FIRE PROTECTION SYSTEMS
ACCEPTANCE INSPECTION AND TESTING PROCEDURE

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Wet Pipe Sprinkler Systems

1. Confirm that the approved plans, hydraulic calculations, and sequence of operations are available at the jobsite.
2. If a special designed sprinkler system, i.e., Large Drop, ESFR, etc, review approved drawings to confirm that installation is satisfactory including correct sprinkler heads.
3. Confirm that all underground mains and lead in connections have been flushed prior to connection to sprinkler system piping.
4. Confirm satisfactory hydrostatic testing of the piping and appurtenances including underground piping and fire department connections.
5. Conduct visual inspection of the system to confirm that system has been properly installed in accordance with including confirmation that sprinkler heads are not obstructed and that piping is properly supported. Visual inspection should also include confirmation of full coverage or area being protected including unprotected areas under large ducts, areas in concealed ceilings, etc.
6. Confirm that pressure gauges have been provided on the system. Document the static pressure on the system.
7. Conduct 2-inch main drain test and record pressures.
8. Confirm that all control valves for the system are indicating valves and are supervised.
9. Test all Supervisory signals.
10. Test all Tamper devices confirming that a supervisory signal is transmitted and received.
11. Test Waterflow Alarm devices from approved test connections.
12. Conduct operational test of the system demonstrating all functions identified in the Sequence of Operation.
13. Confirm that spare sprinklers are provided.
14. Confirm that hydraulic nameplate has been installed on the sprinkler riser.
15. Confirm that system control valve(s) is left open and the system is operational.

Dry Pipe Sprinkler Systems

In addition to Items 1 – 15 above,

16. Confirm that system piping has been tested with air pressure to 40 psi for 24 hours.
17. Confirm that High and Low air pressure supervision is provided and tested.
18. Confirm that an inspectors test connection has been installed at the farthest point away from the dry pipe sprinkler valve. Identify how the inspectors test connection will simulate the operation of one sprinkler head.
19. Document if the system is equipped with a quick opening device and confirm its intended sequence of operation (operating pressures).
20. Confirm that dry-pipe sprinkler valve is located within a heated enclosure. Identify if low temperature alarms for the valve room are provided.
21. Document the number of low point or “drum drip” drains that have been installed on the system.
22. As a part of the visual inspection of the system, identified in Item 4 above, confirm that piping is pitched properly and that the system will drain as required. Identify locations of potential low points that are not provided with drains.

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23. Confirm that pressure gauges have been provided for the air supply to and in the system.
24. Conduct an operational test of the system and record air and water pressure before test, system trip time, QOD operation time and pressure, and time for sufficient water delivery at the inspectors test connection.
25. Confirm that all fire signals have been transmitted and received including low air alarm and waterflow alarm.
26. Inspect the interior of the dry pipe valve after operational test and confirm that clapper latched open.
27. Confirm that the gasket material is not damaged or covered with grease.
28. Witness reset of dry pipe valve and confirm that grease or any other foreign substances are not used.

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Clean Agent Fire Extinguishing System

Total Flooding Systems

1) Confirm that the approved plans, design calculations, and sequence of operations are available at the jobsite.
2) Confirm that only listed and/or approved equipment and devices are installed.
3) Confirm that completed system has been inspected, pre-tested, and documented by qualified personnel including:
   a) Test of electrical wiring for proper connections, continuity, and resistance to earth.
   b) A flow test (puff test) using nitrogen or inert gas shall be performed on the piping network to verify that the flow is continuous.
   c) Pressure test of the piping to check for leaks after installation is complete.
   d) Confirmation of signal transmission to and from control panel including trouble and fire alarm signals.
   e) Test each fire detector to confirm proper operation.
   f) System functional test to satisfy that installed system complies with specifications requirements and sequence of operations including equipment interlocks, such as door release devices, audible and visual devices, equipment shut downs, dampers and local and remote alarms.
   g) Provision of primary and emergency power sources.
4) Confirm that acceptance testing is performed in the presence of equipment manufacturer's representative.
5) Perform visual inspection of the system prior to conducting the final acceptance test including check for proper mounting, installation of containers, distribution piping, etc.
6) Confirm that nameplate data on storage containers meets specifications and calculations from enclosure integrity test.
7) Confirm that inspection tag is attached to container.
8) Confirm installation of warning and instruction signs at entrances and inside protected areas.
9) Verify operation of emergency lighting and confirm exit directional signs installation in protected enclosures.
10) Check locations of audible and visual alarm devices, manual emergency release and abort stations.
11) Conduct room enclosure integrity test to confirm that the agent provided will satisfy minimum concentration for the designed soak time.
12) Perform system operational test to confirm that the system operates as designed including automatic and manual actuation, equipment shut down, audible and visual alarm device operation, abort functions, manual override, and transmission of all alarm signals.
13) Provide as-built drawings.

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Fire Dampers

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Verify that the fire damper installed is correct for the fire rating for the wall.
3) Confirm that the fire damper has been installed in accordance with the manufacturers installation instructions.
4) Confirm that the retaining angles are properly secured to the fire damper sleeve and not the wall.
5) Confirm that fire retardant type caulking has not been placed on or around the retaining angles.
6) Confirm that an approved break-away connection has been provided between the fire damper sleeve and the ductwork on both sides of the rated wall, if required.
7) Confirm that an adequately sized access door has been provided to service the fire damper.
8) Verify the proper operation of the fire damper by removal of the fusible link.

Smoke Dampers

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Confirm that the smoke damper has been installed in accordance with the manufacturers installation instructions. For NYC installations: Leakage Rating not less than Class II, Temperature Rating not less than 250^{o} F.
3) Verify that any sealant installed between the duct and the smoke barrier opening, is not an intumescing type that will expand upon contact with heat and possibly impede the operation of the damper.
4) Confirm that an adequately sized access door has been provided to service the smoke damper.
5) Verify the proper operation of the smoke damper as per the sequence of operations by activation of the fire alarm system.
6) Verify if the smoke damper is a part of a smoke removal or engineered smoke control system and test as per the sequence of operations.

Combination Fire/Smoke Dampers

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Verify that the combination fire/smoke damper installed is correct for the fire rating for the wall.
3) Confirm that the combination fire/smoke damper has been installed in accordance with the manufacturers installation instructions.
4) Confirm that the retaining angles are properly secured to the combination fire/smoke damper sleeve and not the wall for dampers that require retaining angles on both sides of the rated wall. Single-sided retaining angle installations require attachment to the rated wall.

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5) Confirm that fire retardant type caulking has not been placed on or around the retaining angles.
6) Confirm that an approved break-away connection has been provided between the combination fire/smoke damper sleeve and the ductwork on both sides of the rated wall, if required.
7) Confirm that an adequately sized access door has been provided to service the combination fire/smoke damper.
8) Verify the proper operation of the combination fire/smoke damper as per the sequence of operations by activation of the fire alarm system.
9) Verify if the combination fire/smoke damper is part of a smoke removal or engineered smoke control system and test as per the sequence of operations.

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Area Smoke Detector

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Confirm areas of coverage as per approved drawings, applicable laws, codes or standards
3) Ensure device type is listed for environment (e.g. temperature, humidity, air velocity)
4) Ensure devices are installed properly (e.g. Spot-type smoke detectors shall be located on the ceiling not less than 4-inches form sidewall to near edge or if on sidewall between 4-inches and 12 inches down from ceiling to the top of the detector)
5) Ensure adequate spacing of detectors (i.e. 30-foot spacing can be used as a guide, however the Manufactures documented instructions shall be followed)
6) Test device for trouble alarm signal and confirm receipt and location of alarm origin at Fire Alarm Control Panel (FACP)
7) Test device for alarm signal and confirm receipt and location of alarm origin at FACP
8) Confirm that operational test of devices perform within the sequence of operations (e.g. horn strobe devices are activated; electromagnetic locks on emergency egress doors are de-energized)
9) Confirm alarm signal transmission to a constantly attended location (e.g. Central Alarm Monitoring Station)

Duct-type smoke detectors

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Ensure device is installed as per local codes: i.e.
   a) In NJ, detector is to be installed on the return side when HVAC unit is greater than 2000cfm. See IMC 2006 for details
   b) In NY, detector is to be installed on the supply side when HVAC unit is greater than 2000cfm. See City of NY Mechanical Code-2008
3) Verify device is listed for use in air duct system at the design flow rates
4) For devices that use air-sampling tubes confirm that pressure differential between tubes is within manufacturers specifications (New Jersey)
5) Test device for trouble alarm signal and confirm receipt and location of alarm origin at FACP
6) Test device for alarm signal and confirm receipt and location of alarm origin at FACP
7) Confirm that operational test of devices perform within the sequence of operations (e.g. HVAC equipment shutdown; horn strobe devices are activated if required by local laws or AHJ)
8) Confirm alarm signal transmission to a constantly attended location (e.g. Central Alarm Monitoring Station)

Manual Pull Stations

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Ensure that devices are provided as per approved drawings
3) Ensure devices are located within 5-feet of exit doorway at each exit
4) Ensure devices are installed not more than 4.5-feet above the finished floor

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5) Test device for trouble alarm signal and confirm receipt and location of alarm origin at FACP
6) Test device for alarm signal and confirm receipt and location of alarm origin at FACP
7) Confirm that operational test of devices perform within the sequence of operations (i.e. horn/strobe devices are activated)
8) Confirm alarm signal transmission to a constantly attended location (e.g. Central Alarm Monitoring Station)

Heat-Sensing Fire Detectors

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Ensure devices are provided in areas as per approved drawings
3) Ensure device type is listed for environment
4) Ensure device is installed properly (e.g. Spot-type heat detectors shall be located on the ceiling not less than 4-inches form sidewall or if on sidewall between 4-inches and 12 inches down from ceiling)
5) Test device for trouble alarm signal and confirm receipt and location of alarm origin at FACP
6) Test device for alarm signal and confirm receipt and location of alarm origin at FACP
7) Confirm that operational test of devices perform within the sequence of operations (e.g. horn/strobe devices are activated; activation of associated suppression systems are initiated)
8) Confirm alarm signal transmission to a constantly attended location (e.g. Central Alarm Monitoring Station)

Flame Detectors

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Ensure devices are provided as per the approved drawings
3) Ensure device type is listed for environment
4) Ensure device is installed properly (e.g. optical performance and field of view of the device is not compromised)
5) Test device for trouble alarm signal and confirm receipt and location of alarm origin at FACP
6) Perform operational test of detector(s) as per manufacturers recommendations and confirm receipt and location of alarm origin at FACP
7) Verify sequence of operations as per design (e.g. suppression system is initiated; fuel systems shut down)
8) Confirm alarm signal transmission to a constantly attended location (e.g. Central Alarm Monitoring Station)

FIRE PROTECTION SYSTEMS
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Horn/Strobe Devices

- Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
- Ensure devices are provided as per the approved drawings
- Ensure device type is listed for environment
- Verify devices are installed properly (i.e. For Strobes: Wall-mounted appliances shall be mounted such that the entire lens is not less than 80-inches and not greater than 96-inches above the finished floor)
- Test devices for trouble signals and confirm receipt and location of alarm origin at FACP
- When devices are activated, verify that if more than two strobe devices in the same room or adjacent space within the field of view they flash in synchronization (See NFPA 72 - 7.5.4.1.2)
- Verify that audible devices can be heard above ambient sound levels

Fire Alarm Control Panel

1) Confirm that the approved plans, equipment specifications, and sequence of operations are available at the jobsite.
2) Verify correct receipt of alarm, supervisory, trouble signals, circuit supervision including power supply supervision for detection of loss of ac power and disconnection of secondary batteries, loss of primary means of communication
3) Test operation of FACP with battery power (5 minutes with general alarm system)
4) Verify operation of secondary means of communication to constantly attended location (e.g. Central Monitoring Station)

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Fire Pumps

Pre Field Acceptance

1. Verify that the suction piping has been flushed as required by code (flushing shall occur prior to hydrostatic testing).
2. Verify hydrostatic test of all suction and discharge piping for two hours at not less than 200 psi or 50 psi in excess of the maximum pressure to be maintained in the system – whichever is greater.
3. Obtain certificate of flushing and hydrostatic testing from installing contractor prior to any field acceptance testing.
4. Insure that representatives from the pump manufacturer, engine manufacturer, controller manufacturer and transfer switch manufacturer are present for the field acceptance test. A factory-authorized representative is acceptable.
5. Verify that the electrical contractor has checked all wiring prior to start up and field acceptance testing.
6. Obtain a copy of the manufacturers certified pump test curve for comparison. The pump shall equal performance of the certified curve within the accuracy of the test equipment.

Field Acceptance

7. Insure calibrated test equipment is provided to determine net pump pressures, rate of flow through the pump, volts and amps for electric-driven pumps, and speed. All calibrated test gauges shall bear a label with the latest date of calibration that shall be within the past year.
8. Perform flow tests of the pump at minimum, rated and peak loads through approved test devices.
    a. Record the following data:
        i. Pump rpm
        ii. Suction pressure
        iii. Discharge pressure
        iv. Number and size of hose nozzles, pitot pressure for each nozzle and total gpm,
        v. Amps for each phase
        vi. Volts – phase to phase.
    b. If suction supplies do not permit the flowing of 150 percent of rated pump capacity, the fire pump shall be operated at maximum allowable discharge to determine acceptance.
9. Insure that there is no overheating, leaks (water or oil), unusual noises or excessive vibration of any pump component at minimum, rated and peak loads.
10. Insure that any engine governors have been set to properly regulate engine speed at rated pump speed.
11. The fire pump unit shall be started and brought up to rated speed without interruption under the conditions of a discharge equal to peak load.
12. A test shall be performed for all electric motors to ensure that there is not a phase reversal condition in either normal or alternate power supply (if provided).

13. Insure that all local and remote signals as well as all fire alarm devices are properly functioning.
14. Fire pump controllers shall be tested in accordance with the manufacturers recommended test procedure.
15. No fewer that six automatic and six manual operations shall be preformed during acceptance testing.
16. The fire pump driver shall be operated for a period of at least five minutes at full speed during each of the operations.
17. The automatic operation sequence of the controller shall start the pump from all provided starting features including pressure switches or remote starting signals.
18. The fire pump shall be started once from each power service and run for a minimum of five minutes. Manual emergency operation shall be accomplished by placing the emergency handle in the fully latched position for the duration of the test run.
19. Where provided, the automatic transfer switch shall be tested by simulation of loss of primary power. Transfer shall occur while the pump is operating at peak load.
20. Transfer between normal and alternate source and retransfer from alternate to normal source shall not cause overcurrent devices to open.
21. At least half of the manual and automatic operations shall be performed with the fire pump connected to the alternate power source (if provided).
22. Where provided, test sequential timing device(s).
23. Test the weekly timer (engine driven pump).
24. The fire pump shall be in operation for not less than one-hour total time during all tests.

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Water Mains, Tanks and Fire Hydrants

Flushing of Piping

1. Underground piping, from the water supply to the system riser, and lead-in connections to the system riser shall be completely flushed before the connection is made to downstream fire protection system piping.
2. The flushing operation shall be continued for a sufficient time to ensure thorough cleaning.
3. The minimum rate of flow shall be not less than one of the following:
    a. Hydraulically calculated water demand flow rate of the system, including any hose requirements.
    b. Flow necessary to provide a velocity of 10 ft/sec.
    c. Maximum flow rate available to the system under fire conditions.

Hydrostatic Test

4. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure for 2 hours.
5. The test pressure shall be read from one of the following, located at the lowest elevation of the system or the portion of the system being tested:
    a. A gauge located at one of the hydrant outlets.
    b. A gauge located at the lowest point where no hydrants are provided.

Water Tanks

6. Verify that coated steel tank has been tested for holidays and coating thickness.
7. Welded tank bottoms shall be tested by air pressure or vacuum applied to the joints using soap suds, linseed oil, or other suitable material for the detection of leaks, or the joints shall be tested by the magnetic particle method.
8. Pressure tanks shall be hydrostatic tested at a minimum pressure of 150 psi and shall be filled to two-thirds of capacity and tested at the normal working pressure with all valves closed. The pressure shall not drop more than ½ psi over a 24-hour period.
9. All tanks shall be tested as watertight upon completion.

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Fire Hydrants

10. Each hydrant shall be fully opened and closed under system water pressure.
11. Dry barrel hydrants shall be checked for proper drainage.
12. All control valves shall be fully closed and opened under system water pressure to ensure proper operation.
13. Where fire pumps are available, the operating tests shall be completed with the pumps running.

Foam Systems

1. Visual Examination
    a. Conformity with installation plans
    b. Continuity of piping
    c. Removal of temporary blind flanges
    d. Accessibility of valves, controls, and gauges
    e. Installation of vapor seals where applicable (e.g., tank side foam chambers)
    f. Proper identification of all devices
    g. Posting of all operating instructions.

2. Flushing of Piping
    a. Flushing of both the underground and aboveground water supply mains before connection is made to system piping.
    b. The minimum rate of flow for flushing shall not be less than the water demand rate of the system
    c. The flow shall be continued for a time to ensure thorough cleaning
    d. All foam system piping shall be flushed after installation, using the system's normal water supply with foam-forming materials shut off.
        i. Where flushing cannot be accomplished, pipe interiors shall be carefully visually examined for cleanliness during installation.

3. Hydrostatic Tests
    a. All piping shall be subjected to a 2-hour hydrostatic pressure gauge test at 200 PSI, or 50 PSI in excess of the maximum pressure anticipated, whichever is greater.
    b. Bladder tanks shall not be included in pressure tests.

4. Operating Tests
    a. All operating devices and equipment shall be tested for proper function.
    b. Tests for total flooding systems shall establish that all automatic closing devices for doors, windows, and conveyor openings, and automatic equipment interlocks, as well as automatic opening of heat and smoke vents or ventilators, will function upon system operation.
    c. Operating instructions provided by the supplier and proper device identification shall be checked.
5. Discharge Tests

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a. Flow tests shall be conducted to ensure that the hazard is fully protected in conformance with the design specification.
b. The following data shall be required:
    i. Static water pressure
    ii. Residual water pressure at the control valve and at a remote reference point in the system
    iii. Actual discharge rate
    iv. Consumption rate of foam-producing material
    v. Concentration of the foam solution
    vi. Foam quality (expansion and one-quarter drain time) or foam discharge shall be conducted, or the foam discharge shall be visually inspected to ensure that it is satisfactory for the purpose intended.
c. Foam concentration shall have one of the following proportions:
    i. Not less than the rated concentration
    ii. No more than 30 percent above the rated concentrate, or 1 percentage point above the rated concentration (whichever is less).

6. Acceptance Testing for Foam from Foam-Water Deluge and Spray Systems.
    a. Acceptance tests shall be conducted to ensure that the hazard is fully protected and to determine the flow pressures, actual discharge capacity, consumption rate of foam-producing materials, staffing needs, and other operating characteristics.
    b. The tests shall include the following:
        i. Foam discharge from a single system
        ii. Simultaneous foam discharge of the maximum number of systems expected to operate on a single hazard.
    c. The discharge shall be continued for the time required to obtain stabilized discharge.
    d. Proportioning System Testing
        i. Operation of the proportioning equipment shall be verified by flow tests.
        ii. The percentage of foam concentrate in solution shall be verified by flow tests at minimum listed flow capacity of the proportioning equipment and foam concentrate for closed (wet pipe, preaction, or dry pipe) systems or midrange flow for open deluge systems. For eductor systems and deluge systems using fixed orifice proportioning directly into system, full-system flow tests are required.
            1. Foam flow tests shall include a minimum flow test for wet pipe, dry pipe, and preaction systems equal to the flow of the most remote (4) sprinklers. The percentage of foam concentrate shall be greater than the manufacturer's listed percentage rate minus 0 percent to plus 30 percent for balanced pressure systems. For positive pressure systems with pump- or pressure-controlled bladder tank and inline balanced pressure-type proportioning systems, the percentage of foam concentrate shall be minus 0 percent to plus 30 percent or greater at the (4) remote sprinkler flow.
        iii. During the tests the pressure at the proportioning devices shall be at the design operating pressure of the system or systems tested.
        iv. The percentage of all foam concentrates injected into the water at their listed flow rates shall be within the limits given in 5.c.
        v. The foam concentrate induction rate of a proportioner, expressed as a percentage of the foam solution flow (water plus foam concentrate), shall

vi. For balanced pressure systems the minimum listed flow rate shall result in minimum percentage of manufacturer's requirement minus 0 percent.
vii. For positive-pressure proportioning with pumps or pressure-controlled bladder tanks the percentage at minimum listed flow shall be at the maximum percentage of manufacturer's requirement plus 30 percent, or 1 percentage point, whichever is less.
viii. For variable orifice type proportioners the percentage shall be minus 0 percent and plus 30 percent or 1 percentage point, whichever is less.
ix. For balanced pressure and positive pressure proportioning systems, flow tests shall be permitted to be conducted through the test connections. For other proportioning system types, full-flow testing of system and discharge devices is required to properly evaluate the proportioning system.
x. Flow tests for wet pipe, dry pipe, and preaction systems shall be conducted at the low end of the listed design flow rate of the proportioning equipment and shall meet the criteria of 6.d.v.
xi. When performing foam system proportioning tests the discharge foam solution shall be collected and disposed of by the owner, the owner's representative, or the installing contractor.
xii. Where approved by the Port Authority's Engineering Department Quality Assurance Division, simulated foam concentrates or alternative test systems shall be permitted to be substituted for actual foam concentrate, but system pressures and flows shall remain as described above and meet manufacturer's system requirements and recommendations.
xiii. The rate of foam solution discharge shall be computed from hydraulic calculations utilizing recorded inlet or end-of-system operating pressure, or both.
xiv. The foam concentration shall be calculated by a refractometer for protein-type foams or a conductivity meter for aqueous film forming foams.
xv. After operation with foam, foam-water deluge and spray systems shall be flushed with water to remove foam residue.
xvi. Those portions of the system normally containing foam concentrate when the system is in service shall not be required to be flushed.