



Technical Advisory Bulletin

Fire Pump Testing

Fire pumps are a critical part of a fire protection system, especially when they are fed via suction from water tanks. Properly maintained and tested, fire pumps will deliver countless years of worry-free performance.

Two types of testing of fire pumps are needed: 1) Weekly/monthly testing, typically done by facility personnel and 2) annual flow testing that should be done by a contractor. Maintenance and testing of fire pumps should be in accordance with [NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems](#).

The current edition of NFPA 25 requires weekly tests of diesel-driven fire pumps and monthly tests for most electric pumps. However, weekly tests of electric fire pumps are required 1) if a pump serves a high rise building that is beyond the pumping capacity of the fire department, 2) for pumps with limited service controllers, 3) for vertical turbine fire pumps and 4) for pumps that take suction from ground-level tanks or a source of water that does not provide sufficient pressure to be of material value without the pump. Some insurers or authorities having jurisdiction (AHJs) may require weekly testing of electric fire pumps even without any of the above four conditions.

Weekly/monthly fire pump inspections and tests

The weekly/monthly test should be accomplished by a pressure drop. This may be done by opening the valve on the sensing line or another valve in the pump room. Electric pumps should be run for

a minimum of 10 minutes; diesel-driven pumps, a minimum of 30 minutes. Sample forms for weekly/monthly inspections and tests are attached to this bulletin.

Annual fire pump flow test

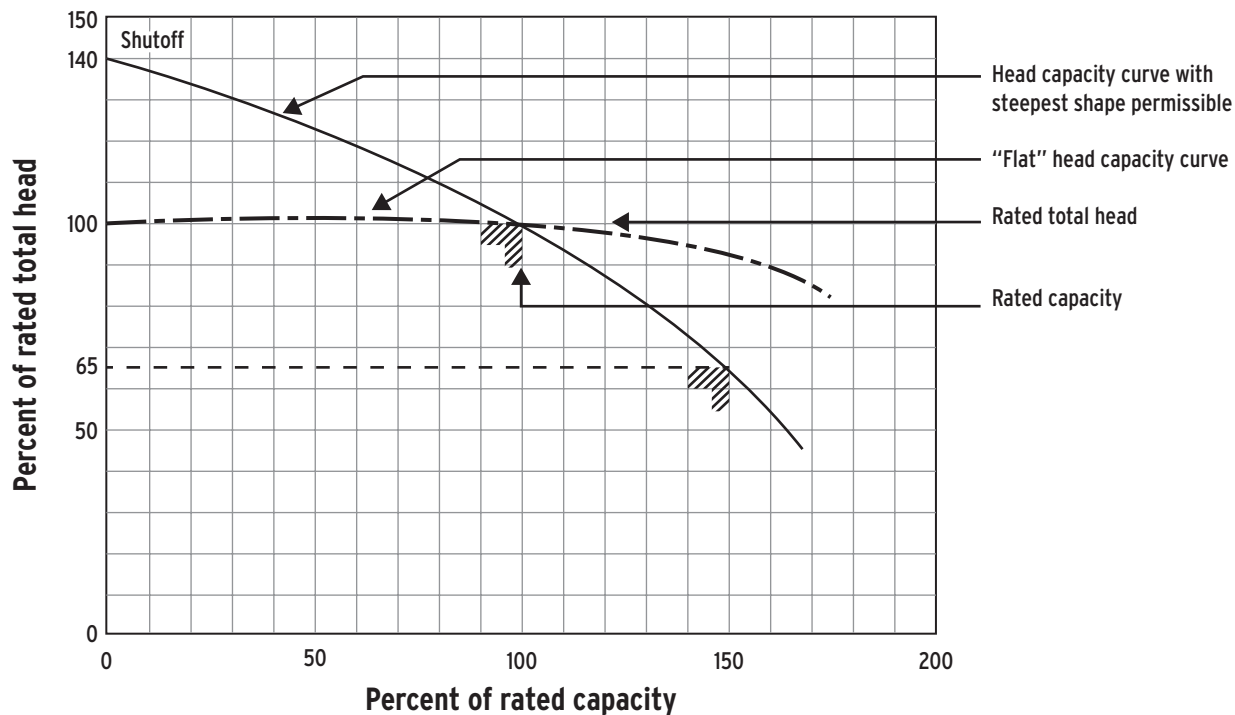
An experienced third-party contractor should perform the annual test. It is not unusual for the performance test results to indicate a problem with the fire pump or with the pump's water supply. However, the contractor often will not interpret the test results for the building owner. Therefore, the building owner must know how to interpret fire pump performance test data. If a problem is identified the contractor should try to address the problem while on site.

This bulletin will provide building owners with information to help them understand and interpret data from the annual performance testing of centrifugal pumps. This information applies to centrifugal pumps only. Other types of pumps have different performance characteristics.

Fire pumps should furnish the pressure delivered during the initial fire pump acceptance test or the pressures as indicated on the pump nameplate. When this information is not available, the pump should deliver:

- 150% of rated capacity at 65% of rated pressure
- 100% of rated capacity at rated pressure
- A maximum of 140% of rated pressure at churn (no flow)

The following figure illustrates the pressures the pump should produce. Acceptable test results can be up to 5% below the above figures due to possible experimental error. Test results worse than 5% below the above figures should be investigated and corrected.



Analysis of a sample fire pump flow test

The results of a fire pump flow test that is taking suction from a 12-inch public water main are shown below (related data color-coded for clarity). The pump is rated at 2500 gpm at 110 psi and is driven by a 200 hp electric motor. At churn (dead head or no flow), the pump nameplate indicates the pump will deliver 129 psi; at the rated flow of 2500 gpm, it will deliver 110 psi, and at 150% of rated flow (3750 gpm) it will deliver 82 psi. The pump test yielded a churn pressure of 126 psi, 117 psi at rated flow and 97 psi at 150% of rated flow (3750 gpm). Therefore, the pump delivered better results than shown on the pump nameplate and is considered to be in good or excellent condition.

If the pump nameplate data had not been available, the pump would have been expected to produce a maximum pressure of 154 psi (140% of pump rating of 110 psi) at churn, a minimum of 110 psi at 2500 gpm and 71.5 psi (65% of pump rating of 110 psi) at 3750 gpm.

Fire Pump									Fire Pump Motor							
Make	ITT AC - 10X8X20F								Make	WEG					HP	200
Size	L	Type	8100		Stages	1			RPM	1780	AMPS	220	VOLTS	460		
RPM	1785	N/S	123456789						FRAME	0	S/N	9876545321				
IMP DIA		17		GPM	2500	at	110	PSI								
Dead Head Pressure			129	PSI	150% at	82	PSI		Coupling		WOODS					

RPM	VOLTS			AMPS			PRESSURE			PITOT TUBE PRESSURE						GPM
							SUCT	DISCH	NET							
1794	486	486	488	87	97	1063	44	170	126	CHURN						0
1780	481	482	485	194	196	200	28	145	117	16	14	14	14			2568
1776	480	483	481	222	222	236	18	115	97	19	19	20	20	20		3732

Water supply performance

The annual fire pump performance test is also an opportunity to determine if there are any problems with the fire pump water supply, such as shut or partially shut valves or obstructions from the water supply to the pump. If the test is conducted with a flow meter, it usually will not be possible to identify problems with the fire pump water supply.

Determining if there is a problem with the fire pump water supply can be difficult unless the person analyzing the test results is familiar with the water supply for the pump and understands hydraulics. The results of the pump test can be compared to previous pump tests to identify any potential problems; however, this may not identify water supply problems that have existed for some time.

In the above example, the city water pressure was 44 psi at no flow, 28 psi at a flow of 2568 gpm and 18 psi at 3732 gpm at the suction side of the fire pump. We don't know the details of the public water system, except that the pump is supplied by a 12-inch water main. It appears that there is not any problem with the water supply to the pump. Had the pressure dropped to a value of 18-20 psi at 2500 gpm, there may have been reason to believe there could be a problem with the public water supply.



Pictures showing a fire pump and a hose monster after a fire pump flow test. The underground water main supplying the pump had not been properly flushed prior to installing the fire pump.

Fire pump flow testing safety and procedural considerations

1. Some pump tests may expose personnel to a confined space; a fall; drowning, electrical, fuel and/or battery explosion hazards. Proper safety precautions must be taken for these and any other potential hazards.
2. If electric fire pump controllers do not have built-in ammeters and volt meters they should only be opened to take amp and voltage readings by qualified electricians who have had proper training and have appropriate personal protective equipment. If a qualified electrician is not available electrical readings should not be taken.
3. Minimize the number of personnel involved in conducting or witnessing the test.
4. Under no circumstances should anyone (including professional fire fighters) manually hold any hoses or hose nozzles during a fire pump test. Hose nozzles must be secured so that there is no chance they will come lose. "Hose monsters" are safer to use than hose nozzles.
5. Avoid discharging nozzles back into the top of a tank. If it is necessary to do so, provide adequate ladders, platforms and guard rails.
6. Hoses should be arranged to minimize damage. If freezing weather is expected have melting salt available.
7. Everyone present should know how to shut the pump off in an emergency.
8. The contractor should replace the fire pump gages with recently calibrated gages.
9. The contractor should carefully examine the pump test header and the pipe and pipe fittings between the pump and pump test header. They should be in good condition and securely attached to the supply pipe.
10. Carefully examine the hose valves on the test header. They should be in good condition, free of any significant rust and free of cracks. Ensure the hose or nozzles are screwed all the way onto the hose valves.
11. Carefully examine the condition of the fire hoses, hose couplings and hose nozzles. Replace any hose that shows signs of possible failure. This is especially important if the test header is located inside the pump room or building. Request documentation on the most recent hydrostatic test of the fire hose if there is any doubt. The use of "hose monsters" instead of hose nozzles reduces the likelihood of injuries.
12. When a fire hose is used, be sure the nozzle is secured so it cannot work or vibrate loose.
13. Be sure to check the oil level, coolant level, battery electrolyte level (low electrolyte level can cause the battery to explode) and fuel level before starting the engine.
14. The fire pump should be started manually to prevent any pump running timers from operating during the test.
15. Before starting the test, only the personnel necessary for the test should be in the vicinity of the hoses and pump.
16. Adjusting water flow through the test header with the test header control valve (typically a 6-10 inch valve) is generally safer and faster than adjusting water flow with the 2½-inch test header valves.
17. Aim hose nozzles or "hose monsters" so that discharged water will not cause damage or injury.
18. During the test, run variable speed drivers (engine or turbine) under governor control.

As a critical part of a fire protection system properly maintained and tested, fire pumps will provide numerous years of reliable performance.

Contact

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Sample monthly electric fire pump report

Pump Location: _____ Pump Rating: _____ gpm @ _____ psi @ _____ rpm

Completed by: _____ Date: _____

1. Is fire pump controller on "automatic"? yes ☐ no ☐
2. Is jockey pump controller on "automatic"? yes ☐ no ☐
3. Are all jockey pump and fire pump control valves open? yes ☐ no ☐
4. Is jockey pump running frequency normal? yes ☐ no ☐
5. Is pump room adequately heated? yes ☐ no ☐
6. Did fire pump start automatically by a drop in water pressure? yes ☐ no ☐
Pump start pressure: _____ psi
Pump discharge pressure: _____ psi
Pump suction pressure: _____ psi
7. Are pump bearings operating at normal temperature? yes ☐ no ☐
8. Are pump packing glands leaking sufficient water? yes ☐ no ☐
9. Is pump free of unusual noises and vibrations? yes ☐ no ☐
10. Is pump circulating relief valve operating? yes ☐ no ☐
11. Is the pump test header drained to prevent freezing? yes ☐ no ☐
12. Is a charged fire extinguisher in the pump room? yes ☐ no ☐
13. Is pump room clean and free of combustible materials? yes ☐ no ☐
14. Is pump controller's "Power Available" light on? yes ☐ no ☐
15. Did all remote pump alarms function properly? (i.e., running, power loss, etc.) yes ☐ no ☐
16. Was water tank overfilled to verify it's full, or is reservoir at normal level? yes ☐ no ☐
17. Was pump run for at least 10 minutes? yes ☐ no ☐
18. Were both the jockey pump and fire pump controllers left on "automatic"? yes ☐ no ☐

Explain all "No" responses and corrective actions taken: (Ex: 8. Pump packing leaking too much – repaired 5/1)

Reviewed by: _____ **Date:** _____

Sample weekly diesel fire pump report

Pump Location: _____ Pump Rating: _____ gpm @ _____ psi @ _____ rpm

Completed by: _____ Date: _____

1. Is fire pump controller on automatic? yes ☐ no ☐
2. Is jockey pump controller on "automatic"? yes ☐ no ☐
3. Are all jockey pump and fire pump control valves open? yes ☐ no ☐
4. Is diesel fuel line locked open? yes ☐ no ☐
5. Is jockey pump running frequency normal? yes ☐ no ☐
6. Is pump room adequately heated? yes ☐ no ☐
7. Is adequate combustion air provided? yes ☐ no ☐
8. Is engine oil at the correct level? yes ☐ no ☐
9. Is engine coolant at the correct level? yes ☐ no ☐
10. Is water level and specific gravity correct for both batteries? yes ☐ no ☐
11. Does battery charger appear to be functioning properly? yes ☐ no ☐
12. Did fire pump start automatically by a drop in water pressure? yes ☐ no ☐
Pump start pressure: _____ psi
Pump discharge pressure: _____ psi
Pump suction pressure: _____ psi
13. Did fire pump start manually on each set of batteries? yes ☐ no ☐
14. Are pump bearings operating at normal temperature? yes ☐ no ☐
15. Are pump packing glands leaking sufficient water? yes ☐ no ☐
16. Is pump free of unusual noises and vibrations? yes ☐ no ☐
17. Is engine cooling water discharging effectively? yes ☐ no ☐
18. Is the pump test header drained to prevent freezing? yes ☐ no ☐
19. Is a charged fire extinguisher in the pump room? yes ☐ no ☐
20. Is pump room clean and free of combustible materials? yes ☐ no ☐
21. Did all remote pump signals function properly? (i.e., running, controller not on "automatic", etc.) yes ☐ no ☐
22. Was water tank overfilled to verify it's full, or is reservoir at normal level? yes ☐ no ☐
23. Was pump run for at least 30 minutes? yes ☐ no ☐
24. Did engine achieve proper operating temperature, speed & oil pressure? yes ☐ no ☐
Record the following: Water temperature: _____ °F Engine speed: _____ rpm
Oil pressure: _____ psi Engine hours: _____ hrs
25. Is diesel fuel tank at least ¾ full? yes ☐ no ☐
Record fuel tank level: _____
26. Were both the jockey pump and fire pump controllers left on "automatic"? yes ☐ no ☐

Explain all "No" responses and corrective actions taken: (Ex: 8. Pump packing leaking too much – repaired 5/1)

Reviewed by: _____ Date: _____

The observations, comments and suggestions we have made in this publication are advisory and are not intended nor should they be taken as legal advice. Please contact your own legal adviser for an analysis of your specific facts and circumstances.

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