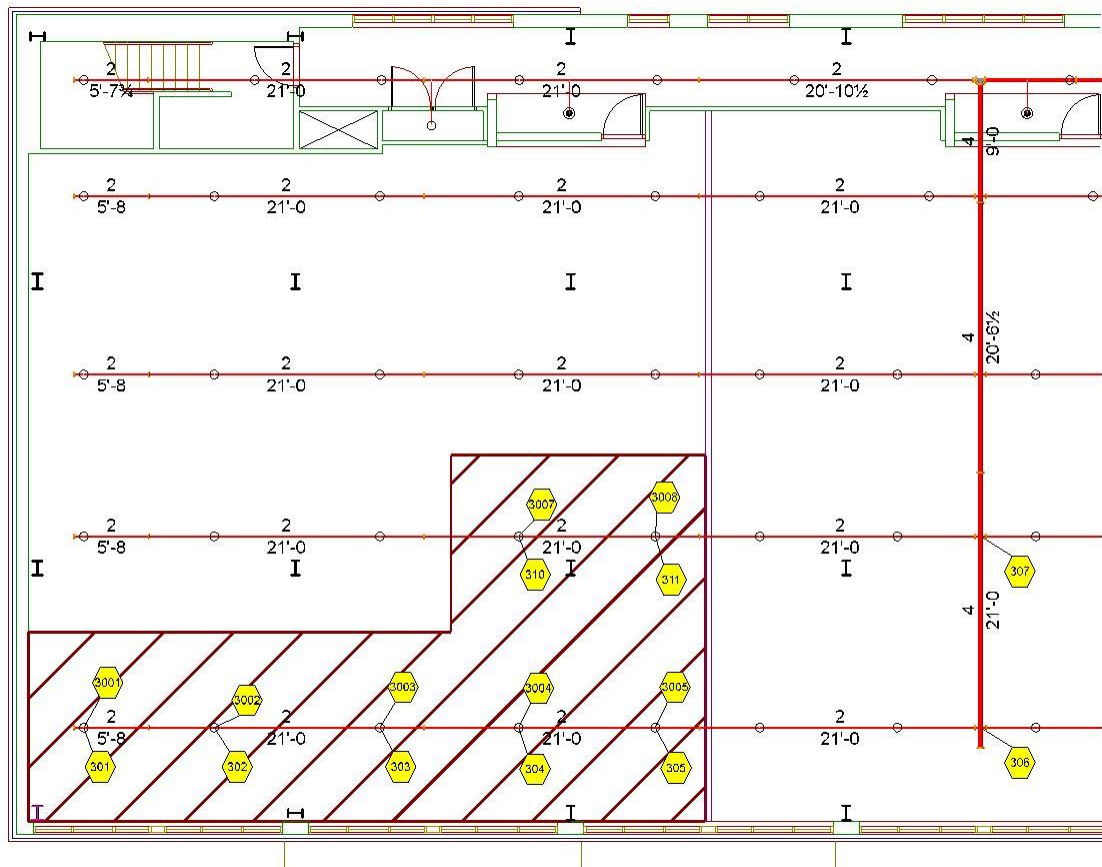


Figure 15: Remote Area Layout

Furthermore, each head can be evaluated individually as to the area it will encompass. The head spacing and area are seen in Table 3-14 below,

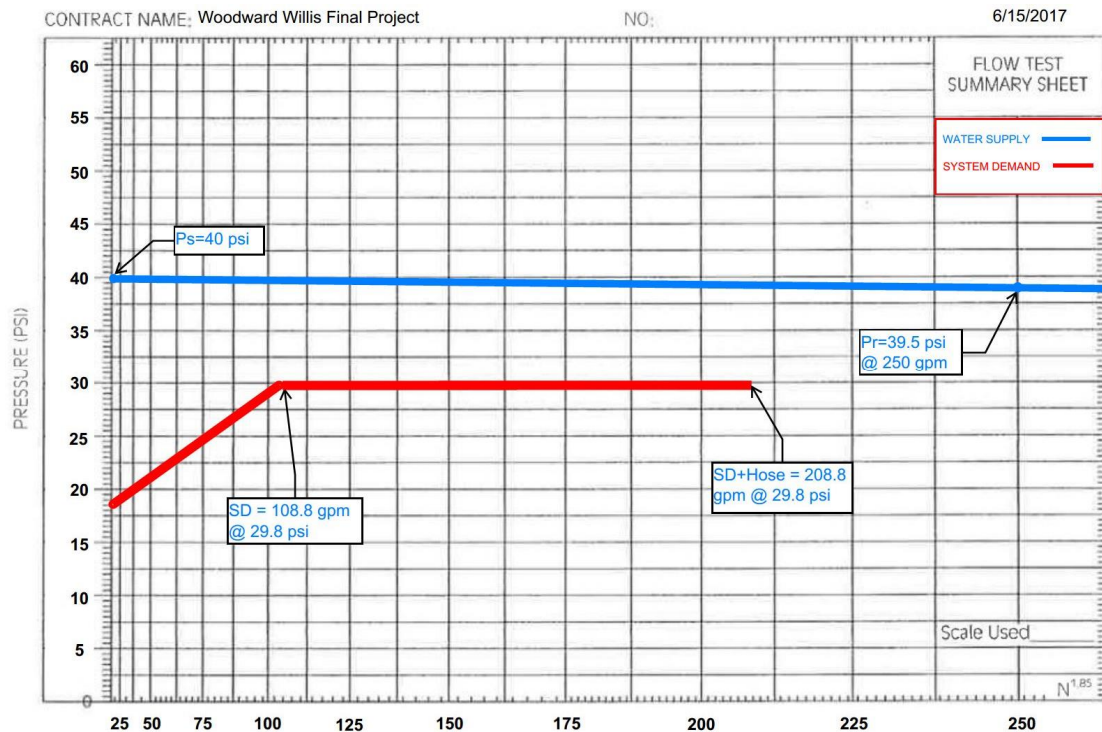
*Table 3-14: Head Spacing and Area Chart*

| Sprinkler ID | Distance Between Branchline | Distance Along Branchline | Coverage Area         |
|--------------|-----------------------------|---------------------------|-----------------------|
| 3001         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3002         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3003         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3004         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3005         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3006         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| 3007         | 12'-6"                      | 11'-7"                    | 145 ft <sup>2</sup>   |
| TOTAL        |                             |                           | 1,015 ft <sup>2</sup> |

A hydraulic calculation is obtained using computer based software, AutoSPRINK.

The breakdown of the calculation and the actual flow of the sprinklers and piping network can be seen in Appendix D: Sprinkler System Calculations.

It is found through this calculation, that the demand at the source (Underground Connection) is 208.74 GPM @ 34.5 PSI. Note that there are an additional 100 GPM added at this point that is used to simulate the water that will be potentially used for hose streams by the fire department. This demand is then compared to the available water supply in Figure 16 below,



*Figure 16: Supply vs Demand Chart*

It is observed that the sprinkler design of the building is sufficient and will respond adequately in the event of a fire scenario in the building.

Upon visiting the site, it shall be noted that there was an issue with the system for the parking garage. This system is housed within a heated plenum and this plenum was opened and not restored to its proper function. Figure 17 reveals the fashion in which this plenum may be exposed and result in damage to the piping network above in freezing conditions.



*Figure 17: Parking Garage Plenum Exposure*

It is recommended that, in the event any tiles are removed for maintenance or any other purpose that they be reinstalled immediately after to maintain the integrity of the insulated plenum.

Inspection, testing, and maintenance requirements for the wet pipe sprinkler system are to be performed per NFPA 25. Appendix F, contains Chapter 5 from NFPA 25 which discusses the minimum requirements for sprinkler systems. These requirements are to be performed by a qualified person who is trained for each task. Inspections are to be done quarterly and annually on the components of the system per Chapter 5 in Appendix F. Records are to be kept for all inspections, testing and maintenance by the owner of the building.

### **3.5.2 Portable Fire Protection**

Fire Extinguishers are implemented throughout the Woodward Willis building in accordance with NFPA 10.

NFPA 10 classifies hazards in a separate manner that of NFPA 13 and bases these hazards on what possible fuels are to be present in the area where the extinguisher is to be located. This classification is in place to minimize the possibility that a fire extinguisher being used by an occupant is not intended to fight a different type of fire than the one presented. Hazards for this building were broken down into Class A (common combustibles) and Class B fires (Liquid Fuels). These hazards will be evaluated by the occupancies that they are found to be present in.



Tables 3-15 and 3-16 represent these areas and the amount of protection that will be required as follows,

*Table 3-15: Fire Extinguisher Class A Hazards Classification*

| Criteria                                | Light Hazard Occupancy | Ordinary Hazard Occupancy | Extra Hazard Occupancy |
|---|------------------------|---------------------------|------------------------|
| Minimum rated single extinguisher       | 2-A                    | 2-A                       | 4-A                    |
| Maximum floor area per unit of A        | 3000 ft <sup>2</sup>   | 1500 ft <sup>2</sup>      | 1000 ft <sup>2</sup>   |
| Maximum floor area for extinguisher     | 11,250 ft <sup>2</sup> | 11,250 ft <sup>2</sup>    | 11,250 ft <sup>2</sup> |
| Maximum travel distance to extinguisher | 75 ft                  | 75 ft                     | 75 ft                  |

*Table 3-16: Fire Extinguisher Class B Hazards Classification*

| Type of Hazard | Basic Minimum Extinguisher Rating | Maximum Travel Distance to Extinguishers |       |
|----------------|-----------------------------------|--|-------|
|                |                                   | ft                                       | m     |
| Light          | 5-B                               | 30                                       | 9.14  |
|                | 10-B                              | 50                                       | 15.25 |
| Ordinary       | 10-B                              | 30                                       | 9.14  |
|                | 20-B                              | 50                                       | 15.25 |
| Extra          | 40-B                              | 30                                       | 9.14  |
|                | 80-B                              | 50                                       | 15.25 |

Minimum Fire Extinguisher ratings can be obtained from the table above and are used to choose a proper extinguisher for that area. For simplicity, a common practice is to select a single extinguisher that will satisfy the most extreme hazard for each case. It is seen throughout the building that a 4A:80B:C rating extinguisher was used. Using the same extinguisher will make it easy to replace in the future as they are all the same. It will also be helpful in the event that there is a fire, since every extinguisher will have the capability to extinguish all present fuel loads.

Spacing for these extinguishers are based on the hazard area for which they are installed. For Class A areas extinguishers must be placed no further than a 75' travel distance from any point within the building. For Class B, this travel distance is reduced to 50'. Travel distances are determined based on the rating of the extinguisher that will be used. The fire extinguishers shall be mounted by using a hanger supplied by the manufacturer with the extinguisher upon purchase. Extinguishers are to be installed no more than 5' above the floor per NFPA 10.

Inspections shall be provided and recorded on a monthly basis by the building manager. These monthly inspections shall be done in a visual manner to ensure that all extinguishers are located on proper hangars and are not missing or moved. Annual maintenance shall be performed and recorded by a certified technician, to ensure all fire extinguishers are in proper working condition.

For stored pressure fire extinguishers which are used in the building, a 6-year internal exam shall be provided by a certified technician. This internal inspection will require each fire extinguisher to be opened and visually check the agent and replace seals before being put back into service.

Upon arrival at the site it was found that the fire extinguishers were missing from the garage. The hangers were installed in correct fashion but there were no extinguishers on them. It was also evident on the third floor that the extinguishers were on the floor behind the columns in the exit corridor. These issues need to be addressed to bring the building in compliance with NFPA 10.

## **4 Prescriptive Summary**

The water based fire suppression system installed in the building is compliant with NFPA 13. In the event of a fire scenario, the sprinklers are designed to provide adequate water to suppress the fire in each area of the building.

The prescriptive Life Safety Analysis has been performed to the applicable codes and standards mentioned. This analysis reviewed the structural fire protection, occupancy and egress analysis, fire detection and alarms, smoke management, and fire suppression systems implemented in the Woodward Willis building.

Overall, the building is in compliance with the applicable codes. There are however some issues that are seen within the building that will not be up to code due to various issues.

The main deficiencies are as follows:

- Occupant load in Rooms 21,22,23,31,32, &33 exceeds the available exit capacity for each room.
- Fire extinguishers are not located throughout the parking garage.
- Fire extinguishers on 3<sup>rd</sup> Floor are located on the floor and not easily visible.
- Wet pipe sprinkler system is currently exposed to the outside freezing conditions in the parking garage area.

These issues were evaluated per the available construction documents attained and by site visit. The actual construction of the building may change due to future renovations and such egress accommodations should be determined as necessary.

The prescriptive analysis of the building has now been completed and the remainder of the report will focus on the performance based analysis. This analysis will focus on modeling a fire within the building to see if the design is such that safe egress will be available to the occupants within.

## **5 Performance Based Analysis**

### **5.1 Scope**

The performance based analysis will be done in a manner to evaluate the life safety of the occupants in the event of a fire in the building. This analysis will establish an ASET (available safe egress time) for the occupants to evacuate the building. This ASET will then be compared to a RSET (required safety egress time) of the occupants to see if there will be sufficient time for a safe evacuation.

This building is currently under construction and changes to the overall floorplans may change. For the purpose of this analysis it will be assumed that the available construction documents are to be the existing conditions of the future building. Any variation from these provided documents will affect the results from this analysis and deem them non-conforming to revised conditions of the building.

### **5.2 Performance Criteria**

The Life Safety Code lists performance criteria that shall be met. The main criteria are that all occupants shall not be exposed to untenable conditions within the building during fire conditions. These tenable conditions require all occupants to have the ability to evacuate under safe conditions from the fire itself as well as from the products emitted from the fire such as smoke and toxic gases.

The following criteria are stated within the Life Safety Code and must be met as follows,

- Prohibit thermal damage from the fire and surroundings
- Prohibit loss of visibility due to smoke
- Prohibit incapacitation due to toxic fumes

These conditions will be the guidelines for the performance review.

#### **5.2.1 Tenability Criteria**

The tenability criteria are used to measure the amount of damage that can be induced on an occupant versus the amount of each item that is produced throughout the process of the fire. These factors will consist of visibility, gas exposure, and thermal radiation to the occupants as described in Method 1 from the Life Safety Code. A breakdown of each factor and their tenability limits are listed as follows,

- Loss of Visibility

For the purpose of this analysis, a limit of 10 meters of visibility will be considered the least amount of visibility for occupants to safely evacuate the building. 10 meters of visibility was determined through Table 63.5 in the SFPE Handbook, where Rasbash indicates that an obscuration density of 0.08 OD/m to be untenable for large rooms and hallways.

If visibility becomes less than 10 meters it will impede occupant's ability to see where to exit the building and they may become disoriented and trapped. Limited visibility will also influence people's decision making, as they may not choose an exit near them due to not being able to clearly see that it is there or if it has been compromised by the fire. The visibility is expected to be the first limiting tenability criteria to the occupants in the building.

- Exposure to Toxic gases

For the purpose of this analysis, 1400 ppm of Carbon monoxide will be considered the tenability limit without incapacitation.

If Carbon Monoxide levels exceed 1400 ppm the occupants can become incapacitated and will not be able to independently evacuate the building. Table 63.9 in the SFPE Handbook reveals that cumulative levels of Carbon Monoxide will induce incapacitation at around 30,000-35,000 ppm\*min. By setting the limit at a level of 1400 ppm to be maintained, it will allow for tenable conditions to be maintained in the building for 25 minutes before accumulations of Carbon Monoxide exceed 35,000 ppm\*min. The Carbon Monoxide tenability conditions will also be applicable throughout the entire building, meaning they will be considered cumulative as long as the occupant is exposed at any given location within the building.

- Exposure to Heat

For the purpose of this analysis, a maximum heat exposure of 60° C will need to be maintained within 60cm from the floor for occupant safety.

From the SFPE Handbook Chapter 63, it is seen that air temperatures above 60° C is harmful when inhaled through the throat and lungs. Breathing in this hot air will cause immediate damage as well as in the time to follow. The temperature must also be maintained below 60C to prevent hyperthermia from occurring. Hyperthermia is the state of the body as it overheats. The average body temperature is around 37°C. When the body temperature reaches 40°C consciousness becomes blurred and at 42.5°C it is fatal. Temperatures exceeding 60°C will be expected during this scenario and is expected to be a factor in tenability evaluation.

## 5.3 Fire Scenarios

The Life Safety Code addresses eight possible fire scenarios that shall comply and demonstrate effectively with the fire chosen for a given building. These scenarios are to be chosen on the basis that is most applicable to the current design of the building. The eight scenarios are as follows,

- 1: Occupancy-specific fire representative of a typical fire for the occupancy.
- 2: Ultra-fast developing fire in the primary means of egress with doors open.
- 3: Fire in a normally occupied room which affects a large room or area.
- 4: Fire that originates in a concealed space adjacent to a large occupied room.
- 5: Slow developing fire shielded from suppression system near occupied room.
- 6: Most severe fire resulting from the largest fuel load of normal occupation.
- 7: An outside exposure fire.
- 8: Fire of ordinary combustible where suppression system is rendered inoperable.

For the evaluation of the Woodward Willis building it is determined that a scenario will be used that renders the sprinkler system inoperable. Without an operating sprinkler system, the fire will not be suppressed and result in a larger uninterrupted fire growth. The sprinkler system can be rendered inoperable by simply closing a valve that supplies the sprinkler. A closed valve scenario could easily happen in the building due to having the sprinkler standpipe and all its systems control valves to the 2<sup>nd</sup> and 3<sup>rd</sup> floors exposed in the north stairwell. This scenario will be evaluated to represent the truest manner possible within the building. Throughout this section, it will be discussed how this will be achieved.

### 5.3.1 Occupant Characteristics

In order to determine how occupants will react for a given fire scenario, more must be established about the occupants that will typically inhabit the building.

The building can be seen as having two separate groups of people in attendance. Those of which are attending the technical college and those that are using the stores for shopping.

The technical college will be comprised of teachers and students. This group of people can be assumed to be familiar with their surroundings within the building as they are in attendance on a regular basis and can be exposed to routine evacuation drill scenarios. This group of people will consist mostly of adults and young adults.

The storefronts will be occupied by a wide range of people ranging from the elderly to that of infants brought in with parents. This wide range of people result in a high level of unfamiliarity within the building as they are not frequently immersed in the surroundings of this building. Unfamiliar occupants will not be as big of an issue though, due to the size of the stores being very small. This small room size will allow an occupant to enter the building and know that, that same

location will provide an exit to the street. These exit locations will never be out of plain sight as the storefronts are not very large and will not have any high storage within them impeding the visibility from within.

### 5.3.2 Analyzed Scenario

#### Scenario 1: Cardboard Desk

Scenario 1 consists of a cardboard desk fire in the 3<sup>rd</sup> floor classroom and will be the chosen fire scenario for this analysis. In this scenario, the fire is assumed to be started from an electrical malfunction of a laptop connected to a charger on top of the cardboard desk. This scenario is assumed to be the most likely non-arson fire to occur with the largest fuel load available within the occupied building space at this time. A representation of this fire scenario can be seen be from Figure 18.



*Figure 18: Cardboard Desk Fire Scenario*

It will be assumed that this fire will occur while the building is at full capacity. Also note that for this fire it will be assumed that the fire sprinkler system is inoperable and cannot suppress the fire. This fire will allow for the greatest threat of smoke, temperature, and toxic gases that are to be presented to the occupants present in the building.

### 5.3.3 Other Potential Scenarios

There are other possible fires that may occur within the building that will not be further discussed but are noted as possible fire scenarios as follows,

## Scenario 2: Wooden Architectural Models

Scenario 2 consists of wooden architectural models housed within the 2<sup>nd</sup> and 3<sup>rd</sup> floor classrooms. These models will be arranged in various manners and sizes throughout the year as the students work on and display them. This scenario would address a volume of fuel load present which would present another worst-case level scenario. This scenario is close in relation to Scenario 1, and would endanger the occupants in a similar manner if they were to ignite. A depiction of this scenario can be seen in Figure 19 below.

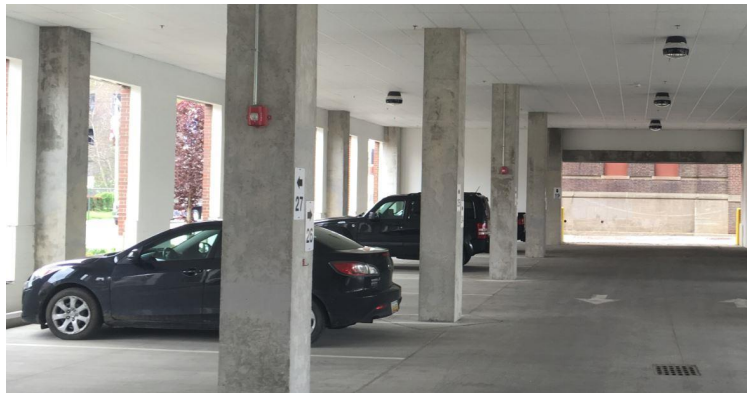


*Figure 19: Wooden Architectural Model Scenario*

As seen from Figure 19, the fire load is much smaller than that of the cardboard desk scenario. This smaller fuel package would be assumed to not be as devastating to the overall tenability when compared to Scenario 1 and will not be further evaluated.

## Scenario 3: Car fire in the Parking Garage

Scenario 3 consists of a car fire in the parking garage. This scenario would address the possibility of a fuel load from a vehicle and would challenge the integrity of the structure above. This scenario is depicted in Figure 20 below.



*Figure 20: Car Fire Scenario*

The car fire does pose the greatest fuel load that would be anticipated, however it is also not totally confined directly within the building. The parking garage is open to the exterior of the building thus allowing much of the emissions to be released outside of the building. It should also be noted that the parking garage only has an occupancy load of 40 occupants and the paths of egress would allow for ample egress from the garage itself. For the limited impact on the safe egress of the building this scenario will not be further evaluated.

## 5.4 RSET: Required Safe Egress Time

A timeline is configured to represent the required time necessary for occupants to evacuate the building. This timeline will establish the required safe egress time (RSET) and will consist of detection time, time from detection to notification, pre-movement time, and travel time. A depiction of this timeline from the SFPE Handbook can be seen in Figure 21 as follows.

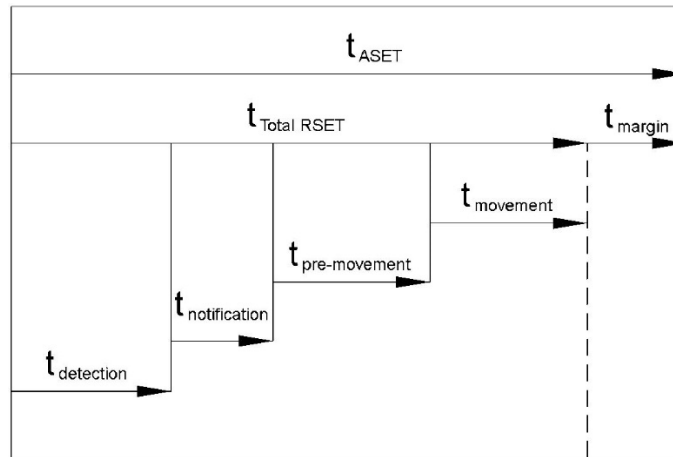


Figure 21: RSET Timeline

The breakdown of each factor can be seen in the following sections.

### 5.4.1 Detection Time

Detection time is determined from the time that it takes for a smoke detector, pull station, or water flow switch to be activated from the start of a fire. For this scenario, a detection time will be determined through the fire model produced in Section 5.5.2 of this report. A smoke detector is used as the means of detecting the fire in this case and is seen to be activated at 2 minutes and 18 seconds seen from section 5.5.2.

Manual pull stations are provided throughout the building where required. These pull stations are not used as a means of detection in this scenario however, as the reliability of human decision is deemed not as reliable as the designed smoke detection system.



The water flow switch would be the other means of detecting a fire threat in the building. This method is also not applicable to this scenario as the assumption of an inoperable sprinkler system has been made. Being inoperable means that even if the sprinkler has been activated there will be no water supplying flowing through it to combat the fire.

#### **5.4.2 Time from Detection to Notification**

The detection to notification time is how long it will take from the point at which the fire is detected by a device and received by the control panel, to the point at which the notification alarms and strobes are activated. This time will be assumed to be 5 seconds. NFPA 72 10.11.1 requires actuation of notification within 10 seconds of the activation of an initiating device.

In the instance of a manual pull station the time would be evaluated that it takes from when a person detects a fire to the point at which they operate the pull station setting off the alarm sequence in the building. For this analysis, the fire will be detected by means of a smoke detector within the room of origin, which will send signal to the fire alarm control panel.

#### **5.4.3 Pre-Movement Time**

The pre-movement time is the time it takes for occupants to react and acknowledge the alarm. This time will consist of the total time from alarm until evacuation has initiated. These times have been studied extensively throughout various applications as seen in the SPFE Handbook in Chapter 64. Table 64.9 from the SFPE Handbook reveals data for similar multi story education buildings, where the pre-movement times range from 30 to 40 seconds. For this analysis, a 40 second pre-movement time will be implemented into the RSET evaluation. This time is representative, in that the staff will be trained in a manner to react to this signal and halt all classroom activities to begin the evacuation of all students.

#### **5.4.4 Actual Movement Time**

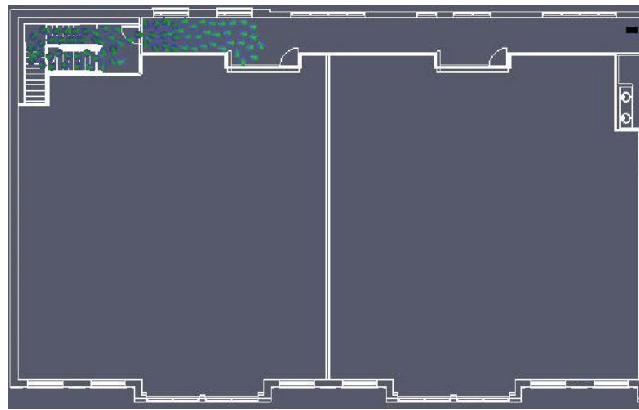
The travel time for this building was determined through modeling in the computer program, Pathfinder. Pathfinder is a validated program and has been proven compliant with codes and experiments as seen from Table 60.1 in the SFPE Handbook. By using Pathfinder, it allowed for a full occupant load of each room to be applied throughout the entire building. The program also allows for separate parameters regarding egress efficiency and speed factors for various occupants, such as for children and elderly. Speed factors for the second and third floors were determined to be 1 m/s for all occupants on these levels from Table 64.14 in the SPFE Handbook, which reveals an exit walking speed ranging from 0.8 to 1.5 m/s. With this range, it was

determined that an average speed of 1 m/s would be sufficient in this analysis due to the main occupants being in the age range of 18-25 years old and in good health.

Disabled occupants have been excluded from this analysis since they would not have to fully complete the evacuation process. For disabled occupants, it is assumed that they will remain in the safe refuge area located in each stairwell during the event of the evacuation. These areas of refuge are within the fire rated stairwell and would not interfere with the evacuation sequence occurring. Here the disabled occupant would remain safe from the effects of the fire until rescue teams arrived and would then assist them in evacuation from the building.

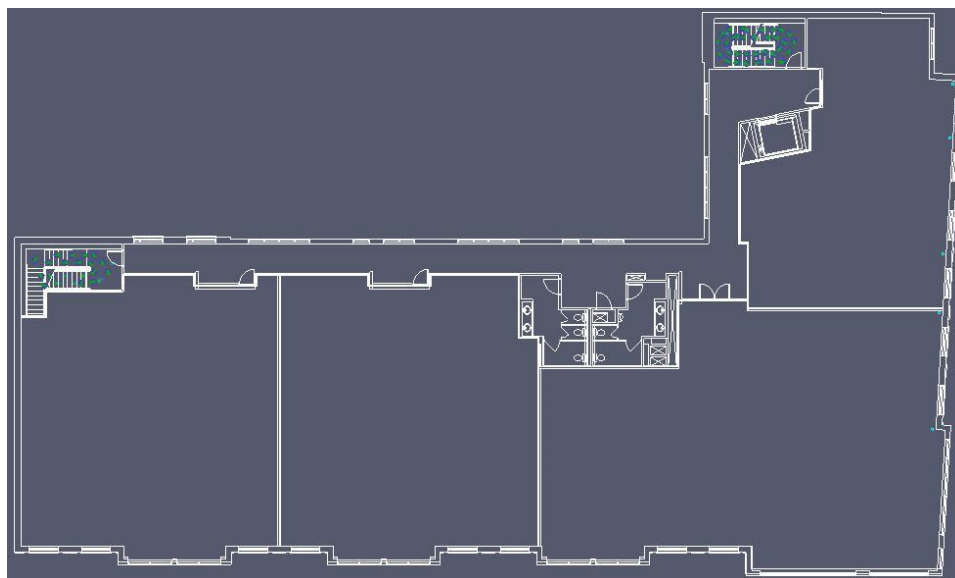
The evacuating occupants were also prescribed within Pathfinder to use any exit as a viable means of egress. Either exit is adequate, as there are only two main exits from the second and third floor to the exterior of the building, so confusion would not be anticipated.

The actual movement time to evacuate the room from which the fire was located on the 3<sup>rd</sup> floor was found to be 135 seconds. At this time, all occupants were outside of the room and within the exit corridor. A depiction from Pathfinder at this time can be seen in Figure 22 below.



*Figure 22: Pathfinder Room Evacuation Time (135 Seconds)*

The total time to evacuate the 3<sup>rd</sup> floor entirely was found to be 240 seconds. At this time there will no longer be any occupant within the 3<sup>rd</sup> floor exposed to the fire as they are evacuated from the building or within the rated stairwells. A depiction from Pathfinder of the 3<sup>rd</sup> floor is seen in Figure 23 as follows,



*Figure 23: Pathfinder 3<sup>rd</sup> Floor Evacuation Time (240 Seconds)*

These movement times will be evaluated respectively with the tenability limiting available safe egress times that are found in Section 5.5.3 and further analyzed in Section 5.5.4.

#### 5.4.5 Conclusion of RSET

The RSET can now be calculated from the determined values. For the room where the fire originated, the RSET can be seen from Table 5-1 as follows.

*Table 5-1: Room RSET*

| <b>Room RSET</b>         |                   |
|--------------------------|-------------------|
| <i>Evacuation Factor</i> | <i>Time (sec)</i> |
| t- detection             | 138 s             |
| t- notification          | 5 s               |
| t- pre-movement          | 40 s              |
| t- evacuation            | 135 s             |
| <b>Total RSET</b>        | <b>318 s</b>      |

The RSET for the room is found to be 318 seconds (5 minutes & 18 seconds) from time of ignition to the time at which no occupant is within the room. This time is significant in that it will be the benchmark of how long tenable conditions will need to be maintained. If tenable conditions are compromised at any point in this period within the room it will have negative effects on the occupants and the scenario will not be acceptable.

Similarly, an RSET was determined for the entire third floor and can be seen represented in Table 5-2 below.

*Table 5-2: 3<sup>rd</sup> Floor RSET*

| <b>3rd Floor RSET</b>    |                   |
|--------------------------|-------------------|
| <i>Evacuation Factor</i> | <i>Time (sec)</i> |
| t- detection             | 138 s             |
| t- notification          | 5 s               |
| t- pre-movement          | 40 s              |
| t- evacuation            | 240 s             |
| Total RSET               | 423 s             |

The RSET for the 3<sup>rd</sup> Floor can be seen as 423 seconds (7 minutes & 3 seconds). Tenable conditions must be maintained within the exits and corridors throughout the 3<sup>rd</sup> floor during this time to allow successful evacuation.

The required safe egress times that were determined are very crucial to the overall analysis of the egress analysis. These times will be directly compared to the available safe egress times found. The next section will discuss the available safe egress times and how they are determined.

## **5.5 ASET: Available Safe Egress Time**

An available safe egress time will be determined in the following sections of this report. This time will be the maximum allowable egress time to evacuate under tenable conditions for the cardboard desk scenario fire present on the 3<sup>rd</sup> floor. The cardboard desk fire will be assumed as the most severe fire scenario within the building and shall provide the most conservative results for available safe egress times.

### **5.5.1 Design Fire**

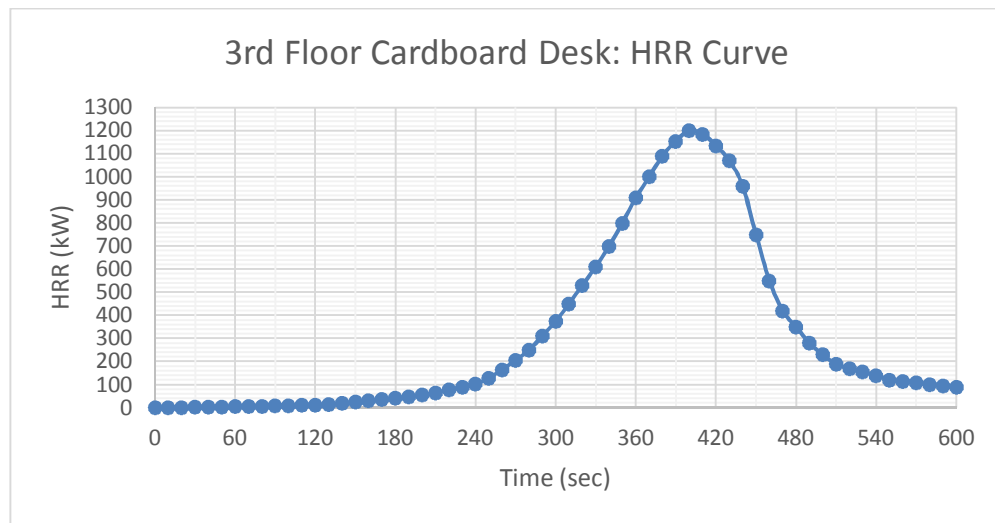
The fire is modeled within Classroom 32, and is arranged along the east wall. The fuel load of the fire is to be comprised of 20 cardboard boxes. These boxes were constructed to function as a computer workstation within the classroom. Ignition for this fire will be from a faulty charger overheating and causing the top of the desk to ignite.

To determine the parameters of the fire, the SFPE Handbook was used in conjunction with a report by William Walton, "Suppression of Wood Crib Fires with Sprinkler Sprays: Test Results". This report used cardboard box arrangements as the testing base to be compared to other materials. With the data from this report, a fire was able to be simulated as the most realistic for the arrangement of the cardboard desk.

The fire parameters that were used are listed as follows,

- Heat of Combustion: 13.2 kJ/g
- CO Yield: 0.01
- Soot Yield: 0.02
- Peak HRR: 1,200 kW

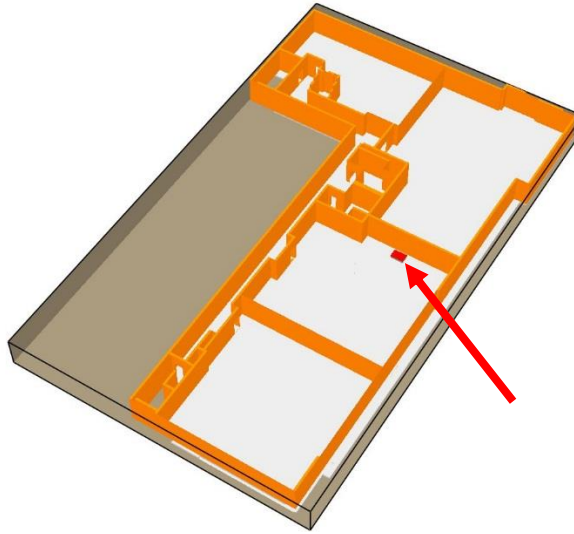
The time of the fire to be considered is 10 minutes (600 seconds). A heat release rate over time for this fire scenario can be seen from Figure 24 below.



*Figure 24: HRR of Cardboard Desk*

The heat release rate can be seen as starting off in a slow growing state. Then at 3 minutes the fire turns into a fast-growing fire. At 6 minutes and 40 seconds the fire becomes fuel limited and as a result the heat release rate begins to decline until it burns completely. The assumption is made that the fire will not spread to any other furnishings within the room as the desk is not near any other fuel loads within the room. It should also be noted that the cardboard will not breakdown and send particles of burning cardboard throughout the rest of the room via the smoke plume. This assumption is made due to the way in which the desk is constructed to keep it together.

The fire is modeled within Classroom 32, and is arranged along the east wall as depicted in the actual model in Figure 25 on the next page.



*Figure 25: FDS Model 3<sup>rd</sup> Floor Layout*

### **5.5.2 Result of 3<sup>rd</sup> Floor Classroom Fire**

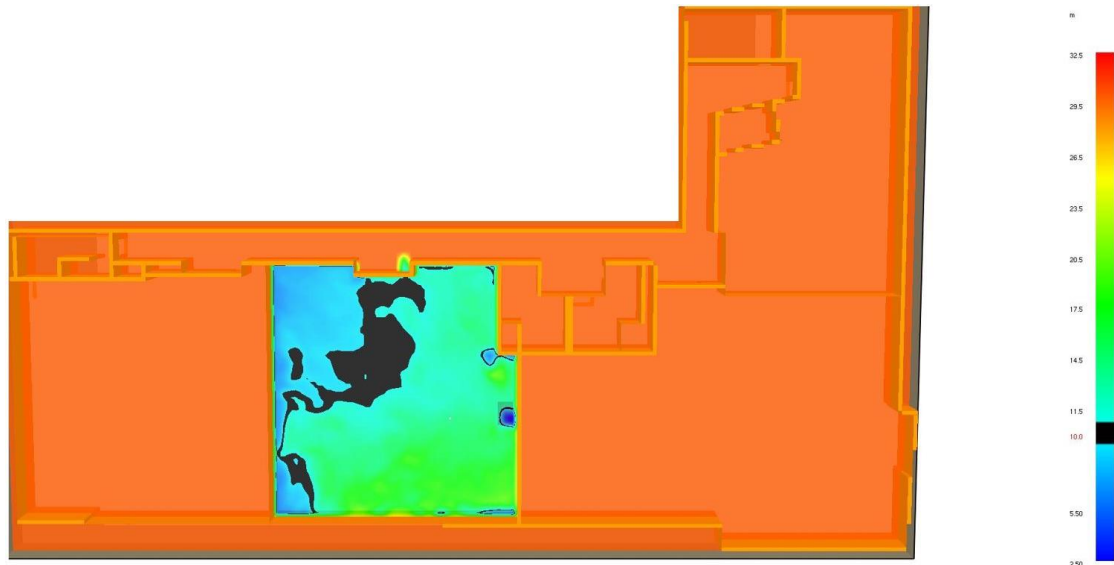
The results of the Fire Dynamics Simulation will be provided in this section. These results will be depicted for the three criteria that are most severe to the occupants. A result will be obtained as to when these tenability criteria are exceeded within Classroom 32 and within the hallway for comparison to the data found for the RSET previously.

Additionally from the model, smoke detectors were located within the room as a means of detecting the fire. It was seen at 2 minutes and 18 seconds that the first detector went into alarm. This alarm activation was used as the detection time that is implemented into the RSET Detection Time from Section 5.4.1.

#### **Visibility Levels:**

The visibility criteria states that 10 meters of visibility must be maintained at 2 meters above the floor at any given point within the building. Visibility was determined in FDS by providing a Slice file over the time of the fire to visually see where and when this occurred in the building at this elevation.

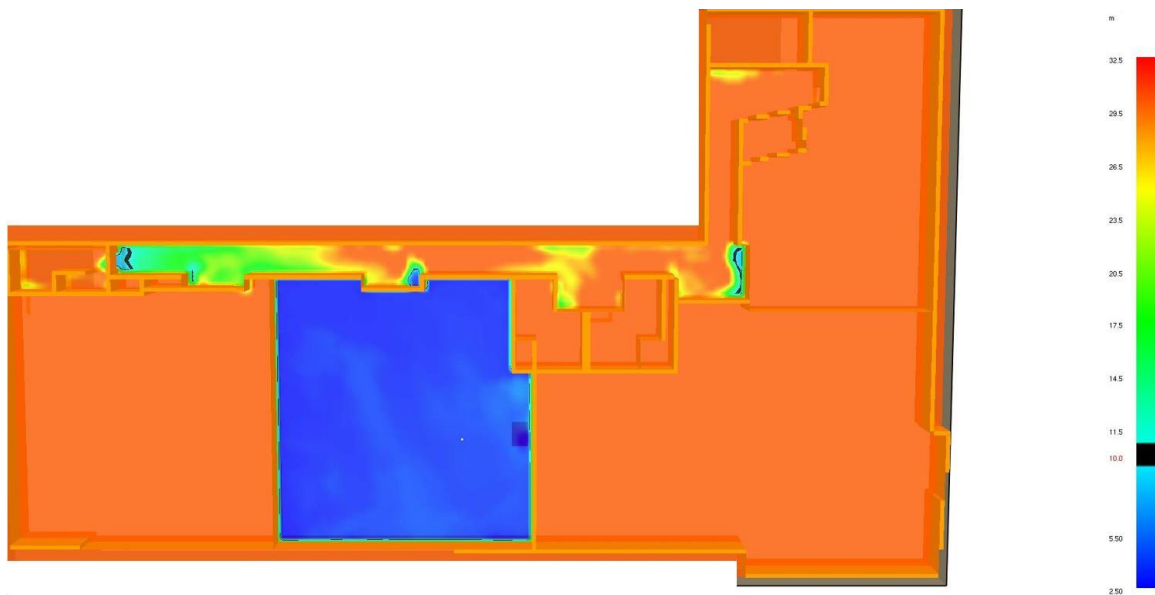
The visibility within Classroom 32 is lost at 335 seconds. Results can be seen with the 10 meter limit being highlighted as the black area in Figure 26 on the next page.



*Figure 26: Classroom 32 Visibility (335 Seconds)*

From Figure 26 it is observed that the black area sweeps across the doorway at 335 seconds, rendering it untenable for occupants to see through to safely evacuate.

The visibility outside of the room in the exit corridor also begins to degrade as the fire continues to burn. The tenability for the entire 3<sup>rd</sup> floor becomes compromised at 425 seconds (7 minutes & 5 seconds). This visibility loss is depicted in Figure 27 below.



*Figure 27: 3<sup>rd</sup> Floor Visibility (425 Seconds)*

From Figure 27 it is seen that visibility falls below 10 meters in the exit corridor near the west stairwell. The area that is compromised near the stairs is a result of smoke traveling down the corridor and meeting the wall, which forced it downward into the path of egress.

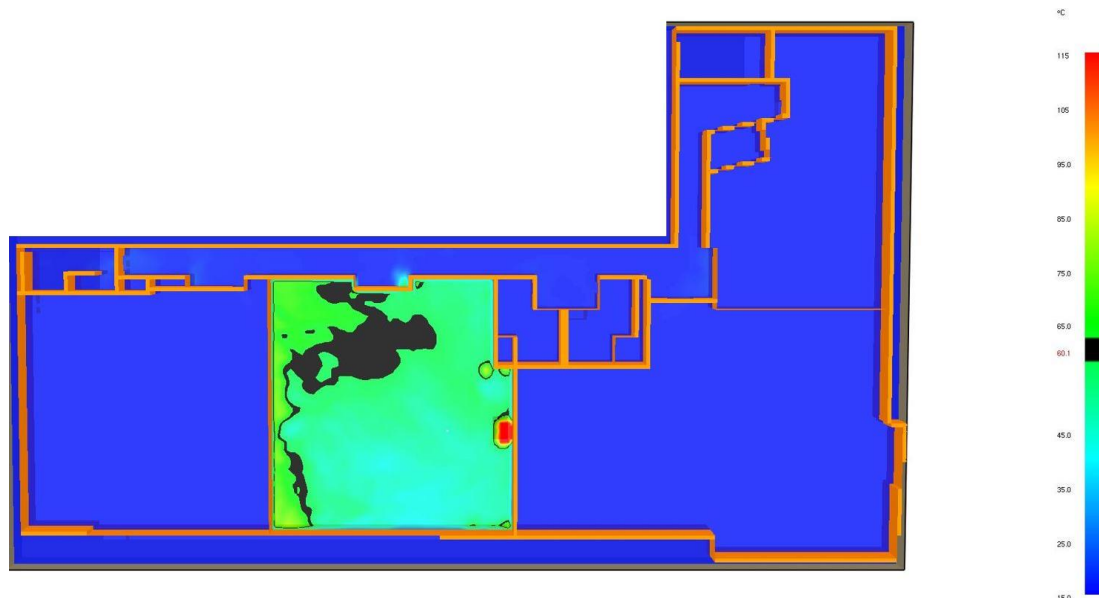
#### Toxicity Levels:

Carbon Monoxide produced from the fire becomes untenable when the conditions reach 1,400 ppm. The results of the FDS model reveal that during the 10-minute fire scenario, Carbon Monoxide levels never exceeded 150 ppm at any point in the building. This level of Carbon Monoxide will not be a threat to the occupants as they evacuate the building. Since the CO levels for incapacitation are 30,000 ppm\*min, it can be seen with an exposure at 150 ppm it would take around 3 hours and 20 minutes to have serious effects. Since our evacuation process from the start of the fire will take only roughly 7 minutes this will not be a factor in life safety.

#### Temperatures:

The temperature criteria states that temperatures below 60°C must be maintained at 2 meters above the floor at any given point within the building. To evaluate this criterion, temperatures were determined in FDS by providing a Slice file over the time of the fire to visually see where and when this occurred in the building at this elevation.

The temperature within Classroom 32 exceeds 60°C at 345 seconds. Results can be seen with the 60°C limit being highlighted as the black area in Figure 28 below.



*Figure 28: Classroom 32 Temperature (345 seconds)*



From Figure 59, it is seen that temperature rises above 60°C across the exit doorway in Classroom 32. This 60°C temperature will result in untenable conditions for any occupants still within this area or trying to exit at this time from the room.

For the remaining duration of the fire temperatures never exceeded the tenable limits for the rest of the building. Not reaching a temperature of 60°C is a result of the fire declining in size after 5 minutes. 12ø high ceilings in the room also enabled more heat to be conserved within the room as the hot gas layer had more volume to be filled before it reached the top of the doorways.

### 5.5.3 ASET Results

The available safe egress time is to be the most limiting time where untenable conditions occur in the building. From the results of the 3<sup>rd</sup> Floor fire it is seen that visibility was the most limiting case in the classroom and throughout the rest of the floor. Temperature was also a limiting factor within the classroom itself, occurring shortly after the visibility loss. A table representing the tenability criterion and when they were exceeded is seen below in Table 5-3.

*Table 5-3: ASET Tenability Times*

|                 | Tenability Exceeded (sec) |           |
|-----------------|---------------------------|-----------|
|                 | Classroom 32              | 3rd Floor |
| Visibilty       | 335                       | 425       |
| Temperature     | 345                       | -         |
| Carbon Monoxide | -                         | -         |

The ASET for the classroom is determined to be 5 minutes & 35 seconds (335 seconds) from ignition. At this time, it would be hard for occupants to evacuate the room safely as the exit could possibly not be within sight for them.

The ASET for the entire 3<sup>rd</sup> Floor occurred at 7 minutes & 5 seconds (425 seconds). This available time limit occurred specifically at the west exit stair and would render the exit as non-usable at this point.

These ASETø will now be analyzed against the RSETø in the next section to determine the outcome of the evacuation times.

#### 5.5.4 Conclusion of Egress Time

In comparing the acquired values for RSET and ASET, Table 5-4 below shows the results.

*Table 5-4: RSET vs ASET*

|      | Classroom 32 | 3rd Floor |
|------|--------------|-----------|
| RSET | 318          | 423       |
| ASET | 335          | 425       |

In both cases, the classroom and 3<sup>rd</sup> Floor it's seen that the available safe egress time exceeds the required safe egress time resulting in a sufficient evacuation time for the occupants to evacuate. This data can be used to provide evidence that the building is adequate to evacuate the number of occupants that has been determined.

These egress times are to be considered conservative due to the automatic sprinkler system being inoperable and also that at full occupancy it is assumed that no occupants were able to detect the fire and signal the manual pull station. A safety factor will not be used for this scenario since such a conservative measure was taken. If the building was to be modeled with consideration to an operable sprinkler system a safety factor would then be determined and implemented into the scenarios and acquired times for evacuation.

These results should be further analyzed if the furnishings of the building were to be changed in the future. Further analyzation will be important as the current fire load is not directly in the exit path of occupants evacuating the room, nor did it spread to other fuels within the room. Upon full completion of the construction of the building it is suggested that the current validity of this scenario be confirmed.

## 6 Report Conclusion

In conclusion of this report, an analysis of the prescriptive and performance based designs will be provided as follows.

### 6.1 Prescriptive Analysis

Overall, the Woodward Willis Building is in compliance with the applicable codes and standards from Section 1.3. Some exceptions are found where fire extinguishers are not properly hung and where the integrity of the heated plenum above the garage exposes the wet pipe system to the outside temperatures. These exceptions are not to take away from the design of the fire protection systems, which prove to be compliant per the applicable codes.

## **6.2 Performance Based Analysis**

A fire scenario within a classroom on the 3<sup>rd</sup> floor was analyzed in detail with a cardboard desk as the present fuel load.

This fire scenario was modeled in FDS which resulted in an available safe egress time of 425 seconds. This safe egress time represents the time to which untenable conditions are reached by the fire. Pathfinder was then implemented to show the actual evacuation time of all occupants. With this time and detection time from FDS, a required safe egress time was determined to be 423 seconds from the third floor. This reveals that the time to exit the building are within the tenability period of the fire scenario.

This model was evaluated in a manner where the sprinkler system was considered inoperable and the detection of the fire was from a smoke detector within the room. In the event where automatic sprinklers would activate, it can be assumed that the heat release rate of the fire would be reduced. By reducing the heat release rate, it would then reduce the overall growth of the fire and limit its ability to spread to other fuel loads. Further analysis would need to be completed to prove how the building conditions could be improved under these conditions.

Loss of visibility due to smoke was the limiting factor to untenability. Any measures taken to reduce the production of smoke is advised as it could increase the safety margin of egress time. Reduction of smoke could be as simple as instructing occupants to close the door to the room as the last person exits the room of the fire.

## **7 Recommendations**

There are some deficiencies that need to be addressed upon construction completion. The first issue would be to determine the actual allowed occupancies within Classrooms 21, 22, 23, 31, 32, & 33. Based on the current drawing there is only one means of egress. This one exit can support a maximum of 49 occupants per each room and it is seen that the calculated occupancy loads for each exceeds this limit. It will need to be determined whether to add an additional door or to reduce the maximum occupant load of each room to 49 persons.

Beyond the occupancy issues of the education areas, there are minor issues that will need to be addressed throughout the building to maintain the integrity of the fire protection systems. The exit corridors on the 2<sup>nd</sup> and 3<sup>rd</sup> floors should be maintained to be clear from obstacles and tripping hazards. These areas are not to be used for storage and it is advised that even temporary storage of such items as bicycles should not be permitted to be stored here.

Fire extinguishers need to be installed at 4 feet above the floor and within open sight. Currently these extinguishers are on the floor and out of site from the occupants. Fire extinguishers are to be installed throughout with the intent that a person can readily find and use them to extinguish the fire before it becomes too large to combat.

Maintenance of any form within the building should be completed with consideration to the fire protection systems installed throughout the building. Proper consideration is most notable in the parking garage where there is a heated plenum that must be maintained to ensure the pipes are not exposed to freezing conditions. If any tiles in this area are removed, they should be placed back as soon as work has commenced to ensure the integrity of the plenum is not disrupted.

To conclude, a fire safety management plan should be set by the proper authorities. This plan should implement staff training of responding to a fire scenario. This plan should include actions to be taken to ensure safe egress of students as well as how to accommodate disabled occupants to the safe refuge areas within the stairwells. Training in the use of fire extinguishers would also be beneficial as this would allow a fire to be extinguished and result in a less damaging scenario within the building. Standard fire evacuation drills are critical as well, as these will provide familiarity with the occupants in where and how to evacuate under fire conditions.

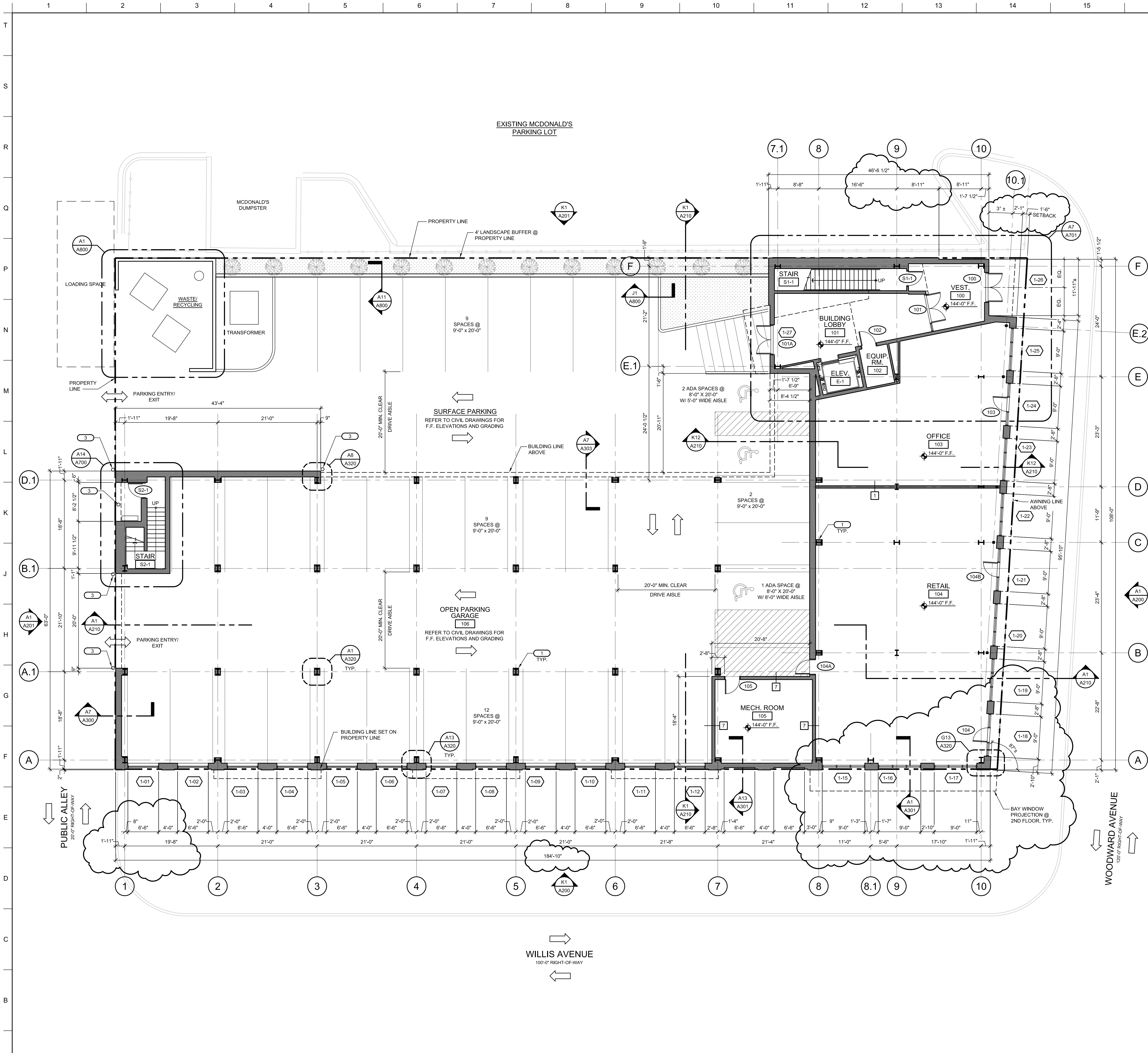
## **8 References**

- SFPE Handbook of Fire Protection Engineering, 5th edition. (2016). Society of Fire Protection Engineers: Springer.
- Arthur E. Cote, P. (2008). Fire Protection Handbook, 20th Edition. National Fire Protection Association.
- NFPA 10 Standard for Portable Fire Extinguishers. (2013). National Fire Protection Association.
- NFPA 13 Standard for Installation of Sprinkler Systems. (2016). National Fire Protection Association.
- NFPA 72 National Fire Alarm and Signaling Code. (2016). National Fire Protection Association.
- NFPA 101 Life Safety Code. (2015). National Fire Protection Association.
- IBC International Building Code. (2015). International Code Council
- NIST. (2016). Fire Dynamics Simulator User's Guide, Sixth Edition. National Institute of Standards and Technology.
- William D. Walton, (1988). Suppression of Wood Crib Fires with Sprinkler Sprays: Test Results. U.S. Department of Commerce.

# **APPENDIX A**

*Architectural Drawings*





GENERAL NOTES

1. PROVIDE ROOM IDENTIFICATION SIGNAGE AT ALL INTERIOR DOORS.
2. PROVIDE EXTERIOR BUILDING SIGNAGE AT BUILDING LOBBY ENTRANCES.
3. PROVIDE EGRESS AND STAIR SIGNAGE AT ALL STAIR LEVELS AND EXIT DOORS.
4. PROVIDE PORTABLE FIRE EXTINGUISHERS IN OPEN PARKING GARAGE, TENANT SPACES, AND ELEVATOR EQUIPMENT ROOM. REFER TO LIFE SAFETY PLANS FOR LOCATIONS.
5. PROVIDE FIRE EXTINGUISHER CABINETS AT BUILDING LOBBY AND CORRIDORS, TWO PER CORRIDOR. REFER TO LIFE SAFETY PLANS FOR LOCATIONS.
6. PROVIDE PAINT STRIPES FOR ALL GARAGE AND SURFACE PARKING AREAS.
7. PROVIDE RECESSED WALK-OFF MATS AT BUILDING LOBBY MAIN ENTRANCE AND REAR DOOR.
8. PROVIDE CONCRETE PARKING BLOCKS AT EACH PARKING SPACE WHERE SPACE ABUTS BUILDING WALL (INCLUDING GARAGE WALL).
9. REFER TO LIFE SAFETY PLANS FOR LOCATION OF FIRE-RATED PARTITIONS.

KEY NOTES

1. PROVIDE CONCRETE ENCASED COLUMN ENCLOSURE FOR ALL STEEL COLUMNS IN OPEN PARKING GARAGE AND EMBEDDED IN ADJACENT WALLS SUPPORTING FLOOR SLAB ABOVE PARKING GARAGE.
2. NOT USED.
3. PROVIDE METAL BOLLARD WITH CONCRETE FOUNDATION.REFER TO CIVIL DRAWINGS FOR DETAIL.

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WOODWARD WILLIS



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QEA No. 31205300

FIRST FLOOR & PARKING PLAN

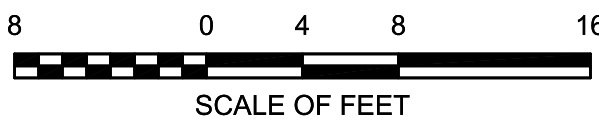
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A1 FIRST FLOOR & PARKING PLAN

A101 1/8" = 1'-0" REFERRED FROM:



A101





1. PROVIDE ROOM IDENTIFICATION SIGNAGE AT ALL INTERIOR DOORS.
2. PROVIDE EXTERIOR BUILDING SIGNAGE AT BUILDING LOBBY ENTRANCES.
3. PROVIDE EGRESS AND STAIR SIGNAGE AT ALL STAIR LEVELS AND EXIT DOORS.
4. PROVIDE PORTABLE FIRE EXTINGUISHERS IN OPEN PARKING GARAGE, TENANT SPACES, AND ELEVATOR EQUIPMENT ROOM. REFER TO LIFE SAFETY PLANS FOR LOCATION.
5. PROVIDE FIRE EXTINGUISHER CABINETS AT BUILDING LOBBY AND CORRIDORS, TWO PER CORRIDOR. REFER TO LIFE SAFETY PLANS FOR LOCATIONS.
6. REFER TO LIFE SAFETY PLANS FOR LOCATION OF FIRE-RATED PARTITIONS



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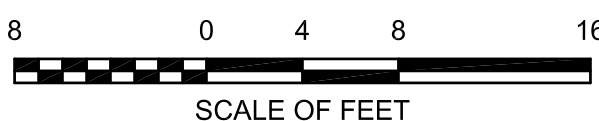
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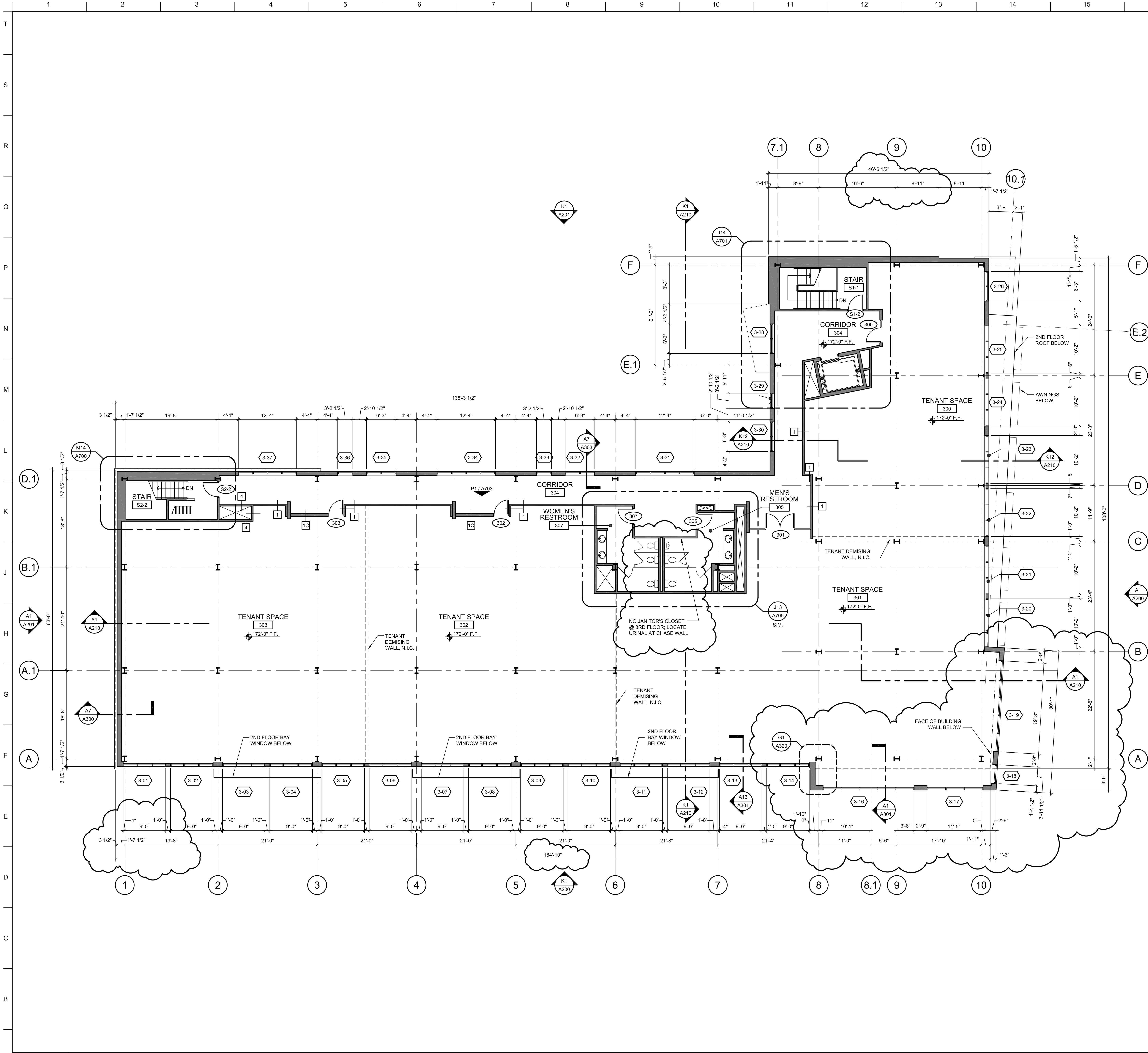
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# A102







GENERAL NOTES

1. PROVIDE ROOM IDENTIFICATION SIGNAGE AT ALL INTERIOR DOORS.
2. PROVIDE EXTERIOR BUILDING SIGNAGE AT BUILDING LOBBY ENTRANCES.
3. PROVIDE EGRESS AND STAIR SIGNAGE AT ALL STAIR LEVELS AND EXIT DOORS.
4. PROVIDE PORTABLE FIRE EXTINGUISHERS IN OPEN PARKING GARAGE, TENANT SPACES, AND ELEVATOR EQUIPMENT ROOM. REFER TO LIFE SAFETY PLANS FOR LOCATIONS.
5. PROVIDE FIRE EXTINGUISHER CABINETS AT BUILDING LOBBY AND CORRIDORS, TWO PER CORRIDOR. REFER TO LIFE SAFETY PLANS FOR LOCATIONS.
6. REFER TO LIFE SAFETY PLANS FOR LOCATION OF FIRE-RATED PARTITIONS.

KEY NOTES

  
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THIRD  
FLOOR  
PLAN

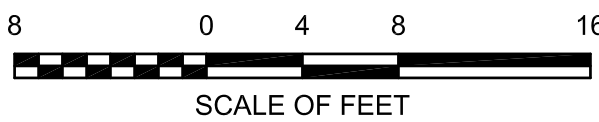
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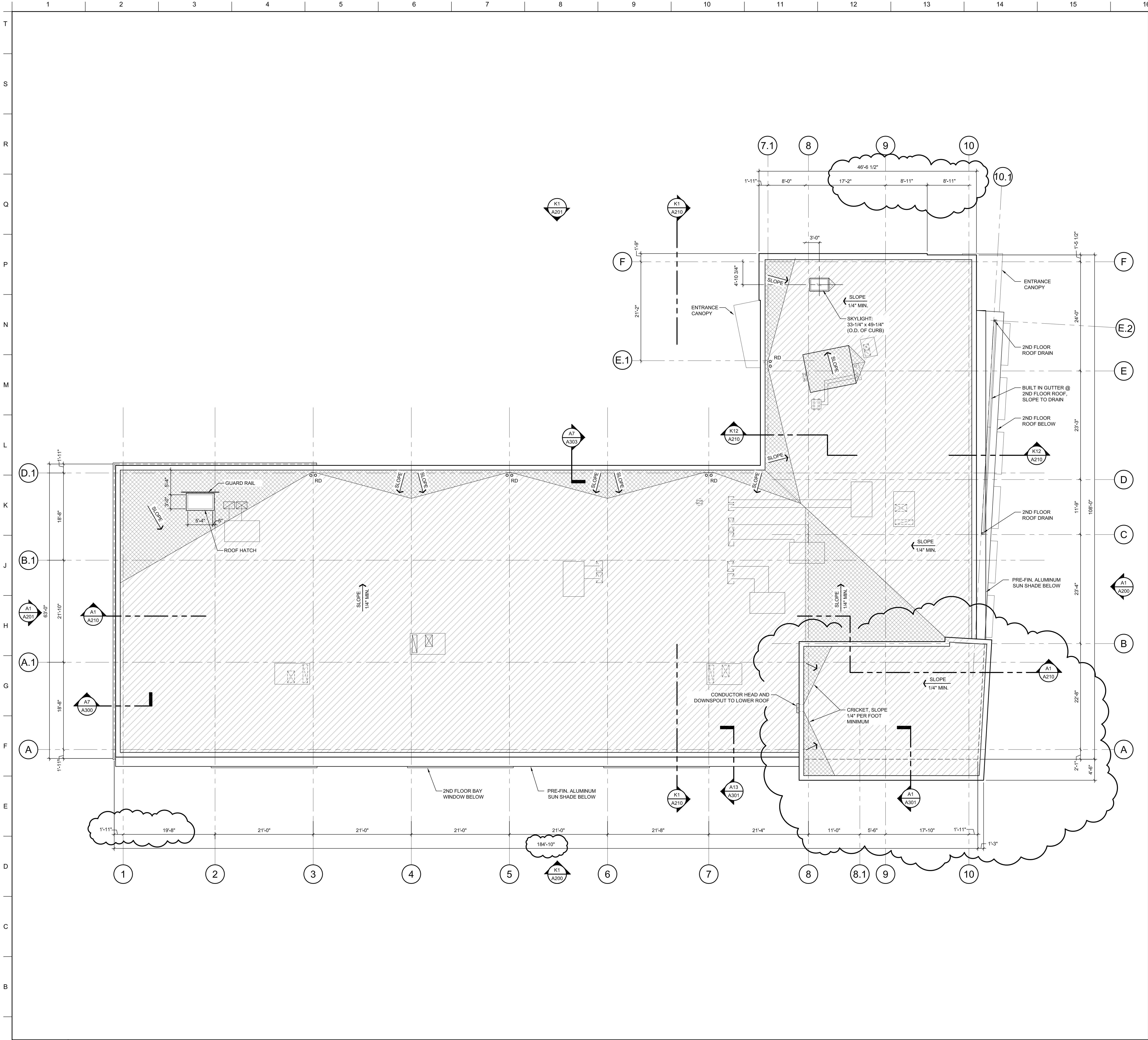
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A103 1/8" = 1'-0" REFERRED FROM:



**A103**





GENERAL NOTES

1. ALL SADDLES AND CRICKETS SHALL BE CONSTRUCTED FROM FULL DEPTH TAPERED INSULATION BOARD TO DIVERT WATER TO ROOF DRAINAGE. PROVIDE 1/4" PER FOOT MIN. SLOPE, U.N.O.
2. PROVIDE 4" WOOD CANT AT ALL WALLS AND CURBS. REFER TO ROOF DETAILS.
3. REFER TO SHEET A 330 FOR TYPICAL ROOF DETAILS

LEGEND

- PROVIDE FULLY ADHERED EPDM ROOF MEMBRANE OVER PROTECTION BOARD AND 4" RIGID BOARD INSULATION OVER SLOPED METAL DECK
- PROVIDE FULLY ADHERED EPDM ROOF MEMBRANE OVER PROTECTION BOARD AND 4" RIGID BOARD INSULATION OVER SLOPED METAL DECK. PROVIDE ADDITIONAL TAPERED INSULATION TO ACHIEVE MIN. 1/4" PER FOOT SLOPE, U.N.O.
- ROOF DRAIN WITH OVERFLOW, REFER TO PLUMBING



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ROOF  
PLAN

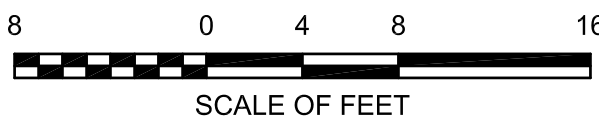
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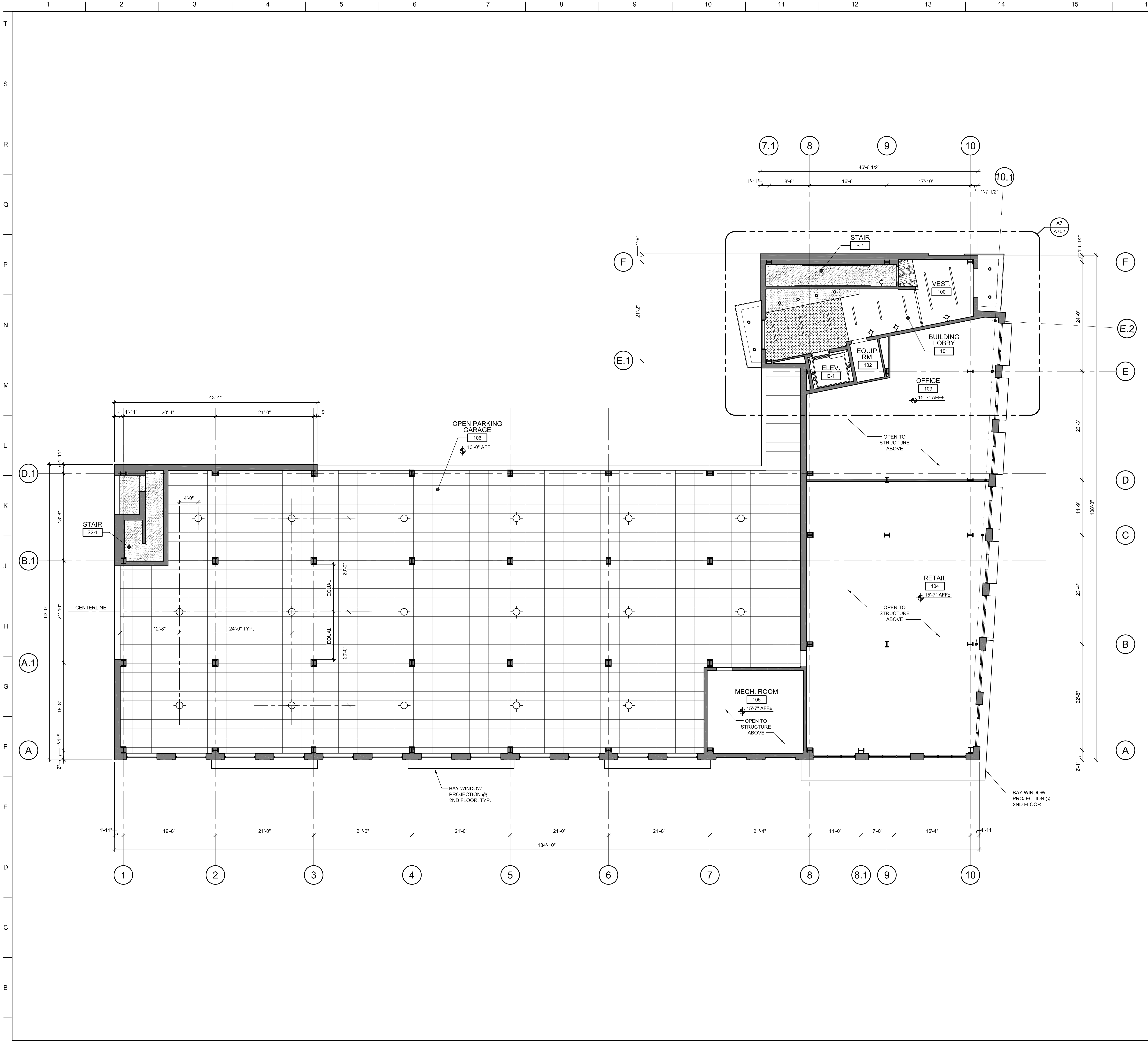
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ROOF PLAN

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A104





GENERAL NOTES

KEY NOTES

LEGEND

- ACOUSTICAL CEILING PANEL
- METAL CEILING PANEL
- GYPSUM WALLBOARD CEILING, PAINTED
- PLYWOOD SOFFIT
- CEILING MOUNTED LIGHT FIXTURE, REFER TO ELECTRICAL DRAWINGS
- DOWNLIGHT, REFER TO ELECTRICAL DRAWINGS
- WALL SCONCE, REFER TO ELECTRICAL DRAWINGS
- LINEAR PENDANT LIGHTING, REFER TO ELECTRICAL DRAWINGS



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FIRST  
FLOOR  
REFLECTED  
CEILING  
PLAN

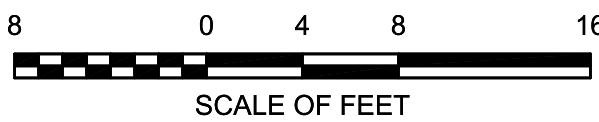
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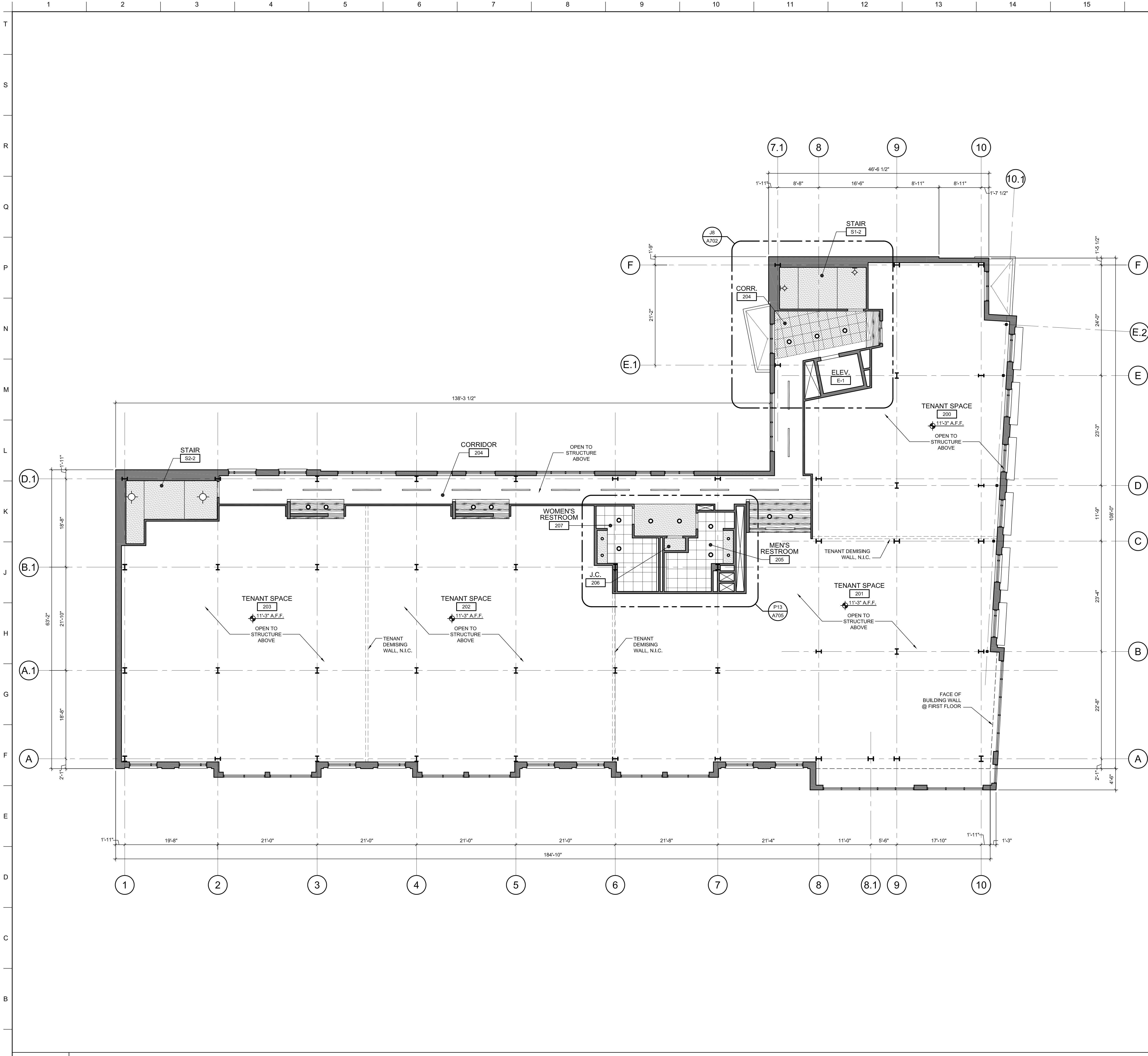
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A111





GENERAL NOTES

KEY NOTES

LEGEND

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- METAL CEILING PANEL
- GYPSUM WALLBOARD CEILING, PAINTED
- PLYWOOD SOFFIT
- CEILING MOUNTED LIGHT FIXTURE, REFER TO ELECTRICAL DRAWINGS
- DOWNLIGHT, REFER TO ELECTRICAL DRAWINGS
- WALL SCONCE, REFER TO ELECTRICAL DRAWINGS
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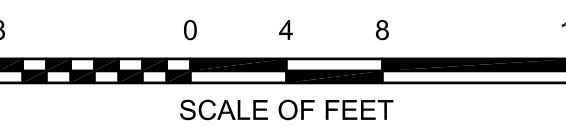
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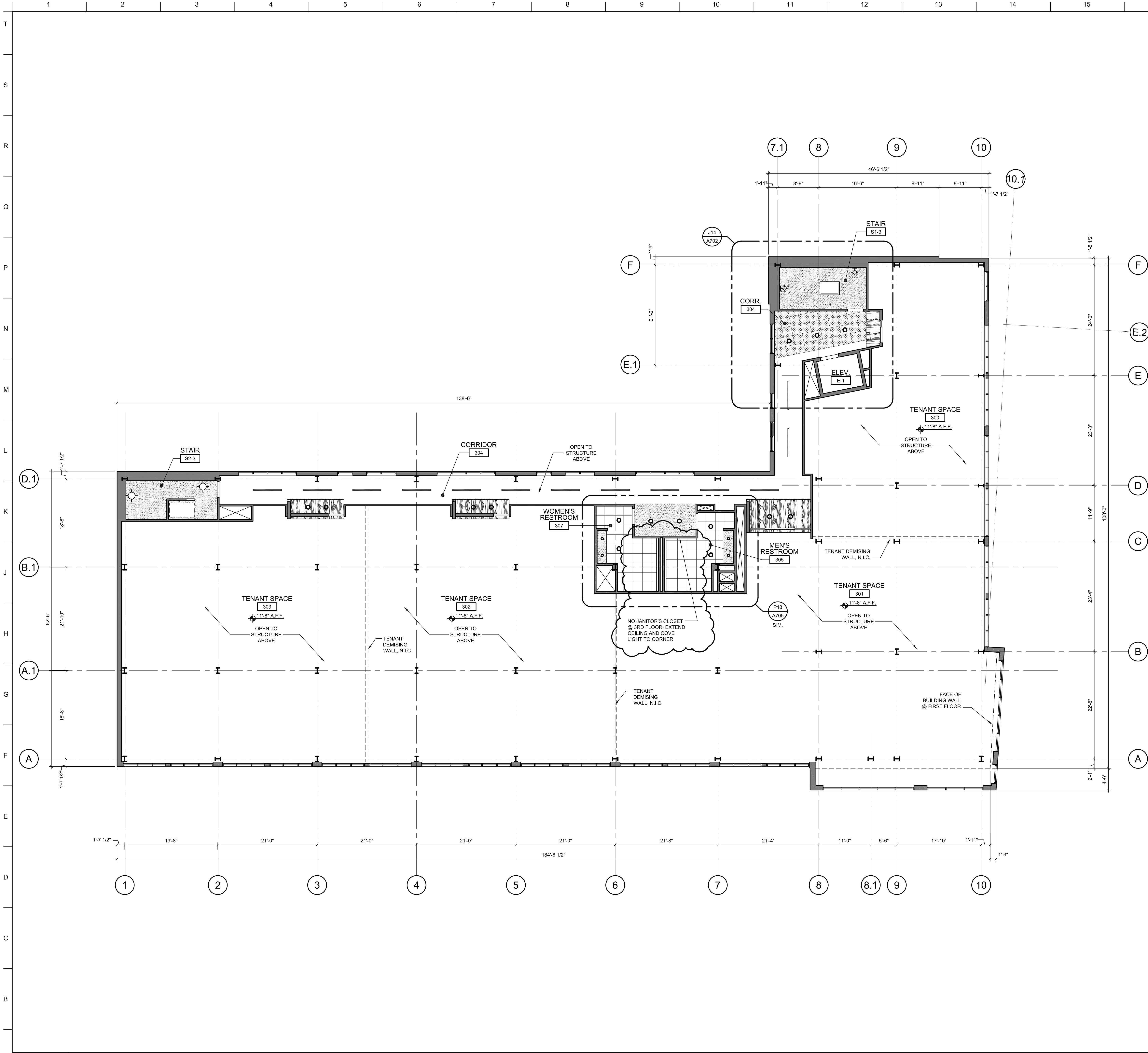
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GENERAL NOTES

KEY NOTES

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- ACOUSTICAL CEILING PANEL
- METAL CEILING PANEL
- GYPSUM WALLBOARD CEILING, PAINTED
- PLYWOOD SOFFIT
- CEILING MOUNTED LIGHT FIXTURE, REFER TO ELECTRICAL DRAWINGS
- DOWNLIGHT, REFER TO ELECTRICAL DRAWINGS
- WALL SCONCE, REFER TO ELECTRICAL DRAWINGS
- LINEAR PENDANT LIGHTING, REFER TO ELECTRICAL DRAWINGS



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THIRD  
FLOOR  
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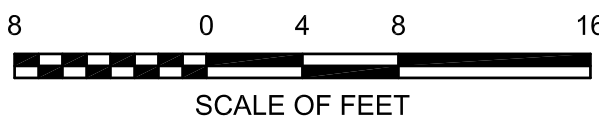
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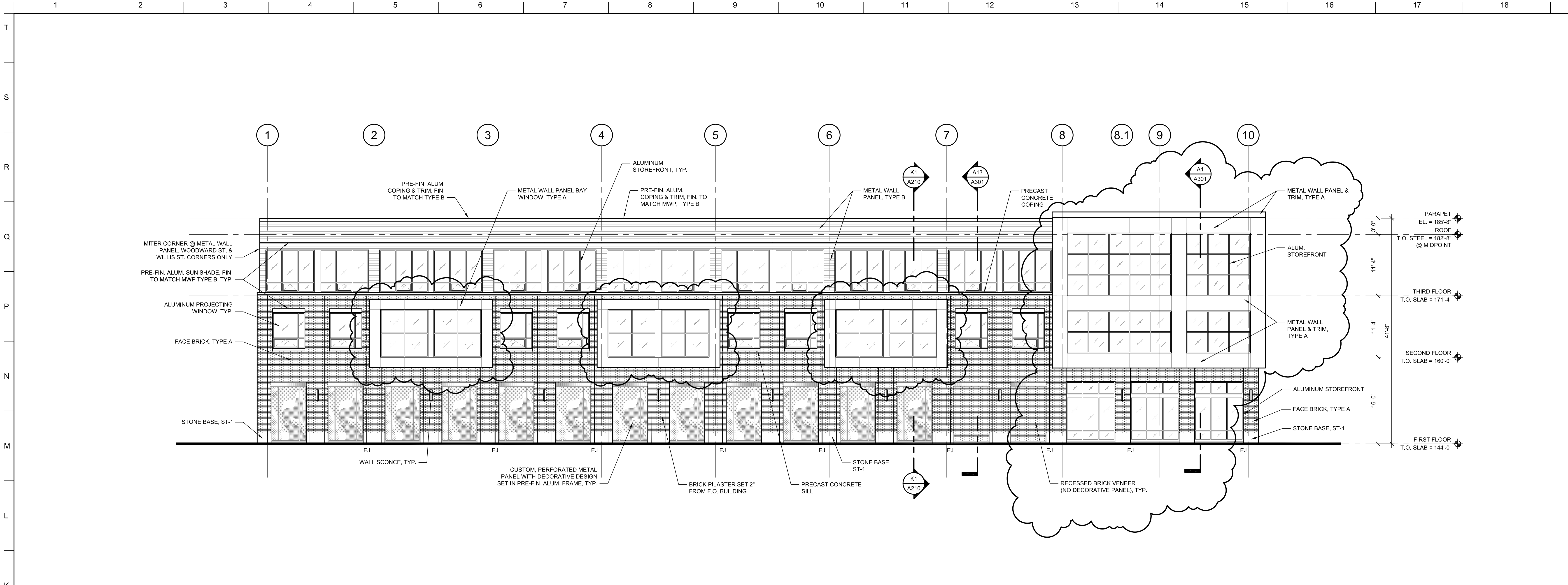
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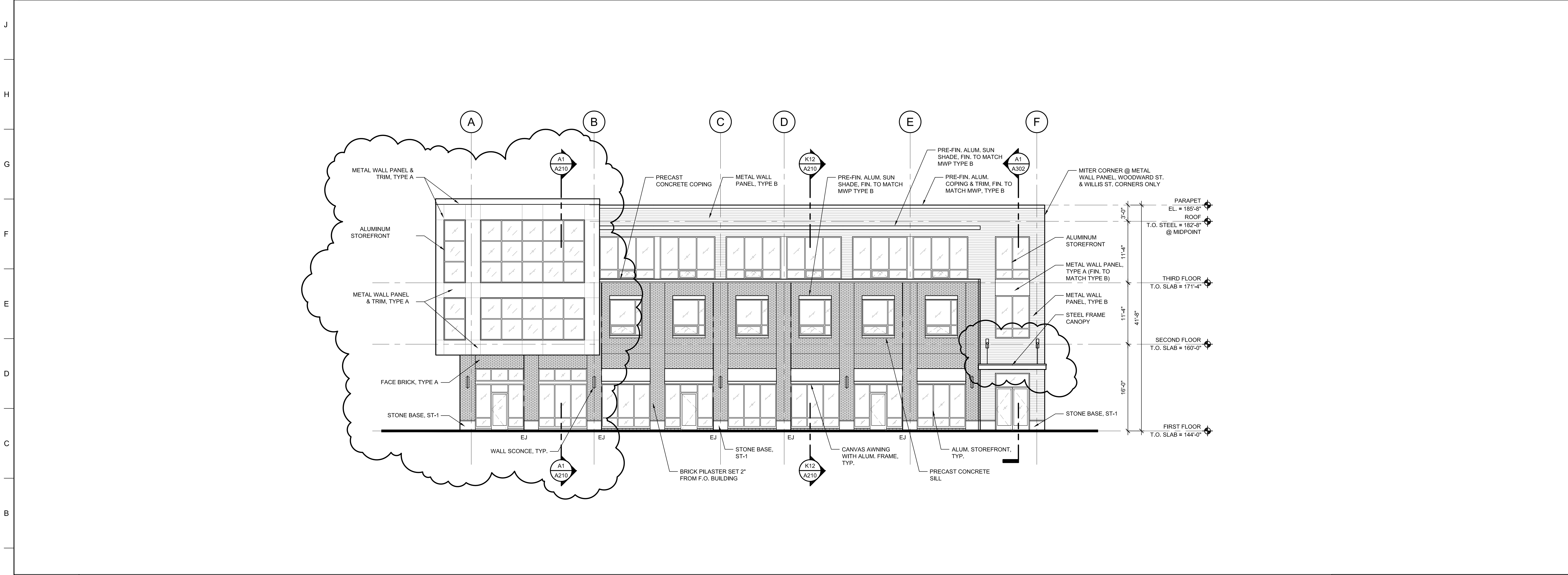
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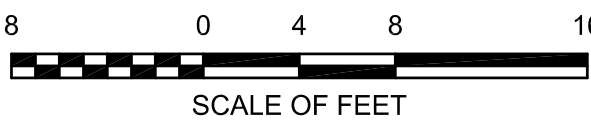
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**A1** EAST ELEVATION

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**WOODWARD  
WILLIS**



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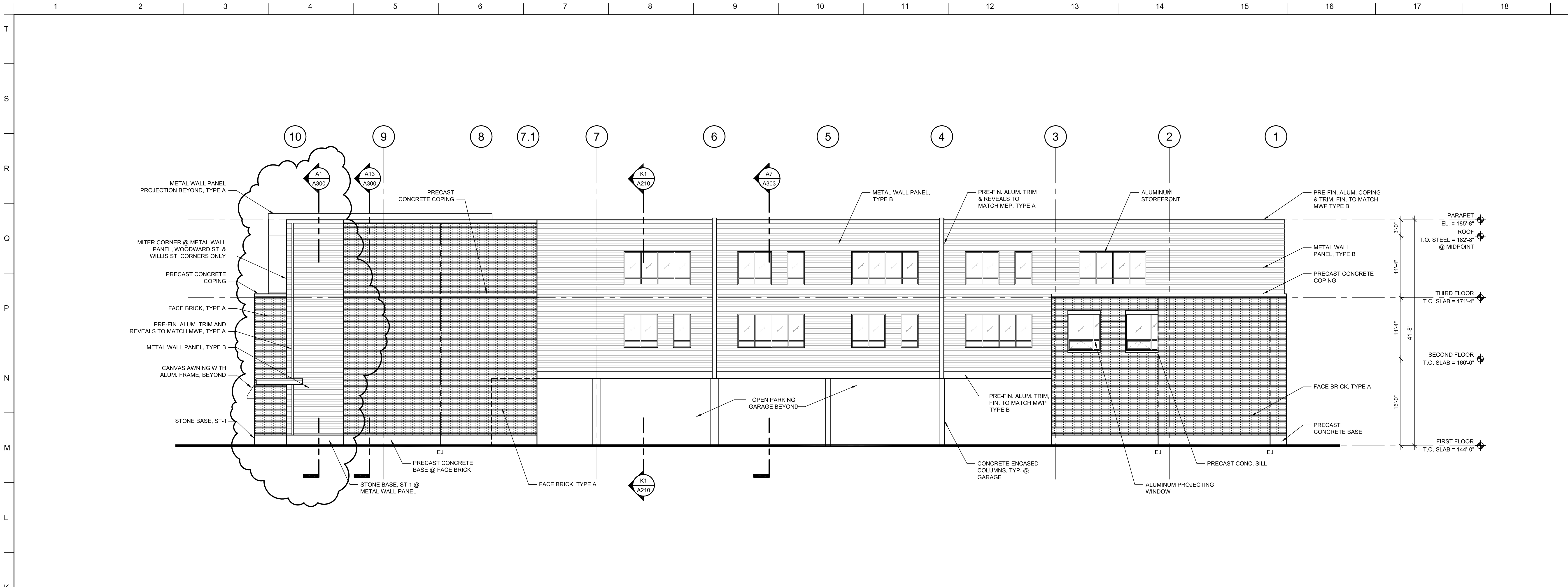
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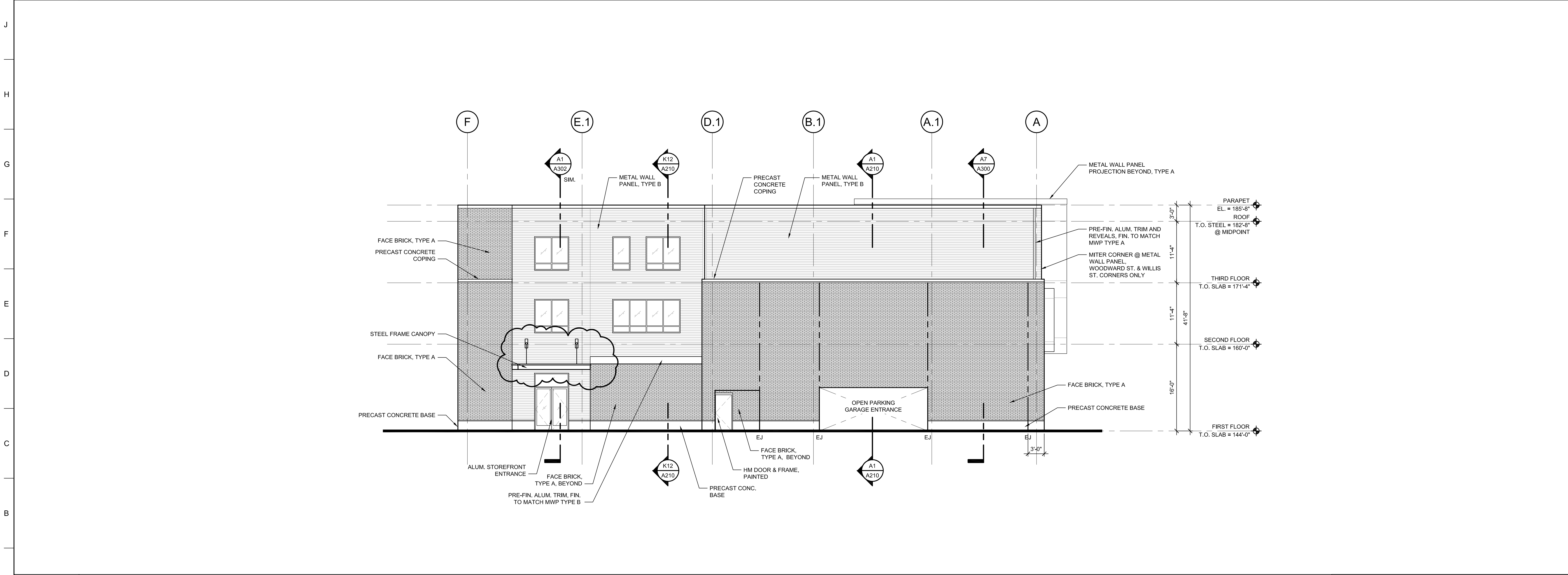
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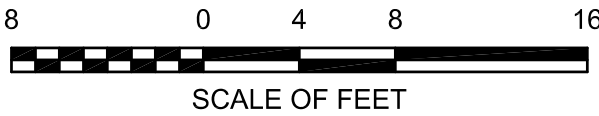
**K1 NORTH ELEVATION**

A201 1/8" = 1'-0" REFERRED FROM:



**A1 WEST ELEVATION**

A201 1/8" = 1'-0" REFERRED FROM:



**WOODWARD  
WILLIS**



4219 Woodward Ave  
Detroit, Michigan  
  
QEA No. 31205300

**BUILDING  
ELEVATIONS**

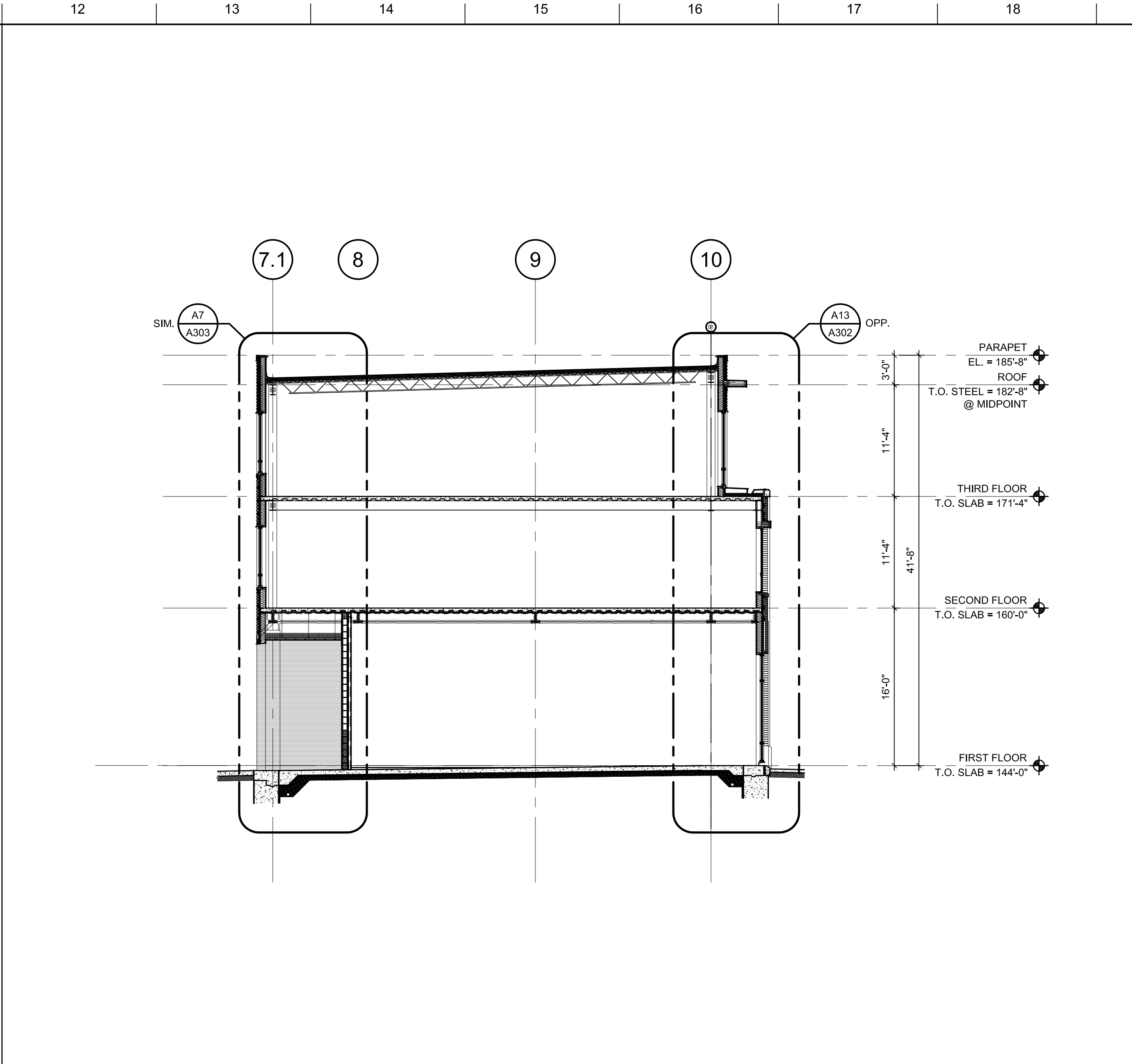
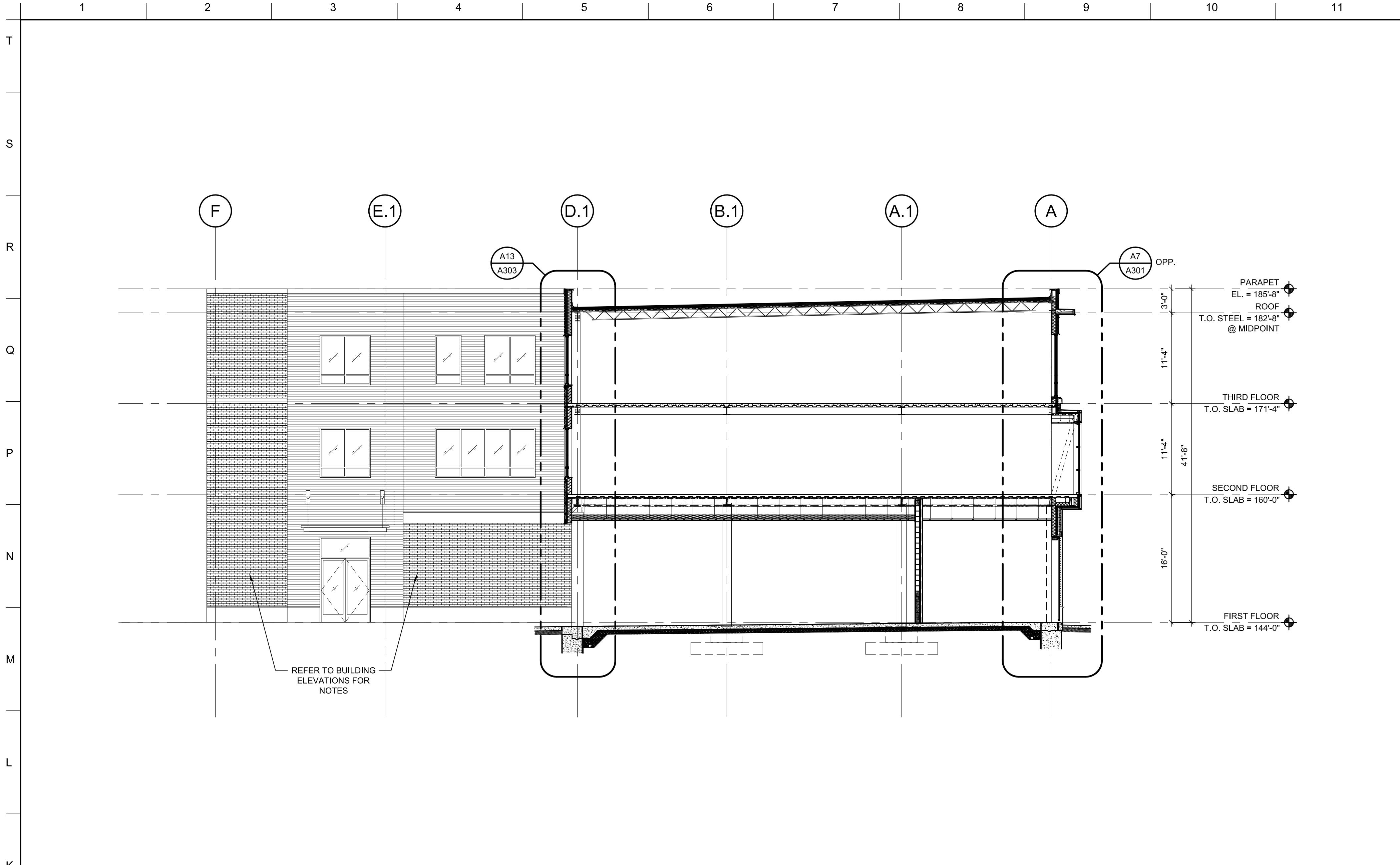
PERMIT SET  
MAY 24, 2013

| REVISIONS |              |          |
|-----------|--------------|----------|
| No.       | Description  | Date     |
| 1         | CONSTRUCTION | 03.25.14 |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |

FILE NAME: A201

**A201**



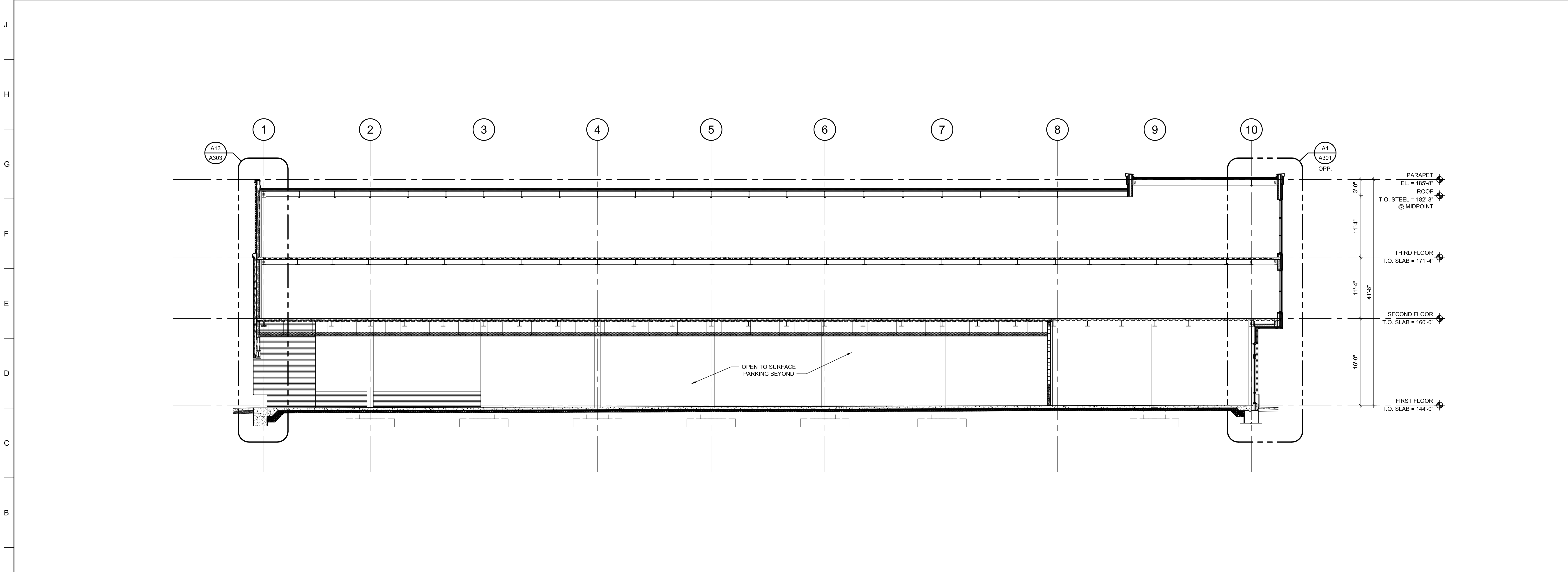


**K1** BUILDING SECTION N-S

A210 1/8" = 1'-0" REFERRED FROM:

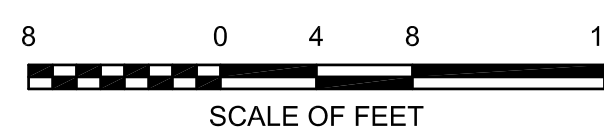
**K12** BUILDING SECTION E-W

A210 1/8" = 1'-0" REFERRED FROM:



**A1** BUILDING SECTION E-W

A210 1/8" = 1'-0" REFERRED FROM:



WOODWARD  
WILLIS



4219 Woodward Ave  
Detroit, Michigan  
QEA No. 31205300

BUILDING  
SECTIONS

PERMIT SET  
MAY 24, 2013

| REVISIONS |              |          |
|-----------|--------------|----------|
| No.       | Description  | Date     |
| 1         | CONSTRUCTION | 03.25.14 |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |
|           |              |          |

FILE NAME: A300

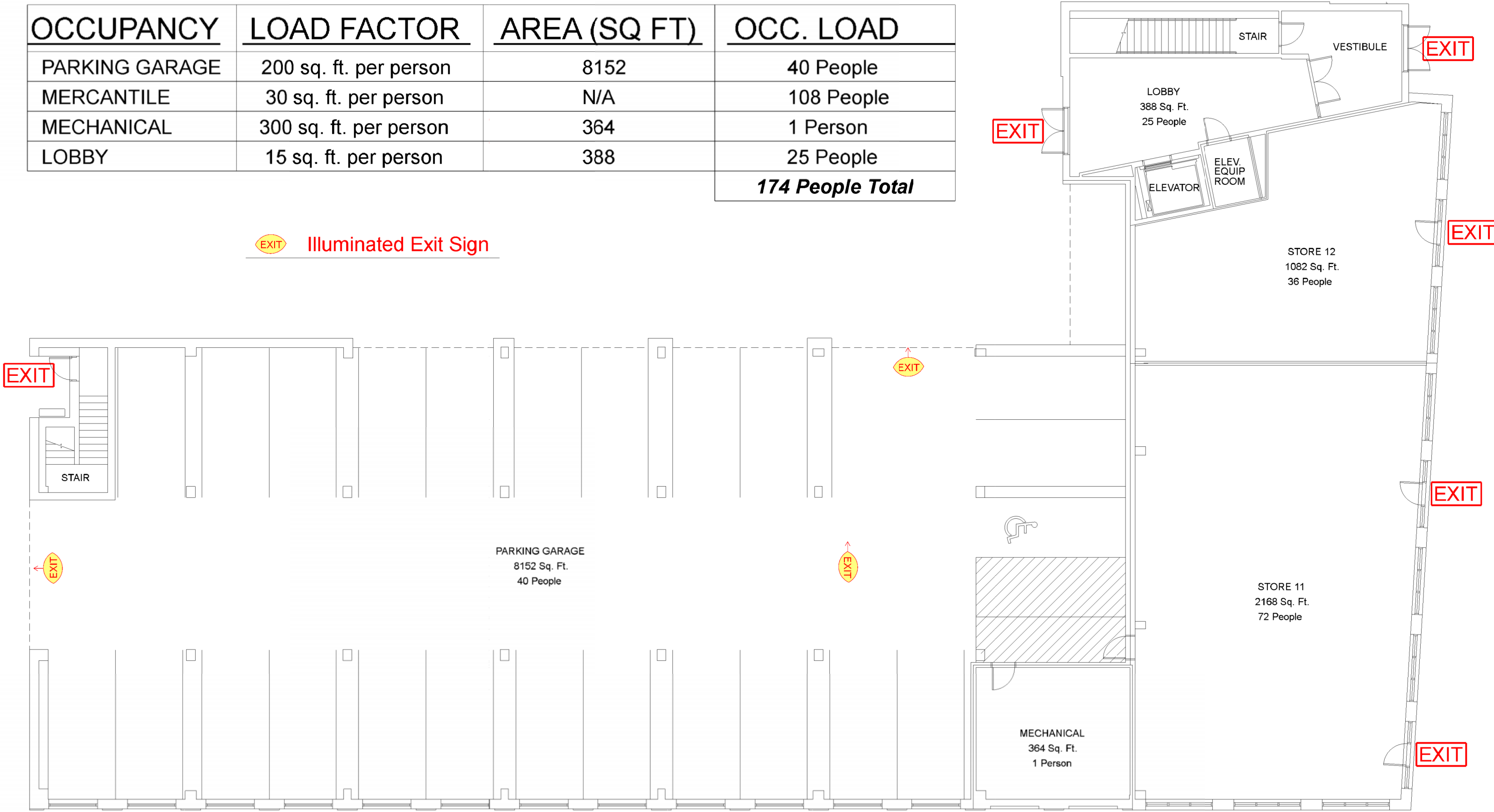
# **APPENDIX B**

*Egress Capacity Drawings*



| OCCUPANCY      | LOAD FACTOR            | AREA (SQ FT) | OCC. LOAD               |
|----------------|------------------------|--------------|-------------------------|
| PARKING GARAGE | 200 sq. ft. per person | 8152         | 40 People               |
| MERCANTILE     | 30 sq. ft. per person  | N/A          | 108 People              |
| MECHANICAL     | 300 sq. ft. per person | 364          | 1 Person                |
| LOBBY          | 15 sq. ft. per person  | 388          | 25 People               |
|                |                        |              | <b>174 People Total</b> |

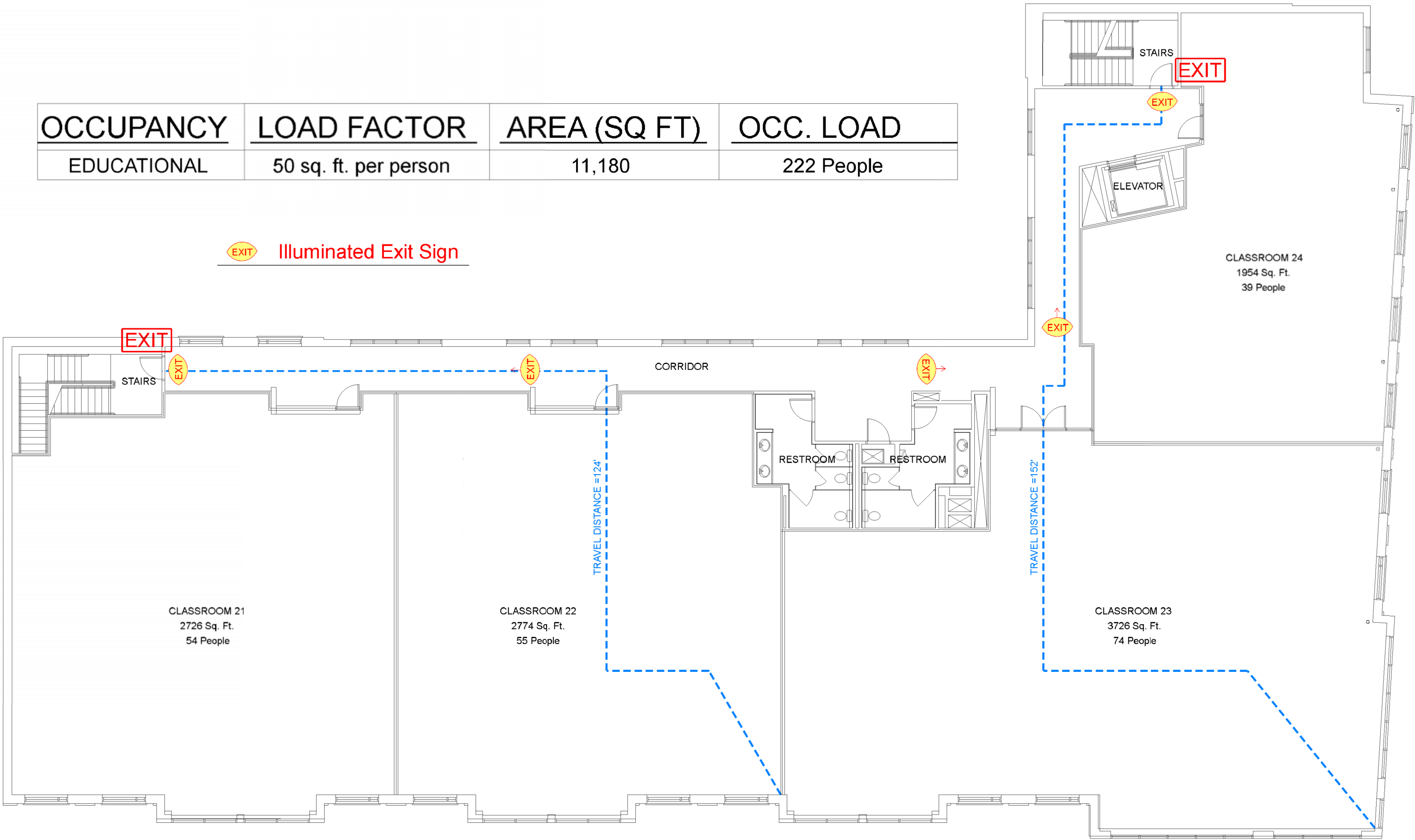
 Illuminated Exit Sign



1st FLOOR

| OCCUPANCY   | LOAD FACTOR           | AREA (SQ FT) | OCC. LOAD  |
|-------------|-----------------------|--------------|------------|
| EDUCATIONAL | 50 sq. ft. per person | 11,180       | 222 People |

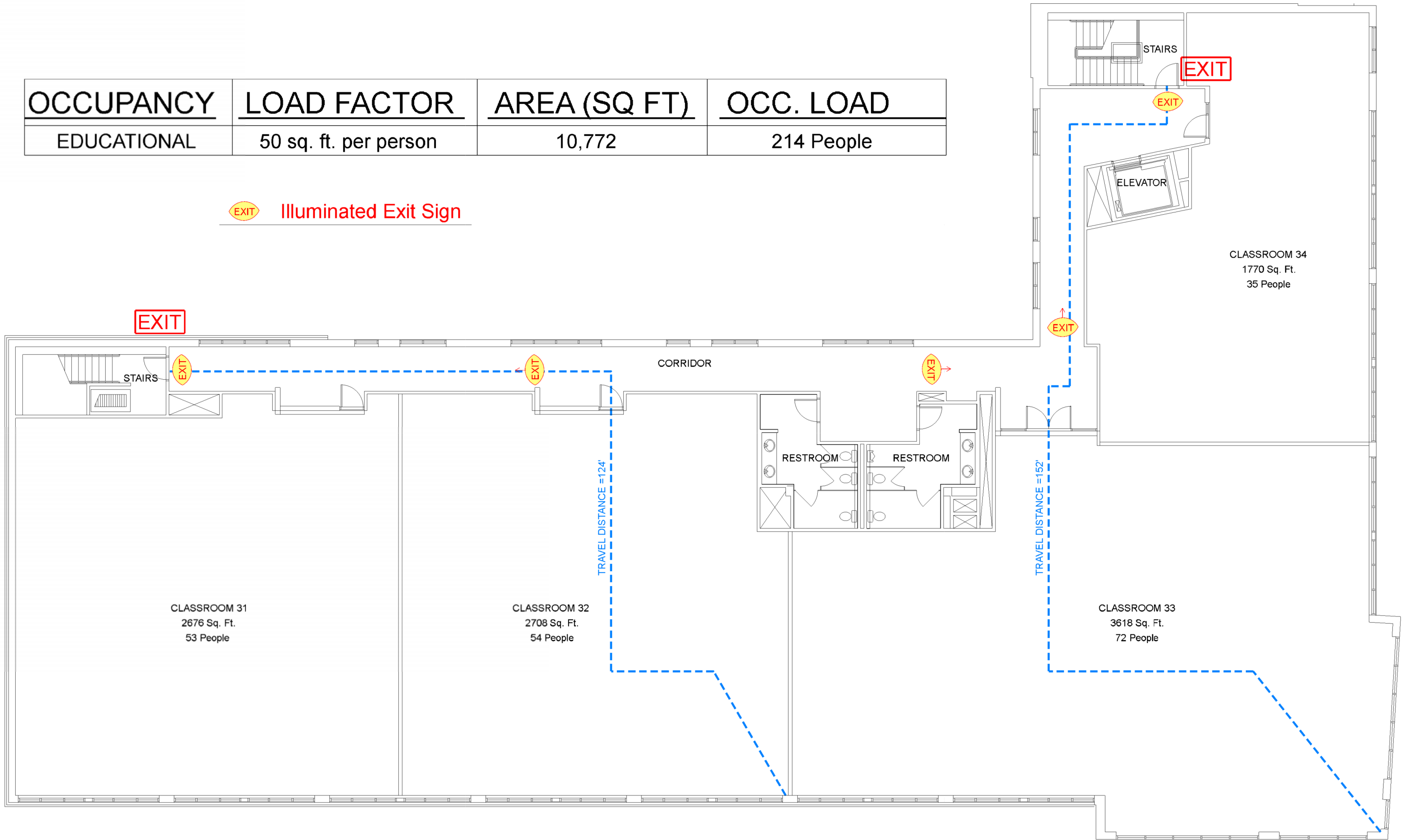
 Illuminated Exit Sign



## 2nd FLOOR

| OCCUPANCY   | LOAD FACTOR           | AREA (SQ FT) | OCC. LOAD  |
|-------------|-----------------------|--------------|------------|
| EDUCATIONAL | 50 sq. ft. per person | 10,772       | 214 People |

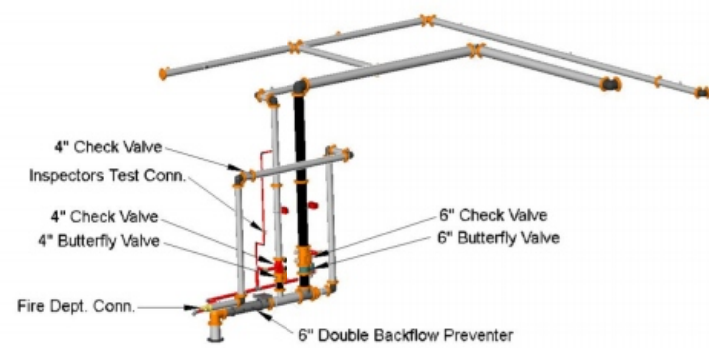
 Illuminated Exit Sign



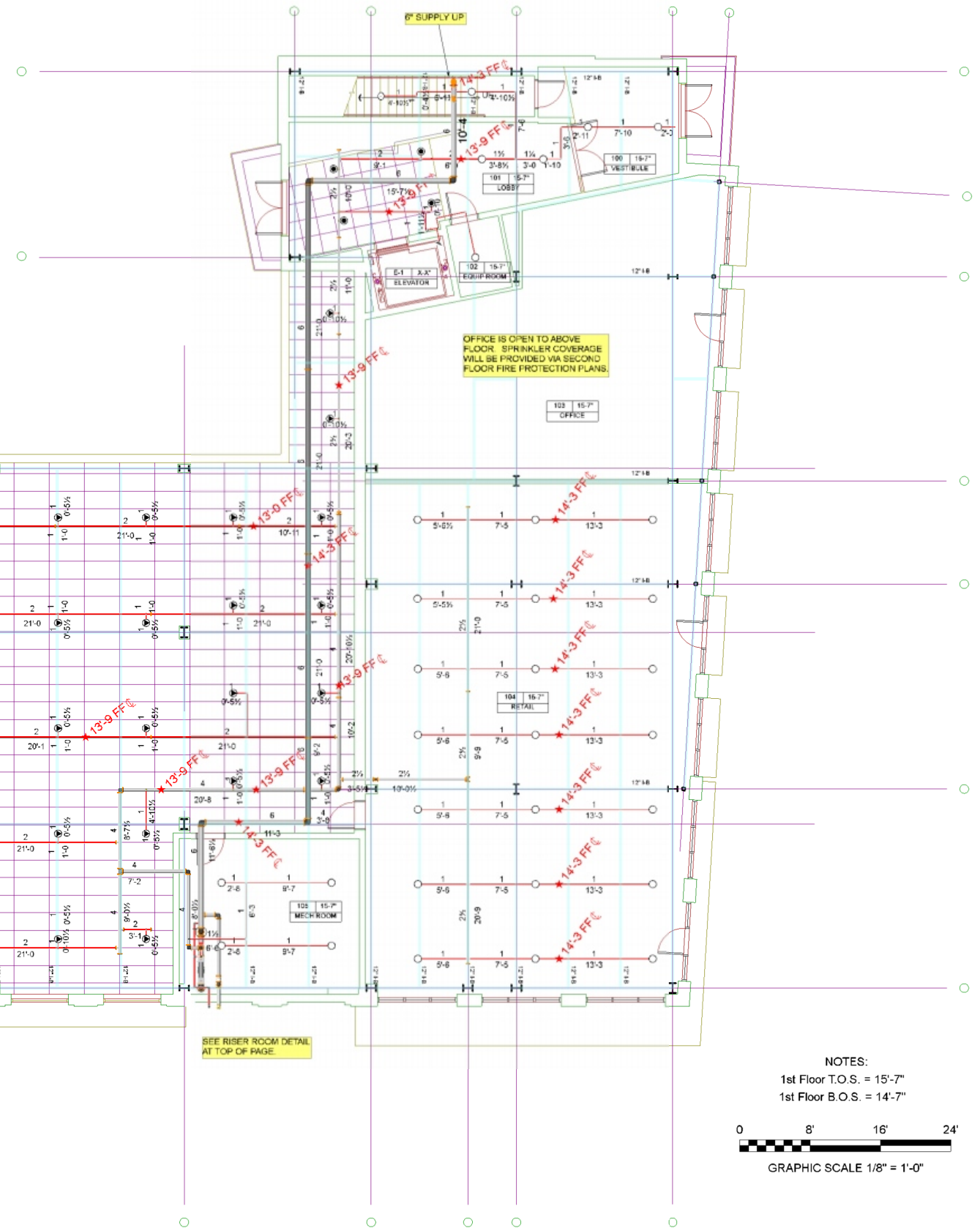
3rd FLOOR

# **APPENDIX C**

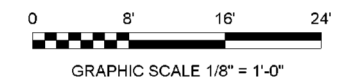
## *Sprinkler System Drawings*



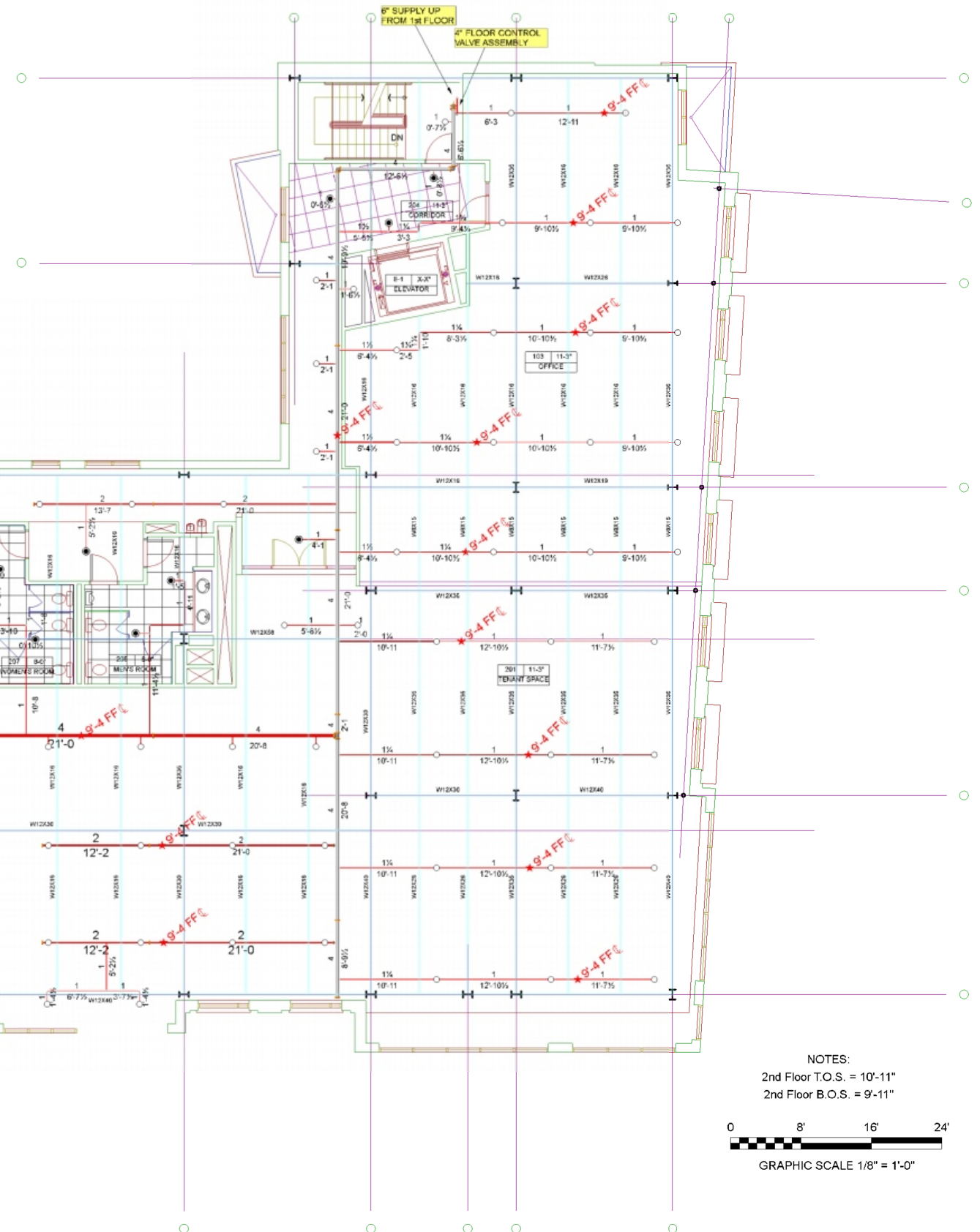
RISER ROOM DETAIL



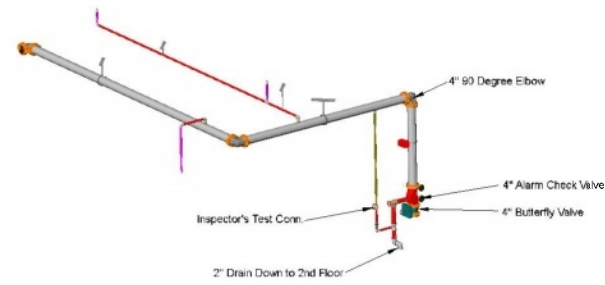
NOTES:  
1st Floor T.O.S. = 15'-7"  
1st Floor B.O.S. = 14'-7"



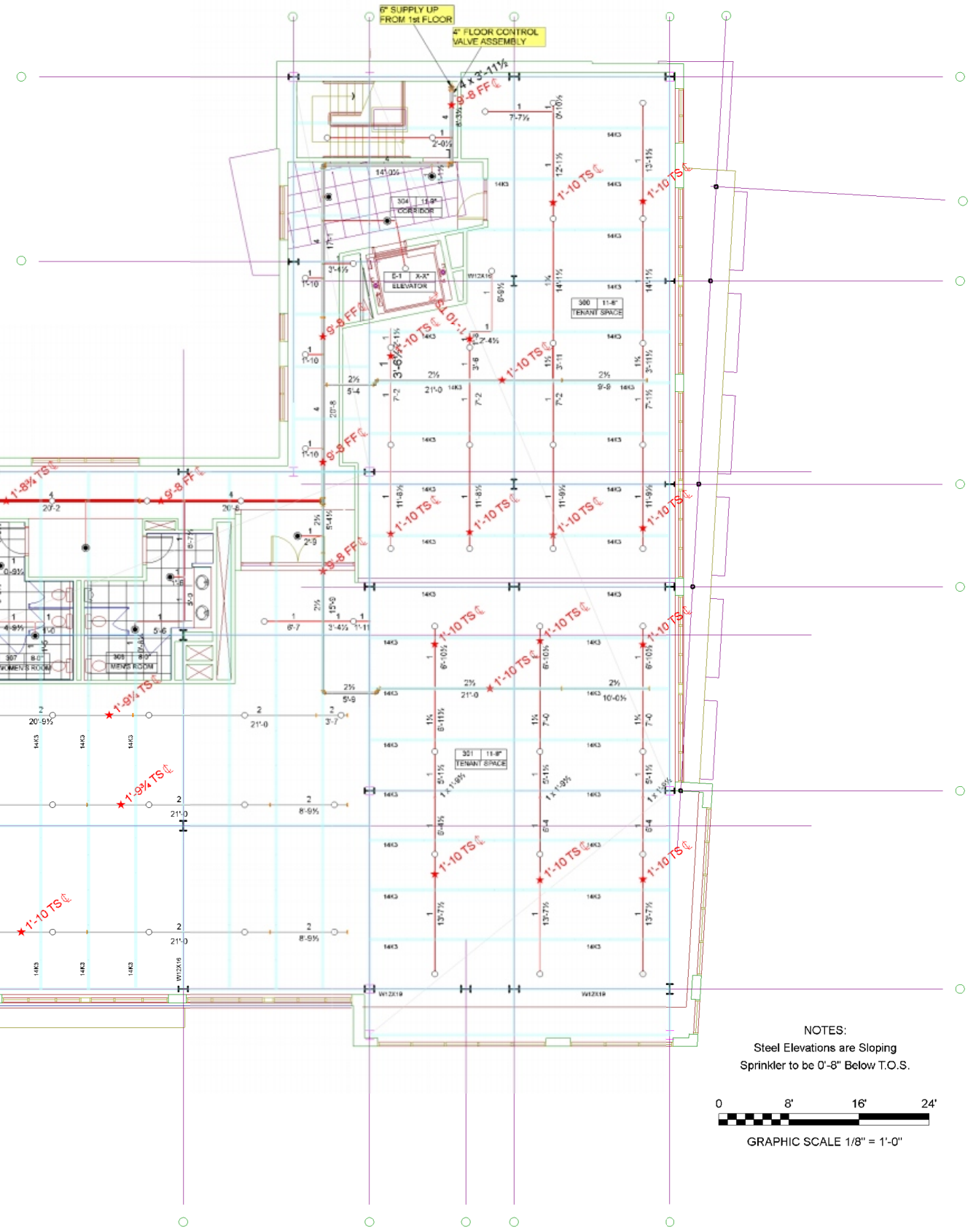
## 1st Floor Fire Sprinkler Layout







FLOOR CONTROL DETAIL

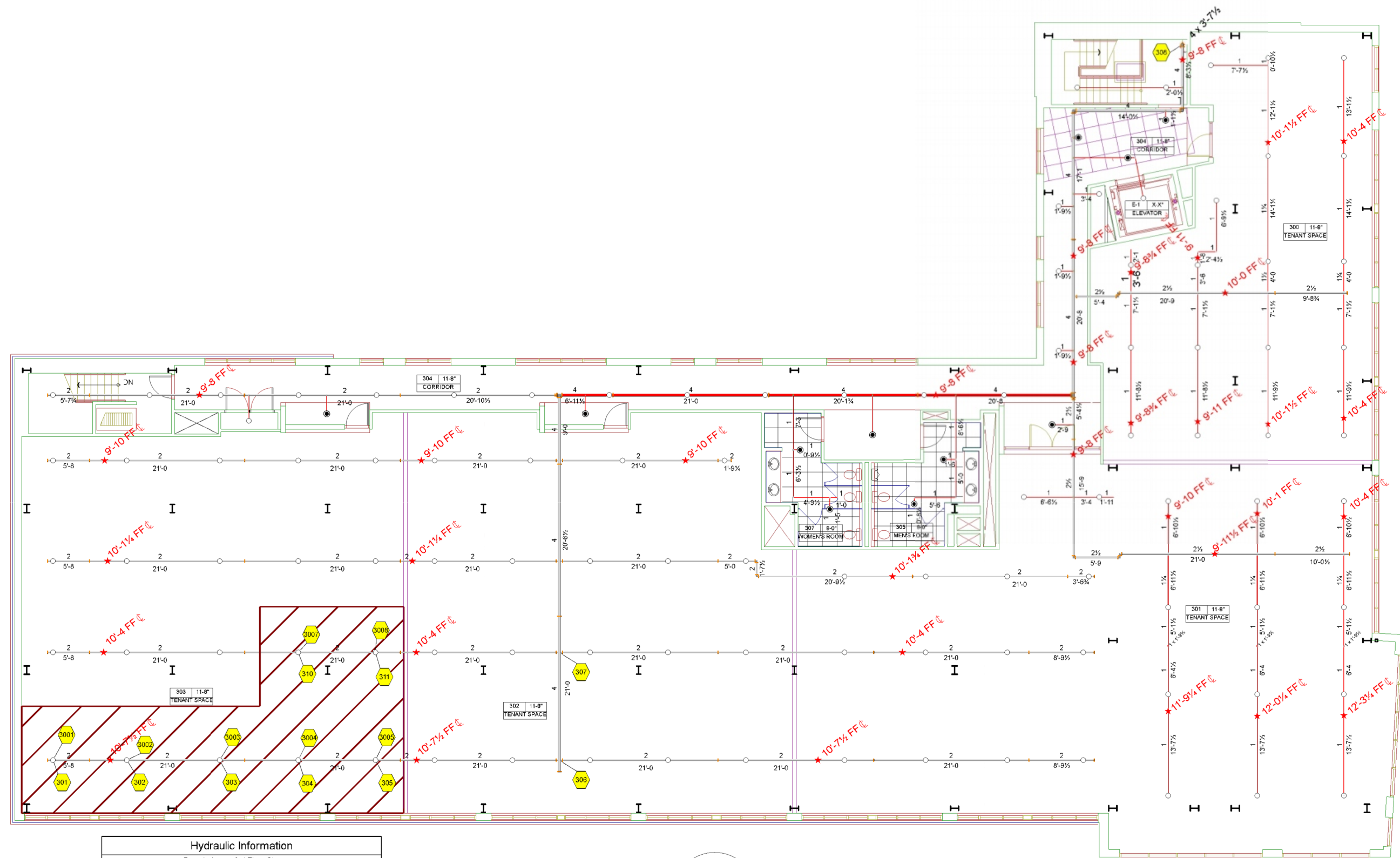


NOTES:  
Steel Elevations are Sloping  
Sprinkler to be 0'-6" Below T.O.S.

0 8' 16' 24'

GRAPHIC SCALE 1/8" = 1'-0"

# 3rd Floor Fire Sprinkler Layout





# Hydraulic Calculations

for

Project Name: WOODWARD WILLIS

Location: 4219 WOODWARD AVE., DETROIT, MI,

Drawing Name: 2014-0387 WoodWard Willis Calcs 3 - Cal Poly.cad

Calculation Date: 3/22/2017

## Design

Remote Area Number: - 3rd Floor Classroom

Remote Area Location: 3rd Level

Occupancy Classification: Light Hazard

Commodity Classification: Classroom

Density: 0.100gpm/ft<sup>2</sup>

Area of Application: 939.40ft<sup>2</sup> (Actual 1006.92ft<sup>2</sup>)

Coverage per Sprinkler: 145.00ft<sup>2</sup>

Type of sprinklers calculated: Upright

No. of sprinklers calculated: 7

Type of System: Wet Volume of Dry or PreAction System: N/A

In-rack Demand: N/A gpm at Node: N/A

Hose Streams: 100.00 at Node: 111 Type: Allowance at Source

Total Water Required (including Hose Streams where applicable):

From Water Supply at Node 111: 208.76 @ 29.785

Water Supply Information:

Name of Contractor:

Address: ,

Phone Number: Name of designer: Jordan Nerat

Authority Having Jurisdiction:

Notes:

Automatic peaking results Left: N/A Right: N/A

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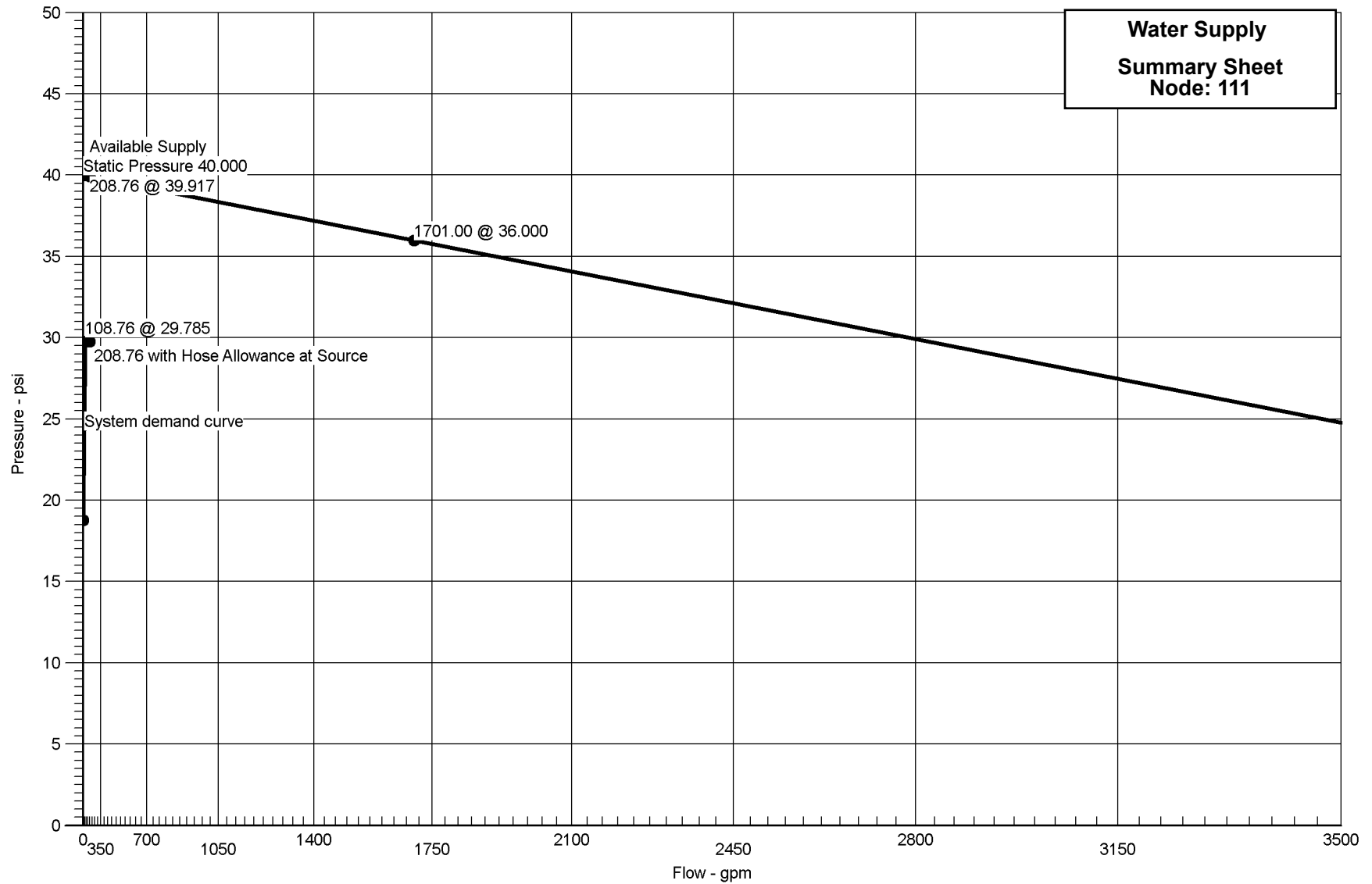
# Hydraulic Graph

Job Name: WOODWARD WILLIS

N 1.85

Remote Area Number: - 3rd Floor Classroom

Date: 3/22/2017





## Summary Of Outflowing Devices

Job Number: 2014-0387

Report Description: Light Hazard ( - 3rd Floor Classroom)

| Device      |      | Actual Flow<br>(gpm) | Minimum Flow<br>(gpm) | K-Factor<br>(K) | Pressure<br>(psi) | Density<br>(gpm/ft <sup>2</sup> ) | Coverage<br>(Foot)    |
|-------------|------|----------------------|-----------------------|-----------------|-------------------|-----------------------------------|-----------------------|
| ⇒ Sprinkler | 3001 | 14.82                | 14.82                 | 5.6             | 7.000             | 0.102gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3002 | 14.84                | 14.82                 | 5.6             | 7.021             | 0.102gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3003 | 14.94                | 14.82                 | 5.6             | 7.117             | 0.103gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3004 | 15.12                | 14.82                 | 5.6             | 7.288             | 0.104gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3005 | 15.41                | 14.82                 | 5.6             | 7.577             | 0.106gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3007 | 16.80                | 14.82                 | 5.6             | 9.002             | 0.116gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |
| Sprinkler   | 3008 | 16.83                | 14.82                 | 5.6             | 9.029             | 0.116gpm/ft <sup>2</sup>          | 145.00ft <sup>2</sup> |

⇒ Most Demanding Sprinkler Data

## Supply Analysis

| Node | Name         | Static (psi) | Residual (psi) @ | Flow (gpm) | Available (psi) @ | Total Demand (gpm) | Required Pressure (psi) |
|------|--------------|--------------|------------------|------------|-------------------|--------------------|-------------------------|
| 111  | Water Supply | 40.000       | 36.000           | 1701.00    | 39.917            | 208.76             | 29.785                  |

## Node Analysis

| Node Number | Elevation (Foot)     | Node Type | Pressure at Node (psi) | Discharge at Node (gpm) | Notes  |
|-------------|----------------------|-----------|------------------------|-------------------------|--|
| 111         | -4'-0                | Supply    | 29.785                 | 108.76                  |  |
| 3001        | 39'-4 $\frac{1}{4}$  | Sprinkler | 7.000                  | 14.82                   | Density: 0.102gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3002        | 39'-4 $\frac{1}{4}$  | Sprinkler | 7.021                  | 14.84                   | Density: 0.102gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3003        | 39'-4 $\frac{1}{4}$  | Sprinkler | 7.117                  | 14.94                   | Density: 0.103gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3004        | 39'-4 $\frac{1}{4}$  | Sprinkler | 7.288                  | 15.12                   | Density: 0.104gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3005        | 39'-4 $\frac{1}{4}$  | Sprinkler | 7.577                  | 15.41                   | Density: 0.106gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3007        | 38'-10 $\frac{3}{4}$ | Sprinkler | 9.002                  | 16.80                   | Density: 0.116gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 3008        | 38'-10 $\frac{3}{4}$ | Sprinkler | 9.029                  | 16.83                   | Density: 0.116gpm/ft <sup>2</sup><br>Coverage: 145.00ft <sup>2</sup> |
| 109         | 2'-3 $\frac{3}{4}$   |           | 26.995                 |                         |  |
| 110         | 0'-9 $\frac{3}{4}$   |           | 27.651                 |                         |  |
| 209         | 14'-3                |           | 21.774                 |                         |  |
| 301         | 38'-2 $\frac{3}{4}$  |           | 7.954                  |                         |  |
| 302         | 38'-2 $\frac{3}{4}$  |           | 7.977                  |                         |  |
| 303         | 38'-2 $\frac{3}{4}$  |           | 8.078                  |                         |  |
| 304         | 38'-2 $\frac{3}{4}$  |           | 8.260                  |                         |  |
| 305         | 38'-2 $\frac{3}{4}$  |           | 8.566                  |                         |  |
| 306         | 38'-2 $\frac{3}{4}$  |           | 10.235                 |                         |  |
| 307         | 37'-11 $\frac{1}{4}$ |           | 10.380                 |                         |  |
| 308         | 32'-1                |           | 13.943                 |                         |  |

Job Name: WOODWARD WILLIS

Remote Area Number: - 3rd Floor Classroom

Date: 3/22/2017

| Node Number | Elevation (Foot) | Node Type | Pressure at Node (psi) | Discharge at Node (gpm) | Notes |
|-------------|------------------|-----------|------------------------|-------------------------|-------|
| 310         | 37'-11¼          |           | 9.974                  |                         |       |
| 311         | 37'-11¼          |           | 10.003                 |                         |       |

| Pipe Information |                      |          |                                |            |                            |                      |                                       |              |  |
|------------------|----------------------|----------|--------------------------------|------------|----------------------------|----------------------|---------------------------------------|--------------|--|
| Node 1           | Elev 1<br>(Foot)     | K-Factor | Flow added<br>this step<br>(q) | Nominal ID | Fittings &<br>Devices      | Length<br>(Foot)     | C Factor                              | Total(Pt)    | Notes<br><br>Fitting/Device (Equivalent<br>Length)<br>Fixed Pressure Losses, when<br>applicable, are added directly<br>to (Pf) and shown as a<br>negative value. |
| Node 2           | Elev 2<br>(Foot)     |          | Total Flow<br>(Q)              | Actual ID  | Equiv.<br>Length<br>(Foot) | Fitting<br>(Foot)    | Pf Friction<br>Loss Per Unit<br>(psi) | Elev(Pe)     |  |
|                  |                      |          |                                |            |                            | Total<br>(Foot)      |                                       | Friction(Pf) |  |
| 3001             | 39'-4 $\frac{1}{4}$  | 5.6      | 14.82                          | 1          | (See<br>Notes)             | 1'-1 $\frac{1}{4}$   | 120                                   | 7.000        | ***** Route 1 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 301              | 38'-2 $\frac{3}{4}$  |          | 14.82                          | 1.0        |                            | 5'-0                 | 0.074703                              | 0.495        |  |
|                  |                      |          |                                |            |                            | 6'-1 $\frac{1}{4}$   |                                       | 0.459        |  |
| 301              | 38'-2 $\frac{3}{4}$  |          |                                | 2          |                            | 9'-11 $\frac{1}{2}$  | 120                                   | 7.954        |  |
|                  |                      |          |                                |            |                            |                      | 0.002232                              | 0.000        |  |
| 302              | 38'-2 $\frac{3}{4}$  |          | 14.82                          | 2.2        |                            | 9'-11 $\frac{1}{2}$  |                                       | 0.022        |  |
| 302              | 38'-2 $\frac{3}{4}$  |          | 14.84                          | 2          |                            | 12'-7 $\frac{1}{2}$  | 120                                   | 7.977        | Flow (q) from Route 2  |
|                  |                      |          |                                |            |                            |                      | 0.008057                              | 0.000        |  |
| 303              | 38'-2 $\frac{3}{4}$  |          | 29.65                          | 2.2        |                            | 12'-7 $\frac{1}{2}$  |                                       | 0.102        |  |
| 303              | 38'-2 $\frac{3}{4}$  |          | 14.94                          | 2          |                            | 10'-7                | 120                                   | 8.078        | Flow (q) from Route 3  |
|                  |                      |          |                                |            |                            |                      | 0.017138                              | 0.000        |  |
| 304              | 38'-2 $\frac{3}{4}$  |          | 44.59                          | 2.2        |                            | 10'-7                |                                       | 0.181        |  |
| 304              | 38'-2 $\frac{3}{4}$  |          | 15.12                          | 2          |                            | 10'-5                | 120                                   | 8.260        | Flow (q) from Route 4  |
|                  |                      |          |                                |            |                            |                      | 0.029411                              | 0.000        |  |
| 305              | 38'-2 $\frac{3}{4}$  |          | 59.71                          | 2.2        |                            | 10'-5                |                                       | 0.306        |  |
| 305              | 38'-2 $\frac{3}{4}$  |          | 15.41                          | 2          | (See<br>Notes)             | 24'-9 $\frac{1}{2}$  | 120                                   | 8.566        | Flow (q) from Route 5<br><br>PO(12'-3 $\frac{3}{4}$ )  |
|                  |                      |          |                                |            |                            | 12'-3 $\frac{3}{4}$  | 0.044980                              | 0.000        |  |
| 306              | 38'-2 $\frac{3}{4}$  |          | 75.13                          | 2.2        |                            | 37'-1 $\frac{1}{4}$  |                                       | 1.669        |  |
| 306              | 38'-2 $\frac{3}{4}$  |          |                                | 4          |                            | 14'-6 $\frac{3}{4}$  | 120                                   | 10.235       |  |
|                  |                      |          |                                |            |                            |                      | 0.001635                              | 0.121        |  |
| 307              | 37'-11 $\frac{1}{4}$ |          | 75.13                          | 4.3        |                            | 14'-6 $\frac{3}{4}$  |                                       | 0.024        |  |
| 307              | 37'-11 $\frac{1}{4}$ |          | 33.63                          | 4          | (See<br>Notes)             | 170'-2 $\frac{1}{2}$ | 120                                   | 10.380       | Flow (q) from Route 6<br><br>2fT(26'-4), 3fE(13'-2),<br>ALV(36'-10 $\frac{1}{2}$ ), BV(15'-9 $\frac{1}{2}$ )   |
|                  |                      |          |                                |            |                            | 144'-10              | 0.003242                              | 2.541        |  |
| 308              | 32'-1                |          | 108.76                         | 4.3        |                            | 315'-0 $\frac{3}{4}$ |                                       | 1.022        |  |
| 308              | 32'-1                |          |                                | 6          | (See<br>Notes)             | 143'-4 $\frac{1}{4}$ | 120                                   | 13.943       | 6fE(12'-7)   |
|                  |                      |          |                                |            |                            | 75'-5 $\frac{1}{4}$  | 0.000462                              | 7.730        |  |
| 209              | 14'-3                |          | 108.76                         | 6.4        |                            | 218'-9 $\frac{3}{4}$ |                                       | 0.101        |  |
| 209              | 14'-3                |          |                                | 6          | (See<br>Notes)             | 12'-3 $\frac{1}{2}$  | 120                                   | 21.774       | ALV(35'-2 $\frac{1}{2}$ ), BV(12'-7),<br>fT(37'-8 $\frac{3}{4}$ )  |
|                  |                      |          |                                |            |                            | 85'-6                | 0.000462                              | 5.175        |  |
| 109              | 2'-3 $\frac{3}{4}$   |          | 108.76                         | 6.4        |                            | 97'-9 $\frac{1}{2}$  |                                       | 0.045        |  |
| 109              | 2'-3 $\frac{3}{4}$   |          |                                | 6          | (See<br>Notes)             | 4'-0                 | 120                                   | 26.995       | BFP, fE(10'-0)   |
|                  |                      |          |                                |            |                            | 10'-0                | 0.000462                              | 0.650        |  |
| 110              | 0'-9 $\frac{3}{4}$   |          | 108.76                         | 6.4        |                            | 14'-0                |                                       | 0.006        |  |

| Pipe Information |                  |          |                                |                   |                       |                            |                                       |              |  |
|------------------|------------------|----------|--------------------------------|-------------------|-----------------------|----------------------------|---------------------------------------|--------------|--|
| Node 1           | Elev 1<br>(Foot) | K-Factor | Flow added<br>this step<br>(q) | Nominal ID        | Fittings &<br>Devices | Length<br>(Foot)           | C Factor                              | Total(Pt)    | Notes<br><br>Fitting/Device (Equivalent<br>Length)<br>Fixed Pressure Losses, when<br>applicable, are added directly<br>to (Pf) and shown as a<br>negative value. |
|                  | Node 2           |          | Elev 2<br>(Foot)               | Total Flow<br>(Q) | Actual ID             | Equiv.<br>Length<br>(Foot) | Pf Friction<br>Loss Per Unit<br>(psi) | Elev(Pe)     |  |
|                  |                  |          |                                |                   |                       | Total<br>(Foot)            |                                       | Friction(Pf) |  |
| 110              | 0'-9¾            |          |                                | 6                 | (See<br>Notes)        | 85'-9¾                     | 140                                   | 27.651       |  |
| 111              | -4'-0            |          | 108.76                         | 6.0               |                       | 20'-0                      | 0.000445                              | 2.086        |  |
|                  |                  |          |                                |                   |                       | 105'-9¾                    |                                       | 0.047        |  |
|                  |                  |          | 100.00                         |                   |                       |                            |                                       | 29.785       | Hose Allowance At Source   |
| 111              |                  |          | 208.76                         |                   |                       |                            |                                       |              |  |
|                  |                  |          |                                |                   |                       |                            |                                       |              | Total(Pt)    Route 1   |
| 3002             | 39'-4¼           | 5.6      | 14.84                          | 1                 | (See<br>Notes)        | 1'-1¾                      | 120                                   | 7.021        | ***** Route 2 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 302              | 38'-2¾           |          | 14.84                          | 1.0               |                       | 5'-0                       | 0.074910                              | 0.495        |  |
|                  |                  |          |                                |                   |                       | 6'-1¾                      |                                       | 0.460        |  |
|                  |                  |          |                                |                   |                       |                            |                                       | 7.977        | Total(Pt)    Route 2   |
| 3003             | 39'-4¼           | 5.6      | 14.94                          | 1                 | (See<br>Notes)        | 1'-1¾                      | 120                                   | 7.117        | ***** Route 3 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 303              | 38'-2¾           |          | 14.94                          | 1.0               |                       | 5'-0                       | 0.075856                              | 0.495        |  |
|                  |                  |          |                                |                   |                       | 6'-1¾                      |                                       | 0.466        |  |
|                  |                  |          |                                |                   |                       |                            |                                       | 8.078        | Total(Pt)    Route 3   |
| 3004             | 39'-4¼           | 5.6      | 15.12                          | 1                 | (See<br>Notes)        | 1'-1¾                      | 120                                   | 7.288        | ***** Route 4 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 304              | 38'-2¾           |          | 15.12                          | 1.0               |                       | 5'-0                       | 0.077541                              | 0.495        |  |
|                  |                  |          |                                |                   |                       | 6'-1¾                      |                                       | 0.476        |  |
|                  |                  |          |                                |                   |                       |                            |                                       | 8.260        | Total(Pt)    Route 4   |
| 3005             | 39'-4¼           | 5.6      | 15.41                          | 1                 | (See<br>Notes)        | 1'-1¾                      | 120                                   | 7.577        | ***** Route 5 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 305              | 38'-2¾           |          | 15.41                          | 1.0               |                       | 5'-0                       | 0.080381                              | 0.495        |  |
|                  |                  |          |                                |                   |                       | 6'-1¾                      |                                       | 0.494        |  |
|                  |                  |          |                                |                   |                       |                            |                                       | 8.566        | Total(Pt)    Route 5   |
| 3007             | 38'-10¾          | 5.6      | 16.80                          | 1                 | (See<br>Notes)        | 0'-11½                     | 120                                   | 9.002        | ***** Route 6 *****<br>Sprinkler,<br><br>PO(5'-0)  |
| 310              | 37'-11¼          |          | 16.80                          | 1.0               |                       | 5'-0                       | 0.094270                              | 0.411        |  |
|                  |                  |          |                                |                   |                       | 5'-11½                     |                                       | 0.561        |  |
| 310              | 37'-11¼          |          |                                | 2                 |                       | 10'-5                      | 120                                   | 9.974        |  |
| 311              | 37'-11¼          |          | 16.80                          | 2.2               |                       |                            | 0.002816                              | 0.000        |  |
|                  |                  |          |                                |                   |                       | 10'-5                      |                                       | 0.029        |  |
| 311              | 37'-11¼          |          | 16.83                          | 2                 | (See<br>Notes)        | 24'-9½                     | 120                                   | 10.003       | Flow (q) from Route 7<br><br>PO(12'-3¾)  |
| 307              | 37'-11¼          |          | 33.63                          | 2.2               |                       | 12'-3¾                     | 0.010168                              | 0.000        |  |
|                  |                  |          |                                |                   |                       | 37'-1¼                     |                                       | 0.377        |  |
|                  |                  |          |                                |                   |                       |                            |                                       | 10.380       | Total(Pt)    Route 6   |

| Pipe Information |                  |          |                                |            |                            |                   |                                       |              |  |
|------------------|------------------|----------|--------------------------------|------------|----------------------------|-------------------|---------------------------------------|--------------|--|
| Node 1           | Elev 1<br>(Foot) | K-Factor | Flow added<br>this step<br>(q) | Nominal ID | Fittings &<br>Devices      | Length<br>(Foot)  | C Factor                              | Total(Pt)    | Notes<br><br>Fitting/Device (Equivalent<br>Length)<br><br>Fixed Pressure Losses, when<br>applicable, are added directly<br>to (Pf) and shown as a<br>negative value. |
|                  |                  |          |                                |            |                            | Fitting<br>(Foot) | Pf Friction<br>Loss Per Unit<br>(psi) | Elev(Pe)     |  |
| Node 2           | Elev 2<br>(Foot) |          | Total Flow<br>(Q)              | Actual ID  | Equiv.<br>Length<br>(Foot) | Total<br>(Foot)   |                                       | Friction(Pf) |  |
| 3008             | 38'-10¾"         | 5.6      | 16.83                          | 1          | (See<br>Notes)             | 0'-11½"           | 120                                   | 9.029        |  |
| 311              | 37'-11¼"         |          | 16.83                          | 1.0        |                            | 5'-0"             | 0.094539                              | 0.411        |  |
|                  |                  |          |                                |            |                            | 5'-11½"           |                                       | 0.562        |  |
|                  |                  |          |                                |            |                            |                   |                                       | 10.003       | Total(Pt)    Route 7   |



## Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

## C Value Multiplier

$$\left( \frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

|                    |       |      |      |      |
|--------------------|-------|------|------|------|
| Value Of C         | 100   | 130  | 140  | 150  |
| Multiplying Factor | 0.713 | 1.16 | 1.33 | 1.51 |

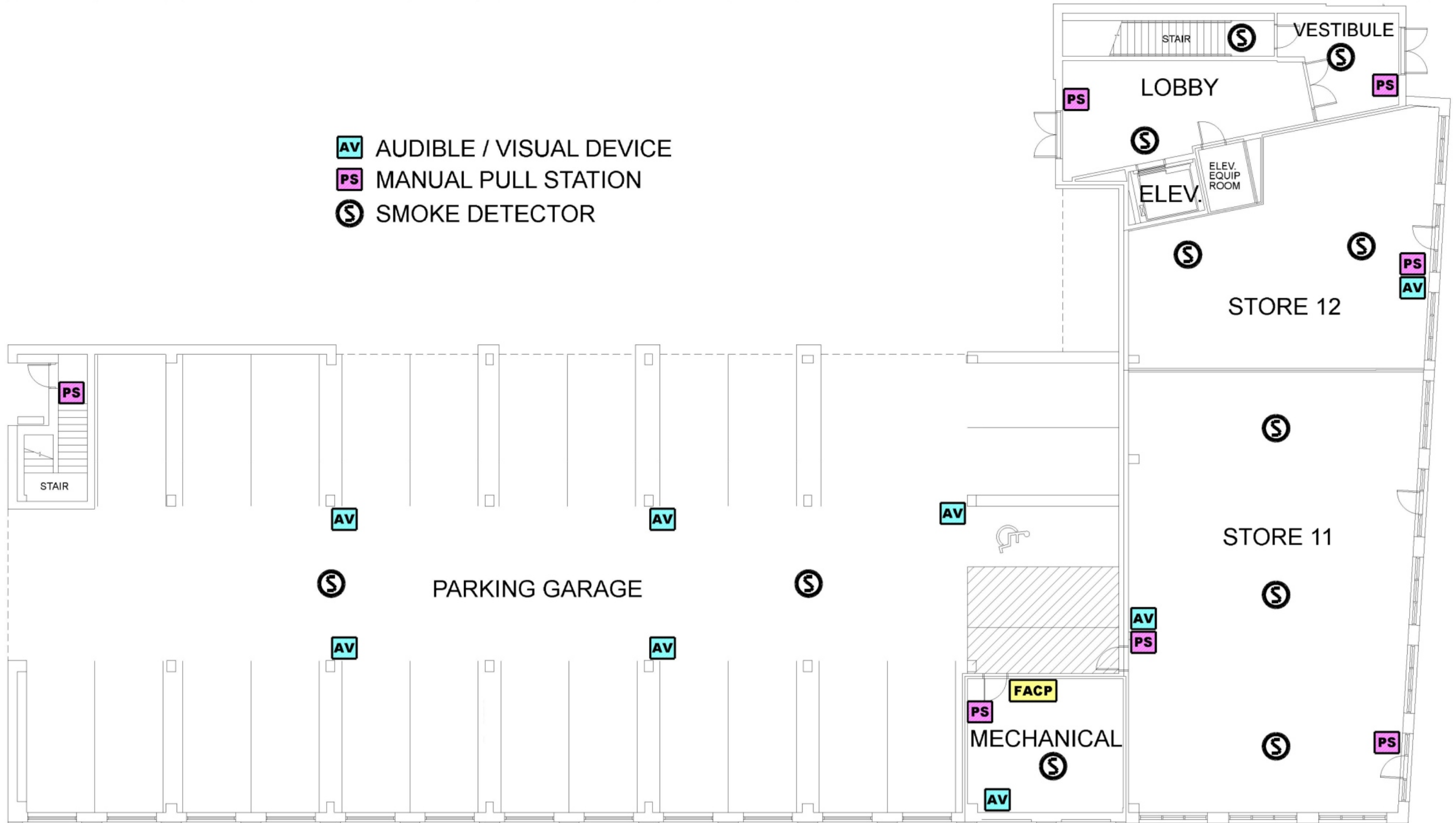
## Fittings Legend

|                                |                           |                             |
|--------------------------------|---------------------------|-----------------------------|
| ALV Alarm Valve                | AngV Angle Valve          | b Bushing                   |
| BaIV Ball Valve                | BFP Backflow Preventer    | BV Butterfly Valve          |
| C Cross Flow Turn 90°          | cplg Coupling             | Cr Cross Run                |
| CV Check Valve                 | DelV Deluge Valve         | DPV Dry Pipe Valve          |
| E 90° Elbow                    | EE 45° Elbow              | Ee1 11¼° Elbow              |
| Ee2 22½° Elbow                 | f Flow Device             | fd Flex Drop                |
| FDC Fire Department Connection | fE 90° FireLock(TM) Elbow | fEE 45° FireLock(TM) Elbow  |
| flg Flange                     | FN Floating Node          | fT FireLock(TM) Tee         |
| g Gauge                        | GloV Globe Valve          | GV Gate Valve               |
| Ho Hose                        | Hose Hose                 | HV Hose Valve               |
| Hyd Hydrant                    | LtE Long Turn Elbow       | mecT Mechanical Tee         |
| Noz Nozzle                     | P1 Pump In                | P2 Pump Out                 |
| PIV Post Indicating Valve      | PO Pipe Outlet            | PRV Pressure Reducing Valve |
| PrV Pressure Relief Valve      | red Reducer/Adapter       | S Supply                    |
| sCV Swing Check Valve          | Spr Sprinkler             | St Strainer                 |
| T Tee Flow Turn 90°            | Tr Tee Run                | U Union                     |
| WirF Wirsbo                    | WMV Water Meter Valve     | Z Cap                       |

# **APPENDIX E**

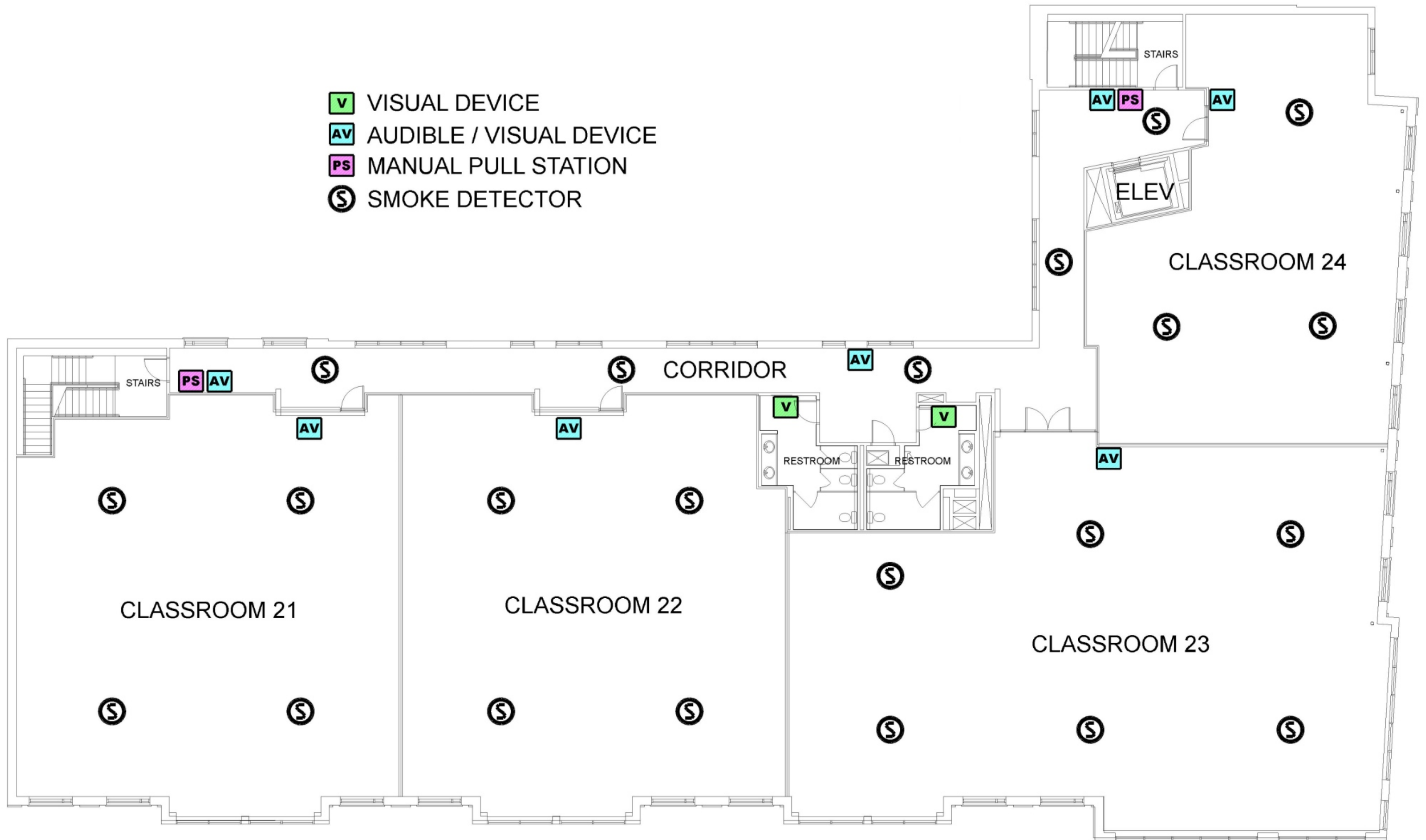
*Fire Alarm Layout Drawings*

- AV** AUDIBLE / VISUAL DEVICE  
**PS** MANUAL PULL STATION  
**S** SMOKE DETECTOR



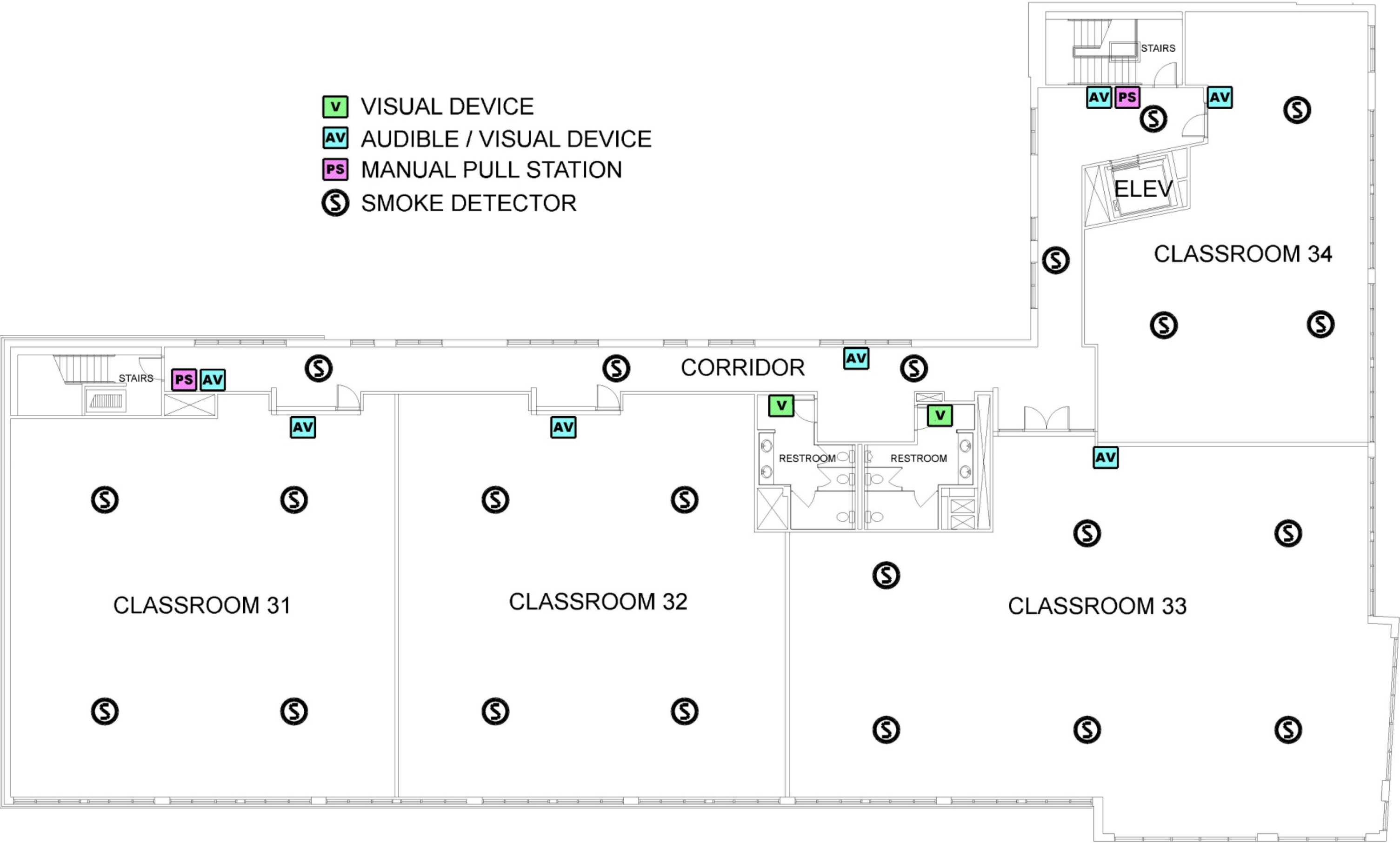
**1st FLOOR**

- V VISUAL DEVICE
- AV AUDIBLE / VISUAL DEVICE
- PS MANUAL PULL STATION
- S SMOKE DETECTOR



## 2nd FLOOR

- V VISUAL DEVICE
- AV AUDIBLE / VISUAL DEVICE
- PS MANUAL PULL STATION
- S SMOKE DETECTOR



3rd FLOOR

# **APPENDIX F**

*Inspection, Testing, & Maintenance Reports*

**N 4.6.6.12** A record of all inspections and testing shall be maintained in accordance with 4.3.2.

**4.7\* Performance-Based Compliance Programs.** Components and systems shall be permitted to be inspected, tested, and maintained under an approved performance-based program.

**N 4.7.1\*** Performance-based programs shall have clearly identifiable goals and clearly define how the program meets those goals.

**N 4.7.2** Compliance with an approved performance-based program shall be deemed as compliance with this standard.

**N 4.7.3** The goals and goal achievement obtained with the approved performance-based program shall be reviewed a minimum of every three years and ITM frequencies adjusted to reflect current conditions and the historical record.

**N 4.7.4** The historical record shall be available for review by the authority having jurisdiction.

**4.8 Maintenance.** Maintenance shall be performed to keep the system equipment operable.

#### 4.9 Safety.

**4.9.1 General.** Inspection, testing, and maintenance activities shall be conducted in accordance with applicable safety regulations.

**4.9.2 Confined Spaces.** Legally required precautions shall be taken prior to entering confined spaces such as tanks, valve pits, or trenches.

**4.9.3 Fall Protection.** Legally required equipment shall be worn or used to prevent injury from falls to personnel.

**4.9.4 Hazards.** Precautions shall be taken to address any hazards, such as protection against drowning where working on the top of a filled embankment or a supported, rubberized fabric tank, or over open water or other liquids.

#### 4.9.5\* Hazardous Materials.

**4.9.5.1** Legally required equipment shall be used where working in an environment with hazardous materials present.

**4.9.5.2** The property owner or designated representative shall advise anyone performing inspection, testing, and maintenance on any system under the scope of this document, with regard to hazardous materials stored on the premises.

**4.9.6\* Electrical Safety.** Legally required precautions shall be taken when testing or maintaining electric controllers for motor-driven fire pumps.

## Chapter 5 Sprinkler Systems

### 5.1 General.

#### 5.1.1 Minimum Requirements.

**5.1.1.1** This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of sprinkler systems.

**5.1.1.2** Table 5.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

**5.1.2 Common Components and Valves.** Common components and valves shall be inspected, tested, and maintained in accordance with Chapter 13.

**5.1.3 Obstruction Investigations.** The procedures outlined in Chapter 14 shall be followed where there is a need to conduct an obstruction investigation.

**5.1.4 Impairments.** The procedures outlined in Chapter 15 shall be followed where an impairment to protection occurs.

**5.1.5 Hose Connections.** Hose connections shall be inspected, tested, and maintained in accordance with Chapters 6 and 13.

### 5.2\* Inspection.

#### 5.2.1 Sprinklers.

**5.2.1.1** Sprinklers shall be inspected from the floor level annually.

**5.2.1.1.1\*** Any sprinkler that shows signs of any of the following shall be replaced:

- (1) Leakage
- (2) Corrosion detrimental to sprinkler performance
- (3) Physical damage
- (4) Loss of fluid in the glass bulb heat-responsive element
- (5) Loading detrimental to sprinkler performance
- (6) Paint other than that applied by the sprinkler manufacturer

**5.2.1.1.2** Any sprinkler that has been installed in the incorrect orientation shall be corrected by repositioning the branchline, drop, or sprig, or shall be replaced.

**5.2.1.1.3\*** Sprinklers installed in concealed spaces such as above suspended ceilings shall not require inspection.

**5.2.1.1.4** Sprinklers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**5.2.1.1.5** Escutcheons and coverplates for recessed, flush, and concealed sprinklers shall be replaced with their listed escutcheon or coverplate if found missing during the inspection.

**N 5.2.1.1.5.1** Where the listed escutcheon or coverplate from a listed assembly is missing and is no longer commercially available, the sprinkler shall be replaced.

**5.2.1.1.6** Escutcheons for pendent sprinklers that are not recessed, flush, or concealed shall not be required to be replaced if found missing during the inspection.

**5.2.1.2\*** The minimum clearance to storage as described in 5.2.1.2.1 through 5.2.1.2.6 shall be maintained below all sprinkler deflectors.

**5.2.1.2.1\*** Unless greater distances are required by 5.2.1.2.2, 5.2.1.2.3, or 5.2.1.2.4, or lesser distances are permitted by 5.2.1.2.6, clearance between the deflector and the top of storage shall be 18 in. (457 mm) or greater.

**5.2.1.2.2** Where standards other than NFPA 13 specify greater clearance to storage minimums, they shall be followed.

**5.2.1.2.3\*** Clearance between the deflector and the top of storage shall be 36 in. (914 mm) or greater for special sprinklers.

**Table 5.1.1.2 Summary of Sprinkler System Inspection, Testing, and Maintenance**

| Item   | Frequency                                 | Reference                           |
|--|---|-------------------------------------|
| <b>Inspection</b>  |   |                                     |
| Control valves   |   | Chapter 13                          |
| Fire department connections  |   | Chapter 13                          |
| Gauges (wet and deluge systems)  | Quarterly                                 | Chapter 13                          |
| Gauges (dry and preaction systems)   | Monthly/quarterly                         | Chapter 13                          |
| Hanger/braces/supports   | Annually                                  | 5.2.3                               |
| Heat tracing   | Per manufacturer's requirements           | 5.2.7                               |
| Hydraulic design information sign  | Annually                                  | 5.2.6                               |
| Information signs  | Annually                                  | 5.2.8, 5.2.9                        |
| Internal piping condition  |   | Chapter 14                          |
| Pipe and fittings  | Annually                                  | 5.2.2                               |
| Sprinklers   | Annually                                  | 5.2.1                               |
| Sprinklers (spare)   | Annually                                  | 5.2.1.4                             |
| Supervisory signal devices (except valve supervisory switches)   | Quarterly                                 | 5.2.5                               |
| System valves  |   | Chapter 13                          |
| Valve supervisory signal devices   | Quarterly                                 | 5.2.5                               |
| Waterflow alarm devices  | Quarterly                                 | 5.2.5                               |
| <b>Test</b>  |   |                                     |
| Antifreeze solution  | Annually                                  | 5.3.4                               |
| Control valves   |   | Chapter 13                          |
| Gauges   | 5 years                                   | Chapter 13                          |
| Main drain   |   | Chapter 13                          |
| Sprinklers   | At 50 years and every 10 years thereafter | 5.3.1.1.1, 5.3.1.1.1.1, 5.3.1.1.1.2 |
| Sprinklers   | At 75 years and every 5 years thereafter  | 5.3.1.1.1.5                         |
| Sprinklers (dry)   | 10 years and every 10 years thereafter    | 5.3.1.1.1.6                         |
| Sprinklers (extra high or greater temperature solder type)   | 5 years                                   | 5.3.1.1.1.4                         |
| Sprinklers (fast-response)   | At 20 years and every 10 years thereafter | 5.3.1.1.1.3                         |
| Sprinklers (harsh environments)  | 5 years                                   | 5.3.1.1.2                           |
| Supervisory signal devices (except valve supervisory switches)   |   | Chapter 13                          |
| System valves  |   | Chapter 13                          |
| Valve supervisory signal devices   |   | Chapter 13                          |
| Waterflow alarm devices (Mechanical)   | Quarterly                                 | 5.3.3.1                             |
| Waterflow alarm devices (vane and pressure switch type)  | Semiannually                              | 5.3.3.2                             |
| <b>Maintenance</b>   |   |                                     |
| Low-point drains (dry pipe and preaction systems)  |   | Chapter 13                          |
| Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems | Annually                                  | 5.4.1.7                             |
| Valves (all types)   |   | Chapter 13                          |
| <b>Investigation</b>   |   |                                     |
| Obstruction  |   | Chapter 14                          |



**5.2.1.2.4** Clearance from the top of storage to sprinkler deflectors shall be 36 in. (914 mm) or greater where rubber tires are stored.

**5.2.1.2.5** In-rack sprinklers shall not be required to meet the obstruction criteria and clearance from storage requirements.

**5.2.1.2.6\*** Clearance between the deflector and the top of storage shall be permitted to be less than 18 in. (457 mm) where shown to be permitted by the installation standard.

**5.2.1.3\*** Storage closer to the sprinkler deflector than permitted by the clearance rules of the installation standard described in 5.2.1.2.1 through 5.2.1.2.4 shall be corrected.

**5.2.1.4** The supply of spare sprinklers shall be inspected annually for the following:

- (1) The correct number and type of sprinklers as required by 5.4.1.5
- (2) A sprinkler wrench for each type of sprinkler as required by 5.4.1.5.5
- (3) The list of spare sprinklers as required by 5.4.1.5.6

**5.2.2\* Pipe and Fittings.** Sprinkler pipe and fittings shall be inspected annually from the floor level.

**5.2.2.1\*** Pipe and fittings shall be free of mechanical damage, leakage, and corrosion.

**5.2.2.2** Sprinkler piping shall not be subjected to external loads by materials either resting on the pipe or hung from the pipe.

**5.2.2.3\*** Pipe and fittings installed in concealed spaces such as above suspended ceilings shall not require inspection.

**5.2.2.4** Pipe and fittings installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**5.2.3\* Hangers, Braces, and Supports.** Sprinkler pipe hangers, braces, and supports shall be inspected annually from the floor level.

**5.2.3.1** Hangers, braces, and supports shall not be damaged, loose, or unattached.

**5.2.3.2** Hangers, braces, and supports that are damaged, loose, or unattached shall be replaced or refastened.

**5.2.3.3\*** Hangers, braces, and supports installed in concealed spaces such as above suspended ceilings shall not require inspection.

**5.2.3.4** Hangers, braces, and supports installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

**5.2.4 Waterflow Alarm and Supervisory Signal Initiating Device.** Waterflow alarm and supervisory signal initiating devices shall be inspected quarterly to verify that they are free of physical damage.

**5.2.5\* Hydraulic Design Information Sign.** The hydraulic design information sign shall be inspected annually to verify that it is provided, attached securely to the sprinkler riser, and is legible.

**5.2.5.1** A hydraulic design information sign that is missing or illegible shall be replaced.

**5.2.5.2** A pipe schedule system shall have a hydraulic design information sign that reads "Pipe Schedule System."

**5.2.6 Heat Tracing.** Heat tracing shall be inspected and maintained in accordance with manufacturer's requirements.

**5.2.7 Information Sign.** The information sign required by 4.1.9 shall be inspected annually to verify that it is provided, securely attached, and legible.

**5.2.8\* General Information Sign.** The general information sign required by NFPA 13 shall be inspected annually to verify that it is provided, securely attached, and legible.

**N 5.2.9 Antifreeze Information Sign.** The antifreeze information sign required by 4.1.10 shall be inspected annually to verify that it is present, securely attached, and legible.

### 5.3 Testing.

#### 5.3.1\* Sprinklers.

**5.3.1.1\*** Where required by this section, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing.

**5.3.1.1.1** Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested.

**5.3.1.1.1.1** Test procedures shall be repeated at 10-year intervals.

**5.3.1.1.1.2** Sprinklers manufactured prior to 1920 shall be replaced.

**5.3.1.1.1.3\*** Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be replaced or representative samples shall be tested and then retested at 10-year intervals.

**5.3.1.1.1.4\*** Representative samples of solder-type sprinklers with a temperature classification of extra high [325°F (163°C)] or greater that are exposed to semicontinuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.

**5.3.1.1.1.5** Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service testing and repeated at 5-year intervals.

**5.3.1.1.1.6\*** Dry sprinklers that have been in service for 10 years shall be replaced or representative samples shall be tested and then retested at 10-year intervals.

**5.3.1.1.2\*** Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, either sprinklers shall be replaced or representative sprinkler samples shall be tested.

**5.3.1.1.3** Where historical data indicate, longer intervals between testing shall be permitted.

**5.3.1.2\*** A representative sample of sprinklers for testing per 5.3.1.1.1 shall consist of a minimum of not less than four sprinklers or 1 percent of the number of sprinklers per individual sprinkler sample, whichever is greater.

**5.3.1.3** Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers within the area represented by that sample shall be replaced.

**5.3.1.3.1** Manufacturers shall be permitted to make modifications to their own sprinklers in the field with listed devices that restore the original performance as intended by the listing, where acceptable to the authority having jurisdiction.

### **5.3.2 Waterflow Alarm Devices.**

**5.3.2.1** Mechanical waterflow alarm devices including, but not limited to, water motor gongs, shall be tested quarterly.

**5.3.2.2\*** Vane-type and pressure switch-type waterflow alarm devices shall be tested semiannually.

**5.3.2.3** Testing of pressure switch-type waterflow alarm devices on wet pipe systems shall be accomplished by opening the inspector's test connection.

**5.3.2.3.1** Where freezing weather conditions or other circumstances prohibit use of the inspector's test connection, the bypass connection shall be permitted to be used.

**N 5.3.2.4** Testing of vane-type waterflow alarm devices on wet pipe systems shall be accomplished by a flow of water equivalent to the flow out of the smallest single k-factor sprinkler (or smaller) past the flow switch.

**5.3.2.4.1** The flow switch shall be tested by opening the inspector's test connection at a minimum frequency of once every three years.

**5.3.2.5** Fire pumps shall not be taken out of service during testing unless constantly attended by qualified personnel or all impairment procedures contained in Chapter 15 are followed.

**5.3.3\* Antifreeze Systems.** Annually, before the onset of freezing weather, the antifreeze solution shall be tested using the following procedure:

- (1) Using the antifreeze information sign required by 4.1.10, installation records, maintenance records, information from the owner, chemical tests, or other reliable sources of information, the type of antifreeze in the system shall be determined and (a) or (b) implemented if necessary:
  - (a) If the antifreeze is found to be a type that is no longer permitted, the system shall be drained completely and the antifreeze replaced with an acceptable solution.
  - (b) If the type of antifreeze cannot be reliably determined, the system shall be drained completely and the antifreeze replaced with an acceptable solution in accordance with 5.3.3.4.
- (2) If the antifreeze is not replaced in accordance with 5.3.3(1)(a) and 5.3.3(1)(b), test samples shall be taken at the top of each system and at the bottom of each system as follows:
  - (a) If the most remote portion of the system is not near the top or the bottom of the system, an additional sample shall be taken at the most remote portion.
  - (b) If the connection to the water supply piping is not near the top or the bottom of the system, an additional sample shall be taken at the connection to the water supply.

- (3) The specific gravity of each solution shall be checked using a hydrometer with a suitable scale or a refractometer having a scale calibrated for the antifreeze solution.
- (4) If any of the samples exhibits a concentration in excess of what is permitted by 5.3.3.4, the system shall be emptied and refilled with a new acceptable solution.
- (5) If a concentration greater than what is currently permitted by 5.3.3.4 was necessary to keep the fluid from freezing, alternative methods for preventing the pipe from freezing shall be employed.

**N 5.3.3.1** The antifreeze solution shall be tested at its most remote portion and where it interfaces with the wet pipe system.

**N 5.3.3.2** Where antifreeze systems have a capacity larger than 150 gal (568 L), tests at one additional point for every 100 gal (379 L) shall be made.

**5.3.3.2.1** If the results indicate an incorrect freeze point at any point in the system, the system shall be drained and refilled with new premixed antifreeze.

**5.3.3.2.2** For premixed solutions, the manufacturer's instructions shall be permitted to be used with regard to the number of test points and the refill procedure.

**5.3.3.3** The use of antifreeze solutions shall be in conformity with state and local health regulations.

**5.3.3.3.1\*** Listed CPVC sprinkler pipe and fittings shall be protected from freezing with glycerine only.

**5.3.3.3.1.1** The use of diethylene, ethylene, or propylene glycols shall be specifically prohibited.

**5.3.3.4** Except as permitted by 5.3.3.4.1 and 5.3.3.4.3, all antifreeze systems shall utilize listed antifreeze solutions.

**5.3.3.4.1\*** For systems installed prior to September 30, 2012, listed antifreeze solutions shall not be required until September 30, 2022, where one of the following conditions is met:

- (1)\* The concentration of the antifreeze solution shall be limited to 30 percent propylene glycol by volume or 38 percent glycerine by volume.
- (2)\* Antifreeze systems with concentrations in excess of 30 percent but not more than 40 percent propylene glycol by volume and 38 percent but not more than 50 percent glycerine by volume shall be permitted based upon an approved deterministic risk assessment prepared by a qualified person approved by the authority having jurisdiction.

**N 5.3.3.4.2** Newly introduced solutions shall be factory premixed antifreeze solutions (chemically pure or United States Pharmacopeia 96.5 percent).

**5.3.3.4.3** Premixed antifreeze solutions of propylene glycol exceeding 30 percent concentration by volume shall be permitted for use with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

## **5.4 Maintenance.**

### **5.4.1 Sprinklers.**

**5.4.1.1** Where a sprinkler has been removed for any reason, it shall not be reinstalled.

**5.4.1.2\*** Replacement sprinklers shall have the proper characteristics for the application intended, which include the following:

- (1) Style
- (2) Orifice size and K-factor
- (3) Temperature rating
- (4) Coating, if any
- (5) Deflector type (e.g., upright, pendent, sidewall)
- (6) Design requirements

**5.4.1.2.1\*** Spray sprinklers shall be permitted to replace old-style sprinklers.

**5.4.1.2.2\*** Where replacing residential sprinklers manufactured prior to 2003 that are no longer available from the manufacturer and are installed using a design density less than 0.05 gpm/ft<sup>2</sup> (204 mm/min), a residential sprinkler with an equivalent K-factor ( $\pm 5$  percent) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded.

**5.4.1.2.3** Replacement sprinklers for piers and wharves shall comply with NFPA 307.

**5.4.1.3** Only new, listed sprinklers shall be used to replace existing sprinklers.

**5.4.1.4\*** Special and quick-response sprinklers as defined by NFPA 13 shall be replaced with sprinklers of the same orifice, size, temperature range and thermal response characteristics, and K-factor.

**5.4.1.5\*** A supply of at least six spare sprinklers shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced.

**5.4.1.5.1** The sprinklers shall correspond to the types and temperature ratings of the sprinklers in the property.

**5.4.1.5.2** The sprinklers shall be kept in a cabinet located where the temperature in which they are subjected will at no time exceed 100°F (38°C).

**5.4.1.5.3** Where dry sprinklers of different lengths are installed, spare dry sprinklers shall not be required, provided that a means of returning the system to service is furnished.

**5.4.1.5.4** The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

- (1) For protected facilities having under 300 sprinklers — no fewer than 6 sprinklers
- (2) For protected facilities having 300 to 1000 sprinklers — no fewer than 12 sprinklers
- (3) For protected facilities having over 1000 sprinklers — no fewer than 24 sprinklers

**5.4.1.5.5\*** One sprinkler wrench as specified by the sprinkler manufacturer shall be provided in the cabinet for each type of sprinkler installed to be used for the removal and installation of sprinklers in the system.

**5.4.1.5.6** A list of the sprinklers installed in the property shall be posted in the sprinkler cabinet.

**5.4.1.5.6.1\*** The list shall include the following:

- (1) Sprinkler identification number (SIN) if equipped; or the manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure rating
- (2) General description

- (3) Quantity of each type to be contained in the cabinet
- (4) Issue or revision date of the list

**5.4.1.6\*** Sprinklers shall not be altered in any respect or have any type of ornamentation, paint, or coatings applied after shipment from the place of manufacture.

**5.4.1.7** Sprinklers and automatic spray nozzles used for protecting commercial-type cooking equipment and ventilating systems shall be replaced annually.

**5.4.1.7.1** Where automatic bulb-type sprinklers or spray nozzles are used and annual examination shows no buildup of grease or other material on the sprinklers or spray nozzles, such sprinklers and spray nozzles shall not be required to be replaced.

#### **5.4.1.8 Protective Coverings.**

**5.4.1.8.1\*** Sprinklers protecting spray areas and mixing rooms in resin application areas installed with protective coverings shall continue to be protected against overspray residue so that they will operate in the event of fire.

**5.4.1.8.2** Sprinklers installed as described in 5.4.1.8.1 shall be protected using cellophane bags having a thickness of 0.003 in. (0.076 mm) or less or thin paper bags.

**5.4.1.8.3** Coverings shall be replaced periodically so that heavy deposits of residue do not accumulate.

**5.4.2\* Dry Pipe Systems.** Dry pipe systems shall be kept dry at all times.

**5.4.2.1** During nonfreezing weather, a dry pipe system shall be permitted to be left wet if the only other option is to remove the system from service while waiting for parts or during repair activities.

**5.4.2.2** Refrigerated spaces or other areas within the building interior where temperatures are maintained at or below 40°F (4.0°C) shall not be permitted to be left wet.

**5.4.2.3** Air driers shall be maintained in accordance with the manufacturer's instructions.

**5.4.2.4** Compressors used in conjunction with dry pipe sprinkler systems shall be inspected, tested, and maintained in accordance with Chapter 13 and the manufacturer's instructions.

**5.4.3\* Marine Systems.** Sprinkler systems that are normally maintained using fresh water as a source shall be drained and refilled, then drained and refilled again with fresh water following the introduction of raw water into the system.

#### **5.5 Component Action Requirements.**

**5.5.1** Whenever a component in a sprinkler system is adjusted, repaired, reconditioned, or replaced, the actions required in Table 5.5.1 shall be performed.

**5.5.2** Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

**5.5.3** These actions shall not require a design review, which is outside the scope of this standard.

**Table 5.5.1 Summary of Component Action Requirements**

| Component   | Adjust | Repair/<br>Recondition | Replace | Required Action  |
|---|--------|------------------------|---------|--|
| <b>Water Delivery Components</b>                        |        |                        |         |  |
| Pipe and fittings affecting not more than 20 sprinklers | X      | X                      | X       | Inspect for leaks at system working pressure                                       |
| Pipe and fittings affecting more than 20 sprinklers     | X      | X                      | X       | Hydrostatic test in conformance with NFPA 13                                       |
| Sprinklers, regardless of number                        | X      |                        | X       | Inspect for leaks at system working pressure                                       |
| Sprinklers, more than 20                                | X      |                        | X       | Hydrostatic test in conformance with NFPA 13                                       |
| Fire department connections                             | X      | X                      | X       | See Chapter 13   |
| Antifreeze solution                                     | X      |                        | X       | Inspect freezing point of solution<br>Inspect for leaks at system working pressure |
| <b>Alarm and Supervisory Components</b>                 |        |                        |         |  |
| Vane-type waterflow                                     | X      | X                      | X       | Operational test using inspector's test connection                                 |
| Pressure switch-type waterflow                          | X      | X                      | X       | Operational test using the inspector's test connection or alarm bypass test valve  |
| Water motor gong  | X      | X                      | X       | Operational test using inspector's test connection                                 |
| High and low air pressure switch                        | X      | X                      | X       | Operational test of high and low settings  |
| Valve supervisory signal initiating device              | X      | X                      | X       | Test for conformance with NFPA 13 and/or NFPA 72                                   |
| Detection system (for deluge or preaction system)       | X      | X                      | X       | Operational test for conformance with NFPA 13 and/or NFPA 72                       |
| <b>Status-Indicating Components</b>                     |        |                        |         |  |
| Gauges  |        |                        | X       | Verify at 0 bar (0 psi) and system working pressure                                |
| <b>Testing and Maintenance Components</b>               |        |                        |         |  |
| Air compressor  | X      | X                      | X       | Operational test for conformance with NFPA 13                                      |
| Automatic air maintenance device                        | X      | X                      | X       | Operational test for conformance with NFPA 13                                      |
| Main drain  | X      | X                      | X       | Main drain test  |
| Auxiliary drains  | X      | X                      | X       | Inspect for leaks at system working pressure; main drain test                      |
| Inspector's test connection                             | X      | X                      | X       | Inspect for leaks at system working pressure; main drain test                      |
| <b>Structural Components</b>                            |        |                        |         |  |
| Hanger/seismic bracing                                  | X      | X                      | X       | Inspect for conformance with NFPA 13   |
| Pipe stands   | X      | X                      | X       | Inspect for conformance with NFPA 13   |
| <b>Informational Components</b>                         |        |                        |         |  |
| Identification signs                                    | X      | X                      | X       | Inspect for conformance with NFPA 13 and this standard                             |
| Hydraulic design information sign                       | X      | X                      | X       | Inspect for conformance with NFPA 13 and this standard                             |
| General information sign                                | X      | X                      | X       | Inspect for conformance with this standard   |

## Chapter 6 Standpipe and Hose Systems

### 6.1 General.

#### 6.1.1 Minimum Requirements.

**6.1.1.1** This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of standpipe and hose systems.

**6.1.1.2** Table 6.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

**6.1.2** Inspection, testing, and maintenance activities required by this chapter shall be followed to determine that components are free of corrosion, foreign material, physical damage,

tampering, or other conditions that adversely affect system operation.

**6.1.3** Common components and valves shall be inspected, tested, and maintained in accordance with Chapter 13.

**6.1.4** The procedures outlined in Chapter 14 shall be followed where there is a need to conduct an obstruction investigation.

**6.1.5** Where the inspection, testing, and maintenance of standpipe and hose systems results or involves a system that is out of service, the impairment procedures outlined in Chapter 15 shall be followed.



**Table 6.1.1.2 Summary of Standpipe and Hose Systems Inspection, Testing, and Maintenance**

| Item   | Frequency                   | Reference   |
|--|-----------------------------|-------------|
| <b>Inspection</b>  |                             |             |
| Cabinet  | Annually                    | 6.2.1       |
| Control valves   |                             | Chapter 13  |
| Gauges   | Weekly/quarterly            | Chapter 13  |
| Hose   | Annually                    | NFPA 1962   |
| Hose connection  | Annually                    | 6.2.1       |
| Hose nozzle  | Annually and after each use | NFPA 1962   |
| Hose storage device  | Annually                    | 6.2.1       |
| Hydraulic design information sign                              | Annually                    | 6.2.3       |
| Hose valves  |                             | Chapter 13  |
| Hose connection  |                             | 6.2.1       |
| Piping   | Annually                    | 6.2.1       |
| Pressure-regulating devices                                    |                             | Chapter 13  |
| <b>Test</b>  |                             |             |
| Flow test  | 5 years                     | 6.3.1       |
| Hose   | 5 years/3 years             | NFPA 1962   |
| Hose connections   | Annually                    | 6.2.1       |
| Hose valves  |                             | Chapter 13  |
| Hydrostatic test   | 5 years                     | 6.3.2       |
| Main drain test  |                             | Chapter 13  |
| Pressure control valve   |                             | Chapter 13  |
| Pressure-reducing valve  |                             | Chapter 13  |
| Supervisory signal devices (except valve supervisory switches) |                             | Chapter 13  |
| Valve status test  |                             | Chapter 13  |
| Valve supervisory devices                                      |                             | Chapter 13  |
| Waterflow alarm devices  |                             | Chapter 13  |
| <b>Maintenance</b>   |                             |             |
| Hose connections   | Annually                    | Table 6.1.2 |
| Hose valves  |                             | Chapter 13  |
| Valves (all types)   | Annually/as needed          | Chapter 13  |

**6.1.6** Where approved by the authority having jurisdiction, existing hose shall be permitted to be removed and shall not be recorded as a deficiency.

## **6.2 Inspection.**

**6.2.1 Components.** Components of standpipe and hose systems shall be visually inspected annually or as specified in Table 6.1.1.2.

**6.2.2\* Hydraulic Design Information Sign.** The hydraulic design information sign for standpipe systems shall be inspected annually to verify that it is provided, attached securely, and legible.

**6.2.2.1** A hydraulic design information sign that is missing or illegible shall be replaced.

**6.2.2.2** A standpipe system that was not sized by hydraulic design shall have a hydraulic design information sign that reads "Pipe Schedule System."

## **N 6.2.3 Hose Connections.**

**6.2.3.1** Hose connections shall be inspected annually for the following conditions:

- (1) Valve cap(s) missing or damaged
- (2) Fire hose connection damaged

- (3) Valve handles missing or damaged
- (4) Cap gaskets missing or deteriorated
- (5) Valve leaking
- (6) Visible and physical obstructions to hose connections
- (7) Pressure restricting device missing
- (8) Manual, semiautomatic, or dry standpipe valve does not operate smoothly
- (9) Valve threads damaged

**6.2.3.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

## **N 6.2.4 Piping.**

**6.2.4.1** Piping shall be inspected annually for the following conditions:

- (1) Damaged piping
- (2) Damaged control valves
- (3) Missing or damaged pipe support device (i.e., missing or damaged hanger or seismic brace)
- (4) Damaged supervisory signal initiating device

**6.2.4.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

**N 6.2.5 Hose.**

**6.2.5.1** Hose shall be inspected annually for the following conditions as required by NFPA 1962:

- (1) Mildew, cuts, abrasions, and deterioration
- (2) Couplings hose threads damaged
- (3) Gaskets missing or deteriorated
- (4) Incompatible threads on coupling
- (5) Hose not connected to hose rack nipple or valve
- (6) Hose test outdated

**6.2.5.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

**N 6.2.6 Hose Nozzle.**

**6.2.6.1** Hose nozzles shall be inspected annually for the following conditions:

- (1) Hose nozzle missing
- (2) Gasket missing or deteriorated
- (3) Obstructions
- (4) Does not operate smoothly

**6.2.6.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

**N 6.2.7 Hose Storage Device.**

**6.2.7.1** Hose storage devices shall be inspected annually for the following conditions:

- (1) Difficult to operate
- (2) Damaged
- (3) Visible or physical obstruction
- (4) Hose improperly racked or rolled
- (5) Nozzle clip not in place and nozzle not correctly contained
- (6) Hose rack enclosed in cabinet not swinging out at least 90 degrees

**6.2.7.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

**N 6.2.8 Cabinet.**

**6.2.8.1** Cabinets shall be inspected annually for the following conditions:

- (1) Overall for corroded or damaged parts
- (2) Difficult to open
- (3) Cabinet door not opening fully
- (4) Door glazing cracked or broken
- (5) Lock on break glass-type cabinet not functioning properly
- (6) Glass break device missing or not attached
- (7) Not properly identified as containing fire equipment
- (8) Visible or physical obstructions
- (9) All valves, hose, nozzles, fire extinguishers, and so forth, easily accessible

**6.2.8.2** Where any deficiency is noted, the appropriate corrective action shall be taken.

**6.3 Testing.** Where water damage is a possibility, an air test shall be conducted on the system at 25 psi (1.7 bar) prior to introducing water to the system.

**6.3.1\* Flow Tests.**

**6.3.1.1\*** A flow test shall be conducted every 5 years on all automatic standpipe systems to verify that the required flow

and pressure are available at the hydraulically most remote hose valve outlet(s) while flowing the standpipe system demand.

**6.3.1.1.1** Where a flow test of the hydraulically most remote outlet(s) is not practical, the authority having jurisdiction shall be consulted for the appropriate location for the test.

**6.3.1.1.2** Pressure gauges maintained in accordance with 8.3.3.2.2 shall be provided for the test.

**6.3.1.2\*** Class I and Class III standpipe system demand shall include 500 gpm (1892 L/min) for the most remote standpipe and 250 gpm (946 L/min) for each additional standpipe until the total system demand is simultaneously flowing.

**6.3.1.2.1\*** The 250 gpm (946 L/min) required from each additional Class I and Class III standpipe shall be allowed to be flowed from the most convenient hose valve on that standpipe.

**6.3.1.2.2\*** Where the 250 gpm (946 L/min) cannot be flowed from each additional Class I and Class III standpipe, the authority having jurisdiction shall determine where the additional flow can be taken.

**N 6.3.1.3** Class II standpipe system demand shall include 100 gpm (379 L/min) for the most remote standpipe connection.

**6.3.1.4** The standpipe system demand shall be based on the design criteria in effect at the time of the installation.

**6.3.1.4.1** Where the standpipe system demand cannot be determined, the authority having jurisdiction shall determine the standpipe system demand.

**6.3.1.4.2** The actual test method(s) and performance criteria shall be discussed in advance with the authority having jurisdiction.

**6.3.1.5** Standpipes, sprinkler connections to standpipes, or hose stations equipped with pressure-reducing valves or pressure-regulating valves shall have these valves inspected, tested, and maintained in accordance with the requirements of Chapter 13.

**6.3.1.6** A main drain test shall be performed on all standpipe systems with automatic water supplies in accordance with the requirements of Chapter 13.

**6.3.1.6.1** The test shall be performed at the low point drain for each standpipe or the main drain test connection where the supply main enters the building (when provided).

**6.3.1.6.2** Pressure gauges maintained in accordance with Chapter 13 shall be provided for the test.

**6.3.2 Hydrostatic Tests.**

**6.3.2.1\*** Hydrostatic tests of not less than 200 psi (13.8 bar) pressure for 2 hours, or at 50 psi (3.4 bar) in excess of the maximum pressure, where maximum pressure is in excess of 150 psi (10.3 bar), shall be conducted every 5 years on manual standpipe systems and semiautomatic dry standpipe systems, including piping in the fire department connection.

**6.3.2.1.1** Manual wet standpipes that are part of a combined sprinkler/standpipe system shall not be required to be tested in accordance with 6.3.2.1.

**6.3.2.2** The hydrostatic test pressure shall be measured at the low elevation point of the individual system or zone being tested.

**6.3.2.2.1** The inside standpipe piping shall show no leakage.

### **6.3.3 Waterflow Alarm and Supervisory Alarm Devices.**

**6.3.3.1** Where provided, waterflow alarm and supervisory alarm devices shall be tested in accordance with 13.2.6 and 13.3.3.5.

**6.3.3.2** Where freezing conditions necessitate a delay in testing, tests shall be performed as soon as weather allows.

### **6.4 Maintenance.**

**6.4.1** Maintenance and repairs shall be in accordance with 6.1.3 and Table 6.1.2.

**6.4.2** Equipment that does not pass the inspection or testing requirements shall be repaired and tested again or replaced.

### **6.5 Component Action Requirements.**

**6.5.1** Whenever components in standpipe and hose systems are adjusted, repaired, reconditioned, or replaced, the actions required in Table 6.5.1 shall be performed.

**6.5.2** Where the original installation standard is different from the cited standard, the use of the appropriate installing standard shall be permitted.

**6.5.3** These actions shall not require a design review, which is outside the scope of this standard.

## **Chapter 7 Private Fire Service Mains**

### **7.1 General.**

#### **7.1.1 Minimum Requirements.**

**7.1.1.1** This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of private fire service mains and their appurtenances.

**Table 6.5.1 Summary of Component Action Requirements**

| Component                                       | Adjust | Repair | Replace | Required Action  |
|---|--------|--------|---------|--|
| <b>Water Delivery Components</b>                |        |        |         |  |
| Control valves                                  | X      | X      | X       | See Chapter 13   |
| Hose valve pressure-regulating devices          | X      | X      | X       | See Chapter 13   |
| System pressure-regulating devices              | X      | X      | X       | See Chapter 13   |
| Piping  | X      | X      | X       | Hydrostatic test in conformance with NFPA 14   |
| Fire hose                                       |        |        | X       | No action required   |
| Fire hose                                       |        | X      |         | Perform hydrostatic test in accordance with NFPA 1962  |
| Hose valve                                      | X      | X      | X       | See Chapter 13   |
| Fire department connections                     | X      | X      | X       | See Chapter 13   |
| Backflow prevention device                      | X      | X      | X       | See Chapter 13   |
| <b>Alarm and Supervisory Components</b>         |        |        |         |  |
| Vane-type waterflow                             | X      | X      | X       | Operational test using inspector's test connection   |
| Pressure switch-type waterflow                  | X      | X      | X       | Operational test using inspector's test connection   |
| Water motor gong                                | X      | X      | X       | Operational test using inspector's test connection   |
| Valve supervisory device                        | X      | X      | X       | Operational test for receipt of alarms and verification of conformance with NFPA 14 and/or NFPA 72 |
| <b>Status-Indicating Components</b>             |        |        |         |  |
| Gauges  |        |        | X       | Verify at 0 psi (0 bar) and system working pressure  |
| <b>System Housing and Protection Components</b> |        |        |         |  |
| Cabinet   | X      | X      | X       | Verify compliance with NFPA 14   |
| Hose storage rack                               | X      | X      | X       | Verify compliance with NFPA 14   |
| <b>Testing and Maintenance Components</b>       |        |        |         |  |
| Drain riser                                     | X      | X      | X       | Inspect for leaks while flowing from connection above the repair                                   |
| Auxiliary drains                                | X      | X      | X       | Inspect for leaks at system working pressure   |
| Main drain                                      | X      | X      | X       | Inspect for leaks and residual pressure during main drain test                                     |
| <b>Structural Components</b>                    |        |        |         |  |
| Hanger/seismic bracing                          | X      | X      | X       | Verify conformance with NFPA 14  |
| Pipe stands                                     | X      | X      | X       | Verify conformance with NFPA 14  |
| <b>Informational Components</b>                 |        |        |         |  |
| Identification signs                            | X      | X      | X       | Verify conformance with NFPA 14  |
| Hydraulic placards                              | X      | X      | X       | Verify conformance with NFPA 14  |

# **APPENDIX G**

*Material Submittal*



WOODWARD WILLIS  
4219 WOODWARD AVE.  
DETROIT, MICHIGAN

[illegible]

# STEEL FIRE SPRINKLER PIPE

## Schedule 10 and Schedule 40

### SUBMITTAL DATA SHEET

#### High Quality, High Performance, Long-Lasting

Wheatland's Schedule 10 and Schedule 40 steel fire sprinkler pipe have set the industry's standards for years. Both products are subjected to the toughest possible testing to assure the highest possible quality and reliable, long-lasting performance.

Each is coated with Wheatland's proprietary mill coating to assure a clean, corrosion-resistant surface that outperforms and outlasts standard lacquer coatings. The coating also allows the pipe to be easily painted, without special preparation.

You can order Schedule 10 or Schedule 40 in black, or with hot-dip galvanizing, to meet FM requirements for dry systems to meet the zinc coating specifications of ASTM A795 or A53.

Both Schedule 10 and 40 are UL, C-UL and FM listed and meet NFPA 13 standards. We coat all of our black products up to 6" with our patented MIC Shield™ coating, which helps protect against the onset of microbial corrosion (MIC). Our MIC Shield was the first factory applied coating to be approved by FM as compatible with hybrid sprinkler systems that include CPVC plastic pipe in mixed use occupancies. MIC Shield is also chemically compatible with Flow Guard Gold®, Blaze Master® and Corizan® CPVC.

#### Why Wheatland?

- Experience: We've manufactured fire sprinkler pipe since 1931
- We produce the most complete line of products in the industry
- We offer a number of proprietary products and unique benefits
- We provide a complete line of coatings:
  - in-house, hot dip galvanizing
  - black sprinkler pipe
  - MIC shield™, the first FM global approved factory applied, anti-microbial coating for use with CPVC plastic pipe systems
  - proprietary mill coatings that provide corrosion resistant properties
  - proprietary mill coatings that extend shelf life

#### Schedule 10 and 40 Meet or Exceed These Standards

- UL, C-UL and FM Listed
- FM Approved
- ASTM A135, , Type E, Grade A (Schedule 10)
- ASTM A795, Type E, Grade A (Schedule 40)

**Green:** The steel used to produce Wheatland's sprinkler pipe contains recycled steel and is virtually totally recyclable.

**Seismic/Sway Bracing:** Wheatland sprinkler pipe data tables are available for determining the forces for piping used as a sway brace component or in Seismic applications.

#### Technical Data Chart

| PRODUCT<br>NPS     | NOM<br>I.D | WT/FT | WT/FT<br>H <sub>2</sub> O<br>FILLED | PCS/<br>LIFT | WT/LIFT<br>21' | WT/LIFT<br>24' | WT/LIFT<br>25' |
|--------------------|------------|-------|-------------------------------------|--------------|----------------|----------------|----------------|
| <b>Schedule 10</b> |            |       |                                     |              |                |                |                |
| 1 1/4"             | 1.442      | 1.807 | 2.514                               | 61           | 2,315          | 2,645          | 2,756          |
| 1 1/2"             | 1.682      | 2.087 | 3.049                               | 61           | 2,673          | 3,055          | 3,183          |
| 2"                 | 2.157      | 2.640 | 4.222                               | 37           | 2,051          | 2,344          | 2,442          |
| 2 1/2"             | 2.635      | 3.534 | 5.895                               | 30           | 2,226          | 2,544          | 2,651          |
| 3"                 | 3.260      | 4.336 | 7.949                               | 19           | 1,730          | 1,977          | 2,060          |
| 4"                 | 4.260      | 5.619 | 11.789                              | 19           | 2,242          | 2,562          | 2,669          |
| 5"                 | 5.295      | 7.780 | 17.309                              | 13           | 2,124          | 2,427          | 2,529          |
| 6"                 | 6.357      | 9.298 | 23.038                              | 10           | 1,953          | 2,232          | 2,325          |
| 8"                 | 8.625      | 219.1 | 8.249                               | 209.5        | 0.188          | 4.78           | 16.96          |
| <b>Schedule 40</b> |            |       |                                     |              |                |                |                |
| 1"                 | 1.049      | 1.681 | 2.055                               | 70           | 2,471          | 2,824          | 2,942          |
| 1 1/4"             | 1.380      | 2.275 | 2.922                               | 51           | 2,437          | 2,785          | 2,901          |
| 1 1/2"             | 1.610      | 2.720 | 3.602                               | 44           | 2,513          | 2,872          | 2,992          |
| 2"                 | 2.067      | 3.656 | 5.109                               | 30           | 2,303          | 2,632          | 2,742          |

|            |                          |              |
|------------|--------------------------|--------------|
| Project:   | Contractor:              | Date:        |
| Engineer:  | Specification Reference: | System Type: |
| Locations: | Comments:                |              |



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JMC STEEL GROUP

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## Wheatland ASTM A 53

www.wheatland.com

## Schedule 40 and ~~Schedule 80~~ Pipe

Wheatland Steel Pipe is made by specialists who understand that it's the small details that make the difference between average products and superior products. At the Wheatland Plant, most department heads and foremen have been employed in some phase of pipe manufacturing for 25 or more years.

This kind of specialization, experience and knowledge pays off...in workable, threadable, uniform pipe. Delivered clean. Delivered promptly.

Wheatland specializes in manufacturing welded steel pipe in 1/2 through 4 nominal sizes. Available inventory in 1/8 to 12 pipe sizes produced to various ASTM standards is maintained to meet your pipe requirements.

Care, pride and personal concern are bonus features that go into every inch of Wheatland Pipe. Don't settle for less.

***Make sure it's quality. Make sure it's Wheatland.***

### Standard Pipe Schedule 40 ASTM A 53 Grades A and B

| NPS Designator   | DN Designator | Outside Diameter |       | Inside Diameter |       | Wall Thickness |      | Nominal Weight (Mass) per unit Length |                  |                            |                           |
|--|---------------|------------------|-------|-----------------|-------|----------------|------|---------------------------------------|------------------|----------------------------|---------------------------|
|  |               | (Inches)         | (mm)  | (Inches)        | (mm)  | (Inches)       | (mm) | Plain End (lb/ft)                     | Plain End (kg/m) | Threads & Coupling (lb/ft) | Threads & Coupling (kg/m) |
| 1/8  | 6             | 0.405            | 10.3  | 0.269           | 6.8   | 0.068          | 1.73 | 0.24                                  | 0.37             | 0.25                       | 0.37                      |
| 1/4  | 8             | 0.540            | 13.7  | 0.364           | 9.2   | 0.088          | 2.24 | 0.43                                  | 0.63             | 0.43                       | 0.63                      |
| 3/8  | 10            | 0.675            | 17.1  | 0.493           | 12.5  | 0.091          | 2.31 | 0.57                                  | 0.84             | 0.57                       | 0.84                      |
| 1/2  | 15            | 0.840            | 21.3  | 0.622           | 15.8  | 0.109          | 2.77 | 0.85                                  | 1.27             | 0.86                       | 1.27                      |
| 3/4  | 20            | 1.050            | 26.7  | 0.824           | 20.9  | 0.113          | 2.87 | 1.13                                  | 1.69             | 1.14                       | 1.69                      |
| 1  | 25            | 1.315            | 33.4  | 1.049           | 26.6  | 0.133          | 3.38 | 1.68                                  | 2.50             | 1.69                       | 2.50                      |
| 1-1/4  | 32            | 1.660            | 42.2  | 1.380           | 35.1  | 0.140          | 3.56 | 2.27                                  | 3.39             | 2.28                       | 3.40                      |
| 1-1/2  | 40            | 1.900            | 48.3  | 1.610           | 40.9  | 0.145          | 3.68 | 2.72                                  | 4.05             | 2.74                       | 4.04                      |
| 2  | 50            | 2.375            | 60.3  | 2.067           | 52.5  | 0.154          | 3.91 | 3.66                                  | 5.44             | 3.68                       | 5.46                      |
| 2-1/2  | 65            | 2.875            | 73.0  | 2.469           | 62.7  | 0.203          | 5.16 | 5.80                                  | 8.63             | 5.85                       | 8.67                      |
| 3  | 80            | 3.500            | 88.9  | 3.068           | 77.9  | 0.216          | 5.49 | 7.58                                  | 11.29            | 7.68                       | 11.35                     |
| 3-1/2  | 90            | 4.000            | 101.6 | 3.548           | 90.1  | 0.226          | 5.74 | 9.12                                  | 13.57            | 9.27                       | 13.71                     |
| 4  | 100           | 4.500            | 114.3 | 4.026           | 102.3 | 0.237          | 6.02 | 10.80                                 | 16.07            | 10.92                      | 16.23                     |
| 5  | 125           | 5.563            | 141.3 | 5.047           | 158.2 | 0.258          | 6.55 | 14.63                                 | 21.77            | 14.90                      | 22.07                     |
| 6  | 150           | 6.625            | 168.3 | 6.065           | 154.1 | 0.280          | 7.11 | 18.99                                 | 28.26            | 19.34                      | 28.58                     |
| 8  | 200           | 8.625            | 219.1 | 7.981           | 202.7 | 0.322          | 8.18 | 28.58                                 | 42.55            | 29.35                      | 43.73                     |
| 10   | 250           | 10.750           | 273.0 | 10.020          | 254.5 | 0.365          | 9.27 | 40.52                                 | 60.29            | 41.49                      | 63.36                     |
| Standard Pipe  |               |                  |       |                 |       |                |      |                                       |                  |                            |                           |
| 12'  | 300           | 12.750           | 323.8 | 12.000          | 304.8 | 0.375          | 9.52 | 9.61                                  | 3.78             | 51.28                      | 76.21                     |
| Note <sup>1</sup> NPS 12 dimensions are for standard wall pipe, not schedule 40. |               |                  |       |                 |       |                |      |                                       |                  |                            |                           |

#### Product Type and Specification:

Standard welded pipe is produced in 1/2 to 6 trade sizes. Wheatland pipe is produced to ASTM A 53 Grades A and B, A 501, and A 589 Type II, API 5L and Federal Specification WW-P404. All pipe threads conform to ANSI B1.20.1. Merchant couplings comply with ASTM A 865.

Specifications and descriptions are accurate as known at time of publication and subject to change without notice.



## ~~Extra Heavy Pipe Schedule 80 ASTM A 53 Grade A~~

| NPS Designator | DN Designator | Outside Diameter |       | Inside Diameter |       | Wall Thickness |       | Nominal Weight (Mass) per unit Length |                  |                            |                           |
|----------------|---------------|------------------|-------|-----------------|-------|----------------|-------|---------------------------------------|------------------|----------------------------|---------------------------|
|                |               | (Inches)         | (mm)  | (Inches)        | (mm)  | (Inches)       | (mm)  | Plain End (lb/ft)                     | Plain End (kg/m) | Threads & Coupling (lb/ft) | Threads & Coupling (kg/m) |
| 1/8            | 6             | 0.405            | 10.3  | 0.215           | 5.5   | 0.095          | 2.41  | 0.31                                  | 0.47             | 0.32                       | 0.46                      |
| 1/4            | 8             | 0.540            | 13.7  | 0.302           | 7.7   | 0.119          | 3.02  | 0.54                                  | 0.80             | 0.54                       | 0.80                      |
| 3/8            | 10            | 0.675            | 17.1  | 0.423           | 10.7  | 0.126          | 3.20  | 0.74                                  | 1.10             | 0.74                       | 1.10                      |
| 1/2            | 15            | 0.840            | 21.3  | 0.549           | 13.9  | 0.147          | 3.73  | 1.09                                  | 1.62             | 1.09                       | 1.62                      |
| 3/4            | 20            | 1.050            | 26.7  | 0.742           | 18.8  | 0.154          | 3.91  | 1.48                                  | 2.20             | 1.48                       | 2.21                      |
| 1              | 25            | 1.315            | 33.4  | 0.957           | 24.3  | 0.179          | 4.55  | 2.17                                  | 3.24             | 2.19                       | 3.25                      |
| 1-1/4          | 32            | 1.660            | 42.2  | 1.278           | 32.5  | 0.191          | 4.85  | 3.00                                  | 4.47             | 3.03                       | 4.49                      |
| 1-1/2          | 40            | 1.900            | 48.3  | 1.500           | 38.1  | 0.200          | 5.08  | 3.63                                  | 5.41             | 3.65                       | 5.39                      |
| 2              | 50            | 2.375            | 60.3  | 1.939           | 49.3  | 0.218          | 5.54  | 5.03                                  | 7.48             | 5.08                       | 7.55                      |
| 2-1/2          | 65            | 2.875            | 73.0  | 2.323           | 59.0  | 0.276          | 7.01  | 7.67                                  | 11.41            | 7.75                       | 11.52                     |
| 3              | 80            | 3.500            | 88.9  | 2.900           | 73.7  | 0.300          | 7.62  | 10.26                                 | 15.27            | 10.35                      | 15.39                     |
| 3-1/2          | 90            | 4.000            | 101.6 | 3.364           | 85.4  | 0.318          | 8.08  | 12.52                                 | 18.63            | 12.67                      | 18.82                     |
| 4              | 100           | 4.500            | 114.3 | 3.826           | 97.2  | 0.337          | 8.56  | 15.00                                 | 22.32            | 15.20                      | 22.60                     |
| 5              | 125           | 5.563            | 141.3 | 4.813           | 122.3 | 0.375          | 9.52  | 20.80                                 | 30.94            | 21.04                      | 31.42                     |
| 6              | 150           | 6.625            | 168.3 | 5.761           | 146.3 | 0.432          | 10.97 | 28.60                                 | 42.56            | 28.88                      | 43.05                     |
| 8              | 200           | 8.625            | 219.1 | 7.625           | 193.7 | 0.500          | 12.70 | 43.43                                 | 64.64            | 44.00                      | 65.41                     |

| Permissible Variations for ASTM A 53 Grades A and B Pipe |                                |                  |                  |
|--|--------------------------------|------------------|------------------|
|  | O.D.                           | Over             | Under            |
| Outside Diameter   | NPS 1/8 to 1-1/2<br>DN 6 to 40 | 1/64"<br>(0.4mm) | 1/64"<br>(0.4mm) |
|  | NPS 2 and up<br>DN 50 and up   | 1%               | 1%               |
| Wall Thickness at Any Point                              |                                | -----            | 12.5%            |



**Black** and Galvanized Pipe is manufactured for ordinary use in steam, water, gas, and air lines. UL Listed and FM Approved, sizes 1" through 6" nominal, for use in Fire Sprinkler Pipe Applications.

Yield 30,000 [205 Mpa] psi minimum Tensile: 48,000 psi [330 Mpa] minimum  
: Yield 35,000 [240 Mpa] psi minimum Tensile: 60,000 psi [415 Mpa] minimum

For additional information or to order , contact our pipe department at 800.257.8182,  
Fax: 724.346.7260, e-mail info@wheatland.com

# **WARD MANUFACTURING**

## **PIPE FITTINGS CATALOG**



**MANUFACTURED IN BLOSSBURG, PENNSYLVANIA  
SOLD AROUND THE WORLD!**

## SECTION 6 STANDARD CAST IRON PIPE FITTINGS CLASS 125, 250



The iron from which Class 125 cast iron fittings are made is held to strict formula by careful chemical analysis and control.

Tapping is done on the most modern machines. All tappings are to USA Standards for iron pipe threads. Straightness and correct depth of threads is assured through continuous capable inspection, by careful trained inspectors.

Every fitting is hand sorted and inspected to eliminate defective castings.

WARD fittings are made to specifications published as American National Standards for pipe fittings.

A chamfer is cut or cast in all openings, permitting easy entrance of pipe and preventing damage to the first thread in handling and threading.

Because of the close attention paid to formula control and the use of modern precision equipment we are able to produce castings of rugged strength and the ability to make a water tight seal.

| NPS   | O.D. of Band (min) | Thread Length (min) | Metal Thickness (min) |
|-------|--------------------|---------------------|-----------------------|
| 1/4   | 0.97               | 0.36                | 0.11                  |
| 3/8   | 1.16               | 0.40                | 0.12                  |
| 1/2   | 1.38               | 0.47                | 0.13                  |
| 3/4   | 1.67               | 0.54                | 0.15                  |
| 1     | 1.99               | 0.62                | 0.17                  |
| 1 1/4 | 2.43               | 0.71                | 0.18                  |
| 1 1/2 | 2.72               | 0.74                | 0.20                  |
| 2     | 3.32               | 0.79                | 0.22                  |
| 2 1/2 | 3.90               | 0.96                | 0.24                  |
| 3     | 4.66               | 1.02                | 0.26                  |
| 3 1/2 | 5.24               | 1.07                | 0.28                  |
| 4     | 5.83               | 1.12                | 0.31                  |

### TEMPERATURE-PRESSURE RATING

| Temp F°    | PSI         |              |
|------------|-------------|--------------|
|            | CLASS 125   | CLASS 250    |
| -20 TO 150 | 175         | 400          |
| 200        | 165         | 370          |
| 250        | 150         | 340          |
| 300        | 140         | 310          |
| 350        | 125 (Note1) | 300          |
| 400        | —           | 250 (Note 2) |

Notes:

1) Permissible for service temperature up to 360° F reflecting temperature of saturated steam at 125 psi.

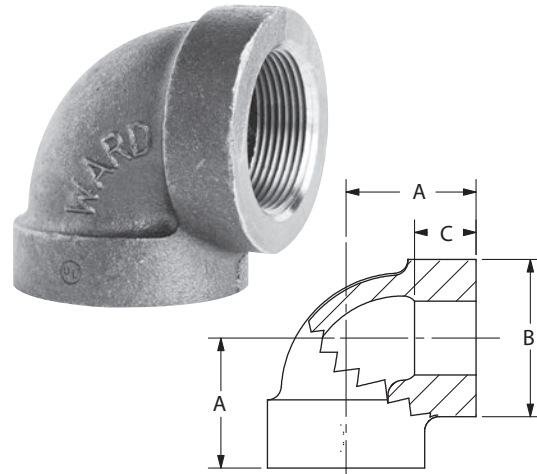
2) Permissible for service temperature up to 406° F reflecting temperature of saturated steam at 250 psig.

|                                   |  |
|-----------------------------------|--|
| <b>Material:</b>                  | ASTM A126 Class A Minimum                                  |
| <b>Dimensions:</b>                | ANSI/ASME B16.4<br>ANSI/ASME B1.20.1                       |
| <b>Pressure Ratings:</b>          | ANSI/ASME B16.4  |
| <b>Coatings:</b>                  | ASTM A153<br>ASTM B633                                     |
| <b>Additional Specifications:</b> | UL, ULC, FM, NSF 61 and<br>NSF 61 Annex G where applicable |



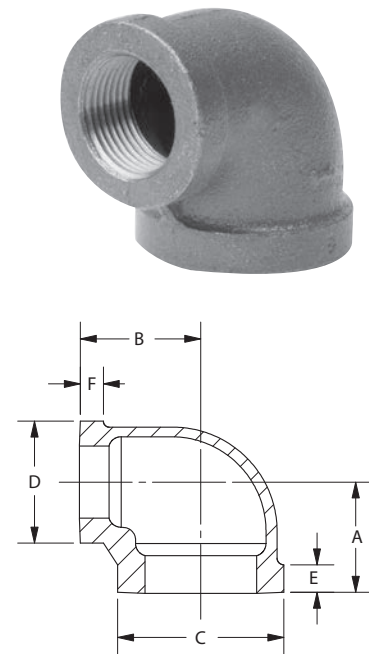
## CAST IRON 90° STRAIGHT ELL CLASS 125

| NPS   | Center to End A | Outside Dia. of Band B (min) | Thread Length C (min) | Take Out |
|-------|-----------------|------------------------------|-----------------------|----------|
| 1/4   | 0.81            | 0.93                         | 0.32                  | 0.408    |
| 3/8   | 0.95            | 1.12                         | 0.36                  | 0.5      |
| 1/2   | 1.12            | 1.34                         | 0.43                  | 0.58     |
| 3/4   | 1.31            | 1.63                         | 0.50                  | 0.76     |
| 1     | 1.50            | 1.95                         | 0.58                  | 0.81     |
| 1 1/4 | 1.75            | 2.39                         | 0.67                  | 1.04     |
| 1 1/2 | 1.94            | 2.68                         | 0.70                  | 1.21     |
| 2     | 2.25            | 3.28                         | 0.75                  | 1.49     |
| 2 1/2 | 2.70            | 3.86                         | 0.92                  | 1.56     |
| 3     | 3.08            | 4.62                         | 0.98                  | 1.88     |
| 3 1/2 | 3.42            | 5.20                         | 1.03                  | 2.17     |
| 4     | 3.79            | 5.79                         | 1.08                  | 2.49     |
| 5     | —               | —                            | —                     | —        |
| 6     | —               | —                            | —                     | —        |
| 8     | —               | —                            | —                     | —        |



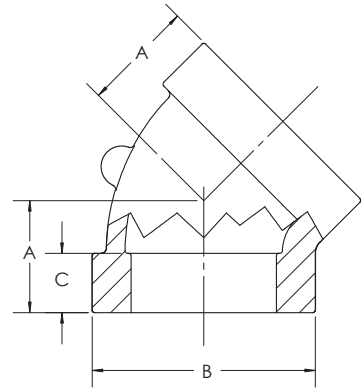
## CAST IRON 90° REDUCING ELL CLASS 125

| NPS           | Center to End A | Center to End B | Outside Dia. of Band C (min) | Outside Dia. of Band D (min) | Length of Threads E (min) | Length of Threads F (min) | Take Out | Take Out |
|---------------|-----------------|-----------------|------------------------------|------------------------------|---------------------------|---------------------------|----------|----------|
| 1/2 x 3/8     | —               | —               | —                            | —                            | —                         | —                         | —        | —        |
| 1/2 x 1/4     | —               | —               | —                            | —                            | —                         | —                         | —        | —        |
| 3/4 x 1/2     | 1.20            | 1.22            | 1.63                         | 1.34                         | 0.50                      | 0.43                      | 0.6      | 0.68     |
| *3/4 x 3/8    | 1.20            | 1.22            | 1.63                         | 1.12                         | 0.50                      | 0.36                      | 0.6      | 0.81     |
| 1 x 3/4       | 1.37            | 1.45            | 1.95                         | 1.63                         | 0.58                      | 0.50                      | 0.6      | 0.90     |
| 1 x 1/2       | 1.26            | 1.36            | 1.95                         | 1.34                         | 0.58                      | 0.43                      | 0.5      | 0.82     |
| 1 1/4 x 1     | 1.58            | 1.67            | 2.39                         | 1.95                         | 0.67                      | 0.58                      | 0.8      | 0.98     |
| 1 1/4 x 3/4   | 1.45            | 1.62            | 2.39                         | 1.63                         | 0.67                      | 0.50                      | 0.7      | 1.07     |
| 1 1/4 x 1/2   | 1.34            | 1.53            | 2.39                         | 1.34                         | 0.67                      | 0.43                      | 0.6      | 0.99     |
| 1 1/2 x 1 1/4 | 1.82            | 1.88            | 2.68                         | 2.39                         | 0.70                      | 0.67                      | 1.09     | 1.17     |
| 1 1/2 x 1     | 1.65            | 1.80            | 2.68                         | 1.95                         | 0.70                      | 0.58                      | 0.92     | 1.11     |
| 1 1/2 x 3/4   | 1.52            | 1.75            | 2.68                         | 1.63                         | 0.70                      | 0.50                      | 0.79     | 1.20     |
| 1 1/2 x 1/2   | 1.41            | 1.66            | 2.68                         | 1.34                         | 0.70                      | 0.43                      | 0.79     | 1.21     |
| 2 x 1 1/2     | 2.02            | 2.16            | 3.28                         | 2.68                         | 0.75                      | 0.70                      | 1.26     | 1.43     |
| 2 x 1 1/4     | 1.90            | 2.10            | 3.28                         | 2.39                         | 0.75                      | 0.67                      | 1.14     | 1.39     |
| 2 x 1         | 1.73            | 2.02            | 3.28                         | 1.95                         | 0.75                      | 0.58                      | 0.97     | 1.33     |
| 2 x 3/4       | 1.60            | 1.97            | 3.28                         | 1.63                         | 0.75                      | 0.50                      | 0.84     | 1.42     |
| 2 x 1/2       | 1.60            | 1.97            | 3.28                         | 1.34                         | 0.75                      | 0.43                      | 0.84     | 1.43     |
| 2 1/2 x 2     | 2.39            | 2.60            | 3.86                         | 3.28                         | 0.92                      | 0.75                      | 1.25     | 1.84     |
| 2 1/2 x 1 1/2 | 2.16            | 2.51            | 3.86                         | 2.68                         | 0.92                      | 0.70                      | 1.02     | 1.78     |
| 2 1/2 x 1 1/4 | 2.04            | 2.45            | 3.86                         | 2.39                         | 0.92                      | 0.67                      | 0.90     | 1.74     |
| 2 1/2 x 1     | 1.87            | 2.37            | 3.86                         | 1.95                         | 0.92                      | 0.58                      | 0.73     | 1.68     |
| *2 1/2 x 3/4  | 1.87            | 2.37            | 3.86                         | 1.63                         | 0.92                      | 0.50                      | 0.73     | 1.82     |
| 3 x 2 1/2     | 2.83            | 2.99            | 4.62                         | 3.86                         | 0.98                      | 0.92                      | 1.63     | 1.85     |
| 3 x 2         | 2.52            | 2.89            | 4.62                         | 3.28                         | 0.98                      | 0.75                      | 1.32     | 2.13     |
| 3 x 1 1/2     | 2.29            | 2.80            | 4.62                         | 2.68                         | 0.98                      | 0.70                      | 1.32     | 2.16     |
| 3 x 1 1/4     | 2.17            | 2.74            | 4.62                         | 2.39                         | 0.98                      | 0.67                      | 0.97     | 2.03     |
| *3 x 1        | 2.17            | 2.74            | 4.62                         | 1.95                         | 0.98                      | 0.58                      | 0.97     | 2.05     |
| 3 1/2 x 3     | —               | —               | —                            | —                            | —                         | —                         | —        | —        |
| 4 x 3 1/2     | 3.54            | 3.69            | 5.79                         | 5.20                         | 1.08                      | 1.03                      | 2.24     | 2.44     |
| 4 x 3         | 3.30            | 3.60            | 5.79                         | 4.62                         | 1.08                      | 0.98                      | 2.00     | 2.40     |
| 4 x 2 1/2     | 3.05            | 3.51            | 5.79                         | 3.86                         | 1.08                      | 0.92                      | 2.00     | 2.46     |
| 4 x 2         | 2.74            | 3.41            | 5.79                         | 3.28                         | 1.08                      | 0.75                      | 1.44     | 2.65     |
| *4 x 1 1/2    | 2.74            | 3.41            | 5.79                         | 2.68                         | 1.08                      | 0.70                      | 1.44     | 2.68     |
| 5 x 4         | —               | —               | —                            | —                            | —                         | —                         | —        | —        |
| 6 x 4         | —               | —               | —                            | —                            | —                         | —                         | —        | —        |
| 6 x 3         | —               | —               | —                            | —                            | —                         | —                         | —        | —        |



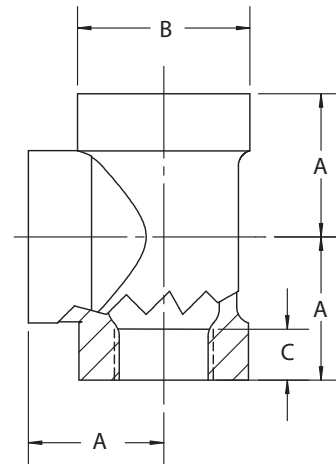
## CAST IRON 45° ELL CLASS 125

| NPS   | Center to End A | Outside Dia. of Band B (min) | Length of Threads C (min) | Take Out |
|-------|-----------------|------------------------------|---------------------------|----------|
| 1/4   | —               | —                            | —                         | —        |
| 3/8   | —               | —                            | —                         | —        |
| 1/2   | 0.88            | 1.34                         | 0.43                      | 0.34     |
| 3/4   | 0.98            | 1.63                         | 0.50                      | 0.43     |
| 1     | 1.12            | 1.95                         | 0.58                      | 0.43     |
| 1 1/4 | 1.29            | 2.39                         | 0.67                      | 0.58     |
| 1 1/2 | 1.43            | 2.68                         | 0.70                      | 0.70     |
| 2     | 1.68            | 3.28                         | 0.75                      | 0.92     |
| 2 1/2 | 1.95            | 3.86                         | 0.92                      | 0.81     |
| 3     | 2.17            | 4.62                         | 0.98                      | 0.97     |
| 3 1/2 | —               | —                            | —                         | —        |
| 4     | 2.61            | 5.79                         | 1.08                      | 1.31     |
| 5     | —               | —                            | —                         | —        |
| 6     | —               | —                            | —                         | —        |



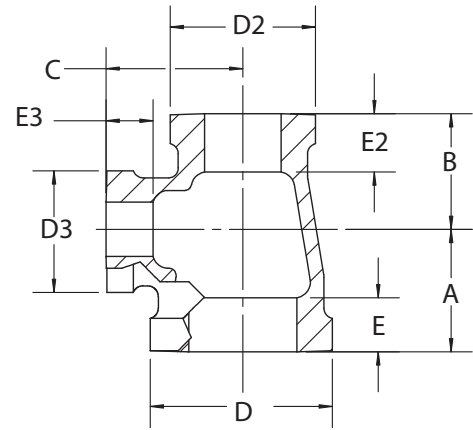
## CAST IRON STRAIGHT TEE CLASS 125

| NPS   | Center to End A | Outside Dia. of Band B (min) | Length of Threads C (min) | Take Out |
|-------|-----------------|------------------------------|---------------------------|----------|
| 1/4   | —               | —                            | —                         | —        |
| 3/8   | 0.95            | 1.12                         | 0.36                      | 0.54     |
| 1/2   | 1.12            | 1.34                         | 0.43                      | 0.58     |
| 3/4   | 1.31            | 1.63                         | 0.50                      | 0.76     |
| 1     | 1.50            | 1.95                         | 0.58                      | 0.81     |
| 1 1/4 | 1.75            | 2.39                         | 0.67                      | 1.04     |
| 1 1/2 | 1.94            | 2.68                         | 0.70                      | 1.21     |
| 2     | 2.25            | 3.28                         | 0.75                      | 1.49     |
| 2 1/2 | 2.70            | 3.86                         | 0.92                      | 1.56     |
| 3     | 3.08            | 4.62                         | 0.98                      | 1.88     |
| 3 1/2 | 3.42            | 5.20                         | 1.03                      | 2.17     |
| 4     | 3.79            | 5.79                         | 1.08                      | 2.49     |
| 5     | —               | —                            | —                         | —        |
| 6     | —               | —                            | —                         | —        |





## CAST IRON REDUCING TEES CLASS 125



| NPS                 | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|---------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|----------------------------|----------------------------|----------|----------|----------|
| 1/2 x 1/2 x 3/8     | 1.04            | 1.04            | 1.03            | 1.34                         | 1.34                          | 1.12                          | 0.43                      | 0.43                       | 0.36                       | 0.50     | 0.50     | 0.62     |
| 1/2 x 1/2 x 1/4     | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| *1/2 x 3/8 x 1/2    | 1.12            | 1.12            | 1.12            | 1.34                         | 1.12                          | 1.34                          | 0.43                      | 0.36                       | 0.43                       | 0.58     | 0.71     | 0.58     |
| *1/2 x 3/8 x 3/8    | 1.12            | 1.12            | 1.12            | 1.34                         | 1.12                          | 1.12                          | 0.43                      | 0.36                       | 0.36                       | 0.58     | 0.71     | 0.71     |
| *3/8 x 3/8 x 1/2    | 1.12            | 1.12            | 1.12            | 1.12                         | 1.12                          | 1.34                          | 0.36                      | 0.36                       | 0.43                       | 0.71     | 0.71     | 0.58     |
| 3/4 x 3/4 x 1/2     | 1.20            | 1.20            | 1.22            | 1.63                         | 1.63                          | 1.34                          | 0.50                      | 0.50                       | 0.43                       | 0.65     | 0.65     | 0.68     |
| 3/4 x 3/4 x 3/8     | 1.12            | 1.12            | 1.13            | 1.63                         | 1.63                          | 1.12                          | 0.50                      | 0.50                       | 0.36                       | 0.57     | 0.57     | 0.72     |
| 3/4 x 3/4 x 1/4     | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3/4 x 1/2 x 3/4     | 1.31            | 1.22            | 1.31            | 1.63                         | 1.34                          | 1.63                          | 0.50                      | 0.43                       | 0.50                       | 0.76     | 0.68     | 0.76     |
| 3/4 x 1/2 x 1/2     | 1.20            | 1.12            | 1.22            | 1.63                         | 1.34                          | 1.34                          | 0.50                      | 0.43                       | 0.43                       | 0.65     | 0.58     | 0.68     |
| 1/2 x 1/2 x 3/4     | 1.22            | 1.22            | 1.20            | 1.340                        | 1.340                         | 1.630                         | 0.430                     | 0.430                      | 0.500                      | 0.68     | 0.68     | 0.65     |
| 1 x 1 x 3/4         | 1.37            | 1.37            | 1.45            | 1.95                         | 1.95                          | 1.63                          | 0.58                      | 0.58                       | 0.50                       | 0.68     | 0.68     | 0.90     |
| 1 x 1 x 1/2         | 1.26            | 1.26            | 1.36            | 1.95                         | 1.95                          | 1.34                          | 0.58                      | 0.58                       | 0.43                       | 0.57     | 0.57     | 0.82     |
| 1 x 1 x 3/8         | 1.18            | 1.18            | 1.27            | 1.95                         | 1.95                          | 1.12                          | 0.58                      | 0.58                       | 0.36                       | 0.49     | 0.49     | 0.86     |
| 1 x 1 x 1/4         | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 1 x 3/4 x 1         | 1.50            | 1.45            | 1.50            | 1.95                         | 1.63                          | 1.95                          | 0.58                      | 0.50                       | 0.58                       | 0.81     | 0.90     | 0.81     |
| 1 x 3/4 x 3/4       | 1.37            | 1.31            | 1.45            | 1.95                         | 1.63                          | 1.63                          | 0.58                      | 0.50                       | 0.50                       | 0.68     | 0.76     | 0.90     |
| 1 x 3/4 x 1/2       | 1.26            | 1.20            | 1.36            | 1.95                         | 1.63                          | 1.34                          | 0.58                      | 0.50                       | 0.43                       | 0.57     | 0.65     | 0.82     |
| 1 x 1/2 x 1         | 1.50            | 1.36            | 1.50            | 1.95                         | 1.34                          | 1.95                          | 0.58                      | 0.43                       | 0.58                       | 0.81     | 0.82     | 0.81     |
| 1 x 1/2 x 3/4       | 1.37            | 1.22            | 1.45            | 1.95                         | 1.34                          | 1.63                          | 0.58                      | 0.43                       | 0.50                       | 0.68     | 0.68     | 0.90     |
| 1 x 1/2 x 1/2       | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 1 x 3/8 x 1         | 1.50            | 1.27            | 1.50            | 1.95                         | 1.12                          | 1.95                          | 0.58                      | 0.36                       | 0.58                       | 0.81     | 0.86     | 0.81     |
| *1 x 1/4 x 1        | 1.50            | 1.20            | 1.50            | 1.95                         | 0.93                          | 1.95                          | 0.58                      | 0.32                       | 0.58                       | 0.81     | 0.79     | 0.81     |
| 3/4 x 3/4 x 1       | 1.45            | 1.45            | 1.37            | 1.63                         | 1.63                          | 1.95                          | 0.50                      | 0.50                       | 0.58                       | 0.90     | 0.90     | 0.68     |
| *3/4 x 1/2 x 1      | 1.45            | 1.45            | 1.37            | 1.63                         | 1.34                          | 1.95                          | 0.50                      | 0.43                       | 0.58                       | 0.90     | 0.91     | 0.68     |
| 1/2 x 1/2 x 1       | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 1 1/4 x 1 1/4 x 1   | 1.58            | 1.58            | 1.67            | 2.39                         | 2.39                          | 1.95                          | 0.67                      | 0.67                       | 0.58                       | 0.87     | 0.87     | 0.98     |
| 1 1/4 x 1 1/4 x 3/4 | 1.45            | 1.45            | 1.62            | 2.39                         | 2.39                          | 1.63                          | 0.67                      | 0.67                       | 0.50                       | 0.74     | 0.74     | 1.07     |
| 1 1/4 x 1 1/4 x 1/2 | 1.34            | 1.34            | 1.53            | 2.39                         | 2.39                          | 1.34                          | 0.67                      | 0.67                       | 0.43                       | 0.63     | 0.63     | 0.99     |
| 1 1/4 x 1 1/4 x 1/8 | ---             | ---             | ---             | ---                          | ---                           | ---                           | ---                       | ---                        | ---                        | ---      | ---      | ---      |
| 1 1/4 x 1 x 1 1/4   | 1.75            | 1.67            | 1.75            | 2.39                         | 1.95                          | 2.39                          | 0.67                      | 0.58                       | 0.67                       | 1.04     | 0.98     | 1.04     |
| 1 1/4 x 1 x 1       | 1.58            | 1.50            | 1.67            | 2.39                         | 1.95                          | 1.95                          | 0.67                      | 0.58                       | 0.58                       | 0.87     | 0.81     | 0.98     |
| 1 1/4 x 1 x 3/4     | 1.45            | 1.37            | 1.62            | 2.39                         | 1.95                          | 1.63                          | 0.67                      | 0.58                       | 0.50                       | 0.74     | 0.68     | 1.07     |

\* Manufactured to WARD specifications

## CAST IRON REDUCING TEE CLASS 125

| NPS                   | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|-----------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|----------------------------|----------------------------|----------|----------|----------|
| 1 1/4 x 1 x 1/2       | 1.34            | 1.26            | 1.53            | 2.39                         | 1.95                          | 1.34                          | 0.67                      | 0.58                       | 0.43                       | 0.63     | 0.57     | 0.99     |
| 1 1/4 x 3/4 x 1 1/4   | 1.75            | 1.62            | 1.75            | 2.39                         | 1.63                          | 2.39                          | 0.67                      | 0.50                       | 0.67                       | 1.04     | 1.07     | 1.04     |
| 1 1/4 x 3/4 x 1       | 1.58            | 1.45            | 1.67            | 2.39                         | 1.63                          | 1.95                          | 0.67                      | 0.50                       | 0.58                       | 0.87     | 0.90     | 0.98     |
| 1 1/4 x 3/4 x 3/4     | 1.45            | 1.31            | 1.62            | 2.39                         | 1.63                          | 1.63                          | 0.67                      | 0.50                       | 0.50                       | 0.74     | 0.76     | 1.07     |
| *1 1/4 x 3/4 x 1/2    | 1.45            | 1.31            | 1.62            | 2.39                         | 1.63                          | 1.34                          | 0.67                      | 0.50                       | 0.43                       | 0.74     | 0.76     | 1.08     |
| 1 1/4 x 1/2 x 1 1/4   | 1.75            | 1.53            | 1.75            | 2.39                         | 1.34                          | 2.39                          | 0.67                      | 0.43                       | 0.67                       | 1.04     | 0.99     | 1.04     |
| 1 1/4 x 1/2 x 1       | 1.58            | 1.36            | 1.67            | 2.39                         | 1.34                          | 1.95                          | 0.67                      | 0.43                       | 0.58                       | 0.87     | 0.82     | 0.98     |
| *1 1/4 x 1/2 x 3/4    | 1.45            | 1.31            | 1.62            | 2.39                         | 1.34                          | 1.63                          | 0.67                      | 0.43                       | 0.50                       | 0.74     | 0.77     | 1.07     |
| *1 1/4 x 1/2 x 1/2    | 1.34            | 1.12            | 1.53            | 2.39                         | 1.34                          | 1.34                          | 0.67                      | 0.43                       | 0.43                       | 0.63     | 0.58     | 0.99     |
| *1 1/4 x 1/2 x 3/8    | 1.58            | 1.45            | 1.45            | 2.39                         | 1.34                          | 1.12                          | 0.67                      | 0.43                       | 0.36                       | 0.87     | 0.91     | 1.04     |
| *1 1/4 x 1/4 x 1 1/4  | 1.75            | 1.53            | 1.75            | 2.39                         | 0.93                          | 2.39                          | 0.67                      | 0.32                       | 0.67                       | 1.04     | 1.12     | 1.04     |
| *1 1/4 x 1/8 x 1 1/4  | 1.75            | 1.53            | 1.75            | 2.39                         | 0.81                          | 2.39                          | 0.67                      | 0.32                       | 0.67                       | 1.04     | 1.26     | 1.04     |
| 1 x 1 x 1 1/4         | 1.67            | 1.67            | 1.58            | 1.95                         | 1.95                          | 2.39                          | 0.58                      | 0.58                       | 0.67                       | 0.98     | 0.98     | 0.87     |
| *1 x 3/4 x 1 1/4      | 1.75            | 1.62            | 1.75            | 1.95                         | 1.63                          | 2.39                          | 0.58                      | 0.50                       | 0.67                       | 1.06     | 1.07     | 1.04     |
| *1 x 1/2 x 1 1/4      | 1.75            | 1.53            | 1.75            | 1.95                         | 1.34                          | 2.39                          | 0.58                      | 0.43                       | 0.67                       | 1.06     | 0.99     | 1.04     |
| 1 1/2 x 1 1/2 x 1 1/4 | 1.82            | 1.82            | 1.88            | 2.68                         | 2.68                          | 2.39                          | 0.70                      | 0.70                       | 0.67                       | 1.09     | 1.09     | 1.17     |
| 1 1/2 x 1 1/2 x 1     | 1.65            | 1.65            | 1.80            | 2.68                         | 2.68                          | 1.95                          | 0.70                      | 0.70                       | 0.58                       | 0.92     | 0.92     | 1.11     |
| 1 1/2 x 1 1/2 x 3/4   | 1.52            | 1.52            | 1.75            | 2.68                         | 2.68                          | 1.63                          | 0.70                      | 0.70                       | 0.50                       | 0.79     | 0.79     | 1.20     |
| 1 1/2 x 1 1/2 x 1/2   | 1.41            | 1.41            | 1.66            | 2.68                         | 2.68                          | 1.34                          | 0.70                      | 0.70                       | 0.43                       | 0.68     | 0.68     | 1.12     |
| 1 1/2 x 1 1/2 x 3/8   | 1.41            | 1.41            | 1.66            | 2.68                         | 2.68                          | 1.12                          | 0.70                      | 0.70                       | 0.36                       | 0.68     | 0.68     | 1.25     |
| 1 1/2 x 1 1/4 x 1 1/2 | 1.94            | 1.88            | 1.94            | 2.68                         | 2.39                          | 2.68                          | 0.70                      | 0.67                       | 0.70                       | 1.21     | 1.17     | 1.21     |
| 1 1/2 x 1 1/4 x 1 1/4 | 1.82            | 1.75            | 1.88            | 2.68                         | 2.39                          | 2.39                          | 0.70                      | 0.67                       | 0.67                       | 1.09     | 1.04     | 1.17     |
| 1 1/2 x 1 1/4 x 1     | 1.65            | 1.58            | 1.80            | 2.68                         | 2.39                          | 1.95                          | 0.70                      | 0.67                       | 0.58                       | 0.92     | 0.87     | 1.11     |
| 1 1/2 x 1 1/4 x 3/4   | 1.52            | 1.45            | 1.75            | 2.68                         | 2.39                          | 1.63                          | 0.70                      | 0.67                       | 0.50                       | 0.79     | 0.74     | 1.20     |
| 1 1/2 x 1 1/4 x 1/2   | 1.41            | 1.34            | 1.66            | 2.68                         | 2.39                          | 1.34                          | 0.70                      | 0.67                       | 0.43                       | 0.68     | 0.63     | 1.12     |
| 1 1/2 x 1 x 1 1/2     | 1.94            | 1.80            | 1.94            | 2.68                         | 1.95                          | 2.68                          | 0.70                      | 0.58                       | 0.70                       | 1.21     | 1.11     | 1.21     |
| 1 1/2 x 1 x 1 1/4     | 1.94            | 1.80            | 1.94            | 2.68                         | 1.95                          | 2.39                          | 0.70                      | 0.58                       | 0.67                       | 1.21     | 1.11     | 1.23     |
| 1 1/2 x 1 x 1         | 1.65            | 1.50            | 1.80            | 2.68                         | 1.95                          | 1.95                          | 0.70                      | 0.58                       | 0.58                       | 0.92     | 0.81     | 1.11     |
| *1 1/2 x 1 x 3/4      | 1.65            | 1.50            | 1.80            | 2.68                         | 1.95                          | 1.63                          | 0.70                      | 0.58                       | 0.50                       | 0.92     | 0.81     | 1.25     |
| *1 1/2 x 1 x 1/2      | 1.41            | 1.34            | 1.66            | 2.68                         | 1.95                          | 1.34                          | 0.70                      | 0.58                       | 0.43                       | 0.68     | 0.65     | 1.12     |
| 1 1/2 x 3/4 x 1 1/2   | 1.94            | 1.75            | 1.94            | 2.68                         | 1.63                          | 2.68                          | 0.70                      | 0.50                       | 0.70                       | 1.21     | 1.20     | 1.21     |
| 1 1/2 x 3/4 x 1 1/4   | 1.82            | 1.62            | 1.88            | 2.68                         | 1.63                          | 2.39                          | 0.70                      | 0.50                       | 1.09                       | 1.21     | 1.07     | 1.17     |
| *1 1/2 x 3/4 x 1      | 1.65            | 1.50            | 1.80            | 2.68                         | 1.63                          | 1.95                          | 0.70                      | 0.50                       | 0.58                       | 0.92     | 0.95     | 1.11     |
| *1 1/2 x 3/4 x 3/4    | 1.65            | 1.50            | 1.80            | 2.68                         | 1.63                          | 1.63                          | 0.70                      | 0.50                       | 0.50                       | 0.92     | 0.95     | 1.25     |
| *1 1/2 x 3/4 x 1/2    | 1.52            | 1.37            | 1.80            | 2.68                         | 1.63                          | 1.34                          | 0.70                      | 0.50                       | 0.43                       | 0.80     | 0.82     | 1.26     |
| 1 1/2 x 1/2 x 1 1/2   | 1.94            | 1.66            | 1.94            | 2.68                         | 1.34                          | 2.68                          | 0.70                      | 0.43                       | 0.70                       | 1.21     | 1.12     | 1.21     |
| *1 1/2 x 1/2 x 1 1/4  | 1.94            | 1.66            | 1.94            | 2.68                         | 1.34                          | 2.39                          | 0.70                      | 0.43                       | 0.67                       | 1.21     | 1.12     | 1.23     |
| *1 1/2 x 1/2 x 3/4    | 1.52            | 1.37            | 1.80            | 2.68                         | 1.34                          | 1.63                          | 0.70                      | 0.43                       | 0.50                       | 0.80     | 0.84     | 1.25     |
| *1 1/2 x 1/2 x 1/2    | 1.52            | 1.37            | 1.80            | 2.68                         | 1.34                          | 1.34                          | 0.70                      | 0.43                       | 0.43                       | 0.80     | 0.84     | 1.26     |
| 1 1/4 x 1 1/4 x 1 1/2 | 1.88            | 1.88            | 1.82            | 2.39                         | 2.39                          | 2.68                          | 0.67                      | 0.67                       | 0.70                       | 1.17     | 1.17     | 1.09     |
| 1 1/4 x 1 x 1 1/2     | 1.88            | 1.80            | 1.82            | 2.39                         | 1.95                          | 2.68                          | 0.67                      | 0.58                       | 0.70                       | 1.17     | 1.11     | 1.09     |
| *1 1/4 x 3/4 x 1 1/2  | 1.94            | 1.75            | 1.94            | 2.39                         | 1.63                          | 2.68                          | 0.67                      | 0.50                       | 0.70                       | 1.23     | 1.20     | 1.21     |
| *1 1/4 x 1/2 x 1 1/2  | 1.94            | 1.66            | 1.94            | 2.39                         | 1.34                          | 2.68                          | 0.67                      | 0.43                       | 0.70                       | 1.23     | 1.12     | 1.21     |

\* Manufactured to WARD specifications

# CAST IRON REDUCING TEE CLASS 125

| NPS                   | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (Min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|-----------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|----------------------------|----------------------------|----------|----------|----------|
| 1 x 1 x 1 1/2         | 1.80            | 1.80            | 1.65            | 1.95                         | 1.95                          | 2.68                          | 0.58                      | 0.58                       | 0.70                       | 1.11     | 1.11     | 0.92     |
| 2 x 2 x 1 1/2         | 2.02            | 2.02            | 2.16            | 3.28                         | 3.28                          | 2.68                          | 0.75                      | 0.75                       | 0.70                       | 1.26     | 1.26     | 1.43     |
| 2 x 2 x 1 1/4         | 1.90            | 1.90            | 2.10            | 3.28                         | 3.28                          | 2.39                          | 0.75                      | 0.75                       | 0.67                       | 1.14     | 1.14     | 1.39     |
| 2 x 2 x 1             | 1.73            | 1.73            | 2.02            | 3.28                         | 3.28                          | 1.95                          | 0.75                      | 0.75                       | 0.58                       | 0.97     | 0.97     | 1.33     |
| 2 x 2 x 3/4           | 1.60            | 1.60            | 1.97            | 3.28                         | 3.28                          | 1.63                          | 0.75                      | 0.75                       | 0.50                       | 0.84     | 0.84     | 1.42     |
| 2 x 2 x 1/2           | 1.49            | 1.49            | 1.88            | 3.28                         | 3.28                          | 1.34                          | 0.75                      | 0.75                       | 0.43                       | 0.73     | 0.73     | 1.34     |
| 2 x 1 1/2 x 2         | 2.25            | 2.16            | 2.25            | 3.28                         | 2.68                          | 3.28                          | 0.75                      | 0.70                       | 0.75                       | 1.49     | 1.43     | 1.49     |
| 2 x 1 1/2 x 1 1/2     | 2.02            | 1.94            | 2.16            | 3.28                         | 2.68                          | 2.68                          | 0.75                      | 0.70                       | 0.70                       | 1.26     | 1.21     | 1.43     |
| 2 x 1 1/2 x 1 1/4     | 2.02            | 1.94            | 2.16            | 3.28                         | 2.68                          | 2.39                          | 0.75                      | 0.70                       | 0.67                       | 1.26     | 1.21     | 1.45     |
| 2 x 1 1/2 x 1         | 1.73            | 1.65            | 2.02            | 3.28                         | 2.68                          | 1.95                          | 0.75                      | 0.70                       | 0.58                       | 0.97     | 0.92     | 1.33     |
| 2 x 1 1/2 x 3/4       | 1.60            | 1.52            | 1.97            | 3.28                         | 2.68                          | 1.63                          | 0.75                      | 0.70                       | 0.50                       | 0.84     | 0.79     | 1.42     |
| 2 x 1 1/2 x 1/2       | 1.49            | 1.41            | 1.88            | 3.28                         | 2.68                          | 1.34                          | 0.75                      | 0.70                       | 0.43                       | 0.73     | 0.68     | 1.34     |
| 2 x 1 1/4 x 2         | 2.25            | 2.10            | 2.25            | 3.28                         | 2.39                          | 3.28                          | 0.75                      | 0.67                       | 0.75                       | 1.49     | 1.39     | 1.49     |
| 2 x 1 1/4 x 1 1/2     | 1.02            | 1.88            | 2.16            | 3.28                         | 2.39                          | 2.68                          | 0.75                      | 0.67                       | 0.70                       | 0.26     | 1.17     | 1.43     |
| 2 x 1 1/4 x 1 1/4     | 1.90            | 1.75            | 2.10            | 3.28                         | 2.39                          | 2.39                          | 0.75                      | 0.67                       | 0.67                       | 1.14     | 1.04     | 1.39     |
| 2 x 1 1/4 x 1         | 1.73            | 1.58            | 2.02            | 3.28                         | 2.39                          | 1.95                          | 0.75                      | 0.67                       | 0.58                       | 0.97     | 0.87     | 1.33     |
| 2 x 1 1/4 x 3/4       | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| *2 x 1 1/4 x 1/2      | 1.49            | 1.41            | 1.88            | 3.28                         | 2.39                          | 1.34                          | 0.75                      | 0.67                       | 0.43                       | 0.73     | 0.70     | 1.34     |
| 2 x 1 x 2             | 2.25            | 2.02            | 2.25            | 3.28                         | 1.95                          | 3.28                          | 0.75                      | 0.58                       | 0.75                       | 1.49     | 1.33     | 1.49     |
| 2 x 1 x 1 1/2         | 2.02            | 1.80            | 2.16            | 3.28                         | 1.95                          | 2.68                          | 0.75                      | 0.58                       | 0.70                       | 1.26     | 1.11     | 1.43     |
| 2 x 1 x 1 1/4         | 1.90            | 1.67            | 2.10            | 3.28                         | 1.95                          | 2.39                          | 0.75                      | 0.58                       | 0.67                       | 1.14     | 0.98     | 1.39     |
| *2 x 1 x 1            | 1.73            | 1.94            | 2.02            | 3.28                         | 1.95                          | 1.95                          | 0.75                      | 0.58                       | 0.58                       | 0.97     | 1.25     | 1.33     |
| *2 x 1 x 3/4          | 1.73            | 1.94            | 2.02            | 3.28                         | 1.95                          | 1.63                          | 0.75                      | 0.58                       | 0.50                       | 0.97     | 1.25     | 1.47     |
| 2 x 3/4 x 2           | 2.25            | 1.97            | 2.25            | 3.28                         | 1.63                          | 3.28                          | 0.75                      | 0.50                       | 0.75                       | 1.49     | 1.42     | 1.49     |
| *2 x 3/4 x 1 1/2      | 2.25            | 1.97            | 2.25            | 3.28                         | 1.63                          | 2.68                          | 0.75                      | 0.50                       | 0.70                       | 1.49     | 1.42     | 1.52     |
| *2 x 3/4 x 1 1/4      | 2.25            | 1.97            | 2.25            | 3.28                         | 1.63                          | 2.39                          | 0.75                      | 0.50                       | 0.67                       | 1.49     | 1.42     | 1.54     |
| *2 x 3/4 x 1          | 1.73            | 1.94            | 2.02            | 3.28                         | 1.63                          | 1.95                          | 0.75                      | 0.50                       | 0.58                       | 0.97     | 1.39     | 1.33     |
| *2 x 3/4 x 3/4        | 1.60            | 1.60            | 1.97            | 3.28                         | 1.63                          | 1.63                          | 0.75                      | 0.50                       | 0.50                       | 0.84     | 1.05     | 1.42     |
| *2 x 3/4 x 1/2        | 1.60            | 1.60            | 1.97            | 3.28                         | 1.63                          | 1.34                          | 0.75                      | 0.50                       | 0.43                       | 0.84     | 1.05     | 1.43     |
| 2 x 1/2 x 2           | 2.25            | 1.88            | 2.25            | 3.28                         | 1.34                          | 3.280                         | 0.75                      | 0.43                       | 0.75                       | 1.49     | 1.34     | 1.49     |
| *2 x 1/2 x 1 1/2      | 2.02            | 1.66            | 2.16            | 3.28                         | 1.34                          | 2.68                          | 0.75                      | 0.43                       | 0.70                       | 1.26     | 1.12     | 1.43     |
| *2 x 1/2 x 1 1/4      | 2.02            | 1.66            | 2.16            | 3.28                         | 1.34                          | 2.39                          | 0.75                      | 0.43                       | 0.67                       | 1.26     | 1.12     | 1.45     |
| *2 x 1/2 x 3/4        | 1.60            | 1.60            | 1.97            | 3.28                         | 1.34                          | 1.63                          | 0.75                      | 0.43                       | 0.50                       | 0.84     | 1.06     | 1.42     |
| *2 x 1/2 x 1/2        | 1.60            | 1.60            | 1.97            | 3.28                         | 1.34                          | 1.34                          | 0.75                      | 0.43                       | 0.43                       | 0.84     | 1.06     | 1.43     |
| 1 1/2 x 1 1/2 x 2     | 2.16            | 2.16            | 2.02            | 2.68                         | 2.68                          | 3.28                          | 0.70                      | 0.70                       | 0.75                       | 1.43     | 1.43     | 1.26     |
| 1 1/2 x 1 1/4 x 2     | 2.16            | 2.10            | 2.02            | 2.68                         | 2.39                          | 3.28                          | 0.70                      | 0.67                       | 0.75                       | 1.43     | 1.39     | 1.26     |
| 1 1/2 x 1 x 2         | 2.16            | 2.02            | 2.02            | 2.68                         | 1.95                          | 3.28                          | 0.70                      | 0.58                       | 0.75                       | 1.43     | 1.33     | 1.26     |
| 1 1/4 x 1 1/4 x 2     | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 1 1/4 x 1 x 2         | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 1 x 1 x 2             | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 2 1/2 x 2 1/2 x 2     | 2.39            | 2.39            | 2.60            | 3.86                         | 3.86                          | 3.28                          | 0.92                      | 0.92                       | 0.75                       | 1.25     | 1.25     | 1.84     |
| 2 1/2 x 2 1/2 x 1 1/2 | 2.16            | 2.16            | 2.51            | 3.86                         | 3.86                          | 2.68                          | 0.92                      | 0.92                       | 0.70                       | 1.02     | 1.02     | 1.78     |

\* Manufactured to WARD specifications

## CAST IRON REDUCING TEE CLASS 125

| NPS                    | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (Min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min)) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|------------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|-----------------------------|----------------------------|----------|----------|----------|
| 2 1/2 x 2 1/2 x 1 1/4  | 2.04            | 2.04            | 2.45            | 3.86                         | 3.86                          | 2.39                          | 0.92                      | 0.92                        | 0.67                       | 0.90     | 0.90     | 1.74     |
| 2 1/2 x 2 1/2 x 1      | 1.87            | 1.87            | 2.37            | 3.86                         | 3.86                          | 1.95                          | 0.92                      | 0.92                        | 0.58                       | 0.73     | 0.73     | 1.68     |
| 2 1/2 x 2 1/2 x 3/4    | 1.87            | 1.87            | 2.32            | 3.86                         | 3.86                          | 1.63                          | 0.92                      | 0.92                        | 0.50                       | 0.73     | 0.73     | 1.77     |
| 2 1/2 x 2 1/2 x 1/2    | 1.87            | 1.87            | 2.23            | 3.86                         | 3.86                          | 1.34                          | 0.92                      | 0.92                        | 0.43                       | 0.73     | 0.73     | 1.69     |
| 2 1/2 x 2 x 2 1/2      | 2.70            | 2.60            | 2.70            | 3.86                         | 3.28                          | 3.86                          | 0.92                      | 0.75                        | 0.92                       | 1.56     | 1.84     | 1.56     |
| 2 1/2 x 2 x 2          | 2.39            | 2.25            | 2.60            | 3.86                         | 3.28                          | 3.28                          | 0.92                      | 0.75                        | 0.75                       | 1.25     | 1.49     | 1.84     |
| 2 1/2 x 2 x 1 1/2      | 2.16            | 2.02            | 2.51            | 3.86                         | 3.28                          | 2.68                          | 0.92                      | 0.75                        | 0.70                       | 1.02     | 1.26     | 1.78     |
| 2 1/2 x 2 x 1 1/4      | 2.04            | 1.90            | 2.45            | 3.86                         | 3.28                          | 2.39                          | 0.92                      | 0.75                        | 0.67                       | 0.90     | 1.14     | 1.74     |
| 2 1/2 x 2 x 1          | 1.87            | 1.73            | 2.37            | 3.86                         | 3.28                          | 1.95                          | 0.92                      | 0.75                        | 0.58                       | 0.73     | 0.97     | 1.68     |
| 2 1/2 x 2 x 3/4        | 1.74            | 1.60            | 2.32            | 3.86                         | 3.28                          | 1.63                          | 0.92                      | 0.75                        | 0.50                       | 0.60     | 0.84     | 1.77     |
| 2 1/2 x 2 x 1/2        | 1.63            | 1.49            | 2.23            | 3.86                         | 3.28                          | 1.34                          | 0.92                      | 0.75                        | 0.43                       | 0.49     | 0.73     | 1.696    |
| 2 1/2 x 1 1/2 x 2 1/2  | 2.70            | 2.51            | 2.70            | 3.86                         | 2.68                          | 3.86                          | 0.92                      | 0.70                        | 0.92                       | 1.56     | 1.78     | 1.563    |
| 2 1/2 x 1 1/2 x 2      | 2.39            | 2.16            | 2.60            | 3.86                         | 2.68                          | 3.28                          | 0.92                      | 0.70                        | 0.75                       | 1.25     | 1.43     | 1.84     |
| 2 1/2 x 1 1/2 x 1 1/2  | 2.16            | 1.94            | 2.51            | 3.86                         | 2.68                          | 2.68                          | 0.92                      | 0.70                        | 0.70                       | 1.02     | 1.21     | 1.786    |
| *2 1/2 x 1 1/2 x 1 1/4 | 2.04            | 1.90            | 2.45            | 3.86                         | 2.68                          | 2.39                          | 0.92                      | 0.70                        | 0.67                       | 0.90     | 1.17     | 1.743    |
| *2 1/2 x 1 1/2 x 1/2   | 1.63            | 1.49            | 2.23            | 3.86                         | 2.68                          | 1.34                          | 0.92                      | 0.70                        | 0.43                       | 0.49     | 0.76     | 1.696    |
| 2 1/2 x 1 1/4 x 2 1/2  | 2.70            | 2.45            | 2.70            | 3.86                         | 2.39                          | 3.86                          | 0.92                      | 0.67                        | 0.92                       | 1.56     | 1.74     | 1.563    |
| 2 1/2 x 1 1/4 x 2      | 2.70            | 2.45            | 2.70            | 3.86                         | 2.39                          | 3.28                          | 0.92                      | 0.67                        | 0.75                       | 1.56     | 1.74     | 1.94     |
| *2 1/2 x 1 1/4 x 1 1/2 | 2.16            | 1.94            | 2.51            | 3.86                         | 2.39                          | 2.68                          | 0.92                      | 0.67                        | 0.70                       | 1.02     | 1.23     | 1.78     |
| *2 1/2 x 1 1/4 x 1 1/4 | 2.04            | 1.90            | 2.45            | 3.86                         | 2.39                          | 2.39                          | 0.92                      | 0.67                        | 0.67                       | 0.90     | 1.19     | 1.74     |
| *2 1/2 x 1 1/4 x 1     | 2.14            | 2.12            | 2.51            | 3.86                         | 2.39                          | 1.95                          | 0.92                      | 0.67                        | 0.58                       | 1.00     | 1.41     | 1.82     |
| 2 1/2 x 1 x 2 1/2      | 2.70            | 2.37            | 2.70            | 3.86                         | 1.95                          | 3.86                          | 0.92                      | 0.58                        | 0.92                       | 1.56     | 1.68     | 1.56     |
| 2 1/2 x 1 x 2          | 2.39            | 2.02            | 2.60            | 3.86                         | 1.95                          | 3.28                          | 0.92                      | 0.58                        | 0.75                       | 1.25     | 1.33     | 1.84     |
| *2 1/2 x 1 x 1 1/4     | 2.14            | 2.12            | 2.51            | 3.86                         | 1.95                          | 2.39                          | 0.92                      | 0.58                        | 0.67                       | 1.00     | 1.43     | 1.80     |
| *2 1/2 x 1 x 1         | 1.94            | 1.75            | 2.37            | 3.86                         | 1.95                          | 1.95                          | 0.92                      | 0.58                        | 0.58                       | 0.80     | 1.06     | 1.68     |
| *2 1/2 x 1 x 3/4       | 1.94            | 1.75            | 2.37            | 3.86                         | 1.95                          | 1.63                          | 0.92                      | 0.58                        | 0.50                       | 0.80     | 1.06     | 1.82     |
| 2 1/2 x 3/4 x 2 1/2    | 2.70            | 2.32            | 2.70            | 3.86                         | 1.63                          | 3.86                          | 0.92                      | 0.50                        | 0.92                       | 1.56     | 1.77     | 1.56     |
| *2 1/2 x 3/4 x 2       | 2.70            | 2.32            | 2.70            | 3.86                         | 1.63                          | 3.28                          | 0.92                      | 0.50                        | 0.75                       | 1.56     | 1.77     | 1.94     |
| *2 1/2 x 3/4 x 3/4     | 1.94            | 1.75            | 2.37            | 3.86                         | 1.63                          | 1.63                          | 0.92                      | 0.50                        | 0.50                       | 0.80     | 1.20     | 1.82     |
| 2 1/2 x 1/2 x 2 1/2    | 2.70            | 2.23            | 2.70            | 3.86                         | 1.34                          | 3.86                          | 0.92                      | 0.43                        | 0.92                       | 1.56     | 1.69     | 1.56     |
| *2 1/2 x 1/2 X 2       | 2.70            | 2.60            | 2.70            | 3.86                         | 1.34                          | 3.28                          | 0.92                      | 0.43                        | 0.75                       | 1.56     | 2.06     | 1.94     |
| 2 x 2 x 2 1/2          | 2.60            | 2.60            | 2.39            | 3.28                         | 3.28                          | 3.86                          | 0.75                      | 0.75                        | 0.92                       | 1.84     | 1.46     | 1.25     |
| 2 x 1 1/2 x 2 1/2      | 2.60            | 2.51            | 2.39            | 3.28                         | 2.68                          | 3.86                          | 0.75                      | 0.70                        | 0.92                       | 1.84     | 1.78     | 1.25     |
| 2 x 1 1/4 x 2 1/2      | 2.60            | 2.45            | 2.39            | 3.28                         | 2.39                          | 3.86                          | 0.75                      | 0.67                        | 0.92                       | 1.84     | 1.74     | 1.25     |
| *2 x 1 x 2 1/2         | 2.70            | 2.45            | 2.70            | 3.28                         | 1.95                          | 3.86                          | 0.75                      | 0.58                        | 0.92                       | 1.94     | 1.76     | 1.56     |
| *2 x 3/4 x 2 1/2       | 2.70            | 2.32            | 2.70            | 3.28                         | 1.63                          | 3.86                          | 0.75                      | 0.50                        | 0.92                       | 1.94     | 1.77     | 1.56     |
| 1 1/2 x 1 1/2 x 2 1/2  | 2.51            | 2.51            | 2.16            | 2.68                         | 2.68                          | 3.86                          | 0.70                      | 0.70                        | 0.92                       | 1.78     | 1.78     | 1.02     |
| 3 x 3 x 2 1/2          | 2.83            | 2.83            | 2.99            | 4.62                         | 4.62                          | 3.86                          | 0.98                      | 0.98                        | 0.92                       | 1.63     | 1.63     | 1.85     |
| 3 x 3 x 2              | 2.52            | 2.52            | 2.89            | 4.62                         | 4.62                          | 3.28                          | 0.98                      | 0.98                        | 0.75                       | 1.32     | 1.32     | 2.13     |
| 3 x 3 x 1 1/2          | 2.29            | 2.29            | 2.80            | 4.62                         | 4.62                          | 2.68                          | 0.98                      | 0.98                        | 0.70                       | 1.09     | 1.09     | 2.07     |
| 3 x 3 x 1 1/4          | 2.17            | 2.17            | 2.74            | 4.62                         | 4.62                          | 2.39                          | 0.98                      | 0.98                        | 0.67                       | 0.97     | 0.97     | 2.03     |
| 3 x 3 x 1              | 2.00            | 2.00            | 2.66            | 4.62                         | 4.62                          | 1.95                          | 0.98                      | 0.98                        | 0.58                       | 0.80     | 0.80     | 1.97     |

\* Manufactured to WARD specifications

# CAST IRON REDUCING TEE CLASS 125

| NPS                   | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (Min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|-----------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|----------------------------|----------------------------|----------|----------|----------|
| 3 x 3 x 3/4           | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3 x 3 x 1/2           | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3 x 2 1/2 x 3         | 3.08            | 2.99            | 3.08            | 4.62                         | 3.86                          | 4.62                          | 0.98                      | 0.92                       | 0.98                       | 1.88     | 1.85     | 1.88     |
| 3 x 2 1/2 x 2 1/2     | 2.83            | 2.70            | 2.99            | 4.62                         | 3.86                          | 3.86                          | 0.98                      | 0.92                       | 0.92                       | 1.63     | 1.56     | 1.85     |
| 3 x 2 1/2 x 2         | 2.52            | 2.39            | 2.89            | 4.62                         | 3.86                          | 3.28                          | 0.98                      | 0.92                       | 0.75                       | 1.32     | 1.25     | 2.13     |
| 3 x 2 1/2 x 1 1/2     | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3 x 2 1/2 x 1 1/4     | 2.17            | 2.04            | 2.74            | 4.62                         | 3.86                          | 2.39                          | 0.98                      | 0.92                       | 0.67                       | 0.97     | 0.90     | 2.03     |
| 3 x 2 1/2 x 1         | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3 x 2 x 3             | 3.08            | 2.89            | 3.08            | 4.62                         | 3.28                          | 4.62                          | 0.98                      | 0.75                       | 0.98                       | 1.88     | 2.13     | 1.88     |
| 3 x 2 x 2 1/2         | 2.83            | 2.60            | 2.99            | 4.62                         | 3.28                          | 3.86                          | 0.98                      | 0.75                       | 0.92                       | 1.63     | 1.84     | 1.85     |
| 3 x 2 x 2             | 2.52            | 2.25            | 2.89            | 4.62                         | 3.28                          | 3.28                          | 0.98                      | 0.75                       | 0.75                       | 1.32     | 1.49     | 2.13     |
| 3 x 2 x 1 1/2         | 2.29            | 2.02            | 2.80            | 4.62                         | 3.28                          | 2.68                          | 0.98                      | 0.75                       | 0.70                       | 1.09     | 1.26     | 2.07     |
| 3 x 1 1/2 x 3         | 3.08            | 2.80            | 3.08            | 4.62                         | 2.68                          | 4.62                          | 0.98                      | 0.70                       | 0.98                       | 1.88     | 2.07     | 1.88     |
| *3 x 1 1/2 x 2        | 2.52            | 2.25            | 2.89            | 4.62                         | 2.68                          | 3.28                          | 0.98                      | 0.70                       | 0.75                       | 1.32     | 1.52     | 2.13     |
| *3 x 1 1/2 x 1 1/2    | 2.52            | 2.25            | 2.89            | 4.62                         | 2.68                          | 2.68                          | 0.98                      | 0.70                       | 0.70                       | 1.32     | 1.52     | 2.16     |
| 3 x 1 1/4 x 3         | 3.08            | 2.74            | 3.08            | 4.62                         | 2.39                          | 4.62                          | 0.98                      | 0.67                       | 0.98                       | 1.88     | 2.03     | 1.88     |
| *3 x 1 1/4 x 2        | 2.52            | 2.70            | 2.89            | 4.62                         | 2.39                          | 3.28                          | 0.98                      | 0.67                       | 0.75                       | 1.32     | 1.99     | 2.13     |
| 3 x 1 x 3             | 3.08            | 2.66            | 3.08            | 4.62                         | 1.95                          | 4.62                          | 0.98                      | 0.58                       | 0.98                       | 1.88     | 1.97     | 1.88     |
| *3 x 1 x 2            | 2.52            | 2.63            | 2.89            | 4.62                         | 1.95                          | 3.28                          | 0.98                      | 0.58                       | 0.75                       | 1.32     | 1.94     | 2.13     |
| 3 x 3/4 x 3           | 3.08            | 2.61            | 3.08            | 4.62                         | 1.63                          | 4.62                          | 0.98                      | 0.50                       | 0.98                       | 1.88     | 2.06     | 1.88     |
| 2 1/2 x 2 1/2 x 3     | 2.99            | 2.99            | 2.83            | 3.86                         | 3.86                          | 4.62                          | 0.92                      | 0.92                       | 0.98                       | 1.85     | 1.85     | 1.63     |
| 2 1/2 x 2 x 3         | 2.99            | 2.89            | 2.83            | 3.86                         | 3.28                          | 4.62                          | 0.92                      | 0.75                       | 0.98                       | 1.85     | 2.13     | 1.63     |
| 2 x 2 x 3             | 2.89            | 2.99            | 2.52            | 3.28                         | 3.28                          | 4.62                          | 0.75                      | 0.75                       | 0.98                       | 2.13     | 2.23     | 1.32     |
| *1 1/2 x 1 1/2 x 3    | 2.83            | 2.83            | 2.27            | 2.68                         | 2.68                          | 4.62                          | 0.70                      | 0.70                       | 0.98                       | 2.10     | 2.10     | 1.07     |
| 3 1/2 x 3 1/2 x 3     | 3.18            | 3.18            | 3.33            | 5.20                         | 5.20                          | 4.62                          | 1.03                      | 1.03                       | 0.98                       | 1.93     | 1.93     | 2.13     |
| 3 1/2 x 3 1/2 x 2 1/2 | 2.93            | 2.93            | 3.24            | 5.20                         | 5.20                          | 3.86                          | 1.03                      | 1.03                       | 0.92                       | 1.68     | 1.68     | 2.10     |
| 3 1/2 x 3 1/2 x 2     | 2.62            | 2.62            | 3.14            | 5.20                         | 5.20                          | 3.28                          | 1.03                      | 1.03                       | 0.75                       | 1.37     | 1.37     | 2.38     |
| 3 1/2 x 3 1/2 x 1 1/2 | 2.39            | 2.39            | 3.05            | 5.20                         | 5.20                          | 2.68                          | 1.03                      | 1.03                       | 0.70                       | 1.14     | 1.14     | 2.32     |
| 3 1/2 x 3 1/2 x 1 1/4 | 2.27            | 2.27            | 2.99            | 5.20                         | 5.20                          | 2.39                          | 1.03                      | 1.03                       | 0.67                       | 1.02     | 1.02     | 2.28     |
| 3 1/2 x 3 1/2 x 1     | 2.10            | 2.10            | 2.91            | 5.20                         | 5.20                          | 1.95                          | 1.03                      | 1.03                       | 0.58                       | 0.85     | 0.85     | 2.22     |
| *3 1/2 x 3 x 3 1/2    | 3.42            | 3.42            | 3.42            | 5.20                         | 4.62                          | 5.20                          | 1.03                      | 0.98                       | 1.03                       | 2.17     | 2.22     | 2.17     |
| 3 1/2 x 3 x 3         | 3.18            | 3.08            | 3.33            | 5.20                         | 4.62                          | 4.62                          | 1.03                      | 0.98                       | 0.98                       | 1.93     | 1.88     | 2.13     |
| 3 1/2 x 3 x 2 1/2     | 2.93            | 2.83            | 3.24            | 5.20                         | 4.62                          | 3.86                          | 1.03                      | 0.98                       | 0.92                       | 1.68     | 1.63     | 2.10     |
| 3 1/2 x 3 x 2         | 2.62            | 2.52            | 3.14            | 5.20                         | 4.62                          | 3.28                          | 1.03                      | 0.98                       | 0.75                       | 1.37     | 1.32     | 2.38     |
| 3 1/2 x 3 x 1 1/2     | 2.39            | 2.29            | 3.05            | 5.20                         | 4.62                          | 2.68                          | 1.03                      | 0.98                       | 0.70                       | 1.14     | 1.09     | 2.32     |
| *3 1/2 x 3 x 1 1/4    | 2.39            | 2.29            | 3.05            | 5.20                         | 4.62                          | 2.39                          | 1.03                      | 0.98                       | 0.67                       | 1.14     | 1.09     | 2.34     |
| *3 1/2 x 2 1/2 x 2    | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 3 1/2 x 1 1/4 x 3 1/2 | 3.42            | 2.99            | 3.42            | 5.20                         | 2.39                          | 5.20                          | 1.03                      | 0.67                       | 1.03                       | 2.17     | 2.28     | 2.17     |
| 3 1/2 x 1 x 3 1/2     | 3.42            | 2.91            | 3.42            | 5.20                         | 1.95                          | 5.20                          | 1.03                      | 0.58                       | 1.03                       | 2.17     | 2.22     | 2.17     |
| 3 x 3 x 3 1/2         | 3.33            | 3.33            | 3.18            | 4.62                         | 4.62                          | 5.20                          | 0.98                      | 0.98                       | 1.03                       | 2.13     | 2.13     | 1.93     |
| 4 x 4 x 3 1/2         | 3.54            | 3.54            | 3.69            | 5.79                         | 5.79                          | 5.20                          | 1.08                      | 1.08                       | 1.03                       | 2.24     | 2.24     | 2.44     |
| 4 x 4 x 3             | 3.30            | 3.30            | 3.60            | 5.79                         | 5.79                          | 4.62                          | 1.08                      | 1.08                       | 0.98                       | 2.00     | 2.00     | 2.40     |

\* Manufactured to WARD specifications

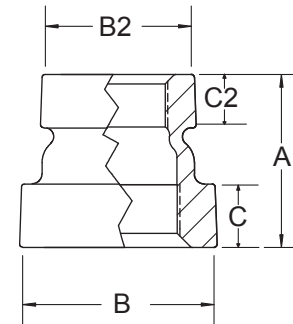
# CAST IRON REDUCING TEE CLASS 125

| NPS                | Center to End A | Center to End B | Center to End C | Outside Dia. of Band D (min) | Outside Dia. of Band D2 (Min) | Outside Dia. of Band D3 (min) | Length of Threads E (min) | Length of Threads E2 (min) | Length of Threads E3 (min) | Take Out | Take Out | Take Out |
|--------------------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|-------------------------------|---------------------------|----------------------------|----------------------------|----------|----------|----------|
| 4 x 4 x 2 1/2      | 3.05            | 3.05            | 3.51            | 5.79                         | 5.79                          | 3.86                          | 1.08                      | 1.08                       | 0.92                       | 1.75     | 1.75     | 2.37     |
| 4 x 4 x 2          | 2.74            | 2.74            | 3.41            | 5.79                         | 5.79                          | 3.28                          | 1.08                      | 1.08                       | 0.75                       | 1.44     | 1.44     | 2.65     |
| 4 x 4 x 1 1/2      | 2.51            | 2.51            | 3.32            | 5.79                         | 5.79                          | 2.68                          | 1.08                      | 1.08                       | 0.70                       | 1.21     | 1.21     | 2.59     |
| 4 x 4 x 1 1/4      | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 4 x 4 x 1          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 4 x 4 x 3/4        | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 4 x 3 1/2 x 4      | 3.79            | 3.69            | 3.79            | 5.79                         | 5.20                          | 5.79                          | 1.08                      | 1.03                       | 1.08                       | 2.49     | 2.44     | 2.49     |
| 4 x 3 1/2 x 3 1/2  | 3.54            | 3.42            | 3.69            | 5.79                         | 5.20                          | 5.20                          | 1.08                      | 1.03                       | 1.03                       | 2.24     | 2.17     | 2.44     |
| 4 x 3 1/2 x 3      | 3.30            | 3.18            | 3.60            | 5.79                         | 5.20                          | 4.62                          | 1.08                      | 1.03                       | 0.98                       | 2.00     | 1.93     | 2.40     |
| 4 x 3 1/2 x 2 1/2  | 3.05            | 2.93            | 3.51            | 5.79                         | 5.20                          | 3.86                          | 1.08                      | 1.03                       | 0.92                       | 1.75     | 1.68     | 2.37     |
| 4 x 3 1/2 x 2      | 2.74            | 2.62            | 3.41            | 5.79                         | 5.20                          | 3.28                          | 1.08                      | 1.03                       | 0.75                       | 1.44     | 1.37     | 2.65     |
| 4 x 3 1/2 x 1 1/2  | 2.51            | 2.39            | 3.32            | 5.79                         | 5.20                          | 2.68                          | 1.08                      | 1.03                       | 0.70                       | 1.21     | 1.14     | 2.59     |
| 4 x 3 x 4          | 3.79            | 3.60            | 3.79            | 5.79                         | 4.62                          | 5.79                          | 1.08                      | 0.98                       | 1.08                       | 2.49     | 2.40     | 2.49     |
| *4 x 3 x 3 1/2     | 3.79            | 3.69            | 3.79            | 5.79                         | 4.62                          | 5.20                          | 1.08                      | 0.98                       | 1.03                       | 2.49     | 2.49     | 2.54     |
| 4 x 3 x 3          | 3.30            | 3.08            | 3.60            | 5.79                         | 4.62                          | 4.62                          | 1.08                      | 0.98                       | 0.98                       | 2.00     | 1.88     | 2.40     |
| 4 x 3 x 2 1/2      | 3.05            | 2.83            | 3.51            | 5.79                         | 4.62                          | 3.86                          | 1.08                      | 0.98                       | 0.92                       | 1.75     | 1.63     | 2.37     |
| 4 x 3 x 2          | 2.74            | 2.52            | 3.41            | 5.79                         | 4.62                          | 3.28                          | 1.08                      | 0.98                       | 0.75                       | 1.44     | 1.32     | 2.65     |
| *4 x 3 x 1 1/2     | 2.51            | 2.39            | 3.32            | 5.79                         | 4.62                          | 2.68                          | 1.08                      | 0.98                       | 0.70                       | 1.21     | 1.19     | 2.59     |
| 4 x 2 1/2 x 4      | 3.79            | 3.51            | 3.79            | 5.79                         | 3.86                          | 5.79                          | 1.08                      | 0.92                       | 1.08                       | 2.49     | 2.37     | 2.49     |
| 4 x 2 1/2 x 3      | 3.30            | 2.99            | 3.60            | 5.79                         | 3.86                          | 4.62                          | 1.08                      | 0.92                       | 0.98                       | 2.00     | 1.85     | 2.40     |
| 4 x 2 1/2 x 2 1/2  | 3.05            | 2.70            | 3.51            | 5.79                         | 3.86                          | 3.86                          | 1.08                      | 0.92                       | 0.92                       | 1.75     | 1.56     | 2.37     |
| *4 x 2 1/2 x 2     | 3.05            | 2.70            | 3.51            | 5.79                         | 3.86                          | 3.28                          | 1.08                      | 0.92                       | 0.75                       | 1.75     | 1.56     | 2.75     |
| 4 x 2 x 4          | 3.79            | 3.41            | 3.79            | 5.79                         | 3.28                          | 5.79                          | 1.08                      | 0.75                       | 1.08                       | 2.49     | 2.65     | 2.49     |
| *4 x 2 x 2 1/2     | 3.05            | 2.70            | 3.51            | 5.79                         | 3.28                          | 3.86                          | 1.08                      | 0.75                       | 0.92                       | 1.75     | 1.94     | 2.37     |
| 4 x 2 x 2          | 2.74            | 2.25            | 3.41            | 5.79                         | 3.28                          | 3.28                          | 1.08                      | 0.75                       | 0.75                       | 1.44     | 1.49     | 2.65     |
| *4 x 2 x 1 1/2     | 2.74            | 2.25            | 3.41            | 5.79                         | 3.28                          | 2.68                          | 1.08                      | 0.75                       | 0.70                       | 1.44     | 1.49     | 2.68     |
| 4 x 1 1/2 x 4      | 3.79            | 3.32            | 3.79            | 5.79                         | 2.68                          | 5.79                          | 1.08                      | 0.70                       | 1.08                       | 2.49     | 2.59     | 2.49     |
| *4 x 1 1/2 x 2     | 2.74            | 2.25            | 3.41            | 5.79                         | 2.68                          | 3.28                          | 1.08                      | 0.70                       | 0.75                       | 1.44     | 1.52     | 2.65     |
| *4 x 1 1/2 x 1 1/2 | 2.74            | 2.25            | 3.41            | 5.79                         | 2.68                          | 2.68                          | 1.08                      | 0.70                       | 0.70                       | 1.44     | 1.52     | 2.68     |
| 4 x 1 1/4 x 4      | 3.79            | 3.26            | 3.79            | 5.79                         | 2.39                          | 5.79                          | 1.08                      | 0.67                       | 1.08                       | 2.49     | 2.55     | 2.49     |
| 4 x 1 x 4          | 3.79            | 3.18            | 3.79            | 5.79                         | 1.95                          | 5.79                          | 1.08                      | 0.58                       | 1.08                       | 2.49     | 2.49     | 2.49     |
| 3 1/2 x 3 1/2 x 4  | 3.69            | 3.69            | 3.54            | 5.20                         | 5.20                          | 5.79                          | 1.03                      | 1.03                       | 1.08                       | 2.44     | 2.44     | 2.24     |
| 3 x 3 x 4          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 5 x 5 x 4          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 5 x 5 x 3          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 5 x 5 x 2 1/2      | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 5 x 5 x 2          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 6 x 6 x 5          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 6 x 6 x 4          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |
| 6 x 6 x 3          | —               | —               | —               | —                            | —                             | —                             | —                         | —                          | —                          | —        | —        | —        |

\* Manufactured to WARD specifications

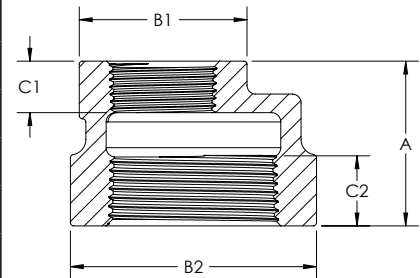
# CAST IRON CONCENTRIC REDUCING COUPLING CLASS 125

| NPS           | Length of Coupling A | Outside Dia. of Band Small End B (min) | Outside Dia. of Large End B2 (min) | Length of Threads Small End C (min) | Length of Threads Large End C2 (min) | Take Out | Take Out |
|---------------|----------------------|--|------------------------------------|-------------------------------------|--------------------------------------|----------|----------|
| 3/4 x 1/2     | 1.50                 | 1.31                                   | 1.62                               | 0.43                                | 0.50                                 | 0.20     | 0.22     |
| 1 x 1/2       | 1.70                 | 1.31                                   | 1.99                               | 0.43                                | 0.58                                 | 0.85     | 0.85     |
| 1 x 3/4       | 1.70                 | 1.63                                   | 1.99                               | 0.50                                | 0.58                                 | 0.85     | 0.85     |
| 1 1/4 x 1     | 2.130                | 1.95                                   | 2.39                               | 0.58                                | 0.67                                 | 0.17     | 0.30     |
| 1 1/4 x 3/4   | 2.13                 | 1.95                                   | 2.39                               | 0.50                                | 0.67                                 | 0.17     | 0.32     |
| 1 1/4 x 1/2   | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 1 1/2 x 1 1/4 | 2.25                 | 2.39                                   | 2.68                               | 0.67                                | 0.70                                 | 0.36     | 0.52     |
| 1 1/2 x 1     | 2.25                 | 2.39                                   | 2.68                               | 0.58                                | 0.70                                 |          |          |
| 1 1/2 x 3/4   | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 1 1/2 x 1/2   | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 2 x 1 1/2     | 2.32                 | 2.68                                   | 3.28                               | 0.70                                | 0.75                                 | 0.40     | 0.44     |
| 2 x 1 1/4     | 2.32                 | 2.39                                   | 3.28                               | 0.67                                | 0.75                                 | 0.40     | 0.45     |
| 2 x 1         | 2.32                 | 1.95                                   | 3.28                               | 0.58                                | 0.75                                 | 0.40     | 0.44     |
| 2 x 3/4       | 2.32                 | 1.63                                   | 3.28                               | 0.50                                | 0.75                                 | 0.40     | 0.45     |
| 2 x 1/2       | 2.32                 | 1.63                                   | 3.28                               | 0.43                                | 0.75                                 | 0.40     | 0.48     |
| 2 1/2 x 2     | 2.63                 | 3.28                                   | 3.86                               | 0.75                                | 0.92                                 | 0.18     | 0.56     |
| 2 1/2 x 1 1/2 | 2.63                 | 3.28                                   | 3.86                               | 0.70                                | 0.92                                 | 0.18     | 0.59     |
| 3 x 2 1/2     | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 3 x 2         | 2.88                 | 3.28                                   | 4.62                               | 0.75                                | 0.98                                 | 0.29     | 0.68     |
| 3 x 1 1/2     | 2.88                 | 3.28                                   | 4.62                               | 0.70                                | 0.98                                 | 0.24     | 0.72     |
| 4 x 3         | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 4 x 2 1/2     | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 4 x 2         | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |
| 6 x 4         | —                    | —                                      | —                                  | —                                   | —                                    | —        | —        |



# CAST IRON ECCENTRIC REDUCING COUPLING CLASS 125

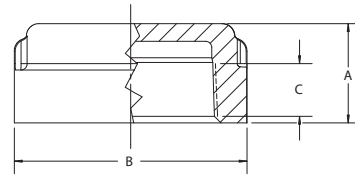
| NPS           | Length of Coupling A | Outside Dia. of Band Small End B1 (min) | Outside Dia. of Large End B2 (min) | Length of Threads Small End C1 (min) | Length of Threads Large End C2 (min) | Take Out | Take Out |
|---------------|----------------------|---|------------------------------------|--------------------------------------|--------------------------------------|----------|----------|
| 3/4 x 1/2     | 1.52                 | 1.34                                    | 1.63                               | 0.43                                 | 0.58                                 | 0.21     | 0.23     |
| 1 x 3/4       | 1.60                 | 1.63                                    | 1.95                               | 0.50                                 | 0.58                                 | 0.12     | 0.25     |
| 1 x 1/2       | 1.59                 | 1.34                                    | 1.95                               | 0.43                                 | 0.58                                 | 0.11     | 0.26     |
| 1 1/4 x 1     | 1.75                 | 1.95                                    | 2.39                               | 0.58                                 | 0.67                                 | 0.17     | 0.19     |
| 1 1/4 x 3/4   | 1.65                 | 1.63                                    | 2.39                               | 0.50                                 | 0.67                                 | 0.12     | 0.28     |
| 1 1/4 x 1/2   | 1.58                 | 1.34                                    | 2.39                               | 0.43                                 | 0.67                                 | 0.08     | 0.26     |
| 1 1/2 x 1 1/4 | 1.85                 | 2.39                                    | 2.68                               | 0.67                                 | 0.70                                 | 0.20     | 0.22     |
| 1 1/2 x 1     | 1.78                 | 1.95                                    | 2.68                               | 0.58                                 | 0.70                                 | 0.17     | 0.21     |
| 1 1/2 x 3/4   | 1.68                 | 1.63                                    | 2.68                               | 0.50                                 | 0.70                                 | 0.12     | 0.29     |
| 1 1/2 x 1/2   | 2.12                 | 2.68                                    | 3.28                               | 0.70                                 | 0.75                                 | 0.09     | 0.28     |
| 2 x 1 1/2     | 2.12                 | 2.39                                    | 3.28                               | 0.67                                 | 0.75                                 | 0.30     | 0.34     |
| 2 x 1 1/4     | 1.99                 | 1.95                                    | 3.28                               | 0.58                                 | 0.75                                 | 0.30     | 0.35     |
| 2 x 1         | 1.79                 | 1.63                                    | 3.28                               | 0.50                                 | 0.75                                 | 0.24     | 0.31     |
| 2 x 3/4       | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 2 x 1/2       | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 2 1/2 x 2     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 2 1/2 x 1 1/2 | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 2 1/2 x 1 1/4 | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 2 1/2 x 1     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 3 x 2 1/2     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 3 x 2         | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 3 x 1 1/2     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 3 x 1 1/4     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 3 x 1         | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 4 x 2 1/2     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 4 x 2         | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 4 x 1 1/2     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |
| 4 x 1 1/4     | —                    | —                                       | —                                  | —                                    | —                                    | —        | —        |





## CAST IRON PIPE CAP CLASS 125

| NPS   | Overall Height<br>A | Outside Dia. of Band<br>B (min) | Length of Threads<br>C (min) |
|-------|---------------------|---------------------------------|------------------------------|
| 2 1/2 | 1.810               | 3.860                           | 0.920                        |
| 3     | 1.910               | 4.620                           | 0.980                        |
| 3 1/2 | 2.030               | 5.200                           | 1.030                        |
| 4     | 2.220               | 5.790                           | 1.080                        |
| 5     | 2.380               | 7.050                           | 1.180                        |
| 6     | 2.630               | 8.280                           | 1.280                        |
| 8     | 2.880               | 10.630                          | 1.470                        |

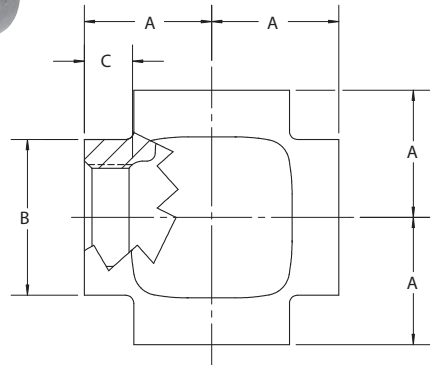


## CAST IRON HEXAGON COUPLING

| NPS | Width Across Flats<br>A HEX. | Overall Length<br>B | Thread Length<br>C | Take Out | Take Out |
|-----|------------------------------|---------------------|--------------------|----------|----------|
| 1   | 1.94                         | 1.69                | 0.58               | 0.16     | 0.16     |

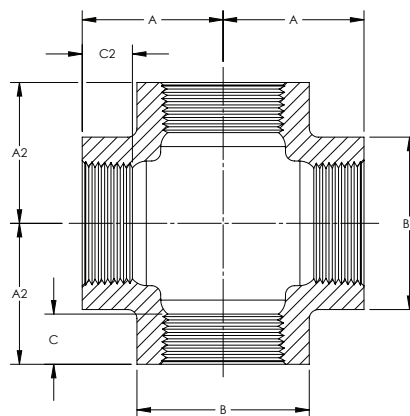
## CAST IRON STRAIGHT CROSS CLASS 125

| NPS   | Center to End A | Outside Dia. Band B (min) | Length of Threads C (min) | Take Out |
|-------|-----------------|---------------------------|---------------------------|----------|
| 1/2   | 1.25            | 1.34                      | 0.43                      | 0.71     |
| 3/4   | 1.44            | 1.63                      | 0.50                      | 0.89     |
| 1     | 1.63            | 1.95                      | 0.58                      | 0.94     |
| 1 1/4 | 1.94            | 2.39                      | 0.67                      | 1.23     |
| 1 1/2 | 2.13            | 2.68                      | 0.70                      | 1.40     |
| 2     | —               | —                         | —                         | —        |
| 4     | —               | —                         | —                         | —        |



## CAST IRON REDUCING CROSS CLASS 125

| NPS                   | Center to End A | Center to End A2 | Outside Dia. Band B (min) | Outside Dia. Band B2 (min) | Length of Threads C (min) | Length of Threads C2 (min) | Take Out | Take Out |
|-----------------------|-----------------|------------------|---------------------------|----------------------------|---------------------------|----------------------------|----------|----------|
| 1 1/4 x 1             | 1.67            | 1.58             | 2.39                      | 1.95                       | 0.67                      | 0.58                       | 0.96     | 0.89     |
| 1 1/2 x 1 1/4         | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 1 1/2 x 1 1/4 x 1     | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 1 1/2 x 1 1/4 x 1 x 1 | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 1 1/2 x 1             | 1.80            | 1.65             | 2.68                      | 1.95                       | 0.70                      | 0.58                       | 1.07     | 0.96     |
| 1 1/2 x 1 x 1 x 1     | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 2 x 1 1/2             | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 2 x 1 1/4             | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 2 x 1 1/2 x 1 x 1     | —               | —                | —                         | —                          | —                         | —                          | —        | —        |
| 2 x 1                 | 2.02            | 1.73             | 3.28                      | 1.95                       | 0.75                      | 0.58                       | 1.26     | 1.04     |



# FireLock® Rigid Coupling

## STYLE 005H

### WITH VIC-PLUS™ GASKET SYSTEM

FireLock Style 005H rigid coupling has a unique, patented angle-pad design which allows the housings to offset while clamping the grooves. By permitting the housings to slide on the angled bolt pads, rigidity is obtained.

Support and hanging requirements correspond to NFPA 13 Sprinkler Systems. Angle-pad design permits assembly by removing one nut/bolt and swinging the housing over the gasket. This reduces components to handle during assembly.

**Style 005H FireLock coupling are designed and recommended for use ONLY on fire protection systems.**

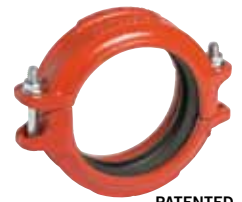
#### Vic-Plus™ Gasket System:

Victaulic offers a gasket system which requires no field lubrication on wet pipe systems that are hydrostatically tested. The Vic-Plus System (patented) is dry, clean, and non-toxic. It reduces assembly time substantially and eliminates the mess and chance of over-lubrication. Please refer to the latest copy of the Victaulic Field Installation Handbook (I-100) for supplemental lubrication requirements and dry pipe fire protection system notes.

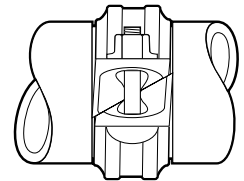


§ LPC and VdS Approved, see notes on page 4

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS



PATENTED



Exaggerated for clarity

## LISTING/APPROVALS

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

| Related Working Pressure – psi |             |      |     |     | Related Working Pressure – psi |             |      |     |      | Related Working Pressure – psi |             |     |     |     |
|--------------------------------|-------------|------|-----|-----|--------------------------------|-------------|------|-----|------|--------------------------------|-------------|-----|-----|-----|
| Pipe Sch.                      | Size Inches | UL   | ULC | FM  | Pipe Sch.                      | Size Inches | UL   | ULC | FM   | Pipe Sch.                      | Size Inches | UL  | ULC | FM  |
| 5                              | 1 ¼ – 3     | 175  | 175 | 175 | EL                             | 1 ¼ – 2     | 300  | N/A | N/A  | MT                             | 1 ¼ – 2     | 300 | N/A | N/A |
|                                | 1 ¼ – 4     | 350  | 350 | 350 | ET                             | 1 ¼ – 2     | 300  | N/A | N/A  | STF                            | 1 ¼ – 4     | N/A | N/A | 300 |
| 10, 40                         | 5 – 8       | 300  | 300 | 300 | EZ                             | 4 – 6       | 300# | N/A | 300  | Steady Thd.                    | 1 ¼ – 2     | N/A | N/A | 300 |
| BLT                            | 1 ¼ – 2     | 300  | 300 | N/A | FF                             | 1 ¼ – 4     | N/A  | N/A | 300  | TF                             | 3 – 8       | N/A | N/A | 300 |
| DF                             | 1 ¼ – 4     | 300  | 300 | 300 | GAL - 7                        | 1 ¼ – 2     | 300  | N/A | N/A  | WLS                            | 1 ¼ – 2     | 300 | 300 | N/A |
| DT                             | 1 ¼ – 2     | 300  | 300 | N/A | MLT                            | 1 ¼ – 2     | 300  | N/A | N/A  | XL                             | 1 ¼ – 3     | 300 | 300 | 300 |
| EF                             | 1 ½ – 4     | 175@ | N/A | 175 | MF                             | 1 ¼ – 4     | 300  | N/A | 300* |                                |             |     |     |     |

\* FM approved for service in 1 ½ – 4" pipe.

# UL Listed for service up to 4" pipe only.

@ UL Listed for service up to 3" only.

#### JOB/OWNER

System No. \_\_\_\_\_

Location \_\_\_\_\_

#### CONTRACTOR

Submitted By \_\_\_\_\_

Date \_\_\_\_\_

#### ENGINEER

Spec Sect \_\_\_\_\_ Para \_\_\_\_\_

Approved \_\_\_\_\_

Date \_\_\_\_\_

www.victaulic.com

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REV\_K



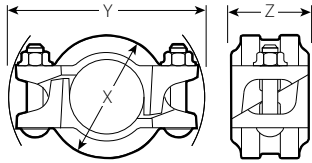
10.02\_1

# FireLock® Rigid Coupling

STYLE 005H

WITH VIC-PLUS™ GASKET SYSTEM

## DIMENSIONS



Rated for wet and dry sprinkler systems at 350 psi/2413 kPa for 1 1/4 - 4 7/32 - 100 mm sizes and 300 psi /2068 kPa for 4 1/4 - 8 7/108 - 200 mm sizes; Schedule 10 roll grooved or Schedule 40 cut or roll grooved steel pipe. Style 005H is rigid and does not accommodate expansion, contraction or angular deflection.

| Size                   |                                   | Max. Work Pressure § * | Max. End Load * | Allow. Pipe End Sep. † | Bolt/Nut@ No - Size | Dimensions - Inches/mm |              |            | Approx. Wgt. Each |
|------------------------|-----------------------------------|------------------------|-----------------|------------------------|---------------------|------------------------|--------------|------------|-------------------|
| Nominal Size Inches/mm | Actual Outside Diameter Inches/mm | PSI kPa                | Lbs. N          | Inches mm              | Inches mm           | X                      | Y            | Z          | Lbs. kg           |
| 1 1/4<br>32            | 1.660<br>42.4                     | 350<br>2413            | 755<br>3370     | 0.05<br>1.2            | 2 - 3/8 x 2 1/4     | 2.75<br>70             | 4.50<br>114  | 1.88<br>48 | 1.2<br>0.5        |
| 1 1/2<br>40            | 1.900<br>48.3                     | 350<br>2413            | 990<br>4415     | 0.05<br>1.2            | 2 - 3/8 x 2 1/4     | 3.00<br>76             | 4.75<br>121  | 1.88<br>48 | 1.2<br>0.5        |
| 2<br>50                | 2.375<br>60.3                     | 350<br>2413            | 1550<br>6900    | 0.07<br>1.7            | 2 - 3/8 x 2 1/2     | 3.50<br>89             | 5.25<br>133  | 1.88<br>48 | 1.6<br>0.7        |
| 2 1/2<br>65            | 2.875<br>73.0                     | 350<br>2413            | 2270<br>10110   | 0.07<br>1.7            | 2 - 3/8 x 2 1/2     | 4.00<br>102            | 5.75<br>146  | 1.88<br>48 | 1.9<br>0.9        |
| 76.1 mm                | 3.000<br>76.1                     | 350<br>2413            | 2475<br>11010   | 0.07<br>1.7            | 2 - 3/8 x 2 1/2     | 4.13<br>105            | 5.75<br>146  | 1.88<br>48 | 1.9<br>0.9        |
| 3<br>80                | 3.500<br>88.9                     | 350<br>2413            | 3365<br>14985   | 0.07<br>1.7            | 2 - 3/8 x 2 1/2     | 4.63<br>118            | 6.13<br>156  | 1.88<br>48 | 2.1<br>1.0        |
| 4<br>100               | 4.500<br>114.3                    | 350<br>2413            | 5565<br>24770   | 0.16<br>4.1            | 2 - 3/8 x 2 1/2     | 5.75<br>146            | 7.25<br>184  | 2.13<br>54 | 3.1<br>1.4        |
| 108.0 mm               | 4.250<br>108.0                    | 300<br>2068            | 4255<br>18940   | 0.16<br>4.1            | 2 - 3/8 x 2 1/2     | 5.63<br>143            | 7.25<br>184  | 2.13<br>54 | 3.1<br>1.4        |
| 5<br>125               | 5.563<br>141.3                    | 300<br>2068            | 7290<br>32445   | 0.16<br>4.1            | 2 - 1/2 x 3         | 6.88<br>175            | 9.00<br>229  | 2.13<br>54 | 4.5<br>2.0        |
| 133.0 mm               | 5.250<br>133.0                    | 300<br>2068            | 6495<br>28900   | 0.16<br>4.1            | 2 - 1/2 x 2 3/4     | 6.63<br>168            | 9.00<br>229  | 2.13<br>54 | 4.5<br>2.0        |
| 139.7 mm               | 5.500<br>139.7                    | 300<br>2068            | 7125<br>31715   | 0.16<br>4.1            | 2 - 1/2 x 2 3/4     | 6.88<br>175            | 9.00<br>229  | 2.13<br>54 | 4.8<br>2.2        |
| 6<br>150               | 6.625<br>168.3                    | 300<br>2068            | 10340<br>46020  | 0.16<br>4.1            | 2 - 1/2 x 3         | 8.00<br>203            | 10.00<br>254 | 2.13<br>53 | 5.0<br>2.3        |
| 159.0 mm               | 6.250<br>159.0                    | 300<br>2068            | 9200<br>40955   | 0.16<br>4.1            | 2 - 1/2 x 2 3/4     | 7.63<br>194            | 10.00<br>254 | 2.13<br>54 | 5.5<br>2.5        |
| 165.1 mm               | 6.500<br>165.1                    | 300<br>2068            | 9955<br>44295   | 0.16<br>4.1            | 2 - 1/2 x 3         | 8.15<br>207            | 10.00<br>254 | 2.13<br>54 | 5.5<br>2.5        |
| 8<br>200               | 8.625<br>219.1                    | 300<br>2068            | 17525<br>78000  | 0.19<br>4.8            | 2 - 5/8 x 4 1/4     | 10.50<br>267           | 13.14<br>334 | 2.63<br>67 | 11.3<br>5.1       |

\* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 1/2 times the figures shown.

† The allowable pipe separation dimension shown is for system layout purposes only. Style 005H couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

@ Number of bolts required equals number of housing segments. Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

§ Style 005H couplings are VdS and LPC Approved to 16 Bar/235 psi.

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## FireLock® Rigid Coupling

STYLE 005H

WITH VIC-PLUS™ GASKET SYSTEM

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### MATERIAL SPECIFICATIONS

**Housing:** Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

**Housing Coating:** Orange enamel (North America); red enamel (Europe)

- **Optional:** Hot dipped galvanized

**Gasket:**

- **Grade “E” EPDM – Type A Vic-Plus™ Gasket System Δ**

(Violet color code). FireLock products have been Listed by Underwriters Laboratories Inc. and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services up to the rated working pressure using the Grade “E” Type A Vic-Plus™ Gasket System, requiring no field lubrication for most installation conditions.

- **Grade “L” Silicone**

Recommended for dry heat, air without hydrocarbons to +350°F and certain chemical services.

For dry services, Victaulic continues to recommend the use of Grade “E” Type A FlushSeal® Gasket. Contact Victaulic for details.

**Bolts/Nuts:** Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

Δ Standard gasket and FlushSeal gasket approved for dry pipe systems to –40°F/–40°C. Based on “typical” pipe surface conditions, supplemental lubricant is recommended for services installed below 0°F/–18°C and for all dry pipe systems or systems to be subjected to air tests prior to being filled with water. Supplemental lubrication may also be required on pipe with raised or undercut weld seams or pipe that has voids and/or cracks at the weld seams. Victaulic continues to recommend the use of FlushSeal gaskets for dry services.

## FireLock® Rigid Coupling

STYLE 005H

WITH VIC-PLUS™ GASKET SYSTEM

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### GENERAL NOTES

WARNING: Depressurize and drain the piping system before attempting to install, remove, or adjust any Victaulic piping products.

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### WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

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### NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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### INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at [www.victaulic.com](http://www.victaulic.com).

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For complete contact information, visit [www.victaulic.com](http://www.victaulic.com)

10.02 1538 REV K UPDATED 02/2013

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10.02



# FireLock EZ® Rigid Coupling

## STYLE 009H



The FireLock EZ Style 009H coupling is a rigid, installation-ready coupling for fire protection pipe joining. The coupling's unique design eliminates loose parts, insures consistent installation and provides substantial gains in productivity.

### IMPORTANT

FireLock EZ Style 009H couplings are recommended for use ONLY on fire protection systems.



PATENTED

### LISTINGS/APPROVALS \*

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

#### Standard Pipe

| Size<br>Nominal<br>Size<br>Inches/<br>mm | cULus/FM          |                    |                    | VdS<br>psi/kPa | LPCB<br>psi/kPa |
|--|-------------------|--------------------|--------------------|----------------|-----------------|
|  | Sch. 5<br>psi/KPa | Sch. 10<br>psi/kPa | Sch. 40<br>psi/KPa |                |                 |
| 1¼<br>32                                 | 175<br>1206       | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 1½<br>40                                 | 175<br>1206       | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 2<br>50                                  | 175<br>1206       | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 2½<br>65                                 | N/A               | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 76.1 mm                                  | N/A               | N/A                | 365**<br>2517**    | 365<br>2517    | 365<br>2517     |
| 3<br>80                                  | N/A               | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 108 mm                                   | N/A               | 365***<br>2517***  | 365***<br>2517***  | N/A            | N/A             |
| 4<br>100                                 | N/A               | 365<br>2517        | 365<br>2517        | 365<br>2517    | 365<br>2517     |
| 133 mm                                   | N/A               | 290***<br>1999***  | 365***<br>2517***  | N/A            | N/A             |
| 139.7 mm                                 | N/A               | N/A                | 290**<br>1999**    | 232<br>1600    | 365<br>2517     |
| 165.1 mm                                 | N/A               | N/A                | 290**<br>1999**    | 232<br>1600    | 365<br>2517     |
| 6#<br>150#                               | N/A               | 290<br>1999        | 365<br>2517        | 232<br>1600    | 365<br>2517     |

\* Listed/Approved for wet and dry pipe systems (> -40°F/-40°C).  
Please refer to the Victaulic Installation Manual (I-009H\_009\_009V.pdf) for details concerning when supplemental lubrication is required.

\*\* EN-10219(L) for 76.1mm size; EN-10255(M)

# Regional availability only#

\*\*\* FM Approved only.

#### JOB/OWNER

System No. \_\_\_\_\_

Location \_\_\_\_\_

#### CONTRACTOR

Submitted By \_\_\_\_\_

Date \_\_\_\_\_

#### ENGINEER

Spec Sect \_\_\_\_\_ Para \_\_\_\_\_

Approved \_\_\_\_\_

Date \_\_\_\_\_

www.victaulic.com

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REV\_G



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# FireLock EZ<sup>®</sup> Rigid Coupling

STYLE 009H

## LISTINGS/APPROVALS \*

### Specialty Pipe

| Pipe |         | Pressure Rating – psi/kPa |             | Pipe |         | Pressure Rating – psi/kPa |             | Pipe |         | Pressure Rating – psi/kPa |             |
|------|---------|---------------------------|-------------|------|---------|---------------------------|-------------|------|---------|---------------------------|-------------|
| Sch. | Inches  | cULus                     | FM          | Sch. | Inches  | cULus                     | FM          | Sch. | Inches  | cULus                     | FM          |
| BLT  | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | EZT  | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | MT   | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 |
| DF   | 1 ¼ – 4 | 300<br>2068               | 300<br>2068 | FF   | 1 ¼ – 4 | 300<br>2068               | 300<br>2068 | MLT  | 1 ¼ – 2 | N/A                       | 300<br>2068 |
| DT   | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | FLF  | 1 ¼ – 4 | N/A                       | 300<br>2068 | ST   | 1 ¼ – 2 | N/A                       | 300<br>2068 |
| EF   | 1 ¼ – 4 | 175<br>1206               | 175<br>1206 | FLT  | 1 ¼ – 2 | N/A                       | 300<br>2068 | STF  | 1 ¼ – 4 | N/A                       | 300<br>2068 |
| EL   | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | FLTL | 1 ¼ – 2 | N/A                       | 300<br>2068 | TF   | 2 ¼ – 4 | N/A                       | 300<br>2068 |
| ET40 | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | GL   | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 | WLS  | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 |
| EZF  | 3 – 4   | 300<br>2068               | 300<br>2068 | MF   | 1 ¼ – 4 | 300<br>2068               | 300<br>2068 | WST  | 1 ¼ – 2 | N/A                       | 175<br>1206 |
|      |         |                           |             |      |         |                           |             | XL   | 1 ¼ – 2 | 300<br>2068               | 300<br>2068 |

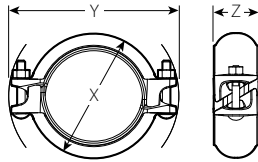
Note: The Specialty Pipe table only applies to imperial sizes, NOT to metric sizes.



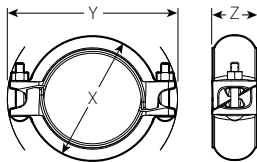
# FireLock EZ® Rigid Coupling

## STYLE 009H

### STYLE 009H DIMENSIONS



STYLE 009H PRE-ASSEMBLED  
(PUSH ON CONDITION)



STYLE 009H JOINT ASSEMBLED

| Size                         |                                     | Max. Work. Press. * | Max. End Load * | Allow. Pipe End Sep. † | @ Bolt/Nut No. – Size      | Dimensions – Inches/mm               |              |                 |              |            | Aprx. Wgt. Ea. |
|------------------------------|-------------------------------------|---------------------|-----------------|------------------------|----------------------------|--------------------------------------|--------------|-----------------|--------------|------------|----------------|
| Nominal Size<br>Inches<br>mm | Actual Outside Dia.<br>Inches<br>mm | psi<br>kPa          | Lbs.<br>N       | Inches<br>mm           | Inches                     | Pre-assembled<br>(Stab in condition) |              | Joint Assembled |              |            | Lbs.<br>kg     |
|                              |                                     |                     |                 |                        |                            | X                                    | Y            | X               | Y            | Z          |                |
| 1 ¼<br>32                    | 1.660<br>42.4                       | 365<br>2517         | 790<br>3514     | 0.10<br>2.54           | 2 - ¾ x 2<br>- M10 x 2     | 2.95<br>75                           | 4.77<br>121  | 2.70<br>69      | 4.63<br>118  | 1.93<br>49 | 1.4<br>0.7     |
| 1 ½<br>40                    | 1.900<br>48.3                       | 365<br>2517         | 1035<br>4604    | 0.10<br>2.54           | 2 - ¾ x 2<br>- M10 x 2     | 3.19<br>81                           | 4.97<br>126  | 2.94<br>75      | 4.79<br>122  | 1.93<br>49 | 1.5<br>0.7     |
| 2<br>50                      | 2.375<br>60.3                       | 365<br>2517         | 1616<br>7193    | 0.12<br>3.05           | 2 - ¾ x 2<br>- M10 x 2     | 3.79<br>96                           | 5.53<br>140  | 3.45<br>88      | 5.42<br>138  | 1.93<br>49 | 1.9<br>0.9     |
| 2 ½<br>65                    | 2.875<br>73.0                       | 365<br>2517         | 2370<br>10542   | 0.12<br>3.05           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 4.29<br>109                          | 6.09<br>155  | 3.92<br>100     | 5.85<br>149  | 1.93<br>49 | 2.1<br>1.0     |
| 76.1 mm                      | 3.000<br>76.1                       | 365<br>2517         | 2580<br>11476   | 0.12<br>3.05           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 4.40<br>112                          | 6.31<br>160  | 4.05<br>103     | 5.90<br>150  | 1.93<br>49 | 2.1<br>1.0     |
| 3<br>80                      | 3.500<br>88.9                       | 365<br>2517         | 3512<br>15622   | 0.12<br>3.05           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 4.91<br>125                          | 6.70<br>170  | 4.55<br>116     | 6.46<br>164  | 1.93<br>49 | 2.3<br>1.0     |
| 108 mm                       | 4.250<br>108.0                      | 365<br>2517         | 5178<br>23030   | 0.17<br>4.32           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 5.56<br>141                          | 7.61<br>193  | 5.27<br>134     | 7.51<br>191  | 2.14<br>54 | 2.8<br>1.2     |
| 4<br>100                     | 4.500<br>114.3                      | 365<br>2517         | 5805<br>25822   | 0.17<br>4.32           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 5.95<br>151                          | 7.82<br>199  | 5.54<br>141     | 7.47<br>190  | 2.14<br>55 | 2.9<br>1.3     |
| 133 mm                       | 5.250<br>133.0                      | 365<br>2517         | 7900<br>35140   | 0.17<br>4.33           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 6.66<br>169                          | 9.11<br>232  | 6.36<br>162     | 9.01<br>229  | 2.14<br>55 | 4.3<br>1.9     |
| 139.7 mm                     | 5.500<br>139.7                      | 365<br>2517         | 8620<br>38340   | 0.17<br>4.32           | 2 - ¾ x 2 ½<br>- M10 x 2 ½ | 6.75<br>172                          | 9.29<br>236  | 6.46<br>164     | 9.23<br>234  | 2.09<br>53 | 4.6<br>2.1     |
| 165.1 mm                     | 6.500<br>165.1                      | 290<br>1999         | 9623<br>42805   | 0.17<br>4.32           | 2 - ¾ x 3 ¼<br>- M16 x 3 ¼ | 7.84<br>199                          | 10.93<br>278 | 7.55<br>192     | 10.85<br>276 | 2.11<br>54 | 5.69<br>2.6    |
| 6<br>150                     | 6.625<br>168.3                      | 290<br>1999         | 9997<br>44469   | 0.17<br>4.32           | 2 - ¾ x 3 ¼<br>- M16 x 3 ¼ | 7.96<br>202                          | 11.08<br>281 | 7.67<br>195     | 11.99<br>305 | 2.11<br>54 | 5.92<br>2.69   |

\* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. See page 1 of this document for Listed/Approved ratings on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 ½ times the figures shown in the chart on page 1, specific to pipe schedule and size.

† The allowable pipe separation dimension shown is for system layout purposes only. FireLock EZ couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

@ Number of bolts required equals number of housing segments.

### MATERIAL SPECIFICATIONS

**Housing:** Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

#### Housing Coating:

- Orange enamel (North America, Asia Pacific)
- Red enamel (Europe)

#### Optional Coatings:

- Hot dipped galvanized

#### Gasket:

- Grade "E" EPDM (Type A)

FireLock EZ products have been Listed by Underwriters Laboratories Inc., Underwriters Laboratories of Canada Limited, and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services within the rated working pressure.

**Bolts/Nuts:** Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

## FireLock EZ<sup>®</sup> Rigid Coupling

STYLE 009H

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### GENERAL NOTES

NOTE: When assembling FireLock EZ couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For FireLock EZ Style 009H couplings, use FireLock No. 006 end caps containing the “EZ” marking on the inside face or No. 60 end caps containing the “QV EZ” marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009H couplings.

IMPORTANT: Gaskets intended for the Style 009 or Style 009V couplings cannot be used with the Style 009H coupling. There is no interchanging of gaskets or housings between coupling styles.

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### USE OF FLUSHSEAL GASKETS FOR DRY PIPE SYSTEMS

FireLock EZ couplings are supplied with FireLock EZ Grade “E” Type A gaskets. These gaskets include an integral pipe stop, that once installed provides the same benefits as a FlushSeal gasket for dry pipe systems. It should be noted that standard FlushSeal gaskets are not compatible and cannot be used with the FireLock EZ couplings.

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### INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at [www.victaulic.com](http://www.victaulic.com).

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### WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

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### NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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For complete contact information, visit [www.victaulic.com](http://www.victaulic.com)

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# Style 744 FireLock® Flange Adapter

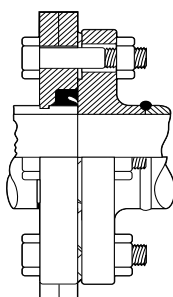
with Vic-Plus™ Gasket System



## PRODUCT DESCRIPTION



2 - 8" Sizes



(Exaggerated for clarity)

Style 744 FireLock Flange adapter is designed for directly incorporating flanged components with ANSI CL 125 or CL 150 bolt hole patterns into a grooved pipe system. Sizes 2 - 8" (50 - 200 mm) are hinged for easy handling with integral end tabs which facilitate assembly.

The design incorporates small teeth inside the key shoulder I.D. to prevent rotation.

Because of the outside flange dimension, FireLock Flange adapters should not be used on FireLock fittings. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.

FireLock Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc., require the use of a FireLock Flange washer.

FireLock Flange adapters with Vic-Plus gaskets do not require lubrication. The gasket must always be assembled with the color coded lip on the pipe and the other lip facing the mating flange.

**Style 744 FireLock Flange Adapters with the Vic-Plus™ Gasket System are designed and recommended for use ONLY on fire protection systems.**

### Vic-Plus Gasket System:

Victaulic® now offers a gasket system which requires no field lubrication on wet pipe systems. The Vic-Plus™ System (patented) is dry, clean, and non-toxic. It reduces assembly time substantially and eliminates the mess and chance of over-lubrication. Please refer to the latest copy of the Victaulic Field Installation Handbook (I-100) for supplemental lubrication requirements.

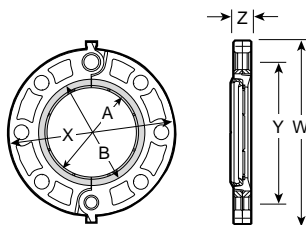


See Victaulic publication 10.01 for details.

## DIMENSIONS

### Style 744

Sizes 2 - 8" (50 - 200 mm)  
ANSI Class 125 and 150 Flange



**Note:** Gray area of mating face must be free from gouges, undulations or deformities of any type for effective sealing.

| Pipe Size                  |                                   | Max. Work Press.*<br>PSI<br>kPa | Max. End Load*<br>Lbs.<br>N | No. Bolts †<br>Req'd. | Bolt Size †<br>Inches | Sealing Surface<br>Inches/mm |             | Dimensions<br>Inches/millimeters |              |              |            | Aprx. Wgt. Each<br>Lbs.<br>kg |
|----------------------------|-----------------------------------|---------------------------------|-----------------------------|-----------------------|-----------------------|------------------------------|-------------|----------------------------------|--------------|--------------|------------|-------------------------------|
| Nominal Diameter<br>In./mm | Actual Outside Diameter<br>In./mm |                                 |                             |                       |                       | "A" Max.                     | "B" Min.    | W                                | X            | Y            | Z          |                               |
| 2<br>50                    | 2.375<br>60.3                     | 175<br>1200                     | 775<br>3450                 | 4                     | 5/8 X 2 3/4           | 2.38<br>60                   | 3.41<br>87  | 6.75<br>172                      | 6.00<br>152  | 4.75<br>121  | 0.75<br>19 | 2.7<br>1.2                    |
| 2 1/2<br>65                | 2.875<br>73.0                     | 175<br>1200                     | 1135<br>5050                | 4                     | 5/8 X 3               | 2.88<br>73                   | 3.91<br>99  | 7.88<br>200                      | 7.00<br>178  | 5.50<br>140  | 0.88<br>22 | 4.2<br>1.9                    |
| 3<br>80                    | 3.500<br>88.9                     | 175<br>1200                     | 1685<br>7500                | 4                     | 5/8 X 3               | 3.50<br>89                   | 4.53<br>115 | 8.44<br>214                      | 7.50<br>191  | 6.00<br>152  | 0.94<br>24 | 4.8<br>2.2                    |
| 4<br>100                   | 4.500<br>114.3                    | 175<br>1200                     | 2780<br>11045               | 8                     | 5/8 X 3               | 4.50<br>114                  | 5.53<br>141 | 9.94<br>252                      | 9.00<br>229  | 7.50<br>191  | 0.94<br>24 | 7.1<br>3.2                    |
| 5<br>125                   | 5.563<br>141.3                    | 175<br>1200                     | 4250<br>18920               | 8                     | 3/4 X 3 1/2           | 5.56<br>141                  | 6.71<br>171 | 11.00<br>279                     | 10.00<br>254 | 8.50<br>216  | 1.00<br>25 | 8.3<br>3.8                    |
| 6#<br>150                  | 6.625<br>168.3                    | 175<br>1200                     | 6030<br>26840               | 8                     | 3/4 X 3 1/2           | 6.63<br>168                  | 7.78<br>198 | 12.00<br>305                     | 11.00<br>279 | 9.50<br>241  | 1.00<br>25 | 9.3<br>4.2                    |
| 8#<br>200                  | 8.625<br>219.1                    | 175<br>1200                     | 10219<br>45475              | 8                     | 3/4 X 3 1/2           | 8.63<br>219                  | 9.94<br>252 | 14.63<br>372                     | 13.50<br>343 | 11.75<br>298 | 1.13<br>29 | 13.9<br>6.3                   |

\*Refer to notes below.

†Total bolts required to be supplied by installer. Bolt sizes for conventional flange-to-flange connection. Larger bolts are required when Vic-Flange adapter is utilized with wafer-type valves.

# Not available with Vic-Plus gasket system. Lubrication is required.

## NOTES

\* Working Pressure and End Load are total, from all internal and external loads, based on standard weight steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 1/2 times the figures shown.

Style 744 FireLock Flange adapters provide rigid joints when used on pipe with standard roll or cut groove dimensions and consequently allow no linear or angular movement at the joint.

WARNING: Depressurize and drain the piping system before attempting to install, remove, or adjust any Victaulic piping products.

## VIC-FLANGE ADAPTER NOTES

- 1 The Style 744 (2 - 8"/50 - 200 mm) design incorporates small teeth inside the key shoulder I.D. to prevent rotation.
- 2 FireLock Flange adapter should not be used on FireLock fittings. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.
- 3 FireLock Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc. require the use of a FireLock Flange washer.
- 4 Area A-B noted in the above drawing must be free from gouges, undulations or deformities of any type for effective sealing.
- 5 FireLock Flange adapter gaskets must always be assembled with the color coded lip on the pipe and the other lip facing the mating flange.
- 6 Flange Washers: FireLock Flange adapters require a smooth hard surface at the mating flange face for effective sealing. Some applications for which the Vic-Flange adapter is otherwise well suited do not provide an adequate mating surface. In such cases, it is recommended that a metal Flange Washer be inserted between the FireLock Flange adapter and the mating flange to provide the necessary sealing surface.

Typical applications where a Flange Washer should be used are:

- A When mating to a serrated flange: a standard flat flange gasket should be used adjacent to the serrated flange and then the Flange Washer is inserted between the FireLock Flange adapter and the flange gasket.
- B When mating to a wafer valve: where typical valves are rubber lined and partially rubber faced (smooth or not), the Flange Washer is placed between the valve and the FireLock Flange adapter.
- C When mating a rubber faced flange: the Flange Washer is placed between the FireLock Flange adapters and the rubber faced flange.
- D When mating AWWA cast flanges to IPS flanges: the Flange Washer is placed between two FireLock Flanges. The hinge points must be oriented approximately 90° to each other. If one flange is not a FireLock Flange adapter (e.g. flanged valve), then a standard flat flange gasket must be placed adjacent to that flange and the Flange Washer inserted between the flange gasket and the FireLock Flange adapter.
- E When mating to components (valves, strainers, etc.) where the component flange face has an insert: follow the same arrangement as in Application 1.
- F When mating to a Series 705-W Butterfly valve, Style 744 may only be used on one side of the connection.

*When ordering Flange Washers, always specify product style (Style 744) and size to assure proper Flange Washer is supplied.*

## MATERIAL SPECIFICATIONS

**Flange Housing:** Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

**Coating:** Black enamel

- **Optional:** Hot dipped galvanized

**Bolts/Nuts:** Supplied by installer

**Gasket:**

- **Grade "E" EPDM - Type A Vic-Plus Gasket System Δ**  
(Violet color code). FireLock products have been Listed by Underwriters Laboratories Inc. and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services up to the rated working pressure using the Grade "E" Type A Vic-Plus Gasket System, requiring no field lubrication for most installation conditions.

Δ Standard gasket approved for dry pipe systems to -40°F (-40°C). Based on "typical" pipe surface conditions, supplemental lubricant is recommended for services installed below 0°F (-18°C) and for all dry pipe systems or systems to be subjected to air tests prior to being filled with water. Supplemental lubrication may also be required on pipe with raised or undercut weld seams or pipe that has voids and/or cracks at the weld seams.

## FireLock® Butterfly Valve

### SERIES 705 WITH WEATHERPROOF ACTUATOR

The Series 705 Butterfly Valve features a weatherproof actuator housing Approved for indoor or outdoor use, a ductile iron body and disc with EPDM seats. Designed for fire protection services only. Victaulic FireLock Series 705 Butterfly Valve is cULus Listed, LPCB Listed, FM and VdS Approved for 300 psi/2068 kPa service. Contact Victaulic for details of agency approvals.



### APPROVALS AND LISTINGS

|             | Approval/Listing Service Pressures<br>Series 705 Butterfly Valve |                      |                      |                      |
|-------------|--|----------------------|----------------------|----------------------|
|             | cULus  | FM                   | VdS                  | LPCB                 |
| 2"/50mm     | up to 300psi/2068kPa   | n/a                  | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 2 1/2"/65mm | up to 300psi/2068kPa   | up to 300psi/2068kPa | n/a                  | up to 300psi/2068kPa |
| 76.1mm      | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 3"/80mm     | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 4"/100mm    | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 5"/125mm    | up to 300psi/2068kPa   | up to 300psi/2068kPa | n/a                  | up to 300psi/2068kPa |
| 139.7mm     | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 6"/150mm    | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 165.1mm     | up to 300psi/2068kPa   | up to 300psi/2068kPa | n/a                  | up to 300psi/2068kPa |
| 8"/200mm    | up to 300psi/2068kPa   | up to 300psi/2068kPa | up to 300psi/2068kPa | up to 300psi/2068kPa |
| 10"/250mm   | up to 300psi/2068kPa   | up to 300psi/2068kPa | n/a                  | up to 300psi/2068kPa |
| 12"/300mm   | up to 300psi/2068kPa   | up to 300psi/2068kPa | n/a                  | up to 300psi/2068kPa |

#### JOB/OWNER

System No. \_\_\_\_\_

Location \_\_\_\_\_

#### CONTRACTOR

Submitted By \_\_\_\_\_

Date \_\_\_\_\_

#### ENGINEER

Spec Sect \_\_\_\_\_ Para \_\_\_\_\_

Approved \_\_\_\_\_

Date \_\_\_\_\_

[www.victaulic.com](http://www.victaulic.com)

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REV\_E



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## FireLock® Butterfly Valve

SERIES 705  
WITH WEATHERPROOF ACTUATOR

### MATERIAL SPECIFICATIONS

**Body:** Ductile iron conforming to ASTM A-536, grade 65-45-12

**End Face, 2 – 6"/50 – 150 mm:** Ductile iron conforming to ASTM A-536, grade 65-45-12

**Seal Retainer, 8 – 12"/200 – 300 mm:** Ductile iron conforming to ASTM A-536, grade 65-45-12

**Coating:** Black alkyd enamel

**Disc:** Ductile iron conforming to ASTM A-536, grade 65-45-12, with electroless nickel coating conforming to ASTM B-733

**Seat:**

- Grade "E" EPDM

**Stems:** 416 stainless steel conforming to ASTM A-582

**Stem Seal Cartridge:** C36000 brass

**Bearings:** Stainless Steel with TFE lining

**Stem Seals:** EPDM

**Stem Retaining Ring:** Carbon steel

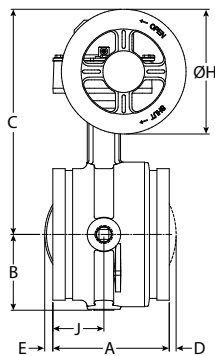
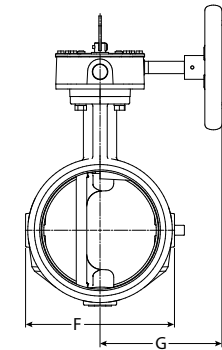
**Actuator:**

- 2 - 8"/50 - 200mm: Brass or bronze traveling nut on a steel lead screw, in a ductile iron housing
- 10 - 12"/250 - 300mm: Steel worm and cast iron quadrant gear, in a cast iron housing

# FireLock® Butterfly Valve

**SERIES 705**  
**WITH WEATHERPROOF ACTUATOR**

## DIMENSIONS –



Note: Optional ½"/15mm tap available.  
Contact Victaulic for details.

| Size            |                  | Dimensions – Inches/millimeters |               |                |              |              |                |               |               |              |
|-----------------|------------------|---------------------------------|---------------|----------------|--------------|--------------|----------------|---------------|---------------|--------------|
| Size            | Outside Diameter | End to End A                    | B             | C              | D            | E            | F              | G             | DIA H         | J            |
| 2"<br>60.3 mm   | 2.375<br>60.3    | 4.25<br>108.0                   | 2.28<br>57.9  | 6.41<br>162.8  | —            | —            | 4.00<br>101.6  | 4.22<br>107.2 | 4.50<br>114.3 | 2.12<br>53.8 |
| 2½"<br>73 mm    | 2.875<br>73.0    | 3.77<br>95.8                    | 2.28<br>57.9  | 7.54<br>191.5  | —            | —            | 4.00<br>101.6  | 4.22<br>107.2 | 4.50<br>114.3 | 1.77<br>45.0 |
| 76.1 mm         | 3.000<br>76.1    | 3.77<br>95.8                    | 2.28<br>57.9  | 7.54<br>191.5  | —            | —            | 4.00<br>101.6  | 4.22<br>107.2 | 4.50<br>114.3 | 1.77<br>45.0 |
| 3"<br>88.9 mm   | 3.500<br>88.9    | 3.77<br>95.8                    | 2.53<br>64.3  | 7.79<br>197.9  | —            | —            | 4.50<br>114.3  | 4.22<br>107.2 | 4.50<br>114.3 | 1.77<br>45.0 |
| 108 mm          | 4.250<br>108.0   | 4.63<br>117.6                   | 2.88<br>73.2  | 8.81<br>223.8  | —            | —            | 5.50<br>139.7  | 4.22<br>107.2 | 4.50<br>114.3 | 2.20<br>55.9 |
| 4"<br>114.3 mm  | 4.500<br>114.3   | 4.63<br>117.6                   | 2.88<br>73.2  | 8.81<br>223.8  | —            | —            | 5.50<br>139.7  | 4.22<br>107.2 | 4.50<br>114.3 | 2.20<br>55.9 |
| 133 mm          | 5.250<br>133.0   | 5.88<br>149.4                   | 3.35<br>85.1  | 10.88<br>276.4 | —            | —            | 6.56<br>166.6  | 6.19<br>157.2 | 6.30<br>160.0 | 2.58<br>65.5 |
| 139.7 mm        | 5.500<br>139.7   | 5.88<br>149.4                   | 3.35<br>85.1  | 10.88<br>276.4 | —            | —            | 6.56<br>166.6  | 6.19<br>157.2 | 6.30<br>160.0 | 2.58<br>65.6 |
| 5"<br>141.3 mm  | 5.563<br>141.3   | 5.88<br>149.4                   | 3.35<br>85.1  | 10.88<br>276.4 | —            | —            | 6.56<br>166.6  | 6.19<br>157.2 | 6.30<br>160.0 | 2.58<br>65.5 |
| 159 mm          | 6.250<br>159.0   | 5.88<br>149.4                   | 3.84<br>97.5  | 11.38<br>289.1 | —            | 0.41<br>10.4 | 7.52<br>191.0  | 6.19<br>157.2 | 6.30<br>160.0 | 2.58<br>65.5 |
| 165.1 mm        | 6.500<br>165.1   | 5.88<br>149.4                   | 3.84<br>97.5  | 11.38<br>289.1 | —            | 0.41<br>10.4 | 7.52<br>191.0  | 6.19<br>157.2 | 6.30<br>160.0 | 2.58<br>65.5 |
| 6"<br>168.3     | 6.625<br>168.3   | 5.88<br>149.4                   | 3.84<br>97.5  | 11.38<br>289.1 | —            | 0.41<br>10.4 | 7.52<br>191.0  | 6.19<br>157.2 | 6.30<br>160.0 | 1.90<br>48.3 |
| 8"<br>219.1 mm  | 8.625<br>219.1   | 5.33<br>135.4                   | 5.07<br>128.8 | 13.53<br>343.6 | 0.80<br>20.3 | 1.47<br>37.3 | 10.00<br>254.0 | 6.19<br>157.2 | 8.10<br>205.7 | 2.33<br>59.2 |
| 10"<br>273 mm   | 10.750<br>273.0  | 6.40<br>162.6                   | 6.37<br>161.8 | 15.64<br>397.3 | 1.41<br>35.8 | 1.81<br>46.0 | 12.25<br>311.2 | 8.10<br>205.7 | 9.00<br>228.6 | —            |
| 12"<br>323.9 mm | 12.750<br>323.9  | 6.50<br>165.1                   | 7.36<br>186.9 | 16.64<br>422.7 | 2.30<br>58.4 | 2.80<br>71.1 | 14.25<br>362.0 | 8.10<br>205.7 | 9.00<br>228.6 | —            |

# FireLock® Butterfly Valve

SERIES 705  
WITH WEATHERPROOF ACTUATOR

## PERFORMANCE

The chart expresses the frictional resistance of Victaulic Series 705 Butterfly Valve in equivalent feet/ meters of straight pipe.

| Size                            |   |                             | Size                            |   |                             |
|---------------------------------|---|-----------------------------|---------------------------------|---|-----------------------------|
| Nominal<br>Size<br>Inches<br>mm | Actual<br>Outside<br>Diameter<br>Inches<br>mm | Equiv.<br>Feet/m<br>of Pipe | Nominal<br>Size<br>Inches<br>mm | Actual<br>Outside<br>Diameter<br>Inches<br>mm | Equiv.<br>Feet/m<br>of Pipe |
| 2<br>50                         | 2.375<br>60.3                                 | 6<br>1.8                    | 6<br>150                        | 6.625<br>168.3                                | 14<br>4.2                   |
| 2½<br>65                        | 2.875<br>73.0                                 | 6<br>1.8                    | 159 mm                          | 159 mm  | 14<br>4.3                   |
| 76.1 mm                         | 3.000<br>76.1                                 | 6<br>1.8                    | 165.1 mm                        | 6.500<br>165.1                                | 14<br>4.2                   |
| 3<br>80                         | 3.500<br>88.9                                 | 7<br>2.1                    | 8<br>200                        | 8.625<br>219.1                                | 16<br>4.9                   |
| 4<br>100                        | 4.500<br>114.3                                | 8<br>2.4                    | 10<br>250                       | 10.750<br>273.0                               | 18<br>5.5                   |
| 108 mm                          | 108 mm  | 8<br>2.4                    | 12<br>300                       | 12.750<br>323.9                               | 19<br>5.8                   |
| 5<br>125                        | 5.563<br>141.3                                | 12<br>3.7                   |                                 |   |                             |
| 133 mm                          | 133 mm  | 12<br>3.7                   |                                 |   |                             |
| 139.7 mm                        | 5.500<br>139.7                                | 12<br>3.7                   |                                 |   |                             |



# FireLock® Butterfly Valve

**SERIES 705**  
**WITH WEATHERPROOF ACTUATOR**

## PERFORMANCE

C<sub>v</sub> values for flow of water at +60°F/+16°C with a fully open valve are shown in the table below. For additional details, contact Victaulic.

Formulas for C<sub>v</sub> Values:

$$\Delta P = \frac{Q^2}{C_v^2}$$

$$Q = C_v \times \sqrt{\Delta P}$$

**Where:**

Q = Flow (GPM/LPM)

ΔP = Pressure Drop (psi/kPa)

C<sub>v</sub> = Flow Coefficient

| Size                         |   | C <sub>v</sub> | Size                         |   | C <sub>v</sub> | Size                         |   | C <sub>v</sub> |
|------------------------------|---|----------------|------------------------------|---|----------------|------------------------------|---|----------------|
| Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                | Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                | Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                |
| 2                            | 2.375<br>60.3                           | 170            | 5<br>125                     | 5.563<br>141.3                          | 1200           | 8<br>200                     | 8.625<br>219.1                          | 3400           |
| 2½<br>65                     | 2.875<br>73.0                           | 260            | 133 mm                       | 133 mm                                  | 1200           | 10<br>250                    | 10.750<br>273.0                         | 5800           |
| 76.1 mm                      | 3.000<br>76.1                           | 260            | 139.7 mm                     | 5.500<br>139.7                          | 1200           | 12<br>300                    | 12.750<br>323.9                         | 9000           |
| 3<br>80                      | 3.500<br>88.9                           | 440            | 6<br>150                     | 6.625<br>168.3                          | 1800           |                              |   |                |
| 4<br>100                     | 4.500<br>114.3                          | 820            | 159 mm                       | 159 mm                                  | 1800           |                              |   |                |
| 108 mm                       | 108 mm                                  | 820            | 165.1 mm                     | 6.500<br>165.1                          | 1800           |                              |   |                |

Formulas for K<sub>v</sub> Values:

$$\Delta P = \frac{Q^2}{K_v^2}$$

$$Q = K_v \times \sqrt{\Delta P}$$

**Where:**

ΔP = Pressure Drop (psi)

K<sub>v</sub> = Flow Coefficient

| Size                         |   | K <sub>v</sub> | Size                         |   | K <sub>v</sub> | Size                         |   | K <sub>v</sub> |
|------------------------------|---|----------------|------------------------------|---|----------------|------------------------------|---|----------------|
| Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                | Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                | Nominal Size<br>Inches<br>mm | Actual Outside Diameter<br>Inches<br>mm |                |
| 2                            | 2.375<br>60.3                           | 147            | 5<br>125                     | 5.563<br>141.3                          | 1040           | 8<br>200                     | 8.625<br>219.1                          | 2940           |
| 2½<br>65                     | 2.875<br>73.0                           | 225            | 133 mm                       | 133 mm                                  | 1040           | 10<br>250                    | 10.750<br>273.0                         | 5020           |
| 76.1 mm                      | 3.000<br>76.1                           | 225            | 139.7 mm                     | 5.500<br>139.7                          | 1040           | 12<br>300                    | 12.750<br>323.9                         | 7790           |
| 3<br>80                      | 3.500<br>88.9                           | 380            | 6<br>150                     | 6.625<br>168.3                          | 1560           |                              |   |                |
| 4<br>100                     | 4.500<br>114.3                          | 710            | 159 mm                       | 159 mm                                  | 1560           |                              |   |                |
| 108 mm                       | 108 mm                                  | 710            | 165.1 mm                     | 6.500<br>165.1                          | 1560           |                              |   |                |

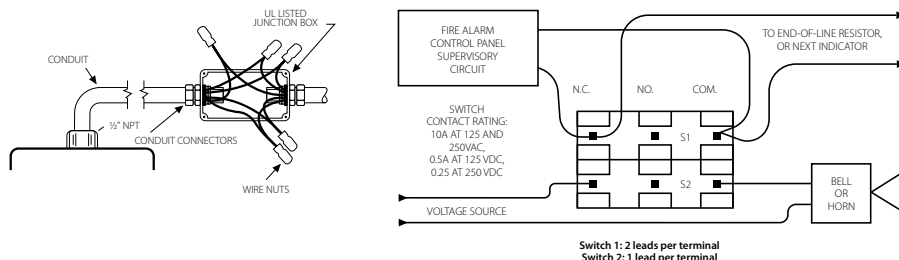
## FireLock® Butterfly Valve

### SERIES 705 WITH WEATHERPROOF ACTUATOR

#### SWITCH AND WIRING

1. The supervisory switch contains two single pole, double throw, pre-wired switches.
2. Switches are rated:
  - 10 amps @ 125 or 250 VAC/60 Hz
  - 0.50 amps @ 125 VDC
  - 0.25 amps @ 250 VDC
3. Switches supervise the valve in the “OPEN” position.
4. One switch has two #18 insulated wires per terminal, which permit complete supervision of leads (refer to diagrams and notes below). The second switch has one #18 insulated wire per terminal. This double circuit provides flexibility to operate two electrical devices at separate locations, such as an indicating light and an audible alarm, in the area that the valve is installed.
5. A #14 insulated ground lead (green) is provided.
  - Switch #1 = S1 For connection to the supervisory circuit of a UL Listed alarm control panel
  - Switch #2 = S2 Auxiliary switch that may be connected to auxiliary devices, per the authority having jurisdiction

|    |   |  |
|----|---|--|
| S1 | { | Normally Closed: (2) Blue                |
|    |   | Common: (2) Yellow                       |
| S2 | { | Normally Closed: Blue with Orange Stripe |
|    |   | Normally Open: Brown with Orange Stripe  |
|    |   | Common: Yellow with Orange Stripe        |



NOTE: The above diagram shows a connection between the common terminal (yellow – S1 and yellow-with-orange stripe – S2) and the normally closed terminal (blue – S1 and blue-with-orange stripe – S2). In this example, the indicator light and alarm will stay on until the valve is fully open. When the valve is fully open, the indicator light and alarm will go out. Cap off any unused wires (e.g. brown with orange stripe).

Only S1 (two leads per terminal) may be connected to the fire alarm control panel.

The connection of the alarm switch wiring shall be in accordance with NFPA 72 and the auxiliary switch per NFPA 70 (NEC).

## FireLock® Butterfly Valve

SERIES 705  
WITH WEATHERPROOF ACTUATOR

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### WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

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### NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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### INSTALLATION

Reference should always be made to the installation sheet included with the valve. Verify you have the latest revision by visiting our website at [www.victaulic.com](http://www.victaulic.com). Further reference can be found in the I-100 Victaulic Field Installation Handbook.

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For complete contact information, visit [www.victaulic.com](http://www.victaulic.com)

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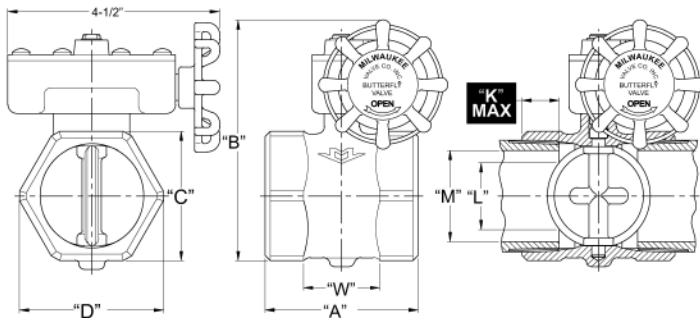
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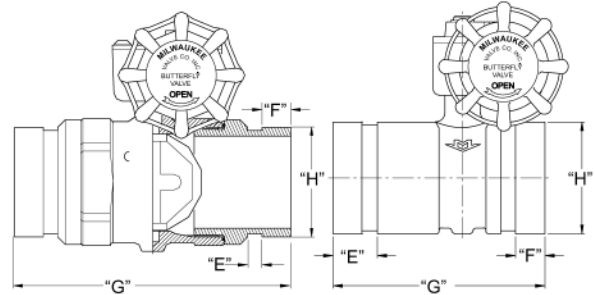


# INDOOR/OUTDOOR butterball® BUTTERFLY VALVES

## VALVES LESS SUPERVISORY TAMPER SWITCH ASSEMBLY



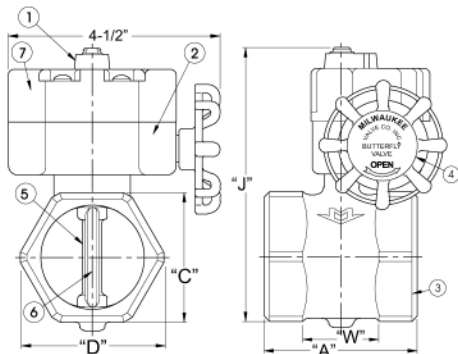
**BB-SC100 (Threaded Ends)**  
Sizes 1", 1-1/4", 1-1/2", 2", 2-1/2"



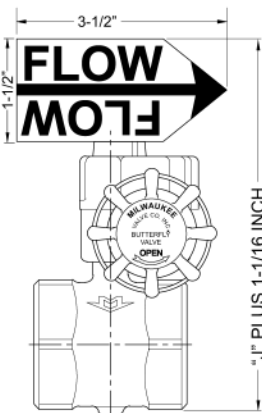
**BBVSC100**  
3 piece with  
Grooved Ends  
Size 2"

**BBVSC100**  
Uni-body with  
Grooved Ends  
Size 2-1/2"

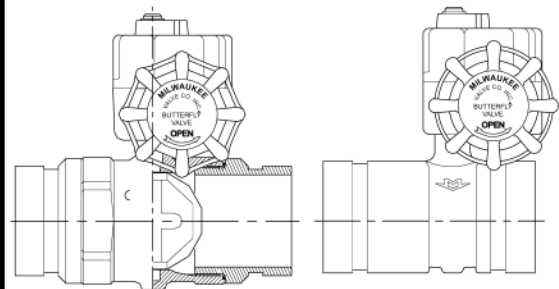
## VALVES WITH SUPERVISORY TAMPER SWITCH ASSEMBLY



**THREADED ENDS**  
**BB-SCS02**



**NYC INDICATOR**  
(Available on both switched and non-switched models.)



**BBVSCS02**  
3 piece with  
Grooved Ends  
Size 2"

**BBVSCS02**  
Uni-body with  
Grooved Ends  
Size 2-1/2"

### ALL DIMENSIONS-INCHES

| Threaded |         |         |         |         | Grooved |        |         |
|----------|---------|---------|---------|---------|---------|--------|---------|
| SIZE     | 1"      | 1-1/4"  | 1-1/2"  | 2"      | SIZE    | 2"     | 2-1/2"  |
| A        | 2-1/8   | 2-5/8   | 2-7/8   | 3-1/4   | A       | -      | 4-1/8   |
| B        | 3-15/16 | 4-9/32  | 4-1/2   | 5       | B       | 5      | 5-13/32 |
| C        | 1-9/16  | 1-15/16 | 2-3/16  | 2-3/4   | C       | 2-3/4  | 3-3/16  |
| D        | 1-23/32 | 2-7/64  | 2-3/8   | 3-1/16  | D       | 3-1/16 | 3-1/2   |
| J        | 4-15/16 | 5-1/8   | 5-19/32 | 6-1/8   | E       | 5/8    | 15/16   |
| K        | .66     | .73     | .73     | .79     | F       | 5/16   | 5/8     |
| L        | .83     | .90     | .99     | 1.41    | G       | 6      | 4-1/2   |
| M-40     | 1.05    | 1.38    | 1.61    | 2.07    | H       | 2-3/8  | 2-7/8   |
| M-80     | .96     | 1.28    | 1.50    | 1.94    | J       | 6-1/8  | 6-1/4   |
| N-40     | 2.25    | 2       | 2.5     | 2.25    | K       | .79    | 1.18    |
| W        | 1-1/8   | 1-1/4   | 1-13/32 | 1-11/16 | L       | 1.41   | 1.29    |
|          |         |         |         |         | M-40    | 2.07   | 2.47    |
|          |         |         |         |         | M-80    | 1.94   | 2.32    |
|          |         |         |         |         | N-40    | 2.25   | 10      |
|          |         |         |         |         | W       | -      | 1-3/4   |

**M-40** ARE DIMENSIONS USING SCHEDULE 40 PIPE

**M-80** ARE DIMENSIONS USING SCHEDULE 80 PIPE

**N-40** IS FLOW RESISTANCE EXPRESSED IN EQUIVALENT LENGTH OF SCHEDULE 40 PIPE

**W** IS THE WRENCH MAKE-UP LENGTH

### MATERIAL LIST

| NO. | PART           | MATERIAL          | SPECIFICATION |
|-----|----------------|-------------------|---------------|
| 1   | Indicator      | Sintered Iron     | F0008P        |
| 2   | Housing        | Bronze            | ASTM 584      |
| 3   | Body           | Bronze            | ASTM 584      |
| 4   | Handle         | Brass             |               |
| 5   | Disc           | Stainless Steel   | Type 304      |
| 6   | Disc Seal      | EPDM Elastomer    |               |
| 7   | Switch Housing | Die Cast Aluminum |               |

# FireLock® Check Valves

## Series 717 & 717H



Series 717  
(2½ – 3"/65 – 80 mm)



Series 717  
(4 – 12"/100 – 300 mm)



Series 717H  
High Pressure Check Valve  
(2 – 3"/50 – 80 mm)

Grooved ends allow fast, easy installation with just two Victaulic couplings or the valve may be mounted to flanged (ANSI CL.150) equipment using either to Victaulic Style 741 Vic-Flange® or Style 744 FireLock flange adapters on either end.

### Approvals/Listings:



See Victaulic Publication 10.01 for more details.

The FireLock Series 717 Check Valve and Series 717H High Pressure Check Valves are CAD designed for hydrodynamic efficiency and available in 2"/50 mm – 3"/80 mm (Series 717H) and 2½"/65 mm – 12"/300 mm (Series 717) sizes.

Series 717H valves are cULus Listed and FM Approved for service up to 365 psi/2517 kPa. See chart below for approved services for the Series 717 valves.

In both valve designs, the single-disc mechanism incorporates a spring-assisted feature for nonslamming operation. This spring-assisted, single-disc design achieves a leak-free seal with as little as 5ft /1.5m of head. Series 717 and 717H FireLock Check Valves can be installed either vertically (flow upwards only) or horizontally. A cast flow arrow indicator is provided to assist with proper valve orientation. Both valves include upstream and downstream pressure taps. Each valve is factory-tested to the rated working pressure. For systems requiring a Riser Check option, refer to publication 10.09.

### Job/Owner

|            |  |
|------------|--|
| System No. |  |
| Location   |  |

### Contractor

|              |  |
|--------------|--|
| Submitted By |  |
| Date         |  |

### Engineer

|              |  |
|--------------|--|
| Spec Section |  |
| Paragraph    |  |
| Approved     |  |
| Date         |  |

## Material Specifications:

---

### Housing:

Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

### Body Coating:

Series 717H Body: Black Paint  
Series 717H Endface: Electroless Nickel  
Series 717 (2 ½ – 3"): PPS Coating  
Series 717 (4 – 12"): Black Paint

### Body Seat:

Series 717H – Nitrile O-ring installed into an electroless nickel plated endface  
Series 717 (2 ½ – 3"): PPS Coated ductile iron  
Series 717 (4 – 12"): Electroless Nickel plated

### Disc Seal or Coating: (specify choice<sup>1</sup>)

Grade "T" nitrile (Series 717H Only)

Nitrile (Orange color code). Temperature range -20°F to +180°F/-29°C to +82°C. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range; except hot, dry air over +140°F/+60°C and water over +150°F/+66°C. NOT RECOMMENDED FOR HOT WATER SERVICES.

Grade "E" EPDM (Series 717 Only)

EPDM (green color code). Temperature range -30°F to +230°F/-34°C to +110°C. Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. NOT RECOMMENDED FOR PETROLUEM SERVICES.

<sup>1</sup> Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

### Discs:

- Series 717H (2 – 3"/50 – 80 mm): CF8M Cast Stainless Steel
- Series 717 (2 ½ – 3"): Aluminum bronze with elastomer seal
- Series 717 (4 – 12"/100 – 300 mm): Elastomer encapsulated disc with electroless nickel plated seat

### Shaft:

- Series 717H (2 – 3"/50 -80 mm): Brass
- Series 717 (2 ½ – 3"): Type 416 Stainless Steel
- Series 717 (4 – 12"/100 – 300 mm) Type 316 Stainless Steel

**Spring:** All sizes Type 302/403 Stainless Steel

### Shaft Plug:

- Series 717H (2 – 3"/50 – 80 mm): Type 416 Stainless Steel
- Series 717 (2 ½ – 12"/65 – 300 mm): Carbon steel zinc plated

### Pipe Plug:

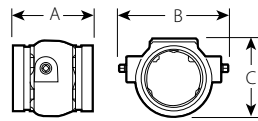
- Series 717H (2 – 3"/50 – 80 mm): carbon steel zinc plated
- Series 717 (4 – 12"/100 – 300 mm): Carbon steel zinc plated

**Approval/Listing:**

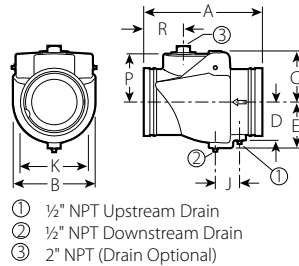
| Size       | Approval/Listing Service Pressures |                        |                        |                        |
|------------|------------------------------------|------------------------|------------------------|------------------------|
|            | Series 717H                        |                        |                        |                        |
|            | cULus                              | FM                     | LPCB                   | Vds                    |
| 2"/50 mm   | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa |
| 2½"/65 mm  | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa |
| 76.1 mm    | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa |
| 3"/80 mm   | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa |
| 4"/100 mm  | n/a                                | n/a                    | n/a                    | n/a                    |
| 5"/125 mm  | n/a                                | n/a                    | n/a                    | n/a                    |
| 139.7 mm   | n/a                                | n/a                    | n/a                    | n/a                    |
| 6"/150 mm  | n/a                                | n/a                    | n/a                    | n/a                    |
| 165.1 mm   | n/a                                | n/a                    | n/a                    | n/a                    |
| 8"/200 mm  | n/a                                | n/a                    | n/a                    | n/a                    |
| 10"/250 mm | n/a                                | n/a                    | n/a                    | n/a                    |
| 12"/300 mm | n/a                                | n/a                    | n/a                    | n/a                    |

| Size       | Approval/Listing Service Pressures |                        |                        |                     |
|------------|------------------------------------|------------------------|------------------------|---------------------|
|            | Series 717                         |                        |                        |                     |
|            | cULus                              | FM                     | LPCB                   | Vds                 |
| 2"/50 mm   | n/a                                | n/a                    | n/a                    | n/a                 |
| 2½"/65 mm  | up to 250 psi/1725 kPa             | n/a                    | up to 365 psi/2517 kPa | n/a                 |
| 76.1 mm    | up to 250 psi/1725 kPa             | n/a                    | up to 365 psi/2517 kPa | up to 16bar/232 psi |
| 3"/80 mm   | up to 250 psi/1725 kPa             | n/a                    | up to 365 psi/2517 kPa | up to 16bar/232 psi |
| 4"/100 mm  | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 16bar/232 psi |
| 5"/125 mm  | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | n/a                 |
| 139.7 mm   | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 16bar/232 psi |
| 6"/150 mm  | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | up to 16bar/232 psi |
| 165.1 mm   | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 365 psi/2517 kPa | n/a                 |
| 8"/200 mm  | up to 365 psi/2517 kPa             | up to 365 psi/2517 kPa | up to 348 psi/2400 kPa | up to 16bar/232 psi |
| 10"/250 mm | up to 250 psi/1725 kPa             | up to 250 psi/1725 kPa | up to 1725 kPa/250 psi | n/a                 |
| 12"/300 mm | up to 250 psi/1725 kPa             | up to 250 psi/1725 kPa | up to 1725 kPa/250 psi | n/a                 |

### Dimensions - Series 717:

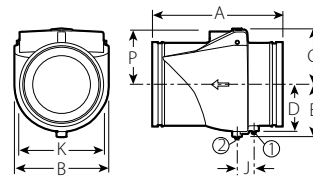


Typical 2 1/2 – 3"/65 – 80 mm



- ① 1/2" NPT Upstream Drain
- ② 1/2" NPT Downstream Drain
- ③ 2" NPT (Drain Optional)

Typical 4 – 8"/100 – 200 mm

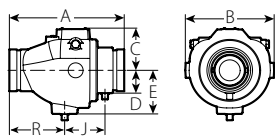


- ① 1/2" NPT Upstream Drain
- ② 1/2" NPT Downstream Drain

Typical 10 – 12"/250 – 300 mm

| Nominal Size | Actual Outside Diameter | Dimensions   |              |              |              |              |              |              |              |              | Approx. Weight Each |
|--------------|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------------|
|              |                         | E to E<br>A  | B            | C            | D            | E            | J            | K            | P            | R            |                     |
| inches<br>mm | inches<br>mm            | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | lbs.<br>kg          |
| 2 1/2<br>65  | 2.875<br>73.0           | 3.88<br>99   | 4.26<br>108  | 3.57<br>91   | –            | –            | –            | –            | –            | –            | 3.6<br>1.6          |
| 76.1 mm      | 3.000<br>76.1           | 3.88<br>99   | 4.26<br>108  | 3.57<br>91   | –            | –            | –            | –            | –            | –            | 3.6<br>1.6          |
| 3<br>80      | 3.500<br>88.9           | 4.25<br>108  | 5.06<br>129  | 4.17<br>106  | –            | –            | –            | –            | –            | –            | 4.5<br>2.0          |
| 4<br>100     | 4.500<br>114.3          | 9.63<br>245  | 6.00<br>152  | 3.88<br>99   | 2.75<br>70   | 3.50<br>89   | 2.00<br>51   | 4.50<br>114  | 3.50<br>89   | 3.35<br>85   | 20.0<br>9.1         |
| 5<br>125     | 5.563<br>141.3          | 10.50<br>267 | 6.80<br>173  | 4.50<br>114  | –            | 4.17<br>106  | 2.15<br>55   | 5.88<br>149  | 4.08<br>104  | 3.98<br>101  | 27.0<br>12.3        |
| 139.7 mm     | 5.500<br>139.7          | 10.50<br>267 | 6.80<br>173  | 4.50<br>114  | –            | 4.17<br>106  | 2.15<br>55   | 5.88<br>149  | 4.08<br>104  | 3.98<br>101  | 27.0<br>12.3        |
| 6<br>150     | 6.625<br>168.3          | 11.50<br>292 | 8.00<br>203  | 5.00<br>127  | –            | 4.50<br>114  | 2.38<br>61   | 6.67<br>169  | 4.73<br>120  | 3.89<br>99   | 38.0<br>17.2        |
| 165.1 mm     | 6.500<br>165.1          | 11.50<br>292 | 8.00<br>203  | 5.00<br>127  | –            | 4.50<br>114  | 2.38<br>61   | 6.67<br>169  | 4.73<br>120  | 3.89<br>99   | 38.0<br>17.2        |
| 8<br>200     | 8.625<br>219.1          | 14.00<br>356 | 9.88<br>251  | 6.06<br>154  | 5.05<br>128  | 5.65<br>144  | 2.15<br>55   | 8.85<br>225  | 5.65<br>144  | 5.75<br>146  | 64.0<br>29.0        |
| 10<br>250    | 10.750<br>273.0         | 17.00<br>432 | 12.00<br>305 | 7.09<br>180  | 5.96<br>151  | 6.69<br>170  | 2.15<br>55   | 10.92<br>277 | 6.73<br>171  | –            | 100.0<br>45.4       |
| 12<br>300    | 12.750<br>323.9         | 19.50<br>495 | 14.00<br>356 | 8.06<br>205  | 6.91<br>176  | 7.64<br>194  | 2.51<br>64   | 12.81<br>925 | 7.73<br>196  | –            | 140.0<br>63.5       |

### Dimensions - Series 717H:



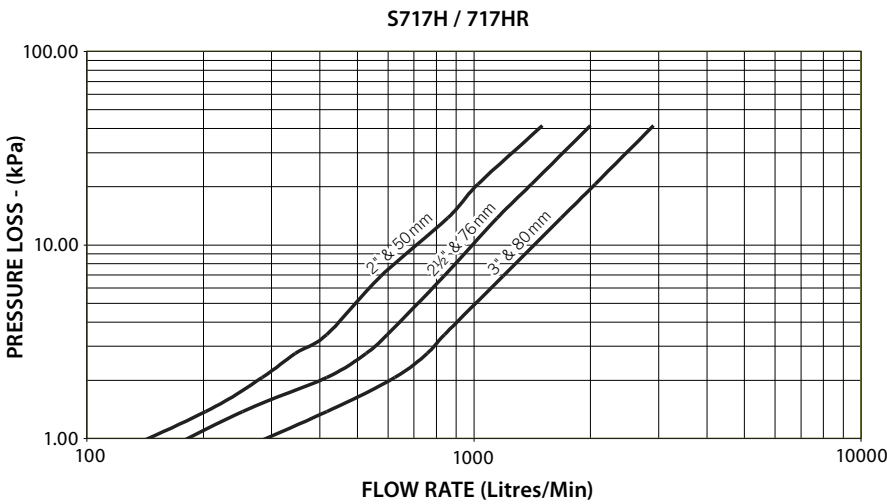
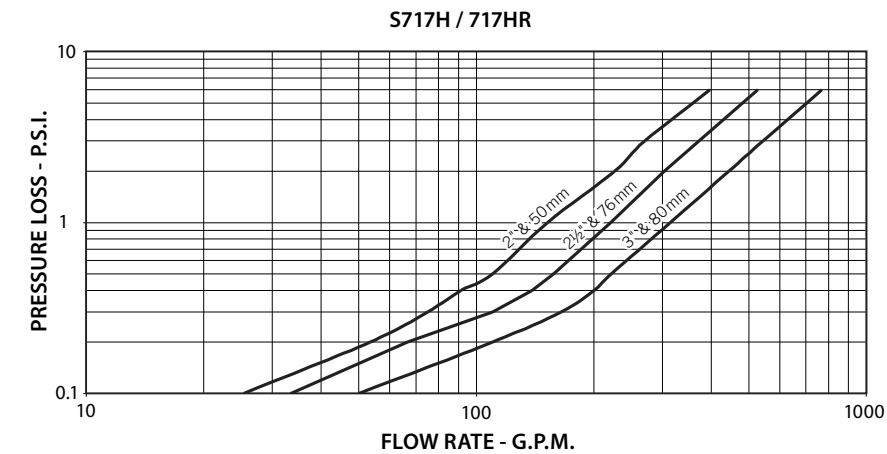
Typical 2"/50 mm – 3"/80 mm

| Nominal Size | Dimensions    |               |              |              |              |              |              |              |               | Approx. Weight Each |
|--------------|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------------|
|              | E to E<br>A   | B             | C            | D            | E            | J            | K            | P            | R             |                     |
| inches<br>mm | inches<br>mm  | inches<br>mm  | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm | inches<br>mm  | lbs.<br>kg          |
| 2<br>50      | 8.66<br>219.8 | 6.46<br>164.1 | 3.23<br>82.1 | 1.48<br>37.5 | 3.02<br>76.7 | 2.80<br>71.0 | –            | –            | 4.25<br>108.0 | 10.7<br>4.9         |
| 2 1/2<br>65  | 9.37<br>238.0 | 6.94<br>176.3 | 3.31<br>84.1 | 1.66<br>42.2 | 3.40<br>86.4 | 3.38<br>85.9 | –            | –            | 4.38<br>111.3 | 13.8<br>6.3         |
| 76.1 mm      | 9.37<br>238.0 | 6.94<br>176.3 | 3.31<br>84.1 | 1.66<br>42.2 | 3.40<br>86.4 | 3.38<br>85.9 | –            | –            | 4.38<br>111.3 | 13.8<br>6.3         |
| 3<br>80      | 9.62<br>244.3 | 7.44<br>189.0 | 3.53<br>89.7 | 1.91<br>48.5 | 3.65<br>92.7 | 3.38<br>85.9 | –            | –            | 4.63<br>117.6 | 20.0<br>9.1         |



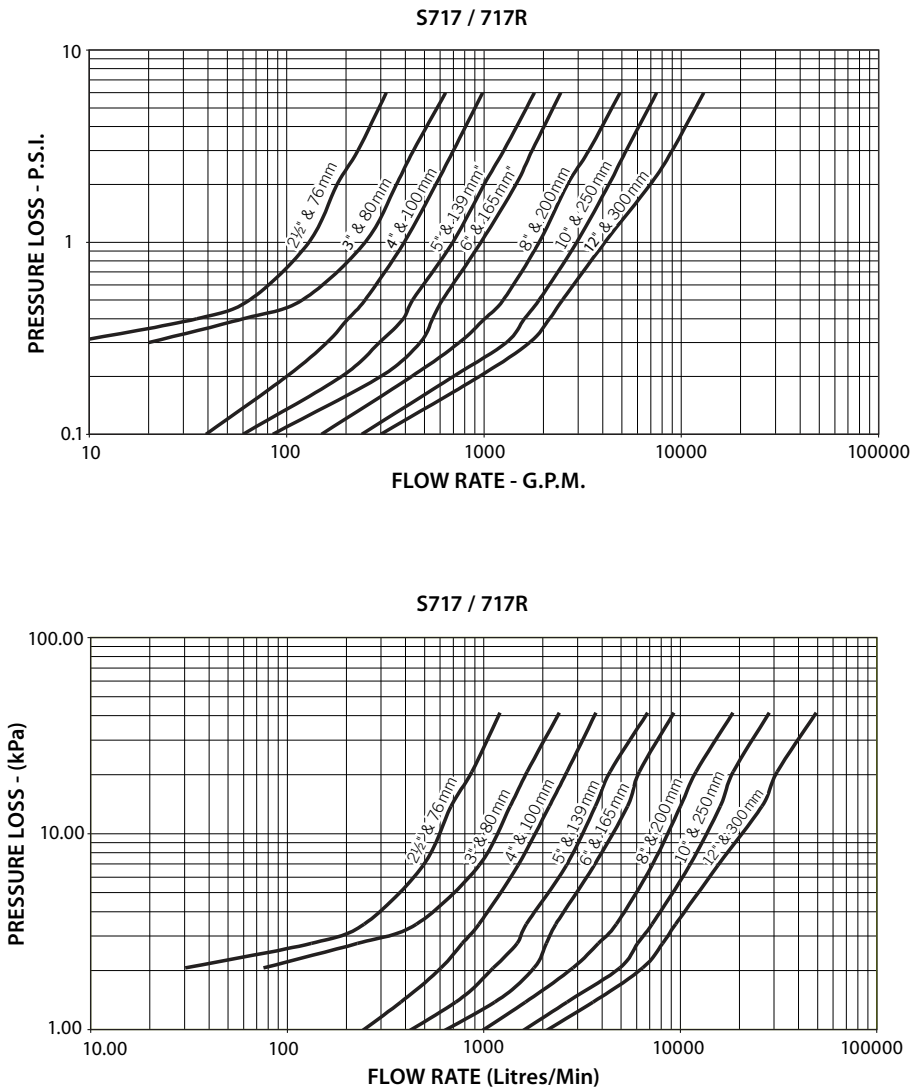
Flow Characteristics

The charts below express the flow of water at 60°F/16°C through valve.



Flow Characteristics

The charts below express the flow of water at 60°F/16°C through valve.



**Installation**

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at [www.victaulic.com](http://www.victaulic.com).

**Warranty**

Refer to the Warranty section of the current Price List or contact Victaulic for details.

**Note**

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

**Trademarks**

Victaulic and FireLock are registered trademarks of Victaulic Company.

## FireLock® Check Valves

**SERIES 717HR HIGH PRESSURE - cULus, FM**  
**SERIES 717R - cULus, FM**

The Series 717R and Series 717HR FireLock High Pressure check valves are CAD-designed for hydrodynamic efficiency and available in 2 – 3"/50 – 80mm (Series 717HR) and 4 – 8"/100 – 200mm (Series 717R) sizes.

Series 717HR valves are cULus Listed and FM Approved for service up to the pressures shown on the chart below.

In the Series 717HR High Pressure Check Valve, the stainless steel disc is seated against the O-ring seal which is installed in the electroless nickel-plated end face. The Series 717R check valve features an elastomer encapsulated disc and a welded in nickel seat for superior corrosion resistance. Both valves feature a spring-assisted, single disc design which provides a leak-free seal with as little as 5 ft/1.5 m of head. Either valve can be installed in horizontal or vertical positions.

In both valve designs, the single disc mechanism incorporates a spring-assisted feature for non-slamming operation. Each valve is factory tested to the rated working pressure. For systems not requiring a Riser Check option refer to publication 10.08. Both valve designs include upstream and downstream pressure taps.

The drain valves supplied with the Victaulic Riser Kit are cULus and FM Approved for services up to 300 psi/2068 kPa. Grooved ends allow fast, easy installation with just two Victaulic couplings or the valve may be mounted to flanged (ANSI CL.150) equipment using Victaulic Style 741 Vic-Flange® or Style 744 FireLock flange adapters on either end.

The Victaulic riser check kit for the 2"/60.3mm S717HR has a ¾" drain valve and the kit for the 2-½ to 3"/65-80mm S717HR includes a 1¼" drain valve. The kit for the 4-8"/100-200mm S717R valve includes a 2" drain valve. All kits also include gauges (2), gauge isolation valves (2), pipe nipples and pipe plugs. In both models, the riser check kit must be specified when ordered.



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS



**SERIES 717HR - SHOWN WITH THE  
VICTAULIC RISER CHECK KIT  
(2 – 3"/50 – 80 mm)**



**SERIES 717R - SHOWN WITH THE  
VICTAULIC RISER CHECK KIT  
(4 – 8"/100 – 200 mm)**

| Size      | Approval/Listing Service Pressures |                       |                      |                      |
|-----------|------------------------------------|-----------------------|----------------------|----------------------|
|           | Series 717HR (bare valve)          |                       | Series 717R          |                      |
|           | cULus*                             | FM*                   | cULus                | FM                   |
| 2"/50mm   | up to 365psi/2517 kPa              | up to 365psi/2517 kPa | n/a                  | n/a                  |
| 2 ½"/65mm | up to 365psi/2517 kPa              | up to 365psi/2517 kPa | n/a                  | n/a                  |
| 76.1mm    | up to 365psi/2517 kPa              | up to 365psi/2517 kPa | n/a                  | n/a                  |
| 3"/80mm   | up to 365psi/2517 kPa              | up to 365psi/2517 kPa | n/a                  | n/a                  |
| 4"/100mm  | n/a                                | n/a                   | up to 365psi/2517kPa | up to 365psi/2517kPa |
| 5"/125mm  | n/a                                | n/a                   | up to 365psi/2517kPa | up to 365psi/2517kPa |
| 6"/150mm  | n/a                                | n/a                   | up to 365psi/2517kPa | up to 365psi/2517kPa |
| 8"/200mm  | n/a                                | n/a                   | up to 365psi/2517kPa | up to 365psi/2517kPa |

\* Note: When supplied with the Victaulic Riser Check Kit, the Series 717HR can be used for services up to 300psi/2068kPa.

### JOB OWNER

System No. \_\_\_\_\_

Location \_\_\_\_\_

### CONTRACTOR

Submitted By \_\_\_\_\_

Date \_\_\_\_\_

### ENGINEER

Spec Sect \_\_\_\_\_ Para \_\_\_\_\_

Approved \_\_\_\_\_

Date \_\_\_\_\_

[www.victaulic.com](http://www.victaulic.com)

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REV\_H



10.09\_1

## FireLock® Check Valves

SERIES 717HR HIGH PRESSURE - cULus, FM  
SERIES 717R - cULus, FM



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

### MATERIAL SPECIFICATIONS

**Body:** Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

**Body Coating:** Series 717HR and Series 717R: painted black enamel.

**Body Seat:** Series 717HR (2 - 3"/50 - 80mm) machined surfaces electroless nickel plated. Series 717R (4 - 8"/100 - 200mm) welded-in nickel seat.

#### Disc Seal or Coating:

- **Grade "T" Nitrile (Series 717HR ONLY)**

Nitrile (Orange color code). Temperature range -20°F to +180°F/-29°C to +82°C

Recommended for petroleum products, air with oil vapors, vegetable and mineral oils

within the specified temperature range; except hot, dry air over +140°F/+60°C and water over +150°F/+66°C. NOT RECOMMENDED FOR HOT WATER SERVICES.

- **Grade "E" EPDM (Series 717R ONLY)**

EPDM (Green color code). Temperature range -30°F to +230°F/-34°C to +110°C.

Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.

\* Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

#### Discs:

- Series 717HR (2 - 3"/50 - 80mm): 300 Series Stainless Steel

- Series 717R valves (4 - 12"/100 - 300mm) Elastomer-coated ductile iron

#### Shaft:

- Series 717HR: Brass

- Series 717R: Type 316 stainless steel

**Spring:** All sizes Type 302/304 stainless

#### Shaft Plug:

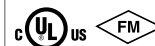
- Series 717HR: Type 416 Stainless Steel

- Series 717R: Zinc-plated carbon steel

**Pipe Plug:** Zinc-plated carbon steel

## FireLock® Check Valves

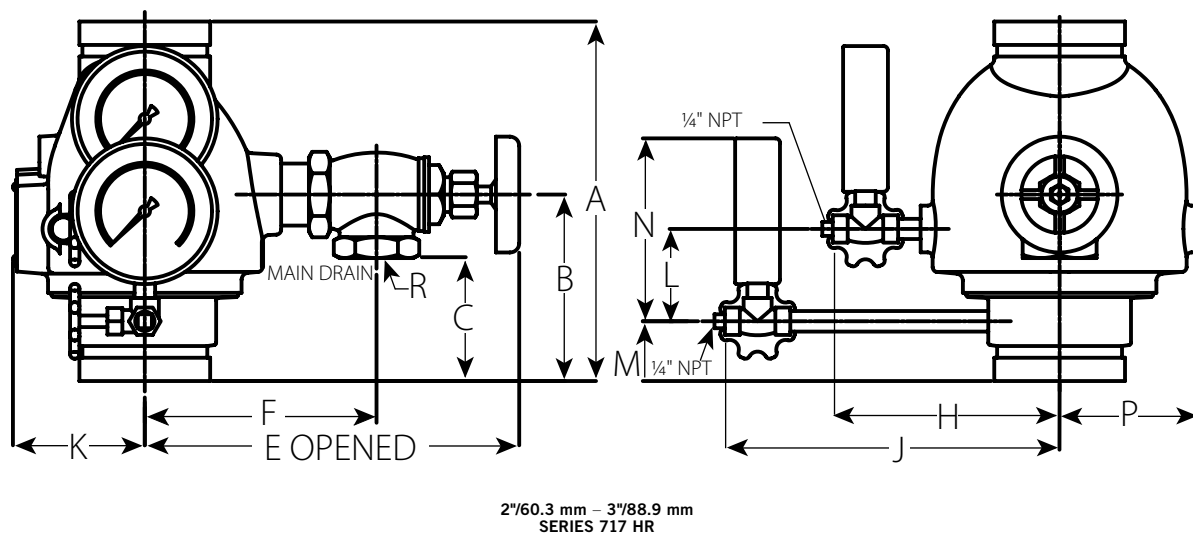
SERIES 717HR HIGH PRESSURE - cULus, FM  
 SERIES 717R - cULus, FM



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

### DIMENSIONS 717HR

| Size                         | Dimensions – Inches/mm |               |              |   |                |               |               |               |              |              |              |               |              |             | Approx.<br>Wgt. Each |
|------------------------------|------------------------|---------------|--------------|---|----------------|---------------|---------------|---------------|--------------|--------------|--------------|---------------|--------------|-------------|----------------------|
| Nominal<br>Size<br>Inches/mm | A                      | B             | C            | D | E (OPENED)     | F             | H             | J             | K            | L            | M            | N             | P            | R           | Lbs.<br>kg           |
| 2<br>60.3                    | 8.66<br>219.8          | 4.40<br>111.9 | 3.16<br>80.1 | – | 8.50<br>215.9  | 4.74<br>120.4 | 5.57<br>141.5 | 8.50<br>216.0 | 3.23<br>82.0 | 2.10<br>53.3 | 1.58<br>40.3 | 4.90<br>124.3 | 3.23<br>82.0 | ¾"<br>NPT   | 15.0<br>6.8          |
| 2 ½<br>73                    | 9.37<br>238.0          | 4.99<br>126.7 | 3.29<br>83.6 | – | 10.50<br>266.7 | 5.87<br>149.0 | 5.82<br>147.8 | 8.71<br>221.2 | 3.31<br>84.1 | 2.37<br>60.2 | 1.60<br>40.7 | 4.90<br>124.3 | 3.47<br>88.1 | 1 ¼"<br>NPT | 19.5<br>8.8          |
| 76.1 mm                      | 9.37<br>238.0          | 4.99<br>126.7 | 3.29<br>83.6 | – | 10.50<br>266.7 | 5.87<br>149.0 | 5.82<br>147.8 | 8.71<br>221.2 | 3.31<br>84.1 | 2.37<br>60.2 | 1.60<br>40.7 | 4.90<br>124.3 | 3.47<br>88.1 | 1 ¼"<br>NPT | 19.5<br>8.8          |
| 3<br>88.9                    | 9.62<br>244.3          | 4.99<br>126.7 | 3.31<br>84.2 | – | 10.78<br>273.8 | 6.20<br>157.6 | 6.07<br>154.2 | 8.96<br>227.6 | 3.53<br>89.7 | 2.47<br>62.7 | 1.60<br>40.6 | 4.90<br>124.3 | 3.72<br>94.5 | 1 ¼"<br>NPT | 25.5<br>11.6         |



# FireLock® Check Valves

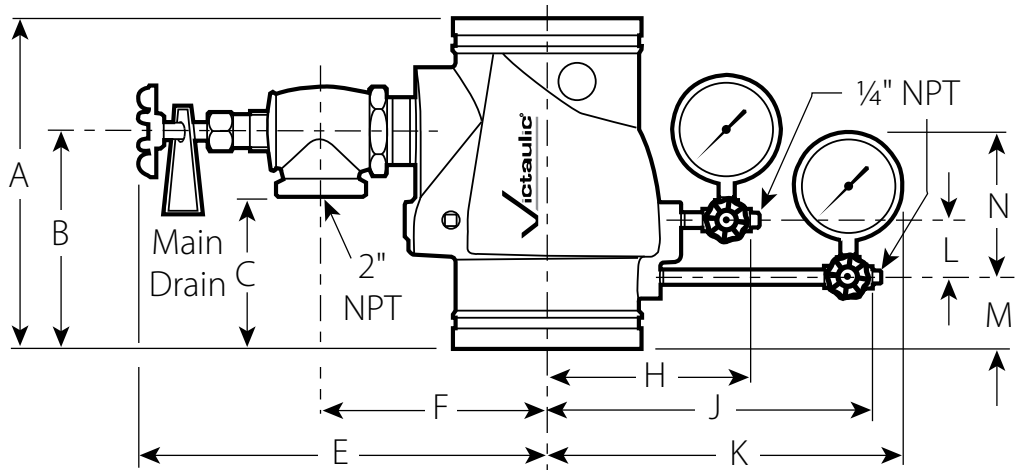
SERIES 717HR HIGH PRESSURE - cULus, FM  
 SERIES 717R - cULus, FM



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

## DIMENSIONS 717R

| Size                      |                                      | Dimensions – Inches/mm |             |             |            |              |             |             |              |              |            |            |             | Approx. Wgt. Each |
|---------------------------|--------------------------------------|------------------------|-------------|-------------|------------|--------------|-------------|-------------|--------------|--------------|------------|------------|-------------|-------------------|
| Nominal Size<br>Inches/mm | Actual Outside Diameter<br>Inches/mm | E-E<br>A               | B           | C           | D          | E            | F           | H           | J            | K            | L          | M          | N           | Lbs.<br>kg        |
| 4<br>100                  | 4.500<br>114.3                       | 9.63<br>245            | 6.25<br>159 | 4.00<br>102 | 3.75<br>95 | 14.25<br>362 | 6.88<br>175 | 6.70<br>170 | 10.45<br>265 | 11.25<br>286 | 2.00<br>51 | 2.00<br>51 | 5.25<br>133 | 28.0<br>12.7      |
| 5<br>125                  | 5.563<br>141.3                       | 10.50<br>267           | 6.50<br>165 | 4.25<br>108 | 3.75<br>95 | 14.75<br>375 | 7.38<br>188 | 7.37<br>187 | 11.87<br>302 | 12.75<br>324 | 2.15<br>55 | 1.88<br>48 | 5.25<br>133 | 35.0<br>15.9      |
| 139.7 mm                  | 5.500<br>139.7                       | 10.50<br>267           | 6.50<br>165 | 4.25<br>108 | 3.75<br>95 | 14.75<br>375 | 7.38<br>188 | 7.37<br>187 | 11.87<br>302 | 12.75<br>324 | 2.15<br>55 | 1.88<br>48 | 5.25<br>133 | 35.0<br>15.9      |
| 6<br>150                  | 6.625<br>168.3                       | 11.50<br>292           | 7.63<br>194 | 5.38<br>137 | 3.75<br>95 | 15.50<br>394 | 8.03<br>204 | 7.70<br>196 | 12.20<br>310 | 13.00<br>330 | 2.38<br>61 | 2.13<br>54 | 5.25<br>133 | 46.0<br>20.9      |
| 165.1 mm                  | 6.500<br>165.1                       | 11.50<br>292           | 7.63<br>194 | 5.38<br>137 | 3.75<br>95 | 15.50<br>394 | 8.03<br>204 | 7.70<br>196 | 12.20<br>310 | 13.00<br>330 | 2.38<br>61 | 2.13<br>54 | 5.25<br>133 | 46.0<br>20.9      |
| 8<br>200                  | 8.625<br>219.1                       | 14.00<br>356           | 8.25<br>210 | 6.00<br>152 | 3.75<br>95 | 16.38<br>416 | 9.00<br>229 | 8.85<br>225 | 12.75<br>324 | 13.50<br>343 | 2.15<br>55 | 2.88<br>73 | 5.25<br>133 | 72.0<br>32.7      |



## FireLock® Check Valves

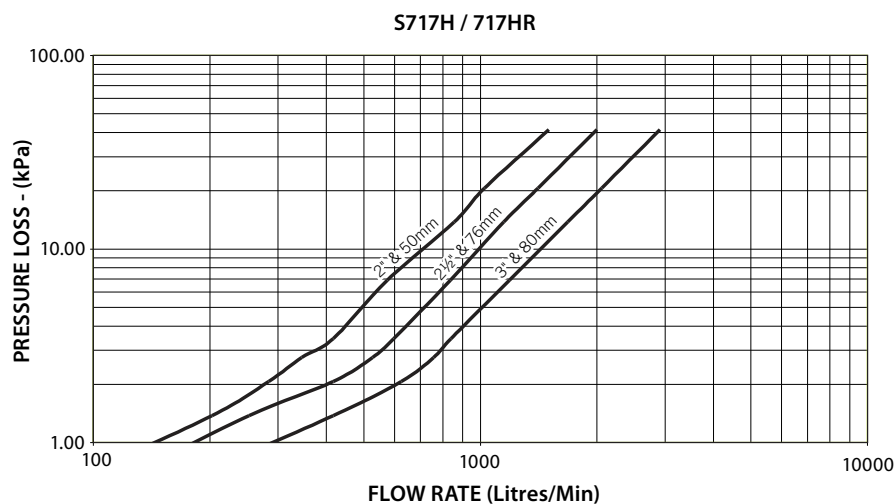
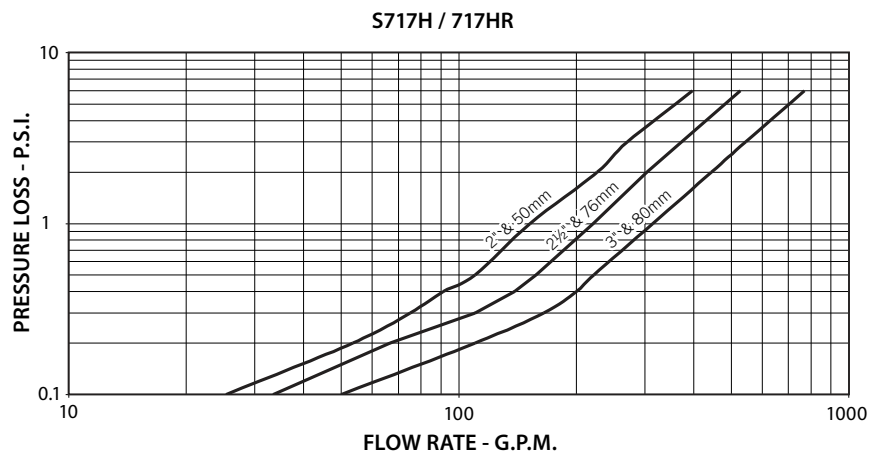
SERIES 717HR HIGH PRESSURE - cULus, FM  
 SERIES 717R - cULus, FM



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

### FLOW CHARACTERISTICS

The charts below express the flow of water at 60°F/16°C through valve.



## FireLock® Check Valves

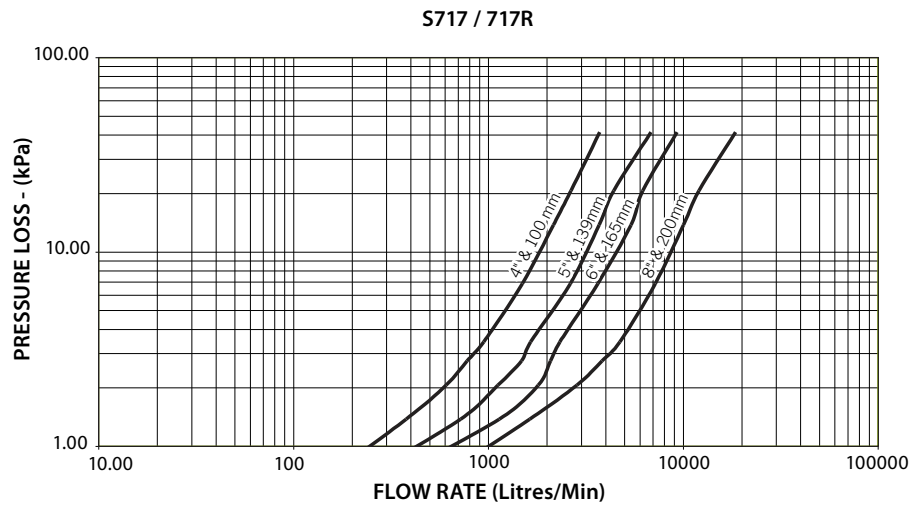
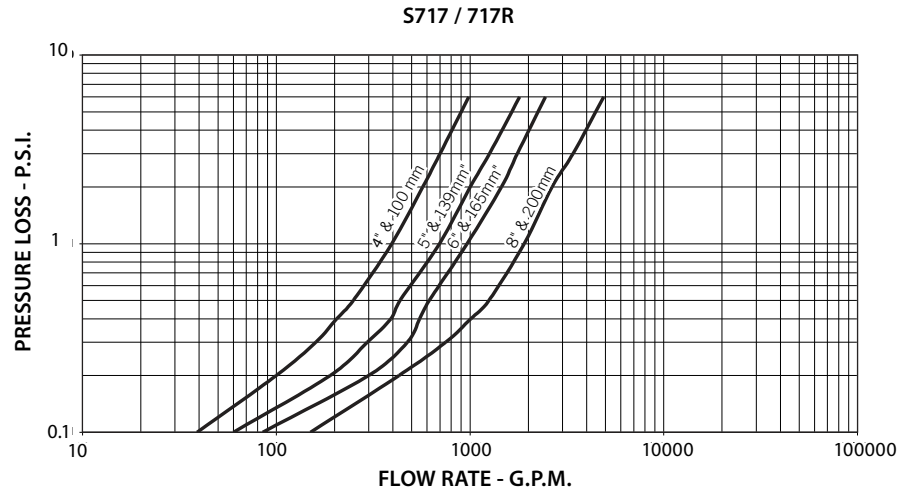
SERIES 717HR HIGH PRESSURE - cULus, FM  
 SERIES 717R - cULus, FM



SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

### FLOW CHARACTERISTICS

The charts below express the flow of water at 60°F/16°C through valve.



### WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

### NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

UPDATED 2/2011

10.09 1540 REV H

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10.09





## For Commercial and Industrial Applications

Job Name \_\_\_\_\_

Contractor \_\_\_\_\_

Job Location \_\_\_\_\_

Approval \_\_\_\_\_

Engineer \_\_\_\_\_

Contractor's P.O. No. \_\_\_\_\_

Approval \_\_\_\_\_

Representative \_\_\_\_\_

## Series **FBV-3**, **FBVS-3**

### 2-Piece, Full Port, Brass Ball Valves

Sizes: 1/4" – 3" (8-80mm)

Series FBV-3, FBVS-3 2-Piece, Full Port, Brass Ball Valves are used in commercial and industrial applications for a full range of liquids and gases. They feature a bottom-loaded blowout-proof stem, virgin PTFE seats, thrust washer, and adjustable stem packing gland, stem packing nut, chrome plated brass ball, brass adapter, and steel handle.

#### Features

- Suitable for a full range of liquids and gases
- Minimal pressure drop due to full size ports
- Bottom loaded, blow-out proof stem
- Virgin PTFE stem packing seal, thrust washer and seats
- Vinyl insulator on heavy duty, zinc plated carbon steel handles
- Fast quarter-turn open or close operation
- Excellent for throttling and balancing applications of nonabrasive fluids where minimum flow is 20% to 100% of valve capacity
- Low operating torque
- Adjustable stem packing gland
- Stem O-ring seal

#### Models

**FBV-3** 1/4" – 3" (8-80mm) with threaded connections

**FBVS-3** 1/2" – 3" (15-80mm) with solder connections

#### Pressure – Temperature

Temperature Range: -40° F – 400° F (-40°C – 204°C)

Pressure Ratings:

##### FBV-3

1/4" – 2" (8 – 50mm)

600psi (41 bars) WOG, non-shock

150psi (10.3 bars) WSP

2 1/2" – 3" (65 – 80mm)

600psi (41 bars) WOG, non-shock

125psi (8.6 bars) WSP

##### FBVS-3

1/2" – 2" (15 – 50mm)

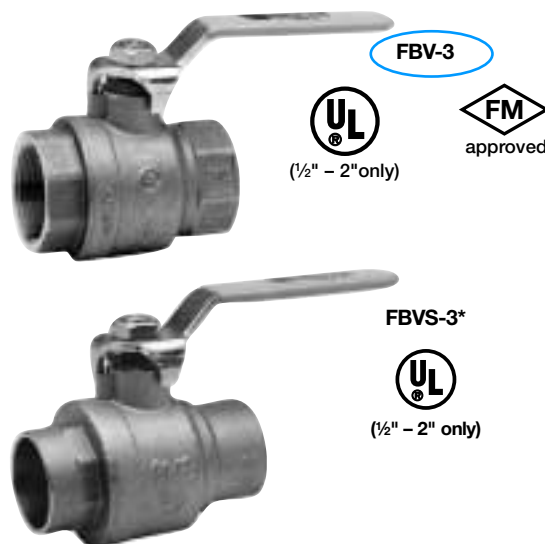
600psi (41 bars) WOG, non-shock

150psi (10.3 bars) WSP

2 1/2" – 3" (65-80mm)

400psi (27.5 bars) WOG, non-shock

125psi (8.6 bars) WSP



#### Approvals

1/2" – 2" (15-50mm) FBV-3 UL/FM approved

1/2" – 2" (15-50mm) FBVS-3 UL listed

Valves comply with MSS-SP-110 standards



#### Gas Approvals (Threaded Valves Only)

1/2" – 2" (15-50mm)

ASME B16.33, CSA



1/2psig and 5psig (14 and 34 kPa) @ -40°F – 125°F (-40°C - 52°C)

125psig (8 bars) @ -40°F – 125°F (-40°C to 52°C)

2 1/2" – 3" (65 – 88mm)

ASME B16.38, CSA

1/2psig and 5psig (14 and 34 kPa) @ -40°F – 125°F (-40°C – 52°C)

125psig (8 bars) @ -40°F – 125°F (-40°C to 52°C)

#### Specifications

Approved valves shall be 2-piece and constructed of forged brass body and end adapter. Ball shall be full port, chrome plated brass. Seats and stem packing shall be virgin PTFE. Bottom loaded, blowout proof stem shall be brass with a fluorocarbon elastomer O-ring and adjustable packing nut threaded to body. Valve sizes 1/4" – 2" shall be rated to 600psi (41 bars) WOG non-shock and 150psi (10.3 bars) WSP. Valve sizes 2 1/2" – 3" (threaded) shall be rated to 600psi (41 bars) WOG non-shock and 125psi (8.6 bars) WSP. Valve sizes 2 1/2" – 3" (solder) shall be rated to 400psi (27.5 bars) WOG non-shock and 125psi (8.6 bars) WSP. Valves shall be equal to Watts FBV-3 (threaded) or FBVS-3 (solder).

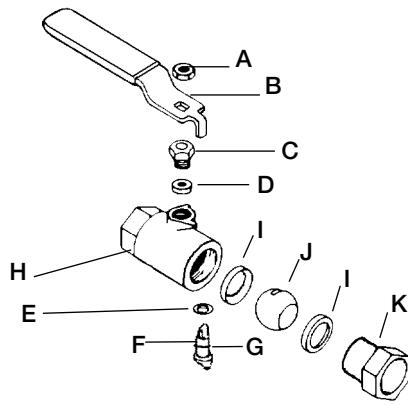
\*This valve is designed to be soft soldered into lines without disassembly, using a low temperature solder to 420°F (216°C). Higher temperature solders may damage the seat material.

Apply heat with the flame directed **AWAY** from the center of the valve body. Excessive heat can harm the seats. After soldering, the packing nut may have to be tightened.

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

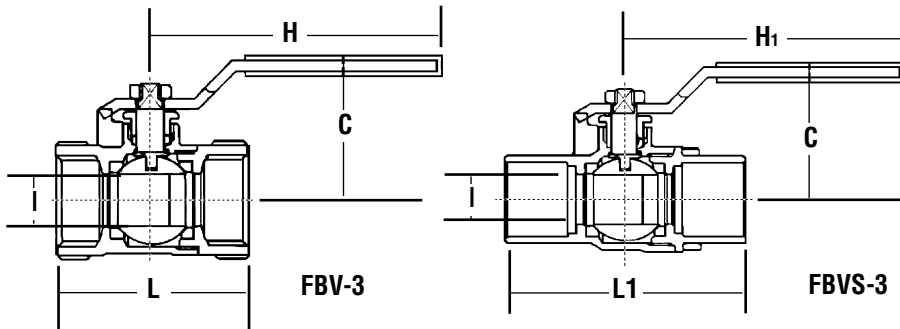


## Materials

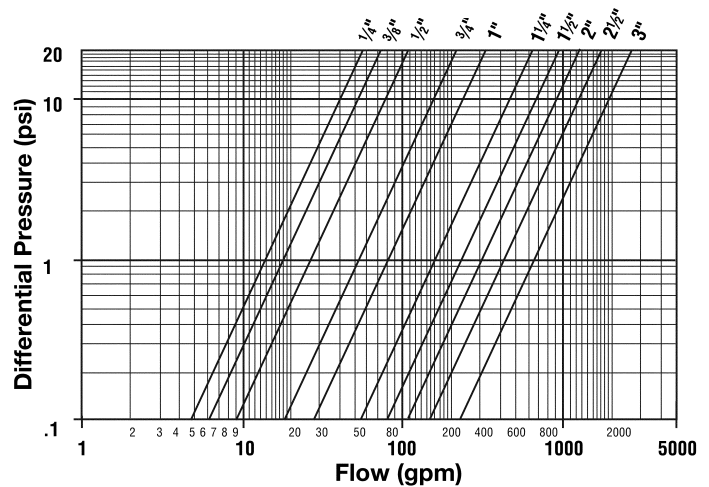


- A. Handle Nut Zinc plated carbon steel
- B. Handle Zinc plated carbon steel with vinyl insulator
- C. Packing Nut Brass
- D. Stem Packing Virgin PTFE
- E. Thrust Washer Virgin PTFE
- F. Stem Machined brass
- G. O-ring Fluorocarbon elastomer (FKM)
- H. Body Forged brass
- I. Seats Virgin PTFE
- J. Ball Chrome plated brass
- K. Adaptor Forged brass

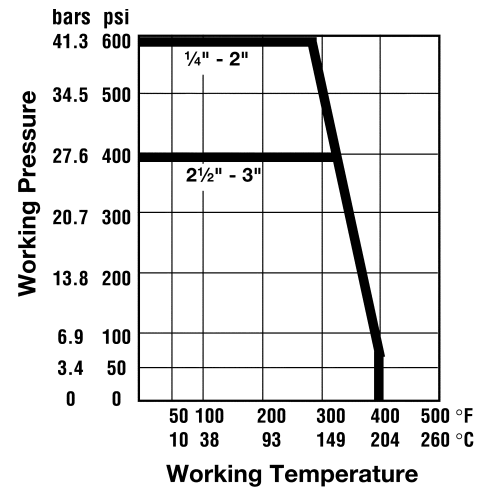
## Dimensions – Weights



## Flow Curves



## Temperature/Pressure Rating



\*See applicable note on reverse side for solder end valves with regards to pressure/temperature rating.

| SIZE (DN)  |           | DIMENSIONS |           |            |           |                |           |            |           |            |           | WEIGHT         |           |             |            |
|------------|-----------|------------|-----------|------------|-----------|----------------|-----------|------------|-----------|------------|-----------|----------------|-----------|-------------|------------|
|            |           | C          |           | H          |           | H <sub>1</sub> |           | I          |           | L          |           | L <sub>1</sub> |           |             |            |
| <i>in.</i> | <i>mm</i> | <i>in.</i> | <i>mm</i> | <i>in.</i> | <i>mm</i> | <i>in.</i>     | <i>mm</i> | <i>in.</i> | <i>mm</i> | <i>in.</i> | <i>mm</i> | <i>in.</i>     | <i>mm</i> | <i>lbs.</i> | <i>kg.</i> |
| 1/4        | 8         | 1 1/16     | 36        | 3 3/16     | 81        | —              | —         | 3/8        | 10.5      | 1 13/16    | 46        | —              | —         | .3          | .1         |
| 3/8        | 10        | 1 1/16     | 36        | 3 3/16     | 81        | —              | —         | 3/8        | 10.5      | 1 13/16    | 46        | —              | —         | .3          | .1         |
| 1/2        | 15        | 1 15/16    | 50        | 3 5/8      | 91        | 3 5/8          | 91        | 19/32      | 12.5      | 2 3/8      | 60        | 2 1/8          | 53        | .5          | .2         |
| 3/4        | 20        | 2 1/16     | 52        | 4 1/2      | 114       | 4 1/2          | 114       | 13/16      | 20.0      | 2 11/16    | 68        | 2 13/16        | 72        | .8          | .3         |
| 1          | 25        | 2 7/16     | 62        | 4 5/8      | 125       | 4 5/8          | 125       | 1          | 25.0      | 3 1/8      | 80        | 3 3/8          | 86        | 1.4         | .6         |
| 1 1/4      | 32        | 2 5/8      | 66        | 4 5/8      | 125       | 4 5/8          | 125       | 1 1/4      | 31.0      | 3 11/16    | 90        | 3 7/8          | 98        | 2.0         | .9         |
| 1 1/2      | 40        | 2 15/16    | 75        | 5 1/2      | 140       | 5 1/2          | 140       | 1 1/2      | 39.0      | 3 7/8      | 99        | 4 3/8          | 112       | 2.6         | 1.2        |
| 2          | 50        | 3 3/8      | 80        | 7 7/8      | 200       | 7 7/8          | 200       | 2          | 50.0      | 4 7/16     | 113       | 5 5/16         | 135       | 4.0         | 1.8        |
| 2 1/2      | 65        | 4 5/16     | 109       | 9 7/8      | 250       | 9 7/8          | 200       | 2 3/8      | 60.5      | 5 1/2      | 140       | 6 5/16         | 161       | 9.0         | 4.1        |
| 3          | 80        | 4 3/8      | 118       | 9 7/8      | 250       | 7 7/8          | 200       | 2 15/16    | 74.0      | 6 1/4      | 159       | 7 3/16         | 182       | 12.8        | 5.8        |

**WATTS®**  
REGULATOR

ISO 9001  
CERTIFIED

USA: 815 Chestnut St., No. Andover, MA 01845-6098; [www.wattsreg.com](http://www.wattsreg.com)  
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; [www.wattscanada.ca](http://www.wattscanada.ca)



**Model 1011T**

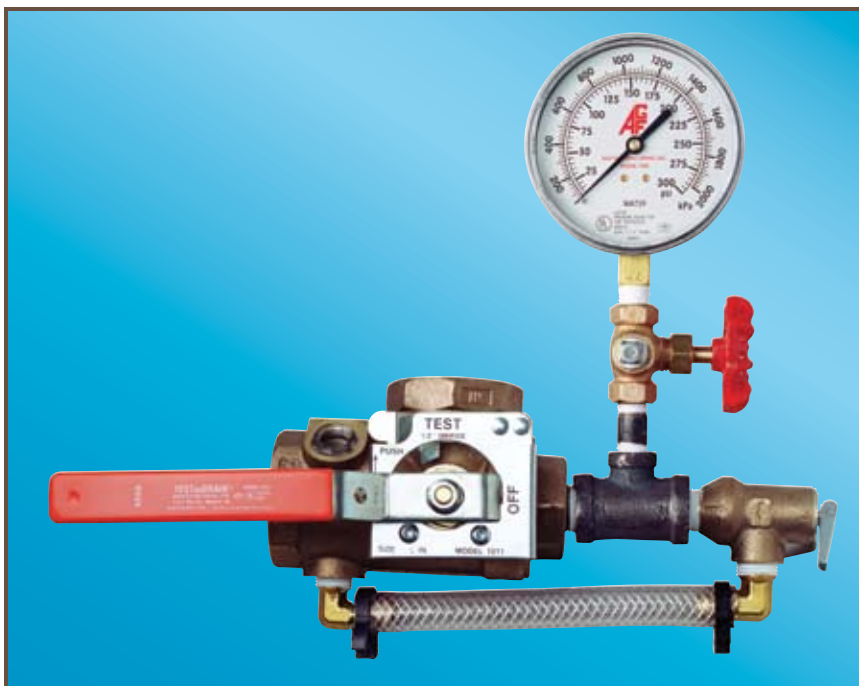
# TEST AND DRAIN®

Sectional Floor Control Test and Drain Valve for Systems  
Requiring Pressure Relief Valve and Pressure Gauge Assembly



**3/4" 1" 1 1/4" 1 1/2" 2"**

- The AGF Manufacturing Inc. **Model 1011T TEST AND DRAIN®** matches all the features and benefits of our **Model 1000** by providing both the test function and the express drain function in a multistory installation for a wet fire sprinkler system, with the added features of an integral **Model 7000 Pressure Relief Valve** with drainage piping, **Model 7500 300 PSI 3 1/2" Pressure Gauge**, and **Model 7600 1/4" 3-Way Globe Valve**.
- The **Model 1011T** complies with the requirements of NFPA-13 that stipulate a pressure relief valve be installed on all gridded systems and downstream of all pressure reducing valves (see reverse).
- The **Model 1011T TEST AND DRAIN®** is a compact single handle ball valve which includes a tamper resistant test orifice and integral tamper resistant sight glasses, and is 300 PSI rated.
- Available in a full range of sizes from 3/4" to 2" NPT and BSPT, with all specifiable orifice sizes 3/8" (2.8K), 7/16" (4.2K), 1/2" (5.6K), 17/32" (8.0K), 5/8" (11.2K, ELO), 3/4" (14.0K, ESFR), and K25 as required by NFPA 13, 2007 (see reverse).
- The included UL/FM **Model 7000 Pressure Relief Valve** features a flushing handle and is factory rated for 175 PSI. Other pressure settings are available and may be substituted.
- Designed to relieve excess system pressure caused by surges or temperature changes as well as solve the difficult problem of providing the relief valve with a convenient drainage-piping outlet.
- The **Model 1011T** is shipped complete with all necessary components including the UL/FM **Model 7500 Pressure Gauge** and UL/FM **Model 7600 Globe Valve**.
- Shipped with relief valve and bypass drain ports plugged to expedite pressure testing the system.
- A locking kit is available and can be ordered with the valve to provide vandal resistance or prevent unintentional alarm activation.
- Repair kits including (1) adapter gasket, (1) ball, (2) valve seats, (1) stem packing, and (1) stem washer are available for all **TEST AND DRAIN®** valves. Valve and orifice size must be specified when ordering.



NOTE: It is important to note that the pressure rating of the relief valve indicates an operating range of pressure for both opening and closing of the valve. Standard relief valves are required to OPEN in a range of pressure between 90% and 105% of their rating. The valves are required to CLOSE at a pressure above 80% of that rating. The relief valve should be installed where it is easily accessible for maintenance. Care should be taken that the relief valve CANNOT be isolated from the system when the system is operational. A relief valve should NEVER have a shutoff valve or a plug downstream of its outlet.

**Reliability, Versatility, Code Compatibility**



# TEST AND DRAIN®

Model 1011T 300 PSI Bronze Ball Valve, Model 7000 Pressure Relief Valve, Model 7500 Pressure Gauge, and Model 7600 1/4" 3-Way Globe Valve

## DIMENSIONS

Orifice Size Available: 3/8", 7/16", 1/2", 17/32", ELO (5/8")\*, ESFR (3/4")\*, & K25\*\*

| SIZE   | A                   | B                 | C                   | D                   | E                    | F                    |
|--------|---------------------|-------------------|---------------------|---------------------|----------------------|----------------------|
| 3/4"   | 10 1/4"<br>(256 mm) | 3 3/8"<br>(86 mm) | 1 13/16"<br>(46 mm) | 4 9/16"<br>(117 mm) | 6 3/8"<br>(162.5 mm) | 8 3/4"<br>(119 mm)   |
| 1"     | 10 1/4"<br>(256 mm) | 3 3/8"<br>(86 mm) | 1 13/16"<br>(46 mm) | 4 9/16"<br>(117 mm) | 6 3/8"<br>(162.5 mm) | 8 3/4"<br>(119 mm)   |
| 1 1/4" | 10 1/2"<br>(263 mm) | 3 5/8"<br>(91 mm) | 1 15/16"<br>(51 mm) | 5 9/16"<br>(141 mm) | 5 1/2"<br>(192 mm)   | 9"<br>(225 mm)       |
| 1 1/2" | 11 1/2"<br>(288 mm) | 3 7/8"<br>(99 mm) | 2 5/8"<br>(67 mm)   | 8 1/4"<br>(207 mm)  | 10 7/8"<br>(274 mm)  | 9 11/16"<br>(242 mm) |
| 2"     | 11 1/2"<br>(288 mm) | 3 7/8"<br>(99 mm) | 2 5/8"<br>(67 mm)   | 8 1/4"<br>(207 mm)  | 10 7/8"<br>(274 mm)  | 9 11/16"<br>(242 mm) |

\* Available on 1 1/4" to 2" size units only

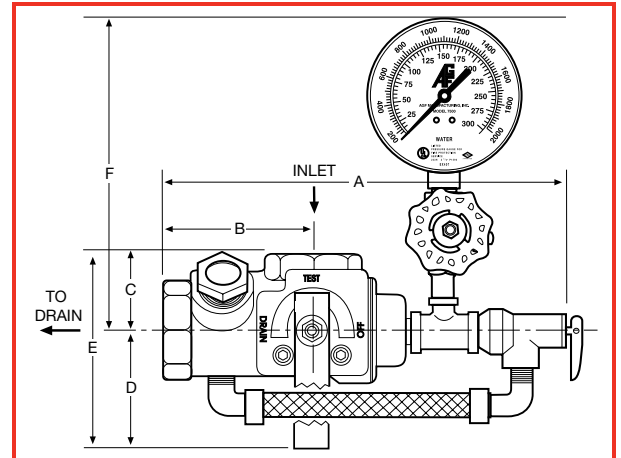
\*\* Available on 1 1/2" and 2" size units only

## THE MODEL 1011T PROVIDES ALL OF THE FOLLOWING...

From the 2007 Edition of NFPA 13

- Chapter 8.16.2.4.1\* Provisions shall be made to properly drain all parts of the system.
- Chapter 8.16.2.4.2 Drain connections, interior sectional or floor control valve(s) – shall be provided with a drain connection having a minimum size as shown in Table 8.16.2.4.2.
- & 8.16.2.4.3
- Chapter 8.16.2.4.4 Drains shall discharge outside or to a drain capable of handling the flow of the drain.
- Chapter A.8.17.4.2 (Wet Pipe System) test connection is permitted to terminate into a drain capable of accepting full flow... using an approved sight test connection containing a smooth bore corrosion-resistant orifice giving a flow equivalent to one sprinkler...
- Chapter 8.17.4.2.2 The test connection valve shall be readily accessible.
- Chapter 8.17.4.2.4 shall be permitted to be installed in any location... downstream of the waterflow alarm.
- Chapter 8.17.4.3.1 (Dry Pipe System) a trip test connection not less than 1" in diameter, terminating in a smooth bore corrosion-resistant orifice, to provide a flow equivalent to one sprinkler...
- Chapter 8.17.4.3.2 The trip test connection... with a shutoff valve and plug not less than 1", at least one of which shall be brass.
- Chapter 7.1.2 - a gridded wet pipe system shall be provided with a relief valve set to operate at 175 PSI or 10 PSI in excess of the maximum system pressure, whichever is greater.
- Chapter 8.16.1.2.3\* A relief valve of not less than 1/2" in size shall be provided on the discharge side of the pressure-reducing valve set to operate at a pressure not exceeding 175 PSI.
- Chapter A.8.16.1.2.3 - consideration should be given to piping the discharge from the (pressure relief) valve
- Chapter 8.16.1.2.2 Pressure gauges shall be installed on the inlet and outlet sides of each pressure-reducing valve.

## MODEL 1011T - FRONT VIEW



## MATERIALS

- Handle: Steel
- Stem: Rod Brass
- Ball: C.P. Brass
- Body: Bronze
- Valve Seat: Impregnated Teflon®
- Indicator Plate: Steel
- Relief Valve: Bronze
- Bypass Fittings: Brass
- Bypass Tubing: Nylobraid

## APPROVALS

- UL and ULC Listed: (EX4019 & EX4533)
- FM Approved
- NYC-BSA No. 720-87-SM



**USA Patent # 4741361 and Other Patents Pending**



**AGF Manufacturing Inc.**  
100 Quaker Lane, Malvern, PA 19355  
Phone: 610-240-4900  
Fax: 610-240-4906  
[www.testandrain.com](http://www.testandrain.com)

Job Name: \_\_\_\_\_  
Architect: \_\_\_\_\_  
Engineer: \_\_\_\_\_  
Contractor: \_\_\_\_\_

# 'Apollo' Valves

## SUBMITTAL SHEET

### LEAD FREE

## Model DCDALF 4A

## Model DCDA2LF 4A

### Double Check Detector Assembly



### SPECIFICATIONS

The 2 1/2" – 12" Double Check Detector Assembly shall be an Apollo® Model DCDALF 4A or DCDA2LF 4A. The assembly shall be manufactured in America and carry a 5-year Apollo® factory warranty. The TriForce™ center-stem guided check valves shall feature reversible silicone rubber seat discs. The check valves shall be held in place by SS snap-in retainers (2 1/2" – 6") or SS studs & nuts (8" – 12"). Access to the check valves shall be by an Apollo® quick-connect SS coupling (2 1/2" – 6") or grooved couplings (8" – 12"). The bodies shall be domestic SS in 2 1/2" – 8" sizes and FDA epoxy-coated ductile iron in 10" & 12" sizes. The assembly consists of a mainline double check valve with a Type 2 bypass consisting of a lead free\* single check (SCV) and meter bypassing the mainline second check to prevent backflow while accurately measuring all flows up to 2 gpm while the mainline 2nd check remains closed. Assemblies with the optional Type 1 bypass consist of a lead free\* double check valve and meter which bypass both mainline checks and accurately meter all flows up to 2 gpm with the mainline checks closed. The Apollo® lead free\* domestic ball valve test cocks shall have SS handles. The pressure drop across the assembly shall be documented by an independent laboratory. The assembly shall prevent contamination of the potable water supply due to back-siphonage or backpressure from substances that are non-health hazards.



### FEATURES

- Domestic Stainless steel body: 2 1/2" – 8"
- FDA epoxy-coated ductile iron body: 10" & 12"
- Easy maintenance – no special tools required
- Snap-in check retainers: 2 1/2" – 6"
- Bolted-in checks: 8" – 12"
- Low pressure loss as documented by an independent laboratory
- Center-stem guided TriForce™ check valves

- Approved for horizontal (2 1/2"–12") and vertical flow up (2 1/2"–8")
- US Patent Nos. 6,443,184; 7,025,085; 7,533,699
- **Made in the USA**

### PERFORMANCE RATING

- Maximum Working Pressure 175 psi
- Temperature Range 33 ° F – 140 ° F
- Hydrostatic Test Pressure 350 psi

### APPROVALS

- Sizes 2 1/2" – 12": ASSE 1048\*, CSA B64.5, FM, UL\*, cUL\*
- \* ASSE, UL, and cUL installations must include indicating-type shut-off valves
- Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California (Model DCDALF 4A, 2-1/2" - 8")

### FACTORY CODE

| 4ALF             | 6 X   | X   | X  | [X]  |
|------------------|---|---|--|--|
|                  | BY-PASS SUB-ASSEMBLY OPTIONS  | SIZE  | METER OPTION   | SHUT-OFF VALVES (Inlet X Outlet)   |
| 4ALF = Lead Free | <input type="checkbox"/> 0 = Type 1 w/ 1/2" Double Check<br><input type="checkbox"/> 2 = Type 2 w/ 1/2" Single Check (Standard)<br><input type="checkbox"/> 3 = Type 1 w/ bypass on left*<br><input type="checkbox"/> 4 = Type 2 w/ bypass on left* | <input type="checkbox"/> 9 = 2-1/2"<br><input type="checkbox"/> 0 = 3"<br><input type="checkbox"/> A = 4"<br><input type="checkbox"/> C = 6"<br><input type="checkbox"/> E = 8"<br><input type="checkbox"/> G = 10"<br><input type="checkbox"/> H = 12" | <input type="checkbox"/> C = Cubic feet/min<br><input type="checkbox"/> E = Gallons/min<br><input type="checkbox"/> G = Less meter | <input type="checkbox"/> 1 = Less Shut-off Valves<br><input type="checkbox"/> 3 = OS&Y Flg x OS&Y Flg<br><input type="checkbox"/> 4 = OS&Y Flg x Monitored (Mon.) Butterfly Vlv Grv†<br><input type="checkbox"/> 6 = OS&Y Flg x Post indicator Flg**<br><input type="checkbox"/> 7 = OS&Y Flg x OS&Y Grv<br><input type="checkbox"/> 8 = OS&Y Grv x OS&Y Grv<br><input type="checkbox"/> 9 = Mon. Butterfly Vlv Grv x Mon. Butterfly Vlv Grv†<br><input type="checkbox"/> 10 = OS&Y Flg x Post Indicator Grv**<br><input type="checkbox"/> 13 = Post Indicator Flg x Mon. Butterfly Vlv Grv†<br><input type="checkbox"/> 14 = Post Indicator Flg x Post Indicator Flg<br><input type="checkbox"/> 16 = Mon Butterfly Vlv Grv x Post Indicator Flg†<br><input type="checkbox"/> 17 = Post Indicator Flg x OS&Y Grv<br><input type="checkbox"/> 18 = OS&Y Grv x Post Indicator Grv<br><input type="checkbox"/> 19 = Mon. Butterfly Vlv Grv x Post Indicator Grv<br><input type="checkbox"/> 20 = Post Indicator Flg x OS&Y Flg |

\* Orientation of bypass looking downstream. Standard is right hand side. Left hand is on opposite side

\*\* Post indicator with plate & nut option not available in 2-1/2" size.

† Butterfly valves not available in 12" size.

\* **LEAD FREE:** The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.

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# 'Apollo' Valves

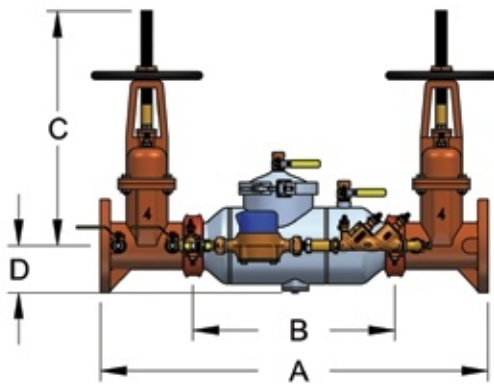
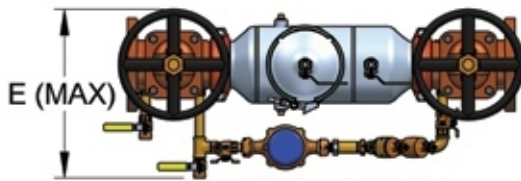
## SUBMITTAL SHEET

### LEAD FREE

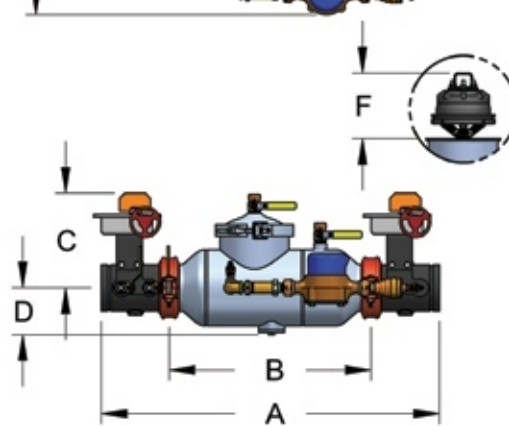
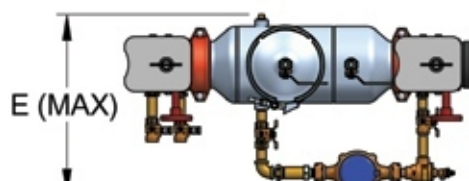
## Model DCDALF 4A

## Model DCDA2LF 4A

### Double Check Detector Assembly



TYPE 1 BYPASS



TYPE 2 BYPASS (STANDARD)

### DIMENSIONS

Nominal dimensions are shown. Allowances must be made for manufacturers' tolerances ( $\pm 1/8"$  (3 mm) per joint)

| DIMENSIONS                    | 2-1/2"     | 60mm      | 3"         | 75mm      | 4"         | 100mm     | 6"         | 150mm     | 8"         | 200mm     | 10"        | 250mm     | 12"        | 300mm     |
|-------------------------------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|
| A (Butterfly Valves)          | 28 ±       | 711 ±     | 28-1/2 ±   | 724 ±     | 33-1/4 ±   | 845 ±     | 38-7/8 ±   | 987 ±     | 46-3/8 ±   | 1178 ±    | 52-1/4 ±   | 1378 ±    | N/A        | N/A       |
| A (Gate Valves)               | 31 ±       | 787 ±     | 32 ±       | 813 ±     | 38 ±       | 965 ±     | 45-7/8 ±   | 1165 ±    | 53-3/8 ±   | 1356 ±    | 62-1/4 ±   | 1581 ±    | 65-1/2 ±   | 1664 ±    |
| B (Less Shut-off Valves)      | 15-7/8 ±   | 403 ±     | 15-7/8 ±   | 403 ±     | 19-5/8 ±   | 498 ±     | 24-1/2 ±   | 622 ±     | 30 ±       | 762 ±     | 36 ±       | 914 ±     | 37 ±       | 940 ±     |
| C (Butterfly Valves)          | 8          | 203       | 8-3/8      | 213       | 9-1/8      | 233       | 10-1/8     | 257       | 12         | 306       | 13-3/8     | 340       | N/A        | N/A       |
| C (NRS/PI Gate Valves)        | 11-3/8     | 289       | 12-3/8     | 314       | 14-3/4     | 375       | 19         | 483       | 22-1/2     | 572       | 26-1/2     | 673       | 30         | 762       |
| C (OS&Y Open)                 | 16-3/8     | 416       | 18-7/8     | 479       | 22-3/4     | 578       | 30-1/8     | 765       | 37-3/4     | 959       | 45-3/4     | 1162      | 53-1/8     | 1348      |
| D (Centerline to bottom)      | 3-7/8      | 98        | 3-7/8      | 98        | 4-5/8      | 117       | 6          | 152       | 8-1/8      | 206       | 11-3/4     | 298       | 12         | 305       |
| E (Width Max)                 | 17         | 432       | 17         | 432       | 17         | 432       | 20         | 508       | 21-1/2     | 546       | 26-1/2     | 673       | 26-1/2     | 673       |
| F (Check Removal Clearance)   | 4-3/4      | 121       | 4-3/4      | 121       | 6-1/2      | 165       | 7-1/2      | 191       | 7-1/2      | 191       | 10         | 254       | 10         | 254       |
| Test Cocks (NPT)              | 1/2"       | 13        | 1/2"       | 13        | 1/2"       | 20        | 3/4"       | 20        | 3/4"       | 20        | 3/4"       | 20        | 3/4"       | 20        |
| <b>WEIGHTS</b>                | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> | <b>lb.</b> | <b>kg</b> |
| Net Wt. (Less Shut-offs)      | 37         | 17        | 38         | 17        | 54         | 25        | 90         | 41        | 223        | 101       | 722        | 327       | 825        | 374       |
| Net Wt. (w/ Butterfly Valves) | 64         | 29        | 68         | 31        | 98         | 45        | 158        | 72        | 354        | 161       | 940        | 426       | N/A        | N/A       |
| Net Wt. (w/ OS&Y Gate Valves) | 133        | 60        | 159        | 72        | 209        | 95        | 339        | 154       | 700        | 318       | 1608       | 729       | 2017       | 915       |

#### Notes:

- Nominal dimensions are shown. Allowances must be made for manufacturers' tolerances (1/8" per joint).
- Internal body connections are grooved on 2 1/2" – 10" sizes.
- Internal body connections are flanged on 12" size.

\* LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.

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# 'Apollo' Valves

## SUBMITTAL SHEET

### LEAD FREE

## Model DCDALF 4A

## Model DCDA2LF 4A

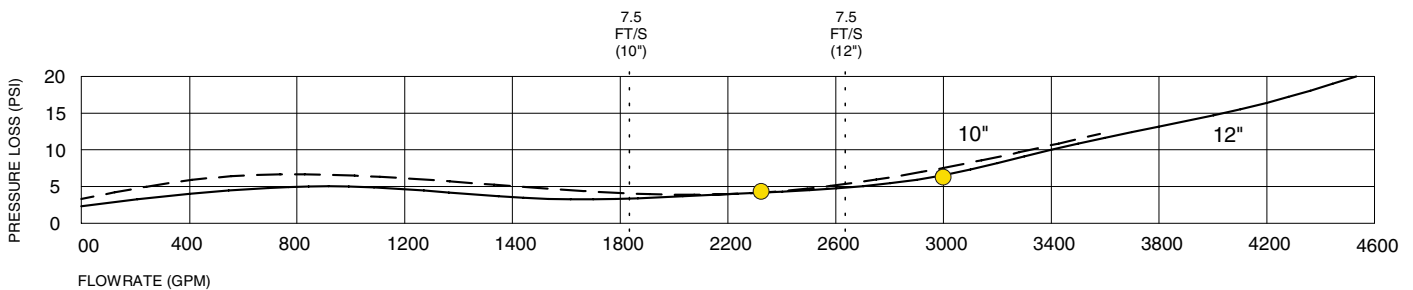
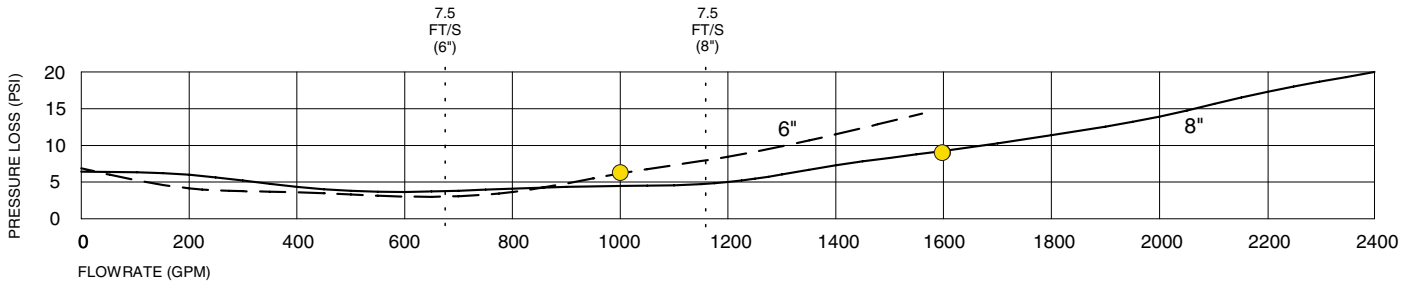
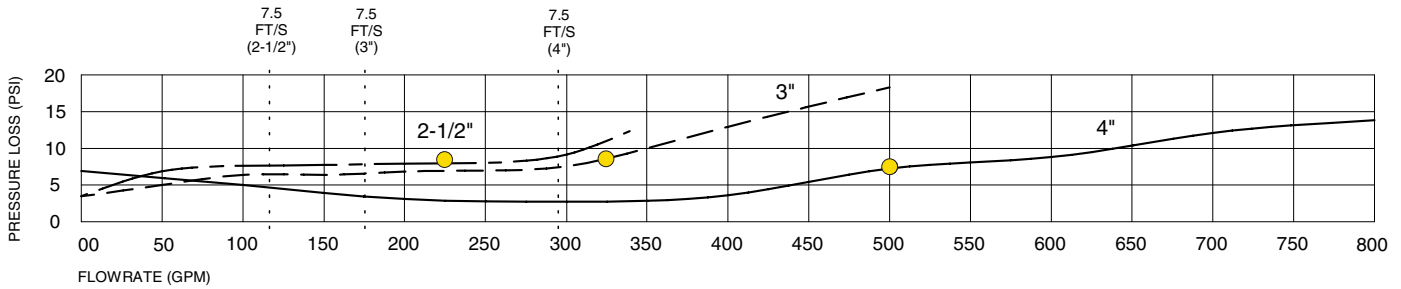
### Double Check Detector Assembly

### STANDARD MATERIALS LIST

| Part Name                   | Material                                       |
|-----------------------------|--|
| Body (2 1/2" – 8")          | 304 Stainless Steel                            |
| Body (10" & 12")            | FDA Epoxy Coated Ductile Iron                  |
| Covers (2 1/2" – 6")        | Glass-filled PPO/Stainless Steel               |
| Cover (8")                  | 304 Stainless Steel                            |
| Covers (10" & 12")          | FDA Epoxy Coated Ductile Iron                  |
| Check Valves (2 1/2" – 12") | Glass-filled PPO/Bronze (C89836 Lead-Free*)/SS |
| Bypass Valves               | Bronze (C89836 Lead-Free*)                     |
| Springs                     | Stainless Steel                                |
| Seat Discs                  | Chloramine-resistant Silicone                  |

### FLOW CURVES

● Meter Rated Flow



#### Notes:

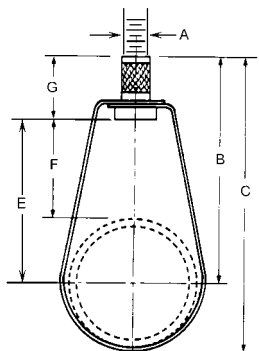
1. Flow curves directly reflect data collected by an independent laboratory.
2. Flow curves shown were recorded with butterfly shut-off valves. Flow curves with gate valves are slightly lower. Contact factory for more information.
3. All data points are based on ASSE increasing flow data, from zero GPM to rated flow (opening curve).
4. For high flow rates/pressure loss information – contact factory.

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**FIG. 310NF "EM-LOK" ADJUSTABLE SWIVEL RING HANGER, NFPA, DOMESTIC**  
~~**FIG. 310NFI "EM-LOK" ADJUSTABLE SWIVEL RING HANGER, NFPA**~~



**Material:** Pre-galvanized carbon steel.  
**Finish:** Pre-galvanized.  
**Service:** Designed for the suspension of non-insulated stationary pipe lines. Typically used as a pipe support for sprinkler piping. Hanger is manufactured to use minimum rod sizes permitted by NFPA.  
**Approvals:** U.L. (sizes 3/4"-8") - U.L.C.(3/4"-2") listed and FM approved (3/4"-8"). Complies with Federal Specification WW-H-171-E (Type# 10), A-A-1192 A (Type# 10) and Manufacturers' Standardization Society MSS SP-58 and SP-69 (Type# 10).  
**Ordering:** Specify pipe size and figure number.

| PIPE SIZE | PIPE OD | MATERIAL SIZE | A   | B       | C       | E       | F      | G      | WGT EACH (lbs) | MAX REC LOAD (lbs) |
|-----------|---------|---------------|-----|---------|---------|---------|--------|--------|----------------|--------------------|
| 1/2       | 0.840   | 18ga x 5/8    | 3/8 | 2 1/2   | 2 7/8   | 1 5/8   | 1 3/16 | 7/8    | 0.08           | 400                |
| 3/4       | 1.050   | 18ga x 5/8    | 3/8 | 2 7/16  | 2 15/16 | 1 9/16  | 1 1/16 | 7/8    | 0.08           | 400                |
| 1         | 1.315   | 18ga x 5/8    | 3/8 | 2 5/8   | 3 1/4   | 1 3/4   | 1 1/16 | 7/8    | 0.08           | 600                |
| 1 1/4     | 1.660   | 18ga x 5/8    | 3/8 | 2 9/16  | 3 3/8   | 1 11/16 | 7/8    | 7/8    | 0.10           | 600                |
| 1 1/2     | 1.900   | 18ga x 5/8    | 3/8 | 2 11/16 | 3 5/8   | 1 13/16 | 7/8    | 7/8    | 0.10           | 600                |
| 2         | 2.375   | 18ga x 5/8    | 3/8 | 3 3/8   | 4 1/2   | 2 1/2   | 1 5/16 | 7/8    | 0.12           | 600                |
| 2 1/2     | 2.875   | 14ga x 3/4    | 3/8 | 3 7/8   | 5 3/8   | 3 1/8   | 1 3/8  | 7/8    | 0.24           | 600                |
| 3         | 3.500   | 14ga x 3/4    | 3/8 | 4 1/2   | 6 1/4   | 3 5/8   | 1 5/8  | 7/8    | 0.28           | 600                |
| 3 1/2     | 4.000   | 14ga x 3/4    | 3/8 | 4 7/8   | 6 7/8   | 4       | 1 3/4  | 7/8    | 0.32           | 600                |
| 4         | 4.500   | 14ga x 3/4    | 3/8 | 5       | 7 1/4   | 4 1/8   | 1 5/8  | 7/8    | 0.32           | 1000               |
| 5         | 5.563   | 13ga x 3/4    | 1/2 | 5 3/4   | 8 1/2   | 4 1/4   | 1 7/8  | 1 1/16 | 0.62           | 1000               |
| 6         | 6.625   | 13ga x 3/4    | 1/2 | 6 3/4   | 10 1/8  | 5 1/8   | 2 1/8  | 1 1/16 | 0.65           | 1250               |
| 8         | 8.625   | 12ga x 3/4    | 1/2 | 7 7/8   | 12 1/4  | 7       | 2 3/8  | 1 1/16 | 1.00           | 1250               |
| 10        | 10.750  | 11ga x 1 1/4  | 1/2 | 9 11/16 | 15 1/16 | 8 5/8   | 3 1/4  | 1 1/16 | 1.675          | 1250               |





Fig. 92 Universal C-type Clamp (Standard Throat)

**Size Range:** 3/8" and 1/2"

**Material:** Ductile iron, hardened steel cup point set screw and locknut.

**Finish:** ☐ Plain or ☐ Galvanized

**Service:** Recommended for use under roof installations with bar joist type construction, or for attachment to the top or bottom flange of structural shapes where the vertical hanger rod is required to be offset from the edge of the flange and where the thickness of joist or flange does not exceed 3/4".

**Approvals:** Complies with Federal Specification A-A-1192A (Type 19 & 23) WW-H-171-E (Type 23), ANSI/MSS SP-69 and MSS SP-58 (Type 19 & 23).  
UL, ULC Listed and FM Approved.

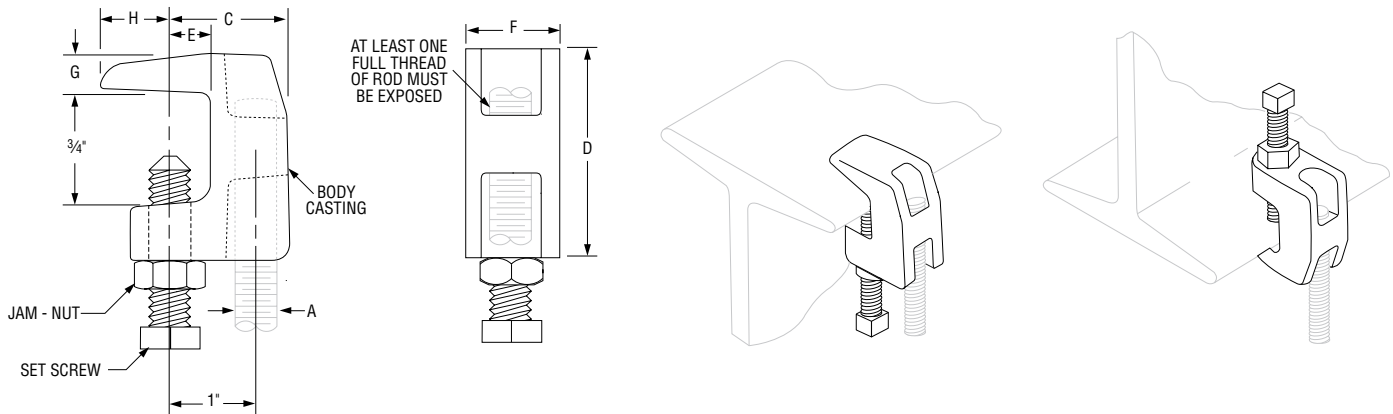
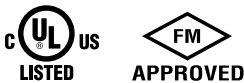
**How to size:** Size of clamp is determined by size of rod to be used.

**Installation:** Follow recommended set screw torque values per MSS-SP-69 (See table on page 233)

**Features:**

- They may be attached to horizontal flanges of structural members in either the top beam or bottom beam positions.
- Secured in place by a cup-pointed Set Screw tightened against the flange.  
A Jam Nut is provided for tightening the Set Screw against the Body Casting.
- Thru tapping of the body casting permits extended adjustment of the threaded rod.
- Can be used with Fig 89X retaining clip for seismic applications.

**Ordering:** Specify rod size, figure number, name of clamp and finish.



| FIG. 92: LOAD (LBS) • WEIGHT (LBS) • DIMENSIONS (IN) • TORQUE (IN-LBS) |                   |                 |             |        |        |        |         |      |        |      |       |
|--|-------------------|-----------------|-------------|--------|--------|--------|---------|------|--------|------|-------|
| Rod Size<br>A  | Set Screw<br>Size | Torque<br>Value | Max Loads ■ |        | Weight | C      | D       | E    | F      | G    | H     |
|  |                   |                 | Top         | Bottom |        |        |         |      |        |      |       |
| 3/8  | 3/8               | 60              | 500         | 250    | 0.34   | 1 5/16 | 1 9/16  | 9/16 | 1 3/16 | 3/8  | 1/2   |
| 1/2  | 1/2               | 125             | 950         | 760    | 0.63   | 1 3/8  | 1 13/16 | 1/2  | 1 1/16 | 7/16 | 23/32 |

■ Maximum temperature of 450° F

| PROJECT INFORMATION |  | APPROVAL STAMP                             |
|---------------------|--|--|
| Project:            |  | <input type="checkbox"/> Approved          |
| Address:            |  | <input type="checkbox"/> Approved as noted |
| Contractor:         |  | <input type="checkbox"/> Not approved      |
| Engineer:           |  | Remarks:                                   |
| Submittal Date:     |  |  |
| Notes 1:            |  |  |
| Notes 2:            |  |  |

## Fig. 98 - Rod Stiffener

## Fig. 98B - Rod Stiffener w/Break-off Bolt Head

**Size Range** — Secures 3/8" thru 7/8" hanger rod

**Material** — Carbon Steel

**Function** — Secures channel to hanger rod for vertical seismic bracing.

**Approvals** — Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (OSHPD). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines

**Finish** — Electro Galvanized

**Note** — Available in HDG finish or Stainless Steel materials.

**Order By** — Figure number

Component of State of California OSHPD Approved Seismic Restraints System

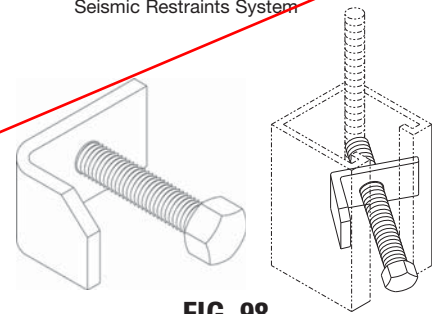


FIG. 98

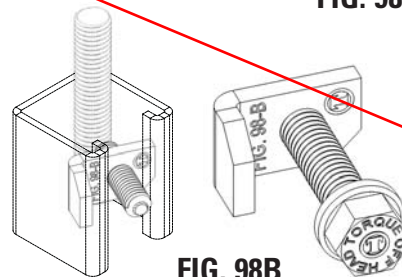


FIG. 98B

## Fig. 99 - All Thread Rod Cut to Length

**Size Range** — Secures 3/8" thru 7/8" rod in 1" increments

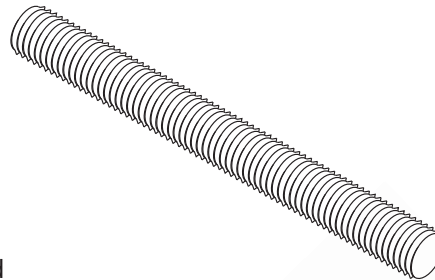
**Material** — Carbon Steel

**Maximum Temperature** — 750°F

**Finish** — Plain

**Note** — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

**Order By** — Figure number, rod diameter, rod length and finish



### Dimensions

| Rod Size | Max. Rec. Load Lbs. For Service Temp 650°F |
|----------|--|
| 3/8      | 730  |
| 1/2      | 1350                                       |
| 5/8      | 2160                                       |
| 3/4      | 3230                                       |
| 7/8      | 4480                                       |

## Fig. 100 - All Thread Rod Full Length

**Size Range** — Secures 3/8" thru 1 1/2" rod in 10' lengths

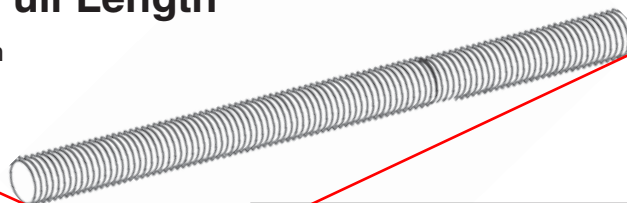
**Material** — Carbon Steel

**Maximum Temperature** — 750°F

**Finish** — Plain

**Note** — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

**Order By** — Figure number, rod diameter and finish



### Dimensions • Weights

| Rod Size | Max Rec. Load Lbs. For Service Temps 650°F | Approx. Wt./100 |
|----------|--|-----------------|
| 1/4      | 240  | 12              |
| 3/8      | 730  | 29              |
| 1/2      | 1350                                       | 53              |
| 5/8      | 2160                                       | 84              |
| 3/4      | 3230                                       | 123             |
| 7/8      | 4480                                       | 169             |
| 1        | 5900                                       | 222             |
| 1 1/4    | 9500                                       | 360             |
| 1 1/2    | 13800                                      | 510             |



Specifications subject to change without notice.

| Ordering Information |       |           |             |
|----------------------|-------|-----------|-------------|
| Nominal Pipe Size    |       | Model     | Part Number |
| 2"                   | DN50  | VSR-2     | 1144402     |
| 2 1/2"               | DN65  | VSR-2 1/2 | 1144425     |
| 3"                   | DN80  | VSR-3     | 1144403     |
| 3 1/2"               | -     | VSR-3 1/2 | 1144435     |
| 4"                   | DN100 | VSR-4     | 1144404     |
| 5"                   | -     | VSR-5     | 1144405     |
| 6"                   | DN150 | VSR-6     | 1144406     |
| 8"                   | DN200 | VSR-8     | 1144408     |

**Optional:** Cover Tamper Switch Kit, stock no. 0090148

**Replaceable Components:** Retard/Switch Assembly, stock no. 1029030

**UL, CUL and CSFM Listed, FM Approved, LPCB Approved, For CE Marked (EN12259-5) / VdS Approved model use VSR-EU**

**Service Pressure:** 450 PSI (31 BAR) - UL

**Flow Sensitivity Range for Signal:**

4-10 GPM (15-38 LPM) - UL

**Maximum Surge:** 18 FPS (5.5 m/s)

**Contact Ratings:** Two sets of SPDT (Form C)  
10.0 Amps at 125/250VAC  
2.0 Amps at 30VDC Resistive  
10 mAmps min. at 24VDC

**Conduit Entrances:** Two knockouts provided for 1/2" conduit.  
Individual switch compartments suitable for dissimilar voltages.

**Environmental Specifications:**

- NEMA 4/IP54 Rated Enclosure suitable for indoor or outdoor use with factory installed gasket and die-cast housing when used with appropriate conduit fitting.
- Temperature Range: 40°F - 120°F, (4.5°C - 49°C) - UL
- Non-corrosive sleeve factory installed in saddle.

**Service Use:**

|  |          |
|--|----------|
| Automatic Sprinkler                      | NFPA-13  |
| One or two family dwelling               | NFPA-13D |
| Residential occupancy up to four stories | NFPA-13R |
| National Fire Alarm Code                 | NFPA-72  |

### ⚠ WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Risk of explosion. Not for use in hazardous locations. Serious injury or death could result.

### CAUTION

Waterflow switches that are monitoring wet pipe sprinkler systems shall not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems. Waterflow switches used for this application may result in unintended discharges caused by surges, trapped air, or short retard times.

### General Information

The Model VSR is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50 mm thru 200 mm). LPC approved sizes are 2" thru 8" (50 mm thru 200 mm). See Ordering Information chart.

The VSR may also be used as a sectional waterflow detector on large systems. The VSR contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 GPM (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

### Enclosure

The VSR switches and retard device are enclosed in a general purpose, die-cast housing. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin number 5401103 for installation instructions of this switch.

**Installation** (see Fig. 1)

These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they shall be installed on the top side of the pipe where they will be accessible. The device should not be installed within 6" (15 cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.

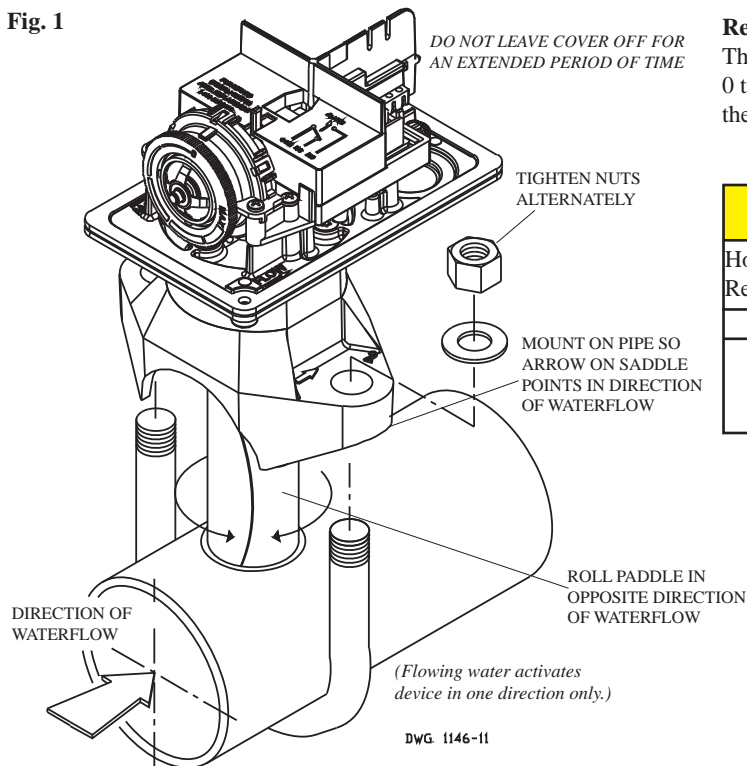
**NOTE:** Do not leave cover off for an extended period of time.

Drain the system and drill a hole in the pipe using a hole saw in a slow speed drill (see Fig. 1). Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole. Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Take care not to damage the non-corrosive bushing in the saddle. The bushing should fit inside the hole in the pipe. Install the saddle strap and tighten nuts alternately to required torque (see the chart in Fig. 1). The vane must not rub the inside of the pipe or bind in any way.

**CAUTION**

Do not trim the paddle. Failure to follow these instructions may prevent the device from operating and will void the warranty.

**Fig. 1**

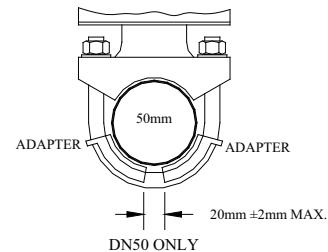
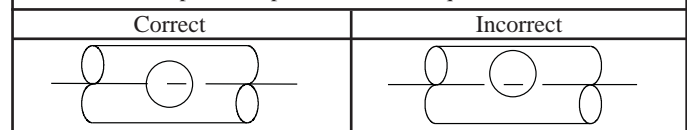


**Retard Adjustment**

The delay can be adjusted by rotating the retard adjustment knob from 0 to the max setting (60-90 seconds). The time delay should be set at the minimum required to prevent false alarms

**CAUTION**

Hole must be drilled perpendicular to the pipe and vertically centered. Refer to the Compatible Pipe/Installation Requirements chart for size.



USE (2) 5180162 ADAPTERS AS SHOWN ABOVE

DWG# 1146-1F

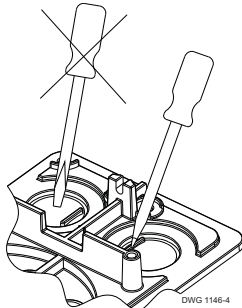
**Compatible Pipe/ Installation Requirements**

| Model     | Nominal Pipe Size |       | Nominal Pipe O.D. |       | Pipe Wall Thickness |      |                  |      |               |     |          |     | Hole Size          |            | U-Bolt Nuts Torque |     |
|-----------|-------------------|-------|-------------------|-------|---------------------|------|------------------|------|---------------|-----|----------|-----|--------------------|------------|--------------------|-----|
|           |                   |       |                   |       | Schedule 10 (UL)    |      | Schedule 40 (UL) |      | BS-1387 (LPC) |     | DN (VDS) |     |                    |            |                    |     |
|           | inch              | mm    | inch              | mm    | inch                | mm   | inch             | mm   | inch          | mm  | inch     | mm  | inch               | mm         | ft-lb              | n-m |
| VSR-2     | 2                 | DN50  | 2.375             | 60.3  | 0.109               | 2.77 | 0.154            | 3.91 | 0.142         | 3.6 | 0.091    | 2.3 | 1.25 + .125/- .062 | 33.0 ± 2.0 | 20                 | 27  |
| VSR-2 1/2 | 2.5               | -     | 2.875             | 73.0  | 0.120               | 3.05 | 0.203            | 5.16 | -             | -   | -        | -   |                    |            |                    |     |
| VSR-2 1/2 | -                 | DN65  | 3.000             | 76.1  | -                   | -    | -                | -    | 0.142         | 3.6 | 0.102    | 2.6 |                    |            |                    |     |
| VSR-3     | 3                 | DN80  | 3.500             | 88.9  | 0.120               | 3.05 | 0.216            | 5.49 | 0.157         | 4.0 | 0.114    | 2.9 | 2.00 ± .125        | 50.8 ± 2.0 |                    |     |
| VSR-3 1/2 | 3.5               | -     | 4.000             | 101.6 | 0.120               | 3.05 | 0.226            | 5.74 | -             | -   | -        | -   |                    |            |                    |     |
| VSR-4     | 4                 | DN100 | 4.500             | 114.3 | 0.120               | 3.05 | 0.237            | 6.02 | 0.177         | 4.5 | 0.126    | 3.2 |                    |            |                    |     |
| VSR-5     | 5                 | -     | 5.563             | 141.3 | 0.134               | 3.40 | 0.258            | 6.55 | -             | -   | -        | -   |                    |            |                    |     |
| VSR-6     | 6                 | DN150 | 6.625             | 168.3 | 0.134               | 3.40 | 0.280            | 7.11 | 0.197         | 5.0 | 0.157    | 4.0 |                    |            |                    |     |
| VSR-8     | 8                 | DN200 | 8.625             | 219.1 | 0.148               | 3.76 | 0.322            | 8.18 | 0.248         | 6.3 | 0.177    | 4.5 |                    |            |                    |     |

**NOTE:** For copper or plastic pipe use Model VSR-CF.

**Fig. 2**

To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



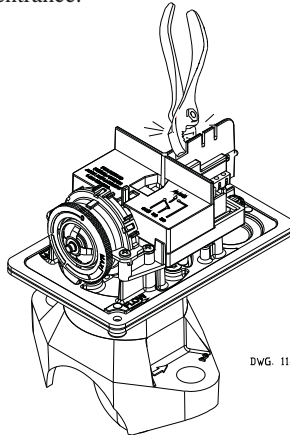
DWG. #1146-4

**NOTICE**

Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

**Fig. 3**

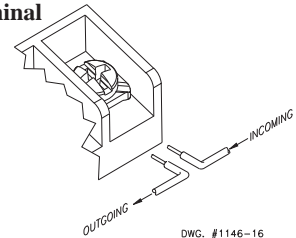
Break out thin section of cover when wiring both switches from one conduit entrance.



DWG. 1146-13

**Fig. 4**

**Switch Terminal Connections Clamping Plate Terminal**



DWG. #1146-16

**WARNING**

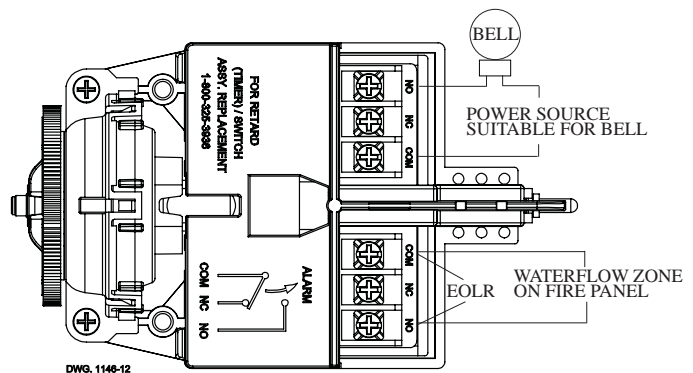
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life.

Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

**Fig. 5 Typical Electrical Connections**

**Notes:**

1. The Model VSR has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. A condition of LPC Approval of this product is that the electrical entry must be sealed to exclude moisture.
3. For supervised circuits, see "Switch Terminal Connections" drawing and warning note (Fig. 4).



DWG. 1146-12

**Testing**

The frequency of inspection and testing for the Model VSR and its associated protective monitoring system shall be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

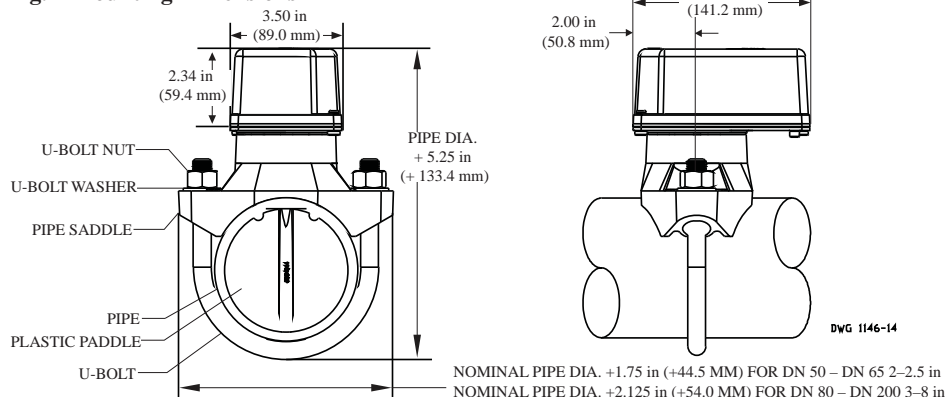
If provided, the inspector's test valve shall always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR is not recommended or advisable.

A minimum flow of 10 GPM (38 LPM) is required to activate this device.

**NOTICE**

Advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.

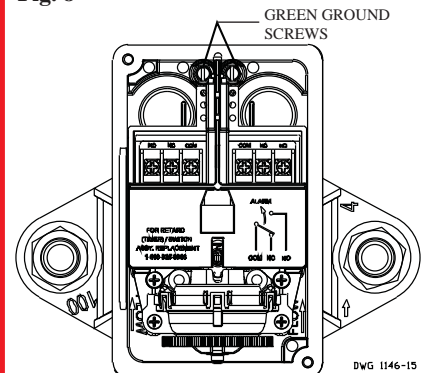
**Fig. 7 Mounting Dimensions**



DWG 1146-14

NOMINAL PIPE DIA. +1.75 in (+44.5 MM) FOR DN 50 - DN 65 2-2.5 in  
NOMINAL PIPE DIA. +2.125 in (+54.0 MM) FOR DN 80 - DN 200 3-8 in

**Fig. 8**



DWG 1146-15



### Maintenance

Inspect detectors monthly. If leaks are found, replace the detector. The VSR waterflow switch should provide years of trouble-free service. The retard and switch assembly are easily field replaceable. In the unlikely event that either component does not perform properly, please order replacement retard switch assembly stock #1029030 (see Fig. 6). There is no maintenance required, only periodic testing and inspection.

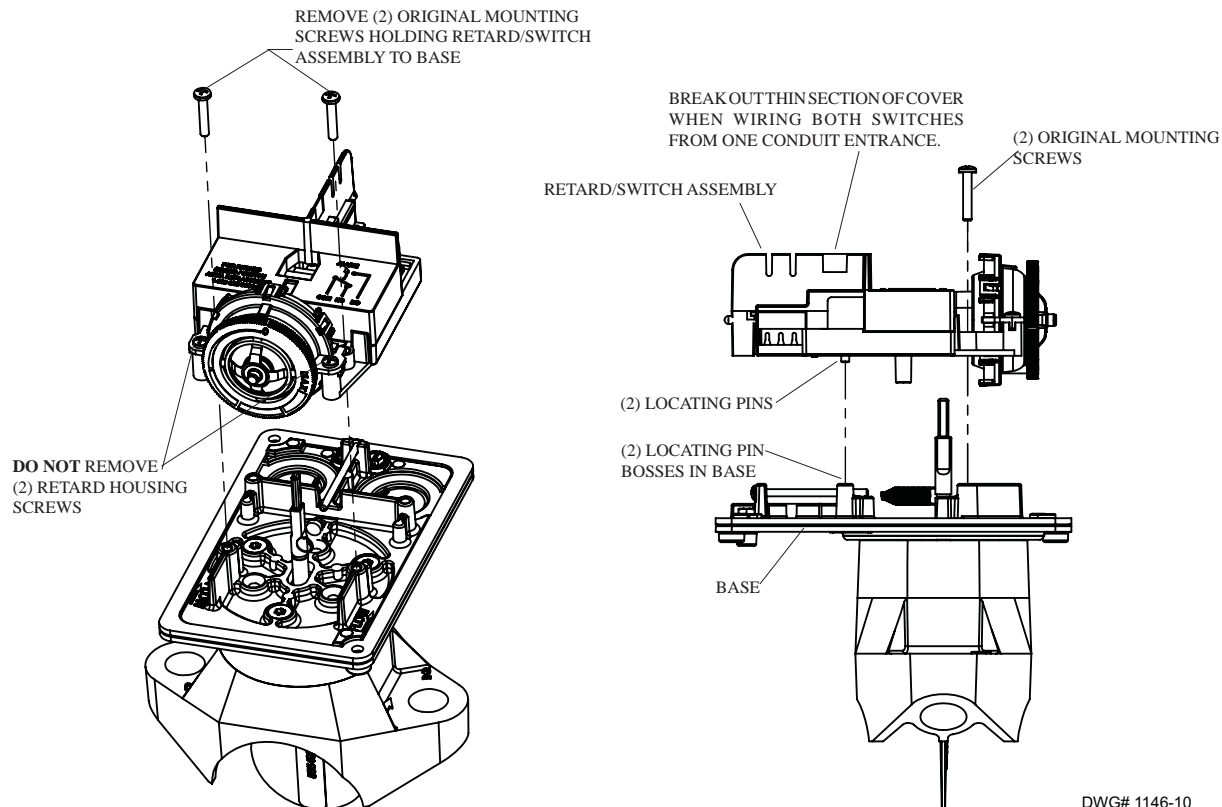
### Retard/Switch Assembly Replacement (See Fig. 6)

#### NOTICE

The Retard/Switch Assembly is field-replaceable without draining the system or removing the waterflow switch from the pipe.

1. Make sure the fire alarm zone or circuit connected to the waterflow switch is bypassed or otherwise taken out of service.
2. Disconnect the power source for local bell (if applicable).
3. Identify and remove all wires from the waterflow switch.
4. Remove the (2) mounting screws holding retard/switch assembly to the base. **Do not** remove the (2) retard housing screws.
5. Remove the retard assembly by lifting it straight up over the tripstem.
6. Install the new retard assembly. Make sure the locating pins on the retard/switch assembly fit into the locating pin bosses on the base.
7. Re-install the (2) original mounting screws.
8. Reconnect all wires. Perform a flow test and place the system back in service.

Fig. 6



### Removal of Waterflow Switch

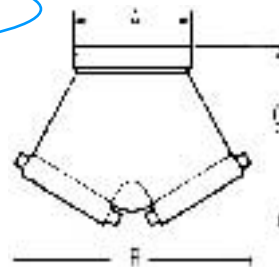
- To prevent accidental water damage, all control valves should be shut tight and the system completely drained before waterflow detectors are removed or replaced.
- Turn off electrical power to the detector, then disconnect wiring.
- Loosen nuts and remove U-bolts.
- Gently lift the saddle far enough to get your fingers under it. With your fingers, roll the vane so it will fit through the hole while continuing to lift the waterflow detector saddle.
- Lift detector clear of pipe.

## SINGLE CLAPPER TWO-WAY INLETS



An exposed auxiliary inlet connection with 500 G.P.M. inlet capacity to supplement fire protection water supply. Exposed design provides an economical method of satisfying Fire Dept. inlet requirements.

Cast brass two-way inlet body only with single swing clapper and pin lug swivel back or angle outlet connection as selected by figure number.

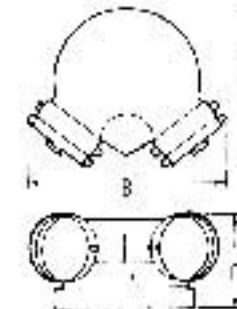


"Auto Spkr."

Cast Brass

PB - Polished Brass  
RC - Rough Chrome Plated  
PC - Polished Chrome Plated

|  | Back  | 5 1/4  | 8 5/64  | 6 1/2 |
|--|-------|--------|---------|-------|
|  | Angle | 6 5/16 | 7 11/16 | 4 3/4 |

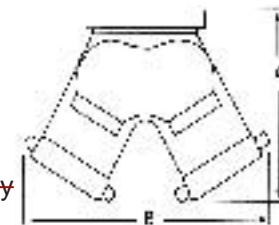


## DOUBLE CLAPPER TWO WAY INLETS



An exposed auxiliary inlet connection with 500 G.P.M. Inlet capacity to supplement fire protection water supply. Exposed design provides an economical method of satisfying Fire Department Inlet requirements.

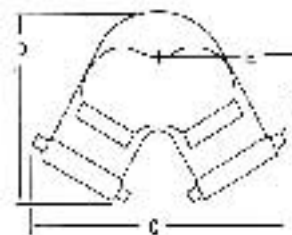
Cast brass two-way inlet body only with double drop clappers and pin lug swivels; back or angle outlet connection as selected by figure number. Branding as selected.



"Standpipe", "Auto Spkr.", "Standpipe-Sprinkler"

Cast Brass

PB - Polished Brass  
RC - Rough Chrome Plated  
PC - Polished Chrome Plated



|  |  | 4 X 2 1/2 X 2 1/2 | 9 5/8  | 12 1/4 |        |        |       |
|--|--|-------------------|--------|--------|--------|--------|-------|
|  |  | 4 X 2 1/2 X 2 1/2 |        |        | 11 3/4 | 9 5/8  | 7 1/4 |
|  |  | 6 X 2 1/2 X 2 1/2 | 10 1/4 | 11 3/4 |        |        |       |
|  |  | 6 X 2 1/2 X 2 1/2 |        |        | 12 1/2 | 10 1/8 | 7 1/2 |
|  |  | 4 X 3 X 3         | 10     | 12 1/2 |        |        |       |
|  |  | 4 X 3 X 3         |        |        | 12 1/2 | 10 1/8 | 7 1/2 |
|  |  | 5 X 3 X 3         | 10 1/8 | 12 1/2 |        |        |       |
|  |  | 5 X 3 X 3         |        |        | 12 1/4 | 10 1/2 | 7 1/2 |
|  |  | 6 X 3 X 3         | 10 3/8 | 12 1/2 |        |        |       |
|  |  | 6 X 3 X 3         |        |        | 12 1/4 | 10 7/8 | 7 1/4 |

BREAKABLE CAPS



Cast iron, Aluminum or plastic cap with breakable ears, two eyebolts with nuts for attachment to female pin lug swivel.  
Painted

- Red
- Green
- Yellow

|  |        |          |
|--|--------|----------|
|  |        |          |
|  | 2 1/2" | Iron     |
|  | 3"     | Iron     |
|  | 2 1/2" | Aluminum |
|  | 2 1/2" | Plastic  |

ROUND ESCUTCHEON PLATES



Brass or red painted aluminum plate, size and material as selected by figure number. Branding as selected.

"Standpipe", "Auto Spkr.", "Standpipe-Sprinkler", "Dry Standpipe", "Wall Hydrant", "Fire Pump Test". (Figure No. 6766 "Auto Spkr.", "Standpipe", "Standpipe-Sprinkler"). Special lettering available.

|  |               |         |          |
|--|---------------|---------|----------|
|  |               |         |          |
|  | 2 1/2"        | 6 1/2"  | Brass    |
|  | 3"            | 7 5/8"  | Brass    |
|  | 4"            | 9 1/2"  | Brass    |
|  | 5"            | 10 5/8" | Brass    |
|  | 6"            | 11 7/8" | Brass    |
|  | 4"            | 9 1/2"  | Aluminum |
|  | 4" (Sillcock) | 9 1/2"  | Brass    |

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass

RECTANGULAR WALL PLATES



Brass or red painted 4 1/2" X 10" plate, material as selected by figure number. Branding as selected.

|  |       |
|--|-------|
|  |       |
|  | Brass |

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass

"Standpipe", "Auto Spkr.", "Standpipe-Auto Spkr.", "Dry Standpipe", "Fire Pump Test".

AUTOMATIC BALL DRIP

Cast brass straight or angle connection, Male NPT both ends. Size and Style selected by figure number.



|  |      |          |
|--|------|----------|
|  |      |          |
|  | 1/2" | Straight |
|  | 3/4" | Straight |
|  | 1/2" | Angle    |
|  | 3/4" | Angle    |



SILLCOCK

Cast brass flanged Sillcock with 3/4" Fem. NPT inlet X Male G.H.T.

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass

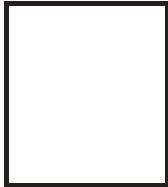


PRESSURE RELIEF VALVE

For use on all closed systems to prevent damage in the event of a malfunction due to some foreign object or matter becoming lodged in an automatic regulating or control valve. Featuring a pop-type relief action for maximum performance.



|  | (PSI)  | Inlet | Outlet | A     | B | C     |
|--|--------|-------|--------|-------|---|-------|
|  | 15-175 | 3/4   | 3/4    | 3     | 3 | 1     |
|  | 175    | 1/2   | 1/2    | 1 3/4 | 1 | 15/16 |



THREE WAY GAUGE VALVE



1/4" valve NPT Bronze three way globe valve with handwheel. Female inlets. 175 PSI.

1/4

GLOBE VALVES  
RISING STEM



Bronze with telfon seat. 125 WSP.

|  |       |
|--|-------|
|  | 1/4   |
|  | 3/8   |
|  | 1/2   |
|  | 3/4   |
|  | 1     |
|  | 1 1/4 |
|  | 1 1/2 |
|  | 2     |

RC - Rough Chrome Plated

CAPS AND CHAINS

Used to cover and protect male outlet threads on valves and hydrants. Prevents entry of foreign matter.

CAST BRASS WITH CHAIN



1 1/2  
2 1/2  
3  
4



PB - Polished Brass  
RC - Rough Chrome Plated  
PC - Polished Chrome Plated

2 1/2

1 1/2  
2 1/2  
3

VALVE ESCUTCHEONS



Used to trim pipe into cabinet.

|  |       |                              |
|--|-------|------------------------------|
|  | 1 1/2 | Stamped Steel Cadmium Plated |
|  | 2 1/2 | Stamped Steel Cadmium Plated |

|  |       |            |
|--|-------|------------|
|  | 1 1/2 | Cast Brass |
|  | 2 1/2 | Cast Brass |

PB-- Polished brass  
RC-- Rough Chrome Plated  
PC-- Polished Chrome Plated





## SERIES LCI INTUMESCENT SEALANT

### APPLICATIONS

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



### PRODUCT DESCRIPTION

SpecSeal® LCI Sealant is a versatile and economical intumescent sealant that has excellent caulking properties as well as high build properties on vertical or overhead surfaces. This single grade may be caulked (standard cartridge or bulk loaded), knifed or troweled. In addition, SpecSeal® LCI Sealant does not contain PCB's or asbestos.

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

#### FEATURES

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

### PERFORMANCE

SpecSeal® LCI Sealant is the basis for systems that meet the exacting criteria of ASTM E814 (UL1479) and ASTM E1966 (UL2079) as well as to the time-temperature requirements of ASTM E119 (UL263). LCI provides up to a 4-hour fire rating for typical service penetrations through concrete or wood floors, concrete or masonry walls, as well as gypsum board walls. SpecSeal® LCI Sealant meets Class A finish requirements for Flame Spread and Smoke Development when tested in accordance with ASTM E84 (UL723). Meets or exceeds the requirements of ASTM C834, Type C, Grade 0. SpecSeal® LCI Sealant is also acoustically tested, demonstrating excellent sound attenuation properties.

### PHYSICAL PROPERTIES

| Properties                                | Series LCI               |
|---|--------------------------|
| Color                                     | Red                      |
| Odor                                      | Mild Latex               |
| Density                                   | 9.0 lb/gal (1.08 kg/L)   |
| pH  | 9.0                      |
| Solids Content By Weight                  | 80%                      |
| Solids Content By Volume                  | 66.9%                    |
| In Service Temperature                    | ≤ 185°F (85°C)           |
| Flame Spread                              | 0*                       |
| Smoke Developed                           | 5*                       |
| STC Rating<br>(ASTM E90/ASTM C919)        | 62                       |
| VOC Content<br>(EPA Method 24/ASTM D3960) | 32.7g/L                  |
| Shelf Life                                | 2 yrs                    |
| Volume Expansion                          | 10X Free Expansion       |
| Storage Temp.                             | 40°F (4°C) - 95°F (35°C) |

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



FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® pipe and fittings. FBC, FlowGuard Gold, BlazeMaster and Corzan are licensed trademarks of The Lubrizol Corporation.



FILL, VOID OR CAVITY MATERIALS FOR USE IN JOINT SYSTEMS AND THROUGH-PENETRATION FIRESTOP SYSTEMS. SEE UL FIRE RESISTANCE DIRECTORY.  
3L73



### SPECIFICATIONS

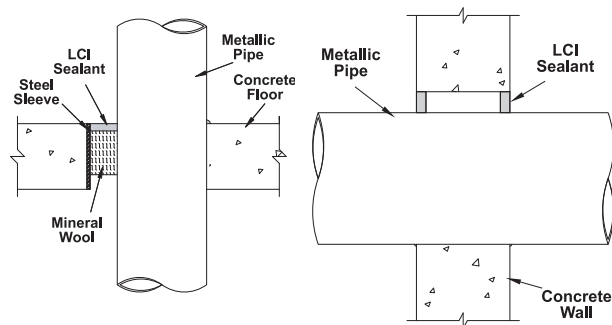
The firestopping sealant shall be a water-resistant, intumescent latex sealant. The sealant when exposed to high heat or flame shall exhibit a free expansion of up to 8 times its original volume. The firestopping sealant shall contain no water soluble nor hygroscopic ingredients and shall be acoustically tested. The sealant shall be UL Classified and/or FM approved and tested to the requirements of ASTM E814 (UL1479), CAN/ULC S115 and shall meet Class A finish requirements when tested in accordance with ASTM E84 (UL723).

### SPECIFIED DIVISIONS

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



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



**UL System No. C-AJ-1353**

F Rating: 3 Hr • T Rating: 0 Hr

Steel or Iron Pipe: <12", Copper Pipe: <4"

Annulus: 0" to 2"

Sealant Depth: 1/4"

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

**UL System No. W-J-1098**

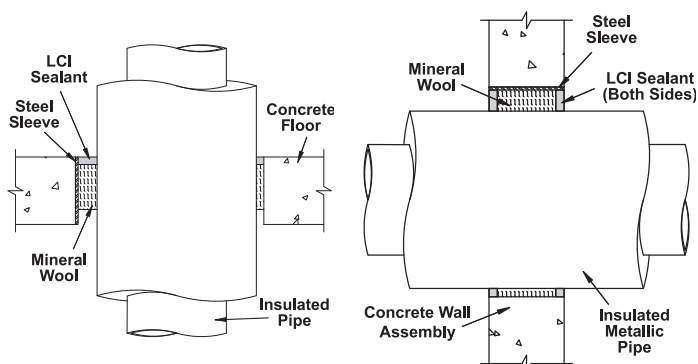
F Rating: 2 Hr • T Rating: 1/4, 3/4 & 1 Hr

Steel or Iron Pipe: <8", Copper Pipe: <4"

Annulus: 0" to 2"

Sealant Depth: 5/8"

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



**UL System No. C-AJ-5138**

F Rating: 2 Hr • T Rating: 3/4 or 1 Hr

Steel or Iron Pipe: 6", Copper Pipe: 4"

Pipe Covering: Max. 2" fiber glass or mineral wool pipe insulation.

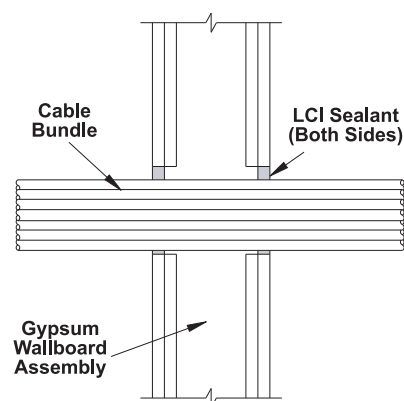
Annulus: 1/4" to 1-5/8" • Sealant: 1/2"

Forming: Nom. 4 pcf mineral wool (3" depth)

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

|                        |                       | Diameter of Opening - in. (mm)  |           |            |            |            |             |             |              |              |              |              |              |
|------------------------|-----------------------|---|-----------|------------|------------|------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| PIPE SIZE              |                       | 1.5 (38)  | 2.0 (51)  | 3.0 (76)   | 4.0 (102)  | 5.0 (127)  | 6.0 (152)   | 7.0 (178)   | 8.0 (203)    | 10 (254)     | 12 (305)     | 14 (356)     | 26 (660)     |
| Trade Size<br>in. (mm) | Pipe O.D.<br>in. (mm) |   |           |            |            |            |             |             |              |              |              |              |              |
| 0.5 (13)               | 0.840 (21)            | 0.3 (4.9)   | 0.6 (9.8) | 1.6 (26.2) | 3.0 (49.2) | 4.8 (78.7) | 6.9 (113.0) | 9.5 (155.7) | 12.4 (203.2) | 19.5 (319.5) | 28.1 (460.5) | 38.3 (627.6) | 132.6 (2173) |
| 1.0 (25)               | 1.315 (33)            | 0.1 (1.6)   | 0.4 (6.6) | 1.4 (22.9) | 2.8 (45.9) | 4.6 (75.4) | 6.7 (109.8) | 9.3 (152.4) | 12.2 (200.0) | 19.3 (316.3) | 27.9 (457.2) | 38.1 (624.3) | 132.4 (2170) |
| 1.5 (38)               | 1.900 (48)            |   |           | 1.1 (18.0) | 2.4 (39.3) | 4.2 (68.8) | 6.4 (104.9) | 8.9 (145.8) | 11.9 (195.0) | 18.9 (309.0) | 27.6 (452.3) | 37.8 (619.4) | 132.0 (2163) |
| 2.0 (51)               | 2.375 (60)            |   |           | 0.7 (11.5) | 2.0 (32.8) | 3.8 (62.3) | 6.0 (98.3)  | 8.5 (139.2) | 11.5 (188.4) | 18.5 (309.7) | 27.2 (445.7) | 37.4 (568.6) | 131.6 (2157) |
| 2.5 (64)               | 2.875 (73)            |   |           | 0.1 (1.6)  | 1.5 (24.6) | 3.3 (54.1) | 5.4 (88.4)  | 8.0 (131.1) | 10.9 (178.6) | 18.0 (295.0) | 26.7 (437.5) | 36.9 (604.7) | 131.1 (2148) |
| 3.0 (76)               | 3.500 (79)            |   |           |            | 0.7 (11.5) | 2.5 (41.0) | 4.7 (77.0)  | 7.2 (118.0) | 10.2 (167.1) | 17.2 (281.9) | 25.9 (424.4) | 36.1 (591.6) | 130.3 (2135) |
| 3.5 (89)               | 4.000 (102)           |   |           |            |            | 1.8 (29.5) | 3.9 (63.9)  | 6.5 (106.5) | 9.4 (154.0)  | 16.5 (270.4) | 25.1 (411.3) | 35.3 (578.5) | 129.6 (2124) |
| 4.0 (102)              | 4.500 (114)           |   |           |            |            | 0.8 (13.1) | 3.0 (49.2)  | 5.6 (91.8)  | 8.5 (139.3)  | 15.6 (255.6) | 24.2 (396.6) | 34.4 (563.7) | 128.7 (2109) |
| 6.0 (152)              | 6.625 (168)           | *Different Sealant Depth?<br>1/2" (12.7) Multiply by 2<br>5/8" (15.9) Multiply by 2.5<br>1" (25.4) Multiply by 4<br>1-1/4" (31.8) Multiply by 5 |           |            |            |            |             | 1.1 (18.0)  | 4.0 (65.5)   | 11.1 (181.9) | 19.7 (322.8) | 29.9 (490.0) | 124.2 (2035) |
| 8.0 (203)              | 8.625 (219)           |   |           |            |            |            |             |             |              | 4.9 (80.3)   | 13.6 (222.9) | 23.8 (390.0) | 118.0 (1934) |
| 10.0 (254)             | 10.750 (273)          |   |           |            |            |            |             |             |              |              | 5.6 (91.8)   | 15.8 (259.0) | 110.0 (1803) |
| 12.0 (305)             | 12.750 (324)          |   |           |            |            |            |             |             |              |              |              | 6.6 (108.1)  | 100.8 (1652) |
| 24.0 (610)             | 24.000 (610)          |   |           |            |            |            |             |             |              |              |              |              | 19.6 (321.2) |

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

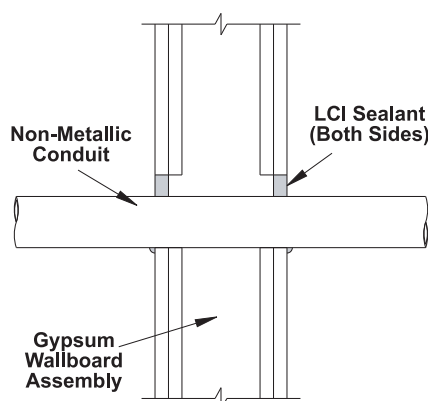


**UL System No. W-L-3169**

F Rating: 1, 2 Hr • T Rating: 1/4 and 3/4

Up to 4-1/2" cable bundle

Annulus: 0" to 1/2" • Sealant: 5/8"



**UL System No. W-L-2241**

F Rating: 1, 2 Hr • T Rating: 0, 1/4, 1, 1-3/4

<2" Rigid PVC or ENMT, CPVC, ABS

Annulus: 0-1" • Sealant 5/8"

**TABLE A: APPLICATIONS**

**TESTED AND CLASSIFIED FOR FIRE RESISTANCE**

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

## INSTALLATION INSTRUCTIONS

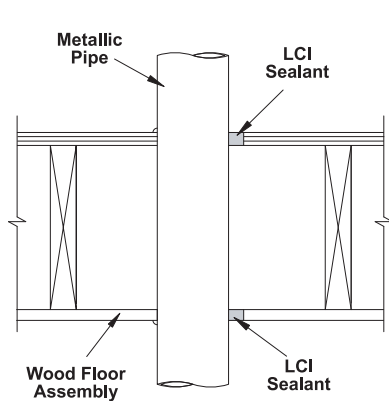
**GENERAL:** Areas to be protected must be clean and free of oil, loose dirt, rust or scale. Installation temperatures must be between 35°F (2°C) and 100°F (38°C). Allow product to dry a minimum of 24 hours before exposure to moisture.

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

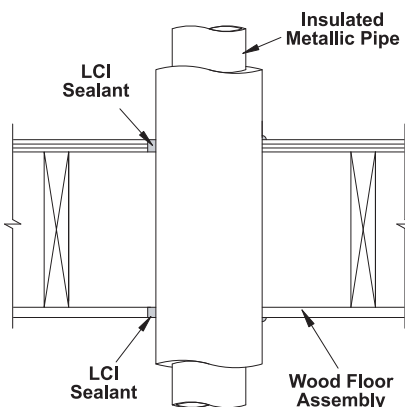
**FORMING:** Some installations may require forming as either an integral part of the system or as an option to facilitate installation. In systems where forming is required, mineral wool batts with a minimum nominal density of 4 PCF (64 kg/m³) are generally required. Cut forming material oversize to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

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

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



**UL System No. F-C-1074**  
 F Rating: 1 & 2 Hr • T Rating: 1/4, 1/2 and 1 Hr  
 Steel, Iron or Copper: 4" • Chase wall optional.  
 Annulus: 0" to 1" • Sealant: 5/8" bottom, 3/4" top



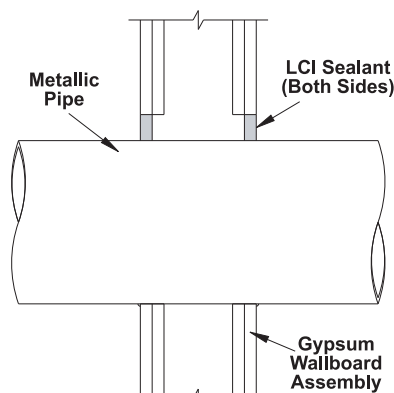
**UL System No. F-C-5043**  
 F Rating: 1 & 2 Hr • T Rating: 3/4 and 1 Hr  
 Steel, Iron or Copper: 4"  
 Pipe covering: 1" Fiber Glass, Mineral fiber or AB/PVC • Chase wall optional.  
 Annulus: 0" to 1" • Sealant: 5/8" bottom, 3/4" top.

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

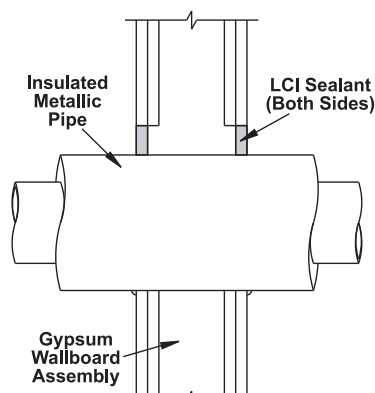
**SMOKE SEALING:** In some applications including firestop collars, SpecSeal® LCI Sealant is recommended as a smoke seal. It is suggested in these applications that the sealant be applied to both sides of walls. In floor applications, a sealing bead is suggested top and bottom.

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

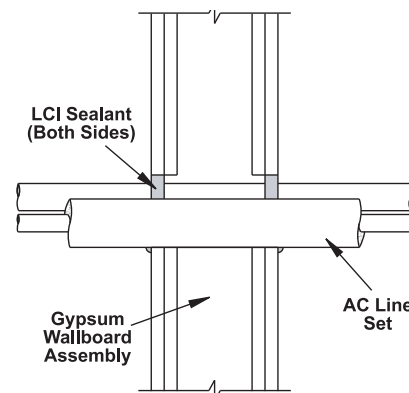
**Fig. 5: BARE & INSULATED METALLIC PIPES - Gypsum Walls**



**UL System No. W-L-1222**  
 F Rating: 1, 2 Hr • T Rating: 1/4, 3/4, 1 Hr  
 Steel or Iron pipe: 8", Copper pipe: 4"  
 Annulus: 0" to 2" • Sealant: 5/8"



**UL System Nos. W-L-5121, W-L-5122**  
 F Rating: 1, 2 Hr • T Rating: 1 Hr & 1/4 Hr  
 Steel or Iron pipe: 6", Copper pipe: 4"  
 Pipe covering: Max. 2" fiber glass, 3/4" AB/PVC or 2" mineral fiber  
 Annulus: 0" to 1-1/2" • Sealant: 5/8"



**UL System No. W-L-8025**  
 F Rating: 1, 2 Hr • T Rating: 1/4 Hr  
 AC Line Set: Two copper tubes, one with 3/4" AB/PVC and thermostat wire  
 Annulus: 0" to 1" • Sealant 5/8"



## MAINTENANCE

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

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

## TECHNICAL SERVICE

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

## PRECAUTIONARY INFORMATION

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

## AVAILABILITY

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

## ORDERING INFORMATION

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

### Additional SpecSeal Products...

#### Series SSS Sealant

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

#### Intumescent Wrap Strips

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

#### SSC & LCC Firestop Collars

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

#### Firestop Mortar

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

#### SSP Firestop Putty

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

#### SIL Silicones

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

#### Elastomeric Joint Seals

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



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

**LIMITED WARRANTY:** STI warrants that its products will be free of defects for one year from the date of purchase. In the event a product does not conform to this warranty, the sole and exclusive remedy is, at STI's option, replacement of the product or refund of the purchase price. The warranty provided herein shall be void and of no effect in the event that the product is not installed in accordance with STI's published instructions, listed systems and applicable building and safety codes. **THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS AND EXPRESSED OR IMPLIED WARRANTIES** (including the implied warranties of merchantability or fitness for a particular use) **AND UNDER NO CIRCUMSTANCES SHALL STI BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING, WITHOUT LIMITATION, ANY LOSS OF REVENUE, PROFIT OR USE.** Prior to use, the user shall determine the suitability of the product for its intended use, and the user assumes all risks and liability for subsequent use. No person other than an officer of STI is authorized to bind STI to any other warranty for any product for which this warranty is issued.

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Technologies  
Inc.

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## Elevator Valve Cabinets and Access Panels

These Cabinets are made with 16 gauge trim and 20 gauge door and body. Standard white. Standard pull knob.



Elevator Valve Cabinets

| Model | Mounting Style | Tub Dimensions | Door Style          | Options       |
|-------|----------------|----------------|---------------------|---------------|
| 996   | Recessed       | 9x9x6          | Full Glass or Solid | Cylinder Lock |
| 994   | Recessed       | 9x9x4          | Full Glass or Solid | Cylinder Lock |
| 12126 | Recessed       | 12x12x6        | Full Glass or Solid | Cylinder Lock |
| 12124 | Recesses       | 12x12x4        | Full Glass or Solid | Cylinder Lock |
| 12126 | Surface        | 12x12x6        | Full Glass or Solid | Cylinder Lock |

**Access Panels are made to order**

BREAKABLE CAPS



Cast iron, Aluminum or plastic cap with breakable ears, two eyebolts with nuts for attachment to female pin lug swivel.  
Painted

- Red
- Green
- Yellow

|  |        |          |
|--|--------|----------|
|  |        |          |
|  | 2 1/2" | Iron     |
|  | 3"     | Iron     |
|  | 2 1/2" | Aluminum |
|  | 2 1/2" | Plastic  |

ROUND ESCUTCHEON PLATES



Brass or red painted aluminum plate, size and material as selected by figure number. Branding as selected.

"Standpipe", "Auto Spkr.", "Standpipe-Sprinkler", "Dry Standpipe", "Wall Hydrant", "Fire Pump Test". (Figure No. 6766 "Auto Spkr.", "Standpipe", "Standpipe-Sprinkler"). Special lettering available.

|  |               |         |          |
|--|---------------|---------|----------|
|  |               |         |          |
|  | 2 1/2"        | 6 1/2"  | Brass    |
|  | 3"            | 7 5/8"  | Brass    |
|  | 4"            | 9 1/2"  | Brass    |
|  | 5"            | 10 5/8" | Brass    |
|  | 6"            | 11 7/8" | Brass    |
|  | 4"            | 9 1/2"  | Aluminum |
|  | 4" (Sillcock) | 9 1/2"  | Brass    |

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass

RECTANGULAR WALL PLATES



Brass or red painted 4 1/2" X 10" plate, material as selected by figure number. Branding as selected.

|  |       |
|--|-------|
|  |       |
|  | Brass |

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass

"Standpipe", "Auto Spkr.", "Standpipe-Auto Spkr.", "Dry Standpipe", "Fire Pump Test".

AUTOMATIC BALL DRIP

Cast brass straight or angle connection, Male NPT both ends. Size and Style selected by figure number.



|  |      |          |
|--|------|----------|
|  |      |          |
|  | 1/2" | Straight |
|  | 3/4" | Straight |
|  | 1/2" | Angle    |
|  | 3/4" | Angle    |



SILLCOCK

Cast brass flanged Sillcock with 3/4" Fem. NPT inlet X Male G.H.T.

- PB- Polished Brass
- RC- Rough Chrome Plated Brass
- PC- Polished Chrome Plated Brass





## Model F1FR Series Quick Response Standard Spray

### Model F1FR56 Sprinkler Types

Standard Upright  
Standard Pendent  
Conventional  
Vertical Sidewall  
Horizontal Sidewall

### Model F1FR56 Recessed Sprinkler Types

Standard Pendent/F1/F2/FP  
Horizontal Sidewall

### Model F1FR56 Concealed Sprinkler Types

Standard Pendent

### Model F1FR42, F1FRXLH & F1FR28 Sprinkler Types

Standard Upright  
Standard Pendent

### Model F1FR42, F1FRXLH & F1FR28 Recessed Sprinkler Types

Standard Pendent

### Model F1FR56LL & F1FR42LL Low Lead Sprinkler Types\*

Standard Pendent  
Less than 0.25% Lead Content

### Listing & Approvals

1. Underwriters Laboratories Inc. and Certified for Canada (cULus).
2. Factory Mutual Approvals (FM)
3. Loss Prevention Council (LPCB, UK)
4. VdS Schadenverhütung GmbH
5. \*NSF Certified to NSF/ANSI Standard 61 Annex G

### UL Listing Category

Sprinklers, Automatic & Open (VNIV)  
Quick Response Sprinkler

### Product Description

Reliable Models F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Series Sprinklers are quick response sprinklers which combine the durability of a standard sprinkler with the attractive low profile of a decorative sprinkler.

The Models F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Series Recessed automatic sprinklers utilize a 3.0 mm frangible glass bulb. These sprinklers have demonstrated response times in laboratory tests which are five to ten times faster than standard response sprinklers. This quick response enables the Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Series sprinklers



Upright



Pendent



Conventional



Vertical Sidewall



Horizontal Sidewall



Recessed  
Pendent/F1/F2



Recessed  
Horizontal Sidewall



Concealed  
Pendent



Recessed  
Pendent/FP



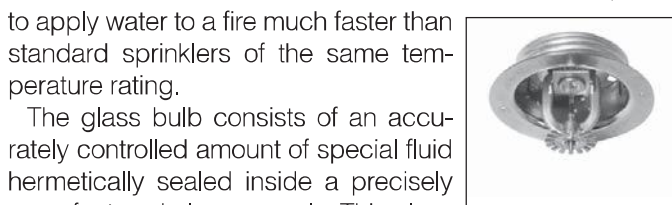
XLH Upright



XLH Pendent



XLH Recessed  
Pendent F1/F2



XLH Recessed  
Pendent FP

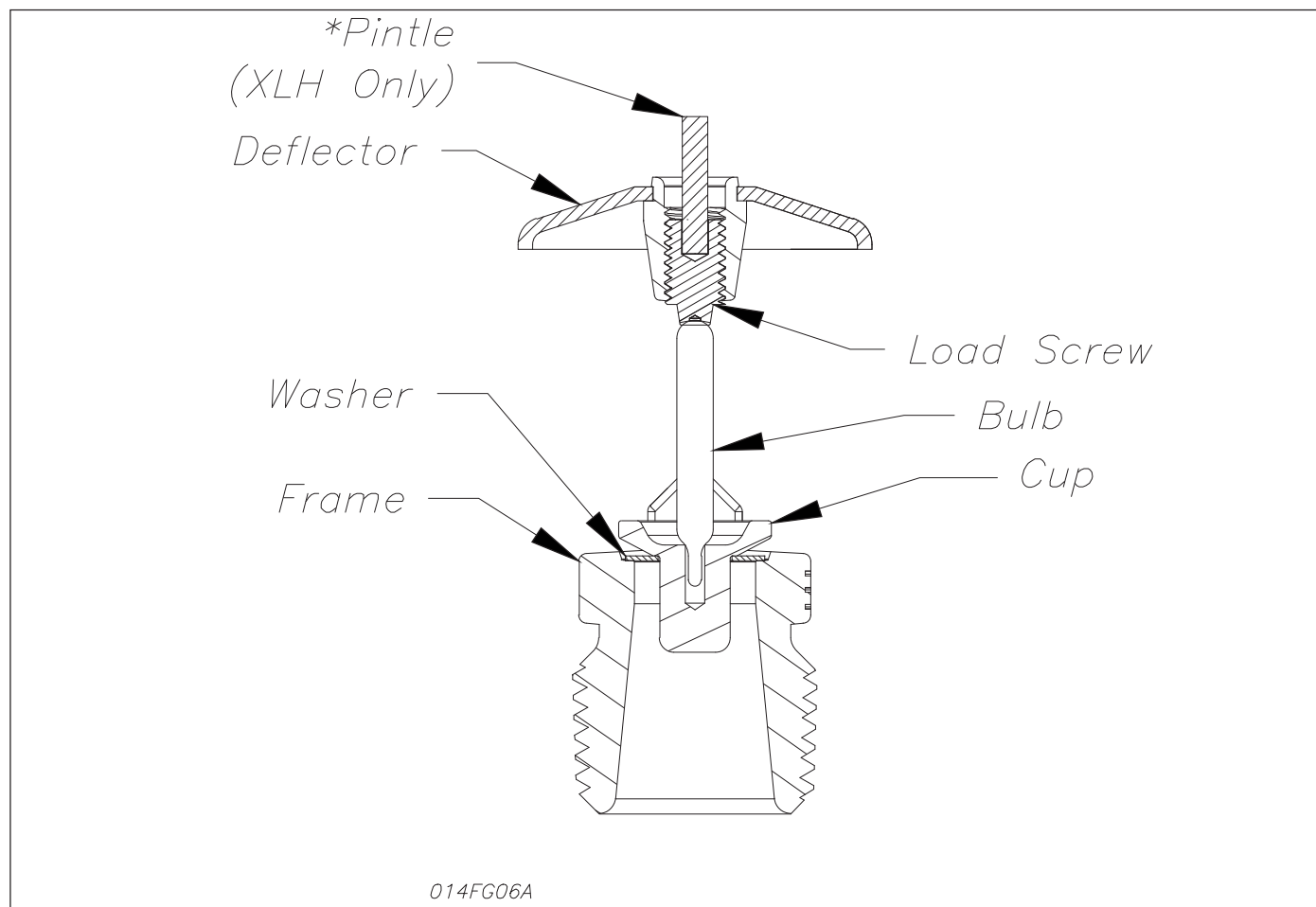
to apply water to a fire much faster than standard sprinklers of the same temperature rating.

The glass bulb consists of an accurately controlled amount of special fluid hermetically sealed inside a precisely manufactured glass capsule. This glass bulb is specially constructed to provide fast thermal response.

At normal temperatures, the glass bulb contains the fluid in both the liquid and vapor phases. The vapor phase can be seen as a small bubble. As heat is applied, the liquid expands, forcing the bubble smaller and smaller as the liquid pressure increases. Continued heating forces the liquid to push out against the bulb, causing the glass to shatter, opening the waterway and allowing the deflector to distribute the discharging water.

## Application

Quick response sprinklers are used in fixed fire protection systems: Wet, Dry, Deluge or Preaction. Care must be exercised that the orifice size, temperature rating, deflector style and sprinkler type are in accordance with the latest published standards of the National Fire Protection Association or the approving Authority Having Jurisdiction. Quick response sprinklers are intended for installation as specified in NFPA 13. Quick response sprinklers and standard response sprinklers should not be intermixed.



Model F1FR42, F1FRXLH Upright

## Technical data:

| Models   | Discharge Coefficient | Response       | Thread Size     | Max. Working Pressure | Min. Working Pressure | Temperature Rating               | Finish             |
|--|-----------------------|----------------|-----------------|-----------------------|-----------------------|----------------------------------|--------------------|
| <b>F1FR56</b><br><b>**F1FR56LL<sup>(1)</sup></b>                   | K 5.6                 | Quick Response | 1/2" NPT (R1/2) | 175 PSI               | 7 PSI                 | See "Temperature Ratings" Table. | See "Finish Table" |
| <b>F1FR42</b><br><b>**F1FR42LL<sup>(1)</sup></b><br><b>F1FRXLH</b> | K 4.2                 |                |                 |                       |                       |                                  |                    |
| <b>F1FR28</b>  | K 2.8                 |                |                 |                       |                       |                                  |                    |

<sup>(1)</sup> Low Lead Sprinklers available only with Temperature Rating 200°F/93°C

## Material Data:

| Frame  | Deflector  | Load Screw                           | *Pintle                              | Cup                                  | Washer  | Bulb  |
|--|--|--------------------------------------|--------------------------------------|--------------------------------------|---|-------|
| DZR Brass<br>QM Brass<br><b>**Low Lead Brass</b> | CDA Alloy 260,<br>CDA Alloy 220<br>or<br>CDA Alloy 510 | CDA Alloy 360<br>or<br>CDA Alloy 544 | CDA Alloy 360<br>or<br>CDA Alloy 544 | CDA Alloy 651<br>or<br>CDA Alloy 693 | Nickel Alloy 440 or Alloy 360<br>coated with PTFE Adhesive Tape | Glass |

## Model F1FR56, Upright, Pendent & Conventional Sprinklers

### Model F1FR42, F1FRXLH & F1FR28 Upright & Pendent Sprinklers

Installation Wrench: Model D Sprinkler Wrench

Installation Data:

| Nominal Orifice   | Thread          | Nominal K Factor |        | Sprinkler    | Approval     | Sprinkler Identification Number (SIN) |                                |
|---|-----------------|------------------|--------|--------------|--------------|---------------------------------------|--------------------------------|
|   | Size            | US               | Metric | Height       | Organization | Upright                               | Pendent                        |
| Standard-Upright (SSU) and Pendent Deflectors Marked to Indicate Position |                 |                  |        |              |              |                                       |                                |
| 1/2" (15mm) <sup>(1)</sup>  | 1/2" NPT (R1/2) | 5.6              | 80     | 2.25" (57mm) | 1,2,3,4      | RA1425 <sup>(1)(2)(3)(4)</sup>        | RA1414 <sup>(1)(2)(3)(4)</sup> |
| 7/16" (10mm)  | 1/2" NPT (R1/2) | 4.2              | 60     | 2.25" (57mm) | 1            | RA1423 <sup>(1)(4)</sup>              | RA1413 <sup>(4)</sup>          |
| 3/8" (10mm)   | 1/2" NPT (R1/2) | 2.8              | 40     | 2.25" (57mm) | 1            | RA1421 <sup>(1)(4)</sup>              | RA1411 <sup>(4)</sup>          |
| Conventional-Install in Upright or Pendent Position                       |                 |                  |        |              |              |                                       |                                |
| 15mm <sup>(1)</sup>   | 1/2" NPT (R1/2) | 5.6              | 80     | 57mm         | 3, 4         | RA1475 <sup>(3)</sup>                 |                                |

<sup>(1)</sup> cULus listed corrosion resistant (Polyester coated) sprinkler.

<sup>(2)</sup> Polyester coated FM approved sprinkler.

<sup>(3)</sup> Polyester coated LPCB & VdS approved sprinkler RA1425, RA1414 & RA1475.

<sup>(4)</sup> Electroless Nickel PTFE (Teflon®)\* Plated - cULus listed Corrosion Resistant



Upright



Pendent



Conventional

## Model F1FR56LL & F1FR42LL Pendent Sprinklers

Installation Wrench: Model D Sprinkler Wrench

Installation Data:

| Nominal Orifice   | Thread          | Nominal K Factor |        | Sprinkler    | Approval     | Sprinkler Identification Number (SIN) |
|---|-----------------|------------------|--------|--------------|--------------|---------------------------------------|
|   | Size            | US               | Metric | Height       | Organization | Pendent                               |
| Standard-Pendent Deflectors Marked to Indicate Position |                 |                  |        |              |              |                                       |
| 1/2" (15mm) <sup>(1)</sup>                              | 1/2" NPT (R1/2) | 5.6              | 80     | 2.25" (57mm) | 1,5          | RA1415                                |
| 7/16" (11mm)  | 1/2" NPT (R1/2) | 4.2              | 60     | 2.25" (57mm) | 1,5          | RA1410                                |

<sup>(1)</sup> cULus listed corrosion resistant (Polyester coated) sprinkler.



\*DuPont Registered Trademark

## Model F1FR56, F1FR42, F1FRXLH & F1FR28 Quick Response Recessed Pendent Sprinkler<sup>(1)</sup>

**Installation Wrench:** Model GFR2 Sprinkler Wrench

**Installation Data:**

| Nominal Orifice | Thread Size     | K Factor |        | Sprinkler Height | Sprinkler Identification Number (SIN) |
|-----------------|-----------------|----------|--------|------------------|---------------------------------------|
|                 |                 | US       | Metric |                  |                                       |
| 1/2" (15mm)     | 1/2" NPT (R1/2) | 5.6      | 80     | 2.25" (57mm)     | RA1414                                |
| 7/16" (10mm)    | 1/2" NPT (R1/2) | 4.2      | 60     | 2.25" (57mm)     | RA1413                                |
| 3/8" (10mm)     | 1/2" NPT (R1/2) | 2.8      | 40     | 2.25" (57mm)     | RA1411                                |

<sup>(1)</sup> Refer to escutcheon data table for approvals & dimensions

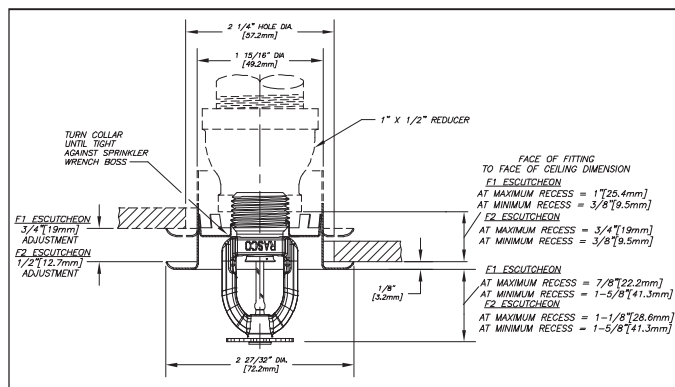
## Model F1FR56LL & F1FR42LL Quick Response Recessed Pendent Sprinkler<sup>(1)</sup>

**Installation Wrench:** Model GFR2 Sprinkler Wrench

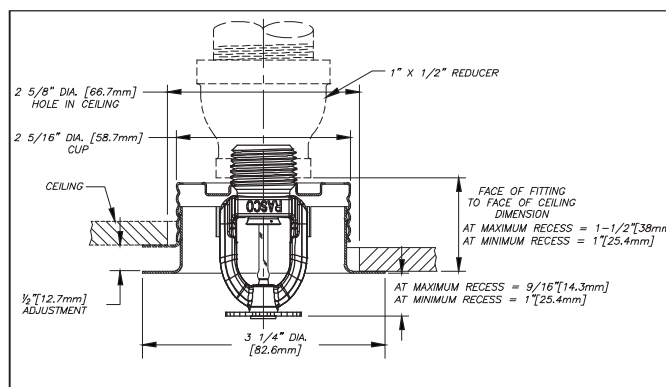
**Installation Data:**

| Nominal Orifice | Thread Size     | K Factor |        | Sprinkler Height | Sprinkler Identification Number (SIN) |
|-----------------|-----------------|----------|--------|------------------|---------------------------------------|
|                 |                 | US       | Metric |                  |                                       |
| 1/2" (15mm)     | 1/2" NPT (R1/2) | 5.6      | 80     | 2.25" (57mm)     | RA1415                                |
| 7/16" (10mm)    | 1/2" NPT (R1/2) | 4.2      | 60     | 2.25" (57mm)     | RA1410                                |

<sup>(1)</sup> Refer to escutcheon data table for approvals & dimensions



Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 F1 or F2



Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 FP

## Model F1FR56 Quick Response Vertical Sidewall Sprinkler

**Installation Wrench:** Model D Sprinkler Wrench

**Installation Position:** Upright or Pendent

**Approval Type:** Light Hazard Occupancy

**Installation Data:**

| Nominal Orifice | Thread Size     | Nominal K Factor |        | Sprinkler Height | Approval Organizations | Sprinkler Identification Numbers (SIN) |
|-----------------|-----------------|------------------|--------|------------------|------------------------|--|
|                 |                 | US               | Metric |                  |                        |  |
| 1/2" (15mm)     | 1/2" NPT (R1/2) | 5.6              | 80     | 2.25" (57mm)     | 1,2,3                  | RA1485 <sup>(2)(3)</sup>               |
| 15mm            | 1/2" NPT (R1/2) | 5.6              | 80     | 2.25" (57mm)     | 3 <sup>(1)</sup>       |  |

<sup>(1)</sup> LPC Approval is for pendent position only.

<sup>(2)</sup> cULus Listed corrosion resistant (Polyester coated) sprinkler.

<sup>(3)</sup> Electroless Nickel PTFE (Teflon®)\* Plated - cULus Listed Corrosion Resistant



Vertical Sidewall

| Sprinkler Type | Deflector to Ceiling Distance (Min. - Max.) |
|----------------|---|
| Upright        | 4" (102mm) - 12" (305mm)                    |
| Pendent        | 4" (102mm) - 12" (305mm)                    |

\*DuPont Registered Trademark





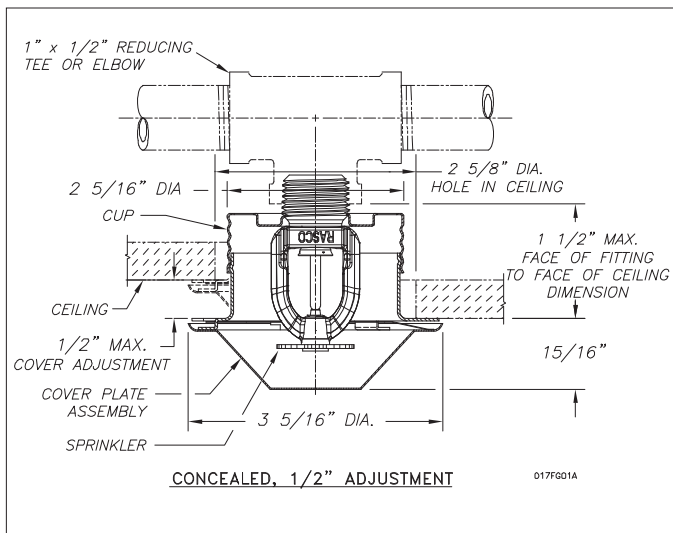


Figure 1

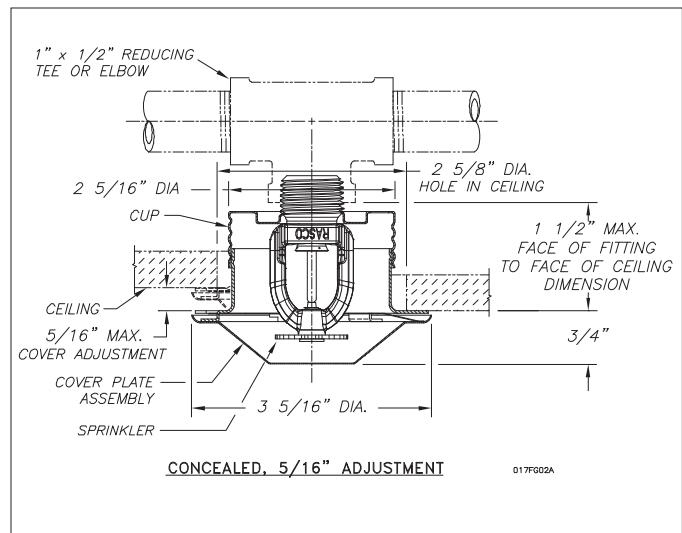


Figure 2

## Installation Aid

A protective cap is included for use during installation.

**Important:** The F1FR56 Sprinkler with Model CCP cover plate is not an FM Approved combination.

## Installation

Quick response sprinklers are intended for installation as specified in NFPA 13. Quick response sprinklers and standard response sprinklers should not be intermixed.

The Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Recessed Quick Response Sprinklers are to be installed as shown. The Model F1 or F2 Escutcheons illustrated are the only recessed escutcheons to be used with the Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Sprinklers. The use of any other recessed escutcheon will void all approvals and negate all warranties.

When installing Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Sprinklers, use the Model D Sprinkler Wrench. Use the Model GFR2 Wrench for installing F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Recessed Pendent Sprinklers. Any other type of wrench may damage these sprinklers.

**NOTE:** A leak tight 1/2" NPT (R1/2) sprinkler joint can be obtained with a torque of 8-18 ft-lbs (10,8 - 24,4 N-m). Do not tighten sprinklers over maximum recommended torque. It may cause leakage or impairment of the sprinklers.

The Models F1FR56/CCP & F1FR56LL/CCP Concealed Sprinkler use the 1/2" orifice, 1/2" NPT (R1/2), Model F1FR56 & F1FR56LL Pendent Sprinkler with a threaded Model CCP cup which is factory attached to the sprinklers. The Model F1FR56 Pndent is available in temperature rating of 135°F (57°C), 155°F (68°C), 175°F (79°C) or 200°F (93°C). The Model F1FR56LL Pendent is available only in a rating of 200°F (93°C). The concealed sprinkler assemblies are completed by the installation of the attractive low profile Model CCP push on cover plate assembly, rated 135°F (57°C) or 165°F (74°C) for the F1FR56 and 165°F (74°C) for the F1FR56LL. The cover plate and sprinkler cup assemblies are joined using a cover plate skirt with flexible tabs for threaded en-

gagement. A choice of two cover plate assemblies provide either 1/2" (13mm) or 5/8" (8mm) of cover adjustment,

Do not install these sprinklers in ceiling which have positive pressure in the space above.

After a 2 5/8" (67mm) diameter hole is cut in the ceiling, the sprinkler is easily installed with the Model RC1 Wrench. A Teflon\* based thread sealant should be applied to the sprinkler threads only. The Model RC1 Wrench is then used to engage the sprinkler wrenching surfaces and to install the sprinkler in the fitting. When inserting or removing the wrench from the sprinkler/cup assembly, care should be taken to prevent damage to the sprinkler. **DO NOT WRENCH ON ANY OTHER PART OF THE SPRINKLER.** The cover plate is then pushed onto the cup. Final adjustment is made by hand turning the cover plate until the skirt flange makes full contact with the ceiling. Cover plate removal requires turning in the counter clockwise direction.

After installation, inspect all sprinklers to ensure that there is a gap between the cover plate and ceiling and that the four cup slots are open and free from any air flow impediment to the space above.

Concealed cover plate/cup assemblies are listed only for use with specific sprinklers. The use of any other concealed cover plate/cup assembly with the Model F1FR56 Pendent Sprinkler or the use of the Model CCP Concealed cover plate assembly on any sprinkler with which it is not specifically listed may prevent good fire protection and will void all guarantees, warranties, listings and approvals.

Glass bulb sprinklers have orange bulb protectors to minimize bulb damage during shipping, handling and installation. REMOVE THIS PROTECTION AT THE TIME THE SPRINKLER SYSTEM IS PLACED IN SERVICE FOR FIRE PROTECTION. Removal of the protectors before this time may leave the bulb vulnerable to damage. RASCO wrenches are designed to install sprinklers when covers are in place. REMOVE PROTECTORS BY UNDOING THE CLASP BY HAND. DO NOT USE TOOLS TO REMOVE THE PROTECTORS.

\*DuPont Registered Trade Mark

## Temperature Ratings

| Classification      | Sprinkler Temperature |     | Max. Ambient Temp. | Bulb Color |
|---------------------|-----------------------|-----|--------------------|------------|
|                     | °C                    | °F  |                    |            |
| Ordinary            | 57                    | 135 | 100°F (38°C)       | Orange     |
| Ordinary            | 68                    | 155 | 100°F (38°C)       | Red        |
| Intermediate        | 79                    | 175 | 150°F (66°C)       | Yellow     |
| Intermediate        | 93                    | 200 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup> | 141                   | 286 | 225°F (107°C)      | Blue       |

<sup>(1)</sup> Not available for recessed sprinklers.

## Escutcheon Data <sup>(1)</sup>

<sup>(1)</sup> SIN RA1435 – cULus permits use with F1, F2 or FP escutcheons for “light hazard” only, while FM limits use for same hazard with F2 escutcheon only.

## Maintenance

The Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH and Model F1FR56, F1FR56LL, F1FR42, F1FR42LL, F1FRXLH & F1FR28 Recessed Sprinklers should be inspected and the sprinkler system maintained in accordance with NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove dust by using a soft brush or gentle vacuuming. Remove any sprinkler which has been painted (other than factory applied) or damaged in any way. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

## Sprinkler Types

Standard Upright  
Standard Pendent  
Conventional  
Recessed Pendent  
Vertical Sidewall  
Horizontal Sidewall  
Recessed Horizontal sidewall  
Concealed pendent

## Maximum Working Pressure

175 psi (12 bar)  
100% Factory tested hydrostatically to 500 psi (34.5 bar)

## Finishes <sup>(1)</sup>

| Standard Finishes                                   |   |                            |
|---|---|----------------------------|
| Sprinkler   | Escutcheon  | Cover plate <sup>(1)</sup> |
| Bronze  | Brass   | Chrome                     |
| Chrome Plated                                       | Chrome  | White                      |
| Polyester   | Plated  |                            |
| Coated <sup>(4)(5)(6)</sup>                         | White Painted                                     |                            |
| Special Application Finishes                        |   |                            |
| Sprinkler   | Escutcheon  | Cover plate <sup>(1)</sup> |
| Electroless Nickel<br>PTFE(Teflon®) <sup>*(7)</sup> | Electroless Nickel<br>PTFE (Teflon®) <sup>*</sup> | Bright Brass               |
| Bright Brass <sup>(3)</sup>                         | Bright Brass                                      | Black Plating              |
| Black Plated  | Black Plated                                      | Black Paint                |
| Black Paint <sup>(2)(6)</sup>                       | Black Paint                                       | Off White                  |
| Off White <sup>(2)(6)</sup>                         | Off White   | Satin Chrome               |
| Chrome Dull   | Chrome Dull                                       |                            |

<sup>(1)</sup> Other finishes and colors are available on special order. Consult the factory for details. Custom color painted sprinklers may not retain their UL Corrosion resistance listing. Coverplate custom paint is semi-gloss, unless specified otherwise.

<sup>(2)</sup> cULus Listed only.

<sup>(3)</sup> 200°F (93°C) maximum.

<sup>(4)</sup> cULus listed “corrosion resistance” applies to SIN Numbers RA1435 (HSW), RA1485(VSW), RA1425 (Upright), RA1414 (Pendent) and RA1415 (Pendent) in standard black or white. Corrosion resistance in other polyester colors is available upon request.

<sup>(5)</sup> FM Approvals finish as “Polyester coated” applies to SIN Number RA1414, RA1435 and RA1425 in standard black or white.

<sup>(6)</sup> LPCB and VdS Approved finish applies only to RA1425, RA1414 and RA1475.

<sup>(7)</sup> cULus listed Corrosion Resistant

## Ordering Information

### Specify:

1. Sprinkler Model
2. Sprinkler Type
3. Orifice Size
4. Deflector Type
5. Temperature Rating
6. Sprinkler Finish
7. Escutcheon Type
8. Escutcheon Finish (where applicable)
9. Cover plate Model
10. Cover plate Thread size
11. Cover plate Temperature
12. Cover plate Adjustment
13. Cover plate Finish

**Note:** When Model F1FR56 Recessed sprinklers are ordered, the sprinklers and escutcheons are packaged separately.





# Model F3QR Quick Response Dry Sprinklers

## Features

1. The Model F3QR sprinkler utilizes Belleville Spring Closure Technology. Reliable is the first in the industry to produce a Quick Response Dry Concealed sprinkler utilizing this technology.
2. Styles available
  - Pendent
  - Recessed FP Pendent
  - Recessed F1 Pendent
  - Concealed
  - Horizontal Sidewall
  - Recessed FP Horizontal Sidewall
  - Recessed F1 Horizontal Sidewall
3. 1½" (38mm) escutcheon adjustment on pendent sprinkler.
4. ½" (13mm) escutcheon adjustment on recessed sprinkler with push-on/ thread-off FP Model Escutcheon ring.
5. 3/8" (9.5mm) cover plate adjustment on concealed sprinkler with push-on/ thread-off CCP Cover Plate.
6. 3/4" (19mm) escutcheon adjustment on recessed sprinkler with F1 Escutcheon.
7. Attractive appearance. Employs 3mm frangible glass bulb and galvanized nipple.
8. Lengths available to accommodate installation dimensions from 2" - to - 48" (51mm - to - 1219mm), in ¼" (6mm) increments. See specific styles for correct "A" dimension range.
9. Available in a variety of plated and painted finishes.
10. Polyester Coated Corrosion Resistant Sprinklers.

**US Patent Numbers 5,775,431 and 5,967,240.**

Other US Patents pending.

## Approvals

1. Listed by Underwriters Laboratories Inc. and UL Certified for Canada (cULus)

| Style  | Response | Sprinkler System Type                 | Hazard            |
|--|----------|---------------------------------------|-------------------|
| Pendent<br>Recessed Pendent<br>Recessed F1 Pendent<br>CCP Concealed<br>(R5714) | Quick    | Wet Pipe<br>Dry Pipe<br>All Preaction | Light<br>Ordinary |
| Horizontal Sidewall<br>Recessed Horizontal Sidewall<br>(R5734)                 | Quick    | Wet Pipe<br>Dry Pipe<br>All Preaction | Light             |

2. Certified by FM Approvals

| Style   | Response | Sprinkler System Type                 | Hazard                              |
|---|----------|---------------------------------------|-------------------------------------|
| Pendent<br>Recessed F1 Pendent<br>(R5714)                         | Quick    | Wet Pipe<br>Dry Pipe<br>All Preaction | Light<br>Ordinary,<br>Groups<br>1&2 |
| Horizontal Sidewall<br>Recessed F1 Horizontal Sidewall<br>(R5734) | Quick    | Wet Pipe<br>Dry Pipe<br>All Preaction | Light                               |

3. NYC MEA 258-93-E

**The Reliable Automatic Sprinkler Co., Inc.,** 103 Fairview Park Drive, Elmsford, New York 10523



Pendent  
(See Fig. 1)



Pendent / HB  
(See Fig. 2)



Recessed FP Pendent  
(See Fig. 3)



Concealed  
(See Fig. 4)



Recessed F1 Pendent  
(See Fig. 5)



Horizontal Sidewall  
(See Fig. 6)



Horizontal Sidewall / HB  
(See Fig. 7)



Recessed FP  
Horizontal Sidewall  
(See Fig. 8)



Recessed F1  
Horizontal Sidewall  
(See Fig. 9)

## Model F3QR Dry Pendent Sprinkler

|          |   |
|----------|---|
| "A" Dim. | 2" to 48" (51mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Finishes<sup>(1)</sup>

| Sprinkler                      | Escutcheon           |
|--------------------------------|----------------------|
| Bronze                         | Brass <sup>(3)</sup> |
| Chrome Plated                  | Chrome Plated        |
| White Polyester <sup>(2)</sup> | White                |

<sup>(1)</sup> Other finishes and colors are available on special order.

Consult factory for details.

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

<sup>(3)</sup> Not available for HB escutcheons.

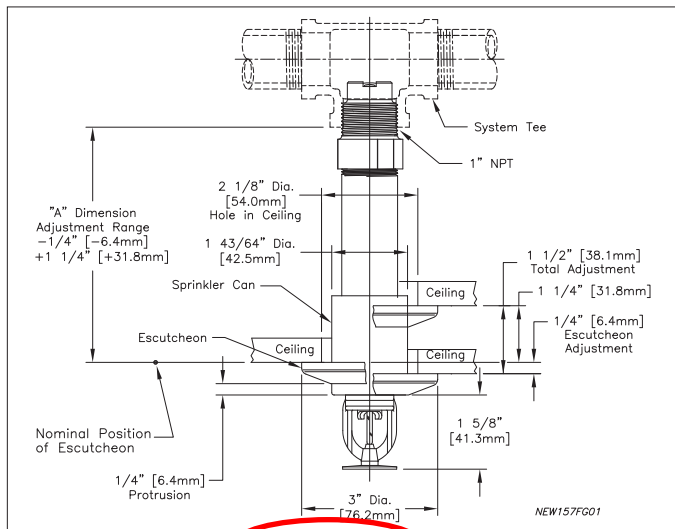


Fig. 1

**Note:** The sprinkler can protrudes 1/4" when escutcheon is in nominal position. Escutcheon adjustment provides -1/4" (-6mm) to +1/4" (+32mm) "A" dimension adjustment range.

## Sprinkler Guard: Model C-2

## Sprinkler Installation Wrench: Model F3 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5714**

## Model F3QR Dry Recessed FP Pendent Sprinkler

|          |   |
|----------|---|
| "A" Dim. | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Finishes<sup>(1)</sup>

| Sprinkler                      | Escutcheon    |
|--------------------------------|---------------|
| Bronze                         | Brass         |
| Chrome Plated                  | Chrome Plated |
| White Polyester <sup>(2)</sup> | White         |

<sup>(1)</sup> Other finishes and colors are available on special order.

Consult factory for details. Cup remains unfinished.

Only the escutcheon will contain desired finish.

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup>         | 286°F (141°C)                | 225°F (107°C)      | Blue       |

Sprinkler cup and FP Escutcheon fabricated of steel and recommended for interior applications.

<sup>(1)</sup> Listed and Certified only by cULus.

## Model F3QR Dry Pendent w/HB Escutcheon

|          |   |
|----------|---|
| "A" Dim. | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup>         | 286°F (141°C)                | 225°F (107°C)      | Blue       |

Sprinkler can and escutcheon fabricated of brass for better weather resistance in exterior applications.

<sup>(1)</sup> Listed and Certified only by cULus.

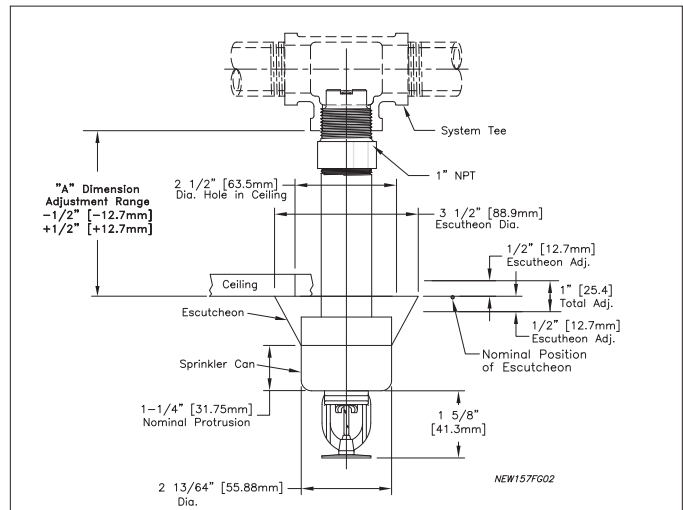


Fig. 2

**Note:** The sprinkler can protrudes 1/4" when escutcheon is in nominal position. Escutcheon adjustment provides -1/2" (-12.7mm) to +1/2" (+12.7mm) "A" dimension adjustment range.

## Sprinkler Installation Wrench: Model XLO2 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5714**

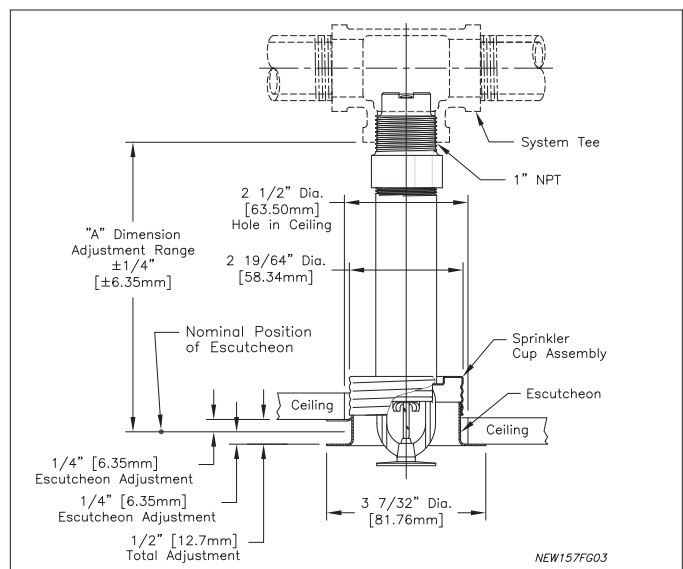


Fig. 3

**Note:** Do not install the Model F3QR Dry Recessed FP Pendent Sprinkler in ceilings which have positive pressure in space above.

## Model F3QR Dry Pendent Concealed Sprinkler

|                 |   |
|-----------------|---|
| <b>"A" Dim.</b> | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|-----------------|---|

### CCP Cover Plate <sup>(1)</sup> Finishes <sup>(2)</sup>

| Standard Finishes      | Special Application Finishes  |
|------------------------|---|
| Chrome Plated<br>White | Bright Brass Plated<br>Black Plated<br>Black Paint<br>Off White<br>Satin Chrome |

<sup>(1)</sup> Utilizes the 1/2" cover plate with 3/8" total adjustment.

<sup>(2)</sup> Other finishes and colors are available on special order.  
Consult factory for details.

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Cover Plate Temp. Rating | Max. Ambient Temp. |
|-----------------------------|------------------------------|--------------------------|--------------------|
| Ordinary                    | 135°F (57°C)                 | 135°F (57°C)             | 100°F (38°C)       |
| Ordinary                    | 155°F (68°C)                 | 135°F (57°C)             | 100°F (38°C)       |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 165°F (74°C)             | 150°F (66°C)       |
| Intermediate                | 200°F (93°C)                 | 165°F (74°C)             | 150°F (66°C)       |
| High <sup>(1)</sup>         | 286°F (141°C)                | 165°F (74°C)             | 150°F (66°C)       |

Sprinkler cup fabricated of steel and CCP Cover Plate fabricated of brass and recommended for interior applications.

<sup>(1)</sup> Listed and Certified only by cULus.

### Sprinkler Installation Wrench:

Model XLO2 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5714**

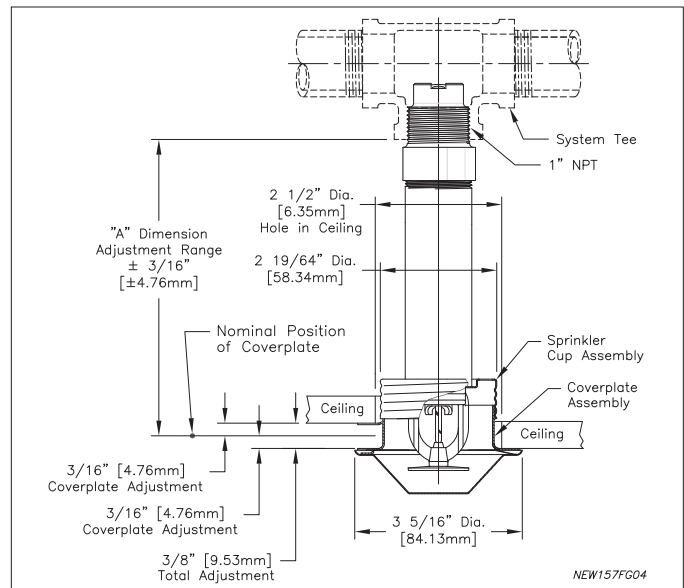


Fig. 4

**Note:** Do not install the Model F3QR Dry Concealed Pendent Sprinkler in ceilings which have positive pressure in the space above.

## Model F3QR Dry Recessed F1 Pendent Sprinkler

|                 |   |
|-----------------|---|
| <b>"A" Dim.</b> | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|-----------------|---|

### Finishes <sup>(1)</sup>

| Sprinkler                                       | Escutcheon             | Collar                 |
|---|------------------------|------------------------|
| Chrome Plated<br>White Polyester <sup>(2)</sup> | Chrome Plated<br>White | Chrome Plated<br>White |

<sup>(1)</sup> Other finishes and colors are available on special order.  
Consult factory for details.

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup>         | 286°F (141°C)                | 225°F (107°C)      | Blue       |

<sup>(1)</sup> Listed and Certified only by cULus.

### Sprinkler Installation Wrench:

Model XLO2 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5714**

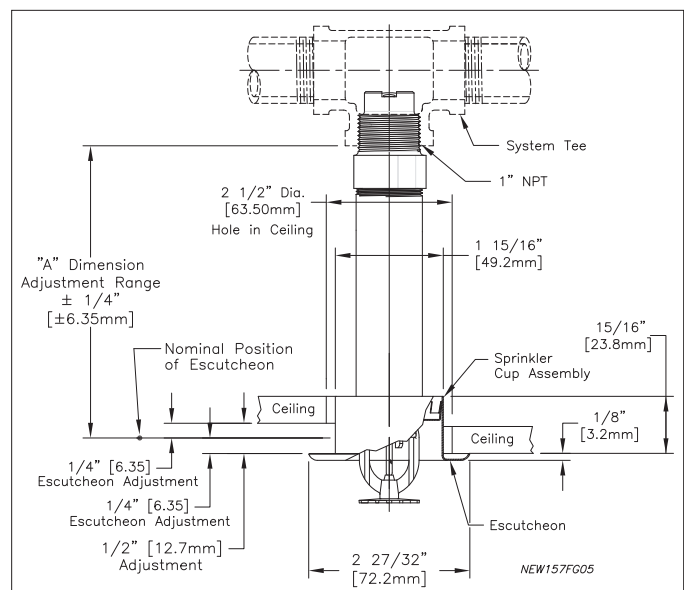


Fig. 5

## Model F3QR Dry Horizontal Sidewall Sprinkler

|          |   |
|----------|---|
| "A" Dim. | 2" to 48" (51mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Finishes<sup>(1)</sup>

| Sprinkler                      | Escutcheon           |
|--------------------------------|----------------------|
| Bronze                         | Brass <sup>(3)</sup> |
| Chrome Plated                  | Chrome Plated        |
| White Polyester <sup>(2)</sup> | White                |

<sup>(1)</sup> Other finishes and colors are available on special order.

Consult factory for details.

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

<sup>(3)</sup> Not available for HB escutcheons.

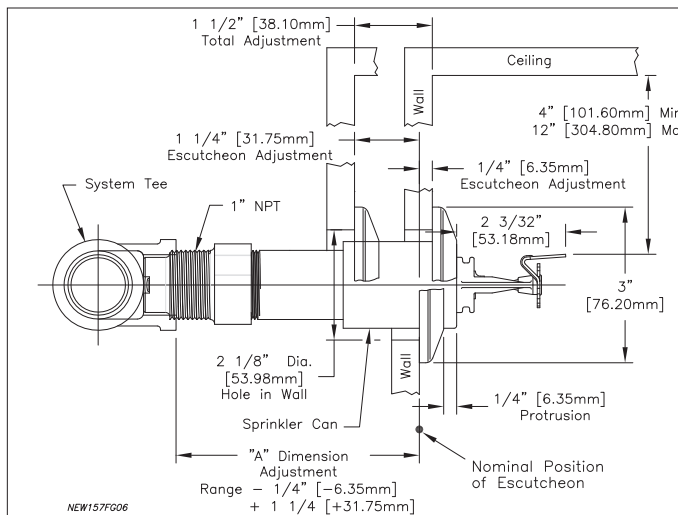


Fig. 6

**Note:** The sprinkler can protrudes 1/4" when escutcheon is in nominal position. Escutcheon adjustment provides -1/4" (-6mm) to +1 1/4" (+32mm) "A" dimension adjustment range.

<sup>(1)</sup> Listed and Certified only by cULus.

**Sprinkler Installation Wrench:** Model F3 Sprinkler Wrench  
**prinkler Identification Number (SIN): R5734**

## Model F3QR Dry HSW w/HB Escutcheon

|          |   |
|----------|---|
| "A" Dim. | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High                        | 286°F (141°C)                | 225°F (107°C)      | Blue       |

Sprinkler can and escutcheon fabricated of brass for better weather resistance in exterior applications.

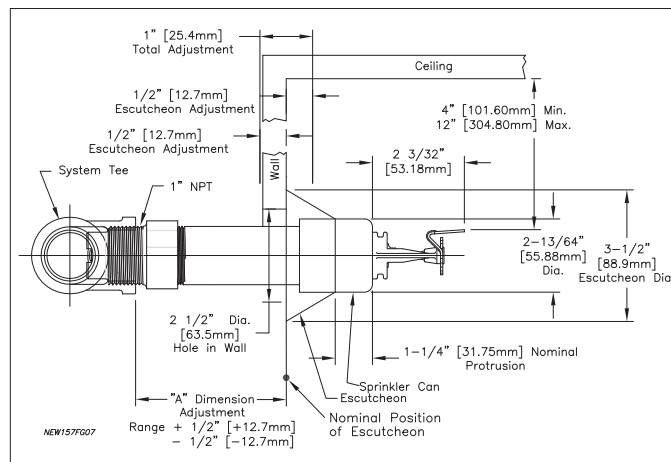


Fig. 7

**Note:** The sprinkler can protrudes 1/4" when escutcheon is in nominal position. Escutcheon adjustment provides -1/2" (-12.7mm) to +1/2" (+12.7mm) "A" dimension adjustment range.

## Model F3QR Dry Recessed FP Horizontal Sidewall Sprinkler

|          |   |
|----------|---|
| "A" Dim. | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|----------|---|

### Finishes<sup>(1)</sup>

| Sprinkler                      | Escutcheon    |
|--------------------------------|---------------|
| Bronze                         | Brass         |
| Chrome Plated                  | Chrome Plated |
| White Polyester <sup>(2)</sup> | White         |

<sup>(1)</sup> Other finishes and colors are available on special order.

Consult factory for details. Cup remains unfinished. "See page 2"

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

### Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup>         | 286°F (141°C)                | 225°F (107°C)      | Blue       |

<sup>(1)</sup> Listed and Certified only by cULus.

**Sprinkler Installation Wrench:**

Model XLO2 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5734**

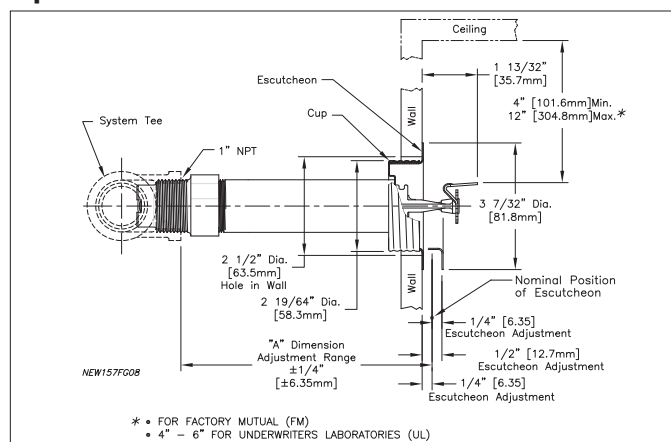


Fig. 8

**Notes:** Do not install the Model F3QR Dry Recessed FP Horizontal Sidewall Sprinkler in walls which have positive pressure in their side space.

- Listed by cULus for Quick Response. Approved by FM for Standard Response.
- Recessed Horizontal sidewall sprinklers are listed with cULus for installation of min. 4" (100mm) - to - max. 6" (150mm) below ceiling and approved by FM for installation of min. 4" (100mm) - to - max. 12" (300mm) below ceiling.

# Model F3QR Dry Recessed F1 Horizontal Sidewall Sprinkler

|                 |   |
|-----------------|---|
| <b>"A" Dim.</b> | 3 1/2" to 48" (89mm to 1219mm) in 1/4" (6mm) increments |
|-----------------|---|

## Finishes<sup>(1)</sup>

| Sprinkler                      | Escutcheon    | Collar        |
|--------------------------------|---------------|---------------|
| Chrome Plated                  | Chrome Plated | Chrome Plated |
| White Polyester <sup>(2)</sup> | White         | White         |

<sup>(1)</sup> Other finishes and colors are available on special order. Consult factory for details.

<sup>(2)</sup> cULus Listed as a Corrosion Resistant sprinkler in standard Black or White.

## Standard Temperature Ratings

| Classification              | Sprinkler Temperature Rating | Max. Ambient Temp. | Bulb Color |
|-----------------------------|------------------------------|--------------------|------------|
| Ordinary                    | 135°F (57°C)                 | 100°F (38°C)       | Orange     |
| Ordinary                    | 155°F (68°C)                 | 100°F (38°C)       | Red        |
| Intermediate <sup>(1)</sup> | 175°F (79°C)                 | 150°F (66°C)       | Yellow     |
| Intermediate                | 200°F (93°C)                 | 150°F (66°C)       | Green      |
| High <sup>(1)</sup>         | 286°F (141°C)                | 225°F (107°C)      | Blue       |

<sup>(1)</sup> Listed and Certified only by cULus.

## Sprinkler Installation Wrench:

Model XLO2 Sprinkler Wrench

**Sprinkler Identification Number (SIN): R5734**

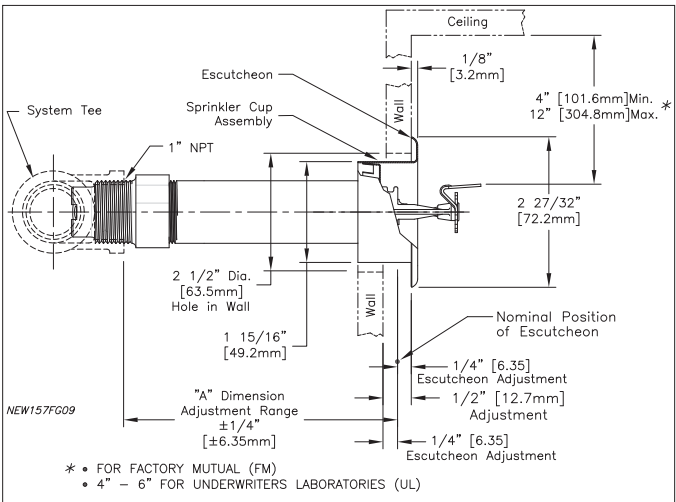


Fig. 9

- Listed by cULus for Quick Response. Approved by FM for Standard Response.
- Recessed Horizontal sidewall sprinklers are listed with cULus for installation of min. 4" (100mm) - to - max. 6" (150mm) below ceiling and approved by FM for installation of min. 4" (100mm) - to - max. 12" (300mm) below ceiling.

## Technical Data:

Orifice Size: 1/2" (15mm)

Thread Size: 1" NPT per ANSI B2.1

Working Pressure: 175 psi (12 bar)

Nominal K Factor - US / (Metric): 5.6 / (80)

## Product Description

Reliable Model F3QR Dry Sprinklers are quick response sprinklers utilizing a durable 3mm frangible glass bulb. This quick response enables these sprinklers to apply water to a fire much sooner than standard response sprinklers of the similar temperature rating.

Model F3QR Dry Sprinklers are intended for use in dry and preaction systems and in areas subjected to freezing temperatures, such as freezers and unheated portions inside and outside buildings.

Environments wherein dry sprinklers are employed can be corrosive. For this reason, Model F3 Sprinklers have a special wax fillet placed in the gap between the cup that supports the bulb and the wrenching boss. This wax will not interfere with the operation of the sprinkler, and it prevents contaminants from entering the internal portion of the drop nipple. The wax must not be removed.

## Operation

The glass bulb consists of an accurately controlled amount of special fluid hermetically sealed inside a precisely manufactured glass capsule. This glass bulb is specially constructed to provide fast thermal response. When the temperature increases sufficiently, due to a fire, the bulb shatters allowing operating parts to clear the waterway. This enables the inlet seal to release air or water and subsequently, cause water flow over the deflector in a uniform spray pattern, controlling or extinguishing the fire.

## Ordering Information

Specify:

1. Sprinkler Type (select one):
  - (a) Model F3QR Dry Pendant
  - (b) Model F3QR Dry Pendant/HB
  - (c) Model F3QR Dry Recessed FP Pendant
  - (d) Model F3QR Dry Recessed F1 Pendant
  - (e) Model F3QR Dry Concealed Pendant
  - (f) Model F3QR Dry Horizontal Sidewall
  - (g) Model F3QR Dry Horizontal Sidewall/HB
  - (h) Model F3QR Dry Recessed FP Horizontal Sidewall
  - (i) Model F3QR Dry Recessed F1 Horizontal Sidewall
2. Sprinkler Temperature Rating.
3. Sprinkler Finish.
4. Escutcheon type (F1 or FP).
5. Cover Plate/Escutcheon Finish.
6. Length:  
"A" Dimension (face of tee to face of ceiling or wall) in 1/4" (6mm) increments.
7. Model F3QR Dry Pendant (a) is available without sprinkler can and escutcheon.

## Note:

1. The "A" dimension is based on a nominally gauged pipe thread "make-up" of 0.600" (15mm) per ANSI B2.1 [7 1/2 threads approximately].
2. All platings and paintings are decorative and intended for interior use.



## General Installation Instructions

Model F3QR dry sprinklers must be installed only in standard (ANSI B 16.3 class 150 and ANSI B 16.4 class 125) pipe tees in the horizontal position, even at branch line ends. They should not be installed into elbows or pipe couplings located on drop nipples to the sprinklers. For these and other fittings including CPVC\*, the dry sprinkler should be installed into a fitting to allow protrusion into the fitting in accordance with the diagrams. The "A" dimension of the dry sprinkler, which extends into the freezers or a freezing zone from wet pipe systems, should be selected to provide, as a minimum, the specified lengths in inches shown in Fig. 10.

### **Caution:**

Do not install Model F3QR Dry sprinklers into CPVC adapter fittings or tees that have an internal obstruction. This will damage the sprinkler and /or the fitting. Refer to Fig. 11.

During installation, the following steps must be followed:

1. Cut the specified size hole (see illustrations) for the sprinkler in the ceiling or wall directly in line with the tee.
2. Apply pipe joint compound to the 1" (25mm) pipe threads and install sprinkler using the Model F3 or XLO2 Sprinkler Wrench as specified.
3. Install the Model FP push-on / thread-off escutcheon or CCP cover plate if required.

**Note:** Installation of the Model F3QR Sprinklers is not recommended in copper pipe systems, as this may reduce the life expectancy of the sprinklers.

## Model F3QR Concealed and Recessed Installation Instructions

- The Model XLO2 wrench (Fig. 12) is designed to locate on the wrenching pads of the recessed sprinkler while centering in the cup. A standard ½" drive ratchet may be used to drive this wrench. Fig. 13 and Fig. 14 show sequentially the insertion of the wrench. First the wrench, with its jaws above the sprinkler deflector, is moved laterally until centered with the cup. Then raise the wrench inside of the cup until its jaws engage the sprinkler's square wrenching pads (Fig. 14). To remove the wrench, follow this procedure in reverse order. Care should be taken to avoid striking the deflector, with the wrench.
- Model F3 Wrench (Fig. 15) is used for installation of Pendent and Horizontal Sidewall sprinklers.
- Glass bulb sprinklers have orange bulb protectors to minimize bulb damage during shipping, handling and installation. REMOVE THIS PROTECTION AT THE TIME THE SPRINKLER SYSTEM IS PLACED IN SERVICE FOR FIRE PROTECTION. Removal of the protectors before this time may leave the bulb vulnerable to damage. RASCO wrenches are designed to install sprinklers when covers are in place. REMOVE PROTECTORS BY UNDOING THE CLASP BY HAND. DO NOT USE TOOLS TO REMOVE THE PROTECTORS.

## Maintenance

The Model F3QR Quick Response Dry Sprinklers should be inspected quarterly and the sprinkler system maintained in accordance with NFPA 25. Do not remove the factory applied thermally sensitive wax fillet between the bulb supporting cup and the wrenching boss. Do not replace this wax with a substitute substance. An Alternate substance may interfere with proper operation of the sprinkler. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove dust by using a soft brush or gently vacuuming. Remove any sprinkler which has been painted (other than factory applied) or damaged in any way. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging until used to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

### **Caution:**

Use specified by RASCO wrenches only, which are designed to engage sprinkler's wrenching pad. (Fig. 15, page 9)

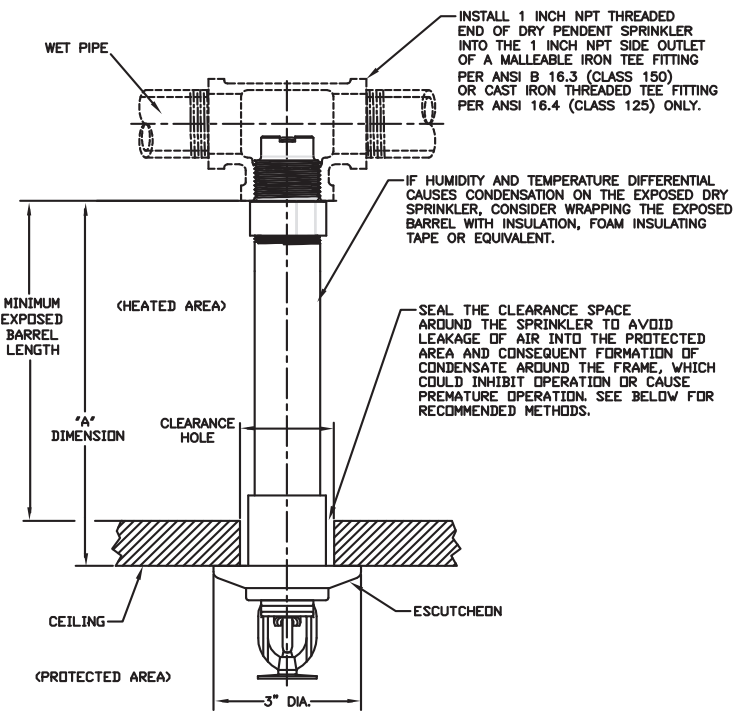


**RECOMMENDED EXPOSED MINIMUM BARREL LENGTH BASED ON AMBIENT TEMPERATURE IN THE PROTECTED AREA  
(STANDARD DRY PENDENT SPRINKLER SHOWN)**

| AMBIENT TEMPERATURE OF PROTECTED AREA* AT THE DISCHARGE END OF THE SPRINKLER | EXPOSED BARREL AMBIENT TEMPERATURE                              |           |           |
|--|---|-----------|-----------|
|  | 40°F/4°C  | 50°F/10°C | 60°F/16°C |
|  | EXPOSED MINIMUM BARREL LENGTH** (FACE OF TEE TO TOP OF CEILING) |           |           |
|  | IN. (MM)  | IN. (MM)  | IN. (MM)  |
| 40°F (4°C)   | 0   | 0         | 0         |
| 30°F (-1°C)  | 0   | 0         | 0         |
| 20°F (-7°C)  | 4 (101)   | 0         | 0         |
| 10°F (-12°C)   | 8 (203)   | 1 (25.1)  | 0         |
| 0°F (-18°C)  | 12 (305)  | 3 (75)    | 0         |
| -10°F (-23°C)  | 14 (356)  | 4 (101)   | 1 (25.1)  |
| -20°F (-29°C)  | 14 (356)  | 6 (152)   | 3 (75)    |
| -30°F (-34°C)  | 16 (406)  | 8 (203)   | 4 (101)   |
| -40°F (-40°C)  | 18 (457)  | 8 (203)   | 4 (101)   |
| -50°F (-46°C)  | 20 (508)  | 10 (254)  | 6 (152)   |
| -60°F (-51°C)  | 20 (508)  | 10 (254)  | 6 (152)   |

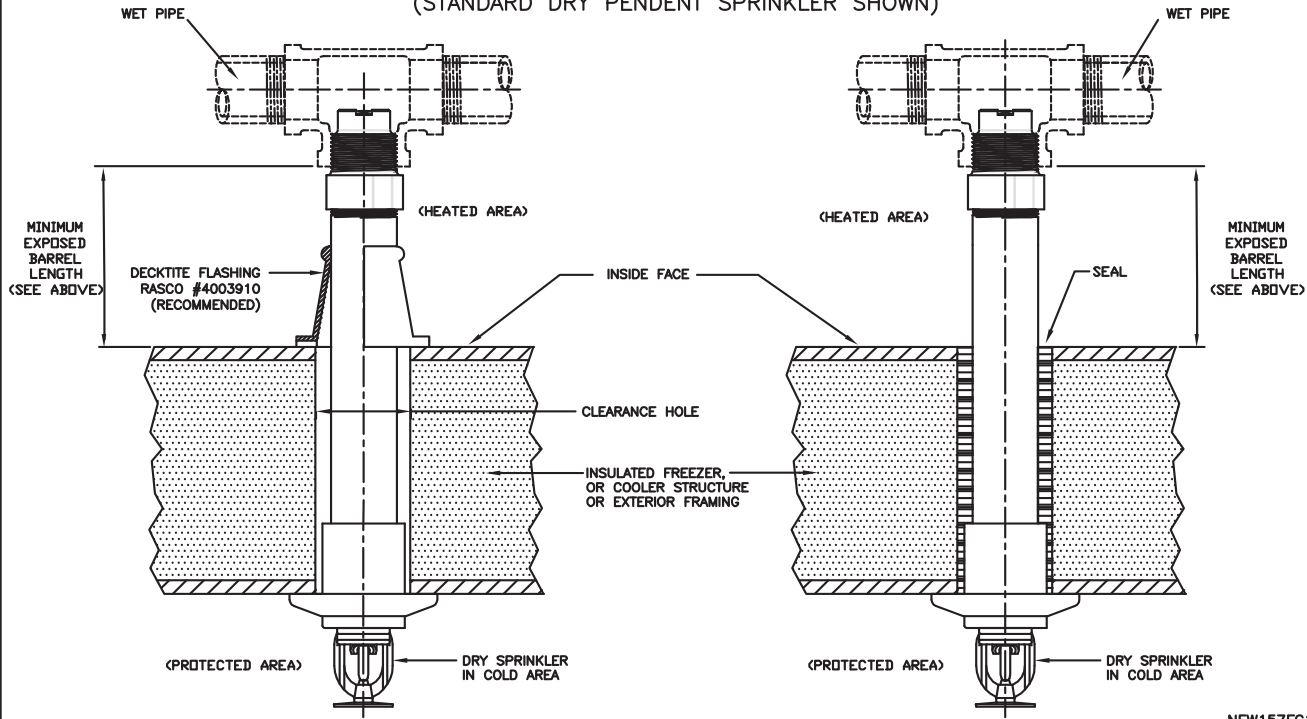
\* THE PROTECTED AREA REFERS TO THE AREA BELOW THE CEILING. THE AMBIENT TEMPERATURE IS THE TEMPERATURE AT THE DISCHARGE END OF THE SPRINKLER.  
FOR PROTECTED AREA TEMPERATURES THAT OCCUR BETWEEN THE VALUES LISTED, USE THE NEXT COOLER TEMPERATURE.

\*\*THE MIN. REQUIRED BARREL LENGTH IS NOT THE SAME AS THE 'A' DIMENSION. NOTE: EXPOSED MINIMUM BARREL LENGTHS ARE INCLUSIVE UP TO 30MPH WIND VELOCITIES IN THE PROTECTED AREA.



\*RECOMMENDED EXPOSED MINIMUM BARREL LENGTHS ALSO APPLY TO HORIZONTAL SIDEWALL DRY SPRINKLERS\*

**RECOMMENDED DRY SPRINKLER SEAL ARRANGEMENTS  
(STANDARD DRY PENDENT SPRINKLER SHOWN)**

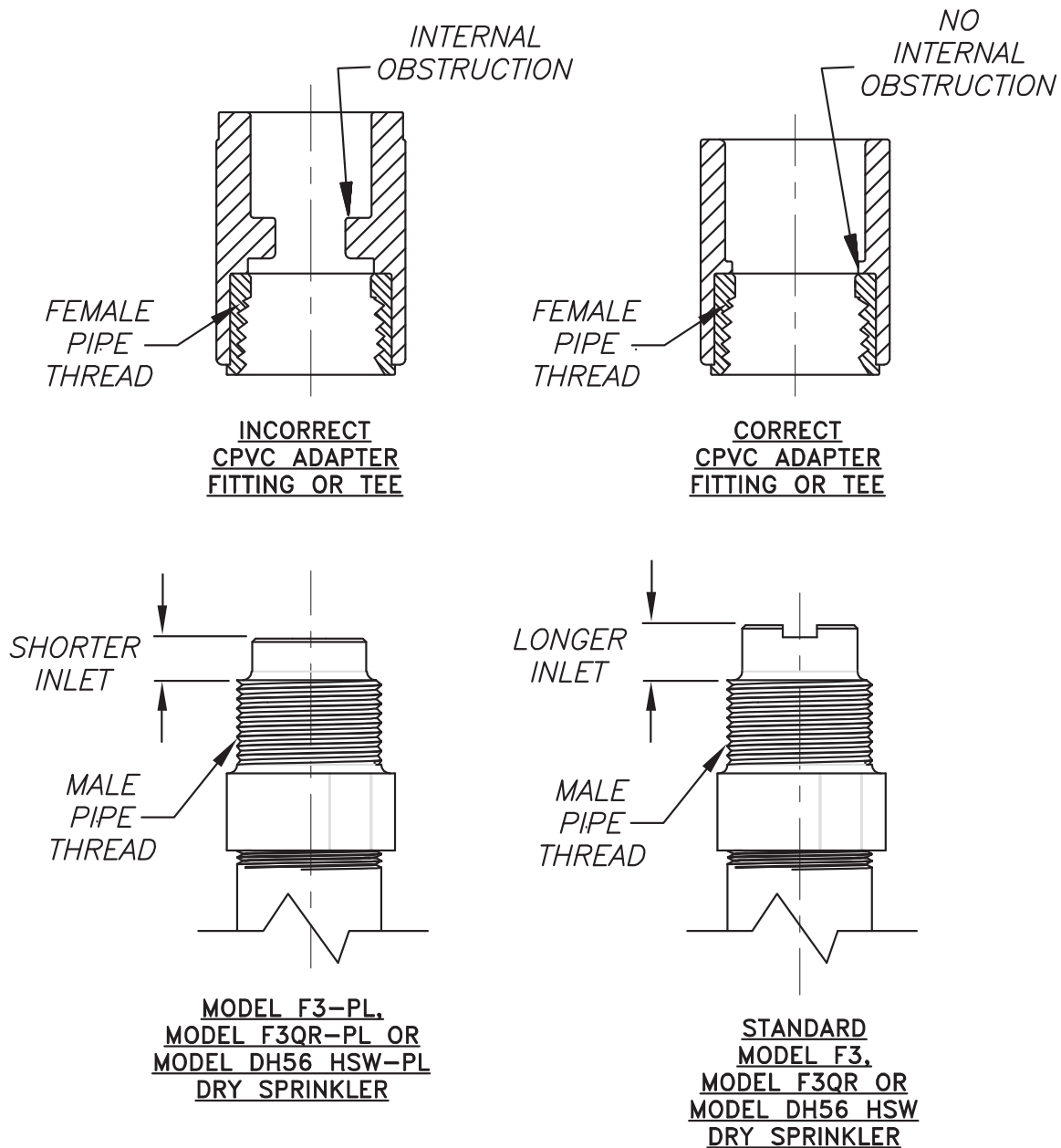


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Fig. 10  
7.

## **\*CAUTION\***

DO NOT INSTALL MODEL F3, MODEL F3QR OR MODEL DH56 HSW DRY SPRINKLERS INTO CPVC ADAPTER FITTINGS OR TEES THAT HAVE AN INTERNAL OBSTRUCTION. THIS WILL DAMAGE THE SPRINKLER AND/OR THE FITTING.  
CPVC ADAPTER FITTINGS AND TEES WITH INTERNAL OBSTRUCTIONS ARE ALSO COMMONLY FOUND DURING THE RETROFITTING PROCESS OF RELIABLE'S OLDER MODEL G3 DRY SPRINKLERS.



BE SURE TO ORDER THE CORRECT SPRINKLERS FOR YOUR APPLICATION

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Fig. 11



Fig. 12 - XLO2 Wrench

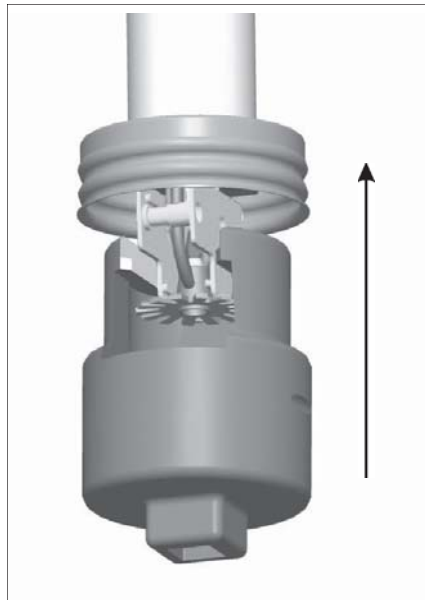


Fig. 13 - XLO2 Wrench

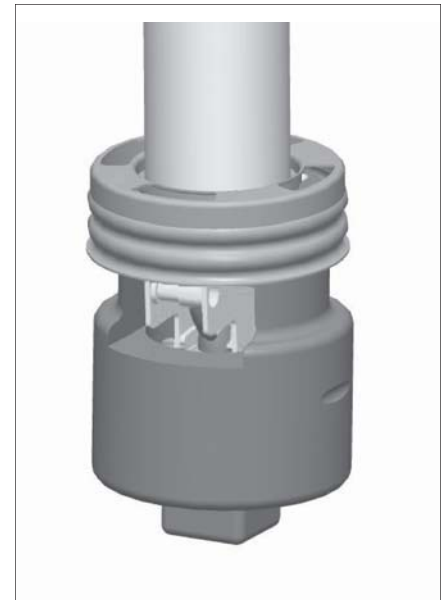


Fig. 14 - XLO2 Wrench

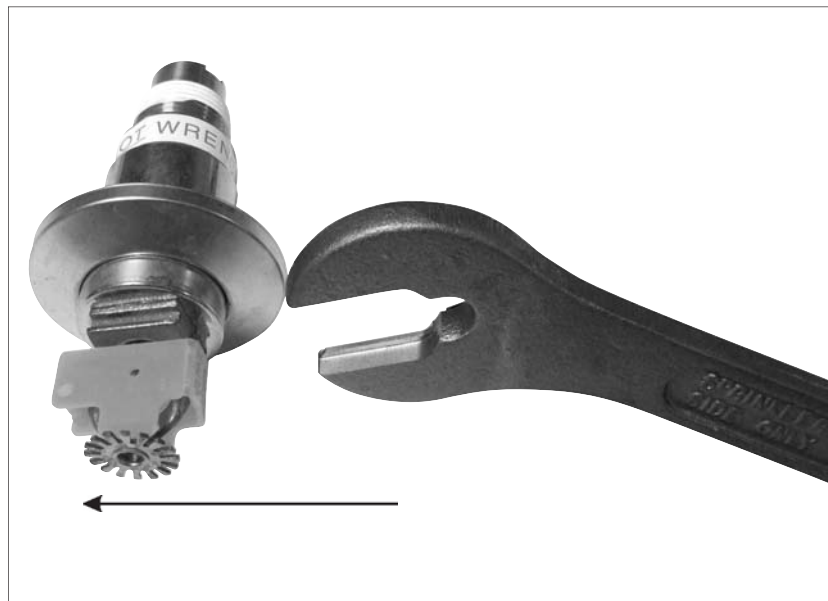


Fig. 15 - F3 Wrench