High-Rise Procedure Appendix 1
Standpipe Operations Supplemental Information

Introduction:

The purpose of this section is to review the types and components of standpipe systems, discuss fire department operations utilizing standpipes/building fire protection systems, and finally to troubleshoot problems that may be encountered during emergency operations at these buildings. This section will focus primarily on information pertinent to the responsibilities of the driver/engineer.

Standpipe Components, Classification and Considerations

The purpose of equipping buildings with standpipe systems is to provide a means for supplying water to elevated floors at a sufficient pressure for fire suppression activities. This is accomplished through installing one or more risers to transport water from ground level to the highest floor of the building, outlets on designated floors (generally every floor) in order to facilitate hose operations to the fire area, and a fire department connection located in an area accessible to fire department vehicles in order to supply water to the system if necessary. Standpipe systems may be equipped with a fire pump, use city water supply, or rely on fire department apparatus in order to supply the water pressures needed for firefighting operations. Standpipe risers may be wet, dry, or pre-action type systems. Building risers may also supply the water necessary for sprinkler systems as well as the outlets used for hose connections. This is a common practice in our jurisdiction. Standpipe risers are classified as Type I, II, or III by NFPA 14, the Standard for the Installation of Standpipe and Hose Systems. This standard was originally developed in 1912, and revised greatly in 1993 in reaction to tragic events like the Meridian One Plaza Fire in 1991 and new practices and technological developments used in engineering these systems.

- **CLASS I -** Riser is equipped with 2 ½" outlets for Fire Department use.
- **CLASS II -** Riser is equipped with 1 ½" outlets (for occupant use hose).
- **CLASS III -** Riser is equipped with both 2 ½" and 1 ½" outlets.

NFPA 14 also sets guidelines requiring the standpipe outlets to provide adequate GPM's for firefighting activities, while keeping water pressures within safe working limits. The standard also sets maximum distances between standpipe outlets and remote areas of the building, etc.

A Quick Summary Chart of NFPA 14, Pre and Post 1993 is located on the next page for reference. The chart only includes basic information that would be useful for initial firefighting actions, and is in no way intended to summarize the entire standard.

NFPA 14 Quick Look Chart

	PRE 1993	POST 1993
Maximum PSI, Top Floor	65 PSI	175 PSI - 2 ½" Outlets 100 PSI - 1 ½" Outlets
Minimum PSI, Top Floor	65 PSI	100 PSI - 2 ½" Outlets 65 PSI - 1 ½" Outlets
Minimum Flow, Top Floor	600 GPM - 1 Riser 750 GPM - 2 Risers	600 GPM - 1 Riser 750 GPM - 2 Risers
Maximum Flow required at top floor, depending on floor area	2,500 GPM For standpipe only	1,250 GPM For both standpipe and sprinklers
Max Distance from a standpipe to all points on the fire floor	Within 30' of a 100' Hose line	150' plus the height of a staircase 200' if sprinklered

Note that 2 1/2" outlets must flow between a minimum of 100 PSI and a maximum of 175 PSI at the most remote outlet (usually the roof). Whether you use the minimum outlet pressures needed on a given floor (+ 5 PSI FL for elevation + hose), a quick rule of thumb for flowing a standpipe (+ 5 PSI FL per floor), or figure out the PSI needed from the nozzle on the fire floor and add FL for hose, the standpipe system, and elevation, it is readily apparent that very high pressures will be needed to supply the proper GPM's of water needed to extinguish the fire at elevation.

Example: Fire located on the 20th Floor

NP (75 PSI) + FL for attack hose (20 PSI) + FL for standpipe (25 PSI) + FL Elev. (100 PSI)

Total Pressure Needed = 220 PSI (conservative)

****This exceeds the NFPA maximum allowable PSI for an outlet****

When the laws of hydraulics are applied to the closed vertical standpipe system, the driver engineer must recognize that these systems must be engineered with mechanisms in place that will reduce the water flow pressure at elevations closer to the fire pump, whether it is a building pump or a fire department apparatus that connects and pumps into the system. This pressure reduction is achieved by using either a pressure reducing device (**PRD**), or a pressure-reducing valve (**PRV**) at the outlets on each floor of a riser. Many varieties of each are currently used, but the basic principles of each are listed below. Without these mechanisms in place, pressures at lower floors may be too high at the outlets for safe firefighting operations. Driver engineers must be familiar with the way each mechanism works, as well as be able to troubleshoot potential problems.

- **Pressure Reducing Device (PRD)**
  These devices only reduce flow pressure; they have no effect on static pressure in a system that is not flowing water. They usually consist of a reduced orifice or adjustable orifice/baffle on the discharge side of the outlet. Some of these are adjustable, and others can be disabled by a firefighter at the riser via a pin, or simply removed. Class III standpipe systems may have PRD's located in the 2 ½" to 1 ½" reducer that firefighters remove from a hose cabinet.

- **Pressure Reducing Valve (PRV)**
  These devices are more complex devices, and generally work by using an internal spring that is calibrated to open up a certain amount when a given pressure is applied to them. It is important for the driver engineer to know that systems using these devices are engineered to work correctly (correct PSI and GPM flow) only when a specific pressure is achieved throughout the system. The individual PRV's must be calibrated for use on each floor, and require regular maintenance and testing to ensure proper function. **<u>In other words, if the correct pump operating pressure is not achieved, the proper PSI or GPM of water flow will not be achieved on any floor</u>**. The correct operating pressure of the system should be posted at the FDC (required by NFPA 14 if the operating pressure is above 175 PSI). If fire department apparatus is supplying pressure to the system in the case of the building's fire pump failure, it is important that the pressure posted is the pressure that is pumped to the system. PRV's are generally found on newer, taller buildings, and it is not uncommon to require pressures from 300-350+ PSI to properly supply these systems. It should also be noted that water cannot flow into a PRV from the discharge side, so additional water supply cannot be achieved to a riser by connecting supply line to a PRV discharge via a double female.

- **Recognizing Systems Utilizing PRV'S**
  It is vital to both the Incident Commander and the driver engineer that a building system that uses PRV's is identified as early as possible. Pre-Incident Planning is the optimal time to recognize these and other building systems features. As stated earlier, a driver engineer should also be alerted to a system that possibly utilizes PRV's when faced with signage at the FDC that shows a high pump operating pressure for the system. Another way to identify a PRV is at the standpipe outlets on each floor. Most PRV's have a large bonnet (like a flying saucer) at the standpipe outlets **(1)**. Yet another way to recognize a PRV is by opening the cap on discharge outlet, and inspecting them. If it has no threads, it is a PRV **(2)**. Any time a system utilizing PRV's is identified by any personnel on scene, command and all of the driver engineers on scene must be notified immediately.

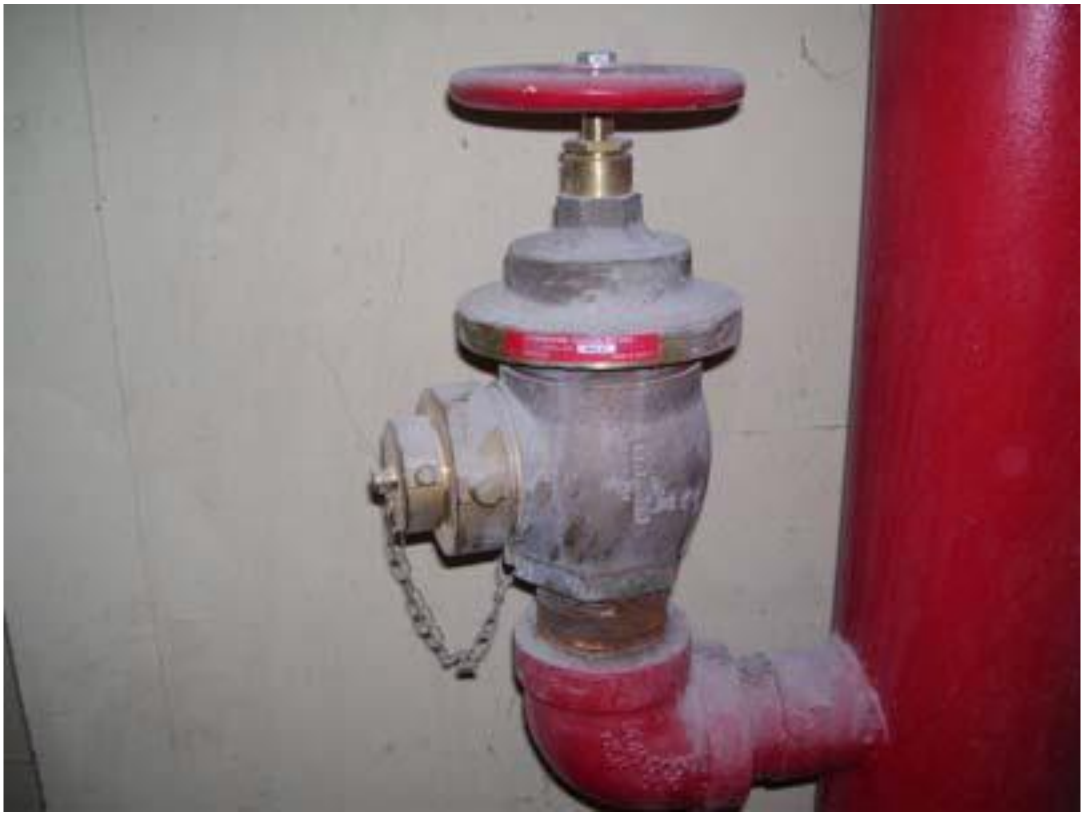


Photo provided by Capt. Bill Gustin

(Picture 1) PRV Note the large bonnet.

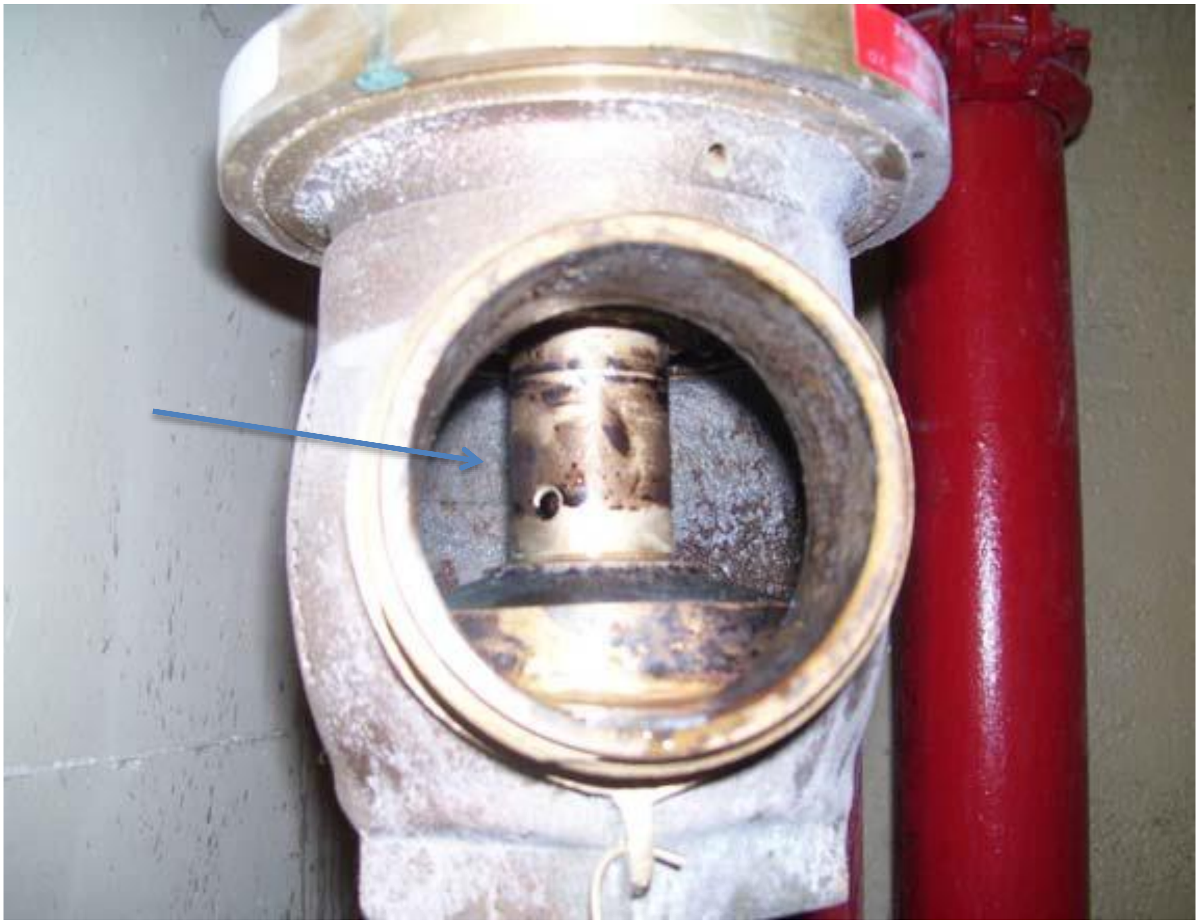
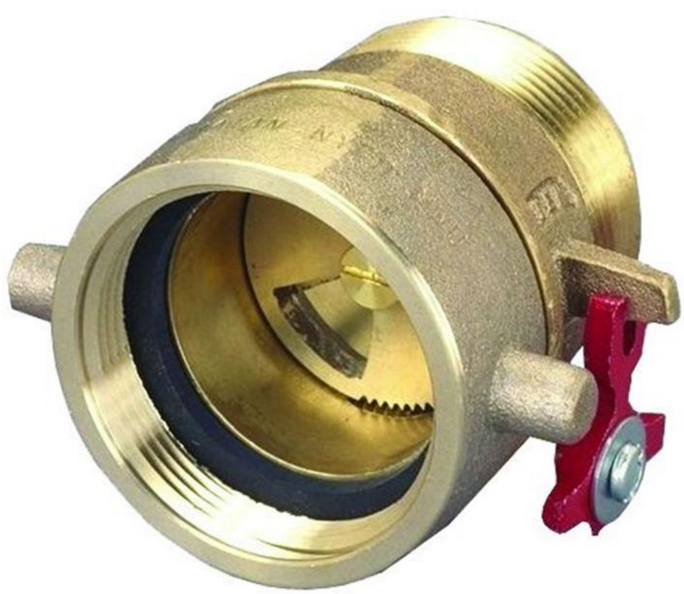


Photo provided by Capt. Bill Gustin

(PICTURE 2) PRV Note the lack of threads on the stem inside the valve.



**(PICTURE 3)
ADJUSTABLE PRD**

Additional Considerations for Standpipe Operations

The driver engineer must remember that during firefighting operations, water pressure is supplied to the system by either **(a)** a functioning building system utilizing it's own fire pump, providing adequate pressure and GPM's for firefighting activities, or **(b)** fire department apparatus. The terminology and statements that the fire department must be able to provide "supplemental" water supply (including NFPA Standards) is relative and can be misleading to some. Remember that the laws of hydraulics always apply, and even though the FDC is connected to the riser on the discharge side of a building's fire pump, the fire department must overcome the pressure provided by the building's system in order to supply additional water and pressure. If the fire department apparatus does not pump a pressure greater than what is in the system, water stops at the check valve at the riser and does not enter the system. This brings up another condition that the driver engineer must be aware of. If a building system is functioning correctly at a working fire, and a driver engineer is instructed to supply the FDC, he or she must be aware that they may not really be flowing any water past the check valve into the riser. This is acceptable, as long as the personnel engaged in firefighting actions have adequate pressure (supplied by the building's fire pump). The fire department role in this scenario is simply emergency back up. What is important for the driver engineer to recognize is the potential to overheat their pump unless they are flowing water. Opening a discharge, flowing a small hose line, or even putting a hose line into a storm drain can prevent the pump from overheating.

Overcoming Problems when Connecting to the FDC

An important point to remember is that a building may have several risers supplied by different FDC's, and/or risers that supply a certain number of floors. The latter is sometimes necessary for tall buildings that use a dedicated pump or pumps to supply upper floor outlets. The point is to confirm that you are connecting to the correct riser.
Another condition to monitor is hose operations that may have to utilize more than one riser. This can occur at a fire near the upper limits of one riser, and the lower limits of another.

The FDC can fall victim to poor maintenance or vandalism. If a driver engineer encounters an FDC with a "frozen" or stuck female swivel, he or she has two options.
The driver engineer could use a double male and a double female adapter from their apparatus to make the connection (preferred), or they can rotate the hose that is stretched counterclockwise 4 full rotations, and make the connection.

If the FDC has a "frozen" or stuck plug that will not separate, it can be left in place, and a gated wye can be placed on the other inlet to make the initial connection.

Lastly, an interior standpipe outlet may be used as an additional supply to a riser by stretching a supply line into the building, and attaching it to the outlet via a double female. Remember to open the discharge outlet that is now the "inlet". **NOTE: THIS CANNOT BE DONE IN A BUILDING EQUIPPED WITH PRV's.**