SECTION 21 12 00

FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

1.2 DESCRIPTION OF WORK:

A. Work Included: Provide a complete building fire protection standpipe and sprinkler system in compliance with these Specifications.

B. Types: The types of fire protection systems shall include, but is not limited to, the following:

[EDIT TO SUIT PROJECT]

1. **[The building [and garage] fire protection system shall consist of a fire standpipe system and fire hose cabinets in accordance with NFPA 14 [and served by a diesel primary fire pump and an electric backup pump]. The combination standpipes will serve fire hose valves located as shown on the Drawings and the building sprinkler systems.]**
2. **[The [building] fire protection system shall consist of a complete sprinkler system in accordance with NFPA 13[, City of Houston Building Code] [and the requirements of the Texas State Board of Insurance]. The sprinkler system shall be served directly from city water pressure via sprinkler alarm valves.]**
3. **[The [building] fire protection system shall consist of a complete sprinkler system served from a combination standpipe system in accordance with NFPA 13, NFPA 14 [and the requirements of the local Fire Marshall.] [, City of Houston Building Code.] [, the City of Houston High-Rise Code.] [, the requirements of Industrial Risk Insurers (IRI)] [and the requirements of the Texas State Board of Insurance.]]**
4. **[The garage fire protection system shall consist of a fire standpipe system and fire hose cabinets in accordance with NFPA 14.]**
5. **[The [_____] shall be protected with a Clean Agent total flooding fire suppression system, as specified in Section 21 22 00, "Clean Agent Fire Suppression System".]**
6. **[Conditioned areas of the building shall be protected with a wet-pipe sprinkler system as specified in Section 21 13 13, "Wet-Pipe Fire Sprinkler System".]**
7. **[Sprinkler system zoning shall correspond to building [smoke compartments], [floors] [and atrium enclosure] as shown on the Drawings.]**
8. **[A dry-pipe (freezeproof) sprinkler system shall be provided for [_____] and all other areas where piping is subject to freezing, as specified in Section 21 13 16, "Dry-Pipe Fire Sprinkler System".**
9. **[Elevator machine rooms and elevator shafts shall be protected with pre-action sprinkler systems in accordance with the ANSI elevator code, as specified in Section 21 13 18, "Pre-Action Fire Sprinkler System".]**

C. Combination Standpipe System:

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1. Install combination standpipe system in the building consisting of risers with 2-1/2" hose valves on each floor in each stairway and at other locations shown on the Drawings.
2. System shall include fire pump(s), jockey pump(s), required drain lines, test connections, tools, fire department inlet connections, water motor alarms, monitor switches, alarm valves, isolation valves, and similar items. Refer to Section 21 30 00 for fire and jockey pumps.
3. Provide riser control valves and sprinkler zone control valve/test assemblies with valve tamper switches, as required.

D. Pressure Ratings: Fire protection piping systems pressure ratings shall be as follows:

[VERIFY REQUIREMENTS]

Location	Working Pressure	Operating Temperatures
High.....Floors [_____] through [_____]	**350 psig**	**55°F to 80°F**
Medium .....Floors [_____] through [_____]	**300 psig**	**55°F to 80°F**
Low.....Floors [_____] through [_____]	**150 psig**	**55°F to 80°F**

E. Basic Materials and Methods: Refer to Section 23 03 00, "Basic Materials and Methods", for additional fire protection piping system requirements.

F. Vibration Isolation: Refer to Section 23 05 48, "Vibration Isolation", for piping system isolation.

G. Insulation: Refer to Section 23 07 00, "System Insulation", for piping system insulation.

1.3 QUALITY ASSURANCE:

A. Contractor: The fire protection system modification and expansion shall be designed and installed by a fire protection contractor who is licensed by the State of Texas to perform fire protection work of the type specified for this project. The fire protection contractor shall have a minimum of 5 years of experience in the installation of fire protection work of the type specified for this project.

B. Applicable Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. National Fire Protection Association (NFPA):
   a. NFPA 13 Standard for the Installation of Sprinkler Systems.
   b. NFPA 14 Standard for the Installation of Standpipe and Hose System.
   c. NFPA 20 Standard for the Installation of Centrifugal Fire Pumps.
   d. NFPA 24 Standard for the Installation of Private Fire Service Mains.
   e. NFPA 70 National Electrical Code.
2. Underwriters' Laboratories, Inc.:
   a. Fire Protection Equipment Directory (Latest Addition).
3. Factory Mutual Engineering Corporation (FM):
   a. Approval Guild (Latest Addition).
4. American National Standards Institute (ANSI):
   a. Z 53 Safety Color Code for Marking Physical Hazards.
   b. A 14 Safety Requirements for Fixed Ladders.

5. Welding: Qualify welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 127.5, for shop and job site welding of piping work. Make welded joints on the piping system with continuous welds, without backing rings and with pipe ends beveled before welding. Gas cuts shall be true and free from burned metal. Before welding, surfaces shall be thoroughly cleaned. The piping shall be carefully aligned and no weld metal shall project inside the pipe.
6. Comply with requirements of the University of Houston Fire Marshal Office and submit Drawings to that agency for approval.
7. Materials shall be installed in accordance with NFPA 13 and NFPA 14. All valves, fittings, hose, and equipment shall be UL or FM-labeled. All necessary points of city connections shall be matched to city equipment.
8. All hose threads and coupling types shall conform to local fire department requirements.
9. Acceptable Manufacturers: The model numbers listed in the Specifications establish a level of quality and material. The following manufacturers are acceptable subject to compliance with the requirements of these Specifications.
   a. Fire Protection Specialties:
      1) Potter-Roemer, Inc.
      2) Elkhart Brass Co.
      3) Allen Co. (W. D. Allen Mfg. Div.).
      4) Standard Fire-West (Sierra Fire Equipment Co.).
      5) Seco Manufacturing, Inc.
   b. Fire Protection Valves:
      1) Crane Company.
      2) Jenkins Bros. Valves.
      3) Lunkenheimer.
      4) Nibco.
      5) Victaulic.
      6) Stockham Valves and Fittings.
      7) Walworth Company.

1.4 SUBMITTALS:

A. Shop drawing submittals shall include, but not be limited to, the following:

1. Cut sheets marked to clearly indicate all fire protection system materials, accessories and manufacturers to be used, including, but not limited to control panels, pipe and fittings, pipe hangers and supports, valves, sprinkler heads, specialties, waterflow switches, valve supervisory switches, and other required materials. This shall include cut sheets on all grooved piping system components **[and all manufacturers]** which will be used on the project.
2. Submittals must include a Responsible Managing Employee (RME) stamp, dated and signed by an individual holding a current RME-General license. Alternatively, the submittals may be dated and stamped by a professional engineer, registered in Texas, who has demonstrated a thorough understanding of fundamental systems and practices as they pertain to life safety and to fire protection, detection, alarm, control and extinguishment.
3. Final fire protection system fabrication/shop drawings showing all piping sizes and elevations, **[sprinkler head types]** and hydraulic calculations. Piping shall be sized and elevation of mains

shall be indicated. Drawings shall be approved by state and local authorities prior to being submitted.

4. Other items as required by Section 23 01 00**[, 21 13 13,] [21 13 16,] [and 21 13 18]**.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver fire protection components in factory-fabricated water-resistant wrapping.

B. Handle fire protection components carefully to avoid damage to components, enclosures, and finish.

C. Store fire protection components in a clean, dry space and protect from weather.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Service Connection to **[Inside Building Wall] [House/Break Tank]**: Refer to Section 22 00 00, "Plumbing Piping Systems".

B. Pipe: Provide pipe and tube of type, joint, grade, size, and weight (wall thickness, schedule or class) indicated for each service. Comply with applicable governing regulations and industry standards.

1. Steel Pipe: Schedule 40, ASTM A53 black or hot-dipped galvanized as specified. All dry and pre-action system piping and fittings shall be externally and internally galvanized. **[Piping shall be domestically manufactured by one of the manufacturers listed in the latest edition of the American Petroleum Institute (API) approved manufacturers listing.]**

C. Fittings: Provide factory-fabricated fittings of type, materials, grade, class, and pressure rating indicated for each service and pipe size. Fittings shall be threaded for 2” and smaller, and schedule 40 steel with grooved fittings for sizes larger than 2”. Provide sizes and types matching pipe, tube, valve, and equipment connections. Where not otherwise indicated, comply with governing regulations, industry standards, and where applicable, with pipe manufacturer's instructions for selections.

1. Malleable Iron Threaded Fittings: ANSI B16.3, Class 150 or Class 300, black or galvanized as specified.

2. Malleable Iron Threaded Unions: ANSI B16.39, select for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze, or brass), plain or galvanized as specified.

3. Threaded Pipe Plugs: ANSI B16.14.

4. Steel Flanges/Fittings: ANSI B16.5, including bolting, gasketing, and butt weld end connections.

5. Forged Steel Socket-welding and Threaded Fittings: ANSI B16.11, rated to match schedule of connected pipe.

6. Wrought Steel Butt-welding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns; rated to match connected pipe.

7. Grooved End Fittings: ASTM A47 or ASTM A536 joined with Victaulic Style 005, 07, 75, or 77 couplings and Grade "E" gaskets.

8. Flanged Fittings: Comply with ANSI B16.15 for bolt-hole dimensioning, materials, and flange-thickness.

9. Flange Bolts: Bolts shall be carbon steel ASTM A307 Grade A hexagon head bolts and hexagonal nuts. Where one or both flanges are cast iron, furnish Grade B bolts. Cap screws utilized with flanged butterfly valves shall be ASTM A307 Grade B with hexagon heads.

10. Flange Bolt Thread Lubricant: Lubricant shall be an antiseize compound designed for temperatures up to 1000°F and shall be Crane Anti-Seize Thread Compound or approved equal.

D. Miscellaneous Piping Materials/Products:

1. Welding Materials: Comply with ASME Boiler and Pressure Vessels Code, Section II, Part C, for welding materials.

2. Brazing Materials: American Welding Society, AWS A5.B, Classification BCup-5.

3. Gaskets for Flanged Joints: 1/16" thick for all pipe size 10" and smaller and 1/8" thick for all pipe size 12" and larger. Ring-type shall be used between raised face flanges and full face-type between flat face flanges with punched bolt holes and pipe opening. Gaskets shall be Garlock Style 3400 compressed nonasbestos or equal.

4. Insulating (Dielectric) Unions: Provide dielectric unions at all pipe connections between ferrous and nonferrous piping. Unions shall be "Clearflow" waterway made by Victaulic, "Delvin" as made by Pipeline Seal and Insulator Company or "EPCO" as made by Epco Sales, Inc. and shall have nylon insulation.

2.2 PIPING FABRICATION/SHOP DRAWINGS:

A. Piping fabrication/shop drawings shall be submitted for all fire protection **[and sprinkler]** piping.

B. Pipe fabrication/shop drawings shall be to scale on **[1/4"] [1/8"]** scale building floor plans and shall indicate pipe size, fittings, valves, accessories, connections, **[head type]**, insulation, support requirements, pipe elevations and other information required for coordination with other trades and fabrication of pipings. Main piping **[in the Central Plant and Utility tunnel and all other piping]** 8" and larger shall be double line.

C. Pipe fabrication/shop drawings shall be coordinated with other trades and building construction prior to submittal to the Engineer for review.

2.3 PIPE HANGERS AND SUPPORTS:

A. Pipe Hangers and Supports: Support fire protection pipe with UL-listed and approved hangers and support devices. Provide any special hangers or supports that may be required. The design, selection, spacing, and application of horizontal and vertical pipe hangers, supports, restraints, anchors, and guides shall be in accordance with the NFPA 13 and NFPA 14. All pipe hangers, rods, supports, inserts and other components shall be galvanized.

2.4 SLEEVES AND ESCUTCHEONS:

A. Pipe passing through walls, floors, and partitions shall be provided with standard weight steel pipe sleeves. Sleeves through walls in finished spaces shall be flush. Where located in the floor construction, the sleeves shall project not less than 2" above the floor line. Refer to Section 15100 for fire stopping and additional sleeve requirements.

B. Provide escutcheons for pipes passing through walls, partitions, or ceilings. Escutcheons shall be provided where pendant sprinkler heads penetrate ceilings or sidewall heads penetrate walls. Pipe escutcheons shall be chrome-plated steel. Sprinkler escutcheons shall be white-painted or chrome-plated steel as specified. Refer to Section 23 03 00 for additional requirements.

2.5 VALVES AND ACCESSORIES:

A. General: All valves and accessories shall be similar to numbers listed. All similar type and size valves and accessories shall be products of one manufacturer.

B. Applications: Valve application shall be as follows:

Service	Application	Type

Fire Protection	Shutoff	OS&Y Gate**[, Ball] [or Butterfly]**
	Check	Swing Check

[VERIFY REQUIREMENTS]

C. Pressure Ratings:

Service	Location	Rating
Fire Protection	Floor **[**_____**]** and Above	175 psi
	Floor **[**_____**]** and Below	250 psi

D. Insulated Piping: Stems on all valves installed in insulated piping shall be extended to allow adequate clearance between the operator and the insulation specified for the piping system when the valve is installed.

E. Chain Operators: Chain operators shall be provided for all valves installed over 8'above finished floor in the central plant, fan rooms, mechanical rooms and other areas where valves are exposed.

F. Flanges: Valve flanges and companion flanges for all valve applications shall be compatible with the valve rating and the system pressure at the point of application. Flanges shall conform to ANSI B16.1 and ANSI B16.10.

G. [Butterfly and Ball Valves: Butterfly and ball valves shall not be used for fire protection applications.]

H. General Requirements:

1. All valves shall be of threaded or flanged type. No solder connected valves on water lines shall be used on this project. All bronze and iron body gate and globe valves shall be of one manufacture for each project. Manufacturers of other types may not be mixed on the same project; i.e., all butterfly valves shall be of the same manufacture, all ball valves shall be of the same manufacture, etc.
2. All valves at system points where the System Working Pressure (SWP) at the point of application, including appropriate pump shutoff head, does not exceed 150 psi, may use Class 150 valves.
3. All bronze gate valves for pressures up to 150 psi shall be ASTM B62 composition bronze. Bronze valves for pressures above 150 psi shall be ASTM B61 steam bronze. All bronze valves shall be union or screw over bonnet, rising stem type with ASTM 584 alloy 876 or equal stem material.
4. All bronze ball valves for pressures up to 300 psi shall be ASTM B62 composition bronze.
5. All iron body valves shall have the pressure containing parts constructed of ASTM A126 Class B cast iron. Stem material shall meet ASTM Alloy 876 or ASTM 371 Alloy 876 silicon bronze or its equivalent. Gates and globes shall be bolted bonnet with OS&Y (outside screw and yoke) and rising stem design. A lubrication fitting shall be provided on yoke cap for maintenance lubrication of the yoke bushing.
6. All valves shall be repackable, under pressure, with the valve in the full open position.
7. All gate valves, globe valves, angle valves and shutoff valves of every character shall have malleable iron handwheels, except iron body valves 2-1/2" and larger which may have either malleable iron or ASTM A126 Class B, gray iron handwheels.
8. Packing for all valves shall be selected for the pressure-temperature service of the valve. It is incumbent upon the manufacturer to select the best quality, standard packing for the intended valve service. At the end of one year period spot checks will be made, and should the packing

show signs of hardening or causing stem corrosion then all valves supplied by the manufacturer shall be repacked at no expense to the Owner with a packing material selected by the Owner.

9. Valves located with stem in horizontal position shall be drilled and tapped in accordance with MSS-SP-45 at Boss G to accommodate a drain valve.

10. All fire protection valves shall be UL-listed and FM-approved for fire protection use.

I. Fire Protection Valves For Service at or Less Than 175 PSIG:

1. Gate Valves:

a. Gate valves 2" and smaller shall be 175 psi WOG rated, UL-listed, FM-approved, all bronze outside screw and yoke, rising stem valves with solid wedges and threaded connections. Valves shall be:

1) Crane No. 459.

2) Jenkins No. 275-U.

3) Nibco No. T-104-O.

4) Stockham No. B 133.

5) Walworth No. 8873.

b. Valves 2-1/2" and larger shall be flanged bronze mounted, UL-listed, FM-approved iron body, outside screw and yoke, rising stem gate valves with bolted bonnets and solid wedges. Valves shall be rated for 175 psi WOG and shall be:

1) Crane No. 467.

2) Jenkins No. 825-A.

3) Nibco No. F-607-OTS.

4) Stockham No. G-634.

5) Walworth No. 8713-F.

2. **[Ball Valves:]**

a. [Ball valves shall be two piece with a standard size port 316 stainless steel balls and stems, and reinforced seats and stuffing box rings. All ball valves shall be designed to permit repacking while valve is in line. Valves shall be furnished with blowoutproof stems.]

b. [Ball valves 3" and smaller shall be threaded or grooved ductile iron body or bronze ASTM B584 alloy 844 of a standard port design with gear operator and position indicator. Valves shall be rated for 300 psi WOG and shall conform to UL 1091 and FM 1112 and shall be:]

1) **[Victaulic Series 727-UNS (unsupervised).]**

2) **[Victaulic Series 727-SOD (with double pole, double throw supervisory switch).]**

3) **[Nibco No. T-505-4 (unsupervised).]**

4) **[Nibco No. T-505-8 (with double pole, double throw supervisory switch).]**

3. **[Butterfly Valves:]**

a. [All butterfly valves shall be full tapped and threaded lug or grooved type, manufacturer certified for bubbletight, dead end shut off from either direction at design working pressure and temperature. Valves shall have enclosed, self-locking wheel-operated worm gear type, waterproof, factory-lubricated operators and position indicators.]

b. [Valves 4" and larger shall be 175 psig with ductile iron lug body, EPDM (EPT) replaceable seat, 316 or 416 stainless steel upper and lower stems (stems shall be positively connected to the valve disc) and EPDM (EPT) stem seals. Valves shall conform to UL 1091 and FM 1112 and shall be:]

1) **[Victaulic Series 708-UNS (unsupervised).]**

2) **[Victaulic Series 708-SOD (with double pole, double throw supervisory switch).]**

3) **[Nibco No. GD1765-4 (unsupervised).]**

4) **[Nibco No. GD1765-8 (with double pole, double throw supervisory switch).]**

5) **[Grinnell equal.]**

4. Check Valves:

a. Check valves 2-1/2" and smaller shall be UL-listed, FM-approved threaded cast iron, bronze-fitted swing check valves with horizontal swing and replaceable discs. Valves shall be rated for 175 psi WOG and shall be:

1) Stockham No. B-321.

b. Check valves 3" and larger shall be UL-listed, FM-approved flanged bronze mounted iron body swing check valves with bolted bonnets and renewable seat and disc, or dual disc spring-loaded stainless steel mounted. Valves shall be rated for 175 psi WOG and shall be:

1) Crane No. 375.

2) Jenkins No. 629.

3) Nibco No. F-908-W.

4) Stockham No. G-939.

5) Walworth No. 8883-F.

6) Victaulic 714.

c. All swing check valves shall be installed in vertical piping only. Allow adequate pipe clearance to allow for proper valve operation. Provide Grinnell No. 1686 or equal ball drip where required to allow drainage at check valves.

J. Fire Protection Valves for Service Over 175 PSIG:

[VERIFY REQUIREMENTS]

1. Gate Valves: Valves 2-1/2" and larger shall be UL-listed, FM-approved, flanged bronze mounted iron body, outside screw and yoke gate valves with bolted bonnets and solid wedges. Valves shall be rated for 300 psi WOG.

a. Nibco No. F-697-O.

b. Stockham equal.

2. **[Ball Valves:]**

a. [Ball valves shall be two piece with a standard size port 316 stainless steel balls and stems, and reinforced seats and stuffing box rings. All ball valves shall be designed to permit repacking while valve is in line. Valves shall be furnished with blowoutproof stems.]

b. [Ball valves 3" and smaller shall be threaded or grooved ductile iron body of a standard port design with gear operator and position indicator. Valves shall be rated for 300 psi WOG and shall conform to UL 1091 and FM 1112 and shall be:]

1) **[Victaulic Series 727-UNS (unsupervised).]**

2) **[Victaulic Series 727-SOD (with double pole, double throw supervisory switch).]**

3) **[Nibco No. T-505-4 (unsupervised).]**

4) **[Nibco No. T-505-8 (with double pole, double throw supervisory switch).]**

3. Check Valves:

a. Valves 2" and smaller shall be 300 psi SWP rated UL-listed, FM-approved all bronze swing check valves with regrinding bronze disc and threaded connections.

b. Valves 2-1/2" and larger shall be 300 psi SWP rated, UL-listed, FM-approved, iron body, bronze fitted swing check valves with regrindable and renewable seats and discs and Class 250 flanged connections or dual disc spring-loaded stainless steel fitted valve.

c. All swing check valves shall be installed in vertical piping only. Allow adequate pipe clearance to allow for proper valve operation. Provide Grinnell No. 1686 or equal ball drip where required to allow drainage at check valves.

K. Test/Drain Valves: Test/drain valves for applications to 300 psi shall be Victaulic Style 718 or equal threaded connection test/drain valve assemblies with ductile iron body, bronze valve assembly, acrylic sight glass and aluminum orifice inserts. Orifice size shall coordinate with sprinkler head sizes, installed on the zone served.

L. Strainers: Water strainers shall be as follows:

1. 150 psig Working Pressure: 150 psig working pressure, 2" and smaller, shall be Muessco No. 351 or equal, 200 pounds WOG, bronze body with perforated 20 mesh stainless steel screen with cleanout and screwed ends. 150 psig working pressure, 2-1/2 through 24", shall be Muessco No. 751 or equal, 150 pounds WOG, perforated stainless steel screen with 1/16" perforations for sizes through 4", and 5/32" perforations for 5" and above, with blowdown connection, and Class 125 ANSI B16.1 flanged ends.

2. 300 psig Working Pressure: 300 psig working pressure, 2" and smaller, shall be Muessco No. 352 or equal, 400 pounds WOG, bronze body with perforated 20 mesh monel screen with cleanout and screwed ends. 300 psig working pressure, 2-1/2 to 24", shall be Muessco No. 752 or equal, 300 pounds WOG, perforated stainless steel screen with 1/16" perforations in sizes through 4", and 5/32" perforations for 5" and above, with blowdown connection, and Class 250 ANSI B16.5 flanges.

M. Unions: Provide in lines assembled with screwed and soldered fittings at points of connection to items of equipment and elsewhere as indicated or required to permit proper connections to be made or so that equipment may be removed. Unions shall also be provided in welded lines at the connections to items of equipment, where flanges are not provided.

1. Unions in steel lines assembled with screwed fittings shall be malleable iron screwed pattern unions with bronze seats. Unions in copper or brass lines shall be all brass, threaded pattern unions. Where unions are required by the above in steel lines assembled by welding, they shall consist of two mating welding flanges.

2. Dielectric unions shall be used at all junctures of dissimilar metals.

3. Unions in 2" and smaller in ferrous lines shall be Class 300 AAR malleable iron unions with iron to brass seats, and 2-1/2" and larger shall be ground flange unions. Unions in copper lines shall be 125 pounds ground joint brass unions or 150 pounds brass flanges if required by the mating item of equipment. Companion flanges on lines at various items of equipment, machines and pieces of apparatus shall serve as unions to permit removal of the particular items. See particular Specifications for special fittings and pressure.

N. Flanges: All 125/150 pound and 250/300 pound ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A181 Grade I or Grade II or A-105-71 as made by Tube Turn, Hackney or Ladish Company. Slip on flanges will not be acceptable. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall

have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forgings or materials will not be acceptable. The flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Submit data for firm certifying compliance with these Specifications. Gaskets used shall be ring form, dimensioned to fit accurately within the bolt circle, shall be 1/16" thick, Manville service sheet packing Style 60. Inside diameter shall conform to the nominal pipe size. Bolts used shall be carbon steel bolts with semifinished hexagon nuts of American Standard Heavy dimensions. All-thread rods will not be an acceptable for flange bolts. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi. Flat faced flanges shall be furnished where required to match flanges on pumps, check valves, strainers, and similar items. Only one manufacturer of weld flanges will be approved for each project.

O. Gaskets: Gaskets shall be placed between the flanges of all flange joints. Such gaskets shall be ring form gaskets fitting within the bolt circle of their respective flanges. Gaskets shall be 1/16" thick Manville Service Sheet Packing Style 60. The inside diameter of such gaskets shall conform to the nominal pipe size and the outside diameter shall be such that the gasket extends outward to the studs or bolts employed in the flanged joint.

P. Flexible Connections: Flexible sprinkler head drops are not allowed.

2.6 FIRE PROTECTION SPECIALTIES:

[EDIT TO SUIT PROJECT]

A. Fire Hose Cabinet (FHC-1): Fire Hose Cabinets shall be Potter-Roemer Fig. No. 1006-F or equal recessed solid door cabinet, Fig. No. 2710-23-44 or equal hose rack with 100'PR-SuperFlex lined hose and red lexan fog nozzle and Fig. No. 3005 or equal 5 pound ABC dry chemical extinguisher. Provide Fig. No. 1125 or equal rain hood for cabinets exposed directly to weather.

B. Fire Hose Cabinet (FHC-2): Same as FHC-1, except with Potter-Roemer Fig. No. 2710-15-23-44 or equal hose rack with 2-1/2 angle pressure regulating valve, 100'PR-SuperFlex lined hose and red lexan fog nozzle.

C. Fire Hose Racks (FHR-1): Fire Hose Racks shall be as specified for Fire Hose Cabinet (FHC-1) except less cabinet and with Potter-Roemer Fig. No. 2894 or equal cover.

D. Fire Hose Racks (FHR-2): Fire Hose Racks shall same as specified for Fire Hose Cabinet (FHC-2) except less cabinet and with Potter-Roemer Fig. No. 2894 or equal cover.

E. Fire Department Valve (FDV-1): Potter-Roemer Fig. No. 4065 or equal 2-1/2" cast-brass valve with red iron handwheel, female inlet by 2-1/2" male hose thread outlet, 300 pound rating. For use up to 100 psi. Furnish with Potter-Roemer Fig. No. 4625 or equal female hose thread cap with pin lugs and chain.

F. Fire Department Valve (FDV-2): Potter-Roemer Fig. No. 4023 or equal 2-1/2" cast-brass valve with red aluminum handwheel, inside screw rising-stem, concealed and tamperproof pressure adjustment, internal parts of brass and stainless steel, 2-1/2" female NPT inlet by 2-1/2" male hose outlet, 400 psi rating. For reducing pressures over 100 psi back to 80 psi at each floor. Furnish with Potter-Roemer Fig. No. 4625 or equal female hose thread cap with pin lugs and chain.

G. Fire Hose Valve Cabinets: [Potter Roemer Fig. No. 1810-C] or equal solid door flush mounted cabinet.

H. Fire Protection Pressure Reducing Valves: Potter Roemer 4020 Series or equal 2-1/2" cast-brass valve with red aluminum handwheel, inside screw rising stem, concealed and tamperproof pressure adjustment, internal parts of brass and stainless steel, 400 psi rating for reducing pressures over 175 psi back to 165 psi for system taps.

I. Roof Manifold: Potter-Roemer Fig. No. [5882] [5887-B] or equal 6" [back] [bottom] inlet fire department roof connection with three Type FDV-1 fire department valves.

J. Free Standing Fire Department Connection: Potter-Roemer Fig. No. 5780-C or equal 6" by 2-1/2" by 4-way connection with drop clapper check valves, polished chrome finish with cover plate marked ["Auto Sprinkler" and] "Standpipes".

K. Wall Mounted Fire Department Connection: Potter-Roemer Fig No. [5406-D] [5426-D] [5226-D] or equal, 6" by 2-1/2" by 4-way, flush, [back outlet] [angle outlet] clapper type fire department inlet, [polished chrome] finish, labeled ["Auto Sprinkler" and] "Standpipes".

L. Indicator Posts:

1. Indicator posts shall have a cast-iron body, 1-1/4" square operating nut, lockable operating wrench, with "OPEN" and "SHUT" targets appearing in full view when the valve is fully open or closed. Base shall be flanged and shall bolt onto the indicator post flange provided on top of the valve. The indicator post shall be fully compatible with the approved valve, capable of accepting a tamper switch, and the bury depth shall govern post dimensions. The Indicator posts shall be UL listed in accordance with NFPA 24 and FM approved. Indicator Posts shall be Mueller, No. A-20806, Kennedy Style 2945 or 2945A, American Flow Control IP-71, or approved equal.
2. Install indicator posts over valves on fire protection lines. Posts shall be bolted to the flange at the top of the valve and shall be installed plumb and true to the elevations indicated. The bury line on the indicator post shall match the final grade at the location of the indicator post. Indicator posts installed on fire protection mains shall be shall be primed and finish painted red.. Indicator posts shall be installed such that grade mark is level with the finish grade. Indicator posts installed on fire protection mains shall be installed with the following provisions: a ¾" inch rigid metal conduit stubbed up through the concrete collar to facilitate the installation of an electric valve supervision switch in accordance with the contract documents.
3. Bollards shall be installed around post indicator valves as required by the construction drawings.

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M. Free Standing Fire Pump Test Header: Potter-Roemer Fig. No

N. Wall Mounted Pump Test Header: Potter-Roemer Fig No.

O. Water Flow Switches: Viking Model C-1 or equal water flow switch with adjustable retard feature. Switch shall be double-pole double-throw type and shall be rated at least 7 amperes at 125/250 volts.

P. Valve Supervisory Switches: Potter Electric Signal Company Model OSYS-U or equal. Switches shall activate within two turns of the valve.

Q. Sight Flow Connection: Provide acrylic sight flow connection in all test lines.

R. Pressure Gauges: Potter-Roemer Fig. No. 6240 or equal 3-1/2" diameter polished brass case, 1/4" NPT male connection, glass enclosed, 0-300 psi dial pressure gauges with isolation valves.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE PROTECTION PIPING SYSTEMS:

A. General: All piping system materials, components and installation shall be in accordance with NFPA **[13] [,] [and]** NFPA 14 **[and] [,] [Chapter 38 of the City of Houston Building Code] [and the requirements of the Texas State Board of Insurance] [and Industrial Risk Insurers (IRI)]. [State Board of Insurance [and IRI] approval will [not] be required.]**

1. Standpipe, riser and main piping shall be Schedule 40 black steel pipe (6" or smaller) or Schedule 30 black steel pipe (8" or larger). Thinwall, chlorinated polyvinyl chloride (CPVC) and copper piping shall not be used.

2. **[All pipe and fittings from the house/break tank up to the fire pump discharge check valves shall be galvanized as specified for domestic water piping. Valves and accessories up to and including the discharge check valves shall be approved for domestic water use.]**

3. Underground fire line piping from **[the fire water source] [and] [Siamese fire department connections]** shall be as specified **[hereinabove] [in Section 22 00 00** and shall be hot dip galvanized. **[Piping shall be protected as specified in Section 22 00 00.]**

4. Sprinkler system piping shall in general be as specified hereinabove for fire standpipe piping.

5. Fittings 2-1/2" and smaller for Schedule 40 pipe shall be malleable iron threaded fittings.

6. Fittings for piping 3" and larger shall be standard welded fittings or shall be a UL-listed grooved piping connection system with "rolled-grooves". Couplings for standpipes shall be Victaulic Style 07 Zero-Flex couplings with Grade "E" gaskets (no substitute) or **[Gruvlok Fig. 7000 couplings with Grade "E" gaskets and proper support at the bottom, top and every other intermediate floor as required]** to prevent vertical up and down movement of the standpipe in accordance with NFPA 13 and NFPA 14. Couplings for piping connections to pumps and their associated valves, to wall mounted Siamese connections, to roof manifolds shall be Victaulic Style 07 Zero-Flex couplings with Grade "E" gaskets (no substitute) or Gruvlok Fig. 7000 couplings with Grade "E" gaskets and adequate supports for proper mounting and operation of connected devices. Couplings for underground piping shall be Victaulic Style 77 or Gruvlok Fig. 7001 with Grade "E" gaskets. All other couplings shall be Victaulic Style 75 or Gruvlok Fig 7000 with Grade "E" gaskets. Taps to mains shall be made using Victaulic Style 72 or Style 920 or Gruvlok Fig. 7045/ 7046 outlet couplings or fittings. Mechanical "T" couplings with U-bolts shall not be permitted. Flange connections shall be made using Victaulic Style 741 or Gruvlok Fig. 7012 flanges with Grade "E" gaskets. Fittings for elbows, tees, reducers, and similar items shall be Victaulic or Gruvlok full flow fitting. All grooved piping couplings and fittings **[shall be the products of a single manufacturer and]** shall be UL listed for fire protection use as used on the project, including pressure and temperature ratings, pipe type and groove type. **[All grooved piping couplings and fittings used in association with the individual coupling or fitting shall be by the same manufacturer.]** The use of boltless couplings, reducing couplings, mechanical "T" fittings with U-bolts and bolt on sprinkler head taps is prohibited. All grooved piping connection materials shall be used with the manufacturer' recommended groove rolling or cutting tool. All proposed grooved piping connection materials shall be suitable for fire protection use at the temperatures and pressures at the point of application. Painted couplings may be utilized in lieu of galvanized couplings.

B. Piping Installation:

1. Piping shall be concealed, except in mechanical equipment rooms, stairwells, or where otherwise indicated on the Drawings. Install exposed piping parallel to or at right angles to the column lines of the building wherever possible.

2. Grade piping to eliminate traps and pockets and for drainage per NFPA 13 and NFPA 14. Where air pockets or water traps cannot be avoided, provide hose bibbs for drainage.

3. Piping shall be concealed above suspended ceilings where installed, in a craftsman like manner, and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Piping in all occupied areas and mechanical area passageways shall not be lower than 7’-6”. Specific written approval may be granted for unavoidable projections, but under no circumstances shall overhead piping be installed lower than 6’-8” above floor. Piping shall not reduce the required width of any means of egress, width of stairs, or clear width of corridor or passageways, to less than 44” in width. Installation of all piping shall be in coordination with piping ducts, light fixtures, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials installed above the ceiling prior to commencement of any work.

4. Piping that is retrofit into an existing building with suspended ceilings shall be installed above the existing ceiling, unless exposed piping is approved by the University.

5. All exposed sprinkler and standpipe system located in areas without suspended ceilings is required to be painted. Prepare galvanized pipe as necessary, such as priming, prior to painting pipe. Coordinate color of pipe with University. All pipe, whether concealed or exposed, is required to be marked “Fire Sprinkler System” with markers spaced at 10’ intervals with red letters at a minimum of 1” in height. Refer to Section 23 03 00 for additional requirements.
6. Fire protection piping shall not be routed over electrical equipment. It shall be the responsibility of the Fire Protection Contractor to coordinate electrical equipment locations with the Electrical Contractor and design the fire protection piping system such that no piping is routed over electrical equipment.
7. All changes in direction, branches, offsets etc., shall be made with standard pipe fittings. Holes in the main for branches shall be made with a hole cutting machine and a standard "Weld-O-Let" or "Thread-O-Let" fitting used. Burning holes in the fire protection System Piping will cause that section of the piping to be cut out and replaced at the Contractor's expense.
8. All pipe shall be reamed to full pipe diameter before joining. Screwed joints shall be made with standard pipe thread and an approved compound applied to the male thread only. Welded joints shall be made in accordance with the procedure outlined in the A.S.A. piping code. Valves and specialties shall be screwed or flanged joints.
9. Install unions or flanges at equipment connections and as indicated on the Drawings.
10. Cold-springing piping will not be permitted. Install piping with adequate support to prevent strain on the equipment and to allow for piping system expansion and contraction.
11. Welded joints on pipe runs shall be made with continuous welds and with pipe ends beveled before fabrication. Piping shall be carefully aligned prior to welding and no metal shall project within the pipe.
12. Piping shall be sized as required by applicable codes and as indicated on the Drawings.
13. Field-grooving of pipe for Victaulic fittings shall use Victaulic groove depth control tool and a hole-cutting tool shall be used instead of burning a hole in the piping. Victaulic reducing couplings and outlet couplings shall not be installed. Victaulic gaskets shall be UL-approved for the service and working pressure of the systems.
14. Provide all test and drain lines as required by Section 3-11 of NFPA 13. Pressure gauges, signs, and other such standard appurtenances shall be furnished as required for a complete installation in accordance with NFPA 13. A nameplate data sign shall be provided at the zone controlling valve to identify the system as a hydraulically designed system indicating the location and basis for design in accordance with Chapter 7 of NFPA 13.
15. All sprinkler piping shall be so installed that it can be thoroughly drained, and where practicable shall be arranged to drain at the zone drain valve. The zone drain valve shall be capable of a full discharge test without allowing water to flow onto the floor. All drips and drains shall conform to Section 3-11 of NFPA No. 13.
16. Field changes in the piping layout or pipe sizes shall not be made without the prior approval of the Engineer.
17. All welding "cut-out" discs shall be retrieved and turned over to the Owner's Representative.

C. Pipe Hangers and Supports:

1. Pipe supports, sway braces, hangers, and clamps shall conform to and be placed in accordance with Section 3-15 of NFPA 13 and listed by Underwriters' Laboratories, Inc., or approved by Factory Mutual.
2. All pipe shall be supported from the building structure in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. The use of

wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted. Spacing of pipe supports shall not exceed 10' on all piping.

3. All standpipe and sprinkler piping shall be adequately supported to avoid excess strain on fittings and joints. As a minimum, all vertical risers shall be supported at the bottom level, the top level and at each alternate level in between.

4. Where pendant sprinklers are used, care shall be taken to resist upward movement of flowing sprinklers by means of rigid hangers or other restraints on the ends of branch lines or arm-overs exceeding 5' in length. No flexible sprinkler head drops will be allowed.

D. Valve Stems: Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane. All valves shall be located so as to make the removal of their bonnets possible. All flanged valves shown in the horizontal lines with the valve stem in a horizontal position shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be made up with their valve stems inclined at an angle of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested for final acceptance. Valves shall be installed as nearly as possible in the locations as shown on and Drawings. Any change in valve location must be so indicated on the As-built Drawings.

E. Valve Chain Operators: In central plant and in fan or mechanical rooms where valves are installed over 8' above floor, provide chain operators.

F. Swing Check Valves: Swing check valves shall be installed in horizontal piping only.

G. Unions and Companion Flanges: Provide unions or companion flanges where required to facilitate dismantling of valves and equipment.

H. Access Doors and Panels: Provide access doors or panels as required to provide full valve access. Refer to Section 15100 for additional requirements.

I. Strainer Blowdown: Provide a blowdown valve with hose connection and cap at each strainer for blowdown.

J. Gauges: Provide gauges as required by NFPA 13 and NFPA 14 and as follows:

1. On the suction side of each fire and jockey pump.
2. On the discharge side of each fire and jockey pump.
3. At the fire service water entry.
4. At the top of each standpipe and sprinkler riser.
5. At each standpipe roof manifold.
6. At the inlet and outlet of each system pressure reducing valve.
7. Where shown on the Drawings.

3.2 PROTECTION DURING CONSTRUCTION:

A. Provide necessary fire protection during construction in accordance with NFPA and local codes.

3.3 CLEANING AND STERILIZATION:

A. Cleaning all fire protection piping shall thoroughly flushed out to remove any slag or debris prior to being tested or put into service.

B. Sterilization: Piping shall be sterilized with a chlorinating material, approved by the Engineer, shall be accomplished upon completion of the sprinkler installation and prior to placing the system in operation. The amount of chlorine applied shall be such as to provide a dosage of not less than fifty parts per million. The chlorinating materials shall be introduced into the water supply lines and sprinkler systems in an approved manner. Following a contact period of not less than 8 hours, the chlorinated water shall be flushed from the system with clean water until the chlorine is not greater

than 0.4 parts per million. All valves in lines being sterilized shall be opened and closed several times during the 8 hour period.

3.4 VALVE SUPERVISORY SWITCHES:

A. All valves that affect the flow of fire protection water to any area shall be supervised. Supervisory switches shall be furnished and installed by this Contractor and wired by Division 16. Coordinate wiring of all switches with Division 16.

3.5 WATERFLOW PRESSURE SWITCHES:

A. Waterflow pressure switches shall be furnished and installed by this Contractor in locations required by NFPA and where shown on the Drawings. Switches shall be wired by Division 16. Coordinate wiring of flow switches with Division 16.

3.6 BUILDING FIRE ALARM SYSTEM INTERFACE:

A. Each panel shall provide an alarm signal output to the Building Fire Alarm System (wiring by Division 28) whenever waterflow conditions exist in the fire protection system.

B. Each valve which controls the flow of sprinkler system water shall be monitored by the Building Fire Alarm System.

3.7 SYSTEM PRESSURE REDUCTION:

A. Where fire system pressures exceed 100 psi, Fire Department Valves **[and Fire Hose Cabinets]** shall be of the pressure reducing type to regulate the pressure at that point to 80 psi.

3.8 FREEZE PROTECTION:

A. All components of the fire protection system shall be protected from freezing. Standpipes shall be protected by routing through heated spaces, insulation and a valve and drain connection in a heated space to protect the roof manifold. Sprinkler piping shall be protected by dry pipe systems **[or antifreeze solution]** in accordance with the requirements of the Texas State Board of Insurance. All sprinkler heads installed on dry sprinkler system and in walk-in freezers and other locations subject to freezing shall be of a dry pendant design.

3.9 TESTS AND INSPECTIONS:

A. Inspections, examinations and tests required by the authorities or agencies specified shall be arranged and paid for by the Fire Protection Subcontractor, as necessary, to obtain complete and final acceptance of the system as installed. The certificates of inspection shall be in quadruplicate, and shall be delivered to the Engineer for review and distribution.

B. Fire protection piping systems shall be hydrostatically tested by the Contractor upon completion of the installation as required by NFPA 14, Section 1-11.2 of NFPA 13 **[in the presence of the Owner's Representative]**. When hydrostatic and alarm tests have been completed and all necessary corrections made, a material and test certification shall be provided in accordance with Section 1-12 of NFPA 13. Final inspection shall include full flow testing through the inspector's test connection. Actuation of the flow switch shall occur within one minute of opening of the inspector's test valve. The final tests may be witnessed by the Engineer or Owner's Representative.

C. The fire protection standpipe system shall be tested as required by the City of **[Houston] [_____]** and as follows. The standpipes shall be tested with 500 gpm flowing from one standpipe roof manifold and 250 gpm flowing from each other standpipe roof manifold or top floor Fire Department connection and a residual pressure of 65 psi at the 500 gpm roof manifold shall be provided. These test shall be conducted with calibrated nozzles, flow pilots and calibrated pressure gauges.

D. [Sprinkler system zone control assemblies shall be tested to demonstrate proper operation of the flow switch and valve supervisory switch.]

E. [Pre-action and dry sprinkler system shall be tested to demonstrate that system charge time is within the requirements of NFPA 13.]

F. Arrange and pay for all tests and inspections required by UH Fire Marshall.

3.10 PERIODIC INSPECTION SERVICE:

A. After completion of the fire protection system installation and at the beginning of the guarantee period, the Automatic Sprinkler Subcontractor shall execute the National Automatic Sprinkler and Fire Control Association, Inc., Standard Form of "Inspection Agreement", without change in the Contract amount, calling for four inspections of the fire protection system during the warranty period. During the warranty period, inspections shall be in accordance with the Inspection Agreement, plus the following maintenance to be performed during the course of the fourth inspection:

1. Operation of all control valves.
2. Lubrication of operating stems of all interior valves.
3. Operation of all alarms, supervisory switches, air compressors, alarm trip switches, flow switches, and similar items.
4. Cleaning of alarm valves.
5. Lubrication of Fire Department valve hose connections.

B. The standard form of the National Automatic Sprinkler and Fire Control Association, Inc., "Report of Inspection", shall be filled out in triplicate after each inspection and the copies sent to the Architect.

3.11 IDENTIFICATION:

A. Refer to Section 23 03 00 for applicable painting, nameplates, and labeling requirements.

END OF SECTION 21 12 00