Date: January 8, 2019

From: Denny Miller
Re: Testing Foam-Water Fire Protection Systems

With the rising costs of permitting, construction, business interruption, and the complexity of commodities we utilize in our everyday lives, fire protection systems have evolved to maintain pace to protect assets and save lives. Low, medium, and high expansion foam-water based systems are commonly used on a wide variety of flammable and combustible hazards. When properly designed, installed, and maintained, they have been proven as a low cost and efficient means of vapor suppression and fire protection. Although the general thoughts are centered on the issue of capital expense without a return, these systems do have a value otherwise code, corporate guidelines, and/or insurance companies would not require them. However, the cost of ownership does not end with the initial installation and acceptance. In order to insure their functionality in the time of need, these specialized systems and their supportive components should be tested at recommended frequencies. Unless superseded by another pamphlet, the environment in which they are installed, or more stringent code, NFPA #25 outlines minimum acceptable testing frequencies of these systems.

In the vast number of systems we have reviewed to be tested, one overwhelming issue arises. In the initial design and installation, no consideration was given to testing or that which was provided, does not meet the requirements. An aircraft hangar may allow an initial foam discharge to the service area at commissioning time, but what about the next annual test when it is occupied? Ideally, a program to accomplish continued testing should be incorporated into the project and placed into the operation manuals with the owner.

What are the principle highlights when testing a system and its supportive components? If we breakdown each of the entities comprising these systems, a major factor is water supply. If the system designed uses a 3% concentration, then 97% is water. Whether the water supply is a dedicated water tank with a pump or a public water main, age or main extensions can be deteriorating factors over time. It is then the most obvious component to be tested first. The results of the pump or city flow test should be compared to those noted in the original acceptance of the system. If deviations are identified that would impair the operation of the foam system, then corrective action should be taken before the foam proportioning testing continues.

When a system can be discharged to the hazard, normally a “water only” delivery would suffice. The foam injection valve is isolated so that no foam is introduced into the system. These systems are hydraulically designed and a certain pressure is required to provide sufficient flow for the system to provide adequate coverage. Placing a test gauge at the remote end discharge device will enable the technician to identify whether

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there is adequate pressure and flow to the system. If there is too much pressure on the gauge, devices or nozzles may be plugged upstream. If there is too little, piping may be obstructed or outflows from damaged piping may be occurring. During this stage of testing, other key devices that are initiating flow can be tested for operation. Deluge, pre-action, and alarm check valves all have operating characteristics that can be checked during this discharge. Again, if results obtained in this sequence are values contrary to the original design, corrective actions should be taken before attempting to discharge foam and verify proportioning.

Testing with foam seems to be the most complex and costly component in the sequence of testing. The environmental issues drive the way we should be designing the systems for testing. Every design should contemplate the ultimate disposition and disposal of foam solution after testing is completed. Large scale users of foam systems may have a site wide waste collection and containment whereas the lesser have arranged with the waste/sewer authority for a direct discharge. On the other hand, those with neither may have to have tanker trucks with connections to allow system discharge and then transport to a waste disposal facility. This is why the previous sequencing of testing needs to be carried out first. Ultimately, when foam testing is carried out, the expense of multiple tests can be costly!

In testing foam proportioning, taking foam concentrate samples from the storage tank for laboratory analysis is necessary but does not constitute a complete test. If you are testing to a single flow or range of flows as in a closed head foam water sprinkler system, these flows must be established, foam concentrate injected, and test samples retrieved for evaluation. If the test flows do not terminate at the discharge devices in the hazard, then the proper quantity and sized connections need to be available downstream of the proportioning device. With a series of block off valves, isolation from the hazard and direction of the flow to the testing connections can be accomplished. The location of the testing discharge should be derived from the testing plan and the disposition of the spent solutions. It is preferred to take solution samples necessary for evaluation on proportioning immediately downstream of the proportioning module and not at the end of the system. Therefore, a small, 1” diameter test valve should be at that location to obtain samples. In the example of the 3% system, on the original commissioning, results obtained should be within the range of 3.0 to 3.9%. The results obtained within this test should mirror those original results given similar conditions. Once laboratory analysis is returned and the concentrate is acceptable, replenishment of the quantity of stored foam to the appropriate design level is essential. Insure all valves and devices are returned to their normal standby condition when testing is completed.

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All special systems of this nature are either controlled or monitored by another electrical or pneumatic system(s). It is necessary to test these systems as well. Detection and control monitoring have a specific role in the matrix of the system. This sequence should also be tested by the frequency and methods established by their respective standards and/or manufacturers recommendations.
In addition to the assurance that a maintained and tested system will operate in the event of an emergency, it also is necessary for fire code compliance and is a factor in insurability. A well-organized owners' file should be maintained at the location of the system. This file would contain the following:

- Original design documents including hydraulic calculations
- Original commissioning/testing documents/procedures that took place before the systems were placed in service
- Subsequent testing reports depicting test results, deficiencies discovered, and corrective actions to be taken
- Documents correcting deficiencies from the previous testing
- Results of any laboratory analysis of the foam concentrate
- Any documents that represent alterations made to the original design.

We hope this information is of benefit to those designing, installing, or contemplating testing foam-water systems. If we can be of further assistance, please feel free to contact our office using the information noted below.

Regards,

Dennis R. Miller
ASSOCIATED FIRE SPECIALISTS, LLC