This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

SECTION 212000 - FIRE SUPPRESSION SYSTEMS

1. GENERAL
   * + 1. DESCRIPTION
          1. This section describes a complete automatic fire sprinkler system with zoning and layout, and standpipe outlets off zone sprinkler piping.
       2. RELATED WORK SPECIFIED ELSEWHERE
          1. Section 210500, Common Work Results for Fire Suppression
          2. Section 210519, Gauges for Fire Suppression Systems
          3. Section 210523, General Duty Valves for Water-Based Fire Suppression Piping
          4. Section 211100, Fire Suppression Piping
          5. Section 211120, Fire Suppression Pumps
       3. REFERENCES
          1. FM: FM Global
          2. NFPA: National Fire Protection Association

NFPA 13: Standard for the Installation of Sprinkler Systems

NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

* + - 1. SUBMITTALS
         1. Shop drawings, hydraulic calculations, and seismic calculations shall be stamped and signed by a fire suppression engineer registered in the State of Oregon.

Prepare fire protection system layout drawings showing the types, location, and layout of sprinkler heads and outlets, alarm valves, and devices, pipe sizes and cutting lengths, test tees and valves, seismic braces, and other related items, coordinated with architectural, structural, mechanical, and electrical details. Indicate types and locations of couplings and seismic support locations and details.

Show complete sway brace layout, including proposed brace type and size, anchor methods and sizes, angle of attachment, etc. The design shall demonstrate that an adequate load path is available from the sprinkler pipe to the primary building structure. Note flexible vs. rigid coupling locations as well as clearances where pipes pass through floors and walls.

Prepare hydraulic calculations in accordance with the quality assurance requirements of this section.

Submit five full-size bond copies of fire protection system layout drawings to the Port for preliminary review prior to submitting documentation to AIG and the fire marshal for final review and approval. Include hydraulic calculations, seismic bracing calculations, and product data.

Upon receipt of comments from the Port, revise and re-submit fire protection system layout drawings, product data, hydraulic calculations, and seismic calculations for final review and approval by AIG and the fire marshal.

* + - * 1. Product data for the following:

Sprinkler heads.

Tamper switches.

Alarm flow switches.

Dry pipe valve.

Pre-action valve assembly.

Wall indicator valve.

Fire department connections.

Standpipe valves.

Standpipe valve cabinets.

Fire department test station.

Electric alarm bell.

Miscellaneous equipment.

* + - * 1. Samples: One of each type of head.
        2. Operation and maintenance data, and operation and maintenance manuals.
        3. Legible copy of approved shop drawings, neatly marked with as-constructed changes.
        4. A shutdown plan for the existing fire sprinkler system based on phasing of work. Minimize system shutdown time where existing systems will be capped, removed, or modified.

Use only if Commissioning Section 019100 is included in the project manual.

* + - * 1. Commissioning Documentation:

Submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.

Submit certificates of completion of tests and inspections.

* + - 1. QUALITY ASSURANCE
         1. Regulatory Requirements:

Fire protection system components shall be new and FM-approved with an installation meeting the current FM NFPA 13 standards covering sprinkler system installation.

On hydraulically designed systems, the remote shall be calculated with a dimension parallel to the branch line equal to 1.4 times the square root of the demand (design) area instead of the NFPA 13 requirement. Should roll grooved pipe be used, account for additional friction loss in the hydraulic calculations resulting from displaced pipe wall material protruding into the waterway. For straight-through flow, regardless of size, each coupling shall have one equivalent foot added to the pipe length. For tees and elbows, regardless of size, add two equivalent feet of pipe to the hydraulic calculations.

Design and install earthquake protection of sprinkler systems in accordance with FM’s Earthquake Protection of Water Based Fire Protection Systems standards. Design details and seismic load calculations are required. Base calculations on water-filled weight of sprinkler piping within the zone of influence times a horizontal acceleration “G” factor of 0.5.

Storage areas shall include a 500 gpm hose allowance, while other areas should reserve 250 gpm hose allowance. All designs shall include a 10 percent cushion in the water supply.

Underground fire mains shall be cement-lined ductile iron pipe. Provide 3-1/2-foot depth of cover for freeze prevention. Install fire service in accordance with FM guidelines. The last underground elbows below the riser or riser manifold shall be rodded to the base of riser as part of seismic protection. Restraining by rod and clamping and/or thrust blocking shall be in accordance with FM guidelines.

Edit table below according to project location.

* + - * 1. Hydraulically Calculated Sprinkler System shall be in accordance with the following table:

| Area | Type of System | Head Rated Temp | Design Density (gpm/sq.ft.) | Design Area (sq.ft.) | Maximum Coverage (per head) |
| --- | --- | --- | --- | --- | --- |
| Public Areas - Lounges, & Circulation Areas, Enplaning, Deplaning, Offices | Wet | 165ºF | 0.10 | 3000 | 150 ft2 |
| Public Lobbies over 10 ft high | Wet | 165ºF | 0.15 | 2500 (<35k sq.ft.)  3000 (>35k sq.ft.) | 150 ft2 |
| Mechanical & Electrical Equipment Rooms, Elevator Equipment Rooms | Wet | 286ºF | 0.20 | 3000 | 100 ft2 |
| Concession/Retail | Wet | 165ºF | 0.15 | 2500 | 100 ft2 |
| Storage | Wet | 286ºF | 0.20 | 2500 | 130 ft2 |
| Baggage Handling & Loading Areas | Wet | 165ºF | 0.15 | 2500 | 130 ft2 |
| Baggage Road, Interior Parking, Sanitation Bay | Dry | 165ºF | 0.15 | 2500 | 130 ft2 |
| Utility Tunnel (new) | Wet | 165ºF | \* | \* | 140 ft2 |
| Steam Utility Tunnel (existing) | Wet | 286ºF | \* | \* | 140 ft2 |

\* Utility tunnel sprinkler systems design based on 10 psi available to the remote 10 sprinkler   
heads. Head spacing shall be 10 to 12 feet on center.

Provide horizontal dry sidewall sprinkler heads for outside air and exhaust plenums and other areas subject to freezing.

Conveyor Sprinkler Systems: Provide head on both sides of roll down shutter at baggage pass-throughs, within enclosed conveyor portions, above and below conveyors and elsewhere as required. All overhead conveyor systems shall have separate isolation valves with tamper switches, and a flow switch. The conveyor systems shall be a sub-zone off the sprinkler system where the conveyor system starts.

* + - * 1. Pipe Schedule Sprinkler System: Size sprinkler system piping in accordance with NFPA 13.

1. PRODUCTS
   * + 1. ACCEPTABLE MANUFACTURERS
          1. All manufacturers and products shall be FM approved.
       2. DELUGE VALVE (AUTOMATIC FIXED WATER SPRAY SYSTEM)
          1. Description:

UL and Factory Mutual Research approved deluge valve system including valve and trim, electric operated. System also includes, but not limited to system control panel, solenoid valve, compatible weatherproof infrared flame detector system, test valves, and drain valves. Deluge system controlled by electric release.

Infrared Flame Detector: Detector to provide an early warning of flaming fires involving all types of hydrocarbons and material containing carbon. Detector to be insensitive to electrical arcs, intrinsically safe, weatherproof, two wire supervised, built-in response indicator. Detector suitable to be used in Class 1, Division 1, Groups A, B, C & D hazardous locations. Detector to include solar blind characteristics making it suited for outdoor areas and not produce unwanted alarms. 16-25.5 VDC (polarity conscious) supply voltage. Factory Mutual approved.

* + - * 1. Manufacturer:

Deluge Valve: Viking, Reliable, or pre-bid approved equal.

Infrared Flame Detector: Siemens or pre-bid approved equal.

* + - 1. ELECTRIC ALARM BELL
         1. 10-inch diameter, 120-volt, 1 phase, red finish, UL and FM approved, labeled “Fire Alarm.”
      2. FIRE DEPARTMENT CONNECTION (FDC)
         1. Two-way polished chrome-plated flush fire department inlet connection with single clapper, lettered “Auto. Spkr.,” 4" x 2-1/2" x 2-1/2" complete with plugs and chains, FM approved.
         2. Potter-Roemer Fig. No. 5710, Standard, or pre-bid approved equal.
      3. WALL INDICATOR VALVE
         1. UL listed, straight type wall indicator post with non-rising stem gate valve, supervisory control valve switch, exterior visual indication (valve is open or shut), means of locking valve position open or closed, FM approved.
         2. Reliable, Sprink-Line, or pre-bid approved equal.
      4. STANDPIPE VALVES
         1. Cast brass 2-1/2-inch-angle hose valve, red hand wheel, 300-pound rated, cap and chain. Rough chrome plated finish, FM approved.
         2. Potter-Roemer Fig. 4065, Standard, or pre-bid approved equal.
      5. STANDPIPE VALVE CABINET
         1. 20-gauge steel box and frame in stainless steel, with glass door indicating “Fire Department Valve,” FM approved.
         2. Potter-Roemer Fig. 1810, Standard, or pre-bid approved equal.
      6. SPRINKLER HEADS
         1. As indicated; equivalent products by Reliable or pre-bid approved equal.
         2. All heads shall be UL listed for application and installation and FM approved. Provide high temperature heads for mechanical rooms, areas below skylights, and other areas which have high heat producing equipment to prevent accidental trippage.
         3. Sprinkler Heads:

Sprinklers installed in finished ceilings shall be recessed plate ceiling type, chrome finish, FM approved.

Sprinklers installed at areas with unfinished ceilings shall be upright or pendant type, rough bronze finish, FM approved.

In finished areas, extended coverage horizontal sidewall, fast response, chrome plated, FM approved.

In outside air and exhaust plenums, sprinkler heads shall be rough brass finish, horizontal dry sidewall sprinkler, FM approved.

At baggage pass-throughs to finished areas, and in finished areas where concealment is appropriate, rough brass finish drop-down concealed style with cover plate, FM approved.

In police holding cells, chrome plated, institutional, quick response, UL listed, extended coverage sidewall, FM approved.

In computer room (pre-action system), chrome plated, dry pendant sprinkler, FM approved.

Water Spray Nozzles: Open nozzle, brass finish, 180° spray pattern, 4.3 K-factor, FM Approved.

* + - * 1. Head Guards: In tunnel or other locations susceptible to damage, provide guards manufactured by Reliable or equal, with welded wire to withstand heavy impact.
      1. FLOW SWITCH
         1. UL listed and FM approved electric flow switch with retard. Provide required accessories.
         2. Two pole type with normally open and normally closed contacts. Location as shown. Provide all required related trimmings. Provide one set of contacts for use by the fire alarm system. Coordinate with pipe size.
         3. Potter Electric Model VSR-D, or pre-bid approved equal.
      2. TAMPER SWITCH
         1. Each sprinkler system control valve shall be equipped with a tamper switch listed by UL for the particular location and type of valve supervised. The switch shall initiate a supervisory signal upon a maximum of two complete turns of a valve wheel or closure of ten percent, whichever is less. The tamper switch shall have the number of poles provided to coordinate with the fire alarm system manufacturer, and shall be FM approved.
      3. FIRE DEPARTMENT TEST STATION
         1. One piece, compact, floor test module for standard alarm test loop, threaded, FM approved, Victaulic Style 720, or equal.
      4. DRY PIPE VALVE
         1. UL and FM approved dry pipe assembly complete, including but not limited to air compressor to maintain air pressure, desiccant air dehydrator to reduce condensation with piping system, and required drain lines provided to floor drain.
         2. Provide all required test valves, drain valve, and related trimmings.
         3. Reliable Model D or Model EX, Automatic Sprinkler, Reliable, Viking, or pre‑bid approved equal.
      5. PRE-ACTION SYSTEM (DOUBLE INTERLOCKED) ELECTRIC/PNEUMATIC RELEASE
         1. The method of release of the deluge valve (priming water pressure) shall be by an electric solenoid valve and a pneumatic actuator. The electric solenoid valve shall open upon activation of the electrical supplemental detection system. The pneumatic actuator shall open upon activation of a sprinkler head on the sprinkler system. The opening of the deluge valve shall not be dependent on the order of activation of the release devices, only that both devices shall activate before the deluge will open. The pre-action system riser shall be a listed and approved assembly. The system riser shall be equipped with a rubber seated check valve downstream of the deluge valve and prior to the supervisory air connection. The pre-action system shall be provided with all necessary appurtenances to complete the system. The pre-action system shall be a double interlock release type, and shall be FM approved.
         2. The system shall include, but not be limited to, the following components:

Water Control Valve: Deluge of pre-action systems shall utilize a 90-degree pattern type of deluge valve. Deluge valve shall employ a positive vent on the priming line to ensure that the deluge valve will not prematurely reset. Inlet and outlet connections of deluge valve can be flanged by flanged or flanged by grooved, respectively. Deluge valve shall be UL listed and FM approved. Deluge valve shall have a working pressure of 175 psi. Valve trim shall be compatible.

Detection: The activation of the system shall incorporate as part of the operation, a compatible electric detection system. The detection devices installed shall be compatible with the deluge valve control panel.

Control Panel:

Be capable of single hazard cross-zone release. Control panel shall be equipped with a local tone alarm to annunciate loss of A/C power, system trouble, circuit trouble and low auxiliary D/C power supply.

Be capable of supervising trouble and audible alarms. Trouble and alarms shall be able to be silenced at release panel.

Housed in a vented enclosure with ambient temperature compatibility of 32ºF to 120ºF. Panel enclosure shall be of adequate size to house auxiliary D/C power supply. Auxiliary D/C power supply shall consist of two 12-volt lead acid batteries of the same ampere hour rating. Actual ampere hour rating will be established by auxiliary D/C power requirement.

Solenoid Valve: Deluge valve priming water release device shall be an electrically operated solenoid valve. The solenoid valve shall:

Be constructed of a 1/2-inch brass body with a stainless steel core tube, core, plugnut and springs.

Have a maximum working pressure of 175 psi.

Be UL listed for its intended use and shall be listed for use with Viking Model E deluge valves and Viking Model H flow control valves.

Fire Protection Rated Compressed Air Supply: Provide an air supply capable of restoring system pressure within 30 minutes. Tankless air compressors are not acceptable. Acceptable air supply arrangements are:

A tank-mounted air compressor with an air maintenance device between the air compressor and the air supply inlet on the system riser.

A riser-mounted air compressor feeding an air reservoir. An air maintenance device shall be placed between the air reservoir and the system riser.

A riser-mounted compressor listed as an air maintenance compressor.

System Check Valve:

UL listed and FM approved for use on all wet fire protection systems.

Manufactured with supply side and system side gauge connections and a main drain outlet in accordance with NFPA 13.

Constructed of a ductile iron body with a brass seat and a rubber faced clapper assembly hinged to a removable access cover.

Equipped with a removable access cover for periodic inspection as required in NFPA 25.

Have a working water pressure of 250 psi.

High-Low Air Pressure Switch: Supervisory air pressure shall be maintained on all pre-action systems with 20 sprinklers or more on the system piping. Low air pressure alarm will activate by way of a pressure supervisory alarm pressure switch. The low air pressure alarm switch shall be compatible with system devices, UL listed and FM approved for the application in which it is used, and have the ability to be wired for Class A or Class B service.

* + - * 1. Water Flow Pressure Switch: Water flow will activate an alarm by way of an alarm pressure switch. The alarm pressure switch shall be compatible with system devices. Alarm pressure enclosure shall be UL listed and FM approved. Alarm pressure switch shall have the ability to be wired for Class A or Class B service.
      1. MISCELLANEOUS ACCESSORIES
         1. Provide UL labeled and FM approved check valve with rubber lined seats.
         2. Provide ball drip drains, test orifices, and other related items as required to provide a complete fire protection system.
         3. Items shall be UL labeled and FM approved for application as required.

1. EXECUTION
   * + 1. COORDINATION
          1. Notify the Port 72 hours in advance of any shutdown of existing sprinkler system.
          2. Coordinate fire protection piping and appurtenances with ducts, other piping, electrical conduit, moving walkways, and other equipment.
          3. Conceal fire protection piping and equipment except in areas without ceilings and as noted on the drawings.
          4. Locate valves, piping, heads, and equipment where shown on the drawings. System drain valves are not shown. Install as required to permit drainage of all systems.
       2. INSTALLATION
          1. General:

Install fire protection systems to serve the entire building.

The drawings indicate approximate locations of piping, sprinkler zones, and types of systems. The drawings do not indicate the locations of sprinkler heads in ceiling areas. In general, sprinklers shall be located in the center of ceiling panels and symmetrically within rooms and down corridors, coordinated and in pattern with lights and grilles. Deviations shall be approved in writing prior to initiation of work.

Locations of sprinkler heads, outlets, piping, and appurtenances are not shown in all areas and therefore shall be installed in accordance with code requirements.

Provide tamper switches on all sprinkler system isolation valves. Provide flow switches for all sprinkler zones.

Provide a corrosion-resistant metal placard on each riser indicating location, number of sprinklers, design criteria, water demand, and date of installation.

Provide window wash (1 hour separation) at 1-hour fire rated curtain walls and at windows installed in 1-hour fire rated walls, unless specified or indicated otherwise on the drawings.

Use for PDX only.

Provide drop-down style heads with brushed cadmium finished cover plate at baggage pass-throughs into finished spaces. Provide deflectors above exposed sprinklers at pass-throughs of unfinished spaces as required.

Provide sprinkler protection below wood decks of bag make-up carousels.

Provide corrosion resistant metal placard at all new fire department connections to indicate areas served (by gate numbers).

Provide half-sized drawings indicating sprinkler zones served by each valve room. Mount drawing within valve room at a location designated by the Port.

* + - * 1. Piping:

Hold piping as tight to structure as possible. In general, run piping in areas without ceilings parallel to building elements.

Provide test tees as required.

* + - * 1. Drain Piping:

Pitch drain piping 1/2-inch per 10 feet minimum; no traps will be allowed.

Pipe inspector test connections to exterior at grade level only and discharge onto suitable splash plate as approved by local applicable governing authorities. Inspector test discharge for mezzanine level or roof/penthouse sprinkler zones shall not discharge onto roofs. Provide chrome plated wall flanges on exterior building wall penetrations.

Drain valves shall be no higher than 5'-0" above floor level.

Pipe drain valves for pre-action systems located within the interior of the building through air gap to the sanitary sewer.

For drains piped to the outside, provide an additional full-sized tee inside the building to discharge to the nearest floor drain.

* + - * 1. Electrical: All electrical work shall comply with Division 26.
        2. Fire Service: Connect to sprinkler line where it enters the building.
        3. Pre-Action System: Install pre-action system riser assembly, compressed air supply, and control panel outside of the area being protected.
      1. EXTRA STOCK
         1. Provide additional number of heads of each type and temperature rating installed as required to meet NFPA 13 requirements.
         2. Provide storage cabinet or cabinets as required to receive reserve sprinkler heads and special installation tools required.
         3. Inside the cabinet, provide a list of heads stored within and a brief description of where installed.
         4. Provide index label for each head indicating manufacturer, model, orifice size or K-factor, and temperature rating.
         5. Provide two sets of tools for removal of flow switch covers.
         6. Locate cabinet near sprinkler control station as approved.

Choose between the Commissioning and Testing articles. Use Commissioning if Section 019100 is included otherwise use Testing.

* + - 1. COMMISSIONING
         1. Commission items specified in this section.
         2. Deluge System Testing: Notify the Port and City of Portland Fire Department personnel one week in advance of the deluge system testing. The Port will determine the date and time of the testing. Witnesses for testing and final certification shall include the Port and City of Portland Fire Department personnel.
      2. TESTING
         1. Check out, start up, and test items specified in this section.
         2. Notify the Port 48 hours prior to any test. Provide final test and certification in the presence of the Port.
         3. Deluge System Testing: Notify the Port and City of Portland Fire Department personnel one week in advance of the deluge system testing. The Port will determine the date and time of the testing. Witnesses for testing and final certification shall include the Port and City of Portland Fire Department personnel.

END OF SECTION 212000