Maintaining the Heart of the Fire Protection System: What is the Condition of Your Fire Pump?

There are many facets of a water-based fire protection system that must function properly on an individual level for the system to operate as intended. Components such as control valves, waterflow devices and valve enclosures must be fully operative as to not compromise the systems effectiveness. In applications where insufficient water pressure exists, a fire pump acts as the heart of the system; providing the water pressure that is required for water-based systems to effectively control fires. Fire pumps should be a focal point of every inspection, testing and maintenance (ITM) program to mitigate the risk of insufficient water pressure in the event of a fire.

Why are Fire Pumps a Critical Component to a Fire Protection System?

It is critical that fire pumps are kept in optimal condition so that they can provide water-based suppression systems with the water pressure that is necessary for them to function properly.

Fire pumps are not installed in every water-based fire protection application but when they are included, they serve as the lifeblood of the system. Facilities such as power generating plants, chemical processing plants and heavy industrial environments require large volumes of water at high pressures. When the available water supply is insufficient to supply the facility's most hydraulically demanding water-based systems or the supply is of inadequate pressure because it is drawn from a source such as a reservoir or city supply, a pump is required. Determining the need for a fire pump can be accomplished by calculating the pressure and flow differential between supply and demand. When these exceed the supply, the facility must increase the pipe size or add a fire pump to the system. Adding a fire pump is usually the preferred option because it may not be possible to achieve the necessary levels of pressure with larger pipe alone and quite often the costs associated with increasing the pipe size exceed that of installing a fire pump.

Fire pumps are often considered to be the most critical component of a water-based fire protection system because without a fully functional pump, water-based systems can be rendered ineffectual. When fires occur in expansive environments that contain high-risk hazards, it can be catastrophic to discover that a fire pump is not performing optimally. As equipment that is not utilized on a regular basis, it is vital that the condition of fire protection system components is perpetually evaluated. This guideline holds especially true for the fire pump.

Why is Inspection, Testing and Maintenance of a Fire Pump Important?

Upon installation, the design and manufacture of the fire pump equipment must meet stringent quality and testing requirements that are set forth in *NFPA 20: Standard for the Installation of Stationary Pumps for Fire Protection.*
Acceptance testing demands that suction and discharge piping are hydrostatically tested at predefined pressures for extended periods of time. Comprehensive flow tests are conducted to ensure that pumps can deliver the required loads for water-based systems to be effective. The initial testing of fire pumps is stringent and involves equipment manufacturers, the local Authority Having Jurisdiction (AHJ) and an electrical contractor to test all of the electrical wiring.

A well-developed ITM plan is essential to ensuring a fire pump is at peak performance when it is needed in the event of a fire.

This rigorous testing is required because a fire pump's functionality is the cornerstone of water-based fire protection. For this reason, it is equally important that a fire pump is still in peak condition years after it has been installed. Insurance requirements, individual corporate regulations and *NFPA 25: Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems* all dictate the nature and frequency of the measures that must be taken by facilities to preserve the integrity of fire pumps. There will always be some variation in ITM procedures because of disparities in AHJs' and corporate standards but the onus is upon the end user to develop an ITM program that fulfills the requirements of all of the aforementioned.

What Does an Effective Inspection, Testing and Maintenance Program Involve?

Developing an ITM program based upon the recommended manufacturer maintenance schedules is not sufficient to keep all of the ancillary fire pump equipment in optimal condition. NFPA 25 details the ITM procedures that must be performed by a facility at varying intervals to ensure fire pumps will be fully functional when employed:

NFPA 25 ITM Schedule Overview

Inspection Item	**Frequency**
Pump house conditions, heating ventilating louvers	Weekly
Fire pump system	Weekly

Pump Operation Testing	**Frequency**
No-flow condition	Weekly
Flow condition	Annually

Maintenance Procedures	**Frequency**
Hydraulic	Annually
Mechanical transmission	Annually
Electrical system	Varies
Controller and components	Varies
Motor	Annually
Diesel engine system and components	Varies

In addition to performing these actions, it is imperative that facilities keep detailed, comprehensive records of their ITM processes, including any additions or deletions to the systems or changes in occupancy to eliminate any question about the pump's current condition or ability to meet demands of the fire protection systems. Keeping organized, readily accessible documentation not only streamlines the maintenance process but it also simplifies audits from AHJ's, insurance companies or corporate authorities.

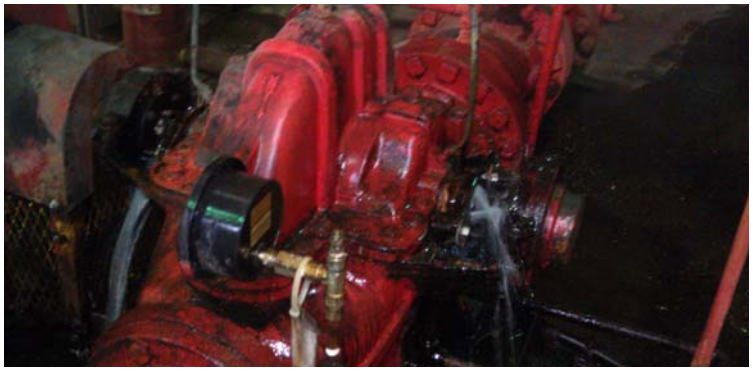
What Types of Issues Can Fire Pump Inspection, Testing and Maintenance Uncover?

Regular inspection and testing can often unearth issues that can be rectified relatively easily but could otherwise result in potentially disastrous consequences if not discovered. It is not uncommon to find a valve in the wrong position following a routine maintenance activity, which could severely impair the pump's ability to function in an emergency if left unchecked. Suction piping or impeller obstructions are additional examples of impediments that can be remedied through straightforward maintenance when they are detected early through abnormal pressures observed during testing.

Oversights related to fire pump maintenance can result in costly impairments and put the facility at risk. This pump was left in "auto" with the cooling water line valve off, resulting in damage to the pump.

Less apparent issues such as air pockets in the suction pipe can result in diminished pressure, hindering the efficiency of the pump. Testing can reveal this deficiency, allowing the facility to locate the pipe and eliminate the air pocket before the impaired pump is called into service in an emergency. Another cause of inadequate pressure can be the drawing of air into the suction connection through leaks in the piping, causing the pump to lose suction.

Negligent ITM practices can also result in serious issues with diesel pumps. Failure to change the oil as frequently as is necessary can cause corrosion in the pump driver, compromising its functionality. Allowing coolant to drop to insufficient levels can result in overheating in the driver, putting the facility at risk that their water-based systems will not have the water pressure necessary to function properly.



Failure to inspect and maintain this pump's packing material resulted in a leak in the pump, consequently compromising the functionality of the pump. Routine inspection and maintenance could have prevented this problem before it worsened.

Investing in Inspection, Testing and Maintenance to Extend the Pump's Life Cycle

In facilities where water-based systems rely on a fire pump to deliver water, there is nothing more important than the functionality of the pump. Without adequate pressure, water-based systems cannot control fires as they are intended to, which can have catastrophic results. In power generating plants, chemical processing plants and heavy industrial environments, it is critical that fire suppression systems function at full capacity to effectively mitigate risks associated with specific equipment. In applications that have electrical equipment such as transformers or in hazardous areas that contain oil or flammable liquids, it is essential that sprinklers deliver the appropriate amount of water and that the spray is of a specific pressure. When there is insufficient pressure or volume, the facility is left vulnerable to fires.

The initial investment of a fire pump is substantial, which makes the protection of this investment even more significant. Fire pumps are manufactured to have long life cycles *if the proper ITM measures are taken.* Establishing and consistently executing a strategic ITM plan that follows the guidelines set forth by NFPA 25, the local AHJ, insurance companies and corporate requirements is a major undertaking. Documenting inspection and testing information can also be a daunting, time-consuming task that requires diligence and a high level of organization. However, with the right resources such as fully developed inspection and testing forms, a streamlined documentation system and knowledgeable experts to perform ITM functions, a facility can maximize the life cycle of its fire pumps while being afforded the peace of mind that their valuable assets are being protected.