



# Best Practices Guide

*for Residential Fire Sprinklers*

**ver.2.0 / 1.16.2017**

**This guide was created by the Washington Fire Sprinkler Coalition with the purpose of uniting AHJs, fire sprinkler contractors, and builders alike in order to create a “best practices” standard for residential fire sprinkler installations in Washington state. It is an ongoing process and we encourage anyone who wants to have a voice to get involved following the link below.**

**For more information on how to get involved visit**

*[www.firesprinklerinitiative.org/state-coalitions/washington.aspx](http://www.firesprinklerinitiative.org/state-coalitions/washington.aspx)*

**Images used courtesy of Home Fire Sprinkler Coalition**

*[www.homefiresprinkler.org](http://www.homefiresprinkler.org)*

**NFPA Code references used courtesy of NFPA**

*[www.nfpa.org](http://www.nfpa.org)*

# Table of Contents

## Background

Guiding Principals of NFPA 13D

**4**

Washington State “Barriers Bill”

**5**

## Design

Criteria

**8**

## Plan Submittal

Plan Submittal Requirements

**11**

Plan Review Procedure

**13**

## Inspections

Coordination

**14**

Inspection Items

**16**

Details

**17**

## Appendix

NFPA 13D Code Reference

**a**

Stand Alone Riser Detail (Typical)

**b**

Passive Purge Riser Detail (Typical)

**c**

Riser Placement Detail - Garage (Typical)

**d**

# Background

## Guiding Principles of NFPA 13D

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In order to manage and enforce requirements for residential fire sprinkler systems, jurisdictions must be aware of the guiding philosophies and principles of NFPA 13D. In 1973, the NFPA Technical Committee on Automatic Sprinklers established the Subcommittee on Residential and Light Hazard Occupancies. The philosophies and principles that the subcommittee established in 1973 still apply today and include the following:

- 1** Life safety is the primary goal of residential fire sprinkler systems; property protection is a secondary goal.
- 2** Cost is a major factor in achieving public acceptance of residential fire sprinkler systems. A system that has fewer operational features than required by NFPA 13, but is still effective, can be installed at a substantially lower cost.
- 3** The goal of the system design is to control the fire for a sufficient time to enable occupants to escape. This led to the requirement for a minimum 10-minute water supply for most systems.
- 4** Piping arrangements, components, and hangers must be compatible with residential construction techniques. Combined sprinkler/plumbing systems are acknowledged in NFPA 13D as an acceptable design option.
- 5** Historical loss data for fires in residential properties serves as a reasonable justification to permit the omission of sprinklers in spaces where a low incidence of fire deaths has occurred, thus lowering costs. As a result, NFPA 13D permits the omission of sprinklers in spaces where fires result in a small percentage of fatalities as compared to other spaces within the dwelling.

# Background

## Washington State “Barriers Bill”

In 2008, the state Legislature passed SHB2575 entitled “An act relating to fire sprinkler systems in private residences.” The bill directed the State Building Code Council (SBCC) to form a Technical Advisory Group (TAG) to “examine issues, barriers, and incentives pertaining to...the voluntary installation of sprinkler systems in private residences.” The bill directed the SBCC to consider the work of the TAG and “develop recommendations for eradicating barriers that prevent the voluntary installation of sprinkler systems in private residences. The TAG developed the following list of barriers to residential fire sprinkler installations.

Progress has been made on many of the barriers listed below and work continues. The Best Practices was developed to help address some of the issues raised in the barriers list.

**1 Lack of Education.** The development of educational materials, guidance documents and a coordinated educational campaign to inform all affected parties was viewed as a critical step.

» **Progress to date:**

- » Substitute House Bill 1295, Chapter 331, Laws of 2011, directed the fire protection licensing fees to fund publishing materials to educate the public on the effectiveness of residential fire sprinkler.
- » Residential sprinkler education trailer has been conducting educational programs around Washington State since 2009.
- » The Washington State Residential Fire Sprinkler Coalition hosts educational efforts, including Fire Team USA, the NW Fire Sprinkler Summit, and displays at the Seattle Home Show.

**2 Lack of Preferred Design and Installation Details & Guidelines.** There was a lack of consistent criteria to assist installers, builders, fire personnel, water purveyors and homeowners.



# Background

## Washington State “Barriers Bill

» **Progress to date:**

» In 2016 the Washington Fire Sprinkler Coalition presented the first draft of the Best Practices guide for Residential Fire Sprinkler Systems at the Fire Marshal Institute in Chelan, WA. This guide is a resource to bring consistent design, installation, and enforcement guidelines to assist the installer, builder, fire personnel, water purveyor, and homeowners throughout our state.

**3**

**Cost and Cost Recovery of a Voluntary RFSS**

**Installation.** The cost for system installations was and continues to be a perceived barrier to installations. The true value of these systems to homeowners and their communities must be clearly and effectively communicated to reduce this barrier.

» **Progress to date:**

» Residential systems have become more affordable in areas where these systems are required. The National average for the cost of residential fire sprinkler installations in new construction is \$1.35/sq ft.. Areas in Washington State that regularly require the installation of residential fire sprinkler systems typically average from \$1.50 to \$2.50/sq ft.  
» Most insurance companies also provide a break in insurance cost if the house is sprinklered.

**4**

**Costs for Permits and Inspections.** The wide range of permit fees and the additional work for builders was, and still is, seen as a barrier.

» **Progress to date:**

» The Washington Fire Sprinkler Coalition’s Best Practice Guide is a direct response to this barrier. The emphasis of this guide is to provide guidance to AHJs in regards to the cost of permit and inspections, and to unify requirements across the state to assist builders through standardization.  
» There does not appear to be any jurisdiction charging additional fees for separate sprinkler inspections.

**5**

**Increased Cost of Hook-up Fees in the Form of Standby/System Development Charges.**

Water purveyors frequently add fees for water connections supplying sprinklers due to the perceived need for a larger meter.

# Background

## Washington State “Barriers Bill

6

**Shut-Off Issues.** Water service to properties may be interrupted for a number of reasons, including routine maintenance, system damage and failure to pay a water bill. Water purveyors expressed liability concerns if a sprinkler system failed to operate due to the water being shut off.

» **Progress to date:**

» With the use of multi-purpose and flow-through sprinkler systems, increase meter sizes, hook-up fees and stand-by charges have been reduced or eliminated. Water agencies consider many of these systems to be no different than a standard residential plumbing system.

» **Progress to date:**

» In 2011, Substitute House Bill 1295, Chapter 331 provided immunity from damages incurred from shutting off the water to a residence with an installed fire sprinkler system if the shut off is due to the following: routine water system management, customer nonpayment for service, or water system emergencies.

7

**Water Use Efficiency Rule Credit for Use of Larger Meter.** Larger water meters were less accurate for low flow levels than smaller meters. Water purveyors must account for water loss in their system to the state Department of Health.

» **Progress to date:**

» The WA Department of Health developed leakage standards for water distribution systems as part of an overall effort to promote water use efficiency. The water distribution system leakage standards are expressly defined to include estimated additional metering losses and demand increases due to meter upsizing required when a residential fire sprinkler system is installed.



Fire sprinkler systems for one- and two-family dwellings are typically designed in accordance with NFPA 13D. A Washington State amendment to the International Residential Code (IRC) allows an alternative design approach by utilizing IRC Section P2904 Dwelling Unit Fire Sprinkler Systems.

### **1 System design should be in accordance with NFPA 13D with no deviations.**

Although some fire safety professionals may feel that additional requirements for residential sprinkler systems will result in a higher level of occupant safety, these additions may have unintended consequences. NFPA 13D is a nationally published standard that has been developed over several decades by a wide variety of safety experts. With the guiding principles in mind, committee members have produced a standard that has been subjected to detailed reviews and evaluations. *Adding local requirements for these systems can increase the cost and complexity of system installations and the thereby make it more difficult for a jurisdiction to adopt a local residential sprinkler mandate.* This affects other jurisdictions trying to adopt a residential sprinkler ordinance because the opposition will use issues from anywhere to argue against sprinklers. In addition, local amendments are not subjected to the evaluation of the standard development committee and could result in potential liability for the jurisdiction if a system does not operate properly under fire conditions.

### **2 Clearly publish up-to-date local requirements for sprinkler system design, such as on a website.**

Contractors that design and install sprinkler systems often work in many different jurisdictions. The inability for contractors to easily access local requirements adds time to the project and results in added costs for the system. When requirements are not clear, Jurisdictions may receive permit submittals that do not meet their needs, adding to review time and unnecessary communications with the contractor. The resulting inefficiencies cause an increased amount of work for all parties involved.



**3 Jurisdictions should develop, document and publish a process where the most recent NFPA standard may be used, whether in whole or in part, even when the local adopted standard is behind NFPA's current code.**

The ICC Code references specific editions of NFPA standards. When adopted by local jurisdictions and the State, those editions of the standard become part of the Code. The referenced standards are typically at least one edition behind the latest published by NFPA. Evaluating and interpreting code provisions is the responsibility of the fire code official. Allowing the use of provisions found in new editions of the standards shows that jurisdictions are forward-thinking and strive to recognize the work of the national standards committees. For instance, the 2010 edition of NFPA 13D required a sprinkler head to be installed above fuel-fired equipment located in attic spaces, but that requirement was removed from the 2013 edition.

**4 In keeping with NFPA 13D, no alarm should be required upon activation of the sprinkler system.**

As noted, reducing cost is a guiding principle for NFPA 13D systems. The addition of a flow switch and bell can add \$500 or more to the cost of the system. NFPA 13D and the IRC require interconnected smoke alarms to be installed in the home to provide early warning to occupants. NFPA 13D does not require the installation of waterflow alarms where smoke alarms are installed. Although not required however, they should be encouraged. When waterflow alarms are installed they should be installed on the exterior of the dwelling. The use of waterflow alarms allows for the prompt notification of sprinkler activation or any other inadvertent flow such as a broken pipe. This is especially beneficial if no occupants are in the dwelling.

# Design

## Criteria

**5**

**Minor plan revisions should be addressed with plan mark-ups or red lines. Do not require revised plans unless absolutely necessary.**

Plan revisions such as relocated heads, an added head or similar minor issues should not be sent back to the designer to be re-drawn. These types of revisions will have minimal impact on the performance of the system. Requiring revised drawings add to the cost of the system and delay the issuance of the permit. Call or email the designer if you have questions about the plans. Significant revisions that affect the hydraulic calculations to the most remote heads, require significant head placement or piping changes or similar issues can be sent back for re-design.

# Plan Submittal

## Plan Submittal Requirements

Clarity of information on what is necessary to submit for a residential fire sprinkler permit is critical to avoiding delays in the contractors' schedule and alleviating headaches for the AHJ. The following items should be addressed and information provided in an easily accessible and up-to-date location such as a website.

**1 Limit the number of additional permits required to install Residential Fire Sprinkler Systems when possible.**

Reducing the number of permits reduces the amount of time spent by both the contractor and the AHJ.

**2 Post current application forms, submittal documents, and other required submittal items on your website.**

Providing all required city specific documents in an easy to find location allows a contractor the ability to be prepared in advance reducing frustration and delay at the permit counter.

**3 Provide process for obtaining water supply information.**

The AHJ should arrange with each water purveyor the method of request and receive water supply information for the sprinkler design. Prearrange the method of getting water supply information from the water purveyor and create an electronic request form that can be used to obtain the information. Clarify whether or not a backflow device will be required.

**4 Allow electronic submission of drawings.**



# Plan Submittal

## Plan Submittal Requirements

Consider allowing electronic plan submittal that can be accomplished remotely. This saves time and money from creating paper plan sets and having to travel to the permit center.

### **5 Streamline application and appointment process.**

Review process for application procedures to eliminate unnecessary appointments. Allow online plan submittals when possible, otherwise drop in submittals. If appointments are necessary, make it easy to schedule appointments. Be clear when the numbers of submittals are restricted. Providing estimated plan review time helps to avoid delays in construction sequencing.

### **6 Simply permit fee calculation.**

Publish easy to understand and up-to-date fee schedules for permits, preferably with a maximum of \$250. This is in keeping with the ideology of NFPA 13D, to make residential fire sprinkler systems as affordable as possible. Notify customers when there is an upcoming change.

### **7 Provide easy way to accept permit fee payments.**

Allow customers the ability to pay fees online or over the phone when possible. This allows more flexibility and security for contractors when selecting employees to submit plans.

# Plan Submittal

## Plan Review Procedure

Reviewing submitted plans, cut sheets, and calculations is the verification process the AHJ undertakes in order to issue the fire sprinkler permit. With customer service as the focus of this process address the following:

### **1 Complete review process in a timely manor.**

The review process should be completed within two weeks. The amount of time to complete the plan review process is the biggest concern of the contractor or builder. Delays in receiving the permit can disrupt the construction sequence and cause the project to become off schedule.

### **2 Accept red lines versus requiring submittals.**

When errors, corrections, or clarifications are discovered in the review process, redline the submitted plans versus requiring the submittal of revised plans. This process works for minor modifications while major adjustments may still require revised plans.

### **3 Implement a basic plan program for select developments.**

Certain large developments will often build the same home throughout the plat resulting in repeat floor plans that have already been reviewed for sprinkler design and layout. Programs can be established to review the repeated floor plans once, and then expedite the review of subsequent similar plans for the rest of the development. These “basic plan” programs can reduce the need for comprehensive plan reviews on plan sets that have been fully reviewed. Because plan review time is reduced, permit fees on such projects should be reduced.

# Inspections

## Coordination

Establishing clear expectations and coordinating multiple inspection items for each inspection will produce the most efficient inspection process and accommodate the builder's intricate construction schedule. The inability for the sprinkler contractor to meet the job timeline will ripple through many other subcontractors and can cause the entire job to fall behind schedule.

- 1 Method of requesting inspections should be clearly defined, easy to do and printed on the face of the permit, on the approved drawing, as well as published on a website.**

Requesting an inspection is one of the most crucial moments of a job schedule. Having your inspection request method published and easy to follow allows the requester confidence that they will receive an inspection as soon as a slot is available by the AHJ without fear that they messed something up and need to keep contacting the jurisdiction.

- 2 Inspections should take place within 48 hours of the initial request and be confirmed with a specific and reasonable timeframe when scheduling. Confirmation should be on the same day of initial request when possible.**

One of the biggest cost to the customer is time. Confirming a specific inspection time allows for efficient coordination, valuable time saved and reduced cost overall of the fire sprinkler system. Just as a good business is responsive to the needs of its customers the AHJ is an integral and helpful member of the sprinkler team. Many home builders are opposed to installing fire sprinklers because they fear any delays or complications added to the job. A history of inspection delays serve to reinforce opposition to fire sprinklers.

# Inspections

## Coordination

- 3 Clearly define what inspections are required by the jurisdiction and avoid using “boiler plate” inspection lists as they can result in unnecessary added time and expense to the system.**

The sprinkler system installer must be informed when an inspector must inspect and approve specific stages of the installation. For instance, if you require an inspection of the piping insulation but it is not clearly communicated to the installer, the system piping could be already covered by sheetrock, making it very difficult to confirm proper insulating of the pipes.

# Inspections

## Inspection Items

The following is the recommended list of inspection items part of the AHJ acceptance testing:

For efficiency combine inspections **1 through 5** into a single visit before "OK to cover" is granted.

- |  |                                |
|--|--------------------------------|
| <b>1</b>                               | Hydrostatic Pressure Test      |
| <b>2</b>                               | Head Placement and Piping      |
| <b>3</b>                               | Flow Test (Bucket Test)        |
| <b>4</b>                               | Insulation Tenting             |
| <b>5</b>                               | Hangers, Bracing, Nail Plating |
| <b>6</b>                               | Final Inspection               |
| <b>Optional Dependant upon Devices</b> |                                |
| <b>7</b>                               | Alarm Device Test              |
| <b>8</b>                               | Tank and Pump Test             |



# Inspections

## Details

### 1 Hydrostatic Pressure Test

Normal operating pressure is utilized for hydrostatic testing on all systems that do not include a fire department connection. Note that NFPA 13D does not require a FDC. Hydrostatic testing is used to discover leaks in the piping and fittings.

### 2 Head Placement and Piping

The designer submitted drawings show head and piping placement for the installation and the AHJ reviewed and approved the plans as drawn. The field verification of proper placement of sprinkler heads and piping requires the inspector to visually verify that the installation is according to the approved plans and/or the designed spacing of the heads. Revised drawings should not be required for minor field changes.

### 3 Insulation Tenting

Sprinkler system piping is filled with water at all times, thus freeze protection of that piping is critical. Insulation must be placed in a manner that provides the piping warmth from the heated space and insulation from the cold space. Tenting of the insulation ensures that the piping has an open air space to the heated environment. The tenting must be stapled in place to ensure that the heat from below reaches the piping and prevents freezing of the water in the pipe.

### 4 Hanger, Bracing, Nail Plating

During the piping and head placement verification, the hangers, braces and nail plates should also be inspected. Pipe supports must follow the piping manufacturer's instructions or listings. Pipes should be supported to prevent movement of piping upon sprinkler activation. Nail plates must be installed to protect the piping where the pipe is installed through a hole or notch in the stud, rafter, or similar members where the pipe is less than 1 ¼ -inch from the edge of the member.

# Inspections

## Details

### **5** **Flow Test (Bucket Test)**

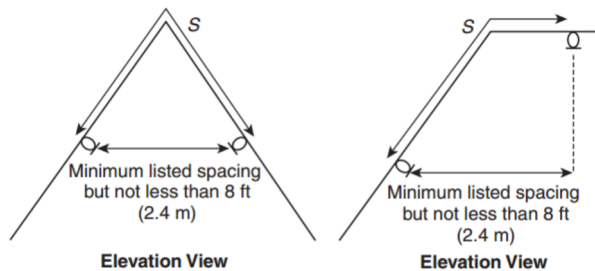
The “bucket test” verifies that the sprinkler design is adequate to provide the minimum pressure and volume of water in the most remote area. This test is embraced by many jurisdictions and contractors as a simple way to verify system design. Note that the test head orifice must be the same size as the approved head. A typical flow test will utilize the two most hydraulic remote heads located in the same compartment as determined by the designer. Simultaneous flow from both heads into containers for 30 seconds is performed. The quantity of water discharged by each head is measured and doubled (to determine the one minute total). The results from each head shall be at least the minimum flow identified by the manufacturer based on the coverage area. Common sense and good safety practices should be utilized where a head identified as a test head is located in a high ceiling area. Another nearby head located in a more accessible location may be utilized if there are significant safety concerns (tall, unstable ladders, etc.) or difficult access to the identified test head.

### **6** **Final Inspection**

A final inspection should be performed when the house is complete, or nearly complete. The final inspection should include verification that sprinkler head trim or concealers have been installed and that no architectural features have been constructed or installed that will obstruct the coverage from the sprinkler discharge or result in a change of sprinkler coverage. In addition, if a flow switch is present, the switch and associated notification devices should be tested for proper operation.

# Appendix a NFPA 13D Code Reference

**8.1.1** Where ceiling is slope, maximum *S* dimension shall be measured along the slope of the ceiling.



**FIGURE 8.1.1.1** Measuring *S* Dimension.

## Continuous Obstructions (8.2.5.3):

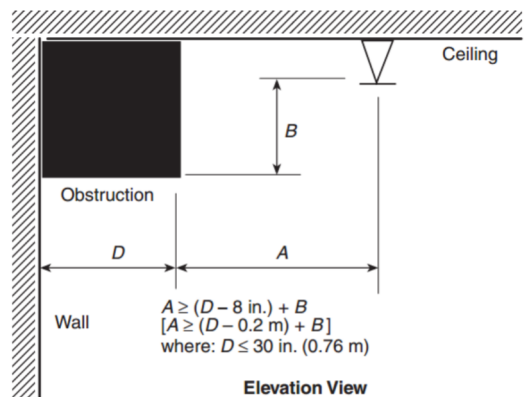
**TABLE 8.2.5.3.2** Positioning of Sprinklers to Avoid Obstructions to Discharge (Residential Upright and Pendent Spray Sprinklers)

Distance from Sprinklers to Side of Obstruction (A)	Maximum Allowable Distance of Deflector Above Bottom of Obstruction (in.) (B)
Less than 1 ft (300 mm)	0
1 ft (300 mm) to less than 1 ft 6 in. (450 mm)	0
1 ft 6 in. (450 mm) to less than 2 ft (600 mm)	1 (25 mm)
2 ft (600 mm) to less than 2 ft 6 in. (750 mm)	1 (25 mm)
2 ft (750 mm) 6 in. to less than 3 ft (900 mm)	1 (25 mm)
3 ft (900 mm) to less than 3 ft 6 in. (1050 mm)	3 (75 mm)
3 ft (1050 mm) 6 in. to less than 4 ft (1200 mm)	3 (75 mm)
4 ft (1200 mm) to less than 4 ft 6 in. (1350 mm)	5 (125 mm)
4 ft (1350 mm) 6 in. to less than 5 ft (1500 mm)	7 (175 mm)
5 ft (1500 mm) to less than 5 ft 6 in. (1650 mm)	7 (175 mm)
5 ft 6 in. (1650 mm) to less than 6 ft (1800 mm)	7 (175 mm)
6 ft (1800 mm) to less than 6 ft 6 in. (1950 mm)	9 (225 mm)
6 ft 6 (1950 mm) in. to less than 7 ft (2100 mm)	11 (275 mm)
7 ft and greater	14 (350 mm)

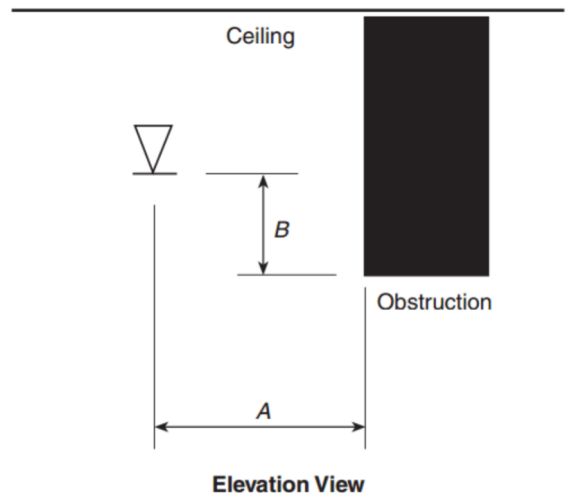
Note: For A and B, refer to [Figure 8.2.5.3.2](#).

**8.2.5.1.1** Pendent sprinklers shall be located at least 3 ft from center of obstructions such as ceiling fans or light fixtures.

**8.2.5.2.1** Sidewall sprinklers shall be located at least 5 ft from center of obstructions such as ceiling fans or light fixtures.



**FIGURE 8.2.5.3.3(a)** Positioning of Sprinkler to Avoid Obstruction Against Walls (Residential Upright and Pendent Spray Sprinklers).



**FIGURE 8.2.5.3.2** Positioning of Sprinkler to Avoid Obstruction to Discharge (Residential Upright and Pendent Spray Sprinklers).

**8.2.5.6** Shadow areas permitted as long as the cumulative dry areas do not exceed 15 sq ft per sprinkler.

# Appendix a NFPA 13D Code Reference

**8.2.5.7** For small areas created by architectural features (i.e. bay windows), no additional sprinklers are required where extra floor area created is less than 18 sq. ft. (9' max length x 2' max depth).

**8.2.7** In all closets/compartments less than 400 cu. ft., including those with mechanical equipment, sprinklers are permitted to be installed either (1) within 18" of ceiling to avoid obstructions or (2) at highest ceiling level without regard to obstructions or min. distances to wall. ("This rule is intended to facilitate the placement of sprinklers in closets with multiple elevations, such as those closets found under stairs and pitched roofs.")

**8.3.2** Sprinklers not required in bathrooms 55 sq. ft. and less (Includes spaces with only a toilet or sink).

**8.3.3** Sprinklers not required in clothes/linen closets and pantries 24 sq. ft. and less.

**8.3.4** Sprinklers not required in garages, open attached porches, carports, and similar.

**8.3.5** Sprinklers not required in attics, crawl spaces, or other concealed spaces not intended for living purposes.

**8.3.5.1.1** Where fuel-fired equipment is above all occupied areas of dwelling unit, no sprinkler protection required in concealed spaces.

**8.3.7** Sprinklers not required in ceiling pockets that meet the following conditions: (1) Total volume of all unprotected ceiling pockets is less than 100 cu. ft. (2) Entire floor under unprotected pocket is protected. (3) Interior finish (excluding decorative treatments) is non-combustible or limited-combustible material. (4) Skylights not exceeding 32 sq. ft. permitted to have a plastic cover.

**8.3.8** Sprinklers not required in closets in garages/exterior closets accessed from outdoors.

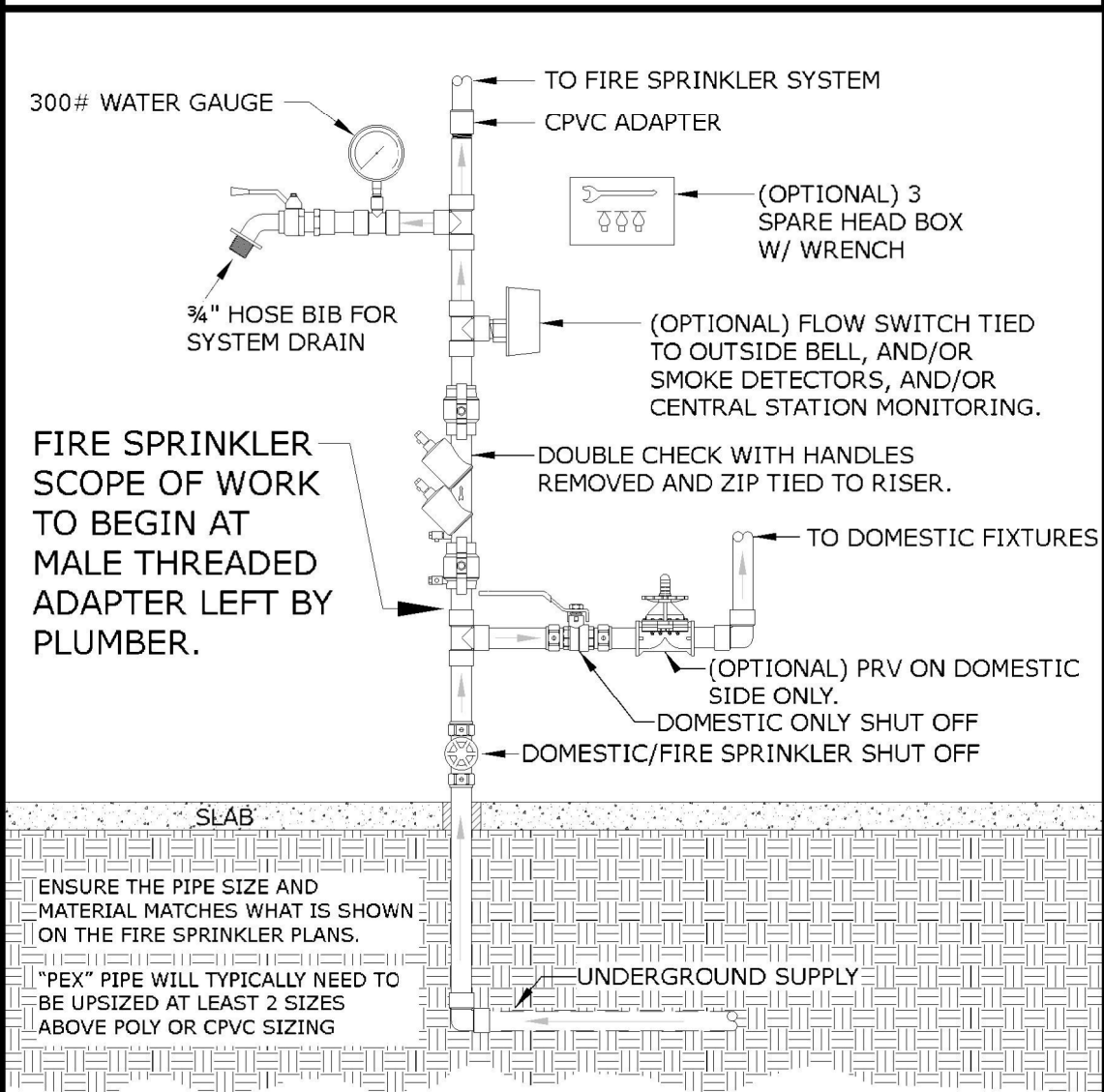
**8.3.9** Sprinklers required in closets used for heating/AC equipment, washers/dryers, or water heaters except as allowed by 8.3.8.

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# Appendix b Stand Alone Riser Detail (Typ.)

ANY PRESSURE REDUCING DEVICE MUST BE ON THE DOMESTIC-ONLY SIDE OF THE TEE. ALL UNDERGROUND TO BE BY OTHERS.



## **STAND ALONE RISER DETAIL (TYP.)**

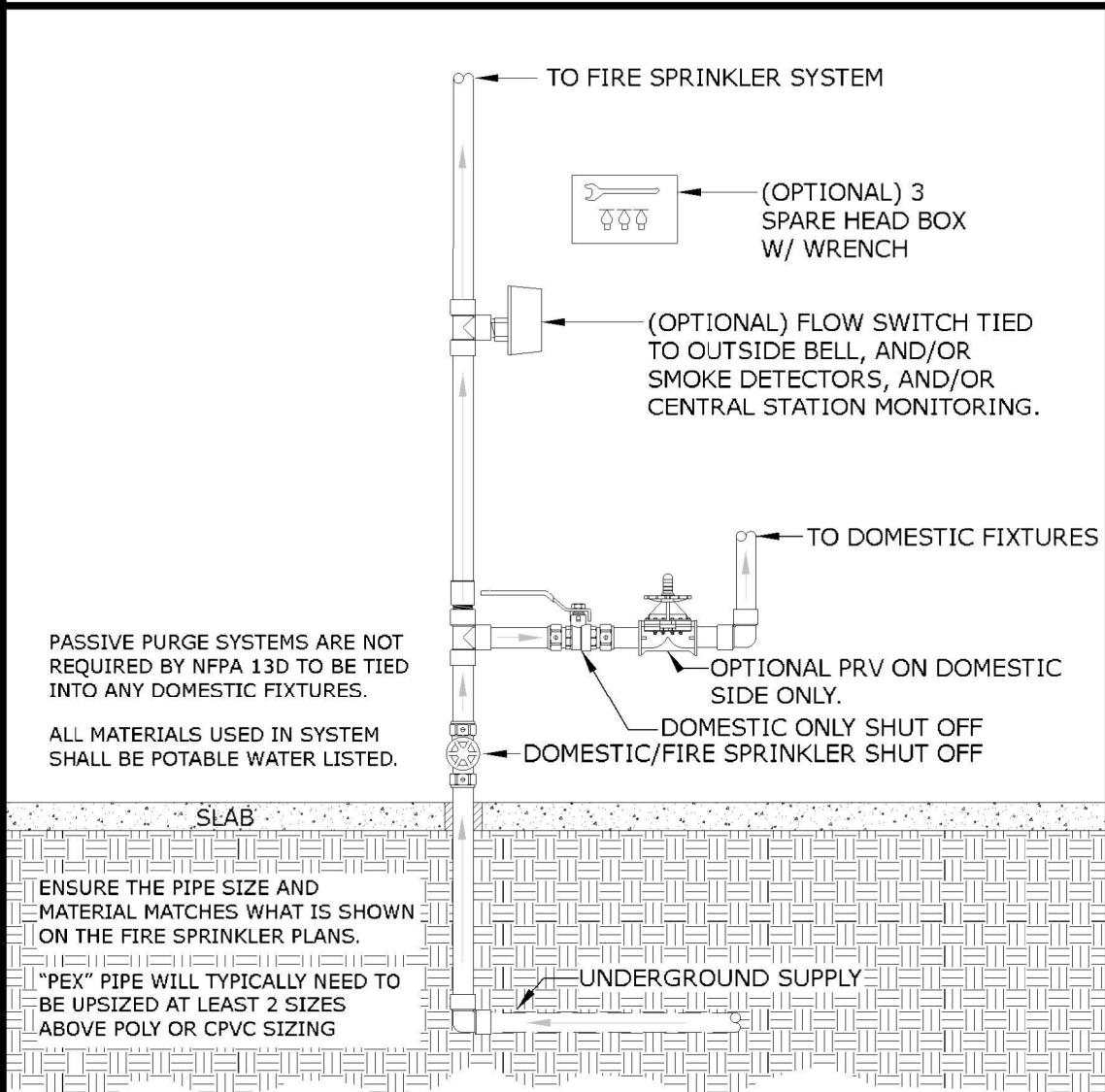
**SCALE: NONE**

### **RECOMMENDED RISER ATTACHMENT CHECK LIST**

- APPROVED DRAWING AND CALCULATIONS
- PERMIT AND ALL INSPECTION REPORTS
- BACKFLOW TEST REPORT

# Appendix C Passive-Purge Riser Detail (Typ.)

ANY PRESSURE REDUCING DEVICE MUST BE ON THE DOMESTIC-ONLY SIDE OF THE TEE. ALL UNDERGROUND TO BE BY OTHERS.



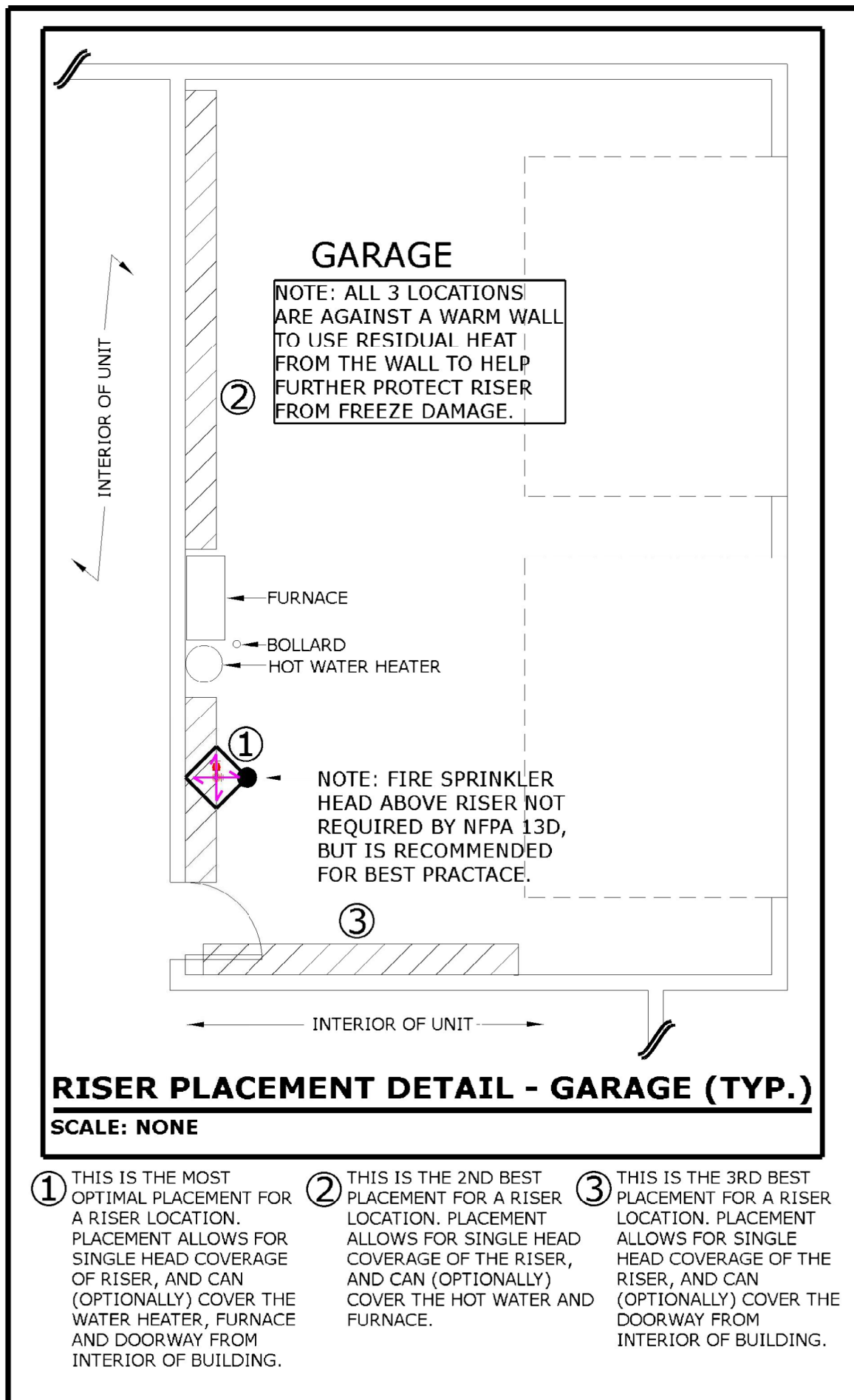
## **PASSIVE-PURGE RISER DETAIL (TYP.)**

**SCALE: NONE**

### **RECOMMENDED RISER ATTACHMENT CHECK LIST**

- APPROVED DRAWING AND CALCULATIONS
- PERMIT AND ALL INSPECTION REPORTS

# Appendix d Riser Placement Detail - Garage (Typ.)



# Notes





*For more information on how to get involved visit [Firesprinklerinitiative.org](http://Firesprinklerinitiative.org)*

