



WATER MIST FIRE PROTECTION

General Specification for Gas-Driven Pump System



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WATER MIST FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

- A. Publications listed below form part of specification to the extent referenced. Publications are referenced in text by basic designation only. Use latest approved revision of all references.
1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
 - a. ANSI/ASME B31.1 Power Piping Code.
 2. DIN STANDARDS (EUROPEAN COMPONENTS)
 - a. DIN 2391, 3861, 3865, 20078, 17457, 17458
As referenced for European fittings pipe, and tube.
 3. FACTORY MUTUAL APPROVALS (FM)
 - a. FM Approval Standard for Water Mist Systems Class Number 5560.
 4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
 - a. NFPA 13 Standard for the Installation of Sprinkler Systems.
 - b. ANSI/NFPA 70 National Electrical Code.
 - c. NFPA 72 National Fire Alarm Code.
 - d. NFPA 750 Standard on Water Mist Fire Protection Systems.
 - e. NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
 5. INTERNATIONAL STANDARDS ORGANIZATION (ISO)
 - a. ISO 261 Standards for Ermetto (EO) high-pressure compression fittings SEE PARKER Fluid Connectors Catalog: Flareless DIN 3861, 3865 and 20078; Weld nipple DIN 3865.

- b. ISO 8434-1, Tube/Hose Connections.

1.2 SYSTEM COMPLETENESS

- A. Provide systems complete, workable, and ready for operation.

1.3 DESIGN REQUIREMENTS

A. General

1. This Specification applies to the design, installation and commissioning of high-pressure, wet-pipe, dry pipe or pre-action water mist fire protection systems using a High Pressure Gas-Driven Pump system.
2. Design and installation of the water mist systems shall meet the applicable requirements of NFPA 750 and FM Approval Standard 5560 except where variances are permitted by this Specification.
3. The design is based on using one Manufacturer's water mist nozzles with specific K factors, cone angles, spray patterns, projection distances, and fire test performance data. If alternative nozzles are proposed, submit data that establishes equivalency with respect to discharge rate, cone angle, spray pattern, projection distances and fire test performance.
4. Water mist nozzles installed shall have passed the fire test portion of the FM Approval Standard 5560 or other international standards for High Pressure Water Mist Systems for the Hazard being protected.
5. The system can be designed as wet-pipe system, dry pipe or pre-action system. Piping network where applicable is pressurized to a supervisory standby pressure of approximately 25 bar (362 psi), monitored by a low pressure alarm switch.

B. Water Mist Nozzles

Nozzles shall be listed or tested for the hazard classification that it is protecting.

C. Hydraulic Calculations

1. Hydraulic calculations shall be performed in conformance with NFPA 750 to confirm that the required demand (flow and pressure) at the pump discharge header is within the capacity of the Pump Unit.
2. Hydraulic calculations shall be performed using the Darcy Weisbach method as described in NFPA 750, Chapter 9 based on instantaneous flow at maximum pressure (beginning of discharge).
3. The design area or number of nozzles shall be per the approved DIOM or fire test results.

D. High-pressure Gas-Driven Pump Unit

1. The system shall be supplied from a Gas-Driven Pump Unit (GPU). Required GPU size and duration will be determined based on system design.

E. Releasing System Panel

1. The GPU monitoring circuits shall be connected to a Fire Alarm Control Panel (FACP). The FACP shall be labeled to properly indicate each of the conditions of the GPU.

1.4 SUBMITTALS

A. Submit under the following information.

1. Manufacturer's Catalog Data
 - a. Fire test data or fire test summary to show that the system has passed FM Approval Standard 5560 or other fire test protocols for applicable hazard occupancies.
 - b. Data on the nozzles including K factor and minimum operating pressure.
2. Drawings
 - a. Submit a Set of Working Drawings in conformance with NFPA 750 for Review and Approval prior to beginning installation.
 - b. Submit a Set of As-Built drawings at completion of the project.
3. Calculations
 - a. Submit hydraulic calculations in conformance with NFPA 750 for review and approval before commencing installation work.
4. Operation and Maintenance Manuals
 - a. Submit written instructions on how to operate and maintain the system.
 - b. Provide a Matrix of Scheduled Maintenance Actions for inspection and maintenance requirements in conformance with NFPA 750, NFPA 25, and the Manufacturer's recommendations. Identify actions for weekly, monthly, semi-annual and/or annual intervals.

1.5 QUALITY ASSURANCE

- A. This Specification intends conformance with NFPA 750, which requires that all components of a water mist system be "listed for their intended use".

1.6 QUALIFICATIONS

- A. Manufacturer shall have the following background:
 - 1. Specialist in manufacturing water mist nozzles and high-pressure pumping equipment and valves for water mist fire protection systems.
 - 2. Demonstrated evidence of fire tests of their equipment conducted to FM Approval Standard 5560 fire test or other international protocols for applicable fire hazards.
- B. Installer shall have the following background:
 - 1. Specialists in the design and installation of high pressure water mist fire protection systems.
 - 2. Received recent training in installation of high-pressure tubing systems. Training shall include make-up of progressive ring compression fittings, use of hydraulic tools for setting ferrules, use of hydraulic tube-bending tools, storage and handling of stainless steel tubing, proper methods of cutting, reaming, swabbing and cleaning stainless steel tubing; and proper installation of pipe clamps and supports.

1.7 REGULATORY REQUIREMENTS

- A. Comply with all regulatory requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site, store, protect and handle in accordance with clients recommendations and instructions.
- B. Deliver materials to Project site in original packaging, containers or bundles labeled with manufacturer's name and product identification information.
- C. Store pipe and stainless steel tubing in a clean, dry area protected from construction traffic. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Store materials, fittings, valves, and nozzles in clean, dry, secure area.
- E. Use proper tools for handling bundles of pipe or tubing, and for accurate placement and support of heavy equipment.

1.9 COORDINATION

- A. Coordinate all work including coring, cutting and patching, welding and electrical work with the General Contractor.

PART 2 PRODUCTS

2.1 HIGH-PRESSURE PUMP UNIT

- A. High-pressure Gas-Driven Pump Unit (GPU).
 - 1. Provide pre-assembled GPU pump unit assembly, as described in Section 1.3 D - Design Requirements, or equivalent.
 - 2. The Pump Unit shall include
 - a. A single piston pump, mounted vertically in a frame arrangement and fitted with all the required accessories for proper operation.
 - b. The pump shall be powered by compressed air or nitrogen stored in high pressure storage cylinders – nominal volume of 50 liters (300 cubic feet) – pressurized to the nominal pressure of 182 bars (2,640 psi) connected directly to the GPU.
 - c. The number of cylinders is a function of the number of spray heads required to protect the hazard and the overall period of protection.
 - d. The GPU shall be fitted with a standby pump capable of maintaining the system standby pressure at 25 bar (365 psi)
 - e. Each cylinder shall be fitted with a pressure monitoring switch set to annunciate low pressure conditions of the high pressure cylinders as well a pressure gauge to provide visual indication of the status of the cylinders.

2.2 INSTRUMENTATION

- A. Provide all instrumentation associated with the proper functioning of the GPU and pre-wired into the supervisory pressure switches and flow switches to be mounted on the piping or sectional control valves.

2.3 PIPING AND TUBING

- A. Pipe and tubing on the discharge side of the GPU shall be suitable for the working pressure of 2,030 psig (140 bar) of the water mist system.
- B. Pipe and tubing on the supply side of the GPU shall be suitable for the working pressure of 2,900 psig (200 bar) of the water mist system
- C. Galvanized pipe shall not be used for any part of the water mist system after the filters on the Pump Unit.
- D. Metric Stainless Steel Tubing shall be used for all system piping. Use only metric size tubing meeting European DIN standards, in order to permit connection to European manufactured water mist system fittings including distribution blocks, sectional control valves, ball valves, and nozzle mounting adapters.
 - 1. Tube OD and wall thickness to DIN 17457 or DIN 17458.

38-mm x 3.0-mm	DIN 17457
30-mm x 2.5-mm	DIN 17457
25-mm x 2.0-mm	DIN 17457
16-mm x 1.5-mm	DIN 17457
12 mm x 1.2-mm	DIN 17457
 - 2. Maximum hardness of stainless steel tubing shall be HRB 90.
- E. Compression Fittings shall be Parker “Ermeto Original (EO or EO2)” progressive ring fittings, Series S (heavy) in metric tube sizes, or equivalent.
 - 1. For tubing running to the exterior of or in the exterior the building, fittings and nuts shall be entirely stainless steel.
 - 2. Special fittings manufactured by the Vendor include stainless steel “distribution blocks”.
- F. Pipe and Tubing Supports
 - 1. Comply with the requirements and as specified herein:
 - 2. Pipe supports for welded stainless steel piping shall conform to the hanging requirements of NFPA 13 and ASME B31.1. Construct stanchions, straddle supports, and trapeze supports based on hanger spacing, span and minimum load capacities in NFPA 13.
 - 3. Supports for stainless steel tubing shall comply with ASME B31.1 and the manufacturer’s recommendations with respect to spacing. The maximum spacing between tube supports and maximum distances from tube supports

to bends or compression fittings shall comply with manufacturer's recommendations.

4. Where obstructions make it impossible to comply with spacing limits for tube supports, the distance between supports may be increased by 75 percent, provided that there are no fittings or changes in direction between the two supports.
5. Tube clamps shall be non-combustible Ermeto Original series A components for normal mechanical stress, or equivalent. Utilize compatible mounting rail attachments with lock nut and locking plate where necessary.
6. Utilize "uni-strut" metal mounting rails or equivalent as trapeze members where required to span between structural members or stanchion supports. Attach all support materials firmly to the building structure, using trapeze bars, back plates, angle brackets, welds, concrete inserts, U-bolts and floor anchors as required.

2.4 VALVES

- A. Valve type and size shall be in accordance with the design drawings.
- B. Drain valves are located at the base of each system riser and at the extreme end of each water mist piping system.

2.5 NOZZLES

- A. Nozzles shall be listed or tested for the intended application, or Approved by the Authority Having Jurisdiction (AHJ).
- B. Provide and install Marioff HI-FOG water mist nozzles or equivalent. Other nozzles shall be permitted, provided that documentation is submitted to confirm equivalency with respect to fire test performance, K factor, spacing rules, distribution pattern, spray cone angle and temperature rating.

2.6 SUPERVISORY AND ALARM DEVICES

- A. The water mist system installer shall provide and install all monitoring, supervisory and alarm devices that attach to the GPU, control valves, or water mist piping system. The contractor responsible for work shall connect the devices to the fire alarm system.

- B. Monitoring supervisory and alarm devices include the following:
1. Tamper Switches. Mount tamper switches on all valves as required by code, so that correct, reliable operation is assured.
 2. Pressure Switches. Provide and install pressure switches on the GPU and on system piping as indicated on the Drawings.
 - a. Pressure switches intended to function as supervisory devices shall be compatible with the electrical requirements of the Fire Alarm and Control Panel. They shall be wired into the Fire Alarm Panel by the contractor responsible for work.
 - b. High-pressure supervisory switches on the wet pipe system risers shall be capable of monitoring a system standby pressure of 25 bar.
 - c. Install isolating valves so that pressure switches can be isolated for removal or replacement without shutting down the system.

2.7 SCREENS AND FILTERS

- A. Comply with the requirements in NFPA 750 for filters and strainers on the water supply connection.

2.8 SIGNAGE AND IDENTIFICATION

- A. Identify all valves including isolation and section valves.

PART 3 EXECUTION

3.1 PREPARATION

- A. Stainless Steel Tubing
1. Protect stored stainless steel tubing against entry of debris and mechanical damage.
 2. Follow the manufacturer's recommendations for best practice in cutting, cleaning and bending stainless steel tubing. Best practices shall include:
 - a. Use of wheel-type tube cutters is prohibited.
 - b. All tube cuts shall be made by saw in a tube cutting vice.
 - c. Use de-burring and reaming tool on every tube end.
 - d. Use 90 degree or 45 degree bends at changes in direction wherever possible, rather than elbows.

- e. Employ tube bend prior to connection to every nozzle adapter fitting, as shown in the Drawings. Do not connect into adapter fitting at 90 degree angle.
- f. Use of hydraulic bending tools with proper radius dies for each size of tubing.
 - i) For 12-mm and 16-mm tubing, use 30-mm minimum radius.
 - ii) For 25-mm tubing, use 45-mm minimum radius.
 - iii) For 30-mm tubing use 50-mm minimum radius.
 - iv) For 38-mm tubing use 65-mm minimum radius.
- g. Reject all bends with visible signs of tube flattening.
- h. Before assembly, remove scale and foreign material from inside and outside of pipe or tube. Use pneumatic “Jet-Cleaner” tool or equivalent to push a cleaning plug properly sized for the tube inside diameter through every section of tubing after preparation and before installation. Cleaning procedures will be inspected for adequacy prior to commencing work, and installed tubing that has not been cleaned shall be removed, cleaned and re-installed
- i. Collect cleaning plugs in a waste receptacle after use. Do not re-use cleaning plugs.

3. Compression Fittings

- a. Follow the compression fitting manufacturer’s recommendations of good practice for setting ferrules and tightening fittings.
- b. Follow the compression fitting manufacturer’s recommendations of good practice for clamp and support details to minimize stress on fittings.
- c. Use hydraulic ferrule-setting machine with correct dies for all progressive-ring ferrules on tubing larger than 16-mm.
- d. Use hand-held hardened pre-assembly tool for setting progressive-ring ferrules in 16-mm and 12-mm tubing. Do not set ferrules by tightening in the fitting.

3.2 INSTALLATION

A. General

1. Coordinate installation of the water mist system equipment, piping, and alarm devices with other work.
- B. Piping and Tubing
1. Risers shall be anchored by tubing clamps at top and bottom, and at all changes in direction, bends or fittings. Spacing between tube clamps and distances from bends or fittings shall be specified in the Drawing details.
 2. To the extent possible, minimize the length of 12-mm or 16-mm tubing between the distribution block and the individual nozzles. The actual length of tubing between the distribution block and nozzle shall be taken into account in the hydraulic calculations.
- C. Pipe Hangers and Supports
1. Pipe clamps or U-bolts shall be used to anchor pipe to stanchions or any other type of support. Clamps shall prevent vertical or lateral movement, but permit longitudinal expansion of the pipe or tube.
 2. Trapeze Hangers shall comply with NFPA 13 for span and structural dimensions. Attachment of hangers or clamps to the trapeze shall be made with rigid vertical members, to provide horizontal rigidity to the supported pipe. Use of long all-thread rods and clevis-type hangers without bracing to prevent horizontal pipe movement shall not be permitted.
 3. Tube hangars (clamps) shall be spaced in accordance with NFPA 750 or Manufacture's recommendations.
- D. Valves
1. Provide clearance around lever handled ball valves sufficient to permit full unobstructed movement of the lever handle.
 2. Provide clearance around the Sectional Control Valves to permit access to connections and attached instrumentation.

PART 4 INSPECTION AND TESTING

4.1 GENERAL

- A. System acceptance tests shall comply with NFPA 750, NFPA 25, manufacturer's acceptance test recommendations and the requirements of this section.
- B. The test procedures may include the following (as applicable):
 1. Visual quality check of installation of nozzles, pipes, tubing and hangers,

2. Pneumatic and Hydrostatic Tests,
3. Review of Mechanical Components,
4. Pump Tests,
5. Review of Electrical Components,
6. Preliminary Functional Tests, and
7. System Operational Tests.

4.2 OVERHEAD PIPE AND TUBING

A. Visual Inspection

1. Hanger details including support fastening to walls, ceilings, ceiling structure, tube clamp spacing and nozzle supports shall be inspected for conformance to recommended practice and the details of this specification.
2. Repair or replace all hangers and tube supports that do not meet the requirements of this specification.

B. Hydrostatic Testing

1. Test all piping and tubing hydrostatically in accordance with the requirements of NFPA 750.
2. Vent air from the system piping and tubing as it is filling with water.
3. Repair all leaks revealed through the hydrostatic test and retest until the test pressure remains stable for the duration of the test.

4.3 WATER MIST FIRE PUMP

- A. A representative of the pump unit manufacturer or trained authorized Distributor shall be present for the commissioning of the water mist fire pump unit. The commissioning of the fire pumps shall be coordinated with the contractor responsible for the work and the AHJ.

1. Commissioning shall be performed in accordance with a written procedure which has been reviewed and approved by the pump unit manufacturer.

PART 5 SYSTEM MAINTENANCE

5.1. MAINTENANCE SCHEDULE

- A. Prepare a maintenance schedule complying with the manufacturer's recommendations and the requirements of NFPA 750 and NFPA 25.
- B. Include maintenance actions for weekly, monthly, bi-annual and annual frequencies.

END OF WATER MIST FIRE PROTECTION SYSTEM SPECIFICATION