

<b>Section No.</b>	<b>Title</b>	<b>Issue Date</b>
21 05 01	Fire Protection General Provisions	8/18/08
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FIRE PROTECTION GENERAL PROVISIONS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The General and Supplementary Conditions and Division 1 are a part of the requirements for the work under this Division of the Specification.

1.02 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the fire protection systems as called for in the Contract Documents and according to applicable codes and regulations.
- B. Provide labor, materials and accessories required to provide complete operating fire protection systems as described or which may be reasonably implied as essential for a complete operating system.

1.03 QUALITY ASSURANCE

- A. Comply with current governing codes, ordinances and regulations of the authority or authorities having jurisdiction over any part of the work and secure all necessary permits. Comply with the regulations and requirements of the Owner's insurance underwriter.
- B. Where codes or standards are referenced, the applicable portions apply.
- C. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.
- D. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress during the Contractor's working hours. A report will be issued to the Contractor if the field review of the fire protection systems construction has revealed elements of the work, which are inconsistent with the Contract Documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks and corrections in the field shall be made as directed.

1.04 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

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|----|------|--|
| 1. | ANSI | American National Standards Institute            |
| 2. | ASME | American Society of Mechanical Engineers         |
| 3. | ASTM | American Society for Testing and Materials       |
| 4. | AWWA | American Water Works Association                 |
| 5. | FM   | Factory Mutual                                   |
| 6. | IEEE | Institute of Electrical and Electronic Engineers |
| 7. | NEMA | National Electrical Manufacturers Association    |

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|-----|------|---|
| 8.  | NFPA | National Fire Protection Association          |
| 9.  | OSHA | Occupational Safety and Health Administration |
| 10. | UL   | Underwriters Laboratories                     |

B. Definitions:

1. Where it is stated in the specifications to submit to Architect or Engineer for review, refer to Architectural General and Special Conditions for proper procedures.
2. "PROVIDE" means to "Furnish" and "Install".
3. "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.
5. "AS DIRECTED" means as directed by the Architect, or the Architect's Representative.
6. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.
7. "SUBMIT" means submit to the Architect for review.

1.05 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with Contract Documents. Guarantee work against faulty and improper material, fabrication, installation, start-up and commissioning for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, at no additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

1.06 USE OF THE ARCHITECT'S AND ENGINEER'S DRAWINGS

- A. The Contractor shall obtain, at the Contractor's expense, from the Architect or Engineer a set of AutoCAD or compatible format architectural and engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Architect and Engineer a written release of liability acceptable to the Architect and Engineer prior to receiving the electronic media files.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.
- B. Products and materials shall not contain asbestos, PCBs or any other material that is considered hazardous by the Environmental Protection Agency or any other authority having jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect.
- D. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

- E. Install materials and equipment with qualified trades people.
- F. Maintain uniformity of manufacture for equipment used in similar applications and sizes.
- G. Applicable equipment and materials to be listed by Underwriters Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by authorities having jurisdiction. The energy-using products shall be certified for use in State of California and meet State energy efficient standards.
- H. Fully lubricate equipment when installed.
- I. Install floor mounted equipment on a 4-inch high concrete pad. Concrete work shall be provided by another trade. Coordinate size and location with actual equipment used and accepted layout shop drawings.
- J. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in concrete under entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.
- K. Locate valves, dielectric unions, access doors, etc., to be easily accessible, either in mechanical spaces or through access panels specified. Obtain Architect's approval of access panel locations.
- L. Follow manufacturers' recommendations and instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- M. Equipment capabilities, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on shop drawings.

## 2.02 ALTERNATIVE EQUIPMENT AND MATERIALS

- A. Contract Documents are based on materials specified and on equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the quality and performance as stated or implied in the Contract Documents.
- B. Equipment manufacturers listed in individual sections are acceptable for this project, subject to requirements of contract documents.
- C. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed alternative whether alternative is accepted or rejected.
- D. Include revisions required to adapt alternatives in such proposals, including revisions by other trades. No increase in the contract price will be considered to accommodate the use of alternative equipment.
- E. Wherever quality standards (such as serviceability, longevity or durability), operating results (such as noise levels, quantity delivered or pressure obtained) are specified or scheduled, or when the manufacturer and size of equipment, for which such operating results are published or determinable, is specified, the substitution being proposed must conform substantially to the quality and quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.
- F. Proposed changes and substitutions of systems, equipment and manufacturers shall be

submitted and include the following information with the proposal:

1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to other trades.
2. Schematic drawings and details to supplement the description.
3. A list of the contract requirements that must be revised if the change is accepted, including any specification revisions.
4. Complete list of materials and equipment proposed for use in the change.
5. Include a description and estimate of costs the Owner may incur in implementing the change, such as additional space requirements, permits, architectural and aesthetic impact, design costs, tests, permits evaluation, operating and support costs.
6. A projection of any effects the proposed change would have on collateral costs to the Owner.
7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
8. A statement indicating the reduction to the contract price if the Owner accepts the change. Be responsible for appropriate modifications to all trades.

### PART 3 – EXECUTION

#### 3.01 FEES

- A. Pay all required fees and obtain required permits related to the fire protection installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.
- C. Provide controlled or witnessed inspection where required by authorities having jurisdiction or by these specifications.

#### 3.02 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. Within two (2) months after notice to proceed by the Owner or Owner's Representative, or after execution of Owner/Contractor Agreement, submit a complete typed list of all fire protection equipment manufacturers and material suppliers for the equipment proposed to be provided on this project as well as names of all subcontractors.
- C. Within three (3) months after notice to proceed by the Owner or Owner's Representative or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the specification sections or drawing number, and an item description. Prefix the submittal identification number by the specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
- E. Review of submittals is for general compliance with the design concept and Contract

Documents. Comments or absence of comments does not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

- F. No part of the work shall be ordered, procured, started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted, reviewed and returned with either "No Exceptions Noted" or "Exceptions Noted" marked on the submission.
- G. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Architect/Engineer's office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor in the scheduling of the work.
- H. Submit one (1) transparency and two (2) bond prints of all items requiring shop drawings. Submit three (3) copies of manufacturer's product submittals. One (1) transparency and one (1) bond print or two (2) copies of submittals will be returned. Additional copies are the responsibility of the Contractor. Electronic media will not be reviewed.
- I. Submissions will be stamped as follows:

Stamp	Interpretation
No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
Exceptions Noted: <input type="checkbox"/> Resubmit for Record <input type="checkbox"/> No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents and Engineer's notations are complied with. Within this category are two options. A resubmission for our records is required when corrections are necessary. A resubmission is not required if there are only minor comments.
Revise and Resubmit	The submittal does not comply with the Contract Documents; do not proceed with fabrication, manufacture, or construction. The work and shop drawings are not permitted at the job site. Resubmit appropriate shop drawings.

- J. Submit materials and equipment by manufacturer, trade name and model number. Include clear, legible copies of applicable brochure or catalog material. Maintenance and operating manuals are not suitable substitutes for shop drawings.
- K. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as voltages, motor efficiencies, special tank linings, pump seals, materials or paint finishes. Cross out all references to "options". Cross out statements such as "subject to change without notice" or "not for construction". Anything not specifically excluded is assumed to be included.
- L. Include dimensional data for roughing in and installation, technical data sufficient to verify that equipment meets requirements of the Contract Documents. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.
- M. Maintain a complete set of the most current reviewed and stamped shop drawings and product data on site.

- N. Prepare and submit detailed shop drawings for piping work and other distribution services in minimum ¼-inch = 1-foot scale, including elevations and locations and sizes of openings in floor decks, walls and roofs.
- O. The work described in shop drawing and product data submittals shall be carefully checked by all trades for clearances (including those required for code compliance, maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. Each submitted shop drawing to include a certification that related field conditions and requirements have been checked by all Contractors and Subcontractors and that conflicts do not exist.
- P. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions or for deviations from requirements in the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.
- Q. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.
- R. Indicate the following in the lower right hand corner of each shop drawing, and on the front cover of each product data brochure: the submittal identification number; title of the sheet or brochure; name and location of the Project; names of the Architect, Engineer, Contractor, Subcontractor, Manufacturer, Supplier, and Vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures, test reports or submittals consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of shop drawings or product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

### 3.03 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. The Contract Documents show the general arrangement of equipment, ductwork, piping and accessories. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the drawings. Investigate the site and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- C. Certain products will be provided by other trades. Examine the Contract Documents to ascertain the requirements for installation of these products.
- D. Carefully check space requirements with other trades to insure that material can be installed in the spaces allotted.
- E. Wherever work interconnects with work of other trades, coordinate with other trades to insure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (valves, dampers, coils, etc.) requiring access in order than the ceiling and partition contractors can install access doors and panels in the correct locations.
- F. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.
- G. Furnish and set sleeves for passage of pipes, and conduits through structural masonry and

concrete walls, roofs and floors and elsewhere as will be required for the proper protection of each pipe and duct passing through building surfaces.

- H. Install firestopping around all pipes, conduits, etc., which pass through rated walls, partitions and floors in strict accordance with the manufacturers published approval listing and rating.
- I. Provide detailed information on openings and holes required in structural elements and precast panels or components for fire protection work.
- J. Provide required structural or architectural supports and hangers for piping and equipment, designed so as not to exceed allowable loadings of structures.
- K. Examine and compare the Contract Drawings and Specifications with the drawings and specifications of other trades, report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of record drawings.
- M. Before commencing work, examine adjoining work on which this work is in any way dependent and report conditions that prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- N. Adjust location of pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.
  - 1. Right-of-Way: Lines which pitch have right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
  - 2. Provide offsets, transitions and changes in direction of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required to effect these offsets, transitions and changes in direction.
- O. Install fire protection work to permit removal (without damage to other parts) of controls, sheaves and drives, and any other parts requiring periodic replacement or maintenance. Arrange pipes and equipment to permit access to valves, starters, motors, and control components, and to clear the openings of swinging doors and access panels.
- P. In cases of doubt as to the Work intended, or in the event of need for explanation thereof, request supplementary instructions from the Architect.

### 3.04 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as piping, busway, conduit, ductwork, etc., including conduit embedded in concrete floors and walls. The Coordination Drawings shall be submitted complete to the Architect and the Engineer within three (3) months after notice to proceed is given and in

compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than ¼-inch to 1-foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate Trade Contractor shall draw their work on separate layers with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and Coordination Drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost to the Owner.

- C. The Contractor's Coordination Drawings shall indicate structural loads at support points for all piping 10-inch and larger, racked piping, racked conduit and busway. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Architect to change them.
- E. Prior to final acceptance of the Work, the Contractor shall submit the Coordination Drawings as part of the Record Drawing submittal.

### 3.05 EXAMINATION OF SITE

- A. The Contract Documents do not make representations regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

### 3.06 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95 percent

of standard proctor density or 75 percent relative density or as specified by the Architect. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

- C. Excavate trenches for utilities that will provide the required minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.
- D. Trenches shall not be placed within ten (10) feet of foundation or soil surfaces that must resist horizontal forces.
- E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive material with limited porosity. Deposit backfill in 6-inch thick layers and tamp carefully until the plumbing work is covered by not less than 12 inches of material. Backfill and tamp remainder of trench at 1 foot intervals until complete. Uniformly grade the finished surface.

### 3.07 CUTTING AND PATCHING

- A. Where cutting, channeling, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- B. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect.
- C. Where piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

### 3.08 PROHIBITED LABELS AND IDENTIFICATIONS

- A. Prohibited Markings: In all public areas, tenant areas, storage areas and similar locations within the project, the inclusion or installation of any equipment, fixture or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Exception: Required Underwriters Laboratories labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

### 3.09 EQUIPMENT PAD AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted plumbing equipment. This includes electrical components, equipment mounted on legs and pipe support stands. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 2-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28-day, 2500-psi concrete reinforced with 6-inch by 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a 3/4-inch radius. Use shop drawings stamped "NO EXCEPTIONS NOTED" or "EXCEPTIONS NOTED" for dimensional guidance in sizing pads.

- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Verify bolts size, number and embed depth recommended by the manufacturer of the equipment with seismic calculations as specified, and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation and seismic restraint manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws will pass through the gypsum board and be securely attached to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6-inch square, 18-gauge galvanized metal backplates that are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

### 3.10 DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost to the Owner.

### 3.11 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work equipment and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials and equipment until finally inspected, tested and accepted. Protect work against theft, injury or damage; and carefully store material and equipment received on site that is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, moisture, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry heated spaces.
- C. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair. Replace all wet or damp insulation.

### 3.12 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

- A. Do not install piping, equipment above switchboards, disconnects, panelboards, dimmers, control panels, VFDs, motor control centers, individual motor controllers, electronics, etc or the code required service space for these electrical devices.

### 3.13 EQUIPMENT GUARDS

- A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, and other moving parts of machinery. Provide tachometer openings in the guards at least 2 inches in diameter, for all belt-driven, gear-driven or variable speed machinery.

Comply with OSHA requirements for all equipment guards.

### 3.14 LUBRICATION

- A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.
- B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

### 3.15 DATE OF COMPLETION AND TESTING OF FIRE PROTECTION SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and the Contract closeout. Complete any adjustments and/or alterations that the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when tests will be performed. Submit completion schedule for review within three (3) months after the notice to proceed by Owner or Owner's Representative has been given. Update this schedule periodically as the project progresses.

### 3.16 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide the services of factory trained specialists to supervise the operation of all equipment and systems specified and train the Owner's operating and maintenance personnel for a ten (10) day operating/instruction period. Operating instruction time is defined as straight time working hours and not including nights, weekends or travel time to and from the project. Refer to individual sections for additional training and instruction by manufacturer's trained specialists.
- B. Notify the Owner in writing at least three (3) weeks before the operating/instruction period begins. Do not commence until the Owner has issued written acceptance of the starting time and schedule.
- C. Instruct Owner's operating personnel in proper starting sequences, operation, shutdown, and maintenance procedures, including normal and emergency procedures.

### 3.17 OPERATING AND MAINTENANCE MANUALS

- A. Provide operating instructions and maintenance manuals for all equipment and materials furnished under this Division.
- B. Submit three (3) final copies of operating and maintenance data books for review at least ten (10) weeks before the completion date. Provide 8½-inch by 11-inch, expanding spine catalog binders bound with heavy red fabric, hot stamp lettering on front and spine identifying project name and owner's name. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.
- C. Index the maintenance manual according to the following system:
  - 1. Tab – 1.0 Fire Protection Systems: Title page identifying project, Owner, Contractor and Engineer with clear plastic protection cover.

2. Tab – 1.1 List of Fire Protection Drawings.
3. Tab – 1.2 Description of Systems: Provide complete descriptions of the operating sequence for each system. Include detailed system description, with individual components described, and description of how components interface with others and to the complete system.
4. Tab – 1.3 Operating Division: Provide information on locations of components, how to energize switches and controls, how components interface with other components, operation of controls including operational sequence, complete troubleshooting sequence, and failure and safeguards to indicate if equipment goes off-line.
5. Tab – 1.4 Maintenance and Lubrication Division: Provide general maintenance and lubrication schedule for major components and include daily, weekly, monthly, quarterly, semiannual and yearly checks and tasks. Explain how to execute maintenance tasks required for typical equipment such as bearings, drives, motors. Compile this information for equipment separate from shop drawings.
6. Tab – 1.5 List of Equipment Suppliers and Contractors: Provide list of equipment suppliers and contractors, including street addresses, web site addresses, fax and toll-free telephone numbers.
7. Tab – Certification (2.0, 2.1, etc.): Include copy of test data on hydrostatic tests performed on piping systems, equipment alignment certifications, copy of pipe color code and inspection approval certificates from authorities having jurisdiction.
8. Tab – Shop Drawings and Maintenance Bulletins (3.0, 3.1, 3.2, etc.): Provide material received in compliance with clause “Submittals and Reviews”.

D. The manual divider and tabs shall be laminated mylar plastic and colored as follows:

Fire Protection Systems	1.0	–	1.5	Orange
Certification	2.0	–	2.4	Green
Shop Drawings & Maintenance	3.0	–	3.17	Yellow

E. Plastic tabs with typewritten card insertions will not be accepted.

F. Maintenance information shall include complete lubrication, cleaning, and servicing data compiled in clearly and easily understandable format. Show model and serial number of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.

G. Provide the following equipment maintenance information where applicable:

1. Identifying name and number
2. Locations (where several similar items are used, provide a list)
3. Complete nameplate data
4. Parts list
5. Performance curves and data
6. Wiring diagrams
7. Lubrication charts
8. Manufacturers' recommended operating and maintenance instructions with all non-applicable information deleted
9. List of spare parts recommended for normal service requirements
10. Assembly and disassembly instructions with exploded view Drawings where necessary
11. Trouble shooting diagnostic instructions where applicable

### 3.18 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the Project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of blue-line prints or AutoCAD files of the Contractor's Coordination Drawings. The prints shall be marked or the AutoCAD files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded piping and valves, and all changes and deviations in the Fire protection work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD electronic format media upon Project completion.

B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two (2) dimensions to permanent structures.

- C. The Contractor and Subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an AutoCAD image similar to the following:

<p>RECORD DRAWING (3/8-inch high letters)</p> <p>To be used for recording Field Deviations and Dimensional Data Only (5/16-inch high letters)</p>
---

- D. Upon completion of the work, the Contractor and subcontractors shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD image similar to the following:

<p>RECORD DRAWING CERTIFIED CORRECT (3/8-inch high letters) (Printed Name of General Contractor)</p> <hr/> <p>(5/16-inch high letters) Date:</p> <hr/> <p>(Printed Name of Subcontractor)</p> <hr/> <p>(5/16-inch high letters) Date:</p> <hr/>
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- E. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified Record Drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the Record Drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD format. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.

3.19 CERTIFICATION

- A. Any certifications required by the Specifications, in addition to those required for shop drawings, product data, equipment and other items, are to be so certified in writing by the Owner, a Partner, or a Corporate Officer of the firm required to provide the Certification, or by another person duly authorized to sign binding agreements for and on behalf of the Owner, Partner or Corporation.

3.20 FINAL REVIEW

- A. At a time designated by the Owner, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.
- B. Demonstrate to the Owner and/or the Architect's personnel prior to the Final Review that systems and equipment have been properly balanced and adjusted and are in compliance with the requirements of the Contract Documents. After these demonstration tests are satisfactorily completed, but prior to the Final Review, submit a written certification that: 1) attests to the Contract Document compliance for this Project; and 2) certifies that the equipment and materials installed in this project contain no lead, asbestos or PCB. Prior to

the final review, the Contractor shall confirm the following items regarding the status of key elements of the work. Negative responses to any of the items indicate that the construction is not substantially complete, and the building is not ready for a final review. The Contractor shall confirm the following in writing:

1. Building has normal electrical power.
  2. The emergency or stand-by power system has been started-up, commissioned, and is standing by.
  3. Building systems have been cleaned.
  4. Seismic restraints have been inspected as specified. Any required special inspections have been completed.
  5. Building fire and life safety systems have been tested and accepted by the local authorities. Any required special inspections have been completed.
  6. All final wiring connections have been rechecked.
  7. All base building lighting systems are completely installed and operating.
  8. There are no deviations or non-compliance with the Contract Documents, or provide a detailed account of any and all deviations or non-compliance.
  9. All items on field review reports have been responded to in writing and are resolved to the satisfaction of the Owner.
  10. All outstanding items on submittals and shop drawings have been addressed in writing and are resolved to the satisfaction of the Owner.
  11. Schedule the final review only after providing written confirmation of all items above. Provide a minimum of ten (10) days notice.
- C. Certificates and Documents required by the Contract shall be presented to the Architect at least two (2) weeks prior to the Final Review.
- D. After the Final Review, any changes or corrections noted as necessary for the work to comply with the Contract Documents shall be accomplished without delay in order to secure final acceptance of the work.

### 3.21 EARLY OCCUPANCY

- A. Be responsible for completing those systems, which are necessary to allow partial occupancy of the building even if systems in the unoccupied areas are incomplete.
- B. Verify and comply with requirements for temporary occupancy with the local Building Department.

END OF SECTION

## SECTION 21 05 48

### VIBRATION ISOLATION AND SEISMIC RESTRAINTS

#### PART 1 – GENERAL

##### 1.01 WORK INCLUDED

- A. The work of this section shall include, but is not limited to the following:
1. Seismic restraints for isolated and non-isolated equipment, piping and ductwork
  2. Supervision and inspection of installed seismic restraints, anchorage and associated hardware

##### 1.02 SUBMITTALS

- A. Shop Drawings: Concrete reinforcing details and templates for all foundations, bases, supports, hanger bolts, etc.; support frame details, pipe support details; including equipment weight, center of gravity and operating speed, location and installation details. Include in the submittal drawing the following information based on equipment submittals released for construction.
1. Note compliance with seismic code regulations and the project specification on the submittals.
  2. Number and location of seismic restraints and anchors for each piece of equipment including but not limited to vertical pipe risers, bolt sizing and embedment depth.
  3. Specific details of restraints including anchor bolts for mounting and maximum loading at each location.
  4. Drawings showing methods of suspension, support guides for piping.
  5. Provide installation instructions, drawings and field supervision to assure proper installation and performance.

##### 1.03 REFERENCE STANDARDS

- A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:
1. NFPA Standards

##### 1.04 MANUFACTURER RESPONSIBILITIES

- A. Manufacturer of seismic restraints shall have the following responsibilities:
1. Determine seismic restraint sizes and required locations.
  2. Provide piping and equipment seismic restraints as scheduled or specified.
  3. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
  4. Seismic restraints shall be designed for the lateral and vertical forces required by the Building Code for the specific project type and site. Confirm lateral force assumptions with the project structural engineer.

##### 1.05 QUALITY ASSURANCE

##### 1.06 DEFINITIONS

- A. Life Safety Systems:
1. All components involved with fire protection including sprinkler and standpipe piping,

fire pumps, jockey pumps, fire pumps control panels, service water supply piping, water tanks.

B. Positive Attachment:

- 1. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double-sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead fire protection piping or any other equipment are not acceptable as seismic anchor points.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Piping Seismic Bracing: Kin-Line, Super Strut, Mason Industries

2.02 SEISMIC RESTRAINTS

A. General:

- 1. Provide restraints capable of safely accepting forces specified in Part 1 of this section, without failure, to maintain equipment and piping in a captive position. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise. Submit calculations by Structural Engineer licensed and registered in the State of the project to verify seismic restraint and cable capacities.

- a. Seismic Restraint, Type I: All directional seismic snubbers shall consist of interlocking steel members restrained by molded neoprene bushing compounded to bridge bearing specifications. Bushing shall be replaceable and a minimum of 1/4 inch thick. Rated loadings shall not exceed 1000 psi. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch or more that ¼ inch. Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8 inch deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to ½ inch deflection in the x, y and z planes.

Type Z-1225-1..... MII

- b. Seismic Restraint, Type III: Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment.

Type SSBS..... MII

PART 3 – EXECUTION

3.01 GENERAL

- A. Install in accordance with manufacturer’s recommendations and written instructions.

### 3.02 SEISMIC RESTRAINTS

#### A. General:

1. Where solid brace restraints are located, the equipment or piping support rods shall be angle braced for compression loads.
2. At all locations where solid brace restraints are attached to pipe clevises, the clevis cross bolt shall be reinforced with cross braces.
3. Provide drill-in concrete anchors for ceiling and wall installation and female wedge type for floor mounted equipment.

#### B. Seismic Restraint of Piping:

1. Fire protection piping shall be braced in accordance with NFPA 13 and 14.

#### C. Seismic Restraint of Equipment:

1. All fire protection equipment is considered life safety equipment and shall be seismically restrained using the seismic force levels for life safety equipment.

END OF SECTION

SECTION 22 05 53

SYSTEMS IDENTIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The work of this section shall include, but is not limited to, the following:
  - 1. Valve identification
  - 2. Equipment identification
  - 3. Piping identification

1.02 SUBMITTALS

- A. Shop Drawings: Submit the following:
  - 1. Valve identification chart
  - 2. Lists of pipe and equipment to be labeled
  - 3. Color chart
- B. Product Data: Manufacturer's latest published data for materials, equipment and installation, including samples of valve tags, equipment identification and piping identification.
- C. Maintenance Manuals: Provide valve tag schedules for inclusion in maintenance manuals.

1.03 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI): A13.1 – 1981: Scheme for Identification of Piping Systems.

1.04 QUALITY ASSURANCE

- A. Piping identification shall comply with ANSI Standard A13.1.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Brady/Seton
- B. Stranco

2.02 VALVE IDENTIFICATION

- A. All tagged components shall be in accordance with ANSI A13.1-1981.
- B. For valves use metal tags 2-inch minimum diameter, fabricated of brass, stainless steel or aluminum.
  - 1. Attach tags with jack chain s-hook or split ring of same materials.
  - 2. For stamped tags, use ¼-inch high letters.

2.03 LABELS

- A. Labels shall have 2-inch high letters and integral directional flow arrows. Smaller letters may

be used only when space does not permit 2-inch high lettering.

1. For piping up to 5-inch diameter, use pre-formed snap-on markers Seton "Setmark" or equal. For piping 6-inch diameter and up, use pre-formed strap-on markers Seton "Setmark" or equal.
2. Pressure sensitive tapes are unacceptable.

#### 2.04 EQUIPMENT IDENTIFICATION

- A. Fire Protection equipment shall be identified by means of nameplates permanently screw fastened to the equipment. Nameplates shall be black surface, white core laminated bakelite with engraved letters. Plates shall be a minimum of 3-inch long by 1-inch wide with white letters 3/8-inch high.

### PART 3 – EXECUTION

#### 3.01 VALVE IDENTIFICATION

- A. Provide schedules of all valves showing number, size, type and service of each valve. Provide separate list for each separate type of system. Incorporate in maintenance manuals.

#### 3.02 EQUIPMENT IDENTIFICATION

- A. Identify equipment with identical letter and/or number as used on Drawings. Where space is available use full name of equipment. Attach nameplates in a permanent manner in a location that will be clearly visible after installation is complete.

#### 3.03 PIPING IDENTIFICATION

- A. Piping identification shall be in conformance with the ANSI A13.1-1981.
- B. Identify piping systems with color-coded bands, sharply contrasting with background. Locate bands near strategic points, such as valves, items of equipment, changes in direction, wall penetrations, capped stub out for future connection and every 40 feet of straight runs. If necessary, paint a strip background of black or white to obtain contrast.
- C. Apply bands where they can be easily read. Provide bands with backgrounds of different colors.

#### 3.04 ACCESS IDENTIFICATION

- A. Identify service, piping and equipment behind all architectural access doors.
- B. Removable ceiling tile shall be marked by small color markings at corner of tile or door in accordance with the following color assignments:

Fire Protection - Red

END OF SECTION

SECTION 21 08 00

COMMISSIONING OF FIRE SUPPRESSION

PART 1 – - GENERAL

1.01 RELATED DOCUMENTS

A. General

1. Work under this contract shall conform under requirements of Division 1, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of the Fire Protection systems for the entire facility.
2. Furnish labor and material to accomplish complete Fire Protection commissioning as specified herein.

B. Commissioning work shall be a team effort to ensure that all Fire Protection equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance parameters for fine tuning of control sequences and operational procedures. Commissioning shall coordinate system documentation, equipment start-up, control system calibration, testing, and verification and performance testing.

C. The commissioning team shall be made up of representatives from the user, design professionals, major equipment suppliers, and construction trades. The trades represented on the commissioning team shall include, but not be limited to, piping and fitting, BMCS (Division 23), test and fire pump manufacturer, fire protection trade and electrical trade. The lead person for each trade who will actually perform or supervise the work is to be designated and the representative to the commissioning team. Responsibility for various steps of the commissioning process shall be divided among the members of the commissioning team, as described in this section.

D. The Commissioning Authority, retained by MGM shall have responsibility for coordinating and directing each step of the commissioning process.

E. Fire Protection system installation, start-up, testing, preparation of O&M manuals, and operator training are the responsibility of the Division 21 Fire Protection Contractors, with coordination, observation, verification and commissioning the responsibility of the Commissioning Authority. The commissioning process does not relieve Division 21 from the obligations to complete all portion of work in a satisfactory and fully operational manner.

F. Definitions

1. Commissioning: the process of ensuring that systems are designed, installed functionally tested and capable of being operated and maintained to perform in conformity with the design intent. For this project, the commissioning includes construction, start-up, acceptance, and training.
2. Commissioning authority: the designated person, company, or agent, retained by the Owner who implements the overall commissioning process.
3. Commissioning Plan: A document defining the commissioning process, which is developed by the commissioning authority.
4. Commissioning report: the document that records the results of the commissioning process, including the as-built performance of the Fire Protection system and documents all sign-offs.
5. Commissioning specification: the contract document that details the objective, scope, and implementation of the construction and acceptance phases of the commissioning process as developed in the Commissioning Plan.
6. Commissioning team: those people responsible for working together in carrying out

the commissioning process.

7. Functional performance testing (FPT): the process of determining the ability of the Fire Protection system to deliver services in accordance with the final design intent.
8. User: the authorized Representative of the Owner.
9. Construction Documents: design plans and specifications. Also referred to as Contract Documents.
10. Design Professional: the Architectural, Engineering and Other Consultants who prepared the Construction Documents. TA – Testing and Adjusting work. Verification: that full range of checks and tests carried out to determine if all components, subsystems, systems, and interfaces between systems operate in accordance with the contract documents. In this context, “operate” includes all modes and sequences of control operation, interlocks and conditional control responses, and specified responses to abnormal or emergency conditions.

G. Purpose

H. The commissioning is a process and its purpose is:

1. to clearly document the design intent
2. to verify that the systems installation and performance is in accordance with the plans, specifications and design intent.
3. to train the user’s operators so that they fully understand the design intent and the operation and maintenance requirements of the equipment.

I. No definitions are included in this section.

J. Heat exchangers shall meet or exceed the performance requirements specified in this specification section.

## 1.02 SCOPE OF WORK

A. Commissioning work of Division 21 (Fire Protection) shall include, but not be limited to:

1. Testing and start-up of the equipment.
2. Testing and adjusting piping and central systems.
3. Cooperation with the Commissioning Authority.
4. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
5. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
6. Providing operation and maintenance manuals, and as-built drawings to the Commissioning Authority for verification.
7. Providing training and demonstrations for the systems specified in this Division.

B. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:

1. Fire standpipe systems.
2. Starters furnished by Division 21 (Fire Protection)
3. Coordination with the BMCS (Division 23)

C. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall include but not be limited to:

1. Progress and status reports, including deficiencies noted.
2. Minutes from all meetings.
3. Pre-start, and start-up procedures.

4. Training agenda and materials.
  5. As-built records.
  6. Commissioning report.
  7. Operational and maintenance (O&M) manuals.
- D. Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the commissioning process:
1. Verification tests are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
  2. Functional performance tests (FPT) shall determine if the Fire Protection system is providing the required services in accordance with the finalized design intent.
- E. Comprehensive training of O&M personnel shall be performed by the Fire Protection Contractor, and where appropriate by other sub-contractors, and vendors prior to turnover of building to the User. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems. All training sessions shall be videotaped or recorded on alternative audiovisual media.

#### 1.03 QUALITY ASSURANCE

- A. Commissioning Authority shall meet the following qualifications:
1. Have a minimum of five (5) years of demonstrated commissioning authority experience in the commissioning of HVAC Systems similar in size and complexity to this Project.
  2. Commissioning Authority shall hold a Certified Commissioning Professional (CCP) designation from the Building Commissioning Association.
- B. The following reference is a guideline to the commissioning process and shall be applied as appropriate.
- C. Reference:
1. ASHRAE Guideline 1-1996: The Fire Protection Commissioning Process
  2. ASHRAE Application Handbook – 1995: Chapter 39 – Building Commissioning.
  3. ASHRAE Guideline 4-1993: Preparation of Operating and Maintenance Documentation for Building Systems.

#### 1.04 ROLES AND RESPONSIBILITIES

- A. User:
1. User will advise Commissioning Authority regarding changes in building occupancy and/or usage.
  2. Assign maintenance personnel and schedule them to participate in meetings, training session as follows:
    - a. Construction Phase coordination meeting.
    - b. Initial User training session at initial placement of major equipment.
    - c. Maintenance orientation and inspection
    - d. Pipe test and flushing verification meetings.
    - e. Procedures meeting for Testing and Adjusting.
    - f. Users training session.
    - g. Verification demonstrations.

- h. Final review at acceptance meeting.
- 3. Provide qualified personnel for video taping and editing of training sessions.
- 4. Video tape construction process, hidden shafts, etc.
- 5. Provide any utilities required for the commissioning process.
- 6. Provide detailed program clearly stating the User's objectives, parameters, budgets, etc. for this facility.

B. Commissioning Authority

- 1. Develop the commissioning requirements and all related testing, verification and quality control sections.
- 2. Prepare the commissioning program required as part of the Commissioning Specification. Include lists of all contractors for commissioning events by name, firm, and trade specialty.
- 3. Develop detailed pretest and final test reports forms, to be used by the Commissioning Authority for data recording purposes throughout the testing process. The Commissioning Authority shall specifically develop these forms for each system and piece of equipment installed on the project. All forms to be submitted for approval a minimum of one hundred and twenty (120) days prior to initial testing.
- 4. Execute the commissioning program, through organization of all tests, meetings, demonstrations, training events and performance verifications described in the Contract Documents and the approved commissioning program. Organizational Responsibilities include preparation of agendas, attendance lists, arrangements for facilities and timely notification to participants for each commissioning event. The Commissioning Authority shall act as chairman at all commissioning events and assure the execution of all agenda items. The Commissioning Authority shall prepare minutes of every commissioning event and send copies to all those in attendance and the User within 5 workdays of the event.
- 5. Schedule regular Construction Phase coordination meetings to include User, Landlord and Contractor. This meeting shall be for the purpose of reviewing the complete commissioning program and establishing tentative schedules for Fire Protection system orientation and inspections, O&M submittals, training sessions, system flushing and testing, job completion, test and adjust (TA) work and verification and functional performance testing.
- 6. The Commissioning Authority shall be solely responsible for conducting and recording the results of periodic inspections, undertaken by the Commissioning Authority, of work in progress to ensure that all systems are installed according to specifications. The Commissioning Authority shall note any deficiencies discovered in writing. Once the deficiencies have been corrected, as reported by the Contractor, the Commissioning Authority shall re-inspect the work and report that the correction have been made
- 7. The Commissioning Authority shall assist the contractor in recommending solutions to minor deficiencies.
- 8. Receive and review the Operation and Maintenance (O&M) manuals as submitted by the contractor, and reviewed and approved by the Design Professional.
- 9. Witness equipment and system start-up and testing. Ensure the results are documented (including a summary of deficiencies), and incorporated in the O&M manuals. The Commissioning Authority shall record all test results on pre-test forms for each piece of equipment.
- 10. Prior to initiating the TAB work, the Commissioning Authority shall meet with the User, Contractor, and TAB Contractor. The TAB Contractor shall outline TAB procedures and get concurrence from the Design Professional and Commissioning Authority. Ensure that the TAB Contractor has all forms required for the job database and understands their importance and use.
- 11. Schedule the O&M training sessions. All training sessions shall be on-site, except where otherwise specified. These training sessions are to be attended by the User, Commissioning Authority, Contractors and equipment suppliers as required by Construction Documents. The format shall follow the outline in manuals. This

mechanical system orientation and inspection should include hands on training. The Commissioning Authority shall be solely responsible for recording all demonstration and training sessions on videotape, or alternative approved media, and furnish two (2) copies of the recording media to the User. Each session shall clearly reflect the content of each training session. Video Tapes or other approved media and enclosures shall be neatly labeled.

12. Upon receipt of notification from the Contractor that the systems have been completed and are operational, the Commissioning Authority shall proceed to verify the TAB report and operation of the control systems in accordance with the Commissioning Specification.
13. Provide and install calibrated test instrumentation to monitor and record data as necessary.
14. The Commissioning Authority shall document the results of all Functional Performance Testing.
15. Participate in re-testing, if necessary, if performance deficiencies are found, corrected and additional testing is requested.
16. Review as-built drawings for accuracy with respect to installed systems. Review revisions to achieve accuracy.
17. Ensure that the O&M manuals and all other as-built records have been updated to include all modifications made during the construction phase.
18. Observe and record repeated Functional Performance Tests to accommodate seasonal tests and correct any performance deficiencies. Revise and re-submit the commissioning report.
19. Assemble the final project documentation, which shall include the commissioning report and all as-built records. Submit this documentation to the User for review and acceptance.
20. The CA shall verify that all O and M manuals; "as-built" documentation and training manuals and training sessions are complete in every aspect and in accordance with the project specifications. The CA shall supplement the above documentation, as required, to make them complete.

C. Architect

1. Provide support to the Design Professional who must provide a service as a part of the commissioning process. This shall include providing adequate space for equipment installation and maintenance.
2. Conduct periodic inspections of work in progress to ensure that all systems and equipment are installed according to specifications.
3. Provide data on structure, building materials, interior finishes, and furnishings for their effect on Fire Protection systems.

D. Fire Protection Design Professional

1. Provide Construction Documents.
2. The Design Professional retains responsibility for the system evaluation, adequacy of the system to meet design intent, capacity of the system, quality control check or any of the other elements of the system design.
3. Review as-built records as required by contract documents and turn them over to the Commissioning Authority for inclusion in final project documentation.

E. Electrical Design Professional

1. Provide documentation or design narratives for electrical services to be provided for specific Fire Protection equipment requirements.
2. Provide electrical system information confirming compatibility with electrical service requirements specified by the mechanical design professional for all Fire Protection equipment and systems. Provide information necessary for the basis of design.
3. Prepare contract documents that coordinate interfaces between life safety systems, BMCS, and Fire Protection systems including commissioning specifications.

4. Attend construction-phase coordination meeting scheduled by the commissioning authority.
5. Participate in the start-up of Fire Protection equipment and systems.
6. Participate in the Fire Protection training sessions as required.
7. Participate in review of shop drawings for Fire Protection equipment.
8. Prepare electrical ladder wiring diagrams indicating power source connections to Fire Protection equipment and systems and interrelationships between life safety systems and Fire Protection systems and equipment, including a review of the automatic control and/or building automation system.
9. Prepare as-built electrical service record drawings as required by contract documents.
10. Verify that any space requirements for electrical equipment are in accordance with relevant code requirements.
11. Participate in O&M personnel orientation and inspection sessions.

F. General Contractor

1. Include cost for commissioning requirements in the contract price
2. General contractor shall coordinate construction progress with the commissioning schedule to assure that the building envelope and systems that affect proper operation and control of Fire Protection equipment and systems being tested are completed prior to testing.
3. Include commissioning requirements in the Fire Protection, electrical, and Division 23 (BMCS) contracts, as well as all other sub-contractors, to ensure cooperation of all parties in the Fire Protection commissioning program.
4. Ensure acceptable representation, with the means and authority to prepare and coordinate execution of the Fire Protection commissioning program as described in the contract documents.
5. Issue a statement that TA work has been completed, and submit the final TA reports for review.
6. Issue a statement that fire suppression system controls have been tested and adjusted.
7. Remedy deficiencies identified in verification tests.
8. Evaluate any performance deficiencies identified in the FPT report for non-performance with contract documents.
9. The equipment supplier shall document the performance of his equipment. Performance testing shall be witnessed by the commissioning authority.

G. Fire Protection Contractor

1. Include cost of commissioning requirements in the contract price.
2. Include requirements for submittal data, O&M data, and training in each purchase order or sub-contract written.
3. Ensure cooperation and participation of specialty sub-contractors such as testing and adjusting (TA).
4. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
5. Attend Construction Phase coordination meeting scheduled by the Commissioning Authority.
6. Assist the Commissioning Authority in all verification and functional performance tests.
7. Prepare preliminary schedule for Fire Protection system orientations and inspections, O&M manual submissions, training sessions, pipe system testing, flushing and cleaning, equipment start-up, TA and task completion for use by the Commissioning Authority. Update schedule as appropriate throughout the construction period.
8. Attend initial training session.
9. Conduct Fire Protection system orientation and inspection at the equipment placement completion stage.
10. Update drawings to the record condition to date, and review with the Commissioning

- Authority.
11. Gather O&M data on all equipment, and assemble in binders as required by the Commissioning Specification. Submit to Commissioning Authority prior to the completion of construction.
  12. Coordinate with the Commissioning Authority to provide sufficient advance notice so that the witnessing equipment and system start-up and testing can begin.
  13. Notify the Commissioning Authority a minimum of two weeks in advance of the time for start of the TA work. Attend the initial meeting for review of the official TA procedures.
  14. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the Commissioning Authority.
  15. Provide written notification to the General Contractor and Commissioning Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
    - a. Fire Protection equipment including all pumps, alarm devices, and all other equipment furnished under this Division.
    - b. Fire standpipe system and equipment, sprinkler systems and equipment.
    - c. Fire stopping in the fire rated construction, including caulking, gasketing and sealing of smoke barriers.
    - d. Fire detection and smoke detection devices furnished under the fire suppression system as they affect the operation of the smoke control systems.
  16. The equipment supplier shall document the performance of his equipment. Performance testing shall be witnessed by the commissioning authority.
  17. Provide a complete set of as-built records to the Commissioning Authority.

H. Test and Adjust Contractor

1. Include cost for commissioning requirements in the contract price.
2. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
3. Submit the TA procedures to the Commissioning Authority and Design Professional for review and acceptance.
4. Attend the TA review meeting scheduled by the Commissioning Authority. Be prepared to discuss the procedures that shall be followed in testing and adjusting the Fire Protection system.
5. At the completion of the TA work, and the submittal of the final report, notify the Fire Protection Contractor and the General Contractor.
6. Participate in training sessions as scheduled by the Commissioning Authority.
7. At the completion of TA work, and the submittal of the final TA report, notify the Fire Protection Contractor and the General Contractor.
8. Participate in verification of the TA report, which will consist of repeating any selected measurement contained in the where required by the Commissioning Authority for verification or diagnostic purposes.
9. The equipment supplier shall document the performance of his equipment. Performance testing shall be witnessed by the commissioning authority.

I. Equipment Suppliers and Miscellaneous Contractors.

1. Include cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Participate in training sessions as scheduled by the Commissioning Authority.
5. Demonstrate performance of equipment as applicable.

J. Electrical Contractor

1. Include costs for commissioning requirements in the contract price.
2. Ensure participation in testing of fire pumps equipment.
3. Ensure coordination, installation, and operation interfaces between life safety and Fire Protection systems.

1.05 DOCUMENTATION

A. The Commissioning Authority shall oversee and maintain the development of commissioning documentation. The commissioning documentation shall be kept in three ring binders, and organized by system and sub-system when practical. All pages shall be numbered, and a table of contents page(s) shall be provided. The commissioning documentation shall include, but not be limited to, the following:

1. Approved test and balance report for the systems being commissioned.
2. All accepted shop drawings and hydraulic calculations of Fire Protection equipment. Shop drawings shall be full size sheets folded as required to fit in binders.
3. All pre-functional performance test checklists, signed by indicating personnel, organized by system and sub-system.
4. All verification and functional performance test checklists/results, signed by indicated personnel, organized by system and sub-system.
5. Three copies of the operation and maintenance (O&M) manuals specified in other sections of these specifications shall be included with the commissioning documentation. The manuals shall be incorporated in the commissioning documentation prior to commencement of O&M training required in this and other sections of the specification. Preparation of O&M manuals shall be as specified in section 3.07 of these specifications.

PART 2 – - PRODUCTS

2.01 TEST EQUIPMENT

A. The appropriate Contractor(s) shall furnish all special tools and equipment required during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. The user shall furnish necessary utilities for the commissioning process.

2.02 TEST EQUIPMENT – PROPRIETARY

A. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate it's use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the user upon completion of the commissioning process.

PART 3 – – EXECUTION

3.01 GENERAL

A. A pre-construction meeting of all commissioning team members shall be held at a time and place designated by the user. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

- B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and acceptance procedures undertaken. This includes the complete installation of all equipment, materials, pipe, wire, insulation, controls, etc. per the contract documents and related directives, clarifications, and change orders.
- C. A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor initiated system changes have been made that alter the commissioning process, the commissioning authority shall notify the user.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 21 Fire Protection contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.
- E. The commissioning authority shall develop a detailed schedule for acceptance procedures and training. The commissioning authority shall work in a cooperative manner with the Contractor to assure that the commissioning process does not interfere with the completion of work in accordance with the overall schedule.

### 3.02 PARTICIPATION IN ACCEPTANCE PROCEDURES

- A. The Contractor shall provide skilled technicians to start-up and debug all systems within Fire Protection Division 21. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc. shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components., The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.
- C. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub-system.

### 3.03 DEFICIENCY RESOLUTION

- A. In some systems, improper adjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the User, with input from the contractor, equipment supplier, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Design Professional shall have final jurisdiction over any additional work done to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Authority shall notify the User, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the User reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

### 3.04 ADDITIONAL COMMISSIONING

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s) suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

### 3.05 ACCEPTANCE PROCEDURES

#### A. Verification Tests

##### 1. Scope of verification tests

- a. Operating tests and checks to verify that all components, equipment, systems, sub-systems, and interfaces between systems, operate in accordance with contract documents. These tests are to include all operating modes, interlocks, specified control responses, specific responses to abnormal or emergency conditions and verifications of the proper response of the building automation system controllers and sensors.
- b. Verify the validity of the TA report.

##### 2. Participants in verification tests

- a. The Commissioning Authority shall be responsible for preparing the scope of these tests. The Commissioning Authority shall schedule the tests and assemble the commissioning team members who shall be responsible for the tests. Participating contractors, manufacturers, suppliers, etc. shall include all costs to do the work involved in these tests in their proposals. Following is a list of tasks and supporting information that shall be required.
- b. Fire Protection contractor – provide the services of a technician(s) who is (are) familiar with the construction and operation of this system. Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.
- c. Electrical contractor – provide a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with alarm and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces, and interlocks.

##### 3. Documentation and Reporting Requirements.

- a. Provide checklists for each component, piece of equipment, system, and sub-system, including all interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. Separate checklists shall be prepared for each mode of operation. Provide space to indicate whether the mode under test responded as required or not. Also, provide space for all necessary parties to sign off on each checklist.
- b. Data sheets used in verification of the proper operation of the control system shall include each controller to be verified, and it's location. For each controller, provide space for recording the readout of the controller, the reading at the controller's sensor(s), and any comments. Also, provide space for all necessary parties to sign off on each checklist.
- c. All test procedures and data sheets shall be submitted to the design professional for review and acceptance.

##### 4. Instrumentation

- a. The Commissioning Authority shall furnish all measurement instrumentation for the verification tests. All instruments will have calibrated within the six-month period prior to these tests.

5. Verification Procedures

- a. The Commissioning Authority shall direct and witness the verification operating tests and checks for all equipment and systems.
  - (1) Set the system equipment (i.e. pumps, controllers) into the operating mode to be tested, i.e. normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions.
  - (2) The Commissioning Authority shall inspect and verify the position of each device and interlock identified on the checklist. Each item shall be signed off as acceptable (yes), or failed (no).
  - (3) This test shall be repeated for each operating cycle that applies to the Fire Protection system being tested.
  - (4) Operating checks shall include all safety cutouts, alarms and interlocks with life safety systems during all modes of operation of the Fire Protection system.
  - (5) If during a test an operating deficiency is observed, appropriate comments shall be added to the checklist data sheet.
  - (6) Verification of the interface of the monitoring and control system, and the criteria shall be included.
  - (7) Verification of the proper responses of monitoring and control system controllers and sensors shall be included.:
  
- b. The Commissioning Authority shall direct and witness the field verification of the final report.
  - (1) The Commissioning Authority shall select, at random, 10 percent of the report data for verifications.
  - (2) The contractor shall be given sufficient advance notice of the date of field verification. However, they shall not be informed in advance of the data points to be verified. The contractor must use the same instruments (by model and serial number) that were used when the original data were collected.
  - (3) Failure of an item is defined as:
    - (a) For all readings, a deviation of more than 10 percent.
  
- c. If the deficiencies are identified during verification, the General Contractor must be notified, and action taken to remedy the deficiency. The final tabulated checklist data sheets shall be reviewed by the Design Professional and the Commissioning Authority, to determine if verification is complete, and the operating system is functioning in accordance with the contract documents.

B. Functional Performance Testing

1. Scope of Functional Performance Testing

- a. Functional performance tests shall determine if the Fire Protection system is providing the required flows and pressure in accordance with the final design intent. Following is a list of test examples:
  - (1) Determine capacity of electric heating system to deliver heating at the design temperature.
  - (2) Determine the ability of the Fire pumps to deliver the required volume and pressure to the distribution system.

2. Submittals

- a. Detailed procedures for each series of tests shall be submitted to the Commissioning Authority for review and acceptance. The procedures shall include samples of the data sheets that will be part of the reports.
- 3. Participants in Functional Performance Tests
  - a. Participants in the functional performance tests shall be the same as those listed in the verification tests.
- 4. Instrumentation
  - a. In addition to the instrumentation requirements detailed under verification, the Commissioning Authority may need to provide data acquisition equipment to record data for the complete range of testing.
- 5. Functional Performance Test Procedures
  - a. The Commissioning Authority shall supervise and direct all functional performance tests.
  - b. For each test, the Commissioning Authority shall install the measuring instruments and logging devices to record test data for the required test period. The instrumentation shall monitor and record all operating conditions to allow for complete evaluation of the test results.
  - c. Measurement will be required to allow for calculation of total capacity of the system for each mode of operation under test.
- 6. Documentation and Reporting Requirements
  - a. All measured data, data sheets, and a comprehensive summary, describing the operation of the Fire Protection system at the time of testing shall be submitted to the Commissioning Authority.
  - b. A preliminary functional performance test report shall be prepared by the Commissioning Authority and submitted to the Design Professional or review. Any identified deficiencies need to be evaluated by the Design Professional and Construction Manager to determine if they are part of the contractor's contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s) and the specific functional performance test repeated.
  - c. If it is determined that the Fire Protection system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the User must decide whether any required modifications needed to bring the performance of the Fire Protection system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the User shall determine if a portion or all required functional performance tests should be repeated, and a revised report submitted.

3.06 OPERATING AND MAINTENANCE MANUAL:

- A. The operating and maintenance manual shall consist of a sturdy binder with 8-½" x 11" sheets in accordance with the Contract Documents.

3.07 OPERATING AND MAINTENANCE TRAINING

- A. The Fire Protection Contractor, and appropriate sub-contractors, shall provide comprehensive operating and maintenance instruction on building systems in accordance with the Contract Documents prior to delivery. The instruction shall include classroom instruction deliver by competent instructors based upon the contents of the operating manual.

- B. Each classroom training period shall be followed by an inspection, explanation and demonstration of the system concerned by the instructors. All specified equipment shall be started up and shut down, with the exception of sprinkler system.
- C. The contractor shall be responsible for organizing, arranging, and delivering manner on a schedule agreeable to the User.
- D. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the User.
- E. Each classroom training session and demonstration shall be recorded on videotape or alternative acceptable media and submitted to the User.

END OF SECTION

SECTION 21 13 19

FIRE PROTECTION SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Under this Division, the Contractor shall furnish all labor, equipment, appliances, and materials to perform all operations in connection with the installation of a complete and tested fire protection system as described in the Contract Documents.

1.02 SYSTEM DESCRIPTION

A. Applicable Standards:

1. All Fire Protection design, products, and installation shall comply with the applicable provisions and recommendations of the following jurisdictional codes, authorities and guidelines:
  - a. National Fire Protection Association Standard 13, ~~1999~~2007 Edition
  - b. National Fire Protection Association Standard 14, ~~2000~~30, 2003 Edition
  - c. National Fire Protection Association Standard 45, 2004 Edition
  - d. National Fire Protection Association Standard 72, ~~1999~~2007 Edition
  - e. National Fire Protection Association Standard 1963, 2003 Edition
  - f. International Building Code, 2003 Edition
  - g. International Fire Code, 2003 Edition
  - h. Applicable Factory Mutual Insurance Company Data Sheets
  - i. Local Codes, Code Amendments and Requirements
2. Provide fire protection products including valves, fittings and couplings, supports, anchors, fire stops, sprinklers, fire hose stations, hose valves, etc., that are Underwriters Laboratories listed, and approved by the local Fire Department.

B. Design Parameters:

1. Scope of Fire Protection:
  - a. The Fire Protection Drawings issued as part of the Contract Documents indicate the following in diagrammatic manner: location of water services, check valves, shutoff valves, fire standpipe risers, fire sprinkler areas, alarm zoning, and special conditions. As such, these Drawings are an interpretation of the project requirements and are to be used as a guide in the layout and design of the complete fire protection system for the entire building floor area; however, it does not relieve the Contractor from providing all work and equipment necessary to provide a complete and operational system, according to the project requirements and applicable standards.
  - b. All equipment and devices shall be Underwriters Laboratories listed, Factory Mutual and local Fire Department approved. Fire Protection Contractor shall sign and seal shop Drawings prior to issuance to Building and Fire Departments for approval. No work shall be installed without approved shop Drawings.
  - c. It shall be the responsibility of the Contractor to coordinate the location of all sprinkler heads with final reflected ceiling Drawings.
  - d. Fire sprinkler mains shall not interfere with the HVAC contractor's ability to place HVAC main ducts tight to bottom of fire proofed structural elements.
  - e. The Contractor shall provide all offsets, drains and drain plugs for trapped

pipng, and drainage piping. The Contractor shall notify the Architect, in writing, of all discrepancies in sprinkler head locations where local codes are violated; i.e., allowable distance from walls or exterior glass, small room spacing, stairs, etc.

- f. System piping shall be hydraulically designed throughout all areas in accordance with the rules and regulations of the applicable standards using the design densities indicated herein:
  - (1) Fire Sprinklers: The fire sprinkler hydraulic calculations shall include hose allowances as defined for the hazard for inside and outside hose streams as required to meet applicable standards.
  - (2) Hydraulically designed sprinkler systems should be designed for a supply pressure of at least 10 percent, but not less than 10 psi, below the supply curve.
  - (3) The velocity of water through the fire protection piping system shall not exceed maximum allowable velocities allowed by applicable standards.
- g. The hydraulic calculations shall be based flow data obtained from local water authority. Confirm flow data prior to design and layout of fire protection systems.
- h. Water Supply:
  - (1) Location:
  - (2) Static Pressure: varies 60 to 65 psi
  - (3) Residual Pressure: to be determined by test
  - (4) Water Flow: to be determined by sprinkler contractor flow test

2. Wet Fire Sprinkler Density Requirements:

- a. All sprinkler systems shall be hydraulically calculated. In the event design criteria information from the project fire insurance underwriter is unavailable at the time of initial design, the following minimum criteria shall be used:
  - (1) ~~Light Hazard~~ Ordinary Hazard – Group 1: Offices, data processing, ~~restaurant seating area~~, and corridor piping systems shall be sized to deliver a minimum ~~0.40~~ 0.15 gpm/sq. ft. over an area of 1500 sq. ft. at the most remote location and 250 gpm for hose stream. The protection area per sprinkler head shall be ~~225~~ 130 square feet.
  - (2) Ordinary Hazard – Group 2: truck dock, storage areas and mechanical rooms, piping shall be sized to deliver a minimum 0.20 gpm/sq. ft. over an area of 1500 sq. ft. at most remote location. Sprinkler head spacing shall be limited to maximum area of 130 sq. ft.
  - (3) Ordinary Hazard – Group 2: Laboratories: piping shall be sized to deliver a minimum 0.20 gpm/sq. ft. over an area of 1500 sq. ft. at most remote location. Sprinkler head spacing shall be limited to maximum area of 130 square feet.

3. Zoning of the Fire Protection System:

- a. Wet Sprinkler System: Water flow detection zoning shall be per floor basis with areas not exceeding maximum allowable per NFPA.
- b. Wet Sprinkler System for computer room is to be supplied by a separate dedicated main with an isolation control valve and flow switch.- Area density to be 0.10 gpm per sq. ft. over 1,500 square feet.

4. Elevator Machine Room Requirements:

- a. The sprinkler supply line to each elevator machine room shall be provided with an accessible shutoff valve with tamper switch.
  - b. Fire sprinklers installed in the elevator machine rooms shall be intermediate temperature rating.
5. Elevator Pit Requirements:
- a. Install automatic sprinkler heads in elevator pits such that the water spray pattern shall not spray higher than 2 feet above the pit floor, with a spray pattern directed level and down.
  - b. ~~An accessible sprinkler shut-off valve shall be provided outside of and near the pit. The valve shall be normally open, with no provision to shut off elevator power.~~
  - c. Do not locate automatic sprinkler heads on a car entrance side or interfere with pit access.
  - d. Provide drain valve and plug at the lowest point of the automatic sprinkler piping in the pit and installed to avoid mechanical damage. Piping shall enter the shaft at the floor level of the bottom landing and be wall mounted, fit tight against the wall, and maintain proper clearance to the car and counterweights. In walk-in pits, sprinkler piping may enter the pit in an approved manner other than the floor level of the car's lowest landing.
- C. No pipes or other apparatus shall be installed so as to interfere in any way with the full swing of doors, building access doors, and access doors in ductwork. The arrangement, positions, and connections of pipes, drains, valves, etc., shown on the Drawings shall be taken as a close approximation and while they shall be followed as closely as possible, the right is reserved by the Project Representative to change the locations to accommodate any conditions which may arise during the progress of the work without additional compensation to this Contractor for such changes, provided that the changes are requested prior to the installation of this Contractor's work.
- D. Piping typically shall be installed concealed in or above building construction; i.e.; hung ceilings, and shall be so arranged that relocation of lighting fixtures, or plumbing and mechanical systems, will not cause any interference.
- E. Coordinate with the fire sprinkler and alarm trades to ensure full awareness of the location of all control valves, flow switches, tamper switches, and alarm and signal switches.

### 1.03 SUBMITTALS

- A. Comply with requirements of:
- 1. Division 1
  - 2. Fire Department:
    - a. Submit five (5) sets of Drawings, five (5) sets of catalog cut sheets for all equipment to be installed, and five (5) sets of hydraulic calculations to the local governing approval authority.
    - b. Submittals shall include all information required by applicable standards. Incomplete submittals shall be returned. The automatic sprinkler devices shall be distinctly discernible, with all extraneous, non-sprinkler information kept to a minimum. "High-lighting" is not acceptable.
  - 3. Insurance Underwriter Company:
    - a. Submit three (3) sets of Drawings, three (3) sets of catalog cut sheets for all equipment to be installed, and three (3) sets hydraulic calculations.
    - b. Include Sprinkler Identification Number (SIN) nomenclature on fire sprinkler product data.

4. Product Data: Submit manufacturer's product literature including, material specifications and other information required to demonstrate compliance with specified requirements. Submit for engineer's approval an equipment manual which will include all technical data of each essential component of the system such as automatic sprinklers, electrical detectors, pressure gauges, flow switches, hanger assemblies, valves, pipe and fittings, and control system, etc.

B. Shop Drawings:

1. Fire Protection Contractor shall sign and seal shop Drawings prior to issuance to local fire authority for approval. No work shall be installed without approved Shop Drawings.
2. Obtain approval on systems in accordance with construction schedule with fire supply mains, standpipes, etc., submitted first then fire sprinkler head layout, floor by floor as schedule dictates.
3. Submit fire sprinkler and standpipe system shop Drawings and hydraulic calculations with submittal of product data.
4. Submit detailed layout Shop Drawings of complete sprinkler systems. Shop Drawings shall indicate plan locations and elevations of piping and hangers, including bottom elevation of major piping and be coordinated with building conditions, ductwork and other mechanical and electrical services.
5. Submit detailed layout Shop Drawings of standpipe. Shop Drawings shall indicate plan locations and elevations of piping and hangers, including bottom elevation of major piping and be coordinated with building conditions, ductwork and other mechanical and electrical services.
6. Include the following in Shop Drawings in addition to requirements of applicable standards. Drawings submitted without these items will be returned unreviewed:
  - a. Finished ceiling components such as ceiling grid, and lights.
  - b. Beams and other sprinkler obstructions in unfinished spaces.
  - c. Details and sections to clarify design and installation to be in conformance with design criteria and standards described in this section.
  - d. Locations and sizes of beam penetrations, approved by the structural engineer.
  - e. Locations of all seismic bracing and additional bracing required for flexible type couplings.

C. Written statement that coordination has been accomplished with work of other contractors and installers.

D. Maintenance and Operation Manual:

- ~~1. PreAction System: Supply a standardized and listed maintenance and operation manual for the preaction system. This manual must include all necessary instructions to operate and maintain the system, and be explicit regarding the interaction between the hydraulic aspect (deluge valve and trim) and the detection portion (control panel and detectors). Emergency procedures must form an integral part of the manual.~~

#### 1.04 QUALITY CONTROL

- A. All welders shall be certified by ANSI B31.1.0-1967—"Standard Qualification Welding Procedures, Welders and Welding Operators." Furnish welder performance qualification test certificates for positions 2G and 5G made in strict compliance with the above codes. Welders shall be certified for the type of pipe materials specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by this Contractor. Two (2) copies of the qualification test report and certification with welder's identification number, letter, etc., shall be delivered to the Project Representative for his file before any welding commences. Each weld shall bear the welder's identification mark permanently indented in the

weld. Welding procedures shall also be in accordance with the requirements of the American Welding Society, current edition where applicable.

- B. Only Subcontractors and workmen experienced and regularly engaged in the installation of automatic sprinkler type fire protection systems for the past five (5) years and licensed as required by the Authority having jurisdiction shall be permitted to install the system.

## PART 2 – PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Following is a list of manufacturers whose products may be submitted for review. All items submitted as being equal to that specified, shall have same quality, finish, material construction, etc., as those specified under base Specification.
- B. Acceptable Manufacturers:
  - 1. Valves: Jenkins, Kennedy, Walworth, Crane, CLA-Val, Nibco, Milwaukee, Victaulic
  - 2. Fire Hose Valves: Wilkins, Croker, Potter Roemer, Standard Fire West, Elkart
  - 3. Sprinkler Heads: Viking, Grinnell, Central, Reliable
  - 4. Waterflow Switches: Potter Electric Co., Potter Roemer, Notifier.
  - 5. Fire Pumps: Peerless, Patterson, ITT A C Fire Pump, Aurora
  - 6. Fire Pump and Jockey Pump Controllers: Firetrol, Metron, Joslyn Clarke, Lexington
  - 7. Jockey Pump: Grundfos, Aurora, Goulds
  - 8. Fire Pump Test Flow Meter: Barco, Preso, Gerand

### 2.02 PIPING AND FITTING MATERIALS

- A. General Characteristics for Threaded Pipe and Fittings: Field Pipe Threading: Comply with ASME B1.20.1 "Pipe Threads, General Purpose (inch)".
- B. General Characteristics for Welded Pipe and Fittings: Welding: Shop Welded and in compliance with AWS B2.1 "Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing".
- C. Buried Fire Main: Cement-Lined Mechanical Joint Ductile Iron Pipe: ANSI/AWWA C151/A21.51, C150/A21.50, C111/A21.11, Class 52, 53, or 54.
  - 1. Interior of Pipe: Cement-lined and seal coated, ANSI/AWWA C104/21.4 and listed by approved certifying agency as conforming to requirements of ANSI/NSF 61.
  - 2. ~~Outside of Pipe: Asphaltic Coated, ANSI/AWWA C153/A21.53.~~  
Outside of Pipe: Polyethylene encasement for ductile iron pipe, 8-mil thick. Refer to ANSI/AWWA C105/A21.5 for material standards and installation procedures.
- D. Automatic Fire Sprinkler Systems:
  - 1. Above Grade Piping Systems Pipe Sizes 2 inch and Smaller: Piping: ASTM A135, or A53 B, schedule 40 carbon steel pipe.
  - 2. Above Grade Piping Systems Pipe Sizes 2½ inches and Larger: Piping: ASTM A135 or A53 B, schedule 10 carbon steel pipe.
  - 3. Dry Sprinkler and Standpipe Pipe and Fittings: Provide Hot dipped zinc coating inside and outside the piping in accordance with ASTM A-123 for all piping materials. Fittings are not required to be galvanized.
  - 4. Fittings:
    - a. Pipe Sizes 2 inch and Smaller:

- (1) Class 125 cast iron threaded fittings for working pressures under 175 pounds per square inch, conforming to ANSI B16.4.
  - (2) Class 150 malleable iron threaded fittings for working pressures under 300 pounds per square inch, conforming to ANSI B16.3.
  - (3) Class 250 cast iron threaded fittings for working pressures up to 400 pounds per square inch, ANSI B16.4
  - (4) Class 300 malleable iron threaded fittings for working pressures greater than 175 pounds per square inch up to 800 pounds per square inch, conforming to ANSI B16.3.
- b. Pipe Sizes 2-½ inch and Larger: ASTM B16.9, B16.25 welded fittings, cast iron flanges, and vee-butt welded joints.
  - c. Pipe Sizes 1½ inch and Larger:
    - (1) Various Victaulic "Firelock" fittings/couplings may be acceptable, however mechanical T-fittings 920, 921, Hooker fittings, etc. will not be permitted. Contractor to submit list of fittings he intends to use and in which systems.
5. Grooveless clamp or saddle fittings are not acceptable.

E. Standpipe Fittings:

- 1. Threaded, cast iron ANSI B16.4, 250 pounds per square inch class.
- 2. Threaded, cast iron flanges and flanged fittings, ANSI B16.1, 250 pounds per square inch class.

2.03 VALVES

- A. All fire protection valves shall be Underwriters Laboratories label, Factory Mutual approved and to be rated of minimum 175 psi working pressure rating or where line pressure exceeds 175 psi, extra heavy. Shut off valves shall be of the indicating type. Where pressure exceeds 175 pounds per square inch, extra heavy rated valves shall be provided.
- B. Floor Control, Riser and Isolation valves:
  - 1. 175 psig Working Pressure:
    - a. Gate Valves:
      - (1) Gate valves up to and including 2 inch Kennedy Figure 66, 175 psig cold water, UL listed, FM approved, bronze body, bronze trim, single disc, outside screw and yoke, screwed bonnet valves with seats of bronze, screwed ends.
      - (2) Gate valves 2½ inch through 12 inch Kennedy Figure 4068, 175 psig cold water, UL listed, FM approved, and approved iron body, outside screw and yoke bolted bonnet valves with double or single disc, Class 125 ANSI B16.1 flanged ends, bronze trim, bronze seats.
    - b. Butterfly Valves:
      - (1) 2-½ inch through 8 inch UL listed for specification 1091, FM approved under Approval Standard 1112, ductile iron body conforming to ASTM A-536 coated with polyphenylene sulfide blend, ductile iron disc conforming to ASTM A-536 with EPDM coating providing bubble tight shut-off, approved weatherproof manual actuator suitable for indoor or outdoor use with two single pole, double throw supervisory switches either pre-wired (WRD) or

unwired (UWD) monitoring the open position as required to meet design requirements, grooved ends for installation with grooved mechanical couplings and rated for service up to 175 psi (1200 kPa) working pressure, equivalent to Victaulic Series 708-W, Gruvlok 7722-3 FD, or Nibco GD4765-4N.

- (2) UL listed, FM approved, slow-open quarter turn valve with built in tamper switches, 175 psi, threaded ends. Valve shall be provided with tamper switches rated for 0.5 Amps, 28 VDC; equivalent to "No. BB-SCS02" by Milwaukee Valve.

C. Check Valves:

1. 175 psig Working Pressure:

- a. Check Valve – 2-1/2 inch and larger: Iron body, swing check, 175 psi working pressure, bronze mounted, flanged pattern, UL listed, FM approved; equivalent to "Fig. F-908-W" by Nibco.
- b. Check Valve – 4 inch and larger: Iron body, swing check, 175 psi working pressure, bronze mounted, flanged pattern, UL listed, FM approved; equivalent to "Fig. F-908-W" by Nibco.

- D. Spring Loaded Check Valve – 4 inch to 8 inch Line Sizes: Dual disc, spring loaded, check valves, UL listed and FM approved for a single check and anti-water hammer service and for horizontal or vertical installation, supplied drilled, tapped and plugged at bosses where required, Grade "E" EPDM seal, housing cast of ductile iron conforming to ASTM A-536 or malleable iron to ASTM A-47 with grooved ends for installation with Victaulic grooved end couplings rated for service up to 250 psi working pressure; equivalent to "Series 714 and 710 Vic-Check" by Victaulic.

~~E. Fire Hose Valve:~~

~~1. Fire Hose Valve:~~

~~a. Line pressure under 175 psi:~~

- ~~(1) 2½ inch angle rough brass hose valve, with cap and chain with 1/8 inch hole drilled in cap to relieve pressure; equivalent to "#V6L Fire Hose Valve" by Standard Fire West.~~
- ~~(2) 2½ inch angle hose valves x 3 inch MPT outlet rough brass with cap and chain by Potter Roemer.~~

~~b. Line pressure over 175 psi: 2½ inch angle rough brass hose valve, with cap and chain with 1/8 inch hole drilled in cap to relieve pressure; equivalent to "PRESSURE TRU #Z 3000" by Wilkins.~~

~~F. Automatic Ball Drip: Installed at boss location "C" on the check valve of the fire department connection, closing against pressure, but opening when pressure is off allowing water to drain from the fire department connection, "1/2 inch Ball Drip Model A" by Automatic Sprinkler or KiddieKiddle.~~

2.04 FIRE DEPARTMENT CONNECTION

- A. Fire department connections shall be three-way, free standing type, rough brass finish with plugs and chains, outlet size and orientation as required. Manufacturers: Badger-Powhatan, Elkhart Brass, Croker Corp., Potter-Roemer, or Tyco.
- B. Signage shall be raised or engraved letters at least 1" in height.

## 2.05 VALVES SUPERVISORY SWITCH

- A. Provide UL listed and FM approved, tamper switches with two single pole, double throw micro switches on all valves with alarm signal to register on fire alarm panel on all control valves. PIV switches shall be weather-resistant and shall monitor target position. Acceptable Manufacturers: Potter Electric Signal or approved equal.
1. Valve Tamper Switches: 2 sets of single pole double throw Form C synchronized sets of contacts rated at 15A, 125/250 VAC and 2.5 A, 0-30 VDC, located within tamper resistant NEMA 6P enclosure with electrical. Plug type switches will not be acceptable.
    - a. OS&Y Gate Valve Tamper Switch: "Model OSYSU-2" by Potter Electric Signal Manufacturing. OS&Y switches shall monitor stem movement and shall be complete with mounting J-bolts.
    - b. Butterfly: "Model PCVS-2T" by Potter Electric Signal Manufacturing or equal.
- B. Plug and loop type tamper switches shall not be used.
- C. All wiring shall be provided under Division 26.

## 2.06 SPRINKLER HEADS

- A. General:
1. Fire sprinklers shall be of one manufacturer throughout building. No mixing of sprinkler brands shall be permitted, unless otherwise noted for window protection sprinkler heads.
  2. Sprinklers shall be of all brass frame construction with a coated metal-to-metal seating mechanism.
  3. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited, including O-Rings.
  4. Sprinklers shall have a quick response frangible bulb type fusible element with a temperature rating of 155 or 200 degrees F or shall have a fast response metal type fusible element with a temperature rating of 165 to 212 degrees F.
  5. Sprinklers to be installed in areas with no ceilings shall be of a brass finish and shall be of adequate temperature for the hazard.
  6. Exposed sprinklers subject to corrosive atmospheres shall have a factory applied corrosion resistant coating.
  7. Provide approved sprinkler head wire guards for sprinkler heads located 7 feet 6 inches or lower above finished floor level.
  8. Provide sprinkler heads with minimum ½ inch discharge orifice.
- B. Finished Ceiling Areas:
1. Pendant Style: Quick response flush style pendant sprinkler, ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved; equivalent to Viking Horizon, SIN VK402. Finish: ~~Bright Brass~~, Polished Chrome, ~~White Polyfinish, and Navajo White Polyester~~.
  2. Concealed Style: Quick response concealed style pendant sprinkler, ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved; finish equivalent to Viking Horizon Mirage, SIN VK404. Finish: ~~Bright Brass, Brushed Brass, Antique Brass, Polished Chrome, Brushed Chrome, and Brushed Copper, Painted White, Painted Custom Color as selected by Architect. Use concealed sprinklers in lobby and under bridge in lobby.~~
  3. Semi Recessed Style: Quick response pendant style semi recessed pendant sprinkler with two piece adjustable chrome plated steel escutcheon for semi recessed installation UL listed and FM approved for use with the sprinkler head in

which they are installed: ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved, "MQR" SIN VK302 with Model E-1 Recessed Escutcheon. Finish: ~~Bright Brass, Brushed Brass, Antique Brass, Polished Chrome, Brushed Chrome, and Brushed Copper, Painted White, Painted Custom Color.~~

4. Sidewall Concealed Style: Quick response concealed sidewall style sprinkler, push-on type cover plate, pull-off assembly with a 2¾ inch diameter ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved; finish equivalent to Viking Horizon Mirage, SIN VK408. Finish: ~~Bright Brass, Brushed Brass, Antique Brass, Polished Chrome, Brushed Chrome, and Brushed Copper, Painted White, Painted Custom Color.~~
5. Sidewall: Quick response sidewall style sprinkler with two piece adjustable chrome plated steel escutcheon for semi recessed installation, ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved; finish equivalent to Viking Horizon Mirage, SIN VK304 with Model E-1 Recessed Escutcheon. Finish: ~~Bright Brass, Brushed Brass, Antique Brass, Polished Chrome, Brushed Chrome, and Brushed Copper, Painted White, Painted Custom Color.~~

C. Unfinished Ceiling Spaces:

1. Upright Style: Quick response upright style sprinkler, ½ inch NPT, a standard orifice, nominal K Factor of 5.6, 165 degrees F, UL listed and FM approved; finish equivalent to Viking Horizon Mirage, SIN VK300. Finish: Bright Brass, Brushed Brass, Antique Brass, Polished Chrome, Brushed Chrome, and Brushed Copper, Painted White, Painted Custom Color.

D. Dry Pendant Sprinkler: Quick response dry pendent barrel shall be of steel construction with an electro-deposited epoxy base coating. Quick response dry pendent sprinklers shall have a 3 mm frangible bulb type fusible element. Quick response dry pendent sprinklers shall have a 1-inch NPT, a standard orifice, and a nominal K Factor of 5.6. The installation of quick response dry pendent sprinklers shall be in conformance with the manufacturer's installation guidelines. Quick response dry pendent sprinklers shall be UL listed. Quick response dry pendent sprinklers shall be listed for installation in an Ordinary Hazard occupancy if installed in an Ordinary Hazard occupancy. Quick Response Dry Pendent Sprinklers (formerly Model M) shall be Viking SIN VK172 (Plain Barrel), SIN VK176 (Adjustable Standard), or SIN VK180 (Adjustable Recessed).

~~E. Dry Sidewall Sprinkler: Quick response dry pendent barrel shall be of steel construction with an electro-deposited epoxy base coating. Quick response dry pendent sprinklers shall have a 3 mm frangible bulb type fusible element. Quick response dry pendent sprinklers shall have a 1-inch NPT, a standard orifice, and a nominal K Factor of 5.6. The installation of quick response dry pendent sprinklers shall be in conformance with the manufacturer's installation guidelines. Quick response dry pendent sprinklers shall be UL listed. Quick response dry pendent sprinklers shall be listed for installation in an Ordinary Hazard occupancy if installed in an Ordinary Hazard occupancy.~~

~~E. Window Protection Sprinkler Heads: Central Model WS, Chrome plated.~~

~~F. Extended Coverage: Extended coverage quick response pendent sprinklers with two piece adjustable chrome plated steel escutcheon for semi recessed installation, extra-large orifice and an 11.2 nominal K Factor, UL and FM listed for extended coverage application. Quick Response Extended Coverage Light Hazard (ECLH) Extra-Large Orifice Sprinklers (formerly Model M) shall be Viking SIN VK608 with Model E-1 Recessed Escutcheon.~~

## 2.07 WATERFLOW DETECTORS

A. Flow Switches: Vane type, UL listed, FM approved water flow detectors in the sprinkler systems where shown on the Drawings or as indicated in these Specifications. Detectors shall be designed for mounting in the horizontal or vertical piping, but shall not be mounted in a fitting or within 12 inches of any fitting that changes direction of water flow, and shall have

sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head. Switches shall be activated by a vane extending into the waterway of the piping. Detectors shall provide a ½ inch conduit entrance.

1. Required whole sizes shall be 1-5/16 inches for piping 2 inches to 3 inches and 2-1/16 inches for piping 4 through 8-inch size.
2. Flow Switch: UL/FM listed, rated for 450 psi and surges up to 18 FPS, alarm activation at 10 gpm, sets of single pole double throw Form C synchronized sets of contacts rated at 15 A, 125 VAC and 2A, 24 VDC; corrosion-resistant using factory-installed, non-corrosive insert.
  - a. Switch Enclosure: Tamper resistant, meeting NFPA 4 rating, and equipped with instantly recycling adjustable retard with 0-90 second range.
  - b. Equivalent to "Model VSR-F" by Potter Electric Signal Manufacturing.
- B. Pressure Switches: UL/FM listed, rated for 250 psi and detect 10 psi pressure increase or decrease from normal line pressure, adjustable from 10 to 175 psi, 2 sets of single pole double throw Form C synchronized sets of contacts rated at 15 A, 125 VAC and 2A, 24 VDC; corrosion-resistant using factory-installed, non-corrosive insert, bleed valve assembly; equivalent to "Model PS40-2A-BVL" by Potter Electric Signal Manufacturing.
- C. All electrical wiring shall be provided under another Division of the Specifications.
- D. Coordinate all requirements with Division 26.

#### 2.08 PIPE SLEEVES

- A. The Contractor shall furnish and install all sleeves required for the lines and mains as needed for sprinkler piping.

#### 2.09 PIPE HANGERS

- A. Provide in accordance with referenced standards. Do not mix piping material and hanger material of dissimilar metals. All beam clamps shall be fitted with steel retainer straps. Hanger rods of less than 3/8 inch diameter are not permitted. All horizontal piping shall be supported by means of UL approved hangers with proper size suspension rods and locknuts, spaced as required by the Underwriters.

#### 2.10 SPARE SPRINKLER HEADS

- A. In addition to the heads actually required, furnish a stock of extra sprinklers of amounts as recommended by the National Fire Protection Associations Standards, including a minimum of six (6) heads of each type and temperature rating used and two (2) suitable wrenches for each type sprinkler head, contained in steel boxes, suitable for use as a service kit on the project.

#### 2.11 IDENTIFICATION SIGNS

- A. Metal identification signs, nominally 2 inch x 6 inch or 3 inch x 5 inch, red background with white lettering; equivalent to Potter-Roemer "Series 6300."
  1. Include appropriate warning and/or identification information such as "Inspectors Test," "Drain," "Main Drain," "Fire Sprinkler Valve - Do Not Close," "Sprinkler Fire Alarm - Call Fire Department," hydraulic design information indicating design flow and residual pressure, etc.
  2. Label control valves, fire riser, etc., with appropriate brief descriptions of operating functions.
  3. Provide signage to locate main or section valves in accordance with applicable standards.

- B. Provide required signs, securely fastened to control valves, fire department connection, sprinkler control valve, etc., by stainless steel wire or chains indicating the purpose and location of each valve.

## 2.12 MISCELLANEOUS

### A. Water Service Pressure Gauge:

1. Dial: White aluminum, 4-1/2 inch diameter, rated to 1000 psi with black markings and numerals, ranges provided to be read at mid-range, slotted and adjustable pointer.
2. Case: Aluminum with phenolic black turret and plastic lens with ¼ inch N.P.T. connections located at bottom, lower back or center back as required.
3. Operation: ANSI B40.1 Grade A accuracy to 1 percent with brushed bushed rotary movement.
4. Manufacturer: Equivalent to "Series PG-1" by Weiss.

### B. Pressure Gauge Accessories

1. Gauge Cock: 1/4 N.P.T. brass ball valve with lever handle, equivalent to "LC -14 or LCU-14" by Weiss.
2. Pressure Snubber: Brass housing, psi rating 15000 psi at 70 degrees F, with corrosion resistant porous metal dampening element with porosity selected to meet type of service, and inlet meeting connection size of gauge.
3. Water and Light Oil (30-225 Saybolt Seconds Universal Viscosity); equivalent to "No.PSN-B-25-E, ¼ inch N.P.T.", or "No.PSN-B-50-E, ½ inch N.P.T." by Weiss.

### C. Pressure/Vacuum Gauge: 4-1/2 inch dial Marsh type 3CP ¼ inch BM threaded, 30 inches Hg x 60 psi pressure vacuum gauge for installation with Crane #88 needle valve or approved equal on the suction side of the pump.

### D. Ball Drip Valve: ¾ inch cast brass, straight or angle as required: equivalent to "No. 6781 or 6783" by Croker.

### E. Escutcheon Plates: Escutcheon Plates shall be pressed stainless steel, chrome plated with concealed hinges and springs to hold position on pipe. Install on pipes passing through floors, ceiling and walls in finished areas. Wall plates exposed to weather shall be stainless steel. Escutcheon wall plates exposed to weather shall be stainless steel.

### F. Sprinkler guards: UL listed, Heavy duty welded wire, red baked enamel finish.

## PART 3 – EXECUTION

### 3.01 INSTALLATION

#### A. All piping, valves, and other materials shall be installed according to the Local Authority rules and an inspection certificate furnished.

#### B. Sprinkler piping shall be installed and coordinated with the ductwork and other mechanical and electrical services in the ceiling cavities by the Contractor to provide the clearances for lighting fixtures as indicated on the Drawings. If any departures from the Drawings are necessary to comply with any NFPA requirements, or the authority having jurisdiction, such revisions and/or departures shall be detailed and submitted for approval. All such revisions shall be made and the sprinkler systems installed in accordance therewith, without additional cost to the Owner. Departures shall not be made without prior written approval by the Project Representative. The Drawings are schematic and do not indicate inferred details. This installation shall also meet the approval of the Local Fire Department.

- C. The sprinkler heads in public areas, and in typical floor elevator lobbies shall be located as indicated on the Architectural reflected ceiling plans and coordinated with the lighting fixtures. Sprinkler head alignment is required in all areas. Sprinklers shall be provided with a temporary plastic cover when installed in plaster or drywall ceilings.
- D. No pipes or other apparatus shall be installed so as to interfere in any way with the full swing of doors, building access doors, and access doors in ductwork. The arrangement, positions, and connections of pipes, drains, valves, etc., shown on the Drawings shall be taken as a close approximation and while they shall be followed as closely as possible.
- E. The right is reserved by the Project Representative to change the locations to accommodate a change of conditions, which may arise during the progress of the work without additional compensation to this Contractor for such changes, provided that the changes are requested prior to the installation of this Contractor's work.
- F. Piping typically shall be installed concealed in or above building construction; i.e.; hung ceilings, and shall be so arranged that relocation of lighting fixtures, or plumbing and mechanical systems, will not cause any interference.
- G. All components of the fire protection system shall be installed in accordance with the manufacturer's installation recommendations.
- H. All sprinkler heads shall be installed in conformance with the UL listing and FM approvals criteria. Spacing of sprinkler heads shall be in conformance with the UL listing and FM approvals criteria for the applicable occupancy type.
- I. The fire protection subcontractor shall coordinate the installation of pipes, hangers, valves, and all other items of the fire protection system with the work of all other trades so that all components will be installed to avoid conflicts, and provide for proper servicing and maintenance of mechanical and electrical equipment in ceiling plenums.
- J. Sprinkler heads shall be installed on a true axis line of ½ inch plus or minus. At the completion of the installation, if any heads are found to exceed this tolerance, heads shall be removed and reinstalled by this Contractor, at no additional cost to the Project Representative.
- K. The Project Representative reserves the right to reject any and all work not in accordance with the approved shop drawings
- L. Components improperly installed shall be removed and/or relocated as directed by the Project Representative at no additional cost to the Owner. Refer to Section 23 05 01 subsection titled "Contractor's Coordination Drawings" for additional requirements.
- M. All sprinkler piping shall be installed concealed in hung ceilings, including drywall ceilings and soffits unless noted otherwise and shall be arranged so that relocation of lighting fixtures shall not cause any interference.
- N. Run all pipe straight and true. Springing or forcing piping into place will not be permitted. Install piping in such a manner as to prevent strain on the equipment.
- O. Conceal piping in ceiling cavity where ceiling are provided. Exposed piping shall be installed as nearly as possible parallel to or at right angles to the column lines of the building.
- P. All piping shall be carefully graded so as to eliminate traps and pockets. Where water traps cannot be avoided, provide drains in conformance with NFPA 13.
- Q. Make all joints smooth and unobstructed inside. Ream all cut pipe ends to remove burrs. Remove all obstructions prior to fabrication.

- R. Install a union or flanges at equipment connections and elsewhere as indicated.
- S. Make welded joints on pipe runs with continuous welds, without backing rings, and with pipe ends beveled before fabrication. 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 metal shall project within the pipe.
- T. All screwed pipe throughout the job shall be reamed smooth before being installed. Use full pipe lengths; random lengths joined by couplings will not be accepted.
- U. Pipe shall not be split, bent, flattened or otherwise damaged either before or during the installation.
- V. All welded elbows shall be long radius type.
- W. The Fire Protection Subcontractor utilizing a grooved piping system shall provide a letter of certification to the Project Representative stating that a project site training session of at least two (2) hours duration was conducted for this Project by the grooved fitting manufacturer for the Subcontractor's supervisory and installing personnel.
- X. All piping that penetrates fire rated construction shall be firestopped.
- Y. All piping shall be of the sizes required by applicable codes, but not less than the sizes indicated on the Drawings.
- Z. Install sprinkler piping and heads at minimum 24-inch distance from variable air volume box or DDC control.

### 3.02 FIRE SPRINKLER CONTROL ASSEMBLY

#### A. Fire Sprinkler Zone Valve Assembly:

1. UL Listed Provide drains at locations indicated or required for complete drainage of systems. Provide other drains, valves or plugs as indicated or required. Pipe drains to approved locations.
2. Provide test pipes as indicated or required and piped to discharge at approved locations.
3. Install control valves, supply valves, in clearly accessible locations within five feet of the floor.
4. Inspector's test valves shall be installed downstream of each water-flow device. Inspector's test outlets shall be piped to drain outside of the building or into the sewer drain. Valves shall be within six feet of the floor or finished grade. When the discharge outlet cannot be seen from the valve or when inspector's test connections are piped into the sewer system, a sight glass shall be provided. Direct interconnections shall not be made between sewers and sprinkler drains.

### 3.03 TAMPER SWITCHES

#### A. Provide an integral tamper switch and control valve on branch lines serving sprinkler protection in elevator spaces and elevator machine rooms.

#### B. Tamper switches:

1. Provide valve tamper switch on each isolation valve indicated below:

~~a. Valves at bases of standpipes.~~

~~b-a. Valves at fire system valves.~~

~~c-b. Valves at backflow protection devices.~~

~~d-c. Sprinkler-zone valves.~~

~~e-d. Post indicator valves.~~

2. Coordinate requirements with Division 26
3. All electrical wiring shall be provided under Division 26.
4. Provide installation in conformance with manufacturer's installation instructions, including mounting, adjustments to actuating lever and notching of valve stem.
5. The valve tamper switch must activate within 1/5 length of travel of valve closure or opening. Two separate and distinct signals shall be initiated, one indicating movement of the valve from its normal position and the other indicating restoration of the valve to its normal position. The off-normal signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position. The off-normal signal shall not be restored at any valve position except normal.

### 3.04 VALVES

#### A. Fire Department Connections:

1. Install fire department connection eighteen inches to twenty-four inches above paving or grade with twelve inch clearance around all sides.
2. ~~Fire [ ]~~

#### B. Provide full line size check valves with automatic ball drip on the boss located on the bottom and inlet side of each check valve serving fire department connections.

#### C. Install check valve (other than FDC check valve as above) and water flow indicators with

eighteen inch clearance from obstructions so that they can be removed and serviced.

- D. Pressure gauges shall be provided at each side of the main check valve and at each control valve for each floor (where applicable).
- E. Provide indicating type isolation valves on fire sprinkler supply piping supplying elevator spaces and elevator machine rooms.

### 3.05 PIPING ACCESSORIES AND EQUIPMENT INSTALLATION

- A. Underground Piping: All bolts, nuts, washers and rodding used for the installation of underground piping, valves and fittings from the riser flange back to, and including, all parts of the water main tap shall be stainless steel conforming to ASTM A194 Grade 8M or ASTM A320 Grade B8M. All of the above materials shall be thoroughly coated with bituminous mastic. After coating, all valves and ferrous fittings shall be wrapped in 8 mil polyethylene film and securely taped in place with underground tape.

### 3.06 SLEEVES AND ESCUTCHEONS

- A. Sleeves: Provide sleeves for all pipes passing through slabs, concrete walls, and lath and plaster ceilings (except drop nipples for heads) and partitions. Sleeves shall extend three inches above floors and be flush with walls, ceilings, and partitions. In concrete construction, sleeves shall be set in forms prior to pour.
- B. Clearance between sleeves and pipes shall be one-inch for pipes through 3-1/2- inches, two-inch for pipe sizes 4-inches and greater, and three-inch for seismic joints.
- C. Packing: For sleeves set in fire walls and floors, caulk space between pipe and sleeve with flexible fire-resistive packing compound to achieve rating at least equal to that of the wall or floor penetrated. Annular space between sleeves and piping shall be sealed with UL through-penetration systems #49 (concrete) or #147 (gypsum/stud). Sleeves in floors on grade or exterior walls below grade shall be packed with oakum between pipe and sleeve flush with top of sleeve for floors and with outer surface for walls. Sleeves at seismic joints shall not be packed unless associated with a fire rated wall, partition, floor or floor ceiling assembly.
- D. Sleeve Material:
  - 1. In concrete slabs and walls: Schedule 40 black steel pipe.
  - 2. Sleeves through waterproof membranes: Sleeves set in walls and slabs may be either cast iron or steel and shall be provided with a flashing clamp device and corrosion-resistant clamping holes.
- E. Escutcheons: Furnish and install escutcheons on all exposed pipes passing through walls, floors, ceilings, (except for sprinkler heads) and partitions.

### 3.07 EARTHQUAKE PROTECTION

- A. Provide seismic protection for sprinkler and standpipe piping in strict accordance with FM GLOBAL Data Sheet 2-8 "Earthquake Protection for Water-Based Fire Protection Systems."

### 3.08 WATER SERVICES

- A. Install fire line water services including backflow preventer in accordance with the Rules and Regulations of the local Fire and Water Departments and obtain all necessary and required approvals, prior to starting any work. The Project Representative shall pay all water service fees.

### 3.09 HANGERS AND SUPPORTS

- A. All pipes throughout the building shall be thoroughly and substantially supported with UL listed FM approved hangers and support devices and installed in accordance with Underwriter's approved methods.
- B. Furnish and install any special hangers or supports that may be required due to any peculiarities of construction. The design, selection spacing, and application of horizontal pipe hangers, supports, restraints, anchors, and guides shall be in accordance with the applicable standards.
- C. All vertical pipes 8-inch in diameter and smaller shall be supported at least every other floor with Grinnell Figure 261 or approved equal riser clamps.
- D. Hanger rods, inserts, etc., shall be sized and installed as recommended by the manufacturer for the service intended. Hanger rods shall be cadmium plated or galvanized.
- E. All horizontal piping shall be supported by means of approved wrought iron clevis type hangers with proper size suspension rods and locknuts, spaced as required by the Underwriters.
- F. Retainer straps shall be used with all beam clamps.
- G. Supports for vertical piping shall be heavy black iron extension clamps with bolts, each end resting on the building structure or hung from the slab in an approved manner.
- H. Provide all auxiliary steel required for pipe supports.
- I. Submit pipe hanger, insert and support details for concrete floor construction to the Project Representative for review and approval. Piping shall be hung from structural slab by means of malleable iron concrete inserts set in place before concrete is poured. Drilled type concrete inserts may be provided as approved by structural engineer. Power driven studs shall not be accepted unless accepted by the Project Representative.
- J. Piping shall not be hung from ductwork, or the work of other trades.

### 3.10 TESTING

- A. General:
  - 1. All inspections, examinations, and tests required by the authorities and/or agencies specified hereinbefore shall be arranged and paid for by this 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 Architect for distribution.  
Note: All hydrostatic tests shall be performed as required by the reference standards cited hereinbefore and the Authority Having Jurisdiction, except the testing period shall be not less than eight (8) hours.
  - 2. Provide acceptance test consisting of hydrostatic tests of the fire protection piping system in accordance with NFPA Pamphlet No. 13 and No. 14, but at not less than 200 pounds pressure for two (2) hours, or at 50 pounds per square inch in excess of the maximum static pressure when the maximum static pressure is in excess of 150 pounds per square inch.
  - 3. Provide a hydrostatic pre-test, same as acceptance hydrostatic tests indicated in the foregoing paragraph, for both above ground and underground piping, prior to calling for fire marshal acceptance test. Written confirmation of passed 100 percent pre-test shall be given to the inspector of record prior to calling for final acceptance test. All cost associated with delays caused by failure to complete 100 percent operational pre-test shall be borne by the contractor. A Contractor Material and Test Certificate shall be filled out on completion of pre-test.

4. Maintenance testing shall be performed in accordance with this code and Administrative Rules published by the chief. Where certified inspection, testing, or qualification of fire protection equipment is required by nationally recognized standards, laws, ordinances, or administrative rules, the chief shall require that the person, firm, or corporation performing such work have a certificate from the fire department.
- B. Fire sprinkler systems: Test in accordance with applicable current NFPA 13 and 25 Standards.
- C. Fire standpipe systems: Test in accordance with applicable current NFPA 14.
- D. Thread Test: A test shall be made of the thread on the hose valves and fire department connections using a coupling from the Local Fire Department hose. The test shall be made in the presence of the Owner or the Project Representative.
- E. Fire alarm devices and tamper switches: Test all alarm devices for proper operation and connection to central alarm system and BMS.

### 3.11 PERIODIC INSPECTION

- A. After completion of the automatic sprinkler system and at the beginning of the warranty period the Automatic Sprinkler Subcontractor shall perform, without charge to the Owner, one (1) inspection of the sprinkler system during the warranty period. Inspection shall be as per the applicable NFPA No. 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", plus the following maintenance to be performed during the course of the inspection:
  1. Operation of all control valves.
  2. Lubrication of operating stems of all interior valves.
  3. Operation of water gong, electric alarms, supervisory panels, air compressors, alarm trip switches, flow switches, etc.
  4. Cleaning of alarm valves.
  5. Lubrication of Fire Department hose connection inlet and fire hose valve threads.
  6. The Standard Form of the National Fire Sprinkler Association, Inc., "Report of Inspection" (Sheets 1 and 2), shall be filled out in triplicate after each inspection and the copies sent to the Project Representative.

END OF SECTION