DIVISION 21 – FIRE SUPPRESSION

Table of Contents

21 00 01	General
21 00 02	Scope
21 00 03	Codes
21 00 04	Design Intent Report
21 00 05	Coordination with University of Minnesota Departments
21 00 06	Access for Maintenance
21 00 07	Fire Protection Drawings
21 00 08	Coordination with Other Trades
21 00 09	Materials, Manufacturers and Suppliers
21 00 10	Equipment Bases
21 00 11	Painting
21 00 12	Existing Facilities
21 00 13	Building Service Outages
21 00 14	Industry Standards
21 00 15	Welding and Brazing
21 00 16	Electrical requirements
21 00 17	Excavation and backfill for Underground Fire Suppression Work
21 01 00	Testing of Fire Suppression System
21 02 00	Submittals
21 03 00	Contractor Qualifications
21 04 00	Materials
21 10 00	Standpipe, Sprinkler and Other fire Suppression Systems
21 30 00	Fire Pumps

21 00 00 Fire Suppression

21 00 01 General: Fire Suppression specifications shall be properly coordinated with Division 01 00 00 - General Requirements and other divisions, and shall conform to the format and organizational requirements stated in the introduction of these standards.

21 00 02 Scope: This division covers the following fire protection systems:

2.1 Fire pumps
2.2 Automatic sprinklers
2.3 Fire and system water supply
2.4 Fire department connections (FDC)
2.5 Fire suppression testing
2.6 Static and residual pressure and flow tests data
2.7 Above ground piping and materials
2.8 Underground piping and materials
2.9 Automatic fire and smoke monitoring and connections to BSAC and central station system monitoring.

21 00 02 Prohibited materials and practices:
Where applicable, individual sub divisions include the prohibited materials and installation practices.

21 00 03 Codes: All work shall meet all applicable U of M, local, state and national codes and standards and including all applicable NFPA standards

21 00 04 Design Intent Report: The Architect/Engineer (A/E) shall provide a design intent report at the preliminary design phase that documents the following:

4.1 Hazard classification of various occupied areas and zones.
4.2 Mechanical rooms shall be designed as Ordinary Hazard Group I.
4.3 Library spaces and laboratories shall be designed as Ordinary Hazard Group II.
4.4 Water densities for different areas and zones per applicable NFPA
4.5 Choice of equipment
4.6 Proposed variances to the codes and standards and their justifications
4.7 B-3, SB-2030 and/or LEED compliance measures when required.
4.8 50 year design considerations and its impact on fire suppression equipment selection.

4.9 Alternates and proposed value engineered construction materials and construction methods.

4.10. Site piping thrust blocks and piping entrance thrust block calculations

4.11 The design area in light hazard, ordinary hazard and extraordinary hazard locations shall be per NFPA 13 fire code. The design in undetermined hazard locations shall be a minimum of 3,000 square feet. The design area shall not be reduced with the use of quick response heads. Room design methods are not acceptable.

4.12 The contractor shall allow a safety factor of 10 psi for new construction and a safety factor of 5 psi for retrofit.

4.13 The design layout generally shall follow the tree system. Cross mains shall be continuous in size from the connection at the standpipe to the end of the corridor. Cross mains shall be a minimum of 2 inches in diameter in light hazard areas, and a minimum of 3 inches in diameter in ordinary hazard areas. The water velocity in the pipes shall not exceed the minimum requirements as stated in NFPA 13.

4.14 The university shall arrange for the results of a hydrant flow test given to the A/E during the programming phase of the building design. Contact Energy Management Civil Engineering for flow information.

21 00 05 Coordination with University of Minnesota Departments.

The architectural and engineering consulting firm (A/E) shall coordinate with the following departments to ensure that the user needs are satisfied:

5.1 Facilities Management
5.2 Board of Regents
5.3 U of M Building Code Office
5.4 Capital Project Management (CPM)
5.5 Office of Classroom Management (OCM)
5.6 Department of Environmental Health and Safety (DEHS)
5.7 Facility Support
5.8 Parking and Transportation Services (PTS)
5.9 Central Security
5.10 Office of Information Technology (OIT)
5.11 . Office of Information Technology (OIT)
5.12 Energy Management and University Planning
5.13 Operations and Maintenance
5.14 District offices
5.15 The A/E shall also coordinate with the University Utility Group to determine the electrical power source for the fire pump.

5.15.1 The architect shall work with the fire protection engineer to ensure that the equipment installation meets the architectural requirements of the building. All fire protection pumps shall be located inside the building.

5.15.2 See division 23 for the diesel driven fire pump room ventilation

21 00 06 Access for maintenance. The contractor shall label all equipment and provide equipment room signs.

6.1. Location of equipment shall be determined by its service need, so it can be easily maintained.

6.2. The A/E shall coordinate the fire suppression design with other disciplines to provide proper freeze protection of wet systems.

21 00 07 Fire Protection Drawings: Fire protection drawings shall be clearly delineated at appropriate scale to accurately define piping, and equipment.

21 00 08 Coordination with other trades. Fire suppression system shall be coordinated with the building design and construction, as well as with electrical, plumbing, HVAC, civil, temperature controls, and other systems to eliminate construction conflicts.

21 00 09 Materials, Manufacturers and Suppliers. Whenever possible, equipment specified and provided shall be of a type and manufacturer that has a local representative and a local replacement and service outlet to give complete coverage on parts and service at all times.

21 00 10 Equipment Bases: Concrete bases with a 4-inch minimum height shall be provided under the fire pump. Base size and location shall be coordinated with the equipment specified and shall be shown on the architectural and structural drawings. Fire pump shall be provided with vibration isolators as recommended by the manufacturer.

21 00 11 Painting. All main standpipes, leaders and main pipes shall be painted to meet the U of M requirements, section 09 91 00

21 00 12 Existing Facilities: For remodeling projects, the U of M shall provide openings in walls and ceilings where required and where the A/E requests to permit verification of existing piping, ductwork and equipment.

21 00 13 Building Service Outages: The A/E shall coordinate this requirement with the Preconstruction Meeting Agenda. form located in the Forms Section

13.1 Service Outage Request: The contractor shall request all building service outages through the owner's representative. The contractor shall provide minimum notification of 24 hours. This includes existing fire and smoke protection systems.
Impairment notices are required for all interruptions.

13.2 Fire Safety Precautions

13.2.1 The A/E shall include the following or similar statement in the specifications with regard to protective measures for the contractor during grinding, cutting, brazing, sweating or welding operations.

13.2.2 All grinding, cutting, brazing, sweating or welding operations carried on in the vicinity of, or accessible to combustible material, shall be adequately protected to make certain that a spark or hot slag does not reach the combustible material and start a fire. For remodeling, all asbestos abatement shall be coordinated with the U of M.

13.2.3 When it is necessary to do grinding, cutting, brazing, sweating or welding close to wood construction in pipe shafts or other locations where combustible materials cannot be removed or adequately protected, employ fireproof blankets and proper fire extinguishers. A helper shall be stationed nearby to guard against sparks and fire.

13.2.4 Whenever combustible material has been exposed to molten metal or hot slag from welding or cutting operations or spatter from electric arc, a fireguard shall be kept at the place of the work for at least one hour after completion to make sure that smoldering fires do not start.

13.2.5 When welding or cutting in a vertical pipe shaft or floor opening, a fireguard shall examine all floors below the welding or cutting operation. The fireguard shall be kept on duty for at least one hour after completion of work to guard against fires.

13.2.6 Before grinding, cutting, brazing, sweating or welding, consult with the A/E as to particular safety precautions.

13.2.7 In the case of a remodeling project in an existing building or connection of a new building to an existing building, the A/E also shall include in the specifications all the mandatory requirements described in the Standard Operating Procedures for Hot Works form located in the Forms section.

21 00 14 Industry Standards. Fire protection systems requiring repairs shall be performed by qualified personal in order to maintain the system listing.

In addition to the requirements of the regulatory agencies listed in Division

01 00 00 - General Requirements, Division 01 41 13 - Building Code Regulatory Requirements, the design and construction shall conform to the latest edition of the following standards where applicable:

14.1 American Concrete Institute
14.2 American Institute of Steel Construction
14.3 National Fire Protection Association
14.4 American Society of Heating, Refrigeration and Air Conditioning Engineering
14.5 American Society of Mechanical Engineers
14.6 American Society for Testing Materials
14.7 American Water Works Association
14.8 American Welding Society
14.9 Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps
14.10 Institute of Electrical and Electronic Engineers
14.11 National Bureau of Standards

21 00 15 Welding and Brazing

15.1. Certified and licensed trades persons shall perform all mechanical welding and brazing. Certification shall be for the type of work being performed and shall be accomplished in accordance with the "Qualification Standard for Welding Procedure, Welders and Welding Operators" as specified by ASME or appropriate governing agency for brazing.

15.2. An independent testing laboratory shall radiograph selected joints, which shall be evaluated on the basis of API and ANSI construction standards appropriate for the service. The A/E shall identify the standard applicable for each welded system.

21 00 16 Electrical Requirements. Two reliable power feeds are required for the fire pump. Check with the U of M utility department for the available power sources and approval of the reliable power sources.

All new buildings requiring fire protection fire pump shall be 460-3-60 or as directed by the Energy Management. All existing buildings remodeling shall be coordinated with the existing available power source; either 208-3-60 or 460-3-60 and as approved by the Energy Management.

21 00 17 Excavation and Backfill for Underground Fire Suppression Work. The requirements specified in Division 31 - Earth Work shall be applicable to

this work, including protecting, sheathing and shoring, blasting, compaction filling, compaction testing and grading.

21 01 00 Testing of the Fire Suppression system: Current NFPA test procedures shall be used for testing automatic sprinkler systems.

21 02 00 Submittals. Separate permits are required for all fire protection work.

1. Plans, specifications and shop drawings for fire protection shall be submitted to the University Building Code Division for review and approval.

2. The contractor shall arrange for a fire hydrant flow test and shall include the hydrant flow test information in the shop drawings. The flow test shall be current within the past three (3) years. The elevation of the gauge hydrant relative to the building floor slab shall be included.

3. Refer to Division 01 33 00 - Submittals for the process of reviewing of shop drawings.

4. Shop and As Built drawings for the fire protection system shall be plotted from full scale Auto CAD-generated .dwg format. Floor plans shall be plotted at 1/8 inch or 1/4 inch per foot.

5. The A/E shall review and approve fire protection shop drawings for compliance with university materials standards.

21 03 00 Contractor Qualifications.

1. The licensed fire protection contractor shall be responsible for the design, layout and hydraulic calculations for wet and dry sprinkler, pre-action and deluge systems.

2. A professional engineer who is competent in the field of fire protection or a NICET Level 4 designer shall certify the fire protection contractor's design by signing the design document.

3. The A/E shall specify that the acceptance of the fire-protection system be based upon completion of the necessary testing as outlined in the state and national fire codes. All testing must be documented on certificate forms. The fire-protection contractor is responsible for maintaining the equipment in service after the acceptance test, as well as minimizing impairments to the system for the remainder of the project. During remodeling or after Certificate of Occupancy or Substantial Completion, coordinate impairments with the owner's representative.

4. Provide permanent signs to identify drains, test connections, control valves, risers supplying hydraulically designed sprinkler systems, and each alarm. Label valves normally open (NO) or normally closed (NC).

5. Fire-stopping shall be installed in accordance with Division 07 - Thermal and Moisture Protection. Provide shop drawings for all fire-stopping applications associated with Division 21 - Fire Protection System.

21 04 00 Materials

Prohibited:
a. No schedule 10 or schedule 20 piping materials is allowed for piping 2" and under.
b. Grooved piping on service piping up to fire pump discharge, main valve or detector check.
c. No schedule 10 and schedule 20 threaded pipe

Materials:

1. Grooved piping is only permitted after the fire pump discharge, main valve or detector check valve.

2. All equipment shall be UL-listed and FM-approved.

3. Flanged, threaded, welded or grooved piping connections are acceptable.

4. Threaded pipe shall be a minimum of Schedule 40 black iron or Schedule 40 galvanized.

5. Grooved pipe shall be Schedule 40 black for 2" and under.

6. Schedule 10 and schedule 20 piping is allowed for 2.5" and larger.

7. Use galvanized pipe for dry-pipe, deluge and pre-action systems, and the fire pump suction pipe.

8. Type 'L' copper pipe shall be used in areas susceptible to magnetic fields.

9. Grooved coupling gaskets for dry pipe and pre-action systems shall be of flush seal type.

10. Galvanized pipe shall be used in exterior locations such as parking ramps.

11. The use of CPVC for sprinkler pipe shall adhere to the following:

11.1. CPVC fire sprinkler pipe shall be allowed only if presented, reviewed and approved by the Standards Exceptions Committee.

11.2. In residence halls, CPVC pipe only will be allowed in retrofit applications where steel pipe cannot be installed in a concealed space.

11.3. Where CPVC pipe would be visibly exposed, conceal it with a university-approved Deco-Shield type enclosure for aesthetic purposes. Sheet rock soffet may be substituted for manufactured enclosure. Proper details shall be followed for freeze protection.

12. HDPE for the underground is approved with prior approval from the U of M utility – civil engineering and the city of Minneapolis. All underground HDPE shall be installed per manufacturer's installation recommendations and shall meet all applicable fire protections codes and standards, including but not limited to the thrust blocks and flange anchors. Thrust blocks and anchor calculations are required.

21 10 00 Standpipe, Sprinkler and Other Fire Suppression Systems

1. General Requirements for Standpipes and Sprinklers

1.1. The design of standpipe and sprinkler systems shall comply with the applicable NFPA standards and with the applicable local and state codes.

1.2. Quick response heads shall be used in light and ordinary hazard locations. Provide heads that are at 286 degrees F in mechanical rooms.

1.3. An exterior horn strobe shall be located over the fire department connection. A fire alarm notification appliance circuit shall power the device, which shall be wired according to NFPA 72. Refer to Division 28 – Electronic Safety and Security for more information on how the device shall be supplied.

1.4. 2-1/2 inch by 1-1/2 inch reducing outlets are required on Class I standpipes on the Duluth and Morris campuses.

1.5. Adequate drainage shall be provided to drain and test the sprinkler system. Typical floor drains and slop sinks usually do not have the capacity to handle tests for full flow main drain. All main drains shall discharge to the exterior of the building. The mechanical engineer shall coordinate a location with the architect to minimize damage to landscaping or the building from the main drain discharge. Provisions shall be made for winter testing as required.

1.6. A spring-loaded, epoxy-coated detector check valve shall be installed immediately after the fire protection water service enters the building.

1.7. Control valves shall be electrically supervised.

1.8. The U of M uses 13,800 volts as a cutoff voltage for the vault classification. All electrical distribution at 13,800 volts shall have no fire sprinklers. Vaults shall be supplied with a detection system for the visible and non visible particles of combustion. The detection system shall be approved by the U of M. The detection system shall be configured to be serviced from the vault exterior without entering the vault.

1.9. The A/E shall determine all requirements necessary to omit sprinkler systems for all high-voltage, electrical equipment rooms.

2. Other Fire Suppression Systems

2.1. Pre-action, deluge and special extinguishing panels shall have 72 hours of battery backup capacity.

2.2. All pre-action, deluge and special extinguishing panels shall have the capability to connect to the building fire alarm system in accordance with the requirements of NFPA 72.

2.3. Fire-extinguishing systems shall be FM200 or Inergen suppression systems or approved equal. A successful door fan test or discharge test is required before the university accepts a special extinguishing system.

21 30 00 Fire Pumps

1. General Requirements

1.1. The A/E shall determine when fire pumps are needed based on hydraulically calculated flow analysis using the highest system demand, including standpipe demand. A fire hydrant flow test shall be conducted some time between April through October to verify water supply information used in the calculations. If this test cannot be performed at this time, the A/E should consider a 20 percent reduction of both flow and pressure in calculations to compensate for a lower system flow during peak summer months.

1.2. The fire pump design shall comply with the latest version of the applicable NFPA standards and all other applicable state and local codes.

1.3. The fire pump system shall be diesel engine driven or electric motor driven. The A/E shall make certain that an adequate emergency power generator is available to the fire pump system to provide uninterrupted power. Two reliable power feeds are required. See section 21 00 16

1.4. The fire alarm system shall monitor essential supervisory fire pump conditions, including pump running, loss of power, phase reversal and controller troubles. Refer to the most recent version of applicable state and local codes.

1.5. Fire pumps shall have a separate two-hour masonry enclosure to protect adjacent space against fire.

1.6. Acceptable fire pump manufacturers: Aurora or Patterson.

1.7. Acceptable diesel engine manufacturers: Caterpillar, Clarke or Cummins.

1.8. A diesel-driven fire pump shall be designed to run at no more than 1,750 rpm. Due to the time required to obtain air emission permits, the A/E shall specify the diesel engine with no substitutions. Specify a residential-rated muffler.

1.9. Notify DEHS of the diesel engine model number, capacity-rated fuel consumption and location of exhaust stack at least seven months prior to starting construction activities, so that if necessary, the MPCA can issue an air permit. Refer to Basic Design Requirements in the Program Information/Requirements section.

1.10. Fuel oil fill box should be accessible from outside the building. Provide overflow protection and sensing capability with alarm.

2. Pre-Test and Field Acceptance Test Procedures

2.1. The contractor responsible for pre-test fire protection also is responsible for pre-tests. The contractor shall witness the pre-test and sign off before scheduling system training or the field acceptance test. The pre-test shall be conducted after installation is substantially complete.

2.1.1. All unusual noises and vibrations that occur during the pre-test shall be taken care of before the field acceptance test.

2.1.2. The jockey pump and all other accessories shall be tested to verify that they function properly.

2.1.3. Representation from the fire pump manufacturer is required for pre-test and acceptance tests.

2.1.4. The pre-test and the acceptance tests shall be based upon manufacturer's recommendation.

2.1.5. The final fire pump acceptance test shall be performed as outlined by the latest applicable code. The University Building Code Division and the university fire inspector shall accept the test.

2.2. Fire Pump System Training: Complete system training with the appropriate University of Minnesota operations and maintenance personnel shall be conducted after pre-testing is complete and prior to scheduling the field acceptance test.

End of Division 21 – Fire Suppression