33rd Annual State Construction Conference

March 27th, 2014

Successful Fire Sprinkler Systems

WAKE UP!!!!
What's wrong with this picture?

Picture at Final Inspection

Obvious

Valve shut

Not Obvious

Valve was abandoned in place.

Does not meet NCFC 901.4.4 Appearance of equipment

Tamper switch commonly not wired

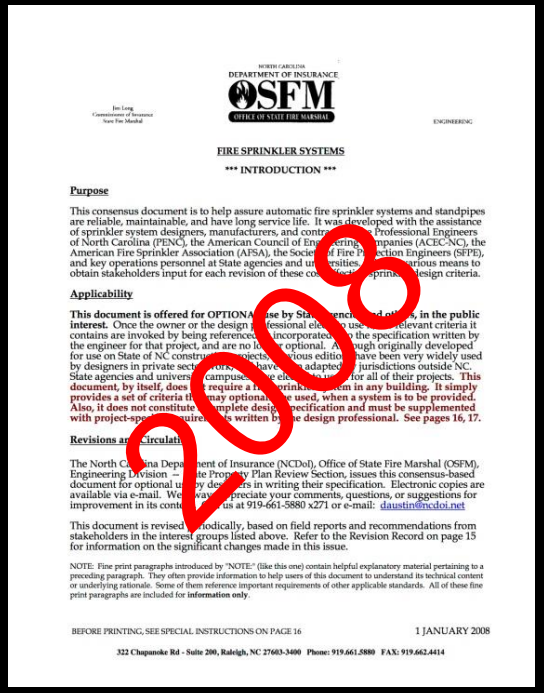
How does Fire Department know?

Good question…

Successful Fire Sprinkler Systems

Topics of Discussion

- SCO Guideline revisions
- Common design issues with examples
- New checklist
- Common field inspection errors
- End with good examples



NORTH CAROLINA
DEPARTMENT OF INSURANCE
OSFM
OFFICE OF STATE FIRE MARSHAL

Jim Long
Commissioner of Insurance
State Fire Marshal

ENGINEERING

FIRE SPRINKLER SYSTEMS

*** INTRODUCTION ***

Purpose

This consensus document is to help assure automatic fire sprinkler systems and standpipes are reliable, maintainable, and have long service life. It was developed with the assistance of sprinkler system designers, manufacturers, and contractors, Professional Engineers of North Carolina (PENC), the American Council of Engineering Companies (ACEC-NC), the American Fire Sprinkler Association (AFSA), the Society of Fire Protection Engineers (SFPE), and key operations personnel at State agencies and universities. It uses various means to obtain stakeholders input for each revision of these cost-effective sprinkler design criteria.

Applicability

This document is offered for OPTIONAL use by State agencies and others, in the public interest. Once the owner or the design professional elects to use it, the relevant criteria it contains are invoked by being referenced or incorporated into the specification written by the engineer for that project, and are no longer optional. Although originally developed for use on State of NC construction projects, various editions have been very widely used by designers in private sector work, and have been adapted for use in jurisdictions outside NC. State agencies and universities campuses have elected to use it for all of their projects. **This document, by itself, does not require a fire sprinkler system in any building. It simply provides a set of criteria that may optionally be used, when a system is to be provided. Also, it does not constitute a complete design specification and must be supplemented with project-specific requirements written by the design professional. See pages 16, 17.**

Revisions and Circulation

The North Carolina Department of Insurance (NCDoI), Office of State Fire Marshal (OSFM), Engineering Division -- State Property Plan Review Section, issues this consensus-based document for optional use by designers in writing their specification. Electronic copies are available via e-mail. We always appreciate your comments, questions, or suggestions for improvement in its content. Contact us at 919-661-5880 x271 or e-mail: daustin@ncdoi.net

This document is revised periodically, based on field reports and recommendations from stakeholders in the interest groups listed above. Refer to the Revision Record on page 15 for information on the significant changes made in this issue.

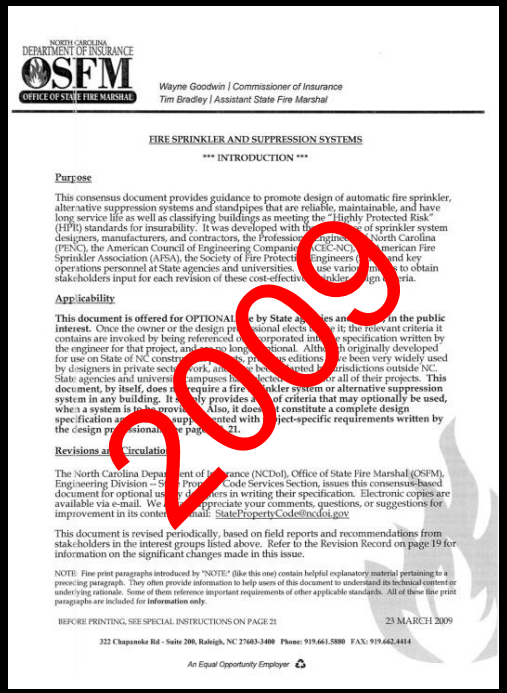
NOTE: Fine print paragraphs introduced by "NOTE:" (like this one) contain helpful explanatory material pertaining to a preceding paragraph. They often provide information to help users of this document to understand its technical content or underlying rationale. Some of them reference important requirements of other applicable standards. All of these fine print paragraphs are included for **information only**.

BEFORE PRINTING, SEE SPECIAL INSTRUCTIONS ON PAGE 16

1 JANUARY 2008

322 Chapanoke Rd - Suite 200, Raleigh, NC 27603-3400 Phone: 919.661.5880 FAX: 919.662.4414

2008



NORTH CAROLINA
DEPARTMENT OF INSURANCE
OSFM
OFFICE OF STATE FIRE MARSHAL

Wayne Goodwin | Commissioner of Insurance
Tim Bradley | Assistant State Fire Marshal

FIRE SPRINKLER AND SUPPRESSION SYSTEMS

*** INTRODUCTION ***

Purpose

This consensus document provides guidance to promote design of automatic fire sprinkler, alternative suppression systems and standpipes that are reliable, maintainable, and have long service life as well as classifying buildings as meeting the "Highly Protected Risk" (HPR) standards for insurability. It was developed with the assistance of sprinkler system designers, manufacturers, and contractors, the Professional Engineers of North Carolina (PENC), the American Council of Engineering Companies (ACEC-NC), the American Fire Sprinkler Association (AFSA), the Society of Fire Protection Engineers (SFPE), and key operations personnel at State agencies and universities. It uses various means to obtain stakeholders input for each revision of these cost-effective sprinkler design criteria.

Applicability

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Revisions and Circulation

The North Carolina Department of Insurance (NCDoI), Office of State Fire Marshal (OSFM), Engineering Division -- State Property Plan Review Section, Code Services Section, issues this consensus-based document for optional use by designers in writing their specification. Electronic copies are available via e-mail. We always appreciate your comments, questions, or suggestions for improvement in its content. e-mail: StatePropertyCode@ncdoi.gov

This document is revised periodically, based on field reports and recommendations from stakeholders in the interest groups listed above. Refer to the Revision Record on page 19 for information on the significant changes made in this issue.

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BEFORE PRINTING, SEE SPECIAL INSTRUCTIONS ON PAGE 21

23 MARCH 2009

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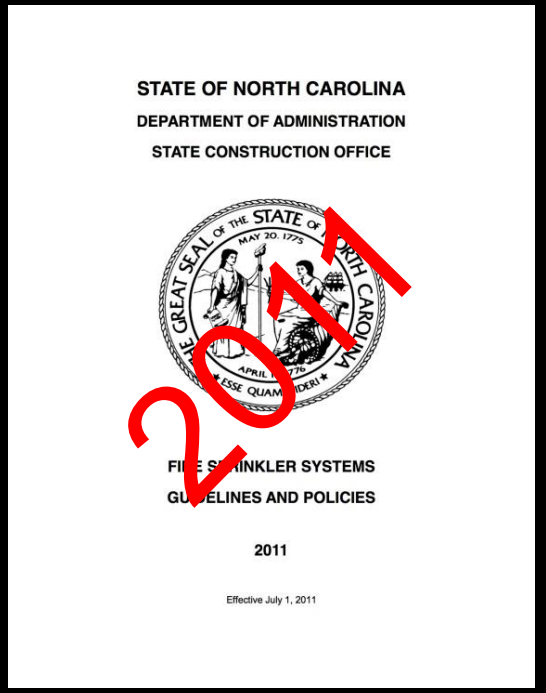
An Equal Opportunity Employer

2009



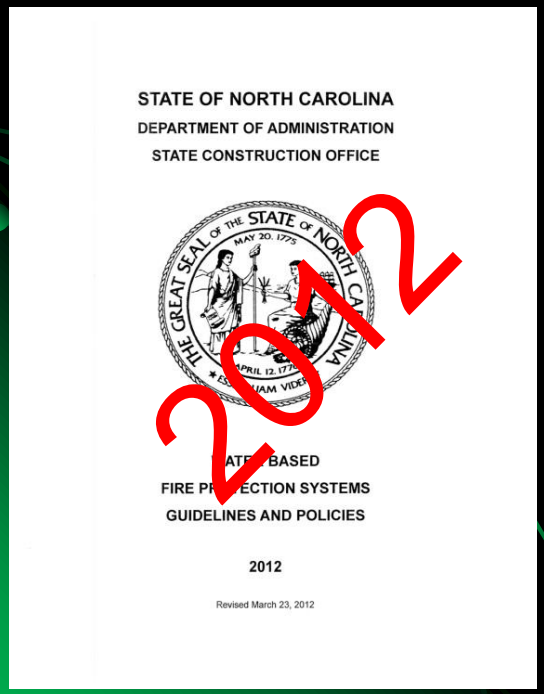
STATE OF NORTH CAROLINA
DEPARTMENT OF ADMINISTRATION
STATE CONSTRUCTION OFFICE

FIRE SPRINKLER SYSTEMS
GUIDELINES AND POLICIES

2011

Effective July 1, 2011

2011



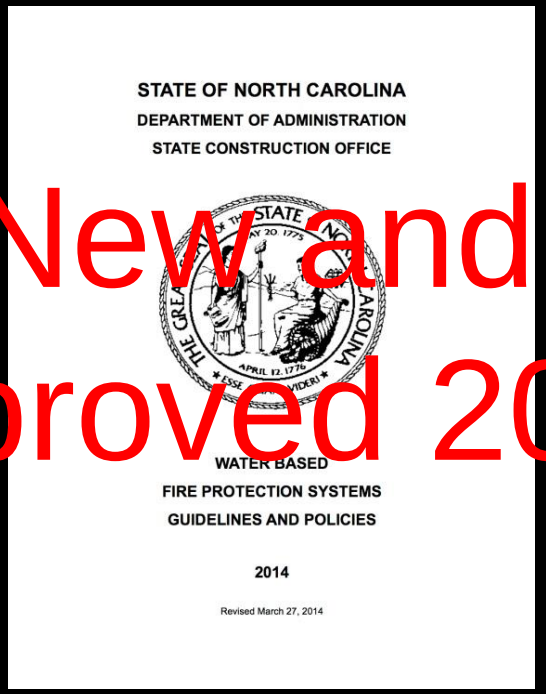
STATE OF NORTH CAROLINA
DEPARTMENT OF ADMINISTRATION
STATE CONSTRUCTION OFFICE

WATER BASED
FIRE PROTECTION SYSTEMS
GUIDELINES AND POLICIES

2012

Revised March 23, 2012

2012



STATE OF NORTH CAROLINA
DEPARTMENT OF ADMINISTRATION
STATE CONSTRUCTION OFFICE

WATER BASED
FIRE PROTECTION SYSTEMS
GUIDELINES AND POLICIES

2014

Revised March 27, 2014

New and improved 2014

2014 SCO Guidelines

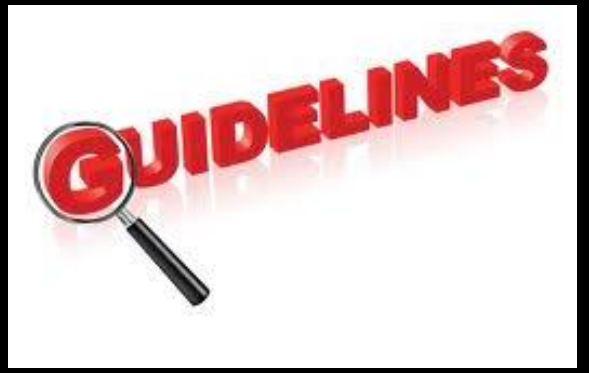
Changes made to guidelines

- Baseline requirements for fire performance designs
- Backflow preventer requirements
- Dry pipe system requirements
- PDF copy of shop drawings and hydraulic calculations on CD at closeout

2014 SCO Guidelines

Baseline requirements for performance designs

- Sprinkler Design Data Summary, refer to guidelines for all items required.
- Drawing scale
- Piping schematic from PIV to most remote valve
- Backflow preventer location
- Main locations (not thru elevator machine rooms, electrical rooms, etc.)

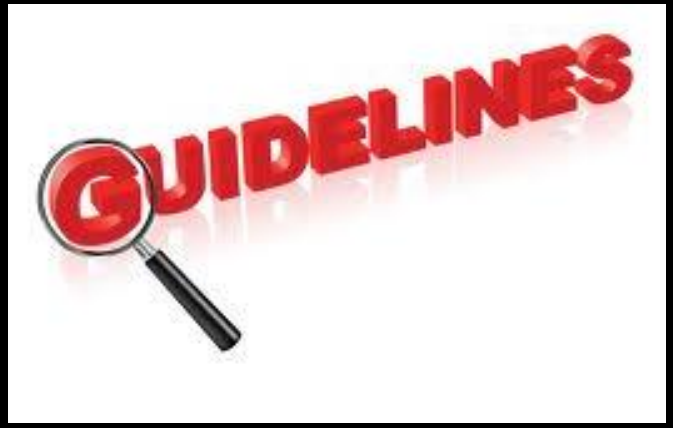


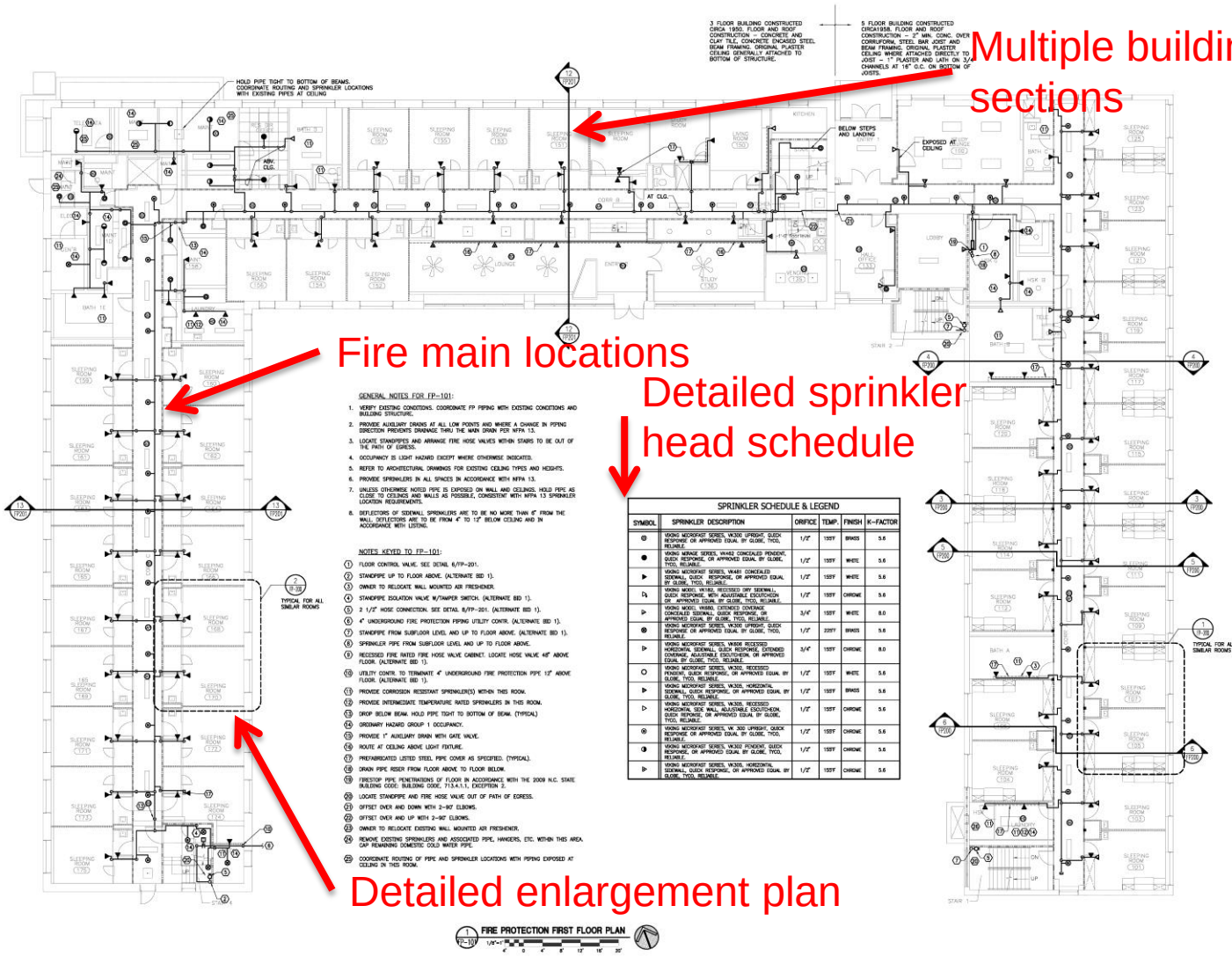
2014 SCO Guidelines

Baseline requirements for performance designs (cont.)

- Electrical equipment locations with schedule, i.e fire pumps, air compressor, tamper and flow switches
- Hanger details
- Riser location, control valves, check valves

The results of showing this information includes more competitive bids, more accurate design, less change orders.




Multiple building sections
Fire main locations
Detailed sprinkler head schedule
Detailed enlargement plan
3 FLOOR BUILDING CONSTRUCTED CIRCA 1930. FLOOR AND ROOF CONSTRUCTION – CONCRETE AND CLAY TILE, CONCRETE ENCASED STEEL BEAM FRAMING. ORIGINAL PLASTER CEILING GENERALLY ATTACHED TO BOTTOM OF STRUCTURE.
5 FLOOR BUILDING CONSTRUCTED CIRCA1958. FLOOR AND ROOF CONSTRUCTION – 2" MIN. CONC. OVER CORRUFORM, STEEL BAR JOIST AND BEAM FRAMING. ORIGINAL PLASTER CEILING WHERE ATTACHED DIRECTLY TO JOIST – 1" PLASTER AND LATH ON 3/4" CHANNELS AT 16" O.C. ON BOTTOM OF JOISTS.
HOLD PIPE TIGHT TO BOTTOM OF BEAMS. COORDINATE ROUTING AND SPRINKLER LOCATIONS WITH EXISTING PIPES AT CEILING
GENERAL NOTES FOR FP-101:
1. VERIFY EXISTING CONDITIONS. COORDINATE FP PIPING WITH EXISTING CONDITIONS AND BUILDING STRUCTURE.
2. PROVIDE AUXILIARY DRAINS AT ALL LOW POINTS AND WHERE A CHANGE IN PIPING DIRECTION PREVENTS DRAINAGE THRU THE MAIN DRAIN PER NFPA 13.
3. LOCATE STANDPIPES AND ARRANGE FIRE HOSE VALVES WITHIN STAIRS TO BE OUT OF THE PATH OF EGRESS.
4. OCCUPANCY IS LIGHT HAZARD EXCEPT WHERE OTHERWISE INDICATED.
5. REFER TO ARCHITECTURAL DRAWINGS FOR EXISTING CEILING TYPES AND HEIGHTS.
6. PROVIDE SPRINKLERS IN ALL SPACES IN ACCORDANCE WITH NFPA 13.
7. UNLESS OTHERWISE NOTED PIPE IS EXPOSED ON WALL AND CEILINGS. HOLD PIPE AS CLOSE TO CEILINGS AND WALLS AS POSSIBLE, CONSISTENT WITH NFPA 13 SPRINKLER LOCATION REQUIREMENTS.
8. DEFLECTORS OF SIDEWALL SPRINKLERS ARE TO BE NO MORE THAN 6" FROM THE WALL. DEFLECTORS ARE TO BE FROM 4" TO 12" BELOW CEILING AND IN ACCORDANCE WITH LISTING.
NOTES KEYED TO FP-101:
1 FLOOR CONTROL VALVE. SEE DETAIL 6/FP-201.
2 STANDPIPE UP TO FLOOR ABOVE. (ALTERNATE BID 1).
3 OWNER TO RELOCATE WALL MOUNTED AIR FRESHENER.
4 STANDPIPE ISOLATION VALVE W/TAMPER SWITCH. (ALTERNATE BID 1).
5 2 1/2" HOSE CONNECTION. SEE DETAIL 8/FP-201. (ALTERNATE BID 1).
6 4" UNDERGROUND FIRE PROTECTION PIPING UTILITY CONTR. (ALTERNATE BID 1).
7 STANDPIPE FROM SUBFLOOR LEVEL AND UP TO FLOOR ABOVE. (ALTERNATE BID 1).
8 SPRINKLER PIPE FROM SUBFLOOR LEVEL AND UP TO FLOOR ABOVE.
9 RECESSED FIRE RATED FIRE HOSE VALVE CABINET. LOCATE HOSE VALVE 48" ABOVE FLOOR. (ALTERNATE BID 1).
10 UTILITY CONTR. TO TERMINATE 4" UNDERGROUND FIRE PROTECTION PIPE 12" ABOVE FLOOR. (ALTERNATE BID 1).
11 PROVIDE CORROSION RESISTANT SPRINKLER(S) WITHIN THIS ROOM.
12 PROVIDE INTERMEDIATE TEMPERATURE RATED SPRINKLERS IN THIS ROOM.
13 DROP BELOW BEAM. HOLD PIPE TIGHT TO BOTTOM OF BEAM. (TYPICAL)
14 ORDINARY HAZARD GROUP 1 OCCUPANCY.
15 PROVIDE 1" AUXILIARY DRAIN WITH GATE VALVE.
16 ROUTE AT CEILING ABOVE LIGHT FIXTURE.
17 PREFABRICATED LISTED STEEL PIPE COVER AS SPECIFIED. (TYPICAL).
18 DRAIN PIPE RISER FROM FLOOR ABOVE TO FLOOR BELOW.
19 FIRESTOP PIPE PENETRATIONS OF FLOOR IN ACCORDANCE WITH THE 2009 N.C. STATE BUILDING CODE: BUILDING CODE, 713.4.1.1, EXCEPTION 2.
20 LOCATE STANDPIPE AND FIRE HOSE VALVE OUT OF PATH OF EGRESS.
21 OFFSET OVER AND DOWN WITH 2-90° ELBOWS.
22 OFFSET OVER AND UP WITH 2-90° ELBOWS.
23 OWNER TO RELOCATE EXISTING WALL MOUNTED AIR FRESHENER.
24 REMOVE EXISTING SPRINKLERS AND ASSOCIATED PIPE, HANGERS, ETC. WITHIN THIS AREA. CAP REMAINING DOMESTIC COLD WATER PIPE.
25 COORDINATE ROUTING OF PIPE AND SPRINKLER LOCATIONS WITH PIPING EXPOSED AT CEILING IN THIS ROOM.
SPRINKLER SCHEDULE & LEGEND
SYMBOL | SPRINKLER DESCRIPTION | ORIFICE | TEMP. | FINISH | K-FACTOR
VIKING MICROFAST SERIES, VK300 UPRIGHT, QUICK RESPONSE OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | BRASS | 5.6
VIKING MIRAGE SERIES, VK462 CONCEALED PENDENT, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | WHITE | 5.6
VIKING MICROFAST SERIES, VK461 CONCEALED SIDEWALL, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | WHITE | 5.6
VIKING MODEL VK460, RECESSED DRY SIDEWALL, QUICK RESPONSE, WITH ADJUSTABLE ESCUTCHEON OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | CHROME | 5.6
VIKING MODEL VK480, EXTENDED COVERAGE CONCEALED SIDEWALL QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 3/4" | 155°F | WHITE | 8.0
VIKING MICROFAST SERIES, VK302 UPRIGHT, QUICK RESPONSE OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 220°F | BRASS | 5.6
VIKING MICROFAST SERIES, VK606 RECESSED HORIZONTAL SIDEWALL, QUICK RESPONSE, EXTENDED COVERAGE, ADJUSTABLE ESCUTCHEON, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 3/4" | 155°F | CHROME | 8.0
VIKING MICROFAST SERIES, VK302, RECESSED PENDENT, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | WHITE | 5.6
VIKING MICROFAST SERIES, VK305, HORIZONTAL SIDEWALL, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | BRASS | 5.8
VIKING MICROFAST SERIES, VK305, RECESSED HORIZONTAL SIDE WALL, ADJUSTABLE ESCUTCHEON, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | CHROME | 5.6
VIKING MICROFAST SERIES, VK 300 UPRIGHT, QUICK RESPONSE OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | CHROME | 5.6
VIKING MICROFAST SERIES, VK302 PENDENT, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | CHROME | 5.6
VIKING MICROFAST SERIES, VK305, HORIZONTAL SIDEWALL, QUICK RESPONSE, OR APPROVED EQUAL BY GLOBE, TYCO, RELIABLE. | 1/2" | 155°F | CHROME | 5.6
TYPICAL FOR ALL SIMILAR ROOMS
FIRE PROTECTION FIRST FLOOR PLAN
FIRST FLOOR - FIRE PROTECTION
FP-101

2014 SCO Guidelines

Backflow preventer requirements

- NCFC 912.5 refers to NCPC for backflow requirements. NCPC Section 608.16.4 requires backflow protection for fire sprinkler systems. Could be DDCV or RPDA type.
- Per NC DENR "TITLE 15A" Minimum backflow preventer for fire protection systems with fire pump, chemicals used or buildings with 5 or more stories above ground is RPDA. (2012)
- The previous requirement included if building had FDC connection RPDA type backflow was required. (2010)

2014 SCO Guidelines

FIGURE 2 NORTH CAROLINA GUIDELINES CROSS CONNECTION CONTROL IN WATER DISTRIBUTION SYSTEMS

These guidelines are supplemental to Section .0406(b). These guidelines are intended as a minimum requirement. Public water suppliers may adopt more stringent requirements. Each supplier of water shall conform to the minimum requirements established in these guidelines.

I. Degree of Hazard:

A. Severe:Actual or potential threat of contamination that presents an imminent danger to the public health with consequence of serious illness or death.

B. Moderate: One that presents foreseeable and significant potential for pollution, nuisance, aesthetically objectionable or other undesirable alterations of the drinking water supply.

II. Backflow Prevention Assembly Requirements:

Degree of hazard	RPZ*	DCVA**	Air Gap
Severe	X	-------	X
Moderate	-------	X	-------

* Reduced pressure zone
** Double check valve assembly
*** This is not intended to be an exhaustive list

III. Facilities that Require Installation of a Backflow Preventer***:

A. Moderate hazard - DCVA:

1. Fire sprinkler systems without booster pump facilities or chemical additives.
2. Connection to tanks, lines and vessels that handle non-toxic substances.
3. Lawn sprinkler systems without chemical injection or booster pumps.
4. Most commercial establishments.
5. Automatic service stations, bakeries and beauty shops with no health hazard and bottling plants with no back pressure.
6. etc.

B. Severe hazard - RPZ or air gap:

1. Lawn sprinkler systems with chemical injection or booster pump
2. Wastewater treatment plants
3. Connection to an unapproved water system or unapproved auxiliary water supply
4. Connection to tanks, pumps, lines, steam boilers or vessels that handle sewage, lethal substances, toxic or radioactive substances
5. Fire sprinkler systems with booster pump facilities or chemical additives
6. Buildings with five or more stories above ground level

2014 SCO Guidelines

Backflow preventer requirements

- Backflow preventer **SHOULD** be installed in a heated enclosure **OUTSIDE**.
- If backflow preventer is installed inside provide emergency drainage to exterior capable of full flow. Could potentially be 500-800 GPM.


Can a 4” floor drain handle 500 GPM? NO!!!!!!!!!!!!!!!!!!!
This is 250 GPM

2014 SCO Guidelines

Dry pipe system requirements

- Black steel piping can be used unless required by NFPA 13 to be galvanized.
- Air dryer recommended for large system
- Nitrogen systems recommended for ultimate protection

2014 SCO Guidelines

Compressor with air dryer

$10,000

Nitrogen generator for large systems with separate tank

$30,000

Nitrogen generator with tank

2014 SCO Guidelines

Group I Occupancy Classifications

- Fire protection zones shall match fire alarm zones.
- Designer shall coordinate with owner to discuss zone locations, egress paths and “defend in place” strategies.

2014 SCO Guidelines

Changes not made to guidelines

- Safety factor consist of 10 psi less static, residual and 10% flow
- Hazard classification is per NFPA 13
- Flow test required within 12 months throughout phases of project.

Common Design Issues

Common Design Issues

- Coordinate with other trades. Electrical demands, site, mechanical equipment, etc.
- Understand site location, i.e elevation changes
- Do not oversize fire pump. Bigger is not better. Example coming up.
- clearly specified

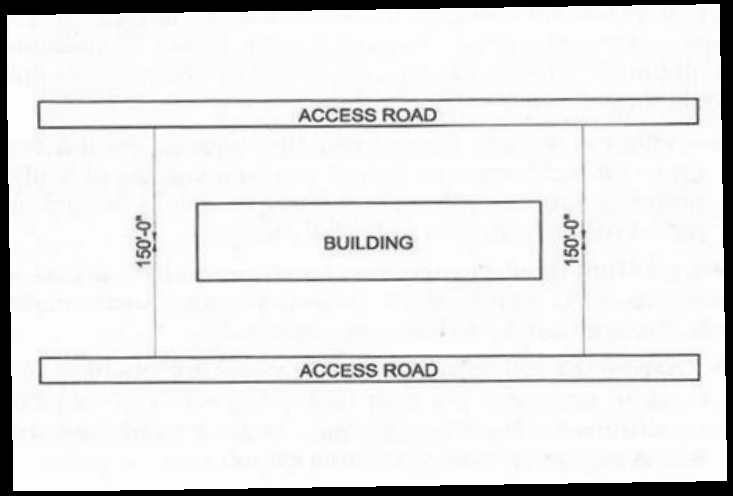
Change Order

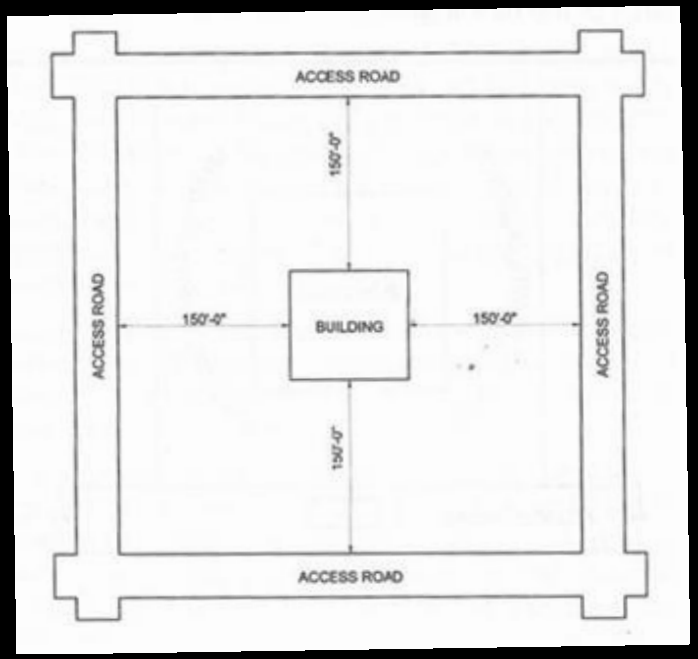
Common Design Issues

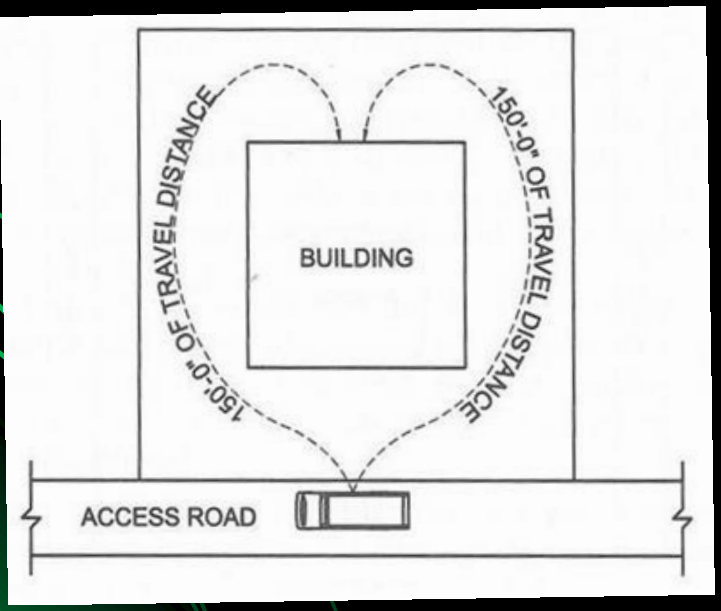
Hose Coverage – Site

- All portions of building must be within 150’ of apparatus road surface.
- Distance must be measured as the hose lays.
- FDC shall be within 100’ from fire hydrant.

Common Design Issues







Hose Coverage Details

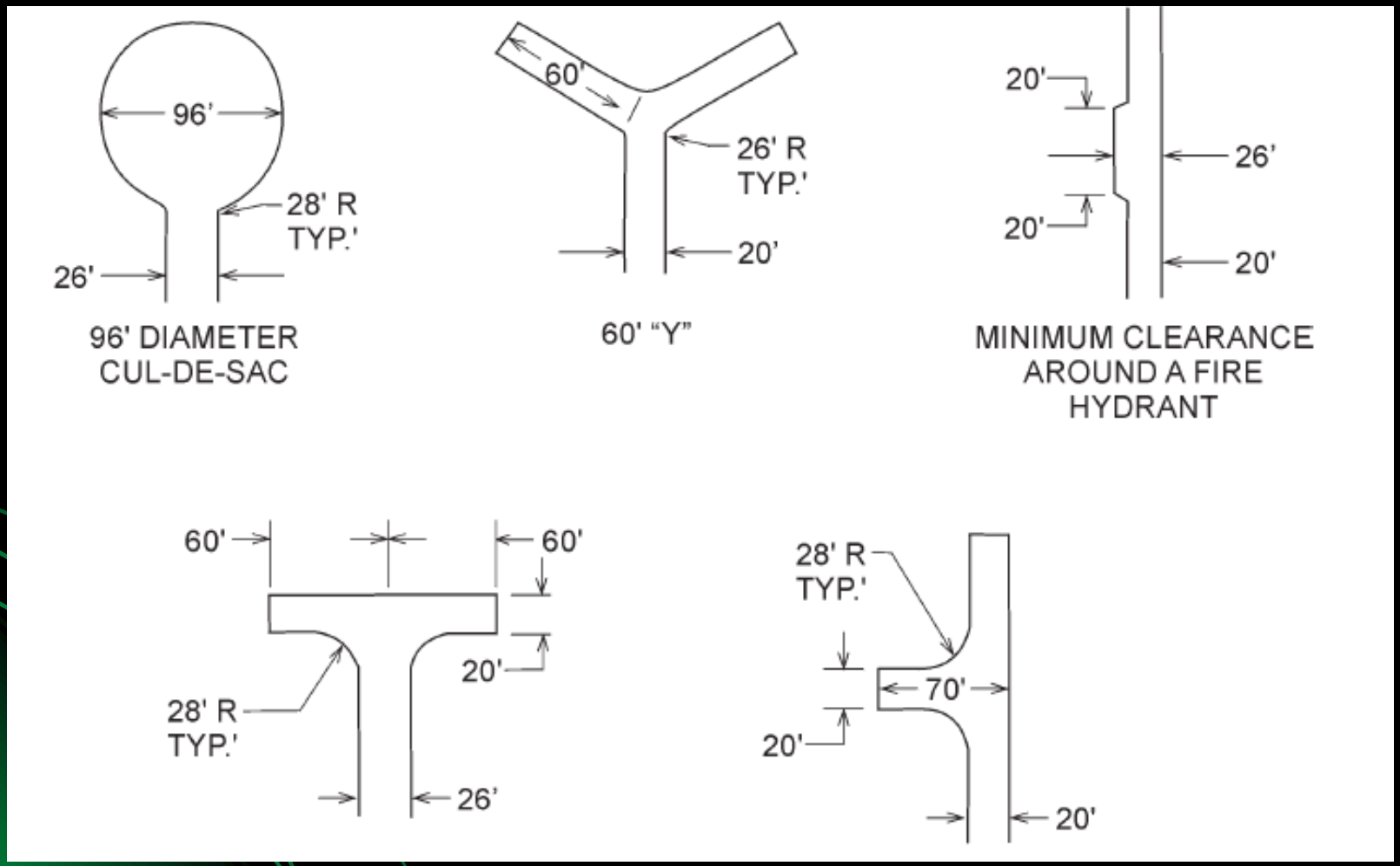
Common Design Issues

Fire Department Access

NCFC 503

- 20’ wide
- Vertical clearance of not less than 13 feet 6 inches
- Greater than 150’ requires turn around
- Constructed of all-weather surface
- Must support fire truck, typically 75,000 lbs
- All plans to be reviewed by local Fire Marshal.

Common Design Issues



Examples of turn arounds from NCFC Appendix D

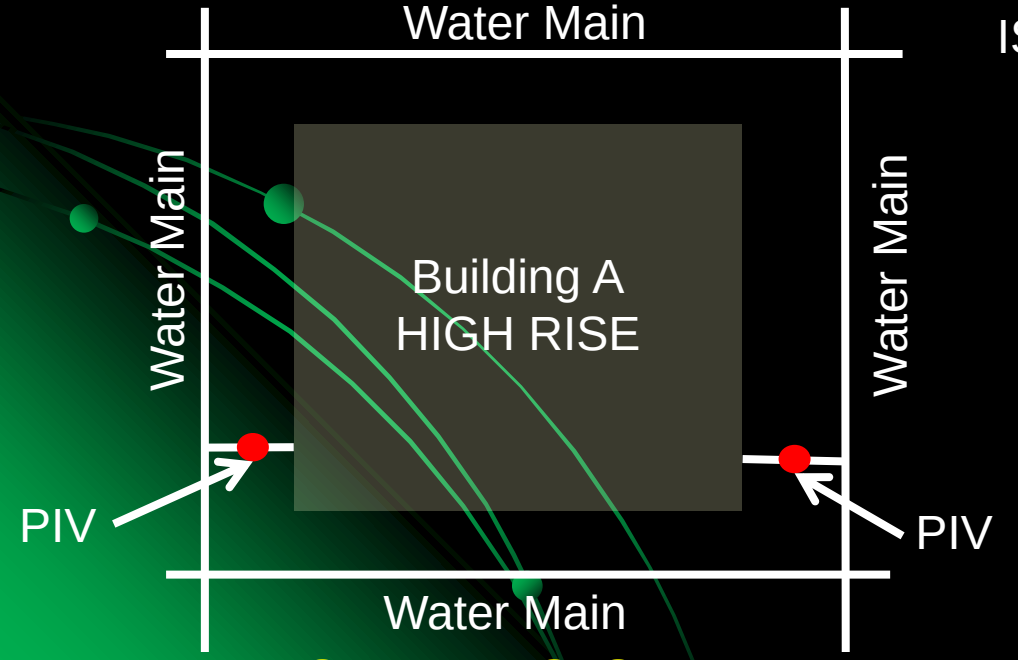
Common Design Issues

- Include a water flow test per NFPA 13 (using two hydrants) will be required for every project within 12 months throughout design phases.

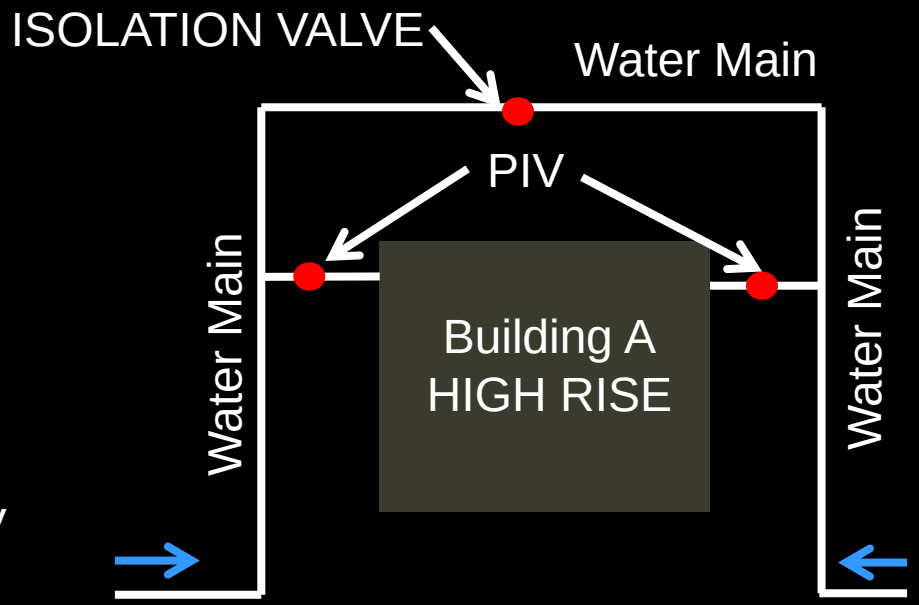
- Some local authorities flow one hydrant to test flows throughout system. This shall not be used for hydraulic calculations.

Common Design Issues

- High rise buildings shall have at least two remotely located fire department connections for each zone. NFPA 14 7.12.2.
- Previous code required secondary water supply for high rise if seismic was required per section 903.3.5.2. (New buildings).
- Current code requires secondary water supply for high rise with fire pump regardless of seismic per section 914.3.1.2. (New or existing buildings.)



GRIDDED SYSTEM



LOOPED SYSTEM

Common Design Issues

Dry pipe systems

- For large dry pipe system with accelerators use air compressor with storage tank.
- Base mounted compressors will not keep up in large systems with huge temperature fluctuations causing accelerators to trip.

Common Design Issues

Dry pipe systems (cont.)

- Try to keep dry pipe systems less than 500 gallons due to required delivery times per NFPA 13-7.2.3.6 and NCFC 903.2.6.1. Group I 60 seconds maximum. SCO does not have maximum since 2009.

- All pipe shall be sloped. Branchlines ½" per 10', Mains ¼" per 10' **MINIMUM**.

Common Design Issues

- Be aware of site location in reference to sprinkler system. Western areas tend to have massive pressure spikes. SCO recommends pressure relief valves on these systems.

- Get updated flow test during design phase. City supply changes all the time due to expansion. In the past a flow test has found errors with closed valves due to new construction.

Common Design Issues

- Piping plan not going back to source. Where was flow test taken? Two miles down road?

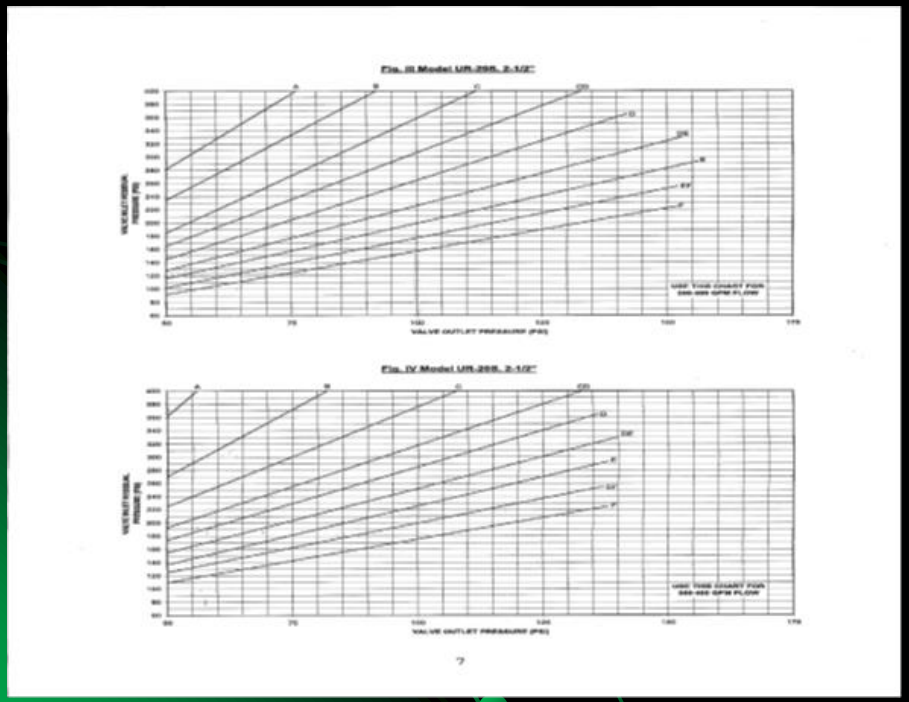
- The source can be a test hydrant, fire pump or PRV valve. The water supply test dates apply to these as well.

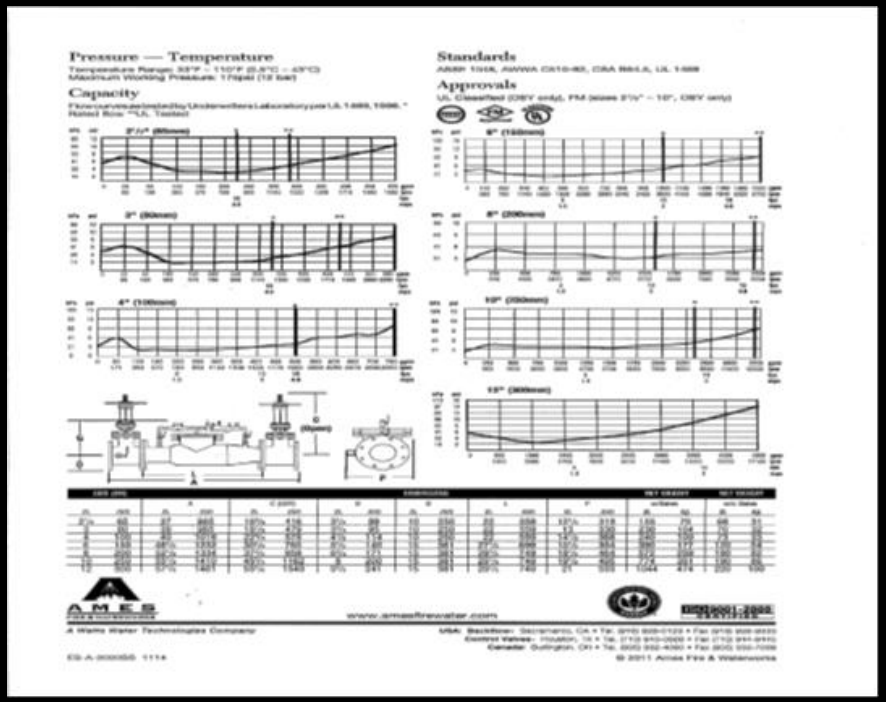
Common Design Issues

- Fire pump shall only be sized at pressure needed at required GPM.
- Oversizing fire pumps could result in change order due to not enough municipal GPM. Oversizing pump also cost project $ up front. Example coming up.

Common Design Issues

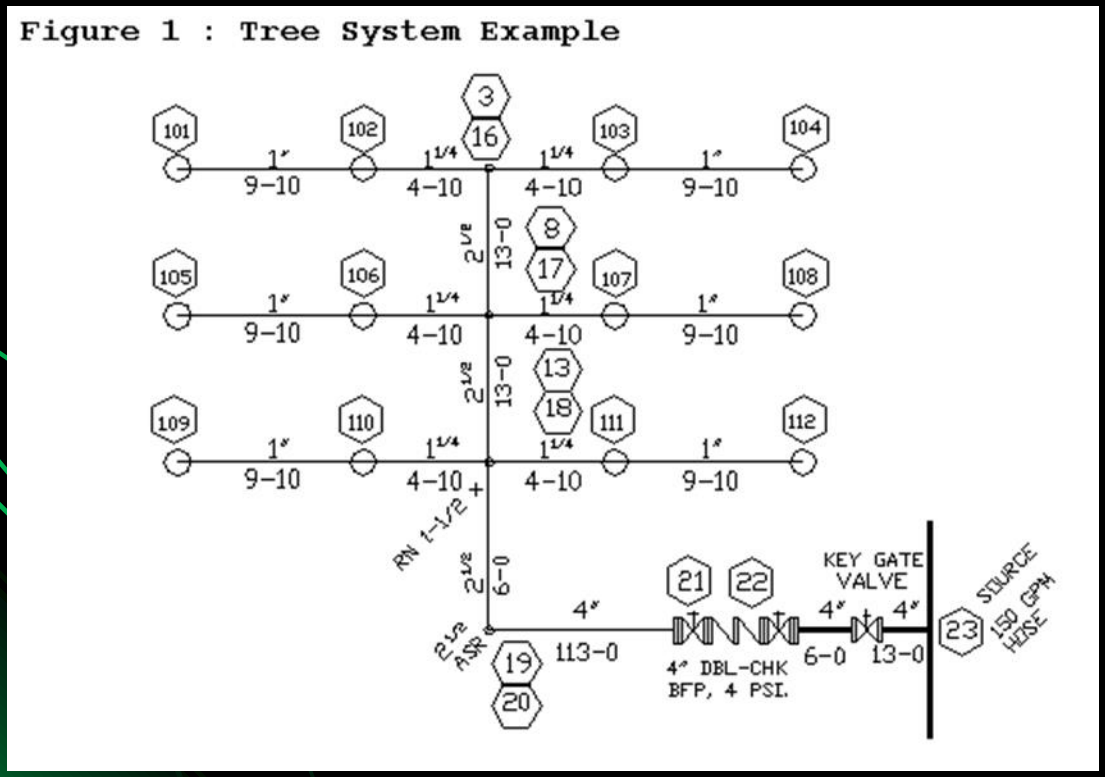
- Pressure loss due to devices. Backflow, PRV, Low suction control valve, etc. not accounted for.
- Pressure losses vary with GPM.





Common Design Issues

- Piping plan does not match hydraulic calculations. The hydraulic calculations show 3” but the plans show 2”.
- Velocities exceed component ratings. Typical flow switch is 18 ft/sec.
- Actual head coverage in remote area does not match entire building.



A = S x L

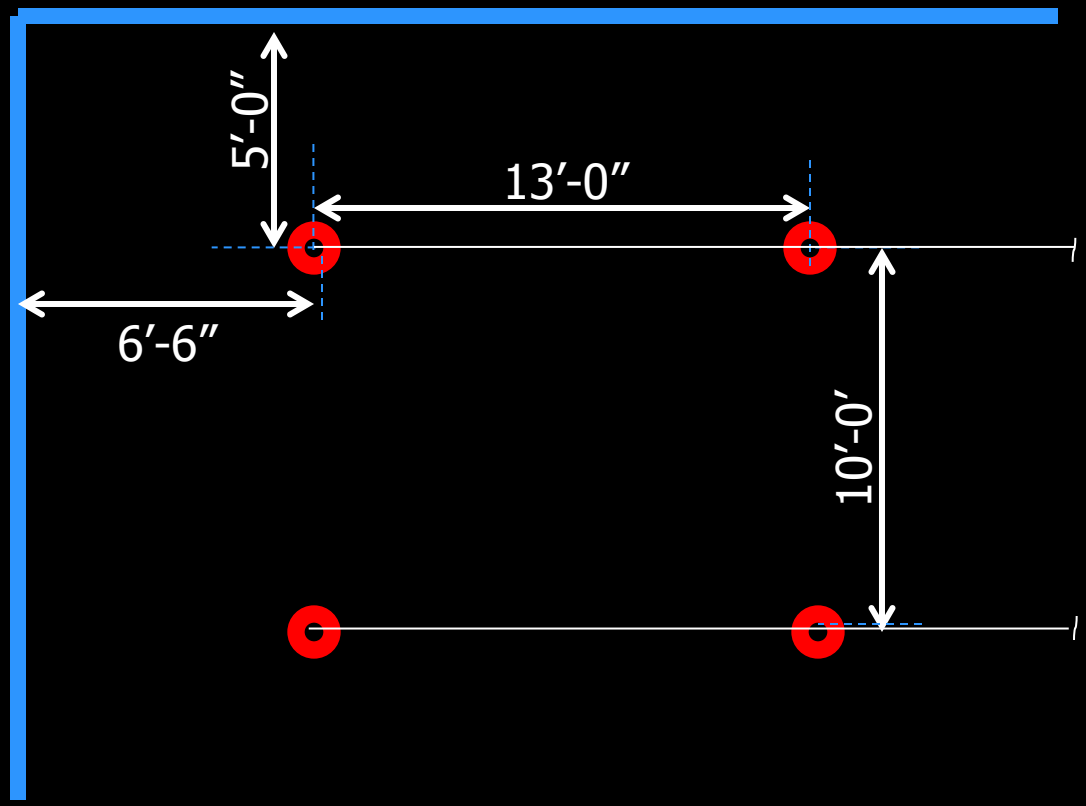
S=(5’-0”x2) or 10’-0 (whichever is greater)

L=(6’-6”x2) or 13’-0 (whichever is greater)

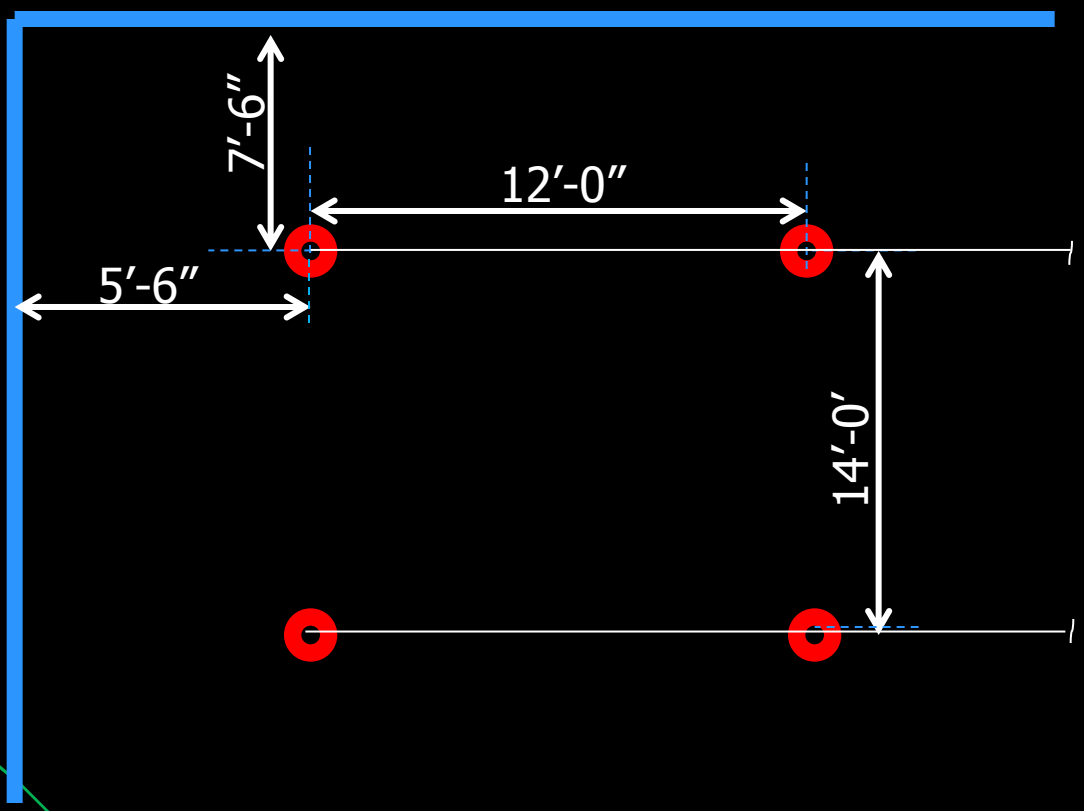
S = 10’ L = 13’

A = 13’ x 10’

A = 130 sq. ft.



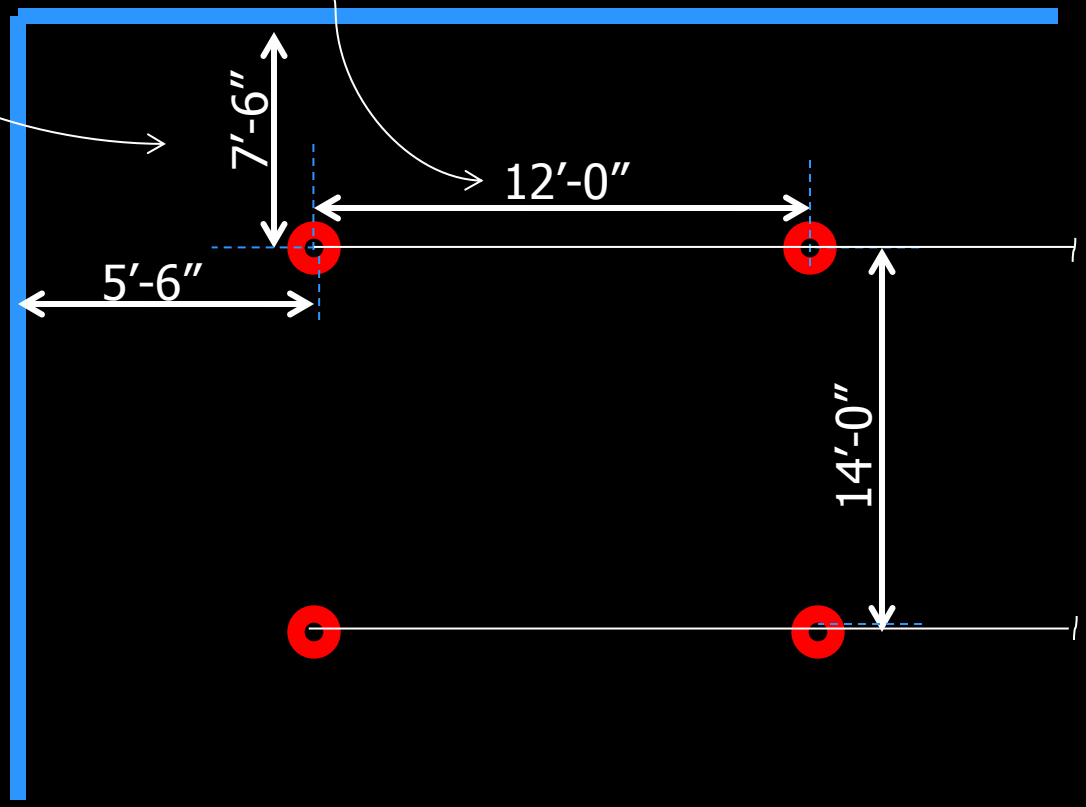
SPRINKLER HEAD AREA OF COVERAGE



WHAT IS SPRINKLER COVERAGE?

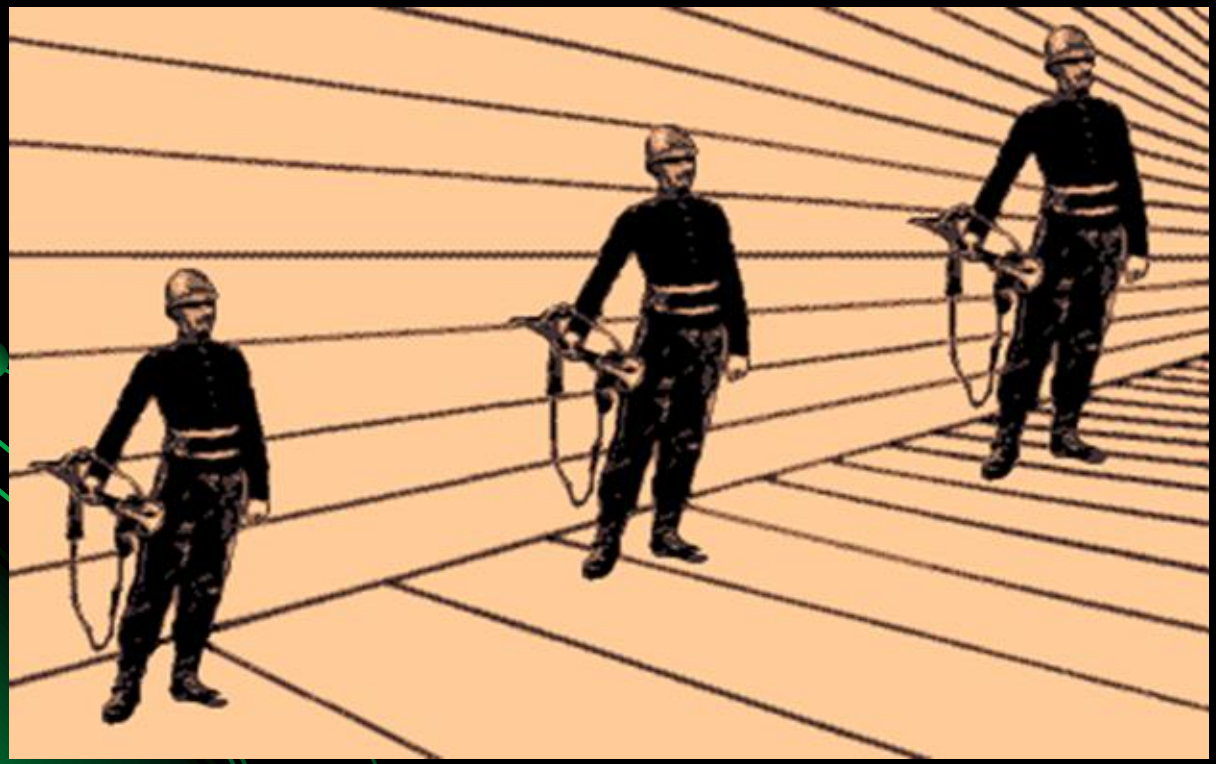
180 SF

7’-6” x 2=15 x 12



Common Design Issues

- Plans scaled incorrectly
- The design is not printed on the intended page size.
- SCO requires graphical scale.

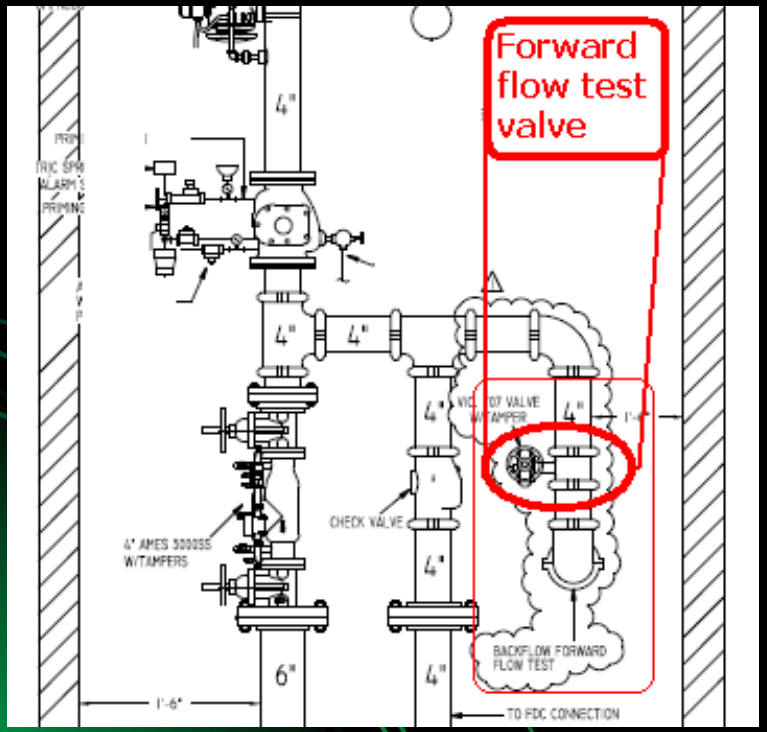


Common Design Issues

Forward flow testing

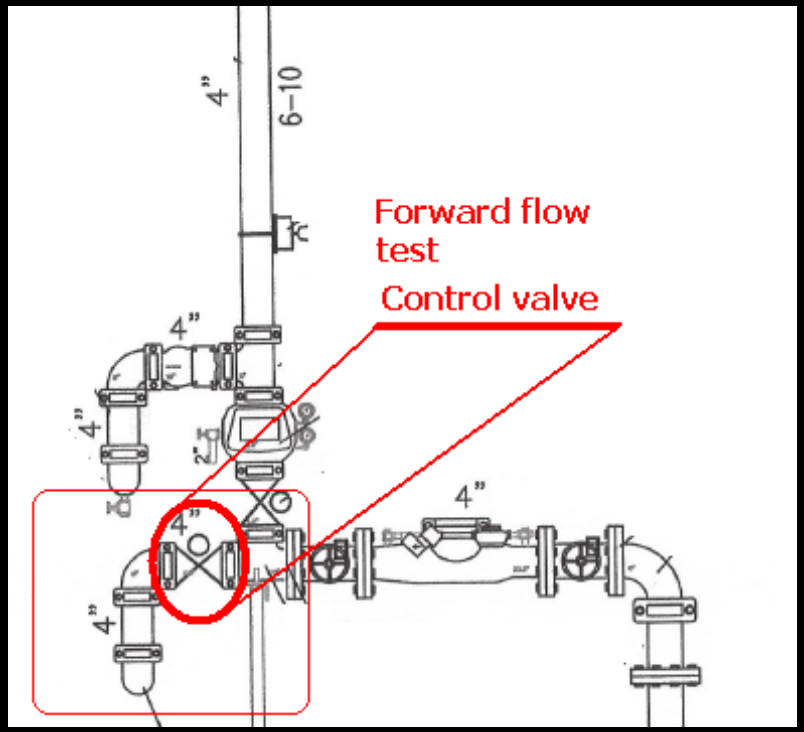
NFPA 13, 2007 edition

10.10.2.5 Backflow Prevention Assemblies. [**24:**10.10.2.5]



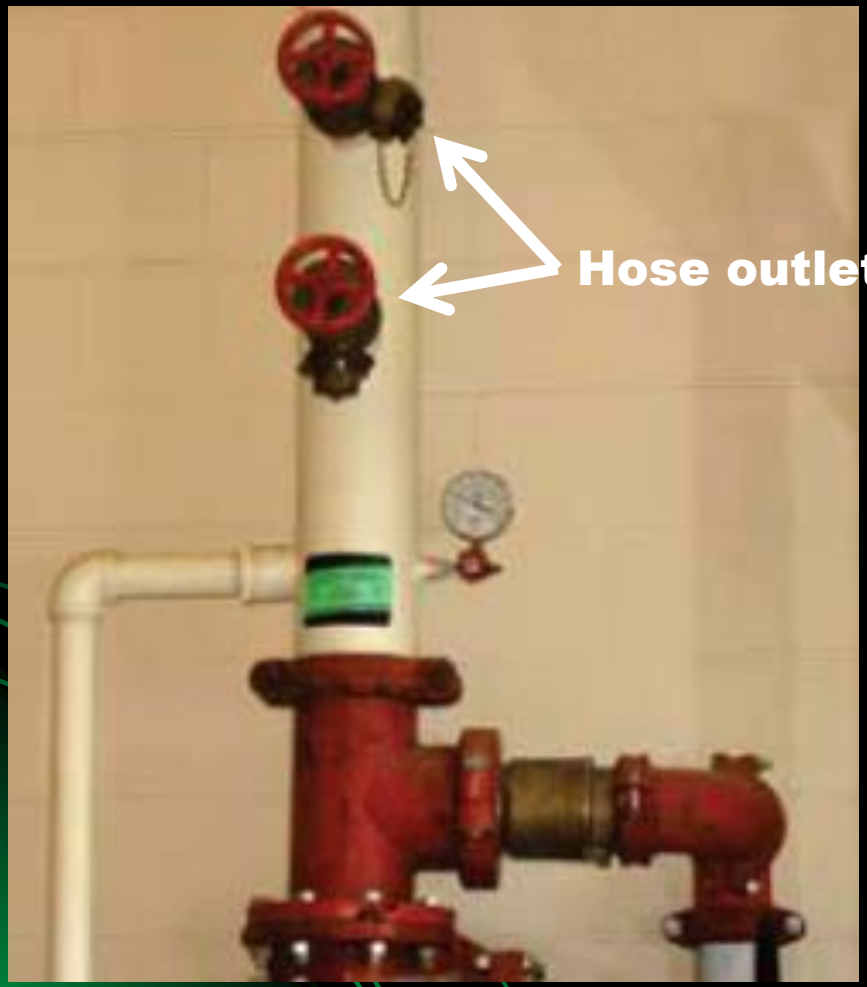
NFPA 25, 2008 edition

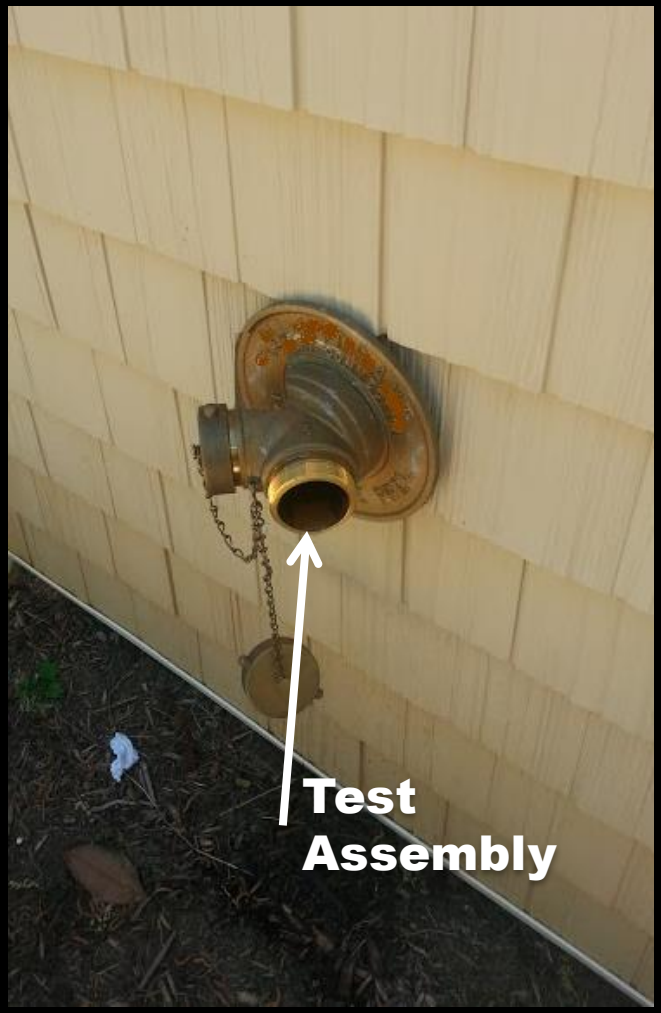
13.6.2 Testing.
13.6.2.1*



Minimum flow rate is system demand and hose stream where applicable.

Common Design Issues

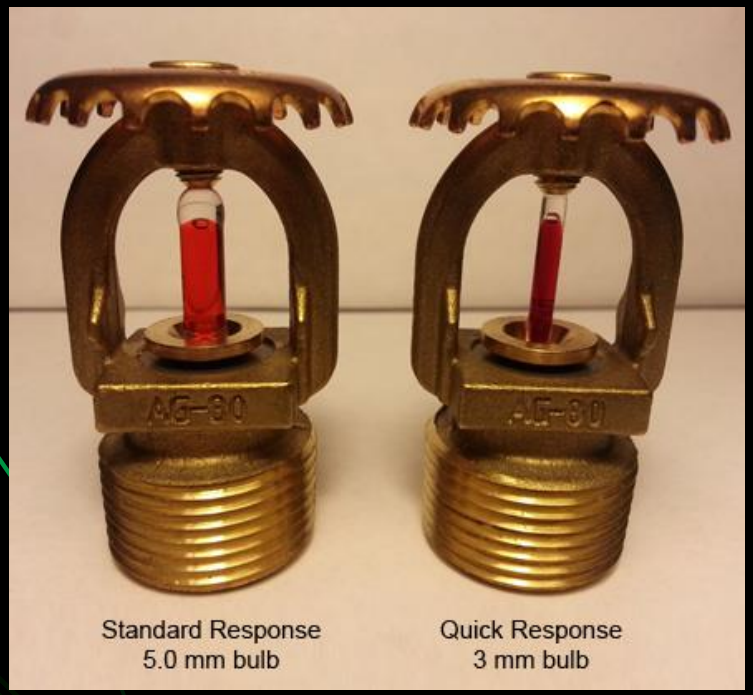




Common Design Issues

- Response Time Index (RTI) of sprinkler heads in same compartment shall be the same. NFPA 13-2007 8.3.3. Cannot mix standard and quick response in same compartment.

- Compartment can be same room with 8” deep lintel depth maximum 8’ wide opening.



Common Design Issues

Fire pump sizing

- A fire pump can only be accurately sized by hydraulic calculations. Do not use “rule of thumbs”.
- Capacity of fire pump is determined by (flow requirements of system provided by hydraulic calculations). This could be sprinkler or standpipes.
- Buildings not classified as high rise that have standpipes are not required to be automatic. Automatic standpipes could increase fire pump size.
- Fire pumps **cannot** create water (flow).

Common Design Issues

Get out calculators

Common Design Issues

Over sizing fire pump – **2 story building**

Scenario #1

Flow test at DD phase
56 Static, 51 residual, 719 gpm

Flow test at shop drawing phase
56 Static, 27 residual, 571 gpm

Notice significant drop in residual pressure and flow

Designer specified 750 GPM pump to satisfy standpipe

Remember previous slide, not required for low rise buildings

Pressure available at pump rating (750 GPM) = 8 psi
Available pressure – (Friction loss + backflow loss)= **-.1 psi remaining pressure**

This scenario could possibly result in not enough water for fire pump and outside hose for fire fighters!!

Common Design Issues

Over sizing fire pump

Scenario #2

Revise pump selection to 500 GPM to **satisfy sprinkler demand**.

Use city fire pump truck as standpipe supply.

Pressure available at pump rating (500 GPM) = 33 psi

Available pressure – (Friction loss + backflow loss)= **+24.9 psi remaining pressure**

Common Design Issues

Conclusion

Scenario #1

750 GPM pump (automatic standpipe)

-.1 psi remaining

$30,000 CHANGE ORDER

Scenario #2

500 GPM pump (sprinkler system demand only)

+24.9 psi remaining

Lesson Learned

Designer to take time to understand system demand and available supply. Just remember you can make pressure but you cannot make water.

New Checklists

New Checklists

Fire pump checklist

- SCO required to witness fire pump test
- NFPA 20 test still required. SCO witness can coincide with NFPA 20 test. (This is preferred)
- Includes electric and diesel.
- Checklist will be available on SCO website.

Clean agent checklist

- Generic due to different types of clean agents.
- Checklist will be available on SCO website.

Checklists are for designer and contractor use. Not required to be used.

Please contact me if you see errors or revisions

New Checklists

ELECTRIC/DIESEL FIRE PUMP CHECK LIST

BUILDING NAME: _____ LOCATION: _____

DESIGNER: _____ INSTALLER: _____

SCO REPRESENTATIVE: _____ DATE: _____

PUMP MANUF.: _____ OWNER NAME: _____

INSTALLATION

- ☐ Certificate for flushing and hydrostatic test furnished
- ☐ Piping been hydrostatically tested at 200 psi or 50 psi above maximum system pressure whichever is greater
- ☐ Electric wiring including control wiring, emergency supply been checked by electrical contractor
- ☐ Indoor fire pump units separated from all other areas of building by 2-hour rated construction, 1-hour if protected by sprinkler system
- ☐ If fire pump unit is located outdoors or if fire pump installation is in a building other than that building being protected by the fire pump, it is located at least 50 feet away from the protected building
- ☐ A suitable means for maintaining 40 degrees ambient temperature provided; 70 degrees if driver is diesel engine
- ☐ Was a copy of the manufacturer's certified pump test curve available for comparison to the results of the acceptance test?
- ☐ Pump room/house provided with normal lighting and emergency lighting
- ☐ Pump room/house adequately ventilated and floor is pitched toward drain
- ☐ Horizontal pump/driver on common base plate and connected by a listed flexible coupling
- ☐ Guard provided for flexible couplings and flexible connecting shafts
- ☐ Baseplate securely attached to concrete foundation

New Checklists

CLEAN AGENT SYSTEM CHECK LIST

BUILDING NAME: _____ LOCATION: _____

DESIGNER: _____ INSTALLER: _____

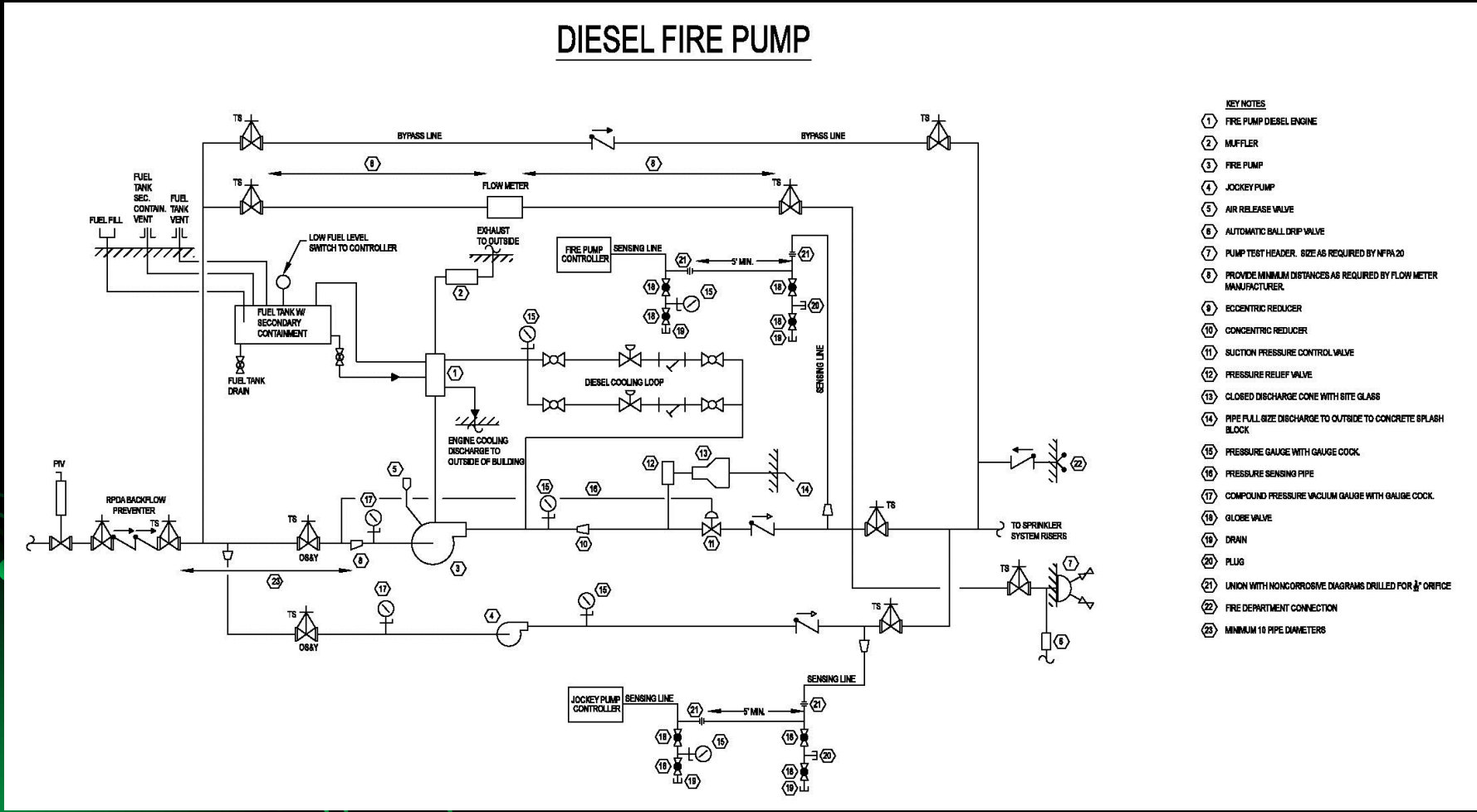
SCO REPRESENTATIVE: _____ DATE: _____

FIRE ALARM TECHNICIAN: _____ OWNER NAME: _____

INSTALLATION

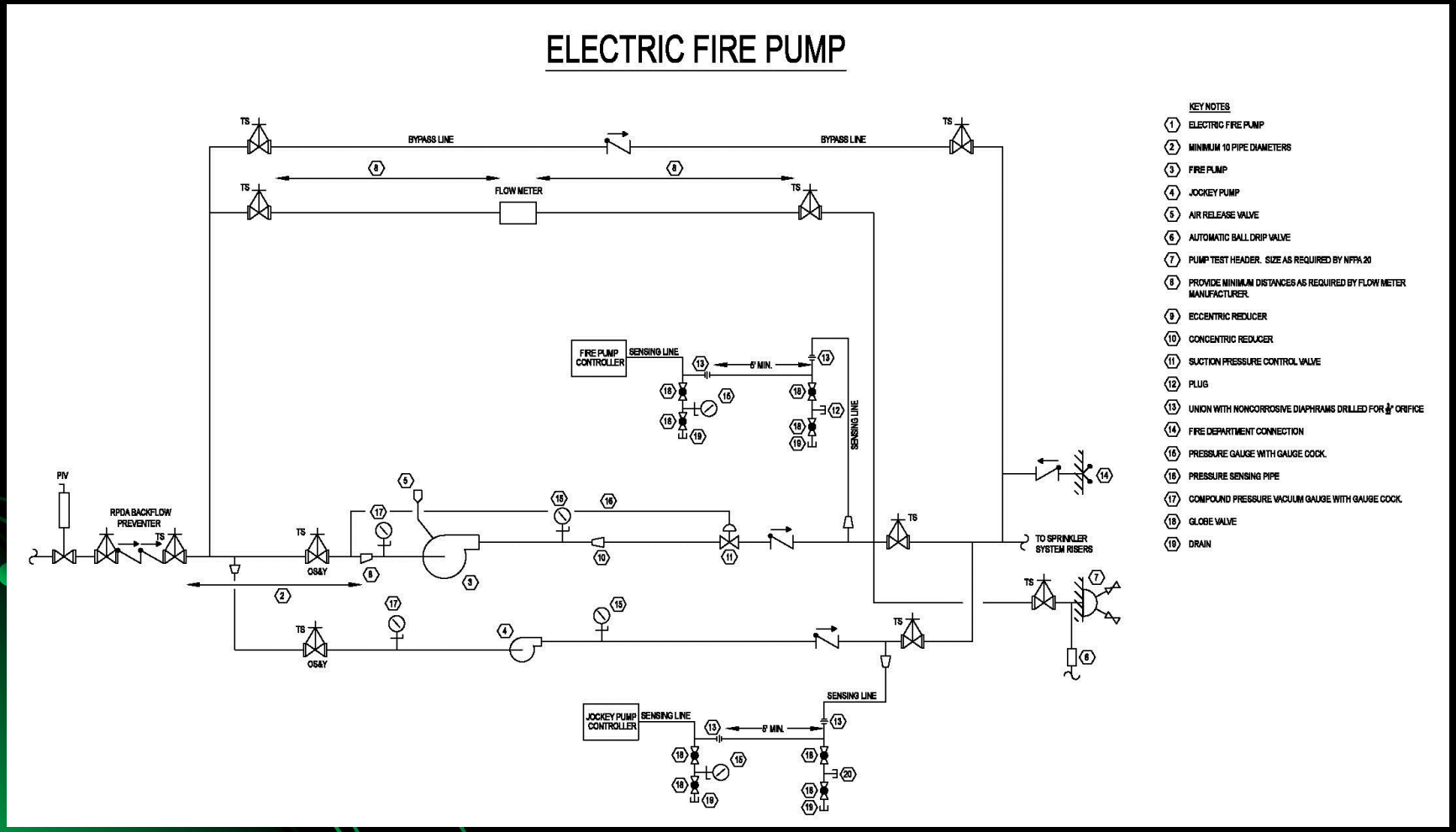
- ☐ Are all openings sealed or equipped with automatic closures?
- ☐ Other than the ventilation systems identified in 5.3.5.2, forced air ventilation systems all mechanical units shall be shut down or closed automatically where their continued operation would adversely affect the performance of the fire extinguishing system.
- ☐ An approved job site copy of plans must be on the site at the time of the inspection in labeled PVC tube.
- ☐ Suitable safeguards shall be provided to ensure prompt evacuation of and prevent entry into hazardous atmosphere. i.e. Personnel training, warning signs, discharge alarms.
- ☐ Verify storage containers are located as indicated on shop drawings.
- ☐ Agent storage shall not be located where it can be rendered inoperable or unreliable due to mechanical damage, exposure to chemicals, harsh weather or any other foreseeable cause.
- ☐ If container is connected to a manifold, automatic means, such as a check valve shall be provided to prevent agent loss and to ensure personnel safety
- ☐ Each agent container shall have a permanent nameplate or other marking that indicates the following
  - -For halocarbons: the agent, gross weights, and super pressurization level of the container.
  - -For inert gases: the agent, pressurization level of the container, and nominal agent volume.
- ☐ Room pressurization test been performed "door fan test"? Typical minimum retention time is 8-10 minutes.
- ☐ O&M manuals been provided to owner

New Checklists



Diesel fire pump piping schematic

New Checklists



Electric fire pump piping schematic

Common Field Inspection Issues

Common Field Inspection Issues

Minimum 36” clear space maintained
NCFC 507.5.5

Common Field Inspection Issues

Who was first?

- NCFC 912.3.2 Working space around FDC not less than 36” in width, 36” in depth and 78” in height

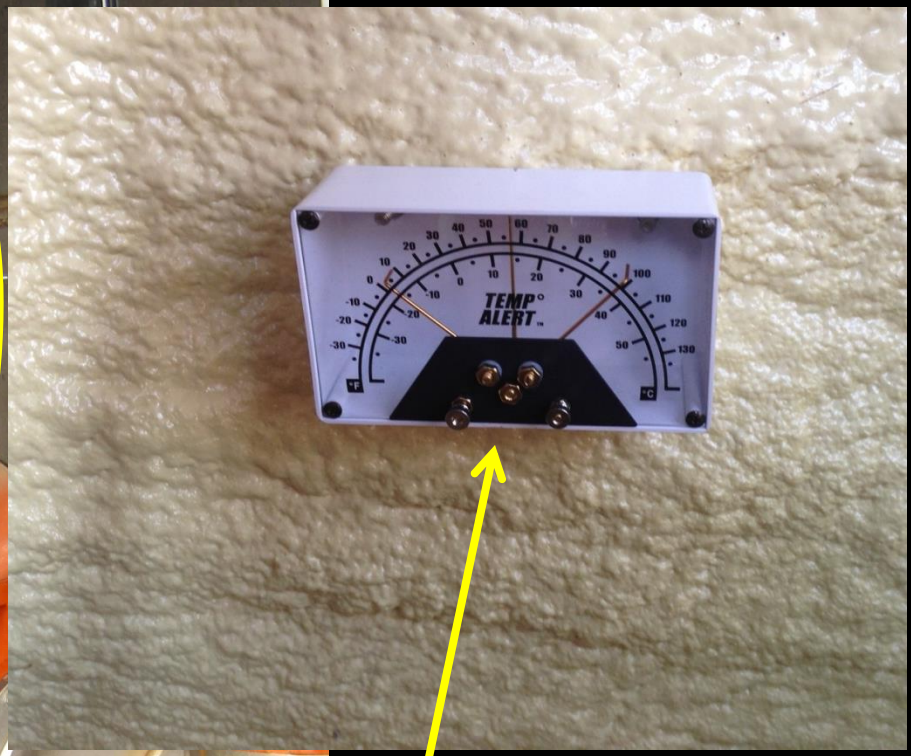
Common Field Inspection Issues

Common Field Inspection Issues

NFPA 13 2007- 8.16.1.3.1

- A post indicator valve (PIV) shall be located 40 feet from building walls.

No FA connection for the tamper switch.



Wireless???

Where’s the heat?

Handles were removed
At testing and never re-
Installed therefore leaving
valve closed,

Reason for not using locks or chains in lieu of tamper switch

Common Field Inspection Issues

- Hangers not installed per NFPA 13 or engineers specifications.
- Sprinkler head spacing around obstructions and heat sources.
- Dry pipe system not properly sloped.
- Dry pipe system not properly sloped.
- Dry pipe system not properly sloped. Get the hint!!!

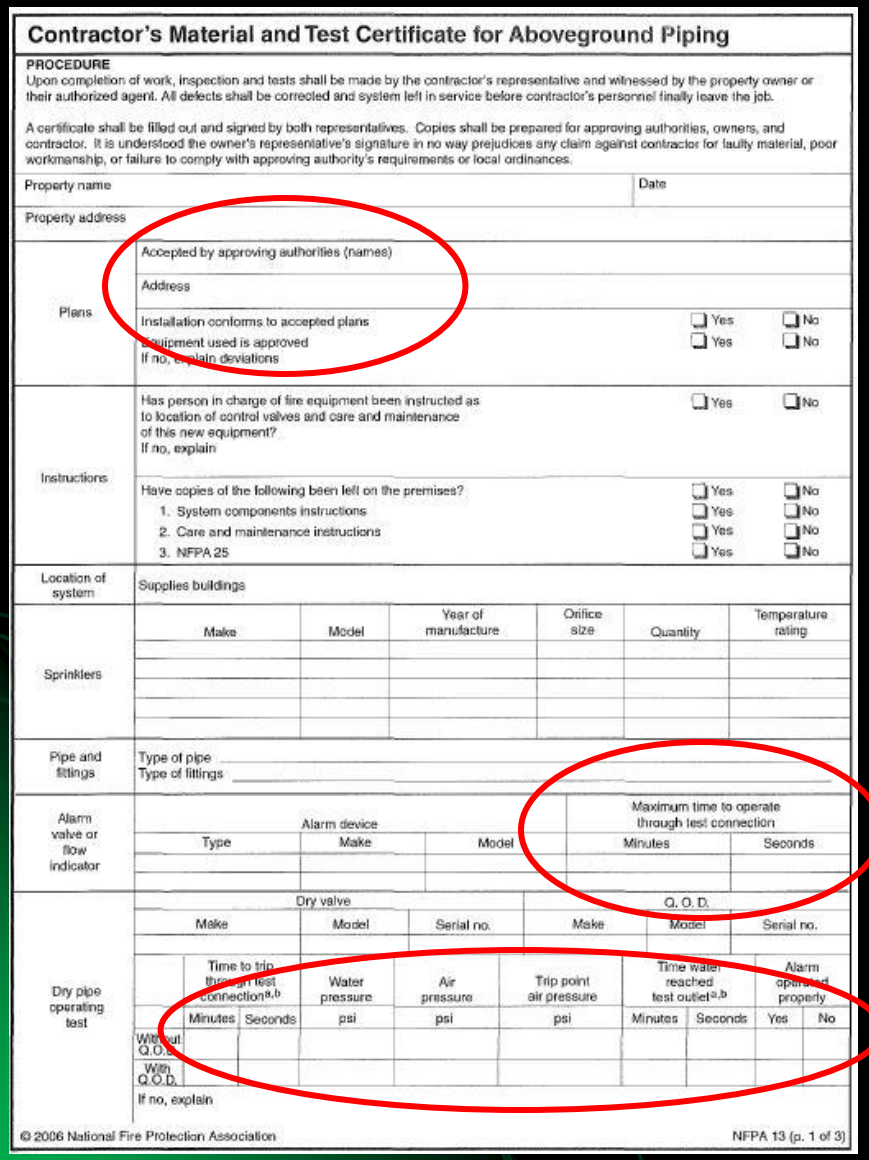
Common Field Inspection Issues

- Seismic not installed per NFPA or shop drawings. Brace angles do not match calculations, cables loose, missing braces.

- Sprinkler heads in walk in coolers with automatic defrost shall be intermediate temperature or higher. Any color other than orange or red.

- NFPA forms on final not filled out correctly. Missing information on forms.

Common Field Inspection Issues



Contractor's Material and Test Certificate for Aboveground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by the property owner or their authorized agent. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name | Date

Property address

Plans
- Accepted by approving authorities (names)
- Address
- Installation conforms to accepted plans ☐ Yes ☐ No
- Equipment used is approved ☐ Yes ☐ No
- If no, explain deviations

Instructions
- Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? ☐ Yes ☐ No
- If no, explain
- Have copies of the following been left on the premises? ☐ Yes ☐ No
  1. System components instructions ☐ Yes ☐ No
  2. Care and maintenance instructions ☐ Yes ☐ No
  3. NFPA 25 ☐ Yes ☐ No

Location of system: Supplies buildings

Sprinklers

Make	Model	Year of manufacture	Orifice size	Quantity	Temperature rating

Pipe and fittings
- Type of pipe
- Type of fittings

Alarm valve or flow indicator

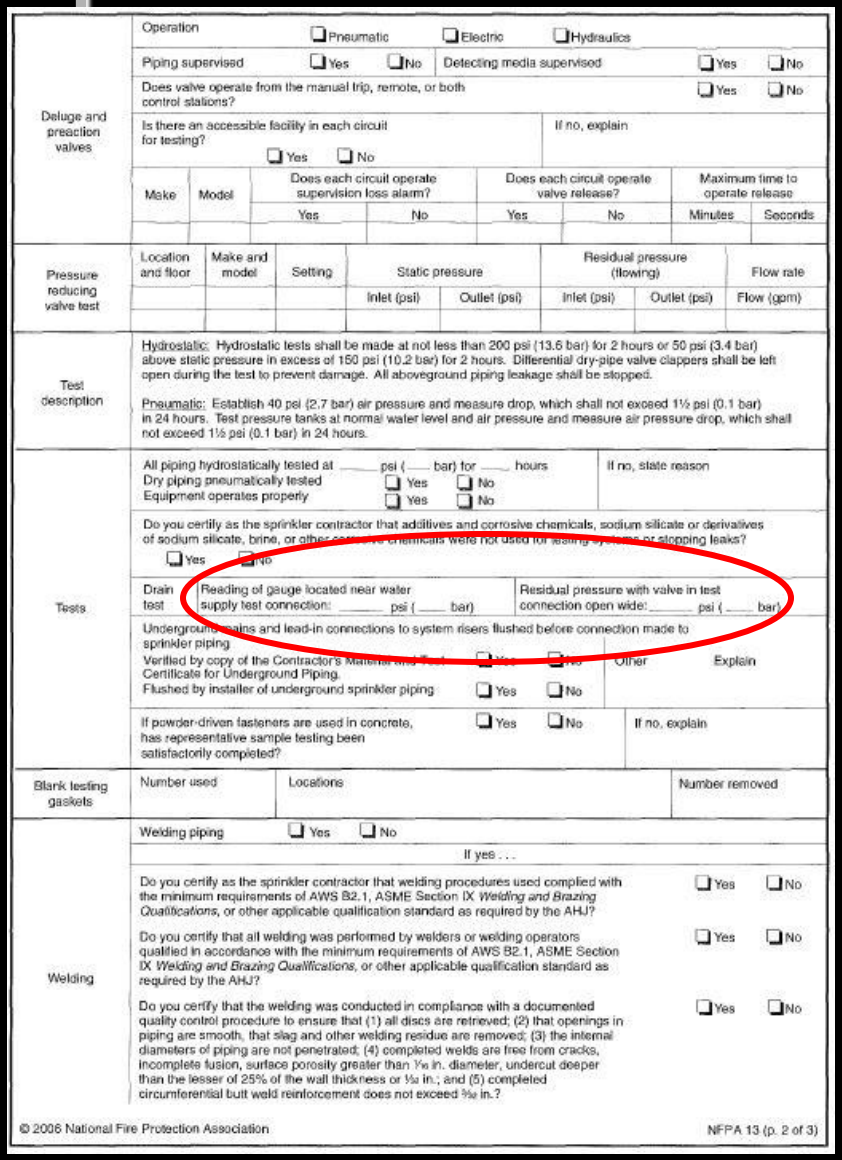
Alarm device: Type	Make	Model	Maximum time to operate through test connection: Minutes	Seconds

Dry pipe operating test

	Dry valve: Make	Model	Serial no.	Q. O. D.: Make	Model	Serial no.

	Time to trip through test connection[a,b]: Minutes	Seconds	Water pressure: psi	Air pressure: psi	Trip point air pressure: psi	Time water reached test outlet[a,b]: Minutes	Seconds	Alarm operated properly: Yes	No
Without Q.O.D.									
With Q.O.D.									

If no, explain



Deluge and preaction valves
- Operation ☐ Pneumatic ☐ Electric ☐ Hydraulics
- Piping supervised ☐ Yes ☐ No — Detecting media supervised ☐ Yes ☐ No
- Does valve operate from the manual trip, remote, or both control stations? ☐ Yes ☐ No
- Is there an accessible facility in each circuit for testing? ☐ Yes ☐ No — If no, explain

Make	Model	Does each circuit operate supervision loss alarm? Yes	No	Does each circuit operate valve release? Yes	No	Maximum time to operate release: Minutes	Seconds

Pressure reducing valve test

Location and floor	Make and model	Setting	Static pressure: Inlet (psi)	Outlet (psi)	Residual pressure (flowing): Inlet (psi)	Outlet (psi)	Flow rate: Flow (gpm)

Test description

Hydrostatic: Hydrostatic tests shall be made at not less than 200 psi (13.6 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 150 psi (10.2 bar) for 2 hours. Differential dry-pipe valve clappers shall be left open during the test to prevent damage. All aboveground piping leakage shall be stopped.

Pneumatic: Establish 40 psi (2.7 bar) air pressure and measure drop, which shall not exceed 1½ psi (0.1 bar) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop, which shall not exceed 1½ psi (0.1 bar) in 24 hours.

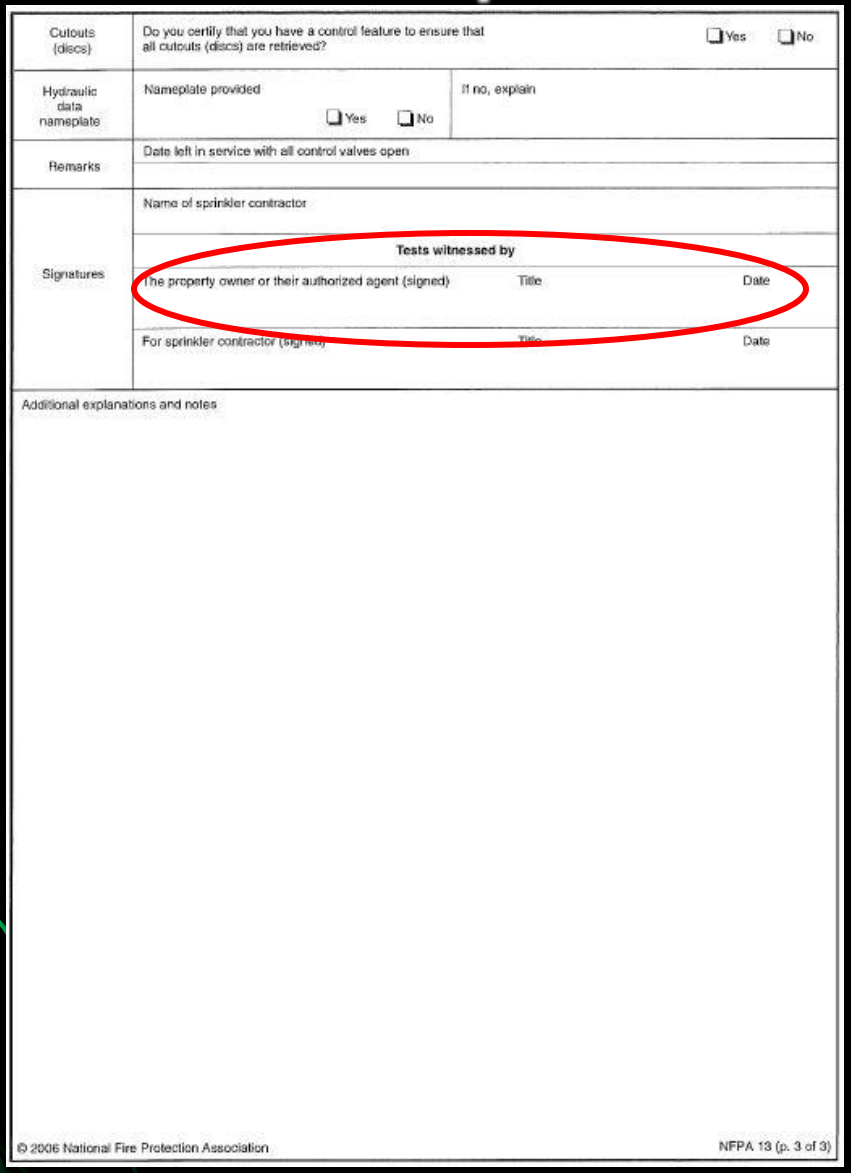
Tests
- All piping hydrostatically tested at ____ psi (____ bar) for ____ hours ☐ Yes ☐ No — If no, state reason
- Dry piping pneumatically tested ☐ Yes ☐ No
- Equipment operates properly ☐ Yes ☐ No
- Do you certify as the sprinkler contractor that additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals were not used for testing systems or stopping leaks? ☐ Yes ☐ No
- Drain test: Reading of gauge located near water supply test connection: ____ psi (____ bar) — Residual pressure with valve in test connection open wide: ____ psi (____ bar)
- Underground mains and lead-in connections to system risers flushed before connection made to sprinkler piping
- Verified by copy of the Contractor's Material and Test Certificate for Underground Piping. ☐ Yes ☐ No — Other — Explain
- Flushed by installer of underground sprinkler piping ☐ Yes ☐ No
- If powder-driven fasteners are used in concrete, has representative sample testing been satisfactorily completed? ☐ Yes ☐ No — If no, explain

Blank testing gaskets

Number used	Locations	Number removed

Welding
- Welding piping ☐ Yes ☐ No
- If yes . . .
- Do you certify as the sprinkler contractor that welding procedures used complied with the minimum requirements of AWS B2.1, ASME Section IX *Welding and Brazing Qualifications*, or other applicable qualification standard as required by the AHJ? ☐ Yes ☐ No
- Do you certify that all welding was performed by welders or welding operators qualified in accordance with the minimum requirements of AWS B2.1, ASME Section IX *Welding and Brazing Qualifications*, or other applicable qualification standard as required by the AHJ? ☐ Yes ☐ No
- Do you certify that the welding was conducted in compliance with a documented quality control procedure to ensure that (1) all discs are retrieved; (2) that openings in piping are smooth, that slag and other welding residue are removed; (3) the internal diameters of piping are not penetrated; (4) completed welds are free from cracks, incomplete fusion, surface porosity greater than 1/16 in. diameter, undercut deeper than the lesser of 25% of the wall thickness or 1/32 in.; and (5) completed circumferential butt weld reinforcement does not exceed 3/32 in.? ☐ Yes ☐ No

Common Field Inspection Issues



Cutouts (discs)	Do you certify that you have a control feature to ensure that all cutouts (discs) are retrieved? ❑ Yes ❑ No	
Hydraulic data nameplate	Nameplate provided ❑ Yes ❑ No	If no, explain
Remarks	Date left in service with all control valves open	
Signatures	Name of sprinkler contractor	
	Tests witnessed by	
	The property owner or their authorized agent (signed) Title Date	
	For sprinkler contractor (signed) Title Date	

Additional explanations and notes

Common Field Inspection Issues

Dry pipe systems

- Breaking news!!!! Water freezes at 32 degrees.
- Verify unit heaters in riser rooms work.
- Do not shut off unit heaters to save energy.
- If multiple auxiliary drains are used in dry pipe system make accessible and create maintenance plan for routine drainage.

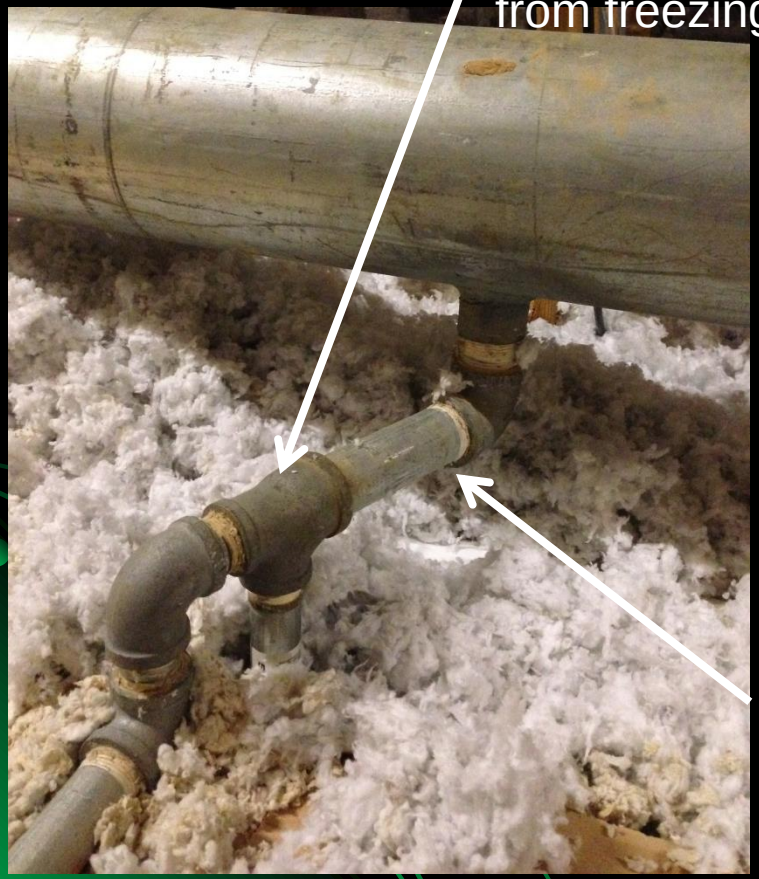
Common Field Inspection Issues

- Dry pipe system not sloped properly
- Piping shown is less than 2 years old

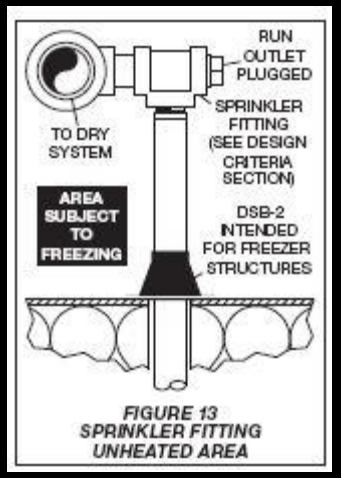
Dry pipe systems

Common Field Inspection Issues

Dry pendent installed in bottom of pipe. This can cause metal seal to deform from freezing resulting in leaking.



Trapped water

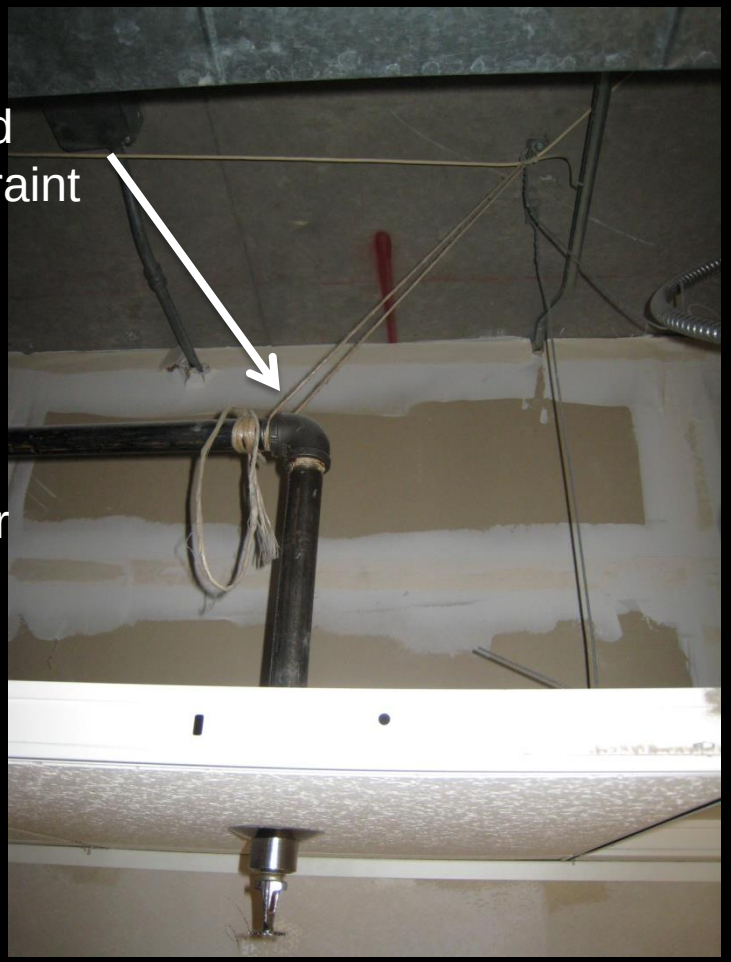


Cause

Effect

Common Field Inspection Issues

Not an approved branch line restraint



Cable around other trades

Minimum crimps for different cables

Seismic bracing

Common Field Inspection Issues

Restraints shall extend to structure

Cables shall be tight

Seismic bracing

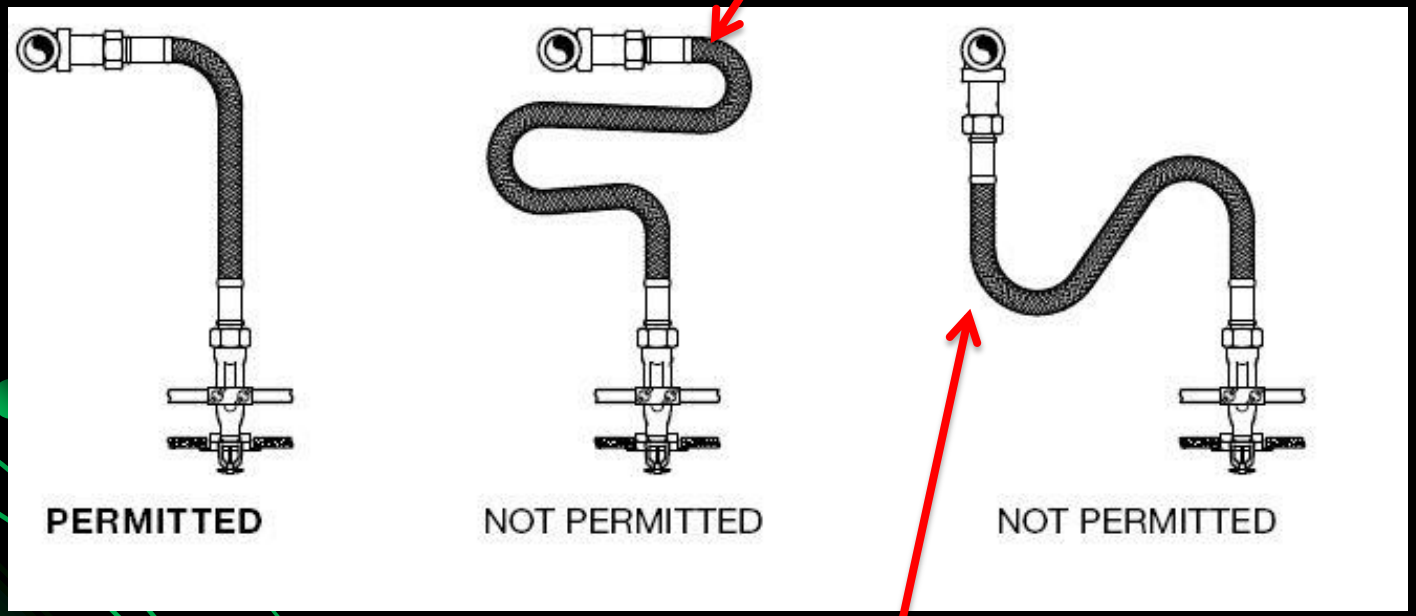
Common Field Inspection Issues

Flexible couplings required within 12” on both sides. NFPA 13 9.3.2.3 (there are exceptions)

Four-way brace missing NFPA 13 9.3.5.5

Common Field Inspection Issues

Refer to listing of pipe
for maximum pipe bends



Water has to drain back to
branchline or sprinkler head

Significant friction loss

TABLE 2A: FRICTION LOSS DATA FOR FM WITH 12" (305 mm) MINIMUM BEND RADIUS (1/2" OUTLET)					
Part Numbers	Outlet Type	Hose Length with Fittings	Equivalent Length of FM 1" Schedule 40 Pipe (ft.)	Equivalent Length of FM 1" Schedule 40 Pipe (meters)	Maximum Number of 90° Bends Allowed
14350-10	1/2" Straight or 90° Angle	39-3/8"*	18.2 ft	5.5 m	1
14350-15		59"*	27.1 ft	8.2 m	2
* Indicates standard Viking offering. Other hose lengths are available-contact Viking Technical Services at 877-384-5464 for friction loss data.					

TABLE 2B: FRICTION LOSS DATA FOR FM WITH 12" (305 mm) MINIMUM BEND RADIUS (3/4" OUTLET)					
Part Numbers	Outlet Type	Hose Length with Fittings	Equivalent Length of FM 1" Schedule 40 Pipe (ft.)	Equivalent Length of FM 1" Schedule 40 Pipe (meters)	Maximum Number of 90° Bends Allowed
14351-10	3/4" Straight or 90° Angle	39-3/8"*	15.5 ft	4.7 m	1
14351-15		59"*	24.8 ft	7.6 m	2
* Indicates standard Viking offering. Other hose lengths are available-contact Viking Technical Services at 877-384-5464 for friction loss data.					

Braided outer jacket required by SCO

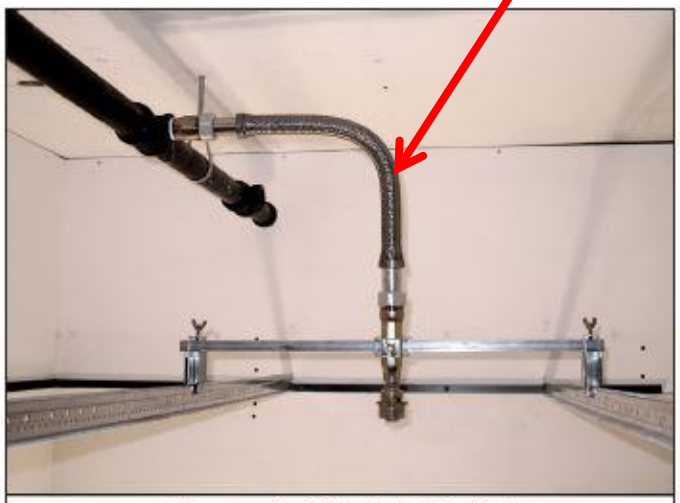
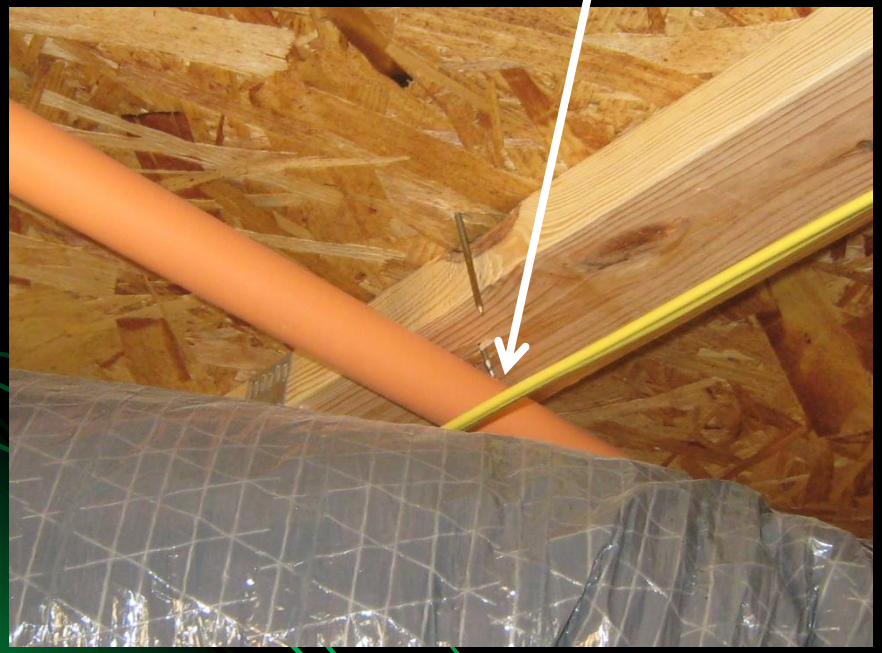


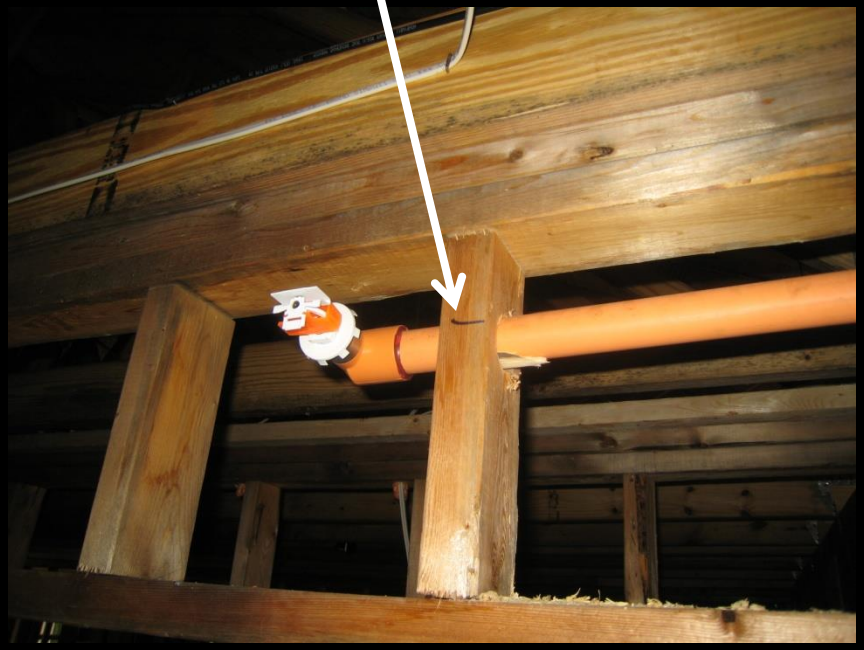
Figure 1: Straight Outlet

Figure 2: Angle Outlet

Could be 200-500 gpm depending on pressure

Common Field Inspection Issues





CPVC is a good product to use, however there are a number of restrictions the designer should keep in mind. Exposed conditions, hazard class, etc.

Common Field Inspection Issues

Table 9.2.2.1(a) Maximum Distance Between Hangers (ft-in.)

	Nominal Pipe Size (in.)							
	¾	1	1¼	1½	2	2½	3	3½
Steel pipe except threaded lightwall	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0
Threaded lightwall steel pipe	N/A	12-0	12-0	12-0	12-0	12-0	12-0	N/A
Copper tube	8-0	8-0	10-0	10-0	12-0	12-0	12-0	15-0
CPVC	5-6	6-0	6-6	7-0	8-0	9-0	10-0	N/A
Polybutylene (IPS)	N/A	3-9	4-7	5-0	5-11	N/A	N/A	N/A
Polybutylene (CTS)	2-11	3-4	3-11	4-5	5-5	N/A	N/A	N/A
Ductile iron pipe	N/A	N/A	N/A	N/A	N/A	N/A	15-0	N/A

Hangers must be listed to be used for CPVC

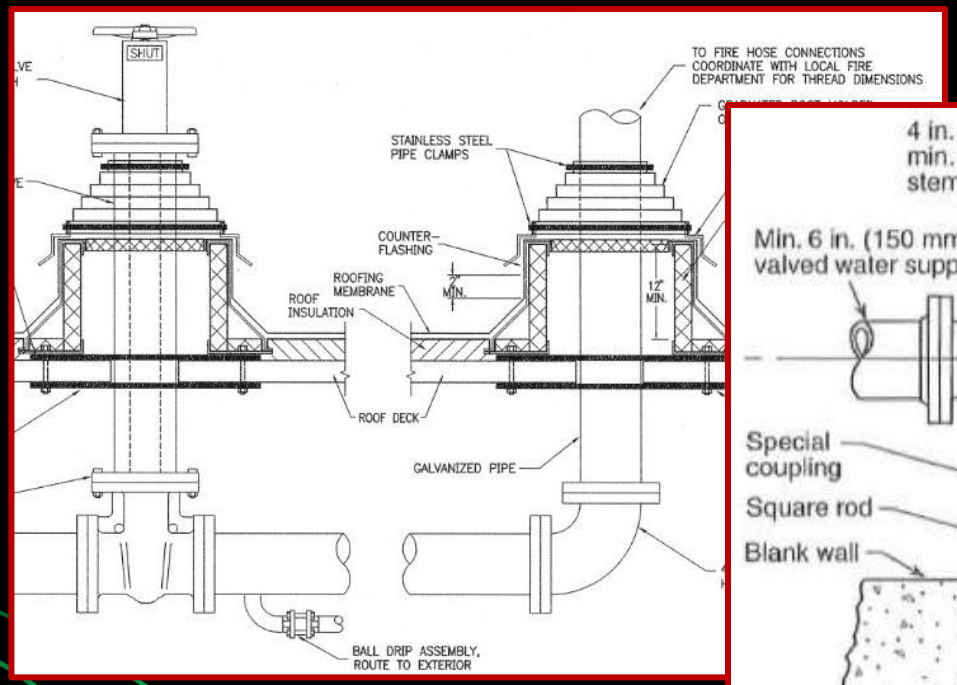
Common Field Inspection Issues

Standpipes on Roofs

- Fire Code: Where roof has slope less than 4 in 12, each standpipe shall be provided with a hose connection located either on roof or on the highest landing of stairway with stair access to roof.

- SCO allows final number on roof to be determined by local Fire Marshal. Stated as such in SCO guidelines.

Common Field Inspection Issues



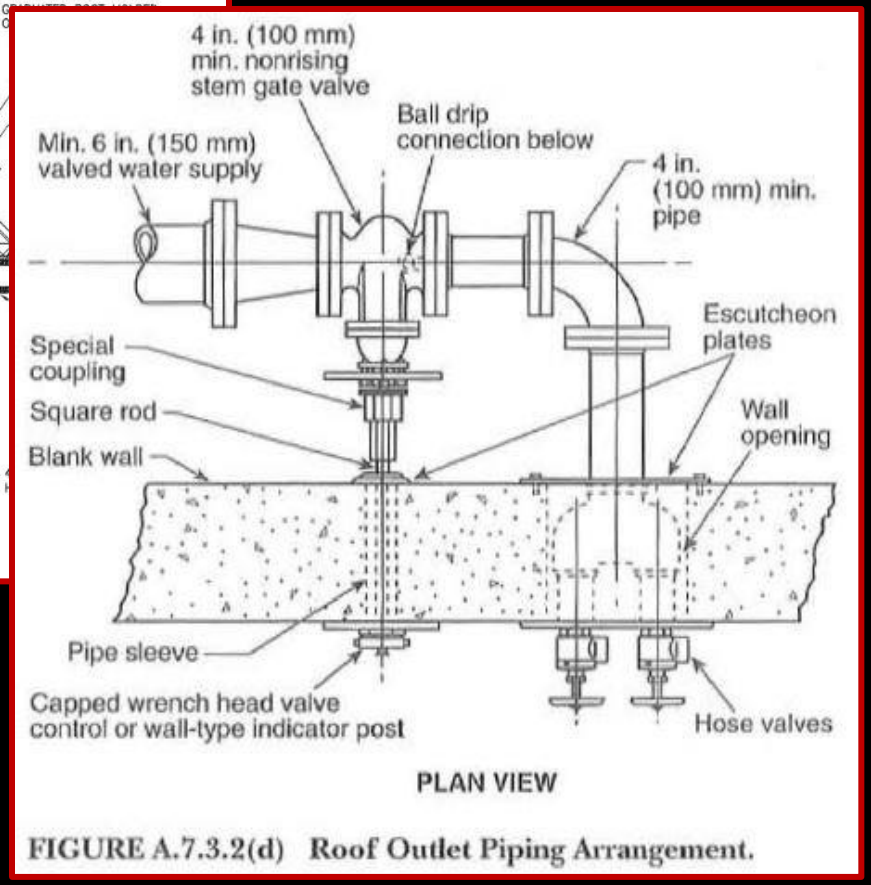


FIGURE A.7.3.2(d) Roof Outlet Piping Arrangement.

Standpipes on roofs

Common Field Inspection Issues

Frozen and cracked due to no automatic drain valve

Common Field Inspection Issues

Provide sprinkler protection below floating ceilings. Also provide protection below anything over 4' wide.

NFPA 13 2007' 8.6.5.3.3

Obstructions

Obstructions

Distance from Sprinklers to Side of Obstruction (A)	Maximum Allowable Distance of Deflector above Bottom of Obstruction (in.) (B)
Less than 1 ft	0
1 ft to less than 1 ft 6 in.	0
1 ft 6 in. to less than 2 ft	1
2 ft to less than 2 ft 6 in.	1
2 ft 6 in. to less than 3 ft	1
3 ft to less than 3 ft 6 in.	3
3 ft 6 in. to less than 4 ft	3
4 ft to less than 4 ft 6 in.	5
4 ft 6 in. to less than 5 ft	7
5 ft to less than 5 ft 6 in.	7
5 ft 6 in. to less than 6 ft	7
6 ft to less than 6 ft 6 in.	9
6 ft 6 in. to less than 7 ft	11
7 ft and greater	14

For SI units, 1 in. = 25.4 mm; 1 ft = 0.3048 m.
Note: For *(A)* and *(B)*, refer to Figure 8.10.6.1.2(a).

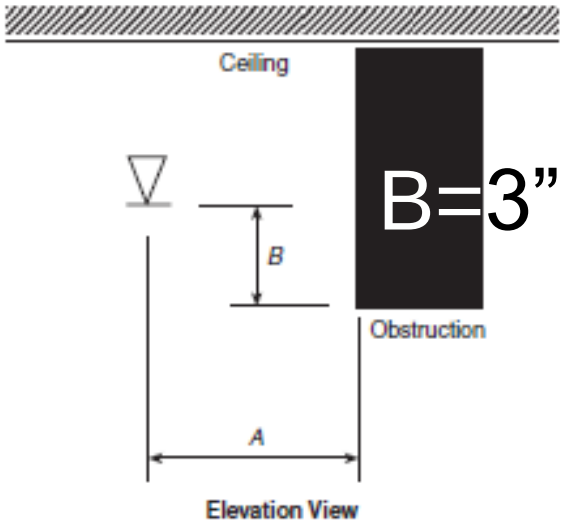
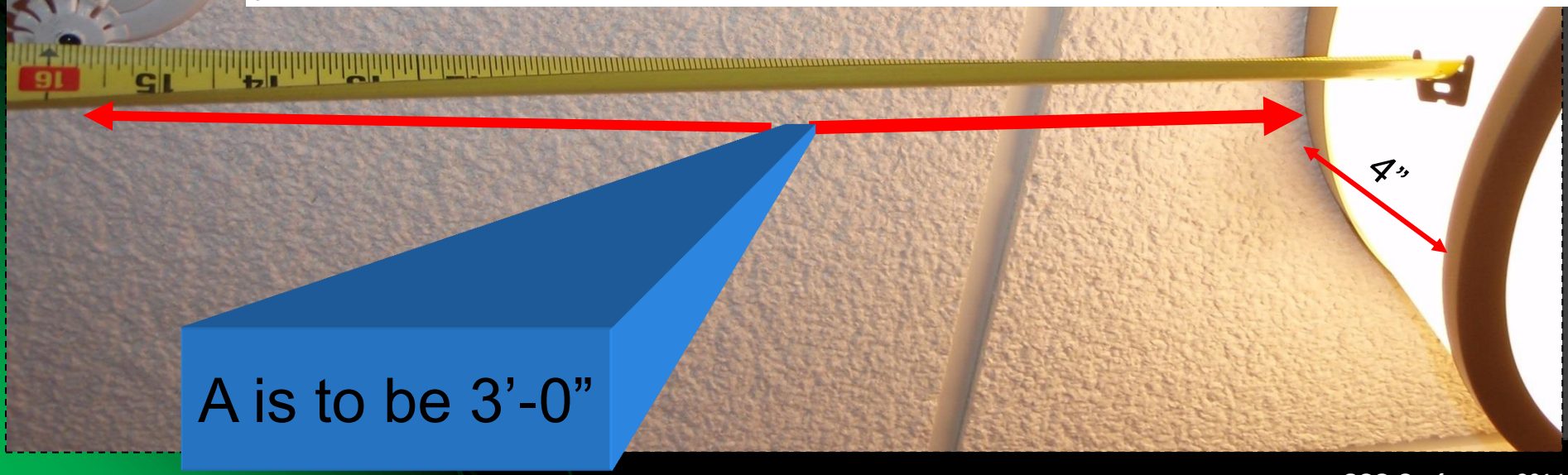
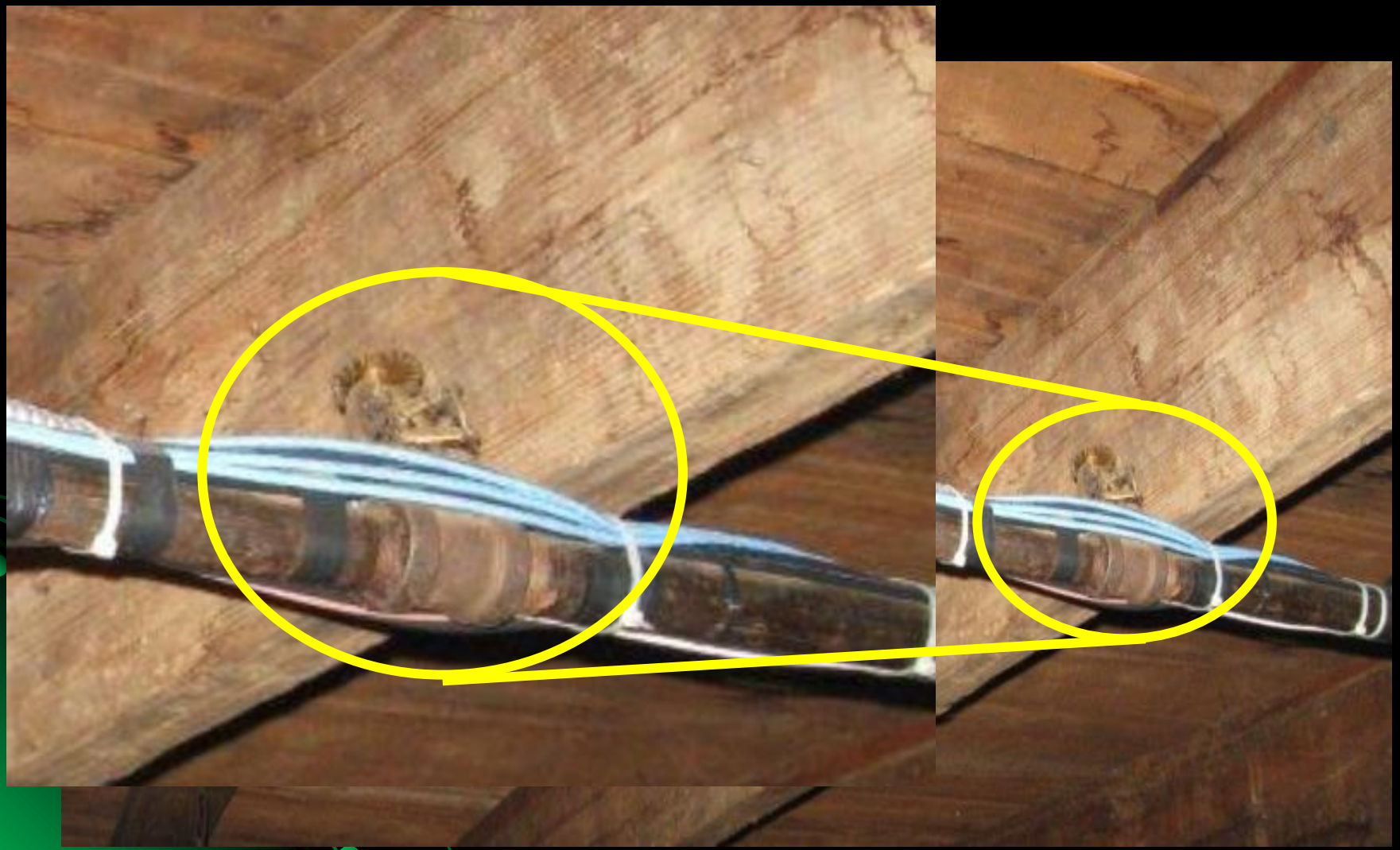


FIGURE 8.10.6.1.2(a) Position of Sprinklers to Avoid Obstructions to Discharge (Residential Upright and Pendent Spray Sprinklers).

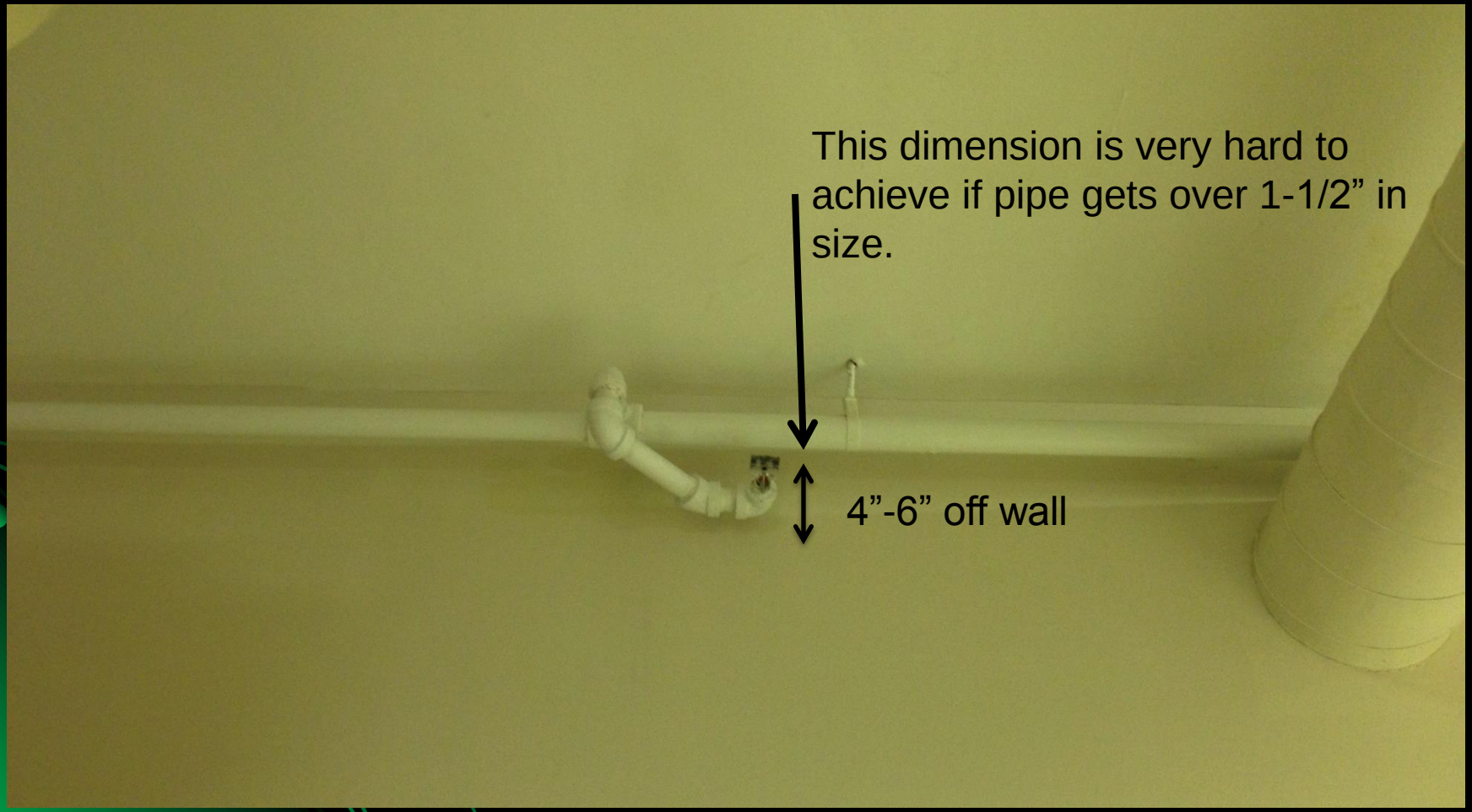


Obstructions

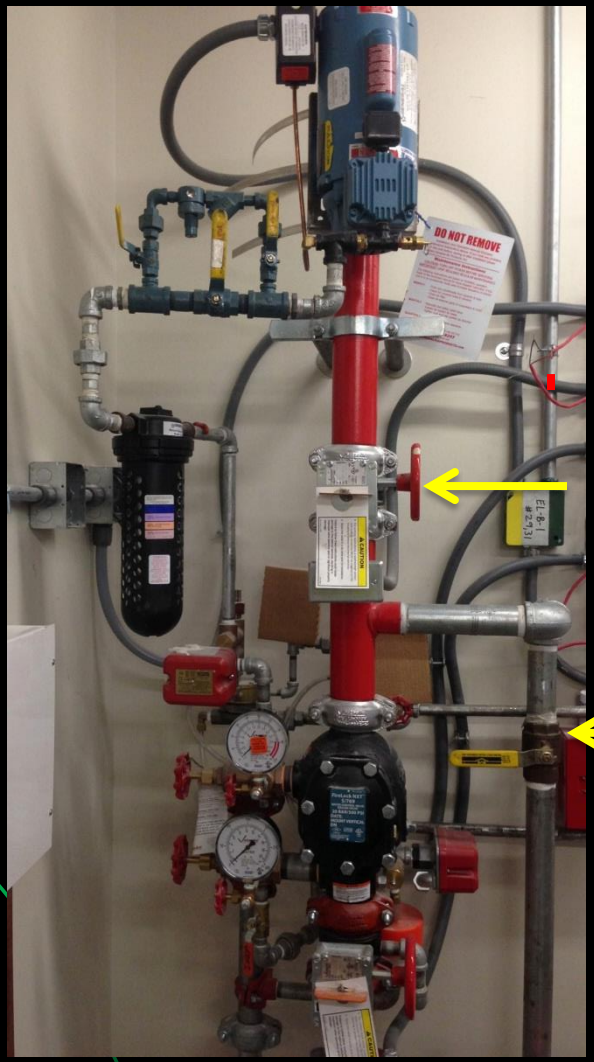
Obstructions



Common Field Inspection Issues



Good Jobs

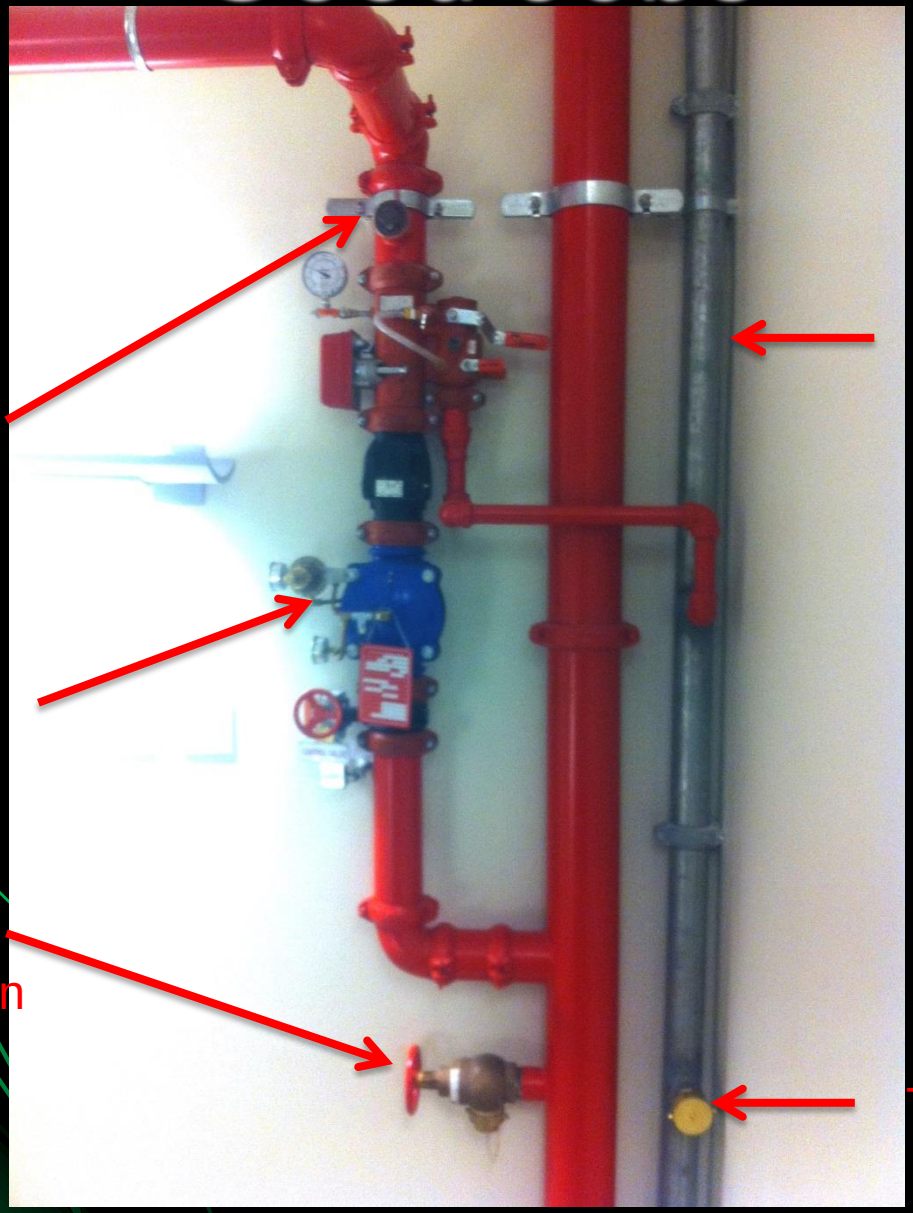


Test isolation valve

Test drain valve

Preaction system

Good Jobs

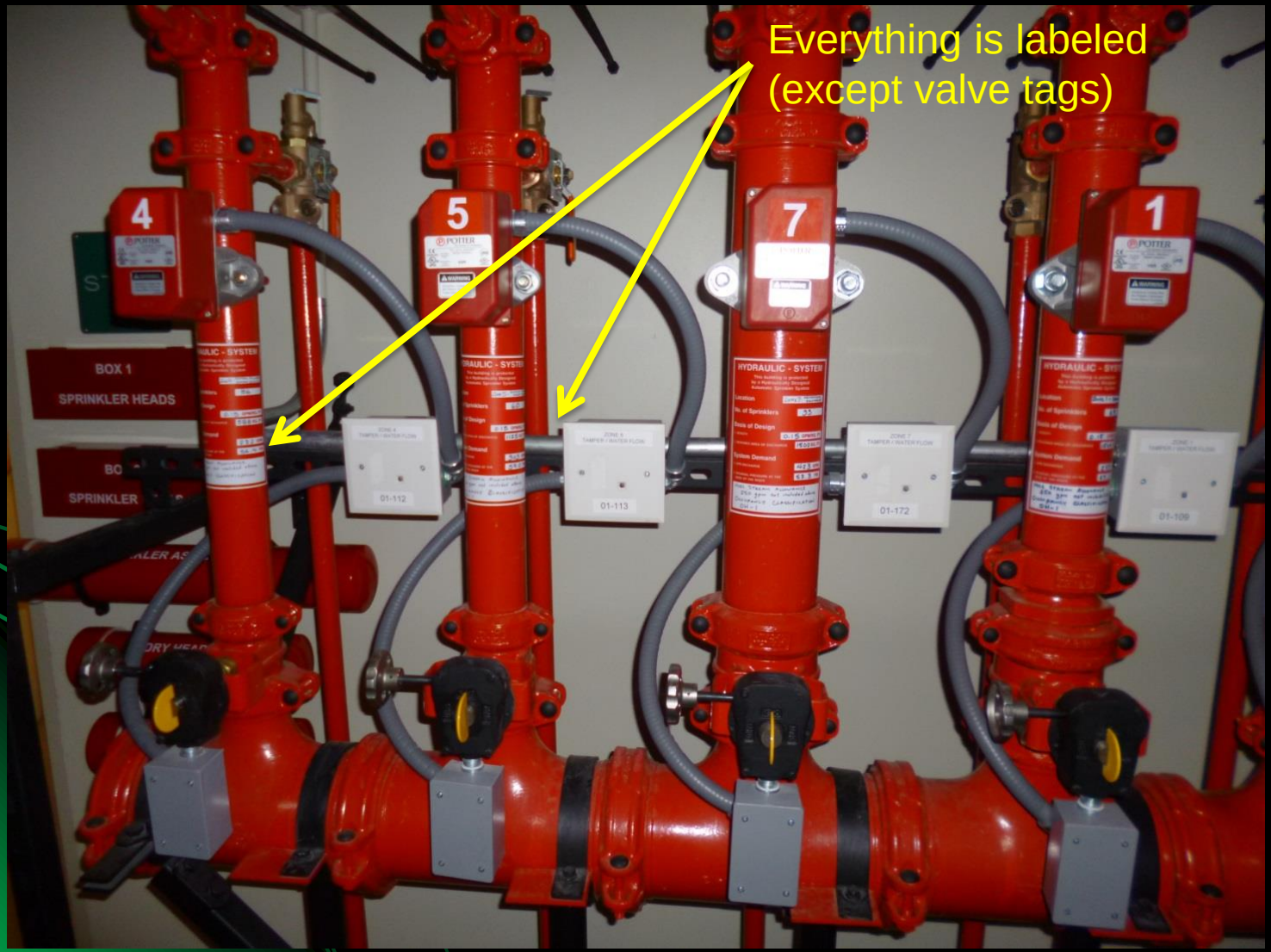

Test connection
Drain stack
Pressure reducing valve
Factory set Fire hose connection
Test connection

Good Jobs


MAIN DRAIN
MAIN DRAIN
MAIN DRAIN
CONTROL VALVE
CONTROL VALVE
CONTROL VALVE
Stair Tower 1
OPEN
Floors 1-7
Stair tower 2
OPEN
OPEN

Good Jobs

Good Jobs


Everything is labeled
(except valve tags)
4
5
7
1
BOX 1
SPRINKLER HEADS
HYDRAULIC - SYSTEM
01-112
01-113
01-172
01-109

Good Jobs

Work performed by inmate labor.

Successful Fire Sprinkler Systems

Questions?

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