

RELIABILITY OF FIRE PROTECTION WATER SUPPLIES

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1.0 SCOPE

This data sheet provides fire protection water supply arrangement recommendations that are intended to ensure that water supplies are continuously available as designed.

This data sheet addresses minimum requirements for fire protection water supplies and risk factors for determining when higher levels of water supply reliability may be considered.

See the appropriate FM Data Sheet for equipment design, installation, maintenance and testing, and fire protection impairment handling.

1.1 Changes

April 2021. Interim Revision. Minor editorial changes were made.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Protection

2.1.1 Fire Protection Water Supplies

2.1.1.1 Provide a reliable water supply for sprinkler systems. A **reliable** water supply is one that is properly arranged, installed, and maintained in accordance with FM data sheets, equipment manufacturers' requirements and whose operating history is free of recurring unplanned/unsupervised impairment conditions.

2.1.1.2 Ensure the water supply is available on a continuous basis and maintained in accordance with the applicable FM Data Sheet. Water supplies should not be subject to conditions that create frequent or prolonged interruptions of service.

Reliability of typical water supply sources in order of preference, include the following:

1. Direct connection to a reliable public or industrial (private) water supply.
2. Connection to an on-site gravity tank.
3. A fire pump(s) taking suction from a closed top tank.
4. A fire pump(s) taking suction from a reliable public or industrial (private) water supply.
5. A fire pump(s) taking suction from an open top reservoir (pond, lake, or river).
6. A fire pump(s) taking suction from a break tank.

2.1.1.3 Provide a reliable water supply that is free from the following conditions.

- A. Deterioration or periodic fluctuations in the water source that reduce the available fire protection water below demand requirements.
- B. Equipment or material deterioration due to age or neglect.
- C. Unreliable fire pumps due to arrangement or conditions.
- D. Improper equipment installation or arrangement.
- E. Improper use of fire protection equipment.
- F. History of impairments to the water supply system.
- G. History of delayed action/response to impairment conditions.
- H. Exposure to unplanned interruption of service from natural hazards (earthquake, wind, flood, freeze, brush fire, etc.).

2.1.2 Enhanced Water Supply Reliability

The water supply recommendations in Section 2.1.1 are minimum criteria for a reliable water supply. When there is an undesirable risk to property and/or operations and a higher level of water supply reliability is desired, consider an enhanced water supply.

Consider that all water supplies will be taken out of service at some point; either unexpectedly (e.g., component or system failure) or for periodic planned maintenance. Depending on the size or nature of the protected facility, being without automatic fire protection for even a short period of time creates property risk which may be unacceptable.

An enhanced water supply meets all of the recommendations described in Section 2.1.1 and is supplemented by a secondary source. This includes (in order of preference):

- A. Two or more fully independent and physically separated water sources that each meet the recommendations for reliability (as described in Section 2.1.1.3) and adequacy and are not subject to a common impairment.
- B. Two adequate water sources that are subject to a common impairment (e.g., an electric and a diesel fire pump taking suction from a common tank).
- C. A single source with redundancies within the system (e.g. An electric pump fed from the municipal power supply and an emergency generator).
- D. A secondary source that is reliable but may not be fully adequate.

Guidance for considering an enhanced water supply can be found in Appendix C.

3.0 SUPPORT FOR RECOMMENDATIONS

Water supplies for fire protection systems are a critical aspect of the overall facility fire protection reliability. Careful consideration is needed when planning a new fire protection water supply.

3.1 Loss History

FM client loss history in sprinklered buildings shows that lack of adequate valve supervision, impairment handling, and lack of adequate testing and maintenance cause approximately 80% of sprinkler system failures. A further 16% of sprinkler system failures are attributed to prematurely shutting off the sprinkler system during a fire event. There is almost no history of uncontrolled fire losses at adequately sprinklered properties where a single water supply exists that is properly designed, installed, maintained, and tested. For this reason, FM recommends a single adequate and reliable fire protection water supply. Additional considerations, such as facility size/value, business continuity, occupancy, arrangement and condition of water supply and geographic location may drive the need for higher levels of reliability and water supply duplication.

4.0 REFERENCES

4.1 FM

Data Sheet 1-2, *Earthquakes*
Data Sheet 2-8, *Earthquake Protection for Water-Based Fire Protection Systems*
Data Sheet 2-81, *Fire Protection System Inspection, Testing and Maintenance*
Data Sheet 3-2, *Water Tanks for Fire Protection*
Data Sheet 3-7, *Fire Protection Pumps*
Data Sheet 3-10, *Private Fire Service Mains and Connections*

4.2 Other

NFPA 20: *Stationary Pumps for Fire Protection*, 2016 edition
NFPA 22: *Standard for Water Tanks for Private Fire Protection*, 2013 edition
NFPA 24: *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2016 edition
NFPA 25: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2014 edition

APPENDIX A GLOSSARY OF TERMS

Adequate Water Supply: A water supply that is expected to provide sufficient volume, flow, pressure and duration to supply sprinklers and hoses as required by FM Data Sheet requirements for fire suppression.

Reliable Water Supply: A water supply that is properly arranged, installed and maintained in accordance with FM Data Sheets and manufacturers requirements such that water will be supplied in accordance with its design parameters going forward under both normal and natural hazard conditions.

Water source: A single source used to provide water to a fire protection system (e.g., a single connection to a public water supply, a single pump, a gravity tank).

Water supply: All sources of water feeding fire protection systems, including the distribution system.

APPENDIX B DOCUMENT REVISION HISTORY

April 2021. Interim Revision. Minor editorial changes were made.

October 2017. This is the first publication of this data sheet.

APPENDIX C ENHANCED WATER SUPPLY RISK FACTORS

Consider the following risk factors to determine if enhanced water supply reliability should be considered. There is no prescriptive approach to determining the required water supply reliability at a given location. In some cases, a single factor may justify the need for enhanced reliability; in others, enhanced reliability would not be necessary unless there were multiple factors present.

C.1 Risk Factors

C.1.1 Size, Value

Is there significant property value at risk?

Explanation: If the fire protection is impaired at the onset of a fire in an undivided, single building with continuity of combustibles, the fire is likely to spread throughout. If the property is split between multiple buildings there may be a greater chance of stopping the fire.

C.1.2 Business Continuity

Would an uncontrolled fire have a significant business impact? Are high-value operations going on? Would there be long rebuild and equipment procurement lead times? Consider upstream and downstream interdependency and supply-chain interruption.

Explanation: At facilities that are identified as essential to business operations, the loss of the facility would result in a severe disruption to business. The disruption could affect just the facility in question or have upstream or downstream consequences that could idle other facilities.

C.1.3 Occupancy

Does the occupancy have a history of frequent fires? (woodworking, machine shop, heat treating, etc.) Does the occupancy or building construction promote rapid fire spread? (warehousing, ignitable liquids, combustible construction, accumulations of oil, dust, or lint, etc.)

Explanation: A high frequency of fires makes it more likely that a fire will occur during an impairment of the fire protection. An occupancy that promotes rapid fire spread makes it highly likely that a fire will grow out of control in the period between the fire's incipient stage and fire service intervention. These occupancies are totally reliant on the performance of their automatic fire protection systems preventing a fire from growing out of control, so a water supply that is rarely out of service is desirable.

C.1.4 Arrangement and Condition of Water Supply

Does the facility have extensive lengths of water supply mains between the furthest area of the plant and the fire protection water supply? How old is the fire protection equipment? Is there any history of underground main breaks? Are there other unfavorable factors present, such as horizontal-shaft pumps that need priming because they take suction under lift? Is there an alternative means of supplying water to fire protection in the event that the primary supply is out of service? (Examples: Can sprinklers be fed from a secondary water supply while a pump is being repaired? Can a pump draw water from a portable tank while the primary suction tank is being repaired?)

Explanation: Having extensive lengths of underground mains can increase the likelihood of an impairment. The reliability of a water supply is affected by its physical configuration. For example, water can be fed around a leak in a looped water main that is fitted with appropriate divisional valves, whereas damage to a single pipe carrying water from a source to its point of use may impair the fire protection. A water pipe may be exposed to freezing, vulnerable to impact damage above ground or earth movement underground. If the facility fire protection systems are supplied by a single water line, that supply is vulnerable to an impairment taking the entire facility fire protection system out of service. Pumps taking suction under lift may be susceptible to failures in priming systems.

C.1.5 Geographic Location

Consider the reliability of utility systems as well as any natural hazards such as earth movement, windstorm, freeze, brush fire or flood that could take the primary water supply out of service.

Explanation: Depending on the water supply arrangement, a natural hazard may impair the fire protection water supply. Would a second or an alternate type of water source improve the system reliability? Is there an onsite self-contained water source that is not dependent on an off-premises utility?

Example: A facility protected by an electric fire pump that is fed by above ground electrical power cables may be vulnerable to a wind or ice storm.