

Sonoma Clean Power Authority

Sonoma Clean Power Headquarters

Tenant Improvement Project

ADDENDUM NO. 1

Date: February 5, 2020

Notice to all Bidders: The following modifications, additions, deletions, clarifications, and/or information are hereby made part of the contract documents. Addendum must be acknowledged as part of the bid form.

ARTICLE 1 – ADDENDUM #1

1.1 ITEM #1 – DIVISION 21 FIRE SUPPRESSION

- A. Add: Fire Suppression Index
- B. Add: 210100 Fire Protection General Requirements
- C. Add: 210500 Basic Materials and Methods
- D. Add: 210529 Support and Anchors
- E. Add: 210548 Noise, Vibration, and Seismic Control
- F. Add: 211100 Fire Protection Pipe and Pipe Fittings
- G. Add: 211313 Fire Protection-Automatic Sprinkler

1.2 ITEM #2 – RESPONSE TO WRITTEN QUESTIONS

1. When is the Job walk and is this open to subcontractors?
 - a. *RESPONSE TO QUESTION 1: The Bidder's Job Walk is February 12, 2020 at 1pm at 431 E Street, Santa Rosa, CA 95404.*

END OF ADDENDUM NO. 1

SONOMA CLEAN POWER

ADDENDUM 1

February 18, 2020

FIRE PROTECTON SPECIFICATIONS INDEX

210100 Fire Protection General Requirements

210500 Basic Materials and Methods

210529 Support and Anchors

210548 Noise, Vibration, and Seismic Control

211100 Fire Protection Pipe and Pipe Fittings

211313 Fire Protection-Automatic Sprinkler

SECTION 21 01 00
GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Comply with the requirements of DIVISION 1.
- B. The requirements of this SECTION apply to all work of this DIVISION.
- C. Provide a complete working installation with all equipment called for in proper operating condition. Documents do not undertake to show or list every item to be provided. When an item not shown or listed is clearly necessary for proper operation of equipment, which is shown or listed, provide an item which will allow the system to function properly at no increase in the Contract Amount.

1.02 QUALITY ASSURANCE

- A. Related Work Specified Elsewhere:
 - 1. Refer to DIVISION 26 for all electrical wiring (except that specifically indicated on Control Drawings) for motor starters (except pre-wired packaged systems, in which case they must conform to DIVISION 26).
- B. Examination of the Site:
 - 1. Visit the site prior to bidding. Take measurements and such other information as to locations, depths, capacities and sizes of existing piping to which connections may be made or which may be abandoned or which require rerouting. If any of the above requires extra work due to discrepancies or omissions on the drawings if such omissions or discrepancies have been revealed by examination before bidding, the Contractor should report the discrepancy to the Architect a minimum of three days prior to receipt of bids. If additional work is required due to omissions and discrepancies after the contract for the work is signed and if such omissions or discrepancies would have been revealed by a visit to the site before receipt of bids, then the corrective additional work shall be performed at no additional cost to the Owner.
- C. Requirements of Regulatory Agencies:
 - 1. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Architect for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing and is approved by the Architect. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.

2. Any specific reference in these Specifications to codes, rules, regulations, standards, manufacturer's instructions or requirements of regulatory agencies shall mean the latest printed edition of each in effect at date of submission of Bid, unless the Document is shown dated.
 3. Perform the work in conformance with the applicable requirements of all regulatory agencies, including, but not limited to the following:
 - a. National Electrical Code.
 - b. International Building Code
 - c. California Code of Regulations (CCR).
 - (1) Title 8, Division 1, Chapter 3.2 - California Occupational Safety and Health Regulations (CAL/OSHA).
 - (2) Title 8, Division 1, Chapter 4 - Safety Orders.
 - (3) Title 19, Division 1, Chapter 5.5- Automatic fire Extinguishing Systems Certificatio
 - (4) Title 24, Building Standards.
 - (a) Part 2 - California Building Code
 - (b) Part 3 - California Electrical Code
 - (c) Part 9 - California Fire Code
 - d. National Fire Protection Association (NFPA), including but not limited to:
 - (1) Life Safety Code, NFPA 101.
 4. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules, regulations.
 5. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules, regulations, Drawings and Specifications take precedence.
 6. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for completeness or clarity.
 7. Work herein shall comply with all applicable requirements of CCR Title 8, Division 1, as they apply to this project, both in reference to Contractor's operations in performing his work and also in construction result to be accomplished. Where an omission or a conflict appears between OSHA requirements and the Drawings and Specifications, OSHA requirements shall take precedence.
- D. When there is an ambiguity or discrepancy between Drawings and Specifications the more stringent requirement of the two shall be provided.
- E. Licenses, Permits and Fees
1. Provide, procure and pay for all permits, licenses, fees, etc., required to carry on and complete the Fire Protection Work. Contact all applicable utility authorities and include in bid all fees, charged by any such authorities.
- F. Fire sprinkler system pipefitters responsible for installing, altering or repairing water-based fire

protection systems shall be certified by CAL FIRE - Office of the State Fire Marshal (CAL FIRE – OSFM) as per CCR, Title 19, Division 1, Chapter 5.5.

G. Operating and Maintenance Instruction:

1. Furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation.

1.03 SUBMITTALS

A. General

1. See additional requirements in other sections of Division 21, including but not limited to Sections 210529, 210548, 211100, 211313.
2. Submit shop drawings, catalog data, supplemental data, for all materials, equipment in all Sections of this DIVISION in accordance with the requirements of SECTION 013323, "SHOP DRAWINGS, PRODUCT DATA AND SAMPLES," and as specified hereinafter.
3. Four weeks after award of the Contract, or earlier it deemed appropriate by the Architect, submit a schedule of all submittals with the date of each equipment submittal or shop drawing submittal clearly indicated.
4. Forward all submittals to Architect, together, at one time. Individual or incomplete submittals are not acceptable. Six (6) copies are required.
5. Submittals shall have been reviewed and stamped by the General Contractor in accordance with the requirements of the GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION. Submittals not so stamped will be returned without review.
6. The contractor shall allow for adequate time for submittal review by the engineer. In general, the contractor shall allow for a minimum of 15 working days from the day the general contractor sends the submittal to the architect to the day the architect returns the submittal to the general contractor. Additional time shall be allowed for large or complex submittals.
7. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
8. Identify each submittal item by reference to Specification SECTION Paragraph in which item is specified or drawing and detail number.
9. Organize submittals in same sequence as they appear in specification sections, articles, or paragraphs.

B. Electronic Submittals: Electronic submittals is (an acceptable) (the preferred) method of review. Follow these procedures:

1. Provide one pdf file for each submittal. PDF file must be unlocked, editable and printable to accommodate electronic mark-ups or printing a hard copy from markup.

2. Electronic submittals are to be complete and self-contained with each item requiring Architect's action highlighted.
 3. Web links or other electronic submittals requiring the Architect to surf websites or navigate to find documents on websites or posting services are not acceptable.
 4. The use of construction phase file hosting services or programs such as BIM 360 or Prolog or Primavera may not be used before prior approval from the Architect.
 5. Any electronic submittal procedures should not require the Architect to search for submittals but should follow procedures that are the electronic equivalent of hard copy submittals sent by Contractor to the Architect in a manner acceptable to the Architect including indexing requirements mentioned below.
 6. No electronic submittals for samples (if needed) will be permitted.
 7. Architect will return one marked up electronic submittal for Contractor to process and distribute to subcontractors and for Owner according to agreed procedure.
 8. On each electronic submittal, provide Contractor review and approval stamp.
- C. Indexing:
1. Submittals shall be indexed according to specification DIVISION and SECTION number and paragraph to identify each item. Sporadic submittals, incomplete data, or unidentified data, or data not showing features to coordinate item with other work will not be accepted.
- D. Binders: Prepare submittal material in accordance with the following:
1. Insert all literature in standard three (3) ring binders for 8-1/2 x 11 inch pages with individual tabs. Do not staple literature on different products together.
 2. Number all binders on the outside of the cover and indicate the specification section. Mark one binder "No. 1 Architect's Copy" and another "No. 2 Engineers Copy". Both these binders shall contain original manufacturer's literature.
 3. Reference each item to the appropriate contract drawing sheet detail and to specification section and paragraph, and to the Mark Numbers appearing on the equipment schedule.
 4. Provide an index with each binder. This index shall follow the same sequence as the project Specifications.
- E. Submittal literature, Drawings and wiring diagrams shall be specifically applicable to this project and shall not contain extraneous material. The literature shall be clearly marked to indicate the proposed item and any accessories or options to be furnished. Submittals shall include, but not be limited to the following:
- a. Valves with Service and Location, Motors * Drives and Guards
 - b. Pipe Trim, Hangers and Seismic Bracing, Insulation, Vibration Isolators
 - c. Tanks, Vents, Pumps*
 - d. Fire Protection Equipment

Notes:

* Include a family of rating curves. See applicable specification section.

- F. Resubmittals shall respond to comments made on the original submittal and shall be marked with a resubmittal number and dated. Resubmittals not in conformance with these requirements will be returned without review.
- G. Shop Drawings: (Also see Division 1 requirements)
1. Submit shop drawings for piping, and equipment. Do not begin fabrication until shop drawings have been coordinated with all trades and have been reviewed and accepted by the Architect.
 2. Drawings shall be a minimum of 8-1/2 inches by 14 inches in size, with a minimum scale of 1/8 inch per foot, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, and other items that must be shown to assure a coordinated installation. Piping layouts and Mechanical Room layouts shall be drawn at a minimum scale of 1/4 inch per foot. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
 3. The Architect's review of Shop Drawings is not intended to verify dimensions or quantities, nor to coordinate items shown on these Drawings. He will review them for general conformance with design concept of the project and general compliance with the information given in the contract requirements of the plans and Specifications. Contractor is responsible for dimensions, which shall be confirmed and correlated at the job site, for fabrication processes and techniques of construction, for coordination of his work with that of all other trades and the satisfactory performance of his work.
- H. Record Drawings
1. Installation drawings shall be drawn at the site by the Contractor on reproducible paper and shall be fully coordinated for interferences by all trades. The Contractor shall maintain at the jobsite a complete set of prints of the installation drawings for all mechanical work. These prints shall be kept up to date by recording all changes daily. The progress of the work shall be clearly, neatly and accurately designated, coloring in the various pipes, and equipment as they are erected. This process shall incorporate all changes to the original drawings including formal change orders or other instructions issued by the Architect. Principal dimensions of all concealed work shall be recorded including inverts of buried piping and height to underside of pipes.
 2. These marked up prints will be used as a guide for determining the progress of the work installed. They will be inspected monthly by the Architect and shall be corrected immediately if found either inaccurate or incomplete.
 3. Prior to final acceptance of the Work of this Division, submit properly certified Record Drawings to the Architect for review and make changes, corrections, or additions as the Architect may require. After the Architect's review and any required Contractor revisions, deliver the Record Drawings 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.
- I. Operating & Maintenance Manuals:
1. Manuals shall conform to SECTION 017823, OPERATION AND MAINTENANCE DATA.

2. Furnish an operation and maintenance manual for each item of equipment. Furnish 4 copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and telephone numbers of each subcontractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts lists for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the project site. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.
3. Submit a DVD disk containing all Operations and Maintenance data in Adobe "pdf" format. Also include an index of Internet web site addresses Section No. and title, equipment name, Web site address for the O&M manual of the equipment, and the O&M Manual filename.
4. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.
5. Three (3) copies of certification signed by Owner's representative, attesting to their receipt of instructions required by paragraph "Operation and Maintenance Instruction" of this Section.

1.04 PRODUCT DELIVERY AND STORAGE

- A. Identify materials and equipment delivered to site to permit check against approved materials list, reviewed shop Drawings.
- B. Protect from loss or damage. Replace lost or damaged material and equipment with new at no increase in the Contract Amount.
 1. Store material in clean, dry locations. Store material off of floor, and wrap material or otherwise protect from contamination by construction debris, dust, etc. Follow manufacturer's recommendation for storing the material at all times.

1.05 DRAWINGS AND COORDINATION WITH OTHER WORK

- A. Contract Drawings:
 1. For purposes of clarity, legibility, the Contract Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings are not shown. Exact locations of items are not indicated, unless specifically dimensioned.
 2. Exact routing of piping shall be governed by structural conditions, obstructions. Contractor shall make use of data in Contract Documents. Architect reserves right, at no increase in price, to make any reasonable change in location of mechanical items, exposed at ceiling

and/or on walls, to group them into orderly relationships and/or increase their utility. Verify Architect's requirements in this regard prior to roughing-in.

3. In addition to the Shop Drawings called for under SUBMITTALS the Contractor shall prepare large scale layout drawings showing location of equipment, piping runs, and all other elements of mechanical systems provided under this DIVISION. Include sections of congested areas to show relative position and spacing of affected elements.
 4. Refer to the electrical "E" series drawings and specifications, Division 26 for the service voltage, power feed, control and interlock wiring for equipment specified under this section. Review the electrical "E" series drawings and Division 26 documents to verify that the electrical services (power, control, interlock, etc.) provided are adequate and compatible with the equipment requirements. Include the cost to furnish and install the additional electrical services, if it is required over and above what is indicated on the electrical "E" series drawings and in Division 26, such as additional control interlock conductors, larger feeder, or separate 120V control power source.
 - a. Prior to proceeding with the installation of any additional electrical work, submit detailed drawings indicating the exact scope of additional electrical work to the Architect for review and approval.
 5. Provide templates, information, and instructions to other DIVISIONS to properly locate holes and openings to be cut or provided for electrical Work.
 6. Not all offsets in piping are shown. Decide which item to offset or relocate. Maintain required slope in piping.
- B. Coordination:
1. Work out all "tight" conditions involving Work under this DIVISION and Work in other DIVISIONS in advance of installation.
 2. Maintain minimum 1 inch clearance from adjacent work, including piping, ductwork, insulation, etc. except as noted or approved.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size.
- B. Alternative Service Record: Products having less than a two-year field service record may be acceptable on approval of the Architect if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.
- C. Service Support: Major equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment, which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

- D. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from site.
- E. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.
- F. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets acceptance.
- G. Equipment Guarding
 - 1. Rotating Equipment Safety:
 - a. Couplings, Motor Shafts, Gears and other exposed rotating or rapidly moving parts shall be fully guarded in accordance with OSHA requirements. The guards shall be cast iron or expanded metal. Guard parts shall be rigid and suitably secured and shall be readily removable without disassembling the guarded unit.
 - b. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with Title 8, Division 1, Chapter 4, Sub-chapter 7, Group 6. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein.

Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.
- H. Equipment or material damaged during transportation, installation or operation is considered as totally damaged. Replace with new. Variance with this permitted only with written acceptance.
- I. Provide an authorized representative to constantly supervise work of this DIVISION, check all materials prior to installation for conformance with Drawings and Specifications.
- J. Equipment shall be as described in the respective SECTIONS of THIS DIVISION and as shown.

2.02 SUBSTITUTIONS

- A. See SECTION 002600, "PROCUREMENT SUBSTITUTION PROCEDURES" and the following.
- B. Where more than one specific name is used, it is to be understood that the name mentioned first represents the manufacturer whose equipment has been used as the basis of design. All other names mentioned are to be considered substitutions within the meaning of this paragraph, and no additional cost to the Owner shall accrue due to any revisions, additions or deletions required to make substituted equipment perform in accordance with the plans and specifications.
- C. Any redesign necessitated by substitutions shall be provided by the Contractor and shall be subject to review and approval by the Architect.
- D. Substitutions will not be considered if they are indicated or implied on Shop Drawings or Project Data Submittal without the formal request required by Division 1.

PART 3 – EXECUTION

3.01 DEMOLITION

- A. Remove all piping, and equipment where shown or otherwise indicated to be removed. Cap piping at mains or source.

3.02 INSTALLATION

A. Manufacturer's Recommendations

1. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, printed copies of these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
2. Provide complete systems in accordance with manufacturers' requirements.
3. Where dimensions or specific installation and operating instructions of equipment are not provided in the Drawings or Specifications, perform the Work according to approved manufacturer's specifications and recommendations. Any material and work required under this heading shall be supplied at no additional cost to the Owner.
4. Assemble equipment which is required to be field assembled, under the direct supervision of the manufacturer's agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

- B. Equipment: Accurately set and level with supports neatly placed and properly fastened. Properly fasten equipment in place with bolts to prevent movement in earthquake. No allowance of any kind will be made for failure on part of Contractor to foresee means of bringing in or installing equipment into position inside building.

C. Piping Systems:

1. Worked into complete, integrated arrangement with like elements to make work neat appearing, finished.
2. Run concealed, except as shown or noted otherwise; where exposed, run parallel with walls or structural elements; vertical runs plumb; horizontal runs parallel with structure and level or uniformly pitched as appropriate.
3. Install with adequate passageways free from obstructions, as high as practicable to maintain adequate head room, as shown or as required. Notify Architect before installation whenever head room of less than 7-feet 6-inches will result. Coordinate with work of other DIVISIONS to achieve proper head room as specified in this DIVISION.
4. Provide bases, piers, metal frames and backings, hangers and supports for the fixtures and systems furnished under this DIVISION.
5. Expansion and Contraction: Make adequate provisions, whether those provisions are shown on Drawings or not.
6. Cleaning and Closing: Inspect all piping, and equipment before placing; clean interior before closing. Close all piping at end of each day's work.

D. Sleeves, Chases, and Concrete Inserts:

1. Cutting and Patching: In accordance with SECTION 017329: "CUTTING AND PATCHING".
2. Provide, to cause no delay, all required sleeves, chases, inserts, anchor bolts, etc., and be responsible for correct location, installation of same.
3. Locating and sizing of openings for pipes through walls, etc., under this DIVISION. Framing of openings provided by respective DIVISIONS in whose work opening is made.
4. Penetrations of fire or smoke rated walls, partitions, and floors:
 - a. Pack space between piping and sleeve or opening with materials approved by Underwriters Laboratories for use in through-penetration fire stop systems. Materials, methods, and installation shall be in accordance with UL approved listings and shall be designed to act as a firestop as well as a cold smoke, noxious gas, and water sealant. Submit UL listings for all such systems to be used.
 - b. Through-penetrations of fire rated walls shall be protected by an approved through-penetration firestop system installed as tested in accordance with ASTM E814 or UL1479, and shall have an F rating of not less than the required fire-resistance rating of the wall penetrated.
 - c. Through penetrations of horizontal assemblies that are not contained inside fire-rated shafts shall be protected by an approved through-penetration firestop system installed as tested in accordance with ASTM E814 or UL1479, and shall have an F and T rating of not less than 1 hour and not less than the required fire-resistance rating of the floor penetrated.
 - i. Floor penetrations contained and located within the cavity of a wall above or below the floor do not require a through-penetration firestop system with a T rating.
5. Pipe Sleeves: Where not otherwise indicated or specified, sleeves through outside walls, floors or roof slabs shall be zinc coated steel pipe conforming to ASTM A53. Sleeves through inside partitions shall be zinc coated sheet steel not less than 0.0217-inches thick conforming to ASTM A653.

E. Cutting and Repairing:

1. Do all cutting, repairing, including structural reinforcing, necessary for Work under this DIVISION.
2. Do no cutting or patching without Architect's review. Repair damage done by this cutting equal to original condition in Architect's opinion.
3. Assume responsibility for all damage to any part of premises or Work of other DIVISIONS, caused by leaks or breaks in piping or equipment furnished and/or installed under this DIVISION during construction and guarantee period.

3.03 TESTING AND ADJUSTING

- A. See also Section 21 13 13 Fire Protection – Automatic Sprinkler System.
- B. Do not start or operate any equipment until the unit as well as all services connected thereto have been supported and seismically braced. Services connected to equipment includes piping and its in-line components, wiring, or other in-line components.
- C. Furnish all labor and test equipment required under this DIVISION and in accordance with applicable

NFPA Standards and as follows.

- D. Clean and purge equipment and piping before each test.
- E. Test various piping systems in portions as work progresses. Any system or portion previously tested shall become part of any repeated test when it becomes part of distribution or collection system.
- F. Repair leaks by remaking with new material. Makeshift leak stopping methods are not acceptable.
- G. Should any piece of equipment or material fail in any of the tests, immediately remove, replace with new; retest system.
- H. Maintain test pressures for periods stated, or as directed without loss in pressure, except that due to change in temperature or atmospheric pressure during test.
- I. Perform all tests in accordance with the requirements and under supervision of authorities having jurisdiction.
- J. At completion of Work, provide written certification that all systems are functioning properly without defects.

3.04 CLEANING AND PAINTING

- A. Refinish Work supplied with final finish under this DIVISION if damaged to satisfaction of Architect.
- B. Thoroughly clean all equipment, piping and all other materials under this DIVISION free from all rust, scale, and all other dirt before covering or painting is done, or the systems put in operation. Leave in condition satisfactory to the Architect.
- C. Thoroughly flush out all piping with domestic water under pressure before sprinkler heads and other constantly operated devices are installed.
- D. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction.
- E. Any insulation damaged shall be repaired.
- F. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the project, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the site of his Work broom clean.
- G. Completely cover all sprinkler heads and all motors and other moving machinery to keep free of dirt and water during construction. Using Visqueen EcoMembrane or other 100% post-use low density polyethylene sheet membrane material, effectively cap all openings into pipes to keep foreign matter out during construction.
- H. Lubricate all equipment at completion of Work. Furnish Owner with a written lubrication schedule for all equipment.
- I. Properly prepare Work under this DIVISION to be finished painted under SECTION 099100, "PAINTING".
 - 1. All exposed work which in general includes piping, insulation, metal items, equipment and supports shall be painted except that polished aluminum, stainless steel, chrome plate and

other finely finished materials shall not be painted unless otherwise noted.

2. Unless otherwise noted all finish colors shall be selected by the Architect.
3. Materials previously shop prime coated by the manufacturer and which have been scuffed or otherwise damaged shall be touched up with the same materials used for priming. Prime coats shall be of a lighter tint than final coats.

3.05 SIGNS, LABELS AND IDENTIFICATION FOR PIPING, VALVES AND EQUIPMENT

A. Signs and Labels:

1. See also Section 21 13 13 Fire Protection – Automatic Sprinkler System.
2. Fasten a red-headed tack to each T-bar suspended ceiling pushout tile at any equipment, component or control devices, requiring maintenance or access.
3. Post a printed sign at each automatically started equipment stating, "WARNING THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME".

B. Pipe Identification:

1. Identify and color-code all piping including piping in furred ceiling spaces.
2. Plastic Markers: Seton Setmark, or equal, for concealed locations or if located in mechanical rooms; or Seton Opticode, or equal, for exposed pipes in public areas, with wording as selected by the Architect. Each marker must show approved color-coded background, proper color of legend in relation to background color, approved legend letter size, approved marker length.
3. Location for Pipe Identification:
 - a. Adjacent to each valve.
 - b. At each branch and riser take-off.
 - c. At each pipe passage through wall, floor and ceiling construction.
 - d. On all horizontal runs spaced 25-feet maximum but not less than one per room.

C. Valve Identification:

1. Provide tags on all control and line shut-off valves. Tags shall note valve service and number as hereinafter specified and shall be Seton Style
 - a. 250-BL, Brady, or equal, brass tag fastened to the valve stem with copper wire.
2. Provide three (3) typewritten schedules giving numbers, service and locations, and notations of normally open or closed, of all tagged valves, where purpose of location is not easily identifiable. Enclose each schedule in separate transparent plastic binder.

3.06 EQUIPMENT IDENTIFICATION

- A. Properly identify each piece of equipment and its controls using engraved laminated plastic descriptive nameplates, attached to equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable.

END OF SECTION

SECTION 21 05 00
BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The requirements of this SECTION apply to all Work of this DIVISION, where applicable. The materials, equipment and methods herein are generally common to the various SECTIONS of this DIVISION of the Specification. Materials that apply to only one SECTION are generally included in that SECTION. Where items specified in other SECTIONS of this DIVISION conflict with requirements of this SECTION, the former shall take precedence.

1.02 QUALITY ASSURANCE

- A. Equipment and Accessories
1. Supply all equipment and all accessories new, free from defects.
 2. All items of a given type shall be the product of the same manufacturer.
 3. Electrical Equipment: Listed by U.L. and bearing their label.
- B. Reference Standards: Refer to individual Mechanical SECTIONS for additional reference standards.
1. ANSI/ASME - B31.9 Building Services Piping
 2. ANSI B2.1 - Pipe Threads
 3. ASTM D1557 - Test Methods for Moisture Density Relationships of Soil and Soil Aggregate Mixtures.
 4. ASTM D2235 - Solvent Cement for ABS Plastic Pipe and Fittings.
 5. ASTM D2564 - Polyvinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
 6. ASTM D2657 - Heat-Joining Polyolefin Pipe and Fittings.
 7. ASTM F493 - Solvent Cements for Chlorinated Poly(vinyl chloride) Plastic Pipe and Fittings.
 8. AWWA C209-83 - Cold applied tape coatings for exterior of connections and fittings for steel water pipe lines.
 9. AWWA C214-83 - Tape Coating Systems for exterior of steel water pipe lines.
 10. AWWA C510-17 Double Check Valve Backflow Prevention Assembly.
 11. AWWA C511-17 Reduced-Pressure Principle Backflow Prevention Assembly
 12. ASC - Adhesive and Sealant Council.
 13. Copper Development Association - Copper Tube Handbook.
 14. NEMA-MG1 National Electrical Manufacturer's Association, Motor and Generator Standards.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Access Doors in Ceilings or Walls:

1. Furnish under this DIVISION where shown, or required by Regulatory Agencies and for access to all concealed valves, unions, etc., even though access doors are not shown for Fire Protection Work. Mark each door to establish its location and deliver doors for installation under SECTION 083100. Access doors shall be as specified in SECTION 083100.
2. Unless otherwise shown or designated, access doors for reaching valves set in walls shall be 12" x 12" for reaching small items within wrist reach of walls, or 24" x 24" for larger items, or items at greater distances than wrist reach, or at ceilings. All ceiling access door locations shall be coordinated with Architectural Reflected Ceiling Plan.
3. Access doors are not required in T-bar suspended pushout ceilings or accessible tile ceilings.
4. For any access door not specifically shown on reflected ceiling plans or Architectural elevations, obtain the Architect's approval of the location, size and type.
5. Access doors shall be Milcor, Bilco, or equal.
 - a. Style A for acoustic tile. Size of this unit must exactly fit single or multiple acoustic tiles.
 - b. Style K for plaster surfaces.
 - c. Style M for masonry, tile, wall board and other non-plastered surfaces.
 - d. U.L. 1 hour B label for one-hour fire rated surfaces.

B. Piping:

1. Refer to individual SECTIONS for general information, materials, and execution of the proper piping for each system.

A. Valves:

1. See SECTION 211313, "Fire Protection – Automatic Sprinkler System".

B. Buried Warning and Identification Tape:

1. Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION: BURIED (intended service) LINE BELOW" or similar wording. Color and printing is to be permanent, unaffected by moisture or soil.
 - a. Warning Tape for Metallic Piping: Acid and alkali resistant polyethylene plastic tape conforming to the width, color, and printing requirements indicated above. Minimum thickness of the tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise with a maximum 350 percent elongation.

- b. Detectable Warning Tape for Nonmetallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements indicated above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when the tape is buried up to 3 feet deep. Encase the metallic element of the tape in a protective jacket or provide with other means of corrosion protection.
- C. Escutcheons: Beaton, Corbin, or equal.
- D. Pipe Hangers: See schedule on Drawings, and individual specification SECTIONS; see also SECTION 210548: NOISE, VIBRATION, AND SEISMIC CONTROL.
- E. Backflow Preventers:
 - 1. Reduced Pressure Type: Febco 825 or 825Y, Watts No. 909, or equal, with two independently operating check valves and shall be designed for installation in a normal horizontal flow attitude. An independent relief valve shall be located between the two check valves. Sizes 2-inch and smaller shall include ball valve shut-offs; 2-1/2 inch and larger shall include OS&Y gate valves. All backflow preventers shall meet all the specifications of AWWA C510-17 Double Check Valve Backflow Prevention Assembly or AWWA C511-17 Reduced-Pressure Principle Backflow Prevention Assembly.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installation of Piping:
 - 1. Definition of "PIPING": The term "piping" as used in Drawings or these Specifications, means all pipe, fittings, nipples, valves, unions, etc., as may be required for a complete, functional system.
 - 2. The general layout of piping on the drawings indicates branch runouts terminated at individual or groups of sprinkler heads or equipment. The piping shall be considered continuous and finally connected to all sprinkler heads and equipment.
 - 3. Run all pipes in the approximate locations shown. Sizes are given on the Drawings. Unless otherwise shown, lines shall be installed in furred spaces. Offset piping wherever necessary to obtain headroom. In all cases, install pipe lines to conform to actual conditions such as offsetting to clear structural members, lights, ducts, etc. Run all piping true to line and grade. The finished work shall present a neat and workmanlike appearance. Unless otherwise noted, minimum pipe size is 1/2" for all piping systems.
 - 4. Accurately cut pipe and work into place without springing or forcing, except when cold springing is required.
 - 5. Install pipe lines free from traps, air pockets, sags and bends. Arrange water piping for draining at low points and provide vent valve at high points. Drain valves shall be accessible.
 - 6. Wherever changes in size of pipes occur, the changes shall be made with reducing fittings, as the use of bushings will not be permitted.

7. Securely fasten all piping and equipment in the building to the building construction. Secure branch piping runouts in partitions to steel partition members with tie wire. Provide pipe taping separation between steel and copper.
 8. Make branch takeoffs with reducing tees or with line size tee and reducers, except that branches less than half diameter of main may be made with forged branch welding outlet fittings.
 9. Piping in any partitions, through plates, studs, etc. shall have sufficient clearance from structure to allow for expansion, contraction of piping. No bare piping should touch wood, concrete, etc., any time.
 10. All pipes piercing roof membranes shall be flashed water-tight. Provide all piping passing through finished floors, ceilings, partitions, or walls exposed to view with chromium-plated escutcheons in bathrooms, prime coated elsewhere. Fit escutcheons for insulated pipe over insulation.
 11. Pipe penetrations at Fire and Smoke rated walls and floors: As specified under SECTION 210100: GENERAL REQUIREMENTS.
 12. Pipe penetrations of exterior foundation walls or slabs on grade are to be sealed using Thunderline Link Seal, Calpico, or equal.
 13. Cut copper tubing with copper tube cutters, ream and size with sizing tools, and thoroughly clean before application of flux or solder.
 14. Tees may be cut into 2-inch and larger copper tubing using Bonney, Brazoletts or equal or by using Tubemaster Tee Turner, T-Drill, or equal.
 15. Copper to Steel Connections:
 - a. Make all copper pipe connections to ferrous piping in domestic water systems with Clearflow, Watts, or equal, dielectric waterway or isolation flanges. Dielectric unions are not acceptable.
 - b. All uninsulated copper pipe shall be isolated from supports by means of Stoneman Trisolators or Unistrut Unicushion.
 16. Install concrete kick blocks at all turns at underground cast iron or non-metallic lines. Thrust blocks shall have 3 square feet minimum bearing surface against the undisturbed side of the pipe trench.
 17. Unless otherwise indicated, drains from all equipment and piping having drain connection, where shown or required, shall be run to the nearest adequately sized clear water waste receptacle.
 18. The 90-degree turn nearest to the pump at the suction end of pump shall be five suction pipe diameters minimum distance from the pump's suction inlet. Alternatively, a suction diffuser may be used.
 19. Unless otherwise shown or specified, strainers, located at pumps, or at other line devices or equipment, shall be of full line size. Provide Wye-type strainers ahead of all automatic valves, pumps, pressure regulating valves and similar devices. Provide basket-type strainers where shown.
 20. Open-ended line valves shall be provided with plugs or blind flanges.
- B. Flexible Connections: See SECTION 210548: NOISE, VIBRATION AND SEISMIC CONTROL.

- C. Trenching and Backfill:
1. In accordance with DIVISION 1 and as follows.
 2. Excavation: Trench excavation shall be true to line and grade. Remove all rock protruding at sides and bottom of trenches. Minimum width shall be 16 inches. Pipe crown shall not be less than 24 inches below ground surface for metallic pipe and 30 inches for non-metallic pipe, unless otherwise indicated on the drawings or otherwise directed by the Architect. Where trenches are cut provide adequate bridging for traffic during construction.
 3. Backfill material, from the bottom of the trench to level 6 inches above the pipe crown, shall be unwashed sand, dampened but not puddled, and subsequently compacted earth, free of organic matter, and dampened and tamped in 6 inch layers by air-hammers to 90 percent compaction in accordance with ASTM D-1557-78T. In graded and undeveloped areas, in addition to backfill specified above, backfill trenches with crown 8 inches above the surrounding surface.
- D. Buried Warning and Identification Tape: Install tape in accordance with manufacturer's recommendations. Bury tape 12 inches below finished grade; under pavements and exterior slabs, bury tape 6 inches below top of subgrade.
- E. Underground Uninsulated Steel Pipe Protection:
1. All straight sections of pipe shall have a plant-applied machine applied tape coating system conforming to AWWA C214 consisting of a liquid primer, an inner-layer tape and an outer-layer tape. The inner-layer shall be not less than 20 mil. thickness, the outer-layer shall be not less than 30 mils. Tape width shall conform to Table 4 of AWWA C214. The coated pipe shall be tested in accordance with Section 4.3 of AWWA C214. Defects disclosed by testing shall be repaired at the coating plant. An affidavit of compliance that all materials and work comply with these specifications shall be furnished to the Architect.
 2. Straight pipe field joints, fittings, flanges and other field joints shall have a manually applied tape coating system conforming to AWWA C209. Tape shall be Type I or Type II, spirally wrapped with a minimum overlap of 1/2-inch applied in a minimum of two layers to provide a minimum total film thickness of 50 mils. After wrapping, all sections shall be tested with an electrical holiday detector in accordance with C209 Section 4.4. Defects shall be repaired in accordance with C209 Section 3.4. An affidavit of compliance that all materials and work comply with these specifications shall be submitted.
 3. At all times during construction the field procedures of AWWA C209 Section 5.1 and 5.2 shall be followed.
- F. Piping Joints:
1. Threaded Joints
 - a. Pipe threads shall be tapered threads in accordance with ANSI/ASME B31.9 and ANSI B2.1 for IPS threaded work. No screwed pipe joints shall be caulked or screwed up with rope or packing of any kind. Teflon pipe tape may be used where appropriate. When erecting plated, polished, or soft metal piping, friction wrenches shall be used exclusively.
 2. Brazed and Soldered Joints:
 - a. Brazed joints and soldered joints shall be in accordance with ANSI/ASME B31.9-1982 with preparation, techniques and procedures in accordance with the Copper

Tube Handbook publication of the Copper Development Association. Brazing materials shall be as specified in the various Sections of these specifications.

3. Joints in Thermoplastic piping:
 - a. Adhesives, cements, and sealers used to join piping components shall be compatible with the materials being joined and shall conform to the applicable ASTM Specifications and as otherwise indicated herein.
 - b. Preparation for solvent cemented joints shall be as specified in ASTM B31.9 -1982, Building Services Piping, Chapter V. Solvent cements for thermoplastics shall conform to the following specifications.
 - (1) Material Specification
 - (2) CPVC ASTM F493
 - c. Heat Fusion Joints: Joint preparation, technique, and procedures shall be in accordance with ASTM D2657-79 except that butt joints are not acceptable. Branches shall be made only by the use of molded fittings.
4. Welded Joints:
 - a. Welding shall comply with the provisions of the latest revision of ASME Code for Pressure Piping ANSI/ASME B31.9-1982 Building Service Piping.
 - b. Unless otherwise indicated, welding shall be permitted on 1-1/2 inch and larger black steel pipe lines. Use long radius forged steel welding elbows. Tees may be cut in where the branch pipe does not exceed one size less than half the size of the main. If a larger branch is used, then only weldolets or threadolets may be installed.
- G. Provide relief valves as indicated. Install relief valves in upright position with discharge piped to nearest floor drain.
- H. System relief valve capacity shall equal makeup valve capacity. Equipment relief valve capacity shall exceed flow rating of connected equipment. Where one pipe vents several relief valves, cross section area shall equal sum of individual vent areas.
- I. Allow ample space for basket removal for strainers and suction diffusers. Where pumps are mounted on inertia pads, support suction diffuser with steel pipe section on inertia pad; for other installations, the suction diffuser shall be supported by steel pipe section on a neoprene pad 1-inch thick. Remove start-up strainer after start-up and pipe cleaning has been accepted by Owner.

3.02 FIELD QUALITY CONTROL

- A. Welding:
 1. Welding Procedure Specifications: Before any welding is performed, the Contractor shall submit copies of his welding procedure specification for all metals included in the work together with proof of its qualification as outlined in ANSI B31.1.
 2. Performance Qualification Record: Before any welder or operator shall perform any welding, the Contractor shall submit 3 copies of the Welder's Performance Qualification Record in conformance with ANSI B31.1 showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition the Contractor shall also submit each welder's assigned number, letter, or symbol which shall be used to identify the

work of the welder which shall be affixed immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be given a requalification test and upon failing to pass the test shall not be permitted to work this contract.

3. Surface Conditions: Surfaces to be welded shall be free from frost, moisture, loose scale, slag, rust, paint, oil, and other foreign material. Joint surfaces shall be smooth, uniform, and free from fins, tears, and other defects which might affect proper welding. Slag shall be removed from flame cut edges to be welded by grinding, but temper color need not be removed. Each layer of weld metal shall be cleaned thoroughly by wire brushing prior to inspection and deposition of additional weld metal.
4. Base Metal Preparation: Follow ANSI B31.1 for base metal preparation and alignment.
5. Quality of Welds: The quality of welds shall be in accordance with ANSI B31.1. The surface of the finished welds shall have a bright metallic luster after cleaning, shall be fairly smooth with regular, even ripples, and shall be uniform in contour. Except as necessary to correct defects, the surfaces shall not be dressed, smoothed, or finished for improving their appearance unless required specifically by the project specification, its accompanying drawings, or the approved detail drawings of the work. Welds shall be sound throughout and fused thoroughly, and shall be free from gas pockets, oxides, slag inclusions, and surface porosity, except that very small pores or specs of oxides or slag will be allowed if dispersed widely and if not larger or more numerous than those produced in passing qualification tests. Welds shall be free from overlaps, undercuts and excessive convexity. The inside of the pipe shall be free from globules of weld metal which would restrict the pipe area or might become loose.
6. Correction of Defects: Defective or unsound welds shall be corrected by removing and replacing the welds with new welds, or as follows:
 - a. Excessive convexity: Chip or grind weld to required size.
 - b. Undercutting, shrinkage cracks, craters, blowholes, and excessive porosity: Chip or grind weld to sound weld and base metal and deposit additional weld metal.
 - c. Undersize and excessive concavity: Clean weld and deposit additional weld metal.
 - d. Overlapping and lack of fusion: Remove weld by chipping or grinding and reweld.
 - e. Slag inclusions: Chip or grind weld to remove slag and fill with weld metal.
 - f. Removal of adjacent base metal during welding: Chip or grind weld to sound base and weld metal and form full size by depositing additional weld metal. Pipe or fittings which cannot be rewelded satisfactorily shall be replaced with new pipe or fittings at the Contractor's expense. Caulking of welds shall not be done. Before adding weld metal or rewelding, the surfaces shall be cleaned thoroughly. The removal of weld metal from a defective weld shall not extend into the base metal beyond the weld penetration. Where incomplete fusion is disclosed by chipping or grinding to correct defects, that part of the weld shall be removed and rewelded. In chipping or grinding welds, the weld or base metal shall not be nicked or undercut.

B. Brazing and Soldering:

1. Brazing and soldering procedure qualification shall conform to ANSI B31.1. Brazing procedure for joints shall be as outlined in the Copper Tube Handbook published by the Copper Development Association.

2. Soldering, soldering preparation and procedures for joints shall be in accordance with ANSI B31.1 and as outlined in the Copper Tube Handbook published by the Copper Development Association.

END OF SECTION

SECTION 21 05 29
SUPPORT AND ANCHORS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Work included in this Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:
1. Pipe Hangers and Supports
 2. Equipment Anchors

1.02 RELATED WORK AND REQUIREMENTS

- A. Section 210100: General Requirements
- B. Section 211100: Fire Protection Pipe and Pipe Fittings
- C. Section 210548: Noise, Vibration and Seismic Control

1.03 QUALITY ASSURANCE

- A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:
1. Pipe Supports: ANSI B31.1, Power Piping.
 2. Automatic Sprinkler Pipe Supports: NFPA No. 13, Standard for the Installation of Sprinkler Systems.
 3. Standpipe Hose System Pipe Supports: NFPA No. 14, Standard for the Installation of Standpipe and Hose Systems.
 4. California Code of Regulations, Title 24, Building Standards.
 - a. Part 2, California Building Code (CBC).
 - b. Part 4, California Mechanical Code (CMC).
 - c. Part 5, California Plumbing Code (CPC).
- B. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- C. All items of a given type shall be the products of the same manufacturer.

1.04 SUBMITTALS

- A. Submit the following:
1. Shop Drawings showing attachments to structure.
 2. Calculations showing deflections of trapeze hangers or other multiple pipe supports.

3. Details of upper hanger attachments for pipe supports with calculations stamped and signed by a Structural Engineer registered in the State of California.
4. Include structural calculations when required by Section 210548 Noise, Vibration and Seismic Control.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Hangers, Supports and Miscellaneous Attachment Accessories:

1. Eaton's B-Line
2. Superstrut
3. Unistrut
4. Or equal

2.02 PIPE HANGERS AND SUPPORTS

A. Where pipe supports are not shown but are required to avoid excessive pipe deflections, provide in accordance with schedule and to meet seismic code requirements. Pipe supports shall be similar in construction to those detailed on the Drawings for similar applications.

B. Spacing:

1. Piping not otherwise indicated:
 - a. Maximum spacing for horizontal piping:

Type of Pipe	Size	Maximum Spacing	Hanger Rod Size (inch)
Steel	1-1/2 in and smaller	7 ft	3/8
	2 in. to 4 inches	10 ft	1/2
	5 inches and larger	12 ft	5/8
Brass or Copper	3/4 in. and smaller	5 ft	3/8
	1 - 1-1/4 in.	6 ft	3/8
	1-1/2 - 3 in.	8 ft	1/2
	4 in. and larger	10 ft	5/8

C. Supports

1. Provide additional supports at:
 - a. Changes in direction.
 - b. Branch piping and runouts over 5 ft.
 - c. Concentrated loads due to valves, strainers and other similar items.
 - d. At valves 4 in. and larger in horizontal piping.
 - e. Support piping on each side of valve.
 - f. Where number of grooved couplings exceeds 3 between supports or provide continuous steel between supports.
2. Other piping support spacing shall be as scheduled on Drawing or as required by manufacturer or referenced standard.

D. Pipe Bracing shall be provided as required by other Sections of this Division.

E. Fastening: Non-metallic Pipes shall be anchored for limiting expansion where shown or required by means of non-metallic clamps or other approved means, fastened to the pipe by approved means and rigidly attached to the building construction.

F. Multiple pipes shall be attached to zinc coated steel channels using zinc coated clips or pipe clamps with zinc coated steel nuts and bolts, channel nut springs to be 18-8 stainless steel. For external supports use hot dipped galvanized or baked epoxy coated steel channels and angles.

G. Single pipe hanger to be zinc coated steel Clevis type with spacer bar and nuts and rod. Similar to B-Line Fig. B3100.

H. Struts, mounting brackets, channels, structural box sections, etc. shall be galvanized steel with zinc rich touch up of cut edges.

I. Floor stands shall only be used where indicated on the Drawings.

1. Pipe sections and fittings may be used for supports where lightly loaded. Floor stands shall be anchored to the floor with no less than 4 bolts.
2. Floor stands may be used only for vertical loads. Pipe diameter shall be a minimum of 1/12 of vertical height of stand.

J. Riser clamps at each floor:

1. Non metallic pipes shall be supported with solvent welded collar above loose pipe clamp.
2. Galvanized steel riser clamp for steel pipes. Similar Eaton's B-Line B3373C.
3. Plastic coated steel riser clamp for copper pipe. Similar Eaton's B-Line B3373CTC.

2.03 STRUCTURAL ANCHORS

A. Mechanical Expansion Anchors

1. Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193.
 2. Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 3. Hilti Kwik Bolt TZ (ICC ESR-1917), ITW Red Head "Trubolt+" (ICC ESR-2427), or equal, conforming to ACI 318-14, Chapter 17, as modified by 2016 CBC.
 4. Do not exceed manufacturer's published allowable working loads.
 5. All anchors shall be qualified in accordance with current edition of ICC-ES AC193.
- B. Beam Clips: B-Line Fig. B3060 side angle clips, Superstrut, or equal.
- C. Concrete Inserts:
1. Eaton's B-Line B2505, Stainless Steel, for roof slab and external.
 2. Eaton's B-Line B2505 or Superstrut 452, Galvanized, for internal use only.
- D. Beam Clamps: B-Line Fig. B3050 or B3055, Tolco, Superstrut, or equal.
- E. Maximum load safety factors:
1. Static loads: 5
 2. Vibratory loads: 8
 3. Shock loads: 10
- 2.04 PIPE SHIELDS
- A. For all insulated pipes and uninsulated CPVC pipes, see Section 210500 Basic Materials and Methods.
 - B. Copper pipe bearing on metal surface, including hangers, use minimum 1/16 inches PVC separation strip, or approved cushion strip. Minimum length 12 inches. Where pipe bears on wood or PVC, no shield is required.
- 2.05 SUPPLEMENTARY SUPPORTS
- A. Where support spacing is more frequent than distance between structural members provide steel angles, channels or beams sized to provide a deflection less than 1/240 of span when fully loaded, to transfer pipe support loads to structural members.
 - B. Where deflection of center of trapeze support exceed 1/240 of distance between hanger rods provide additional hanger rods.
 - C. Where multiple risers are supported within shafts provide steel angles, channels, or beams, sized to provide a deflection of less than 1/240 of span when fully loaded, to transfer loads to the concrete floor

slab. Anchor supplemental supports to the slab, and provide resilient element where required by other Sections of this Division.

- D. Hot dip galvanized all supports exposed to weather.

PART 3 – EXECUTION

3.01 PIPE HANGERS, SUPPORTS AND GUIDES

A. General:

1. Assure adequate support for pipe and contents.
2. Prevent vibration or swaying.
3. Provide for expansion and contraction.
4. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted.
5. Comply with applicable requirements at ANSI B31.1.0 and B31.2 for piping.
6. Support piping independently so that equipment is not stressed by piping weight or expansion.
7. See other Sections of this Division for hangers, guides, anchors and supports requiring vibration isolation units.
8. Hangers and supports shall have minimum safety factor of 5, based on ultimate tensile or compressive strength, as applicable, of material used.

B. Horizontal piping, except as noted:

1. Provide adjustable clevis type hanger and hanger rod.
2. Rollers or slide bases:
 - a. At pipe stands.
3. Trapeze hangers:
 - a. Provide individual guides for pipes on trapezes.
 - b. Where rods are unequally loaded, design for maximum load at both ends.
 - c. Deflection of channel not to exceed 1/240th of span.
4. Threaded rods:
 - a. 2 in vertical adjustment with 2 nuts each end for positioning and locking.
 - b. Size as indicated hereinbefore.
 - c. For double rod hangers: 1 size smaller than scheduled.
5. Adjust trapeze and individual hanger rods so as to equalize loads on successive hangers.
6. Plastic Piping Supports: All horizontal plastic piping shall be supported on continuous trough supports, with hanger spacing and rod sizes same as specified for metallic piping above. Trough shall be galvanized steel, "V" shaped, "U" shaped, or semi-circular shaped. "V" or "U"

shaped troughs shall have blocking at hangers to prevent rotation. Troughs shall be sized for a maximum deflection of 1/360 under actual load, with "S" equal to 25,000 psi and "E" equal to 29,000,000 psi.

- C. Vertical piping:
 - 1. Base support:
 - a. Hanger within 24 inches of elbow
 - b. Provision for expansion.
 - 2. Guides at every floor
 - 3. Top support:
 - a. Riser clamp/anchor within 24 inches of elbow.
 - 4. Intermediate supports: pipe clamp at floor:
 - a. See 2.2J.
 - b. Extension ends bearing on concrete.
- D. Install Cushion strip pipe isolators between steel hangers and:
 - 1. Uninsulated copper tubing.
 - 2. Wherever any pipe requires sound and vibration isolation.

3.02 ATTACHMENT TO STRUCTURE

- A. Concrete and CMU
 - 1. Install attachments with expansion shields. Shot in anchors may not be used.
- B. Side Wall Supports:
 - 1. Stud Walls:
 - a. Toggle bolts.
 - b. Lag screws into wood backing.
- C. Wood Beams and Roof Decks;
 - 1. Through-bolts for roof mounted pipe and equipment. Provide weatherproofing of penetration where exposed to outdoors.
 - 2. Beam clamps or beam clips for suspended pipe and equipment.
- D. Steel Beams:
 - 1. Beam clamps without retaining straps in lieu of the specified beam clamps shall not be used without a substitution request.

END OF SECTION

SECTION 21 05 48

NOISE, VIBRATION, AND SEISMIC CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide complete systems including design, materials, equipment and installation for vibration isolation and seismic restraints for equipment and piping.
- B. The work of this Section includes, but is not limited to:
 - 1. Seismic Restraints.
 - 2. Vibration Isolators.
 - 3. Flexible Pipe Connections.
 - 4. Field Dynamic Balancing.

1.02 WORK INCLUDED

- A. Objective: It is the objective of this specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, and/or due to interconnected piping, or conduit.
- B. Description of Work: Furnish, install, assemble, set up, test (hereinafter "provide") the following systems and equipment in accordance with the Contract Documents.
 - 1. Isolation of equipment including but not limited to pumps, including bases.
 - 2. Isolation for piping connected to vibrating equipment.
 - 3. Inspection of installation of vibration isolation to equipment.
 - 4. Provision of all Motion Restraints required by applicable codes for noise and vibration control equipment/systems specified herein.
 - 5. Coordination of Airtight Installation requirements at Fire Pump Room.
 - 6. Dynamic balancing of equipment.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 3: Concrete
- B. Division 7: Thermal and Moisture Protection
- C. Division 9: Finishes
- D. Division 21: Fire Protection
 - 1. Section 210529: Support and Anchors.
- E. Division 26: Electrical

1.04 QUALITY ASSURANCE

A. General:

1. Anchor, support, and brace all equipment and systems to resist seismic forces as specified hereinafter.
2. Comply with CCR 2016 California Building Codes.
3. Where anchorage support and bracing for various manufactured and fabricated items and systems are detailed and scheduled on the drawings, provide as shown.
4. For anchorage, support and bracing not detailed, provide in accordance with OSHPD Certified systems or submit details of anchors, supports and bracings complete with calculations. Details and calculation shall be signed and stamped by a Structural Engineer licensed in the state having jurisdiction over the project.

B. Reference Standards:

1. Standards: Provide equipment in accordance with the latest edition and revisions of all applicable standards and specifications of all appropriate agencies including, but not limited to, the following:
 - a. ASCE American Society of Civil Engineers
 - (1) Standard 7-10 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures
 - (a) Chapter 13 – Seismic Design Requirements for Non-Structural Components
 - b. ASTM - American Society for Testing and Materials
 - (1) Specification A123/A123M-01a Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - (2) Test Method ASTM D471-98e1 Standard Test Method for Rubber Property-Effect of Liquids.
 - (3) Test Method ASTM D2240-02 - Standard Test Method for Rubber Property-Durometer Hardness.
 - (4) Test Method ASTM E84-01 - Surface Burning Characteristics of Building Materials.
 - c. ASA - Acoustical Society of America/ANSI
 - (1) ANSI S12.2-1995 (R1999) American National Standard Criteria for Evaluating Room Noise
 - (2) ANSI S12.18-1994 (R1999) American National Standard Procedures for Outdoor Measurement of Sound Pressure Level
 - (3) ANSI S12.30-1990 (R1997) American National Standard Guidelines for the Use of Sound Power Standards and for the Preparation of Noise Test Codes
 - (4) ANSI S12.31-1990 (R2001) American National Standard Precision Methods for the Determination of Sound Power Levels of Broad-Band Noise Sources in Reverberation Rooms

- (5) ANSI S12.36-1990 (R1997) American National Standard Survey Methods for the Determination of Sound Power Levels of Noise Sources
 - (6) ANSI S12.54-1999 ISO 3744:1994 NAIS Standard Acoustics - Determination of sound power levels of noise sources using sound pressure - Engineering method in an essentially free field over a reflecting plane
 - d. AWS - American Welding Society, Inc.
 - (1) AWS D1.1 - 2002 Structural Welding Code – Steel
 - e. NFPA – National Fire Protection Association
 - (1) NFPA 13 – Standard for the Installation of Sprinkler Systems
 - f. B-line/TOLCO - Seismic Bracing and Support Systems (OSHPD OPM-0052-13)
 - g. Anvil International - Seismic Sway Bracing for Fire Sprinkler Systems (OSHPD OPM-0062-13)
 - h. Erico International Corporation - Seismic Sway Bracing for Fire Sprinkler Systems (OSHPD OPM-0351-13)
- C. Codes: Perform installation in accordance with all applicable international, federal, state, county, municipal and local codes and regulations, including but not limited to Chapters 16 and 17 of the California Building Code.
- D. Conflicts: Present any conflicts between codes, regulations, specifications and/or requirements at least thirty (30) days prior to the commencement of the scheduled work.
- E. Schedules: See contents of this Section for specific specifications and schedules of vibration isolators, frames and static deflections. Also see equipment support schedule on the drawings.
- F. Product Suppliers: All vibration isolation devices, equipment bases and frames for equipment and piping furnished under this Division shall be designed and furnished by no more than two different isolator manufacturers and no single vibrating element shall be isolated by the products of more than one isolator manufacturer.
- G. Supervision: The installation of all vibration isolation units, and associated hangers and bases shall be under the direct supervision of the vibration isolation manufacturer's representative.

1.05 COORDINATION

- A. Coordinate with all trades and Electrical Division for installation of Vibration Isolation. Coordinate with Concrete trade for equipment inertia bases. Coordinate Work of this Section with all other impacted trades.
- B. Unit Noise Levels
 - 1. The following are the maximum sound power levels acceptable for equipment delivered for this Project. Coordinate these requirements with other Division 21 Equipment submittals.
 - a. Submit manufacturer data obtained in an approved acoustical testing facility for the submitted unit tested at the proposed operational parameters for this project
 - (1) Test to be conducted according to the relevant laboratory standards for equipment submitted.

(a) Exception: Manufacturers may extrapolate data from other similar units operating at brake horsepower within 20% of the values scheduled for this Project.

b. Maximum Equipment Sound Power Levels

(1) Equipment casing radiated sound power levels (PWL), in dB re. 10⁻¹² watts shall not be more than the following levels:

Tag	Source	PWL							
		Octave Center Band, in Hertz							
		63	125	250	500	1000	2000	4000	8000
	Radiated								
	Radiated								
	Radiated								

1.06 SUBMITTALS

A. Descriptive Data - Submit the following:

1. Catalog cuts and data sheets on specific vibration isolators to be utilized showing compliance with the specifications and schedules herein. Include load versus deflection curves.
2. An itemized list showing the items of equipment, piping, etc., to be isolated, the isolator type and model number selected, isolator loading and deflection, wire diameter and number of coils in springs, and references to specific shop drawings showing frame construction where specified.
3. Written approval of the frame design to be used, obtained from the equipment manufacturer.

B. Seismic Bracing

1. Where pre-approved bracing systems will be employed, submittals shall include:
 - a. Approval identification number.
 - b. System component brochure describing components used and detailed installation instruction.
 - c. Loads to be transmitted to structure at anchor point.
2. Where anchorage, support and bracing are not detailed on the drawings and pre-approved systems are not used, Contractor shall submit designs and calculations of proposed systems. Submittals shall include:
 - a. Detailed sketches showing system to be installed, stamped and signed by a California registered Structural Engineer.

- b. Written instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices, including hangers and bases; alternatively the equipment may be installed by the vibration isolation manufacturer.
 - c. For each Motion Restraint, a stress analysis prepared by a Structural Engineer licensed to practice in the State of project jurisdiction.
 - (1) Provide sufficient detail to permit architect and authorities having jurisdiction to verify compliance with all applicable Codes and these specifications.
 - (2) For vibration isolation used with floor or roof mounted equipment over 400 pounds or suspended equipment over 20 pounds, provide calculations for:
 - (a) shear
 - (b) pull-up
 - (c) primary overturning
 - (d) secondary overturning
 - d. A certification in the calculation cover sheet stating:
 - (1) "These calculations demonstrate that the system detailed complies with the requirements of Chapter 16 of the California Building Code."
3. An itemized list of all items of equipment to be fitted with flexible piping duct connections.
- a. Flexible piping submittals shall contain all information and calculations to demonstrate conformance and suitability for the equipment operating conditions including but not limited to pressure, capacity, mounting, maintenance, etc.
 - b. Submittals shall also include independent acoustical test data demonstrating at least 20 dB attenuation of vibration accelerations at typical blade passage frequencies.
- C. Shop Drawings - Submit the following and secure approvals prior to fabrication:
- 1. Drawings showing equipment frame construction for each machine, including dimensions, structural member sizes, support point locations, etc.
 - 2. Drawings showing methods for suspensions, support, guides, etc., for piping.
 - 3. Drawings showing methods for isolation of pipes, piercing walls, slabs, beams, etc.
 - 4. Drawing showing methods numbers and details of Motion Restraints and anchors for equipment, frames, isolators, piping, etc., including calculations as above.
 - 5. Details for concrete and steel bases including anchor bolt locations.
 - 6. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, showing compliance with Code and coordination with the Project Architectural, Structural and Mechanical Documents.
 - 7. Details of flexible piping connections for all typical conditions listed in the schedule provided above.
- D. Seismic Qualification Requirements Certificate of Compliance: Submit certificates of compliance for all applicable equipment as required by the California Building Code, Chapter 17 and ASCE 7-10.

E. Anchorages and Supports

1. Where Contractor-proposed substitutions change the weight, size, configuration or other aspects of systems and equipment that will affect the performance of anchorages and/or supports, the Contractor shall submit calculations for proposed anchors and supports, and install them as shown in these calculations. The calculations shall include the same certification and engineer's stamp as required above for seismic bracing.
2. Where contractor-proposed substitutions are claimed to have no effect on anchors and supports detailed on the Contract Documents, Contractor shall submit information on sizes, weights, center of gravity and other relevant information to demonstrate this fact.
3. Contractor shall submit details and calculations for all embedded inserts, drilled inserts and other fasteners for attachments of suspended components showing the load-carrying capacity of each device calculated in accordance with Chapter 16 of the California Building Code. The calculations shall include the same certification and engineer's stamp as required above for seismic bracing.
4. For all anchorages and supports not detailed on the Contract Documents, Contractor shall submit details and calculations. The calculations shall include the same certification and engineer's stamp as required above for seismic bracing.

PART 2 – PRODUCTS

2.01 GENERAL PROPERTIES

- A. Deflection: Vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
- B. Range: Isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 60 percent above the design deflection.
- C. Ratio: Ratio of lateral to vertical stiffness shall not be less than 1.0 or greater than 1.3.
- D. Nested: Unless specifically noted, nested spring designs shall not be permitted.
- E. Uniformity: Vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than +/- 10 percent.
- F. Isolation: Wave motion through the isolator shall be reduced to the following extent: Isolation above the primary vertical system resonance frequency shall follow the theoretically predicted isolation curve for single degree of freedom systems within 10% up to 50 dB or greater at all frequencies above 150 Hz.
- G. Protection: Isolators installed outdoors shall be designed for such exposure suitable to the Project conditions.
 1. Springs shall be coated in neoprene or PVC. Spring housings shall be hot dip galvanized.
 2. All neoprene mountings shall have a Shore A hardness of 30 to 50, after minimum aging of 20 days or corresponding oven aging.

2.02 ACCEPTABLE MANUFACTURERS

- A. Pipe Bracing Systems:
1. Badger Industries
 2. Eaton's B-Line
 3. Super Strut
 4. Or equal
- B. Vibration Isolators:
1. Mason Industries
 2. Peabody Kinetics
 3. M.W. Sausse & Co.
 4. Or equal

2.03 ISOLATOR DESCRIPTION

- A. Application Cross-Reference: For application and the specific static deflection requirements of the isolators described below, refer to schedules and references elsewhere herein.
1. Type MS: Bare spring type equipped with leveling bolts and with two layers of ribbed or waffled neoprene pad separated by a 1/16" galvanized steel plate under the base plate.
 2. Type MSL: Bare spring type with two layers of ribbed neoprene pad with 1/16" galvanized steel separator between layers under the base plate. Provide limit stops to prohibit spring extension if the load is removed. These stops shall serve as rigid blocking during erections so that the installed and operating heights shall be the same. Provide a maximum of 1/4" clearance around restraining bolts and between the limit stops and the housing so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation.
 3. Type HS: Suspension hangers having a steel frame and spring element in series with a 1 inch thick neoprene pad with integral grommet. The design static deflection under load shall be as shown on the schedule. The isolator shall be designed so hanger rod may be misaligned 15 degrees relative to the vertical without touching integral grommet inset in hanger box frame.
 4. Type HD: Spring hangers, load transfer. Same as Type HS with washer and nut assembly and indicator for load transfer and deflection readout.
 5. Type HN: Suspension hangers having a neoprene isolator unit having a minimum static deflection range of 0.25" to 0.5" designed to preclude contact of hanger rods with frame at up to 15 degree misalignment.
 6. Type MN: Neoprene isolator unit having a minimum static deflection range of 0.25" to 0.5".
 7. Type NSP: Neoprene pad. Waffled or ribbed. Typically 5/16 to 2" thick. Durometer of 50 maximum. Static deflection typically 0.05". Nominal design 40 durometer for 0.05" static deflection under 60 psi load. Provide steel load distribution plates. Size of pad to be selected by isolator supplier based on load per point.
 8. Type MND: Neoprene Mount, Deep Displacement. A machinery mount with a neoprene diagonal lattice structure located between steel base and support plates. Suitable for loads from 300 to 4000 lbs and for driving frequencies as low as 6 Hz. Capable of providing static deflections from 5/8" to 1" with lateral stability.

9. Corrosion Protection: Steel parts of vibration isolators and seismic snubbers, except springs, shall be hot dipped galvanized in accordance with ASTM A123. Where steel parts are exposed to the weather, galvanized coating shall be at least 2 ounces of zinc per square foot of surface. Springs shall be neoprene coated.

2.04 EQUIPMENT FRAMES

- A. General Properties: Mounting frames and/or brackets shall be provided to carry the load of the equipment without stressing or causing mechanical distortion of the equipment. Each piece of equipment shall be supported at least four points by vibration isolators and restrained at least four locations by Motion Restraint.
 1. Rigid Steel (SB): Construction:
 - a. Rectangular with a minimum of four pieces of welded, wide flange or channel structural steel with welded height saving brackets to accept the isolators. Additional frame members shall be provided as necessary to support pumps, motors, etc.
 - b. The section depth of the frame members shall be greater than 1/10 of the length of the longest frame member, and shall be constant in all four perimeter frame pieces. Provide height saving brackets at all mounting locations to maintain a 1 inch clearance below the base.
 2. Floating Concrete Bases (CB): Construction:
 - a. Provide rectangular steel concrete pouring forms for floating concrete bases, with a minimum of four pieces of welded, wide flange or channel structural steel with welded or integral height saving brackets to accept the isolators and to maintain a 1 inch clearance below the base. Additional frame members shall be provided as necessary to support pumps, motors, etc. Forms shall include minimum concrete reinforcing consisting of 2 inch bars welded in place on 6 inch centers running both ways in a layer 1.5 inch above the bottom. Provide forms with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured.
 - b. The section depth of the frame members shall be greater than 1/12 of the length of the longest frame member, but not less than 6", and shall be constant in all four perimeter frame pieces.
 3. Integrated Roof mounted Spring and Frame (IRSF): The integrated roof mounted spring and frame assembly shall consist of a rectangular angle iron equipment frame supported by a type MS isolator on a steel channel roof perimeter. This assembly integrates with the roof insulation and canting to provide a weather tight seal with cover plates removable for isolator inspection. The IRSF shall provide integral motion restraint and shall be available in stock modular construction components.

2.05 EQUIVALENT VIBRATION ISOLATORS AND EQUIPMENT FRAMES

- A. Isolators
 1. Acceptable subject to 2.03 above:
-

Type	Description	Mason Industries	Vibrex/ Sauser	Lord Mechanical Products	Kinetics	Amber Booth	Vibration Mountings & Controls
MS	Spring Mount	SLF*	RMSG*	B	FDS*	SW*	ADC*
MSL	Spring Mount with Limit Stop	SLR C series	RMLS-EQ	--	FLS	CT	AWR
	Under 1.5" S.D. and under 200 pounds load per isol.	SLR A series	RMUJ-EQ-SH	B	FLS	CT	AWR
HS	Spring Hanger	30N*	HXA*	B	SRH*	BSRA*	SH*
HD	Spring Hanger	PC30N*	HXA-PC	--	--	--	
HN	Neoprene Hanger	HD*	HSS*	--	RH*	HRD*	RHD*
MN	Neoprene Mount	ND*	DD*	--	RD*	RVD*	RD*
MND	Neoprene Mount, Deep Deflection*	--	--	Lattice Mount	--	--	--
NSP	Neoprene	W, WM*	R*		NPS*	SP-NR*	Shear-flex

*Unrestrained isolation systems require separate Motion Restraint as specified below.

B. Frames and Curbs

1. Acceptable subject to 2.04 above:

Type	Description	Mason Industries	Vibrex/ Sauser	Kinetics	Amber Booth	Vibration Mountings & Controls
SB	Rigid Steel Base	MSL/WFSL	RMSB	SFB	B	WFB-AC
CB	Floating Concrete Base	BMK				
IRSF	Integrated Roof Mount	RSC	VIC-EQ	ESR	B	B

2.06 MOTION RESTRAINTS

- A. Objective: Provide motion restraining devices at all vibration isolated piping and equipment. Design restraints to comply with applicable Code in Project Jurisdiction.

- B. General properties: Restraints shall permit adjustment during installation to insure sufficient clearance between vibration isolated element and rigid restraining device. Restraints at base supported equipment shall include resilient neoprene pads at all potential contact areas between isolated equipment and rigid restraining element.
- C. Equipment, equipment bases and concrete inertia bases shall be restrained against excessive movement during a seismic event by the use of resilient snubbers designed to resist forces in accordance with Title 24 requirements. The steel members of the snubbers shall be designed to yield but not fail under these design conditions. Calculations by a Registered Professional Engineer, or certified tests reports from a nationally recognized independent test laboratory shall be submitted which verify the capacity of each snubber.
- D. Restraint Description
 - 1. Restraining devices at base supported vibration isolated equipment shall be as manufactured by Mason Industries, type Z-1011 or equal by Vibrex, Amber Booth or Kinetics.
 - 2. Coordinate restraint bolt locations with the structural and fire protection drawings and field conditions.
 - 3. Restraints at suspended piping and equipment shall consist of stainless steel cables together with neoprene snubbers arranged to achieve the required all directional restraint and sized to resist the forces defined. Shop Drawings shall indicate proposed method for achieving vertical restraint for ceiling suspended piping. Cables shall have sufficient slack to avoid short circuiting the vibration isolators.
 - 4. Snubbers shall be welded steel, and shall be attached to the supporting structure in a manner consistent with anticipated loads. Such attachments shall meet current State Building Codes.
 - 5. Snubbers shall be placed around equipment to limit lateral or vertical movement at each snubber to one-quarter inch (1/4"). A minimum of four (4) snubbers shall be installed around each piece of resiliently supported equipment.
 - 6. Snubbers shall include resilient pads to cushion any impact, and shall be installed so as to be out of contact during equipment operation.

2.07 VIBRATION ISOLATOR APPLICATION AND SCHEDULES - EQUIPMENT

- A. General: The isolator type scheduled shall be furnished and installed for the following equipment in accordance with Part 3 herein, loaded to yield the specified deflection per the schedule below at each isolator. The contractor shall verify that the dead load deflection of the structure at each isolator location is less than 0.25 times the isolator static deflections scheduled herein. In the event that the dead load deflection of the structure at any isolator location is greater than 0.25 times the scheduled isolator static deflection, the contractor shall increase the static deflection of such isolators to be at least 4.0 times the dead load deflection of the structure.
- B. Application Schedule: See also equipment schedule on drawings.

Equipment Designation	Isolation Type	Frame Type	Minimum Static Deflection (inches)	Mounting Notes
Close Coupled Pumps - Up to 5 HP	MN	CB	0.5	Provide double sphere flexible piping connection at both inlet and outlet prior to first stanchion support. See

(slab on grade)				requirements elsewhere herein
Close Coupled Pumps - larger than 5 HP (slab on grade)	MS	CB	1.0	
Close Coupled Pumps - Up to 5 HP	MS	CB	1	
Close Coupled Pumps – larger than 5 HP	MS	CB	1.5	
Base Mounted Pump up to 60 HP	MS	CB	2.0	
Base Mounted Pump up to 60 HP (slab on grade)	MS	CB	0.75	

2.08 FLEXIBLE PIPING CONNECTIONS

- A. Provide elastomeric flexible piping connections between piping and vibrating equipment including but not limited to the inlets and outlets of pumps, and compressors. Alternately, provide appropriately sized metallic hoses as described below.
1. Provide flexible piping connections to units listed above and similar at all connection points via flexible neoprene connectors consisting of multiple plies of nylon tire cord fabric and neoprene. Neoprene elements shall form at minimum a dual sphere muffler construction at each connection. Connectors up to and including 1-1/2" diameter may have threaded ends. Connectors 2" in diameter or larger shall be manufactured with floating metal flanges recessed to lock the connector's raised face neoprene flanges.
 2. Connectors shall be rated to suit system pressure with a minimum of 150 psi at 220 degree F. Flanged equipment shall be directly connected to neoprene elbows in the size range of 2-1/2" to 12" diameter if the piping makes a 90 degree turn at the equipment. All straight through connections shall be made via twin sphere configuration per A above.
 3. Provide steel restraint cables with fittings, nuts, steel washer, and acoustical washers where elongation would exceed manufacturer's limits at operating pressure. Elastomeric connectors shall have either tubular or spherical configuration as required or indicated. Spherical type straight connectors shall have two spheres. Elastomeric elbow connectors will not be acceptable.
- B. Acceptable subject to above:
1. Safeflex SFDEJ by Mason Industries, Inc.
 2. Type 242 by Proco.
 3. Style 2600 by Amber/Booth Company.
 4. Merflex Style 5500 TS by Mercer Rubber Company.
 5. Type VMT by Vibration Mounting & Controls.

- C. Provide metallic hoses at all piping crossing seismic joints in the building, sized appropriately to accommodate the seismic movement specified on the structural and/or architectural drawings.
1. Provide two each at every location where A applies above.
 2. Provide flexible connectors fabricated of Grade E phosphor bronze, monel or corrugated stainless steel tube covered with comparable bronze or stainless steel braid restraining and pressure cover. Stainless steel grades shall be 304, 316, or 321 as required for the application. Live lengths shall be as indicated, but not less than that recommended by the manufacturer for continuous vibration application.
 3. Acceptable:
 - a. Type BBS, SS or BBF by Mason Industries, Inc.
 - b. Type BBS, SS or BBF by Mercer Rubber Company.
 - c. Metal-Flex by Amber/Booth Company.
 - d. Stainless steel flexible connectors by DME, Inc.
 - e. Type MFP by Vibration Mountings & Controls, Inc.
 - f. Metrafire by Metraflex

2.09 RESILIENT PENETRATIONS

- A. For piping (Field Fabricated Method):
1. Sleeves: Sleeves of appropriate gage galvanized sheet metal shall be formed to at least the thickness of the penetrated construction and 3/4" to 1" larger in each cross-sectional dimension than the penetrating element.
 - a. Acceptable:
 - (1) Century-Line Sleeves by Thunderline Corporation
 - (2) Custom by Contractor
 2. Batt: Glass fiber of batt or mineral wool, 1 to 3 lb/cu ft density.
 - a. Acceptable Manufacturers
 - (1) Certain-Teed
 - (2) Johns Manville
 - (3) Owens-Corning
 3. Acoustical Sealant:
 - a. Acceptable Manufacturers:
 - (1) DAP
 - (2) Pecora
 - (3) Tremco
 - (4) U.S. Gypsum

4. Firestop Sealant:
 - a. Where piping penetrate sound isolation partitions or walls around mechanical rooms, the penetration shall have a maximum clearance of 3/4-inch on all sides and shall be packed with glass fiber and caulked airtight on both sides with acoustically rated sealant, or equal. Acoustic sealant shall be fire rated to meet UL designs for applicable fire rated wall assemblies. For smoke or fire rated partitions see other Sections of this Division.
 - b. Fully hardened firestop caulk shall develop a Shore A hardness of no greater than 35.
 - c. Acceptable, subject to approval for intended application by Authorities Having Jurisdiction:
 - (1) G.E. Pensil 100 Firestop Sealant
 - (2) Tremco Fyre-Sil Silicone Fire-stop Construction Sealant

B. For piping penetrations (Factory Fabricated Component Method):

1. A factory fabricated sleeve assembly with outer sleeve of sheet metal and inner resilient liner of moisture and vermin resisting felt neoprene, glass fiber or foam rubber 2 to 3/4" thick and bonded to the sheet metal sleeve. Sleeve inside diameter shall be equal to outside diameter of penetrating element. Sleeve length shall be at least equal to the thickness of the penetrated construction. Sleeve shall be set and caulked airtight in penetrated construction and clamped tightly around penetrating element.
2. Acceptable:
 - a. Mason Type SWS
 - b. Peabody Type PS-1-D
 - c. Potter Roemer PR-Isolator
 - d. Stoneman Engineering Trisolator
3. Where required, a fire rated factory fabricated sleeve and inner resilient liner of solid rubber links may be substituted for the preceding when installed in strict accordance with the manufacturer's instructions.
 - a. Acceptable, subject to by Authorities Having Jurisdiction:
 - (1) Link Seal by ThunderLine Corp.

PART 3 – EXECUTION

3.01 INSTALLATION/APPLICATION/PERFORMANCE/ERECTION

- A. Seismic Restraint Systems: Maintain equipment and piping in a captive position. Do not short circuit vibration systems or transmit objectionable vibration or noise. Structural bases shall be reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment.
- B. Vibration Isolation: Mechanical and associated electrical machinery and piping ductwork shall be mounted on vibration isolators and seismic snubbers as indicated or specified and required to minimize transmission of vibrations and structure borne noise to the building structure or spaces. All mechanical equipment, unless otherwise noted, shall be isolated from the structure by means of resilient vibration and noise isolators.

1. Rotating and reciprocating machinery shall be balanced statically and dynamically.
- C. After installation and before equipment start-up an authorized representative of the manufacturer shall visit the site, and shall inspect each isolator and certify in writing that each is installed in accordance with the manufacturer's instructions. Make all adjustments and corrections required by the manufacturer's representative to enable this certification.
- D. Bases: Equipment shall be set on concrete bases, minimum of 4-inches high.
- E. Piping mounted on roof or floor slab: Attach all support points to roof structural member and provide seismic bracing of all piping at an interval of not more than 40 feet.

3.02 FIELD QUALITY CONTROL

- A. Testing and Inspection: See SECTION 014523.
 1. Special Inspections as defined in CBC Chapter 17, paragraph 1705.12.6, shall be provided as required.
- B. Testing of Concrete Anchors: Anchors drilled into concrete and which are to be loaded in tension (pull-out) will be proof-tested by the Owner to two times the maximum allowable load. 50% of all anchors will be proof-tested. In the event of a single failure, testing of all remaining anchors will be performed as directed by the Architect **[and approved by OSHPD]**. Additional testing required because of a test failure shall be paid for by the Contractor.
- C. Field Balancing:
 1. Dynamic balancing of certain critical rotating equipment is required.
 - a. Maximum Permissible Machinery Vibration Levels:
 - (1) Mechanical balance of rotating equipment as shown shall be field tested with final drives and couplings in place and with the units in normal operation.
 - b. Overall vibration amplitude 0.003-inch maximum peak-to-peak, for frequencies below 10 cycles/second (600 rpm) and 0.1-inch/second maximum peak velocity for frequencies above 10 cycles/second (600 rpm).
 - c. Take measurements on bearing housings (not end caps) or other heavy structural element directly connected to bearing housing at both ends of each unit.
 - d. Pulley runout in radial and axial directions shall be less than 0.001-inch.
 - e. Correct and retest equipment exceeding the limits for compliance.

3.03 INSPECTION OF CONDITIONS

- A. Examine related Work and surfaces before starting Work of this Section. Report to the Architect, in writing, conditions which will prevent proper provision of this work. Beginning the Work of this Section without reporting unsuitable conditions to the Architect constitutes acceptance of such conditions by Contractor. Perform any required removal, repair, or replacement of this Work caused by unsuitable conditions at no additional cost to the Owner.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Stress: Installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.
- B. Prior Approval: The Contractor shall not install any equipment or piping which makes rigid contact with the "building" unless it is approved in this specification or by the Architect. "Building" includes, but is not limited to slabs, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
- C. Rigid Contact: Prior to installation, bring to the Architect's attention any conflicts between trades which will result in unavoidable rigid contact at equipment or piping, as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- D. Discrepancies: Prior to installation, the Contractor shall bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection. Corrective work necessitated by discrepancies after installation shall be at the Contractor's expense.
- E. Protection: Isolators exposed to the outdoors during construction shall either be designed for such exposure or shall be protected by suitable means.
- F. Access: The Contractor shall obtain inspection and approval from the Architect of any installation to be covered or enclosed, prior to such closure.
- G. Instructions: The Contractor shall obtain written instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices; alternatively, the equipment may be installed by the vibration isolation manufacturer.
- H. Defective Installations: Correct, at no additional cost to the Owner, all installations which are deemed defective in workmanship or materials by the Architect or Consultant.
- I. Component Importance Factors: All fire protection equipment and systems shall be procured and installed to meet the requirements of a Component Importance Factor of 1.5 as defined in ASCE 7-10 and CBC Chapters 16 and 17.
- J. Component Importance Factors: All fire protection equipment and systems shall be procured and installed to meet the requirements of a Component Importance Factor of 1.5 as defined in ASCE 7-10 and CBC Chapters 16A and 17A.

3.05 EQUIPMENT ISOLATORS

- A. Structural Frames: Machines to be isolated shall be supported by a structural steel frame, Type RS, or Type IRSF frames as described herein.
- B. Brackets: Brackets shall be provided as required to accommodate the isolator and provide a mechanical stop. The vertical position and size of the bracket shall be submitted by the isolator manufacturer.
- C. Clearance: Operating clearance between the bracket and the pad or floor shall be 3/8". The minimum operating clearance between the frame and the housekeeping pad or floor shall be 1", for rigid steel and 2" for concrete inertia base.
- D. Shims: Frame shall be placed in position and the brackets supported temporarily by 3/8" shims prior to the installation of the machine or isolators.

- E. Support: Isolators shall be installed without raising the machine and frame assembly.
- F. Adjustment: After the entire system installation is completed and under full operation load, the isolator shall be adjusted so that the load is transferred from the shims to the isolator. When all isolators are properly adjusted, the shims should be barely free and shall be removed. Thereafter, the shims should be used as a gauge to check that the 3/8" clearance is maintained so that the system will remain free of stress.
- G. Roof curbs: Installation of Type IRSF shall be in strict conformance with the manufacturer's instructions.

3.06 INSTALLATION REQUIREMENTS, MOTION RESTRAINTS

- A. Inspection: All installations shall be inspected and approved by a Civil or Structural Engineer licensed in the Project jurisdiction for adequate motion restraint and to assure that such does not short-circuit vibration isolators during normal operation. Adjustments, as reasonably required, shall be made by the Contractor at no expense to the Owner. Such inspector shall be provided by the Contractor, and the Engineers shall certify the installation in writing.

3.07 INSTALLATION REQUIREMENTS, FLEXIBLE PIPING CONNECTIONS

- A. Application: Flexible piping connections shall be installed within 10 feet of all vibrating equipment, or prior to penetration of the building, whichever is shorter, on all piping connected to such equipment.
- B. Placement: Flexible piping connections shall be located such that their length is at right angles to the principal direction of movement and thus such that the movement of the equipment does not alternately place the connection into tension and compression.
- C. Length: Flexible piping connectors shall be installed in accordance with the manufacturer's recommended procedures and in lengths complying with Table 28, Chapter 52, ASHRAE 1995 Applications Handbook.
- D. Braided metal hose: Where permitted as a substitution, shall be installed in pairs, one in the vertical plane and one in the horizontal plane at each location that a single flexible piping connection is required in this section.

3.08 INSTALLATION REQUIREMENTS, RESILIENT PENETRATIONS

- A. Application: Penetrations included in this Section of the Specifications include all piping connected to vibrating equipment within 30 feet of such equipment.
- B. Alternate A for round or rectangular penetrations:
 1. Cut a clean opening in the penetrated construction very nearly the size of the sleeve for each penetrating element. Provide lintels above, relief structure below and vertical framing between and to the sides, as required. Provide the above, escutcheon plates and such related construction as is necessary to make the penetrated structure as solid and massive near the penetrations as the surrounding construction.
 2. Set the metal sleeve into the penetrated construction in an airtight manner around its outer periphery, using grout, dry packing, plaster or drywall compound full depth and all around - but only to a maximum width of 2" - or the requirements of the above paragraph shall not have been satisfied.
 3. Pack annular opening with glass fiber between metal sleeve and penetrating element full depth, all around to a firm degree of compaction. Leave a 2" deep annular opening free at each end of the metal sleeve; fill this fully with sealant.

- C. Alternate B for round penetrations: Observe requirements above, except that use of sealant at sleeve ends is not required. In lieu of sealant, clamp factory fabricated sleeve assemblies specified in Part 2 tightly around penetrating elements, using built-in or field supplied clamping devices. Apply clamping of sleeves to penetrating services before sealing of sleeves to penetrated constructions. Refer to manufacturer's instructions for installation of fire rated rubber link systems.

3.09 EQUIPMENT ROOM / PLENUM REQUIREMENTS

- A. Airtight Enclosure: All mechanical rooms shall be constructed airtight. This means that every precaution shall be taken to maintain construction completely airtight around a room so designated. Construction joints, pipe penetrations, electrical boxes, frames, supports, cabinets, doors, access panels, fixtures, etc., all shall be built or installed in such a manner as to prevent sound transmission through any construction enclosing a room horizontally or vertically.

Appropriate lintels, frames, blocking, escutcheons, grouting, gaskets, packing, caulking, taping, filling, etc., all shall be employed to prevent sound transmission. Refer to requirements of this Section for Resilient Penetrations.

- B. Discrepancies: All work under this section is to comply with the above. Report to architect any construction conditions which arise which might compromise compliance with this requirement.

END OF SECTION

SECTION 21 11 00

FIRE PROTECTION PIPE AND PIPE FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work included in this Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Fire Protection system piping.
2. Equipment drain piping.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210529: Support and Anchors
- B. Section 210548: Noise, Vibration and Seismic Control
- C. Section 211313: Automatic Fire Protection

1.03 APPLICABLE PUBLICATIONS: THE PUBLICATIONS LISTED BELOW FORM A PART OF THIS SPECIFICATION TO THE EXTENT REFERENCED. THE PUBLICATIONS ARE REFERRED TO IN THE TEXT BY THE BASIC DESIGNATION ONLY.

A. American National Standards Institute (ANSI) Publications:

1. B16.5 Steel Pipe Flanges, Flanged Valves, and Fittings
2. B16.9 Factory Made Wrought Steel Butt Welding Fittings
3. B16.11 Forged Steel Fittings, Socket Welding and Threaded
4. B16.18 Cast Bronze Solder Joint Pressure Fittings
5. B16.21 Nonmetallic Gaskets for Pipe Flanges
6. B16.22 Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
7. B16.39 Malleable Iron Screwed Fittings
8. B18.2.1 Square and Hex bolts and Screws, including Hex Cap
Screws and Lag Screws
9. B18.2.2 Square and Hex Nuts
10. B31.1 Power Piping
11. B31.9 Building Service Piping
12. B40.1 Gages, Pressure, Indicating Dial Type, Elastic Element

B. American Society for Testing and Materials (ASTM) Publications:

1. A 47 Malleable Iron Castings
 2. A 53 Pipe, Steel, Black and Seamless Steel Pipe
 3. A 183 Carbon Steel Track Bolts and Nuts
 4. A 307 Carbon Steel External and Internally Threaded
Standard Fasteners
 5. A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel
Products
 6. A125-96(2001) Standard Specification for Steel Springs, Helical, Heat-
Treated
 7. A 536 Ductile Iron Castings
 8. B 32 Solder Metal
 9. B 88 Seamless Copper Water Tube
 10. C 564 Rubber Gaskets for Cast-Iron Soil Pipe and Fittings
- C. American Society of Mechanical Engineers (ASME) Publications:
1. ASME Boiler and Pressure Vessel Code and Interpretations
 2. Section VIII - Pressure Vessels - Division 1
- D. American Welding Society Inc. (AWS) Publication:
1. A5.8-76 Brazing Filler Material
- E. Copper Development Association Inc. Publication:
1. Copper Tube Handbook
- F. Underwriters Laboratories Inc. (UL).

1.04 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.03 of this section and with all applicable national, state and local codes.
- D. All items of given type shall be the products of the same manufacturer.
- E. Welding materials and labor to conform to ASME code and applicable state Labor Regulations.
- F. Use fully qualified welders licensed by state authorities.
- G. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with:
 1. Weight or quality.

2. Maker's name or mark.

1.05 SUBMITTALS

A. Manufacturer's Literature and Data

1. Piping and Fittings, Gaskets, Brazing and Soldering Metals, Piping Accessories, Shop Drawings and Catalog Cuts: Submit shop drawings and catalog information showing plan, elevations, dimensions, capacities.

PART 2 – PRODUCTS

2.01 CLASSES AND MAXIMUM WORKING PRESSURES:

- A. Equipment and piping components shall be suitable for use under the maximum working pressures indicated. Except as modified herein, the pressure limitations shall be as specified in the referenced standards and specifications.

2.02 PIPE SERVICES

A. Relief, Safety Valve discharge

1. Steel, Schedule 40, welded or screwed, ASTM A53 Grade B

B. Equipment Drains

1. Copper Type L, ASTM B88

C. Fire Protection

1. Inside and underground:
 - a. Sch 40 steel to ASTM A53 or A135, grooved end, screwed or welded.

2.03 PIPING AND FITTINGS

A. Pressure Piping

1. Pressure piping shall be:
 - a. Ferrous and copper piping conform to requirements of ANSI Safety Code for Pressure Piping, B31.1.
 - b. Be commercially round and straight.
 - c. Be of uniform quality and workmanship.
 - d. Be free from all defects.
 - e. Be identified.
2. Pressure ratings herein are "W.O.G." or "Water Working Pressure."
3. Black Steel, welded or screwed:
 - a. Schedule 40, ASTM A-53.

- b. 2-1/2" and larger.
 - c. Steel welding fittings, ANSI B16.9. Shaped nipples and saddles not permitted.
 - d. Steel welding-neck flanges and flanged fittings, ANSI B16.5, 150 psi.
4. Black Steel, grooved end:
- a. ASTM A-53
 - b. 1-1/4" and larger, grooved end fittings as hereinafter specified.
 - c. Roll-grooved - Schedule 40
 - d. Schedule 10 pipe shall not be used.
 - e. Couplings of painted malleable iron to ASTM A47 or ductile iron to ASTM A536.
 - f. Gaskets to be product of coupling manufacturer.
 - g. Gaskets to be elastomer conforming to ASTM D2000 EDPM to 200 degree F water.
5. Copper Tubing:
- a. ANSI H23.1.
 - b. Wrought-copper, solder joint fittings, ANSI B16.22, in sizes available.
 - c. Cast-bronze solder-joint fittings, ANSI B16.18, only in sizes not available in wrought copper.
 - d. Cast bronze, threaded, ground-joint unions, ANSI B16.18, 2" and smaller.
 - e. Cast-bronze, flanged unions, ANSI B16.24, 150 psi class, 2-1/2" and larger.
 - f. Copper tubing flared fittings: bronze castings for flared type joints, ANSI B-16.26.
6. Brass:
- a. Standard weight and red brass pipe, 85 percent copper, 15 percent zinc, ANSI H27.1.
 - b. 125 psi threaded brass fittings, ANSI B16.15
- B. Pipe Threads: ANSI B1.20.1.
- C. Flange Gaskets:
- 1. Full faced or flat ring type to suit flange facings, selected from one of following materials:
 - a. Steel Piping Systems:
 - (1) Full face fluorinated elastomer.
 - (2) 1/16" thick.
 - 2. Gaskets coated with thread lubricant when being installed.
- D. Flange Bolts, Nuts and Washers:
- 1. Steel piping systems: carbon steel conforming to ASTM A307, grade B, and material for nuts shall conform to ASTM A194, grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI

B18.2.1 and ANSI B18.3.2 with threads conforming to ANSI B1.1 coarse type with class 2A fit for bolts and studs, and class 2B fit for nuts.

2. Copper piping systems: bronze bolts.
- E. Unions:
1. Steel piping 2-1/2" and smaller:
 - a. 250 psi: ground joint
 - b. Similar to Grinnell Fig. J-3, Watts 3004.
 2. Steel piping larger than 2-1/2": welding flanges.
 3. Copper Piping:
 - a. Similar to Nibco No. 733.
 4. Other systems to match piping.
- F. Dielectric flanges, waterways, couplings.
1. 2-1/2" and smaller:
 - a. 250 psi WOG conforming to ASTM F-492-77
 - b. Threaded ends, electro-zinc plated steel body with thermoplastic liner.
 - c. Similar to Victaulic "Clearflow".
 2. 3" and larger:
 - a. Flanged, 175 psi WOG. ANSI B16.42 (iron) and B16.24 (bronze).
 - b. Similar to Watts 3110. EPCO Model X.
 3. Dielectric unions shall not be used.
- 2.04 ESCUTCHEONS, FLASHINGS AND SLEEVES
- A. Escutcheons:
1. Similar to Grinnell Fig. 2 for copper tubing.
 2. Similar to Grinnell Fig. 13 for steel pipe.
 3. Brushed chrome plated brass.
- B. Flashings for pipes through roofs:
1. See Architectural drawings.
 2. Secure pipe below roof to prevent relative movement.
- C. Sleeves; of following types as required:
1. Minimum 22 gauge, galvanized steel sleeves if removed entirely after concrete pour, Schedule 40 PVC if remaining after pour.
 2. With welded PVC flange to serve as water stop in waterproofed walls.

2.05 FLEXIBLE COUPLINGS

- A. Provide flexible couplings at pump suctions and discharges. Use molded spherical or convoluted rubber couplings at flanged pump and braided hose at screwed pump connections.
- B. Molded-rubber covered, "Twin Sphere" type design, multi-layered cord fabric design suitable for working pressures ranging from negative ten psi to positive 50psi on continuous basis. Backing rings and other flange plates shall be of galvanized steel. For unrestrained applications provide stainless steel wire restraints.
- C. Metal Flexible Connectors: Provide flexible connectors fabricated of Grade E phosphor bronze, monel or corrugated stainless steel tube covered with comparable bronze or stainless steel braid restraining and pressure cover. Stainless steel grade shall be 340. Live lengths shall be as indicated, but not less than that recommended by the manufacturer for continuous vibration application.
- D. For flanged pumps, flex couplings to be installed outboard of pump supports.

2.06 EXPANSION JOINTS

- A. 304 or 321 stainless steel bellows type with stainless steel flow liner, carbon steel flanges, minimum 3" axial compression. Similar to Hyspan series 2500.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Arrangement:
 - 1. Portions of the piping is diagrammatically indicated. Install generally as shown.
 - 2. Do not scale Drawings for exact location of piping.
 - 3. Install piping to coordinate with other trades and accommodate field conditions.
 - 4. Piping arrangement unless otherwise noted:
 - a. Arrange piping neatly along walls.
 - b. In neat, horizontal groups.
 - c. Each group to be in one plane, in so far as possible.
 - d. Piping connections to equipment shall be arranged so that removal of equipment or components of equipment including pump casing, shaft seals and similar work can be accomplished with the least amount of disassembly or removal of the piping system. Piping connected to equipment with vibration isolators shall be provided with flexible connections conforming to vibration and sound isolation requirements of other Sections of this Division.
 - 5. Do not sleeve structural members without consent of Architect.
 - 6. Maintain minimum 1" clearance from adjacent work, including insulation, except as noted or approved.
 - 7. Install piping concealed above ceilings or in walls unless otherwise indicated.

8. All steel pipe and fittings, not insulated or wrapped to be cleaned.
- B. Expansion, Contraction and Bending:
1. Install piping with provisions for expansion and contraction.
 - a. Provide expansion loops, offsets, swing joints, and/or expansion joints where indicated or otherwise required. Nesting of grooved joint couplings for expansion provision not permitted.
 2. Do not spring or force piping during installation.
 3. Do not bend piping without use of pipe bending machine.
- C. Strainers:
1. Provide strainers in pumps. Strainer shall be located close to equipment it is intended to protect. Strainers shall have isolating service valves to permit servicing the strainer with minimum loss of fluid. Provide clearance for removal and replacing of strainer screens.
- D. Pumps:
1. Support, anchor and guide piping so that no strains are imposed on pump by weight or thermal movement of the piping. Provide air vent valve on pump casing. Drain outlets on pump bases shall be piped to floor terminated with hose adaptor. Pig tails or pet cocks for pressure gages shall be provided on suction and discharge for water balancing measurements.
- E. Valves:
1. Install at equipment to allow maintenance or isolation, and to establish proper and sequential operation of the complete system.
- F. Piping Specialties:
1. Locate and orient gauges to permit observation by personnel standing on floor.
 2. Provide instrument cocks at pressure gauges.
- G. Grooved Couplings:
1. Where grooved couplings occur at a frequency greater than 4 joints in 10 feet use rigid style.
 2. See other Sections of this Division for support requirements.
- H. Copper:
1. Crimping of copper tubing, piping or fittings is prohibited.
 2. Isolate copper pipe and tubing from contact with steel.
 3. On exposed piping wipe clean all solder joints.
- I. Care of Floors:
1. Do not set pipe vises or threading machines on any unprotected concrete floors.
 2. Cover floor when making plumbing connections to avoid staining floors with oil, white or red lead or other substances.

3. Contractor shall bear cost of removing any stains.

3.02 SYSTEMS INSTALLATION

A. Fire Protection:

1. See Section 211313, Fire Protection / Automatic Sprinkler System.

B. Threaded Joints for steel, copper pipes.

1. Sealed with sealant compounds or teflon tape.
2. Sealant compounds:
 - a. General Service: John Crane JC-40, Permatex "Blue", "or equal".

C. Welded Joints:

1. In addition to requirements of Section 210500, welding of pressure piping shall be done by welders who have been qualified by recognized agency within 6 months prior to date of Contract.
 - a. Perform welding in accordance with provisions of latest issue of all applicable codes including:
 - (1) ASME Boiler Construction Code
 - (2) ANSI Code for Pressure Piping
 - b. Standard Procedure Specifications of, and operators qualified by National Certified Pipe Welding Bureau will be considered as compliance with requirements of Specifications.
2. Where required, peen and wheel-grind welds.
3. Ends of pipe may be burned for welding:
 - a. Grind bevel and remove scale between welding joint.
 - b. Ragged edges with metal beads, poor alignment other inferior work will be rejected.
4. Perform welding with oxyacetylene or electric arc process.
5. Welded Branches:
 - a. Welded branch connections not permitted with schedule 10 pipe.
 - b. Where welded branches have intersecting center lines provide stress calculations per ASME B31.1.

D. Soldered and Brazed Joints:

1. Use 95-5, tin-antimony for domestic water, solder for other copper piping. Use flux meeting ASTM B813 requirements. Assemble solder joints in accordance with ASTM B828.
2. Brazing filler material BCuP-3 or BCuP-4 to AWS A5.8 during brazing of the pipe connections, the interior of the pipe shall be purged continuously with dry nitrogen. Use a flow meter and regulator to control flow rates.
3. Clean surfaces to be jointed, of oil, grease, rust and oxides.

- a. Remove grease from fittings by washing in solution of 1/16 sodium carbonate and three gallons hot water.
- b. Clean socket of fitting and end of pipe thoroughly with emery cloth to remove rust and oxides.

3.03 ADJUSTMENT AND CLEANING

A. General:

- 1. During construction:
 - a. Keep openings in piping closed to prevent entrance of foreign matter.
 - b. Clean pipe, fittings and valves internally.
 - c. Hammer welds to remove slag and weld beads.

3.04 FIELD QUALITY CONTROL

- 1. Perform tests and inspections.
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Coordinate with fire-alarm tests. Operate as required.
 - f. Verify that equipment hose threads are same as local fire-department equipment.
- 2. See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- 3. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- 4. Prepare test and inspection reports. Furnish written report and certification that tests have been satisfactorily completed.
- 5. Submit as-built drawings and testing certificates after the acceptance testing.
- 6. Test concealed piping prior to concealment.
- 7. Notify Architect and Owner's inspector in writing one week before test.
- 8. It is the Contractor's responsibility to plan for the testing procedure and to provide all necessary plugs, flanges and fittings, or to temporarily cap pipes to perform the tests.

END OF SECTION

SECTION 21 13 13

FIRE-PROTECTION – AUTOMATIC SPRINKLER SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide complete and operative Automatic Sprinkler System as shown and specified providing full coverage, including connection to existing mains and new piping and new heads to suit partitioning arrangements.
- B. System to provide coverage for exterior overhangs.

1.02 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Design, furnish and install the automatic sprinkler system to provide full coverage for all areas of the building where required by code, and including sprinklers for exposure protection where required by code.
 - 2. Base the piping system and arrangement of heads upon Architectural and Structural considerations. All pipe sizes and number of heads to be used for each area or room shall conform to the requirements of the CCR Title 24, California Buildings Standard Code, Section 904.
 - 3. Provide pendant position sprinkler heads at suspended ceilings and in upright position at all other locations.
 - 4. Where heads are located at suspended ceilings, spacing shall be as required by Standard 9-1 and the following:
 - a. Sprinkler heads shall be approximately equidistant between lights, between wall and lights, between lights and air diffusers, and between wall, lights and air diffusers.
 - b. Sprinkler heads shall be approximately centered in tiles in order to conform to Par. A.4.a above.
 - c. It shall be understood that Paragraph A.4.a and A.4.b may require more heads than would be required to satisfy the spacing allowed under the Code.
 - d. See Architectural reflected ceiling plans, but comply with codes for general design.
 - 5. Obtain water flow test data from authorities having jurisdiction to determine volume and pressure available from incoming water supply.
 - 6. Provide separate valved branch mains for exterior sprinklers. Each valved branch main shall not serve more than 10 heads. Valves shall be accessible for easy access in the event of a pipe or head failure.
 - 7. Provide sprinkler coverage for the cooling towers.
- B. Requirements of Regulatory Agencies: Type, size, arrangement and configuration shall be as approved by:
 - 1. Local Fire Marshal.
 - 2. OSHPD Fire Marshal.

3. State Fire Marshal.
- C. Reference Standards:
1. CCR California Code of Regulations
 - a. California Building Code
 - (1) Chapter 9
 - (2) Chapter 16
 2. UBC Uniform Building Code
 - a. Standard 9-1 - Design Installation and Acceptance of Automatic Sprinkler Systems.
 3. NFPA National Fire Protection Association
 - a. Pamphlet 13 - Installation of Sprinkler Systems.
 - b. Pamphlet 14 – Installation of Standpipe and Hose Systems.
 4. ASCE American Society of Civil Engineers
 - a. Standard 7-10 – Minimum Design Loads for Buildings and Other Structures
 - (1) Chapter 13 – Seismic Design Requirements for Non-Structural Components

1.03 SUBMITTALS

- A. Shop Drawings and Product Data:
1. Prior to obtaining approvals noted below, submit reflected ceiling scale drawings showing sprinkler heads in relation to lights, air diffusers, ceiling joints and tiles, speakers, TV outlets, and any other ceiling outlets or obstructions, to the Architect for Architect's review. Complete Shop Drawings shall incorporate revisions required by the Architect's review and shall then be submitted to the Fire Marshal.
 2. Shop drawings shall show the location of all sprinkler heads, piping, bracing, hangers and anchors and shall included all necessary working drawings showing complete details of the piping within the building.
 3. All drawings and calculations prepared by the Contractor shall be stamped by a professional engineer licensed in the State of California. Drawings and calculations submitted for review shall have been reviewed and approved by the Fire Marshal prior to commencement of any Work on the sprinkler system. Submit proof of these approvals.
- B. Product Data Shall Include, but Not be Limited to the Following:
1. Pipe, fittings and valves.
 2. Pipe hangers, supports and sway braces.
- C. Hydraulic Calculations: The sprinkler system shall be hydraulically calculated from the point of connection to the building fire service supply main to the most remote hydraulic area, for occupancy classification as required by NFPA-13.
- D. Sway bracing calculations and shop drawings.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pipe:
 - 1. See Section 221100.
- B. Valves: U.L. listed and F.M. approved.
 - 1. Gate - 2-Inch and Smaller: Outside screw and yoke, NIBCO T-104-0, Stockham, or equal, all bronze.
 - 2. Gate - 2-1/2-Inch and Larger: Outside screw and yoke, NIBCO F-607-0, Stockham, or equal, bronze mounted.
 - 3. Butterfly, 2-1/2 -inch and smaller, Milwaukee BB-SC100, Stockham, or equal.
 - 4. Butterfly, 3-Inch and Larger: wafer lug type body, 200 psi CWP, conforming to ASTM A-126 Class B cast iron, with field replaceable EPDM sleeve, aluminum bronze disc, 410 stainless steel stem, and EPDM O-ring stem seals. NIBCO, Stockham, or equal.
- C. Gauges: U.L. approved Marsh WO414, 3-1/2-inch dial. Equal by Weiss or Trerice.
- D. Pipe Escutcheons: Stamped steel, chrome plated, hinged, with set screw, Grinnell Fig. 13.
- E. Identification Signs: Enameled metal of the standard design adopted by the Automatic Sprinkler Industry.
- F. Sprinkler Heads: Standard type of the temperature rating required for various ceiling conditions. Provide heads with a wire screen guard at any location subject to mechanical injury. Provide upright or pendant type as conditions require with plain bronze finish and white enamel escutcheons. Provide recessed type sprinklers in finished areas, chrome plated, metal cover plate. Provide wax coated heads at exterior overhangs.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS FOR PIPING

- A. Connect to existing piping where shown.
- B. Whenever changes in sizes of pipe occur, make the change with reducing fittings as the use of bushings will not be permitted.
- C. Support and brace all piping from the building structure by means of hangers, inserts and other supports in accordance with the requirements of UBC Standard 9-1, California Building Code Chapter 16 and SECTION 210548: "NOISE, VIBRATION, AND SEISMIC CONTROL". Horizontal and vertical seismic design forces shall be calculated in accordance with ASCE 7-10, Chapter 13, using a Component Importance Factor (I_p) equal to 1.5, a Component Amplification Factor (a_p) of 2.5, and a Component Response Modification Factor (R_p) of 9.0 for welded and brazed pipe joints and 4.5 for threaded or grooved joints. However, in no case shall the horizontal force factor be less than 50% of the weight of the piping filled with water.
- D. Conceal all piping within the building construction except as shown otherwise and in spaces with no ceiling.

- E. Install all piping to maintain required headroom and to not interfere with operation or maintenance of equipment.
- F. Install system to provide for complete drainage and testing.
- G. Provide systems with identification signs specified or required by code.

3.02 FIELD QUALITY CONTROLS

- A. See also Section 21 11 00, Fire Protection Pipe and Pipe Fittings
- B. Automatic Sprinkler Piping: Upon completion and prior to acceptance of the installation subject the system to a hydrostatic test pressure of 200 psi for four (4) hours duration with no visible leakage. Remove and replace all defects due to materials or workmanship discovered during this test and retest after corrections have been made.
 - 1. Prior to this test, notify the Building and Fire Departments, the Architect and the Owner. Forty-eight (48) hour notification shall be provided.
- C. Upon completion of inspections and tests, complete and sign a "Contractor's Material and Test Certificate" and any witnesses to the tests. Submit the original of the completed certificate to the Owner's Representative prior to acceptance of the system.

END OF SECTION