

Does Your Plant Have Adequate Fire Water Supply?

The issue of fire water supply was one that formerly was not a high priority for most power generating plants or industrial processing facilities. However, this aspect of fire protection has recently become a point of focus for many insurance underwriters, which has consequently elevated its importance to these facilities.

Properly maintaining a fire protection system within a power generating or industrial processing facility involves diligent testing, inspection and maintenance practices that are performed at regular intervals. The scope of these functions is quite broad, entailing a host of actions on a wide variety of equipment. Unfortunately the breadth of these testing and inspection tasks can often cause critical elements of a system, such as fire water supply, to be overshadowed. Adequate fire water supply is essential to the operation of water-based fire protection systems, yet many facilities are not aware that their supply may be insufficient for optimal performance.

Why is Sufficient Fire Water Supply Important?

Fire water supply is the lifeblood of fire protection systems and when demand exceeds supply, the consequences can be disastrous. Fire protection systems depend on a specific pressure and volume of water to control fires and when the supply is not sufficient, their effectiveness is compromised.

As supply becomes diminished, each demand item (e.g. monitor, hose stream, sprinkler system) becomes ineffective in direct proportion to the failing supply. A supply shortage can be evidenced by lower pressures and reduced volumes discharged from the equipment. Every piece of a fire protection system has a minimum water supply design specification and when that standard is not achieved, systems do not function at optimum capacity.



Adequate fire water supply is required to maintain sufficient water pressure and volume, allowing fire protection systems to function optimally

Another more grave consequence of inadequate supply occurs when the water supply source runs dry. For example, if a system demands 10,000 gallons per minute and the system's fire water supply is 100,000 gallons, the system would run dry after only 10 minutes. Most plants have a finite fire water supply and if the allocated amount is not substantial enough to distribute sufficient water to the fire protection systems for the designed amount of time, there is a possibility that fires will not be properly controlled, potentially causing considerable damage to the plant.

How do Plants Become Deficient in Water Supply?

When the hydraulic design calculations for a fire protection system are performed for a specific facility, they are based upon the current configuration of the plant at that time. Because the lifespan of most power generating facilities or industrial processing plants is several decades, it is likely that modifications will be made to the site plan of the plant to reflect fluctuations in production or expansion of the facility. As this occurs, fire protection systems must also expand to correspond with the developing facility to remain in compliance with NFPA standards and insurance underwriters' requirements.

A growing fire protection system demands additional fire water supply but this aspect of system expansion is too often overlooked, putting the facility at risk that their fire protection system will not function as intended in the event of a fire. To perpetuate the issue, many facilities find themselves

under multiple ownership histories, making it a strong possibility that the original design data has been lost. Without the initial design information, it is difficult to make a valid determination about how much fire water supply is needed for systems to function properly. When a plant cannot verify their supply versus their demand, it becomes necessary to conduct testing to establish whether or not modifications need to be made to increase a facility's supply.

Methods for Determining Fire Water Supply

There are a few methods that are effective for determining if fire protection systems are receiving enough water for effective operation. Each of these options has varying degrees of effort, usually with corresponding levels of accuracy.

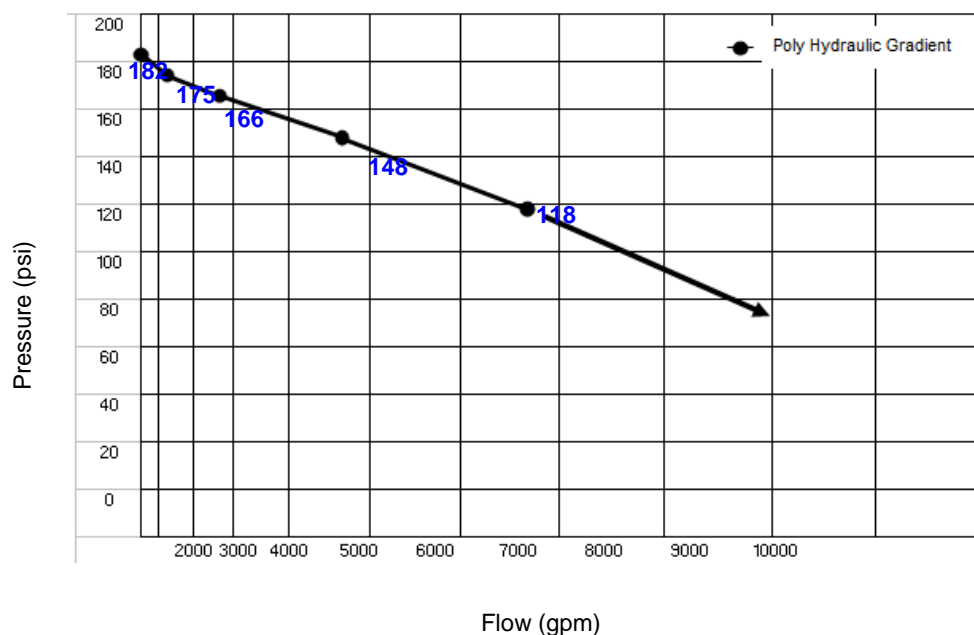
Gradient Flow Test

Conducted to determine the volume of water available at any given location, gradient flow tests are more precise than any computer-modeling-based test because the data is collected from actual flow test results as opposed to theoretical assumptions. Calibrated flow measurement devices are installed at appropriate test locations based on the hazard and system configuration. Water is flowed through the devices at several increasing volumes and the residual pressure is recorded at the test point for each flow rate test. The data is subsequently analyzed and plotted on a flow curve to provide visual results of flow volume in terms of gallons per minute at a specific pressure.



Gradient flow tests are the most accurate indicator of fire water supply, utilizing calibrated flow measurement devices to gauge water pressure

Sample Gradient Flow Test Curve



Fire Pump Performance Test

Another technique for measuring fire water supply that is less intensive than gradient flow tests is a fire pump performance test. These tests are performed to determine the volume of water that is produced by the fire pumps, which is an indicator of the facility's fire water supply.

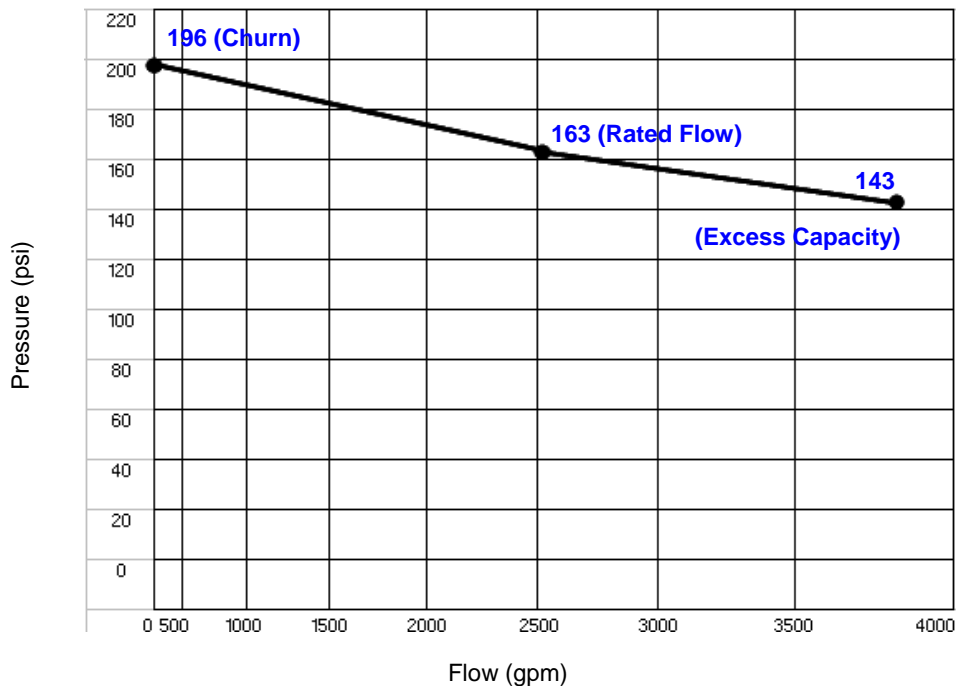
Before beginning the test, the manufacturer's pump ratings, such as gallons per minute (gpm), pressure (psi) and speed of the pump (rpm) must be determined. The pump is tested on three points per NFPA 25:

1. Churn – No flow
2. Rated Flow – Flowed at 100%
3. Excess Capacity – Flowed at 150%



Fire pump tests provide information about a facility's fire water supply by measuring psi at various flow rates

Sample Fire Pump Test Curve



Factor Testing

To rule out the presence of an obstruction that is impeding the flow of water within an underground piping system, a factor test can be conducted. In the event that an obstruction is present within the piping, it can result in excessive loss of volume, rendering the fire protection system ineffective.

Factor test are conducted by using two points – a pressure measurement point and a flow point– that are typically established on a straight run of pipe. The actual distance between the two points is recorded and water is subsequently flowed from the flow point. After data is collected, it is analyzed and compared to the flow characteristics of normal pipe interiors to determine if there is a possible obstruction inhibiting the water flow.



Factor testing can identify obstructions within the piping which impede the flow of water

Methods for Determining Fire Water Demand

Equally important, the fire water demand of a power generating plant or industrial processing facility must be calculated in relationship to the supply. The various methodologies for acquiring this information depend upon not only the level of exactness that the facility requires but also the design information that is available to the personnel conducting the tests.

Hazard Classification

A process that involves taking a detailed inventory of the occupancy and material hazards of a facility, hazard classification surveys verify that the proper fire protection design criteria is being used. Surveys of all handled and stored materials as well as the different structures and their occupancy are performed to determine the hazard classifications throughout the site. Water supply demands can then be assessed based on the acquired data. These surveys are normally performed by someone well-versed in the applicable NFPA standards who has the expertise to formulate an accurate analysis.

Water Spray Systems Analysis

An alternative means for establishing water demand is through examination of each water spray system. If they are available, the facility can utilize the original design prints and hydraulic calculations to determine if the fire water supply meets the demand of the fire protection system. It is crucial to verify that if the system has been modified from its original form that the design and calculations that are being used in the water spray analysis correspond with the current design.

In instances where the original design is not available or reflective of the current installation, the facility must undergo a reverse engineering process to gauge the fire water demand. To begin, the existing pipe must be carefully surveyed and a set of as-built sketches created. Once the sketches have been formed, they are converted into Auto-CAD drawings to create a set of hydraulic calculations. This procedure is far more intensive than the former processes and requires highly skilled professionals who are experienced in fire protection system layout and design.

A Summary of Fire Water Supply vs. Demand

The issue of fire water supply was one that formerly was not a high priority for most power generating plants or industrial processing facilities. However, this aspect of fire protection has recently become a point of focus for many insurance underwriters, which has consequently escalated its importance to facilities as well.

Calculating the supply and demand of a fire protection system can be a complex, labor-intensive endeavor, which unfortunately deters many facilities from completing the process. Many times, the tests that must be performed exceed the knowledge of plant staff and should be performed by qualified fire protection personnel to ensure accurate analyses.

Beyond the requirements of insurance companies, fire water supply is a critical piece of the fire protection puzzle that is essential to the functionality of water-based systems. Having accurate knowledge of the current supply versus demand should be a top concern for facilities that are committed to protecting their valuable assets. When considering all of the time and investment that are spent on maintaining the functionality of fire protection systems, it must be remembered that without adequate water supply to meet the demand, systems may not perform to the degree that is necessary to sufficiently protect facilities.