Fire Pump Inspection, Testing and Maintenance

NFPA 20; 2019 Edition
NFPA 25; 2020 Edition

Housekeeping
- Participate in Polling
- Ask questions
- Post Training Assessment
Guidelines for earning IACET CEUs

1. Attendee must register/sign-in with all required information.
2. Attendee must attend the entire online session (monitored by polling and the host).
3. Attendee must actively participate in discussion via polling and chat function.
4. A passing score of 70% on the final assessment (within 24 hours).
5. Successful completion will earn attendee 0.1 CEU

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Portfolio of Flagship Brands

Learning Records

If you need copies of your records from class or the learning record policy, please contact Talya Pacheco at training@tycofp.com, 401-781-8220 ext 0500, 1467 Elmwood Avenue, Cranston, RI 02910.
Poll Questions 1 and 2

How comfortable are you with fire pump installation and ITM?

A. This is brand new to me.
B. I understand the concept but have limited experience.
C. I am very familiar with the topic.
D. I am extremely familiar with the topic.

How do pumps relate to your job?

A. I inspect, test and maintain fire pumps for customers.
B. I review inspection, testing and maintenance reports for customers.
C. I am responsible for pumps on my site.
D. They don’t, I would like to gain more information.
E. Other

Introduction

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Purpose

- To provide adequate pressure and flow rate to satisfy the designed demand of the fire protection systems it supplies.
  - Systems can be designed to be supplied from a municipal or private water supply or to be installed within a static water supply.
  - Can be driven by electric, diesel, or steam.
Horizontal Split Case

- Common fire pump type
- Capable of high flows and high pressures
  - 150-7000 GPM
  - 40-500+ psi
- Can be horizontal or vertical

Horizontal Split Case Cut-Away
**End Suction**

- Usually used in lower flow situations 50 -1500GPM.
- Lower pressures <175 psi
- Less dependent on additional base support

**Inline**

- Lower space requirements
- Lower flow rates 50-1500 GPM
- Lower pressures <175 psi
- Common centerline makes piping arraignment easier
**Vertical**

- Utilized for pulling water from a below grade tank or well
- Common flows from 250-5000GPM
- Capable of high pressures in excess of 500 psi
- Can be electric or diesel powered with right angle gear drive

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**4.14.3 Heat**

- An approved or listed source of heat shall be provided for maintaining the temperature of the pump room or pump house, where required, above 40°F (4°C).

- The requirements of 11.6.5 shall be followed for higher temperature requirements for internal combustion engines.
Normal Lighting and Drainage

- 4.14.4.1 Artificial light shall be provided in the pump room or pump house.

- 4.14.7.1* Floors shall be pitched for adequate drainage of escaping water away from critical equipment such as the pump, driver, controller and so forth.

- 4.14.7.2 The pump room or pump house shall be provided with a floor drain that will discharge to a frost-free location

4.14.8 Guards

- Couplings and flexible connecting shafts shall be installed with a coupling guard in accordance with Section 7 of ANSI B11.19, Performance Requirements for Safeguarding.
Poll Question 3

Which of the following standards lays out the installation requirements for fire pumps?

A. NFPA 20  
B. NFPA 25  
C. NFPA 13  
D. NFPA 72

Fire Pumps Components
Drivers
- Electric motor
- Diesel engine

Electric Motor
- Most common
- Direct feed from utility
  - Disconnect ahead of building power shut-off
- High voltage
- Risk of arc flash
Electric Fire Pump

Pump

Electric Motor

Electric Fire Pump

Coupling Shroud
Electric Fire Pump

Casing Air Relief

Electric Fire Pump

Circulation Relief Valve
**Electric Motor Driven Pump**

- Both suction control & discharge control valves must be open

**Electric Pump Controller**

- Pressure Sensing Line
Electric Pump Controller

- Manual Start Button
- Stop Button

Diesel Engine

- More reliable than electric motor driven pumps
- More required maintenance
Diesel Fire Pump

Diesel Pump Cooling Line
Diesel Fire Pump Batteries

Diesel Pump Controller

Pressure Sensing Line
**Diesel Pump Controller**

Ability to manually start using either button

**By-pass**

Bypass

Control Valves Normally Open
Test Line

Jockey Pump
Poll Question 4

How does a fire pump start in a fire scenario?

A. Manual Green Button Start  
B. Pressure Loss Sensed by a Pressure Transducer  
C. Smoke Detection
NFPA 25 2020 8.1.1.2

- NFPA 25 (2020) Table 8.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allipers</td>
<td>Annually</td>
<td>8.3.8.4</td>
</tr>
<tr>
<td>Cable/wire insulation</td>
<td>Annually</td>
<td>8.1.1.2.5</td>
</tr>
<tr>
<td>Diesel engine system</td>
<td>Weekly</td>
<td>8.2.2(1)</td>
</tr>
<tr>
<td>Electric system</td>
<td>Weekly</td>
<td>8.2.2(5)</td>
</tr>
<tr>
<td>Engine crankcase breather</td>
<td></td>
<td>8.1.1.12</td>
</tr>
<tr>
<td>Exhaust system, drain condensate trap, and silencers</td>
<td>Annually</td>
<td>8.1.1.11</td>
</tr>
<tr>
<td>Flexible hoses and connections</td>
<td>Annually</td>
<td>8.1.1.2.11</td>
</tr>
<tr>
<td>Fuel tank vents and overflow</td>
<td>Annually</td>
<td>8.1.1.2.10</td>
</tr>
<tr>
<td>Plumbing parts — inside and outside of panels</td>
<td>Annually</td>
<td>8.1.1.2.6</td>
</tr>
<tr>
<td>Primed circuit board (PCB) corrosion</td>
<td>Annually</td>
<td>8.1.1.2.4</td>
</tr>
<tr>
<td>Pump</td>
<td>Weekly</td>
<td>8.2.2(2)</td>
</tr>
<tr>
<td>Pump house/room</td>
<td>Weekly</td>
<td>8.2.2(0)</td>
</tr>
<tr>
<td>Shaft movement or endplay while running</td>
<td>Annually</td>
<td>8.1.1.2.1</td>
</tr>
<tr>
<td>Steam pump system</td>
<td>Weekly</td>
<td>8.2.2(5)</td>
</tr>
<tr>
<td>Suction screen</td>
<td>Annually</td>
<td>8.3.5.15</td>
</tr>
</tbody>
</table>

NFPA 25 2020 8.1.1.2

- NFPA 25 (2020) Table 8.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

<table>
<thead>
<tr>
<th>Test</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic transfer switch</td>
<td>Annually</td>
<td>8.3.5.12</td>
</tr>
<tr>
<td>Automatic transfer switch and emergency/standby generators</td>
<td>Per NFPA 110</td>
<td>8.3.6.1, 8.3.6.2</td>
</tr>
<tr>
<td>Diesel engine-driven fire pump (no flow)</td>
<td>Weekly</td>
<td>8.3.1.1</td>
</tr>
<tr>
<td>Diesel fuel testing</td>
<td>Annually</td>
<td>8.3.4.1</td>
</tr>
<tr>
<td>Electric motor-driven fire pump (no flow)</td>
<td>Weekly/monthly</td>
<td>8.3.1.2</td>
</tr>
<tr>
<td>Electronic control module (ECM)</td>
<td>Annually</td>
<td>8.3.5.13</td>
</tr>
<tr>
<td>Fire pump alarm signals</td>
<td>Annually</td>
<td>8.3.5.3.3</td>
</tr>
<tr>
<td>Flow meters</td>
<td>Annually</td>
<td>8.3.5.3.3</td>
</tr>
<tr>
<td>Fuel tank, float switch, and supervisory signal for interstitial space</td>
<td>Quarterly</td>
<td>8.1.1.2.7</td>
</tr>
<tr>
<td>Gauges, transducers, and other devices used for testing</td>
<td>Annually</td>
<td>8.3.5.3.2</td>
</tr>
<tr>
<td>Main pressure relief valve</td>
<td>Annually</td>
<td>8.3.5.11, 8.3.6.2.3</td>
</tr>
<tr>
<td>Pump house/room environmental conditions</td>
<td>Weekly/monthly</td>
<td>8.3.2, 8.3.5</td>
</tr>
<tr>
<td>Pump operation (no flow)</td>
<td>Weekly/monthly</td>
<td>8.3.2, 8.3.5</td>
</tr>
<tr>
<td>Pump performance (flow)</td>
<td>Annually</td>
<td>8.3.5, 8.3.5</td>
</tr>
<tr>
<td>Supervisory signal for high cooling water temperature</td>
<td>Annually</td>
<td>8.1.1.2.8</td>
</tr>
</tbody>
</table>
### NFPA 25 2020 8.1.1.2

- NFPA 25 (2020) Table 8.1.1.2 shall be used to determine the minimum required frequencies for inspection, testing, and maintenance.

#### Maintenance

- **Limitations:**
  - Alternative Inspection, Testing, and Maintenance Procedures. In the absence of manufacturer’s recommendations for preventive maintenance, can be found in NFPA 25 2020 (Table 8.6.1)

#### Table 8.6.1 Summary of Component Action Requirements

<table>
<thead>
<tr>
<th>Component</th>
<th>Adjust</th>
<th>Repair</th>
<th>Rebuild</th>
<th>Replace</th>
<th>Test Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Pump System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x Perform acceptance tests in accordance with NFPA 20</td>
</tr>
<tr>
<td>Impeller/rotating assembly</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x Perform acceptance tests in accordance with NFPA 20</td>
</tr>
<tr>
<td>Casing</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x Perform acceptance tests in accordance with NFPA 20</td>
</tr>
<tr>
<td>Bearings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
<tr>
<td>Bearings (ball)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
<tr>
<td>Packing</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
<tr>
<td>Mechanical Transmissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
<tr>
<td>Gear teeth/coupling</td>
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<td>x</td>
<td>x</td>
<td></td>
<td>x Performance in accordance with NFPA 25.3.5</td>
</tr>
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</table>

*Previously Annex Information*
Maintenance

<table>
<thead>
<tr>
<th>Electrical System Controller</th>
<th>X</th>
<th>X</th>
<th>Perform acceptance test in accordance with MPS 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermostat control</td>
<td></td>
<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Electronic components:</td>
<td></td>
<td></td>
<td>Control the controller from starting or running</td>
</tr>
<tr>
<td>Elements of the controller</td>
<td>X</td>
<td>X</td>
<td>Perform weekly test in accordance with 8.3.2</td>
</tr>
<tr>
<td>Switches:</td>
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<td></td>
<td>Perform weekly test in accordance with 8.3.2</td>
</tr>
<tr>
<td>Switches:</td>
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<td></td>
<td>Perform test in accordance with 8.3.2 and exercise on filters</td>
</tr>
<tr>
<td>Circuit breaker</td>
<td></td>
<td></td>
<td>Perform an acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Cables and connectors</td>
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<td></td>
<td>Test in accordance with 8.3.5, including all major</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>transformer and operator panels for a minimum of 1 hour</td>
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<tr>
<td>Battery charger</td>
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<td></td>
<td>Perform acceptance test in accordance with 8.3.5</td>
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<tr>
<td>Battery charger</td>
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<td></td>
<td>Test in accordance with 8.3.5 and operate panel for a minimum of 1 hour</td>
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<tr>
<td>Emergency power system</td>
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<td></td>
<td>Perform acceptance test in accordance with 8.3.2</td>
</tr>
<tr>
<td>Emergency power system</td>
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<td></td>
<td>Test in accordance with 8.3.2 and operate panel for a minimum of 1 hour</td>
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<tr>
<td>Transfer switch - overload</td>
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<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Transfer switch - overload</td>
<td>X</td>
<td>X</td>
<td>Test in overload operations of transfer of power</td>
</tr>
<tr>
<td>Electric Motor Drive</td>
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<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Electric motor</td>
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<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Electric motor</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Motor bearings</td>
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<td>Perform acceptance test in accordance with 8.3.5</td>
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<tr>
<td>Generator power system</td>
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<td></td>
<td>Test in accordance with 8.3.5 and operate panel for a minimum of 1 hour</td>
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<tr>
<td>Diesel Engine Drive</td>
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<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Fuel tank</td>
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<tr>
<td>Fuel tank</td>
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<td>X</td>
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<tr>
<td>Coolant reservoir</td>
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<tr>
<td>Coolant reservoir</td>
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<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Positive Displacement Pump</td>
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<td>Pump</td>
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<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Pump</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Pump</td>
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<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Shaft</td>
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<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Shaft</td>
<td></td>
<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Sump</td>
<td></td>
<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Sump</td>
<td></td>
<td></td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Pressure and Miscellaneous</td>
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<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Component:</td>
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<tr>
<td>Expansion tank</td>
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<td>Expansion tank</td>
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<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Foundation</td>
<td>X</td>
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<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Foundation</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Sump discharge pipe</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
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<tr>
<td>Sump discharge pipe</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Section discharge fittings</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
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<td>Section discharge fittings</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
<tr>
<td>Section discharge valves</td>
<td>X</td>
<td>X</td>
<td>Perform acceptance test in accordance with MPS 20</td>
</tr>
</tbody>
</table>
8.3.1 Frequency

- 8.3.1.2.1 Except as permitted in 8.3.1.2.2 and 8.3.1.2.3, a *weekly* test frequency shall be required for the following *electric* fire pumps:
  - Fire pumps that serve fire protection systems in buildings that are beyond the pumping capacity of the fire department
  - Fire pumps with limited service controllers
  - Vertical turbine fire pumps
  - Fire pumps taking suction from a ground level tanks or a water source that does not provide sufficient pressure to be of material value without the pump

Common Components, Obstruction Investigations and Impairments

- 8.1.2 Valves and fire department connections shall be inspected, tested, and maintained in accordance with Chapter 13.

- 8.1.3 The procedures outlined in Chapter 14 shall be followed where there is a need to conduct an obstruction investigation.

- 8.1.9 The procedures outlined in Chapter 15 shall be followed where an impairment to protection occurs.
8.2 Inspection

- 8.2.1: The purpose of inspection shall be to verify that the pump assembly appears to be in operating condition and is free from physical damage.

- 8.2.2*: The pertinent visual observations specified in the following checklists shall be performed weekly:
  - (1) Pump house conditions
  - (2) Pump system conditions
  - (3) Electrical system conditions
  - (4) Diesel engine system conditions
  - (5)*Steam system conditions

Weekly

- Pump house condition
  - Heat is Adequate
    - Not Less than 40°F (4°C)
    - 70°F (21°C) for diesel driven pumps without engine heaters
  - Ventilating louvers free to operate
  - Excessive water does not collect on the floor.
  - Coupling Guard in place
Weekly

Pump system conditions

- Pump suction and discharge and bypass valves are fully open.
- Piping is free of leaks.
- Suction line pressure gauge reading is within acceptable range.
- System line pressure gauge reading is within acceptable range.
- Suction reservoir has the required water level.
- Wet pit suction screens are unobstructed and in place
- Waterflow test valves are in the closed position, hose connection is closed, and the line to the test valves is free of water

Weekly

Electrical system conditions

- Controller pilot light (power on) is illuminated.
- Transfer switch normal pilot light is illuminated.
- Isolating switch is closed — standby (emergency) source.
- Reverse phase alarm pilot light is off, or normal phase rotation pilot light is on.
- Oil level in vertical motor sight glass is within acceptable range.
- Power to pressure maintenance (jockey) pump is provided.
Weekly

Diesel engine system conditions
- Fuel tank is at least two-thirds full.
- Controller selector switch is in auto position.
- Batteries' (2) voltage readings are within acceptable range.
- Batteries' (2) charging current readings are within acceptable range.
- Batteries' (2) pilot lights are on or battery failure (2) pilot lights are off.

Weekly

Diesel engine system conditions
- All alarm pilot lights are off.
- Engine running time meter is reading.
- Oil level in right angle gear drive is within acceptable range.
- Crankcase oil level is within acceptable range.
- Cooling water level is within acceptable range.
- Electrolyte level in batteries is within acceptable range.
- Battery terminals are free from corrosion.
- Water-jacket heater is operating.
Battery Inspections

- Diesel engines equipped with lead acid batteries require electrolyte levels to be inspected weekly

Battery Maintenance PPE

**PPE required for battery maintenance includes at a minimum:**

1. Goggle and face shields
2. Chemical-resistant gloves (Nitrile/Neoprene)
3. Protective aprons (Nitrile/Neoprene)
4. Protective overshoes (Nitrile/Neoprene)
5. Portable or stationary water facilities with 15 minute continuous flushing capability for rinsing eyes and skin in case of electrolyte Spillage
6. Battery spill containment kit
7. Battery Fluid filler bottle
Weekly

- Steam system conditions
  - Steam pressure gauge reading is within acceptable range

8.3.1 Testing Frequency

- Diesel engine–driven fire pumps shall be operated weekly and shall run a minimum of 30 minutes.

- Electric motor–driven fire pumps shall be operated weekly/monthly and shall run a minimum of 10 minutes.
8.3.1 Testing Frequency

• 8.3.1.2.3* A monthly test frequency shall be permitted for electric pump systems having a redundant fire pump.

• 8.3.1.2.4* The test frequency shall be permitted to be established by an approved risk analysis.

No-Flow Checklist

• Pump System
  • Record the pump starting pressure from the pressure switch or pressure transducer
  • Record the system suction and discharge pressure gauge readings
  • Inspect the pump packing glands for slight discharge
  • Adjust gland nuts if necessary
  • Inspect for unusual noise or vibration
  • Inspect packing boxes, bearings, or pump casing for overheating
  • Record pressure switch or pressure transducer reading and compare to the pump discharge gauge
  • For pumps that use electronic pressure sensors to control the fire pump operation, record the current pressure and the highest and the lowest pressure shown on the fire pump controller event log
  • For electric motor and radiator cooled diesel pumps, check the circulation relief valve for operation to discharge water
No-Flow Checklist

Electrical System
• Observe the time for motor to accelerate to full speed
• Record the time controller is on first step (for reduced voltage or reduced current starting)
• Record the time pump runs after starting (for automatic stop controllers)

Diesel Engine System
• Observe the time for engine to crank
• Observe the time for engine to reach running speed
• Observe the engine oil pressure gauge, speed indicator, water, and oil temperature indicators periodically while engine is running
• Record any abnormalities
• Inspect the heat exchanger for cooling waterflow
No-Flow Checklist

- Steam System
  - Record steam pressures
  - Observe time for turbine to reach full speed

8.3.2.10 Remotely Monitored Automated Testing

- The requirements of 8.3.2.10 are new to the 2020 Edition and have been added to specifically address automated testing, as it relates to fire pumps. For the general requirements on automated inspections and testing, see Chapter 4. These requirements ensure that the automated tests provide the same outcome as having a qualified person in the pump room performing the tests and recording the information.

- Remotely monitored automated testing performed in accordance with 4.6.6 shall be permitted for the no-flow test.
8.3.2.10 Remotely Monitored Automated Testing

- All of the pertinent observations or adjustments specified in the checklists described in 8.3.2.8 and 8.3.2.9 shall be performed.
  - Any abnormalities shall be recorded.
  - If, during the automated test, it becomes apparent that the packing gland nuts need to be adjusted as described in 8.3.2.9 (1) (d), the need for adjustment shall be recorded and the necessary adjustment shall be made by qualified personnel.

- The controller for a diesel engine-driven fire pump shall be equipped with automatic engine shutdown as referenced in 12.7.2.7 of NFPA 20.

- Qualified personnel shall be able to respond to the pump location upon abnormal condition within 5 minutes.

8.4 Reports

- Any abnormality observed during inspection or testing shall be reported promptly to the property owner or designated representative.

- Test results shall be recorded and retained for comparison purposes in accordance with Section 4.3 of NFPA 25 (2020).
Poll Question 5

What is the purpose of churn (no-flow) testing a fire pump?

A. To test the fire pump performance
B. Ensure the fire pump is running normal based on pressure drop
C. Ensure the green start button works
D. Suffices the NFPA standard

Annual Testing, Testing Set-up, & Data Collection

8.1 General

- This chapter shall provide the minimum requirements for the routine inspection, testing, and maintenance of fire pump assemblies.

- The minimum frequency of inspection, testing, and maintenance shall be in accordance with the manufacturer’s recommendations and Table 8.1.1.2.

### 8.1.1.2

**Table 8.1.1.2: Summary of Fire Pump Inspection, Testing, and Maintenance**

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic transfer switch</td>
<td>Annually</td>
<td>8.5.1.2</td>
</tr>
<tr>
<td>Auxiliary power switch and emergency/steady</td>
<td>Per NBSA 110</td>
<td>8.5.6.2</td>
</tr>
<tr>
<td>Diesel engine-driven fire pump (no load)</td>
<td>Weekly</td>
<td>8.5.1.4</td>
</tr>
<tr>
<td>Diesel fuel storage</td>
<td>Annually</td>
<td>8.5.1.4</td>
</tr>
<tr>
<td>Electronic control module (ECM)</td>
<td>Annually</td>
<td>8.5.8.6</td>
</tr>
<tr>
<td>Fire pump alarm signals</td>
<td>Annually</td>
<td>8.5.8.11</td>
</tr>
<tr>
<td>Fan motor</td>
<td>Annually</td>
<td>8.5.8.15</td>
</tr>
<tr>
<td>Fan performance, ventilation, and operability</td>
<td>Quarterly</td>
<td>8.5.8.27</td>
</tr>
<tr>
<td>Generator, controllers, and other devices used for testing</td>
<td>Annually</td>
<td>8.5.8.2</td>
</tr>
<tr>
<td>Main pressure relief valve</td>
<td>Annually</td>
<td>8.5.8.11, 8.5.6.2</td>
</tr>
<tr>
<td>Paraffin (inviscid) storage</td>
<td>Weekly</td>
<td>8.5.8.6</td>
</tr>
<tr>
<td>Pump operation (no load)</td>
<td>Weekly</td>
<td>8.5.8.7, 8.5.8.15</td>
</tr>
<tr>
<td>Supervised signal for high cooling water temperature</td>
<td>Annually</td>
<td>8.5.1.28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td></td>
<td>8.1.2.12</td>
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<tr>
<td>Reciprocating water filter</td>
<td>Annually</td>
<td>8.1.2.21</td>
</tr>
<tr>
<td>Control and power wiring connections</td>
<td>Annually</td>
<td>8.1.2.26</td>
</tr>
<tr>
<td>Controller and all other components of the pump assembly</td>
<td>Per manufacturer</td>
<td>8.5</td>
</tr>
<tr>
<td>Diesel engine fuel system</td>
<td>Annually or per</td>
<td>8.5.6.3</td>
</tr>
<tr>
<td>Diesel engine system</td>
<td>Per manufacturer</td>
<td>8.5</td>
</tr>
<tr>
<td>Electric motor and power system</td>
<td>Per manufacturer</td>
<td>8.5</td>
</tr>
<tr>
<td>Electrical connections</td>
<td>Annually</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Engine lubricating oil</td>
<td>24 operating hours or</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Engine oil filter</td>
<td>24 operating hours or</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Fuel filter</td>
<td>24 operating hours or</td>
<td>8.1.2.27</td>
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<tr>
<td>Fuel tank—check for water and foreign materials</td>
<td>Annually</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Fire pump check</td>
<td>5 years or</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Power transmission components (including cooling)</td>
<td>5 years or</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Pressure gauges and sensors</td>
<td>Per manufacturer</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Pumps and motor bearings and coupling</td>
<td>Annually or as required</td>
<td>8.1.2.27</td>
</tr>
<tr>
<td>Isolation switch</td>
<td>Annually</td>
<td>8.1.2.27</td>
</tr>
</tbody>
</table>
8.3 Testing

- The purpose of testing the pump assembly is to ensure automatic or manual operation upon demand and continuous delivery of the required system output.

- An additional purpose is to detect deficiencies of the pump assembly not evident by inspection.

- Qualified operating personnel shall be in attendance whenever the pump is in operation.

8.3 Testing Constant Speed Pumps

- 8.3.3.1* Except as permitted in 8.3.3.4, an annual test of each constant speed pump assembly shall be conducted by qualified personnel under no-flow (churn), rated flow, and 150 percent of the pump rated capacity flow of the fire pump by controlling the quantity of water discharged through approved test devices.
8.3 Variable-speed Pumps

- 8.3.3.2* Except as permitted in 8.3.3.4, an annual test of each variable-speed pump assembly shall be conducted by qualified personnel under variable-speed control under no-flow (churn), 25 percent, 50 percent, 75 percent, 100 percent, 125 percent, and 150 percent of the rated pump capacity flow of the fire pump by controlling the quantity of water discharge through approved test devices.

- 8.3.3.3 Except as permitted in 8.3.3.4, an annual test of each variable speed pump assembly shall be conducted by qualified personnel under constant speed control under no-flow (churn), 100 percent rate, and 150 percent of the pump rated capacity flow of the fire pump by controlling the quantity of water discharged through approved test devices.

- 8.3.3.4 If available suction supplies do not allow flowing of 150 percent of the rated pump capacity, the fire pump shall be tested at flow rates at 100 percent of the rated pump flow rate, and at the maximum flow allowed at the lowest permissible suction pressure.

*New to 2020 Edition*

8.3.3.9.1 Use of Pump Discharge via Hose Streams

- Pump suction and discharge pressures and the flow measurements of each hose stream shall determine the total pump output.

- Prior to flow testing, the entity performing testing shall make the owner or their representative aware of the location, approximate flow rate, and duration of flow testing.
8.3.3.9.3 Use of Pump Discharge via Bypass Flowmeter to Pump Suction (Closed-Loop Metering)

- Pump suction and discharge pressures and the flowmeter measurements shall determine the total pump output.

- If the test results are not consistent with the previous annual test, the test shall be repeated using the test arrangement described in 8.3.3.9.1.

- If testing in accordance with 8.3.3.9.1 is not possible, a flowmeter calibration shall be performed and the test shall be repeated.

8.4 Reports

- A complete written report of the fire pump test results shall be prepared for and retained by the owner.
8.4 Reports

- At a minimum, the report shall contain the following information:
  - All raw data necessary for a complete evaluation of the fire pump performance, including suction and discharge pressures, voltage and amperage readings, and pump speed at each flow rate tested
  - The fire protection system demand as furnished by the owner
  - Pump performance, whether satisfactory or unsatisfactory
  - Deficiencies noted during the testing and identified during analysis, with recommendations to address deficiencies as appropriate
  - Manufacturer’s performance data, actual performance, and the available pump discharge curves required by this standard
  - Time delay intervals associated with the pump’s starting, stopping, and energy source transfer
  - Where applicable, comparison with previous test results

8.5 Maintenance

- A preventive maintenance program shall be established on all components of the pump assembly in accordance with the manufacturer’s recommendations or an approved alternative maintenance plan.
- Records shall be maintained on all work performed on the pump, driver, controller, and auxiliary equipment.
- The preventive maintenance program shall be initiated immediately after the pump assembly has passed acceptance tests.
Pump Testing Setup

Equipment List:

- Fire hoses
- Flow devices
- Calibrated gauges
- RPM meter
- Electrical meter
- Safety cones
- PPE
- Radios
- 2 people for testing
**Before You Begin**

- Establish communications like with your partner
  - Test hand-held radios
- Visually inspect fire pump installation
  - Test header
  - Pump
  - Controller area
- Monitoring/Fire Department
  - Contact before testing

**Pump Testing Setup**

- **Header**
  - Before charging test header
    - Check header valve closed
    - Check header and valve integrity
- **Flow Device**
  - Safety cone off area
  - Always have 2 people on any pump test
    - Hose bursts
    - Pump room damage
  - Consider flow discharge and potential flooding issues
Pump Testing Setup

- Determine the pumps:
  - Rated GPM
  - Data plate
  - Rated voltage
  - Rated amps

- Verify all equipment is off to prevent automatic start before working on any pump
  - Controllers
  - Electrical disconnects
  - Batteries disconnected

- Locate / install
  - Reflective tape for RPM

- Install your calibrated
  - Suction gauge
  - Discharge gauge
Pump Testing Setup

- Coupling Guard
  - Remove guard
  - Check pump shaft alignment
  - Inspect coupling guard condition
  - Replace coupling guard

- Install your calibrated
  - Suction gauge
  - Discharge gauge
Safety

- Slips, trips, and falls
  - Liquids on floors of pump room, roofs, and driveways can lead to slip and falls
  - Drain pipes and grates can be trip hazards

Fire Hose

- Hoses must be annually inspected per NFPA 1962
**Water diffusion**

- Water diffusion risks
  - Poor placement of water diffuser
  - Use of non listed devices

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**Poll Question 6**

What is the purpose of the annual flow test?

A. Test the performance of the fire pump
B. Wash off the parking lot
C. To suffice the NFPA 25 standard
D. To make up for the fact that it hasn’t been run in over 10 months
Questions?

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  Or contact JCI Technical Services at
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