

STATE OF NEW HAMPSHIRE
BUREAU OF PURCHASE AND PROPERTY
STATE HOUSE ANNEX - ROOM 102
25 CAPITOL ST
CONCORD NH 03301-6398

DATE: 9/1/2020

CONTRACT #: 8002748

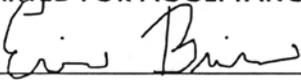
NIGP CODE: 934-0000

CONTRACT FOR: Plumbing and Pipefitting Services

CONTRACTOR: Alliance Group, Inc.

VENDOR CODE #: 216354

SUBMITTED FOR ACCEPTANCE BY:


ERICA BRISSON, PURCHASING AGENT
BUREAU OF PURCHASE AND PROPERTY

DATE 9/2/2020

RECOMMENDED FOR ACCEPTANCE BY:


PAUL RHODES, ADMINISTRATOR III
BUREAU OF PURCHASE AND PROPERTY

DATE 9/2/2020

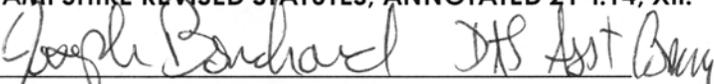
APPROVED FOR ACCEPTANCE BY:


GARY S. LUNETTA, DIRECTOR
DIVISION OF PROCUREMENT & SUPPORT SERVICES

Digitally signed by Gary S Lunetta
DN: cn=Gary S Lunetta, o=Department of Administrative Svs, ou=Division
of Procurement & Support Svs, email=Gary.Lunetta@das.nh.gov, c=US
Date: 2020.09.02 12:30:15 -0400

DATE

ACCEPTED FOR THE STATE OF NEW HAMPSHIRE UNDER THE AUTHORITY GRANTED TO ME BY NEW HAMPSHIRE REVISED STATUTES, ANNOTATED 21-I:14, XII.

for 
CHARLES M. ARLINGHAUS, COMMISSIONER
DEPARTMENT OF ADMINISTRATIVE SERVICES

DATE 9/2/20

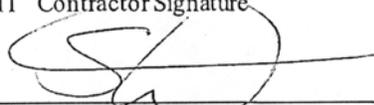
Notice: This agreement and all of its attachments shall become public upon submission to Governor and Executive Council for approval. Any information that is private, confidential or proprietary must be clearly identified to the agency and agreed to in writing prior to signing the contract.

AGREEMENT

The State of New Hampshire and the Contractor hereby mutually agree as follows:

GENERAL PROVISIONS

1. IDENTIFICATION.

1.1 State Agency Name State of New Hampshire Department of Administrative Services Bureau of Purchase and Property		1.2 State Agency Address State House Annex Room 102 25 Capitol Street Concord, NH 03301	
1.3 Contractor Name Alliance Group, Inc.		1.4 Contractor Address 6 David Drive, PO Box 666 Essex Junction, Vermont 05453	
1.5 Contractor Phone Number 802-864-4000	1.6 Account Number Various	1.7 Completion Date September 30, 2023	1.8 Price Limitation \$500,000.00
1.9 Contracting Officer for State Agency Erica Brisson		1.10 State Agency Telephone Number 603-271-7272	
1.11 Contractor Signature  Date: 8/19/2020		1.12 Name and Title of Contractor Signatory Steven Patraude, V.P.	
1.13 State Agency Signature  Date: 9/2/20		1.14 Name and Title of State Agency Signatory JOSEPH BOUTCHARD ASST. Charles M. Atlinghaus, Commissioner	
1.15 Approval by the N.H. Department of Administration, Division of Personnel (if applicable) By: _____ Director, On: _____			
1.16 Approval by the Attorney General (Form, Substance and Execution) (if applicable) By: _____ On: _____			
1.17 Approval by the Governor and Executive Council (if applicable) G&C Item number: _____ G&C Meeting Date: _____			

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2. SERVICES TO BE PERFORMED. The State of New Hampshire, acting through the agency identified in block 1.1 ("State"), engages contractor identified in block 1.3 ("Contractor") to perform, and the Contractor shall perform, the work or sale of goods, or both, identified and more particularly described in the attached EXHIBIT B which is incorporated herein by reference ("Services").

3. EFFECTIVE DATE/COMPLETION OF SERVICES.

3.1 Notwithstanding any provision of this Agreement to the contrary, and subject to the approval of the Governor and Executive Council of the State of New Hampshire, if applicable, this Agreement, and all obligations of the parties hereunder, shall become effective on the date the Governor and Executive Council approve this Agreement as indicated in block 1.17, unless no such approval is required, in which case the Agreement shall become effective on the date the Agreement is signed by the State Agency as shown in block 1.13 ("Effective Date").

3.2 If the Contractor commences the Services prior to the Effective Date, all Services performed by the Contractor prior to the Effective Date shall be performed at the sole risk of the Contractor, and in the event that this Agreement does not become effective, the State shall have no liability to the Contractor, including without limitation, any obligation to pay the Contractor for any costs incurred or Services performed. Contractor must complete all Services by the Completion Date specified in block 1.7.

4. CONDITIONAL NATURE OF AGREEMENT.

Notwithstanding any provision of this Agreement to the contrary, all obligations of the State hereunder, including, without limitation, the continuance of payments hereunder, are contingent upon the availability and continued appropriation of funds affected by any state or federal legislative or executive action that reduces, eliminates or otherwise modifies the appropriation or availability of funding for this Agreement and the Scope for Services provided in EXHIBIT B, in whole or in part. In no event shall the State be liable for any payments hereunder in excess of such available appropriated funds. In the event of a reduction or termination of appropriated funds, the State shall have the right to withhold payment until such funds become available, if ever, and shall have the right to reduce or terminate the Services under this Agreement immediately upon giving the Contractor notice of such reduction or termination. The State shall not be required to transfer funds from any other account or source to the Account identified in block 1.6 in the event funds in that Account are reduced or unavailable.

5. CONTRACT PRICE/PRICE LIMITATION/ PAYMENT.

5.1 The contract price, method of payment, and terms of payment are identified and more particularly described in EXHIBIT C which is incorporated herein by reference.

5.2 The payment by the State of the contract price shall be the only and the complete reimbursement to the Contractor for all expenses, of whatever nature incurred by the Contractor in the performance hereof, and shall be the only and the complete

compensation to the Contractor for the Services. The State shall have no liability to the Contractor other than the contract price.

5.3 The State reserves the right to offset from any amounts otherwise payable to the Contractor under this Agreement those liquidated amounts required or permitted by N.H. RSA 80:7 through RSA 80:7-c or any other provision of law.

5.4 Notwithstanding any provision in this Agreement to the contrary, and notwithstanding unexpected circumstances, in no event shall the total of all payments authorized, or actually made hereunder, exceed the Price Limitation set forth in block 1.8.

6. COMPLIANCE BY CONTRACTOR WITH LAWS AND REGULATIONS/ EQUAL EMPLOYMENT OPPORTUNITY.

6.1 In connection with the performance of the Services, the Contractor shall comply with all applicable statutes, laws, regulations, and orders of federal, state, county or municipal authorities which impose any obligation or duty upon the Contractor, including, but not limited to, civil rights and equal employment opportunity laws. In addition, if this Agreement is funded in any part by monies of the United States, the Contractor shall comply with all federal executive orders, rules, regulations and statutes, and with any rules, regulations and guidelines as the State or the United States issue to implement these regulations. The Contractor shall also comply with all applicable intellectual property laws.

6.2 During the term of this Agreement, the Contractor shall not discriminate against employees or applicants for employment because of race, color, religion, creed, age, sex, handicap, sexual orientation, or national origin and will take affirmative action to prevent such discrimination.

6.3. The Contractor agrees to permit the State or United States access to any of the Contractor's books, records and accounts for the purpose of ascertaining compliance with all rules, regulations and orders, and the covenants, terms and conditions of this Agreement.

7. PERSONNEL.

7.1 The Contractor shall at its own expense provide all personnel necessary to perform the Services. The Contractor warrants that all personnel engaged in the Services shall be qualified to perform the Services, and shall be properly licensed and otherwise authorized to do so under all applicable laws.

7.2 Unless otherwise authorized in writing, during the term of this Agreement, and for a period of six (6) months after the Completion Date in block 1.7, the Contractor shall not hire, and shall not permit any subcontractor or other person, firm or corporation with whom it is engaged in a combined effort to perform the Services to hire, any person who is a State employee or official, who is materially involved in the procurement, administration or performance of this Agreement. This provision shall survive termination of this Agreement.

7.3 The Contracting Officer specified in block 1.9, or his or her successor, shall be the State's representative. In the event of any dispute concerning the interpretation of this Agreement, the Contracting Officer's decision shall be final for the State.

8. EVENT OF DEFAULT/REMEDIES.

8.1 Any one or more of the following acts or omissions of the Contractor shall constitute an event of default hereunder (“Event of Default”):

- 8.1.1 failure to perform the Services satisfactorily or on schedule;
- 8.1.2 failure to submit any report required hereunder; and/or
- 8.1.3 failure to perform any other covenant, term or condition of this Agreement.

8.2 Upon the occurrence of any Event of Default, the State may take any one, or more, or all, of the following actions:

8.2.1 give the Contractor a written notice specifying the Event of Default and requiring it to be remedied within, in the absence of a greater or lesser specification of time, thirty (30) days from the date of the notice; and if the Event of Default is not timely cured, terminate this Agreement, effective two (2) days after giving the Contractor notice of termination;

8.2.2 give the Contractor a written notice specifying the Event of Default and suspending all payments to be made under this Agreement and ordering that the portion of the contract price which would otherwise accrue to the Contractor during the period from the date of such notice until such time as the State determines that the Contractor has cured the Event of Default shall never be paid to the Contractor;

8.2.3 give the Contractor a written notice specifying the Event of Default and set off against any other obligations the State may owe to the Contractor any damages the State suffers by reason of any Event of Default; and/or

8.2.4 give the Contractor a written notice specifying the Event of Default, treat the Agreement as breached, terminate the Agreement and pursue any of its remedies at law or in equity, or both.

8.3. No failure by the State to enforce any provisions hereof after any Event of Default shall be deemed a waiver of its rights with regard to that Event of Default, or any subsequent Event of Default. No express failure to enforce any Event of Default shall be deemed a waiver of the right of the State to enforce each and all of the provisions hereof upon any further or other Event of Default on the part of the Contractor.

9. TERMINATION.

9.1 Notwithstanding paragraph 8, the State may, at its sole discretion, terminate the Agreement for any reason, in whole or in part, by thirty (30) days written notice to the Contractor that the State is exercising its option to terminate the Agreement.

9.2 In the event of an early termination of this Agreement for any reason other than the completion of the Services, the Contractor shall, at the State’s discretion, deliver to the Contracting Officer, not later than fifteen (15) days after the date of termination, a report (“Termination Report”) describing in detail all Services performed, and the contract price earned, to and including the date of termination. The form, subject matter, content, and number of copies of the Termination Report shall be identical to those of any Final Report described in the attached EXHIBIT B. In addition, at the State’s discretion, the Contractor shall, within 15 days of notice of early termination, develop and

submit to the State a Transition Plan for services under the Agreement.

10. DATA/ACCESS/CONFIDENTIALITY/PRESERVATION.

10.1 As used in this Agreement, the word “data” shall mean all information and things developed or obtained during the performance of, or acquired or developed by reason of, this Agreement, including, but not limited to, all studies, reports, files, formulae, surveys, maps, charts, sound recordings, video recordings, pictorial reproductions, drawings, analyses, graphic representations, computer programs, computer printouts, notes, letters, memoranda, papers, and documents, all whether finished or unfinished.

10.2 All data and any property which has been received from the State or purchased with funds provided for that purpose under this Agreement, shall be the property of the State, and shall be returned to the State upon demand or upon termination of this Agreement for any reason.

10.3 Confidentiality of data shall be governed by N.H. RSA chapter 91-A or other existing law. Disclosure of data requires prior written approval of the State.

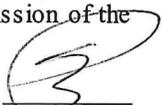
11. CONTRACTOR’S RELATION TO THE STATE. In the performance of this Agreement the Contractor is in all respects an independent contractor, and is neither an agent nor an employee of the State. Neither the Contractor nor any of its officers, employees, agents or members shall have authority to bind the State or receive any benefits, workers’ compensation or other emoluments provided by the State to its employees.

12. ASSIGNMENT/DELEGATION/SUBCONTRACTS.

12.1 The Contractor shall not assign, or otherwise transfer any interest in this Agreement without the prior written notice, which shall be provided to the State at least fifteen (15) days prior to the assignment, and a written consent of the State. For purposes of this paragraph, a Change of Control shall constitute assignment. “Change of Control” means (a) merger, consolidation, or a transaction or series of related transactions in which a third party, together with its affiliates, becomes the direct or indirect owner of fifty percent (50%) or more of the voting shares or similar equity interests, or combined voting power of the Contractor, or (b) the sale of all or substantially all of the assets of the Contractor.

12.2 None of the Services shall be subcontracted by the Contractor without prior written notice and consent of the State. The State is entitled to copies of all subcontracts and assignment agreements and shall not be bound by any provisions contained in a subcontract or an assignment agreement to which it is not a party.

13. INDEMNIFICATION. Unless otherwise exempted by law, the Contractor shall indemnify and hold harmless the State, its officers and employees, from and against any and all claims, liabilities and costs for any personal injury or property damages, patent or copyright infringement, or other claims asserted against the State, its officers or employees, which arise out of (or which may be claimed to arise out of) the acts or omission of the

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Contractor, or subcontractors, including but not limited to the negligence, reckless or intentional conduct. The State shall not be liable for any costs incurred by the Contractor arising under this paragraph 13. Notwithstanding the foregoing, nothing herein contained shall be deemed to constitute a waiver of the sovereign immunity of the State, which immunity is hereby reserved to the State. This covenant in paragraph 13 shall survive the termination of this Agreement.

14. INSURANCE

14.1 The Contractor shall, at its sole expense, obtain and continuously maintain in force, and shall require any subcontractor or assignee to obtain and maintain in force, the following insurance:

14.1.1 commercial general liability insurance against all claims of bodily injury, death or property damage, in amounts of not less than \$1,000,000 per occurrence and \$2,000,000 aggregate or excess; and

14.1.2 special cause of loss coverage form covering all property subject to subparagraph 10.2 herein, in an amount not less than 80% of the whole replacement value of the property.

14.2 The policies described in subparagraph 14.1 herein shall be on policy forms and endorsements approved for use in the State of New Hampshire by the N.H. Department of Insurance, and issued by insurers licensed in the State of New Hampshire.

14.3 The Contractor shall furnish to the Contracting Officer identified in block 1.9, or his or her successor, a certificate(s) of insurance for all insurance required under this Agreement. Contractor shall also furnish to the Contracting Officer identified in block 1.9, or his or her successor, certificate(s) of insurance for all renewal(s) of insurance required under this Agreement no later than ten (10) days prior to the expiration date of each insurance policy. The certificate(s) of insurance and any renewals thereof shall be attached and are incorporated herein by reference.

15. WORKERS' COMPENSATION.

15.1 By signing this agreement, the Contractor agrees, certifies and warrants that the Contractor is in compliance with or exempt from, the requirements of N.H. RSA chapter 281-A (*"Workers' Compensation"*).

15.2 To the extent the Contractor is subject to the requirements of N.H. RSA chapter 281-A, Contractor shall maintain, and require any subcontractor or assignee to secure and maintain, payment of Workers' Compensation in connection with activities which the person proposes to undertake pursuant to this Agreement. The Contractor shall furnish the Contracting Officer identified in block 1.9, or his or her successor, proof of Workers' Compensation in the manner described in N.H. RSA chapter 281-A and any applicable renewal(s) thereof, which shall be attached and are incorporated herein by reference. The State shall not be responsible for payment of any Workers' Compensation premiums or for any other claim or benefit for Contractor, or any subcontractor or employee of Contractor, which might arise under applicable State of New Hampshire Workers' Compensation laws in connection with the performance of the Services under this Agreement.

16. NOTICE. Any notice by a party hereto to the other party shall be deemed to have been duly delivered or given at the time of mailing by certified mail, postage prepaid, in a United States Post Office addressed to the parties at the addresses given in blocks 1.2 and 1.4, herein.

17. AMENDMENT. This Agreement may be amended, waived or discharged only by an instrument in writing signed by the parties hereto and only after approval of such amendment, waiver or discharge by the Governor and Executive Council of the State of New Hampshire unless no such approval is required under the circumstances pursuant to State law, rule or policy.

18. CHOICE OF LAW AND FORUM. This Agreement shall be governed, interpreted and construed in accordance with the laws of the State of New Hampshire, and is binding upon and inures to the benefit of the parties and their respective successors and assigns. The wording used in this Agreement is the wording chosen by the parties to express their mutual intent, and no rule of construction shall be applied against or in favor of any party. Any actions arising out of this Agreement shall be brought and maintained in New Hampshire Superior Court which shall have exclusive jurisdiction thereof.

19. CONFLICTING TERMS. In the event of a conflict between the terms of this P-37 form (as modified in EXHIBIT A) and/or attachments and amendment thereof, the terms of the P-37 (as modified in EXHIBIT A) shall control.

20. THIRD PARTIES. The parties hereto do not intend to benefit any third parties and this Agreement shall not be construed to confer any such benefit.

21. HEADINGS. The headings throughout the Agreement are for reference purposes only, and the words contained therein shall in no way be held to explain, modify, amplify or aid in the interpretation, construction or meaning of the provisions of this Agreement.

22. SPECIAL PROVISIONS. Additional or modifying provisions set forth in the attached EXHIBIT A are incorporated herein by reference.

23. SEVERABILITY. In the event any of the provisions of this Agreement are held by a court of competent jurisdiction to be contrary to any state or federal law, the remaining provisions of this Agreement will remain in full force and effect.

24. ENTIRE AGREEMENT. This Agreement, which may be executed in a number of counterparts, each of which shall be deemed an original, constitutes the entire agreement and understanding between the parties, and supersedes all prior agreements and understandings with respect to the subject matter hereof.

EXHIBIT A
SPECIAL PROVISIONS

There are no special provisions of this contract.

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**EXHIBIT B
SCOPE OF SERVICES**

1. INTRODUCTION

Alliance Group, Inc. (hereinafter referred to as the "Contractor") hereby agrees to provide the State of New Hampshire (hereinafter referred to as the "State"), with Plumbing and Pipefitting Services in accordance with the bid submission in response to State Request for Bid #2322-21 and as described herein.

2. CONTRACT DOCUMENTS

This Contract consists of the following documents ("Contract Documents"):

- a. State of New Hampshire Terms and Conditions, General Provisions Form P-37
- b. EXHIBIT A Special Provisions
- c. EXHIBIT B Scope of Services
- d. EXHIBIT C Method of Payment
- e. EXHIBIT D RFB 2322-21

In the event of any conflict among the terms or provisions of the documents listed above, the following order of priority shall indicate which documents control: (1) EXHIBIT A "Special Provisions," (2) Form Number P-37, (3) EXHIBIT B "Scope of Services," (4) EXHIBIT C "Method of Payment," and (5) EXHIBIT D "RFB 2322-21."

3. TERM OF CONTRACT

This contract shall commence upon execution by the Commissioner of Administrative Services and shall continue thereafter for a period of approximately three (3) years.

The Contract may be extended for two (2) additional one-year extension terms thereafter upon the same terms, conditions and pricing structure with the approval of the Commissioner of the Department of Administrative Services.

The maximum term of the Contract (including all extensions) cannot exceed five (5) years.

4. SCOPE OF WORK

The Contractor shall provide all supervision, labor, materials, transportation, tools, equipment, construction equipment and machinery necessary to satisfactorily complete the Plumbing and Pipefitting Services as identified herein.

The Plumbing and Pipefitting services shall include, but are not limited to, the following:

- a) Installation and repair of plumbing fixtures
- b) Installation and repair of water supply and distribution piping
- c) Installation and repair of water heaters: gas, electric, solar and others
- d) Installation and repair of backflow prevention devices

- e) Installation and repair water pumps, tanks and systems
- f) Installation and repair drainage, waste and vent piping
- g) Installation and repair sewer and dewatering pump systems
- h) Installation and repair process piping and air distribution systems
- i) Installation and service of gas equipment
- j) Installation and service of gas piping, both natural gas and propane, and appliances
- k) Clean, trace and inspect drain lines
- l) Drain cleaning, jetting, pump station repair and installation
- m) Perform work on electrical, electronic and pneumatic control systems associated with plumbing systems. This may include subcontracting with a company that has access to any proprietary systems
- n) Install heating and cooling systems such as steam, hot water, forced air and others
- o) Perform all work associated with pipefitting systems and materials
- p) Other installations, repairs and maintenance work commonly performed by a plumbing and pipefitting contractor

Individual projects are not to exceed \$25,000 including all costs associated with any individual project, including supervision, labor, material, equipment, construction equipment, machinery and supplies etc.

A Request for Quote (RFQ) and Statement of Work (SOW) shall be issued to each contractor. The Individual projects shall be awarded to the contractor with the lowest not to exceed quotes based on contract rates meeting the RFQ/SOW requirements. Emergency plumbing repair projects will be based upon the Emergency/Repair Rates specified by the Contractor in Exhibit C.

For emergency projects requiring immediate attention, the Contractor shall work on a Time and Materials basis subject to review and approval by the by the requesting supervisor or manager. Agency will provide a brief summary of the emergency and select the contractor who can be on site the soonest.

All work performed under this Contract shall be scheduled by the requesting supervisor or manager.

Unless the Contractor is directed differently by the requesting project supervisor or manager, all materials, parts, and work shall be in compliance with specifications as detailed in Appendix A

All materials and supplies shall be invoiced at a markup not to exceed 10% over Contractor's cost. A detailed receipt shall accompany each invoice.

For Plumbing and Pipefitting Services issued on a fixed price basis, the following information is required on all invoices:

Description of the project; Time frame indicated of when work was performed; Copy of original quote submitted to Project Manager; Provide supporting documentation of material costs and or subcontractor costs, not to exceed 10% mark up.

For Emergency Plumbing and Pipefitting Repair Services awarded on a Time and Material basis, the following additional information must be included on all invoices:

Description of the Work Number of hours per person worked including copies of time sheets; Copies of original receipts for all materials purchased, not to exceed 10% mark up, or costs incurred as a result of the scope of work.

Invoices must be submitted to the State by the Contractor at the rates listed in Exhibit C. If additional equipment is required beyond the equipment listed in the contract, they must be procured and billed to the project subject to prior approval of the Project Manager. All materials shall be invoiced not exceed 10% over the Contractor's cost. Contractor's typical working hours under the contract will range from 7:00 AM and 5:00 PM Monday through Friday, but occasions may arise which would require work to be performed before or after these hours, on weekends, or holidays. The typical working hours may vary by the type of facility or the operational needs of the State agency where work is being performed, and will be established in the RFQ/SOW of each project.

The Contractor shall notify the requesting State agency supervisor or manager of any maintenance related issues that are discovered while performing services.

Permits are required for new and renovation construction based on the provisions of the current NH State Building Code and applicable amendments. For further information:

<https://www.nh.gov/safety/divisions/firesafety/building/state-building-permit-system.html>

The Contractor shall be responsible for obtaining permits, scheduling inspections, and being on site during inspection. The State agencies shall be invoiced for the permit, at no markup, as part of the services. The permit cost will be itemized on the detailed invoice at completion of work

The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the work.

The Contractor shall initiate, maintain and supervise all safety precautions and programs in connection with the work. The Contractor shall utilize lock out tag out services on plumbing systems in support of their construction or repair services. The person responsible for applying their lock or tag to isolate the system(s) shall have their name, company and contact number attached to the lock or written on the tag. The Contractor shall coordinate with the State Project Manager before effecting any systems.

The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to: a) All employees of the work and all other persons who may be affected thereby; b) all the work and all materials and equipment to be incorporated therein, whether in storage on or off-the site, under the care; custody or control of the Contractor or any of their subcontractor(s); and c) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavement, roadway structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.

The Contractor shall erect and maintain; as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

The Contractor shall provide and maintain; as required any traffic control measures to ensure safety to employees and the public.

The Contractor shall also be aware of laws and regulations relating to hazardous materials that may be encountered during construction operations. The health and safety of employees, the general public, and the potential of damage to the overall environment is possible if hazardous materials are not recognized, reported, and the appropriate action taken to dispose of, remove from the site, or otherwise contain the possible contaminants.

If any abnormal condition is encountered or exposed that indicates the presence of a hazardous material or toxic waste, construction operations shall be immediately suspended in the project area and the Project Manager notified. No further work shall be conducted in the area of the contaminated material until the site has been investigated and the State has given approval to continue the work in the area. The Contractor shall fully cooperate with the State and perform any remedial work as directed. Work shall continue in other areas of the Project unless otherwise directed.

The Contractor shall provide adequate supervision of their employees to ensure complete and satisfactory performance of all work in accordance with the terms of the contract.

The Contractor shall pre-mark areas of any intended excavation in accordance with NH PUC 806 and notify NH Dig Safe. The Contractor shall comply with all NH Public Utilities 800, Underground Utility Damage Prevention Program Rules.

The Contractor shall make service available twenty-four hours per day, seven days per week for emergency plumbing repair services. The Contractor shall provide one (1) dispatch telephone number or other electronic means of communicating that shall be available 24/7 for emergencies.

The Contractor shall execute the work by methods that minimize raising dust from construction operations. The Contractor shall provide positive means to prevent air borne dust from dispersing into the atmosphere.

The Contractor shall provide methods, means, and facilities to minimize noise from demolition and noise produced by construction operations.

The Contractor shall provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

The Contractor shall comply with pollution and environmental control requirements of authorities having jurisdiction.

The Contractor shall employ sufficient number of trained personnel so that all request for plumbing repair service calls are answered within the required time limitations.

The Contractor shall provide high quality technicians with adequate training to resolve all the inspections or repair issues encountered. All technicians used by the contractor in contract performance must be licensed plumbers and pipefitters & Gasfitters (as appropriate for the work) for the State of New Hampshire.

The Contractor shall respond by phone or other electronic device to all non-emergency plumbing repair service calls within eight (8) hours after report of occurrence.

The Contractor shall respond by phone or other electronic device to all emergency plumbing repair service calls within fifteen (15) minutes of reported occurrence. The Contractor shall physically respond to the site within four (4) hours of receipt of notification from the State.

The Contractor's equipment shall be the size and type appropriate for completing the various types of plumbing work. The Contractor shall ensure that any equipment considered by the Project manager or supervisor to be improper or inadequate for the purpose is removed from the site and replaced with satisfactory equipment.

The Contractor shall ensure that all materials shall be of the best quality, all work is completed in a professional manner, and all aspects of the project are delivered in good working order, complete and perfect in every respect. All materials and equipment shall be new unless otherwise specified and all plumbing and pipefitting services shall be good quality free from faults and defects.

The State shall require correction of defective work or damages to any part of a building or its appurtenances when caused by the Contractor's employees, equipment or supplies. The Contractor shall replace in satisfactory condition all defective work and damages rendered thereby or any other damages incurred. Upon failure of the Contractor to proceed promptly with the necessary corrections, the State may withhold any amount necessary to correct all defective work or damages from payments to the Contractor.

The Contractor shall keep the premises free from accumulation of waste materials or rubbish. At the completion of the project they shall remove all their waste materials and rubbish from and about the project as well as all their tools, construction equipment, machinery any surplus materials and shall leave the premises in a clean and satisfactory condition at all times.

The Contractor shall supervise and direct the work, using their best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portion of the work. All aspects of the project shall be subject to the inspection and approval of the State. The Contractor guarantees to repair, replace, re-execute or otherwise correct any defect in workmanship, materials, of the like that fails to conform to the requirements of the State, or that appear during the progress of the work or within one year of final acceptance by the State.

The Contractor shall be responsible to the State for the acts and omissions of their employees, subcontractors and their agents and employees and other persons performing any of the work under a contract.

The Contractor shall acquaint themselves with the limits of the property or right-of-way of the State and shall not trespass on other property. The Contractor shall adequately protect the project, adjacent property and the public, and shall be responsible for any damage or injury due to the Contractor's act or neglect, and shall save the State harmless in respect thereto.

All work shall be done in such a manner as not to interfere with the State's operating functions. The Contractor and their employees shall familiarize themselves and comply with all rules and regulations applicable to each project.

The work staff shall consist of qualified persons completely familiar with the products and equipment they shall use. The Contracting Officer may require the Contractor to dismiss from the work such employees as deems incompetent, careless, insubordinate, or otherwise objectionable, or whose



continued employment on the work is deemed to be contrary to the public interest or inconsistent with the best interest of security and the State.

The Contractor or their personnel shall not represent themselves as employees or agents of the State.

While on State property, employees shall be subject to the control of the State, but under no circumstances shall such persons be deemed to be employees of the State.

All personnel shall observe all regulations or special restrictions in effect at the State Agency.

The Contractor shall have a minimum of three years' experience completing plumbing and pipefitting services as described herein.

Proof of plumbing license(s) shall be made available upon request of the Contractor and their employees.

The Contractor shall not commence work until a conference is held with each State agency intending to utilize the Contractor's services, at which representatives of the Contractor and the State are present. The conference will be arranged by the State agency.

Itemized invoices shall be submitted to the individual agency after the completion of the job/services and shall include a brief description of the work done along with the location of work.

Contractor shall be paid within 30 days after receipt of properly documented invoice and acceptance of the work to the State's satisfaction.

The invoice shall be sent to the address of the using agency under agreement.

If sub-contractors are to be utilized, Contractor shall provide information regarding the proposed sub-contractors including the name of the company, their address, contact person and three references for clients they are currently servicing. Approval by the State must be received prior to a sub-contractor starting any work.

5. TERMINATION

The State of New Hampshire has the right to terminate the contract at any time by giving the Contractor thirty (30) days advance written notice.

6. OBLIGATIONS AND LIABILITY OF THE CONTRACTOR

The Contractor shall provide all services strictly pursuant to, and in conformity with, the specifications described in State RFB #2239-21 as described herein, and under the terms of this Contract.

The Contractor shall agree to hold the State of NH harmless from liability arising out of injuries or damage caused while performing this work. The Contractor shall agree that any damage to building(s), materials, equipment or other property during the performance of the service shall be repaired at its own expense, to the State's satisfaction.

7. DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS

The Contractor certifies, by signature of this contract, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal Department or Agency.

8. INSURANCE

Certificate of insurance amounts must be met and maintained throughout the term of the contract and any extensions as per the P-37, section 14 and cannot be cancelled or modified until the State receives a 10 day prior written notice.

9. CONFIDENTIALITY & CRIMINAL RECORD

If requested by the using agency, the Contractor and its employees, and Sub-Contractors (if any), shall be required to sign and submit a Confidential Nature of Department Records Form and a Criminal Authorization Records Form. These forms shall be submitted to the individual using agency prior to the start of any work.

Contractor Initials 
Date 8/19/2020

**EXHIBIT C
METHOD OF PAYMENT**

1. CONTRACT PRICE

The Contractor hereby agrees to provide plumbing and pipe fitting services in complete compliance with the terms and conditions specified in Exhibit B for an amount up to and not to exceed a price of \$500,000.00; this figure shall not be considered a guaranteed or minimum figure; however it shall be considered a maximum figure from the effective date through the expiration date as indicated in Form P-37 Block 1.7.

2. PRICING STRUCTURE

HILLSBOROUGH, MERRIMACK, SULLIVAN, BELKNAP & GRAFTON COUNTIES				
Description	Monday - Friday 7 AM to 5 PM	Monday - Friday 5:01 PM to 6:59 AM	Saturday	Sunday & Holidays
Master Plumber	\$89.00 per hour	\$133.50 per hour	\$133.50 per hour	\$178.00 per hour
Journeyman Plumber	\$89.00 per hour	\$133.50 per hour	\$133.50 per hour	\$178.00 per hour
Apprentice Plumber	\$79.00 per hour	\$118.50 per hour	\$118.50 per hour	\$158.00 per hour

3. PRICING QUOTATIONS FOR INDIVIDUAL PROJECTS

State will request quotations by providing a RFQ/SOW describing the services required and the applicable technical qualifications. Contractor must return quotes within three (3) business days, or as otherwise specified in the RFQ/SOW. The quoted hourly rates shall not exceed the rates established under this contract. The RFQ/SOW shall be issued to all Contractors under this contract for a quote. The project engagement will be based upon the lowest cost qualified quote.

4. PAYMENT

Payments may be made via ACH. Use the following link to enroll with the State Treasury for ACH payments: <https://www.nh.gov/treasury>

Contractor Initials 
Date 8/19/2020

EXHIBIT D

RFB #2322-21 is incorporated here within.

Contractor Initials 
Date 8/19/2020

State of New Hampshire

Department of State

CERTIFICATE

I, William M. Gardner, Secretary of State of the State of New Hampshire, do hereby certify that ALLIANCE GROUP INC. is a Vermont Profit Corporation registered to transact business in New Hampshire on June 22, 2015. I further certify that all fees and documents required by the Secretary of State's office have been received and is in good standing as far as this office is concerned.

Business ID: **728145**

Certificate Number: **0004964144**



IN TESTIMONY WHEREOF,

I hereto set my hand and cause to be affixed
the Seal of the State of New Hampshire,
this 23rd day of July A.D. 2020.

A handwritten signature in cursive script, appearing to read "Wm Gardner".

William M. Gardner
Secretary of State

Certificate of Authority # 1

(Corporation, Non-Profit Corporation)

Corporate Resolution

I, Shawn Patnaude, hereby certify that I am duly elected Clerk/Secretary/Officer of
(Name)

Alliance Group Inc. I hereby certify the following is a true copy of a vote taken at
(Name of Corporation)

a meeting of the Board of Directors/shareholders, duly called and held on August 7, 2020
at which a quorum of the Directors/shareholders were present and voting.

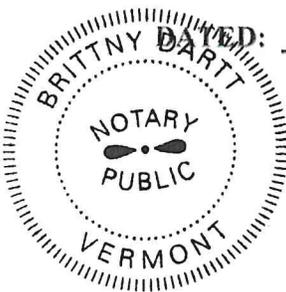
VOTED: That Shawn Patnaude (V.P.) (may list more than one person) is
(Name and Title)

duly authorized to enter into contracts or agreements on behalf of

Alliance Group Inc. with the State of New Hampshire and any of
(Name of Corporation)

its agencies or departments and further is authorized to execute any documents
which may in his/her judgment be desirable or necessary to effect the purpose of
this vote.

I hereby certify that said vote has not been amended or repealed and remains in full force
and effect as of the date of the contract to which this certificate is attached. This authority
remains valid for thirty (30) days from the date of this Corporate Resolution. I further certify
that it is understood that the State of New Hampshire will rely on this certificate as evidence that
the person(s) listed above currently occupy the position(s) indicated and that they have full
authority to bind the corporation. To the extent that there are any limits on the authority of any
listed individual to bind the corporation in contracts with the State of New Hampshire, all such
limitations are expressly stated herein.



DATED: 8/20/20

[Signature]
Exp. 1/31/21
Chittenden County

ATTEST: Shawn Patnaude, Project Manager
(Name & Title)

SECTION 01 4000

PIPE AND MANHOLE LEAKAGE TESTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section covers the requirements for performing leakage tests on water and sewer pipelines, manholes, steam vaults, and appurtenances, and is one of the several bases for acceptance of the Work.
- B. All pressure pipes, non-pressure pipes, sanitary manholes, steam vaults, and appurtenances shall be tested for leakage.
- C. Testing for mechanical steam piping systems is covered in other sections.

1.02 QUALITY ASSURANCE

- A. Prior to final acceptance of the Work, all pressure pipes, non-pressure pipes, sanitary manholes, and appurtenances shall meet specific leakage requirements. These leakage requirements must be satisfied by the basic materials alone. Where joint fillers and the like have been specified, primarily to protect jointing materials, and secondarily to provide a factor of safety, they shall not be applied until after leakage tests have been completed and have been accepted by State Project Manager.
- B. Every test must be witnessed by State Project Manager and any test not so witnessed will be considered as not having been performed. Contractor shall pretest the Work and shall not request State Project Manager to witness the final test until they are reasonably certain that the test will yield results within the acceptable limits.

1.03 SEQUENCING AND SCHEDULING

- A. Notify State Project Manager at least 48 hours in advance of a scheduled test so that the test may be witnessed.

PART 2 MATERIALS

2.01 TESTING APPARATUS

- A. Provide all labor, pumps, plugs, measuring equipment and other apparatus, complete, and as required to perform all testing.
- B. Provide clean water, air, nitrogen and other materials as required to accomplish all testing.
- C. Provide plugs and caps capable of withstanding the test pressures.
- D. Provide all temporary flanges, plugs, bulkheads, thrust blocks, weighting, bracing and other items necessary to prevent joints from separating, and to prevent any injuries or damage.
- E. Monitoring air pressure gauge shall have a range of 0-10 psi, divisions of 0.10 psi, and accuracy of 0.05 psi+.

PART 3 EXECUTION

3.01 PREPARATION

- A. Manhole and Steam Vault Inspections - Given ample notice, State Project Manager will conduct their inspection of manholes prior to the performance of leakage tests. If the inspections are not completed before leakage testing, and subsequent modifications are made to a manhole, the manhole shall be retested for leakage.
- B. Bracing Pressure Piping - Plug open ends, adequately block bends, tees, ends, and other fittings, and do whatever is necessary to brace the piping system so that it will safely withstand the pressures developed under the tests and so that no damage or injury will occur to the pipeline, people or property.
- C. Protection - Before tests are conducted, isolate or remove any regulator, gauge, trap, or other apparatus or equipment which may be damaged by test pressures.
- D. Flushing - Flush all piping systems, except air piping, with water prior to testing.

3.02 GENERAL

- A. Trapped Air - Trapped air may cause a false indication of the rate of leakage during exfiltration testing. Points of concern include ends of lines, stubs, house connections and high points in pipe lines. No credit will be made for this condition and no adjustment will be made to the allowable leakage. Where trapped air is suspected of causing a test failure, do whatever is necessary to evacuate the air and repeat the tests until the actual leakage is equal to or less than the allowable rate of leakage.
- B. Water Absorption - No credit will be given for absorption of water in pipe and manhole walls. If necessary, fill pipes and manholes with water well in advance of exfiltration testing and allow them to soak in order to eliminate or minimize the effects of absorption.

3.03 TESTS FOR NON-PRESSURE PIPING (EXCEPT STORM DRAINS)

- A. General
 - 1. Leakage shall be determined by air testing or exfiltration testing. State Project Manager reserves the right to require infiltration testing.
 - 2. Leakage testing shall include the main non-pressure pipe, new house connections, and all other appurtenances on the section of pipeline being tested.
 - 3. Generally limit pipeline test sections to runs between adjacent structures. Manholes may be tested simultaneously with pipes when using exfiltration testing.
 - 4. Adequately plug ends of all house connections, stubs and all other openings from which air or water may escape.
 - 5. Use clean water for exfiltration tests.
 - 6. All pipe trenches shall be backfilled prior to performing testing procedures.
- B. Exfiltration Test on Pipes Only
 - 1. The minimum water level required for testing is the higher of either 4' above the crown of the upstream (highest) end of the pipe being tested or 4' above the maximum groundwater level along the test section. Where such a water level will be more than 25 feet above the lowest

point in the Section being tested, the Project Manager will prescribe test modifications or require that other methods of testing be utilized.

2. Install a watertight plug in the downstream end and a watertight plug in the upstream end fitted with a 2" diameter, clear rigid tube installed in a vertical position to facilitate observation of water levels. Tube shall be long enough to obtain the required head and made of extruded Lucite acrylic, Polycarbonate (Lexan), Tenite butyrate or other plastic material. Glass is unacceptable.
3. Fill pipe with water and let stand for at least four (4) hours and conduct test. Adjust water to reference mark, then continually add water from a graduated container to keep water in tube at a constant level for 60 minutes.
4. Upon satisfactorily completing the test, remove the downstream plug in the presence of Engineer. Do not touch nor remove the upstream plug until approved by State Project Manager.
5. Allowable exfiltration is 100 gallons/day/inch diameter/mile of pipe.

C. Exfiltration Testing of Pipelines and Manholes

1. Lower groundwater table to below the bottom of the manhole. Install a watertight plug in the pipe at a downstream manhole and another watertight plug(s) in the incoming pipe(s) in the upstream manhole. Fill upstream manhole until water reaches its highest point without overflowing.
2. More than one manhole may be included in a test section, provided that when the lowest manhole is filled, the water level in the other manholes is at least 2' above the highest manhole joint, and the pipe is subjected to at least a 4' differential hydrostatic pressure.
3. Allow at least 4 hours for stabilization. Conduct the test for a minimum of 6 hours. Allowable exfiltration is the allowable pipe exfiltration as specified in subsection 3.03.B.5 plus the allowable manhole exfiltration as specified in Subsection 3.05 E.

D. Infiltration Test

1. The minimum head of groundwater required for infiltration testing is 4' above the crown of the pipe at the upstream end.
2. Infiltration may be measured with an approved graduated container capable of intercepting all inflow, by a pipeline V-notch weir, or by other approved methods. When using instream type measuring devices, do not measure flows until steady state conditions are established.
3. Allowable infiltration is same as allowable exfiltration test as specified in Subsection 3.03 B.5.
4. Where groundwater level is at least 2' above the highest manhole joint, manholes may be included in the test. No visible leakage will be permitted in manholes.

E. Air Testing-Pipes Only

1. Install tapped plug at air inlet and airtight plugs at other ends of test section.
2. Connect air supply equipment to tapped plug and fill slowly until a constant pressure of 3.5 psig is maintained.

3. Maintain pressure above 3.0 psig for at least 5 minutes for stabilization of the temperature. Check plugs for leaks.
4. Adjust pressure to 3.5 psig and disconnect air supply.
5. Begin timing pressure drop at 3.0 psig and record time interval for the pressure to drop to 2.5 psig.
6. Increase above pressures 0.5 psig for each foot groundwater is above the lowest invert of the pipe.
7. Minimum time for pressure drop of 0.5 psig shall be 75 seconds per inch diameter.
8. Contractor may conduct water test if air test fails.

3.04 TESTS FOR PRESSURE PIPES

A. General

1. Leakage testing shall include the main pressure pipe, service connections, and all other appurtenances on the section of pipeline being tested.
2. All pipes shall be tested prior to applying insulation and before they are concealed or furred-in.
3. Provide all necessary gauges. Gauges shall be standard pressure type with a minimum 6" diameter dial and a pressure range not in excess of 150% of the maximum required test pressure.
4. Provide and maintain at the site a gauge stand with an approved laboratory calibrated test gauge. Periodically check test gauges used for testing against the test gauge, and whenever requested by Engineer.
5. Where it is absolutely necessary for testing, tap pipes and insert approved plugs after testing is completed. Install air release valves at high points for water testing if hydrants or blowoffs are not available.
6. Provide a hand or motor driven pump to maintain the required test pressure constant throughout the duration of the test. If a water pump is used, install water meter on supply side of pump. If an air or inert gas pump is used, leakage shall be determined and calculated by the cycling of the pump.
7. All concrete thrust blocks and restraints shall be in place and cured at least 7 days.
8. All buried pipe shall be backfilled.
9. All water main testing shall be in accordance with the requirements of AWWA Standard C600.

B. Nongaseous Pipe Hydrostatic Test

1. Open all air release valves and fill pipe with water at a rate not to exceed venting capacity of the valves.
2. Raise pressure to 150 percent of the highest working pressure, or 100 psig, whichever is greater, adjusted to lowest point of the test section. Maintain a minimum of 125 percent of the

working pressure at the highest point of the test section. In some instances the lengths of test sections will have to be shortened to meet the above requirements.

3. Maintain pressure for a minimum of two (2) hours.
4. Perform leakage test.

C. Nongaseous Pipe Leakage Test

1. Perform simultaneously with hydrostatic test.
2. Maintain pressure within a maximum variation of ∇ 5 psi for 2 hours minimum.
3. Record amount of leakage from water meter.
4. Allowable leakage is:
 - a. Exposed piping: Exposed piping with flanged, threaded or welded joints, or buried pipe in conflict with potable water lines: No leakage allowed.
 - b. Other pipe by the formula:

$$L = (S)(D)\%P \quad \text{where: } 133,200$$

L = Maximum allowable leakage in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal internal diameter of the pipe in inches.
P = Average test pressure in pounds per square inch gage.

D. Gas and Air Pipe Test

1. Install tapped plug at air inlet and airtight plugs at other ends of the test section.
2. Connect air supply equipment to tapped plug and fill slowly until test pressure is attained. For chlorine gas lines, test with nitrogen. Nitrogen may be used in lieu of air.
3. Allow ample time for the temperature of the gas and piping to stabilize.
4. Set pressure to 150 percent of designed operating pressure and maintain a minimum of one hour. Examine all joints for leaks using a concentrated liquid soap or a commercial leak detection preparation.
5. Allowable leakage is:
 - a. Chlorine Gas Lines - No leakage
 - b. Air Lines - 5 percent of starting test pressure.
 - c. Other lines - As specified elsewhere or directed by the Engineer.

3.05 WATER TESTS FOR SANITARY MANHOLES AND STEAM VAULTS

- A. Structures may be water tested simultaneously with non-pressure pipes. If the allowable leakage is exceeded, separately test each structure and each run of pipe in the failed section.

- B. Structures may be tested prior to or after backfilling by filling them with clean water to the top. Conduct test for 6 hours.
- C. Engineer reserves the right to require an infiltration test if he is not satisfied with exfiltration test.
- D. Test manholes and wet wells prior to filling interior joints and prior to constructing the structure inverts and benches, but after all pipe connections to the manholes have been made.
- E. Allowable exfiltration leakage is one gallon/ day/vertical foot.

3.06 VACUUM TESTS FOR SANITARY MANHOLES AND STEAM VAULTS

- A. Structures may be vacuum tested in lieu of the previously described water test. The vacuum tests must be accomplished prior to back-filling the structure, filling joints, and constructing the structure inverts and benches. All pipe connections shall be made prior to the test.
- B. Test Procedure
 - 1. Plug pipe openings and securely brace the plugs and pipe.
 - 2. Set the tester onto the top section of the structure and inflate the compression band to effect a seal between the structure and the vacuum base.
 - 3. Connect the vacuum pump to the outlet port, open the valve, start the motor and draw a vacuum of 10" Hg (Mercury).
 - 4. Close the valve and monitor the vacuum gauge.
 - 5. The test shall pass if the vacuum holds at 10" Hg or drops no lower than 9" Hg within the following times:

Depth of Manhole	Time
0'-10'	5 sec.
10'-15'	40 sec.
15'-20'	55 sec.
20'-25'	70 sec.

- 6. If the vacuum drops in excess of the prescribed rate, the contractor shall locate the leak, make proper repairs, and retest the manhole.
- 7. If the unit fails the test after repair, the unit shall be water exfiltration tested.

3.07 TESTS FOR STORM DRAINS AND DRAINAGE STRUCTURES

- A. Structures - Leakage testing of drainage structures is not required. However, visible infiltration into structures is not permitted and shall be stopped when it is found to exist.
- B. Culverts - Leakage testing of culverts is not required, provided that manufacturer provides a certification that pipe and joints have satisfactorily passed factory hydrostatic testing as prescribed in the applicable pipe standards.

3.08 ALLOWABLE LEAKAGE

- A. It is the intent of this Contract to secure piping systems with leakage, in each section of pipe and within each structure, equal to, or less than that specified. It is also the intent to secure a piping

system free from visible drips, streams, and leaks. Therefore, even if a portion of the system meets the requirements for allowable leakage, visible leaks are not permitted and shall be stopped.

- B. Leakage tests will be considered satisfactorily passed when the rate of leakage is equal to or less than the stipulated allowances, there is no evidence of visible leaks, and there is no evidence of other system defects.

3.09 RETESTING

- A. Pipes and manholes not passing the tests shall have all defects corrected to the satisfaction of State Project Manager, and shall be retested and recorrected as often as is necessary until the test requirements have been met.
- B. It is the intent of this Contract to obtain work meeting test requirements on their own and solely through the use of the normal integral sealing components. Joint leaks shall not be stopped through the use of concrete, caulking, mortar, or other patching materials. Leaking pipe joints shall be rejoined and leaking manhole joints shall have joints reset, or replaced if necessary.
- C. Methods other than rejoining, resetting or replacing joint seals shall require the written approval of State Project Manager.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Fire\stopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

- A. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
- B. ASTM EB14 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- C. ASTM E1966 – Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).
- D. ASTM E2174 – Standard Practice for On-Site Inspection of Installed Firestops; 2014.
- E. ASTM E2393 – Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.
- F. ASTM E2307 – Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.
- G. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- H. ITS (DIR) – Directory of Listed Products; current edition.
- I. FM (AG) – FM Approval Guide; current edition.
- J. UL 2019 – Standard for Test for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- K. UL (DIR) – Online Certifications Directory; current listings at database.ul.com.
- L. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number, Include compliance data showing the product/assembly meets or exceeds ASTM E814 or ASTM E1966 as applicable.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

-
1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING – GENERAL REQUIREMENTS

- A. Manufacturers:
1. 3M Fire Protection Products; www.3m.com/firestop.
 2. Hilti, Inc: www.us.hilti.com/#sle.
 3. Nelson FireStop Products; www.nelsonfirestop.com.
- B. Firestopping: Any material meeting requirements.
- C. Mold resistance: Provide firestopping materials with mold and mildew resistance rating of 1 as determined ASTM G21.
- D. Primers. Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: type required for tested assembly design.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F rating equal to required fire rating of the floor assembly. (1 hour unless noted otherwise.)
1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
 2. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
 3. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
- B. Floor-to-Floor, Wall-to-Wall and Wall-to-Floor Joints, Except Perimeter, Where Both are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs. (1 Hour, unless noted otherwise).

-
- C. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly (1 hour unless noted otherwise.)
 - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.03 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814 or ASTM E119 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
 - 2. Provide system meeting 1 hour fire rating, unless noted otherwise.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

- A. Install materials in a manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.
 - 1. Provide stenciled signage reading “_x_ HR RATED FIRE WALL - DO NOT PENETRATE”
 - 2. Spray paint stencil above ceilings at 30' intervals on rated walls and within 10' of corners.

3.04 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location of the entire project.
- B. The Documentation Form for through penetrations is to include:
 - 1. A Sequential Location Number.
 - 2. The Project Name.
 - 3. Date of Installation.
 - 4. Detailed description of the penetrations location.
 - 5. Tested System of Engineered Judgment Number.

-
6. Type of assembly penetrated.
 7. A detailed description of the size and type of penetrating item.
 8. Size of opening.
 9. Number of sides of assemblies addressed.
 10. Hour rating to be achieved.
 11. Installers Name.
- C. Copies of these documents are to be provided to the State Project Manager at the completion of the project.
- D. Identify through –penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Permanently attach identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeing to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to identify quickly the penetration attributes. Attach labels permanently to surfaces to on both sides of wall.
- E. Include the following information on labels:
1. The words: “Warning-Through penetration Firestop System- Do Not Disturb. Notify Building Management of Any Damage.”
 - 2 Contractor’s Name, address, and phone number.
 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of Installation.
 5. Through-Penetration firestop system manufacturer’s name.
 6. Installer’s Name.

3.05 ADJUSTING AND CLEANING

- A. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 22 1005

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for pipping systems.

1.02 RELATED REQUIREMENTS

- A. Section 23 0719 - Piping Insulation.
- C. Section 23 0516 – Expansion Fittings for Piping.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 – American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).
- B. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2010.
- C. ASME B16.3 – Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2010).
- D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).
- E. ASME (PBV IX) – Boiler and Pressure Vessel Code, Section IX – Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings; 2009
- G. ASTM B32 – Standard Specification of Solder Metal; 2008.
- H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.
- I. ASTM C564 – Standard Specification for Rubber Baskets for Cast Iron Soil Pipe and Fittings; 2011.
- J. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waster and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005.
- K. MSS SP-67 – Butterfly Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2011
- L. MSS SP-80 – Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2008.
- M. MSS SP-85 – Cast Iron Globe & Angle Valves, Flanges and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 2011.
- N. MSS SP-110- Ball Valves Threaded, Socket-Welding, Solder Joint, Groove and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 2010.
- O. NFPA 54 – National Fuel Gas Code; National Fire Protection Associations (adopted latest version).

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen. Provide temporary tenting and heat as required to maintain proper and dry bedding.
- B. Provide dewatering as required to maintain a dry trenches and bedding. Wet bedding shall be replaced at no additional cost to the State.

1.07 LEAD-FREE PIPE, FIXTURES, AND FITTINGS

- A. Pie, fixtures, and fittings used for human consumption (water for drinking or cooking) shall meet the most recent NSF/ANSI low lead standard (<0.25% weighted average lead content-wetted surface).

PART 2 PRODUCTS

2.01 SANITARY SEWER, STORM WATER, AND VENT PIPING, BURIED WITHIN 5 FET OF BUILDING and UNDERSLAB.

- A. Cast iron Pipe: CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 301, neoprene gasket and stainless steel clamp and shield assemblies.

2.02 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L, Drawn (H).
 - 1. Joints : ASTM B32 Alloy Sn 95 solder, provide tape coating for joints and fittings.

2.03 NATURAL GAS PIPING, BURIED

- A. Manufacturers:
 - 1. Gastite / FlashShield: www.gastite.com
- B. Underground gas Polyethylene (PE) Piping.
 - 1. Polyethylene Piping (IPS): ASTM D-2513, Category 1. Polyethylene gas piping systems specifically engineered and certified for the underground environment. Piping exterior is yellow in color.
 - 2. Joints and Fitting: Continental Industries Con-Stab ID Seal Fittings, Category 1 mechanical

- joint designed to join pipe meeting ASTM D2513 Fitting join PE piping and transitions of PE to steel and copper piping.
3. Provide and install with 5.0 mil underground detectable underground equal to Pro-Line Detectable Marking Tape.
 4. Installation shall be by a State of NH licensed gas fitter that is also factory certified for installation of FlashShield CSST systems.

2.04 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 2 inches and less:
 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size over 2 inches:
 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
Note: Utilize sealant/lubricant designed specifically for flange and gasket applications (steam, condensate, etc.)
 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 1. Dimensions and Testing: In accordance with AWWA C606.
 2. Housing material: Malleable iron or ductile iron, galvanized.
 3. Gasket Material: EPDM suitable for operating temperature range from -30 degrees F to 230 degrees F.
 4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 6. Manufacturers:
 - a. Grinnell Mechanical Products, a Tyco International Company: www.grinnell.com.

2.05 GATE and GLOBE VALVES

- A. Manufacturers:
 1. Tyco Flow Control: www.tycoflowcontrol.com.
 2. Conbraco Industries: www.conbraco.com.
 3. Nibco, Inc: www.nibco.com.
 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 2 inches:
 1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.
- C. 2 Inches and Larger:
 1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke or rising stem, handwheel, solid wedge disc, flanged ends.

2.06 BALL VALVES

- A. Manufacturers:
 1. Conbraco Industries: www.conbraco.com.
 2. Grinnell Mechanical Products, a Tyco International Company; www.grinnell.com.
 3. Nibco, Inc: www.nibco.com.

4. Milwaukee Valve Company: www.milwaukeevalve.com.

- B. Construction, 3 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel, or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out stem, level handle with balancing stops, solder, or threaded ends with union.

2.07 BUTTERFLY VALVES

- A. Manufacturers:
 1. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
 2. Tyco Flow Control: www.tycoflowcontrol.com.
 3. Hammond Valve: www.hammondvalve.com.
 4. Crane Co.: www.cranvalve.com.
 5. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction: 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle. Hot and chilled water service only.

2.08 SWING CHECK VALVES

- A. Manufacturers:
 1. Tyco Flow Control; www.tycoflowcontrol.com.
 2. Hammond Valve: www.hammondvalve.com.
 3. Nibco, Inc: www.hibco.com.
 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up to 2 Inches:
 1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
- C. Over 2 Inches:
 1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.09 STRAINERS

- A. Manufacturers:
 1. Armstrong International, Inc: www.armstronginternational.com.
 2. Green Country Filtration: www.greencountryfiltration.com.
 3. EAMCO: www.weamco.com.
- B. Size 2 inch and Under:
 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.
 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 stainless steel perforated screen.
- C. Size 2-1/2 inches to 4 inch:
 1. Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

2.10 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 1. GPT Industries: Link-Seal: www.gptindustries.com.

2. Metraflex Company: MetraSeal: www.metraflex.com.
- B. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide water tight seal between pipe and wall/casing opening.
 3. Elastomeric element size and material in accordance with manufacturer's recommendations.
 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.
- B. Do not install in wet or frozen trenches or bedding.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls. Pitch piping to maintain adequate and code-compliant drainage.
- D. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Provide support for utility meters in accordance with requirements of utility companies.
- J. Install valve with stems upright or horizontal, not inverted. Provide handle extensions for insulated piping systems.
- K. Install water piping to ASME B31.9.
- L. Sleeves: Provide welded 14 GA sheet metal or Schedule 10 pipe sleeves through new or existing masonry block and /or brick walls. Core drill new or existing concrete walls or floors.
- M. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- N. Manufactured Sleeve-Seal Systems:
 1. Install manufactured sleeve- seal system components in sleeves in grade slabs and exterior

- concrete walls at piping entrances into the building.
- 2. Provide sealing elements of the size, quantity and type required for the piping and sleeve inner diameter or penetration diameter.
- 3. Locate piping in center of sleeve of penetration.
- 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
- 5. Tighten bolting for a water-tight seal.
- 6. Install in accordance with manufacturer's instructions.
- O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure glands, union and couplings for servicing are consistently provided.
- P. FlashShield CSST system DETECTGALBE TAPE 5.0 MIL.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible location.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install ball or butterfly valves for throttling, bypass, or manual flow control services.
- F. Provide plug valves in natural gas systems for shut-off service.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within ½ inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. In final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take sample no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry and analyze in accordance with AWWA C651.
- I. Provide final Report to State Project Manager with test results.

END OF SECTION

SECTION 23 0505

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Any general provisions of the Contract.

1.02 SUMMARY

- A. This section includes the following mechanical materials and methods to complement other Division 23 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete equipment base construction requirements.
 - 3. Equipment nameplate data requirements.
 - 4. Non-shrink grout for equipment installations.
 - 5. Field-fabricated metal and wood equipment supports.
 - 6. Installation requirements common to equipment specification sections.
 - 7. Cutting and patching.
 - 8. Selective demolition.
- B. Pipe and pipe fitting materials are specified in piping system sections.

1.03 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms or pump pits.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installation within unheated shelters.
- G. The word "Provide" is defined to mean both furnish and install the specified material and equipment, or service.

1.04 QUALITY ASSURANCE

- A. Qualify welding processes and operators for piping according to ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
 - 1. Comply with provision of ASME B 31 Series Code for Pressure Piping.
 - 2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

- B. Soldering and brazing procedures for refrigeration piping according to ANSI B9.1 "Standard Safety Code for Mechanical Refrigeration".

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture-and grit. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight, support to prevent sagging and bending.
- E. Deliver joint sealer and fire-stopping materials in original unopened container or bundles with labels, informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- F. Store and handle joint sealer and fire materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.07 PROJECT CONDITIONS

- A. Conditions Affecting selective demolition: the following project conditions apply:
 - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are completed.
 - 2. Coordinate the shut-off and disconnection of utility services with the State Project Manager.
 - 3. Notify the State Project Manager a minimum of 2 days before commencing demolition operations, No work shall commence without direct permission of the State Project Manager.
 - 4. Perform demolition in phases as specified, indicated or required.
- B. Environmental conditions: Apply joint sealers and fire stopping under temperature and humidity conditions within the limits permitted by the manufacturer. Do not apply joint sealers and fire stopping to wet substrates, provide ventilation per manufacturer's requirements.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification sections for pipe and fitting materials and joining methods.
- B. Elbows for all pipe sizes over 2" diameter shall be long radius type (1.5 the diameter to centerline of pipe).
- C. Use reducers, increasers, or reducing tees for change of pipe size. Bushings are not allowed.
- D. Utilize eccentric-style reducers (flat on top) in steam piping for connections to control valves and pressure reducing valves. Pitch pipe away from valve body or in-line device to prevent condensate build-up within valve body.
- E. Forged steel branch connectors, per the limits set forth in Part 3 of this section, may be used to create branch connections in steel piping systems. All branch connectors shall be 3,000# fittings.
 - 1. "Weld-O-Lets", "Three-O-Lets", or "Sock-O-Lets"
 - 2. "Trans-O-Con".

2.02 JOINING MATERIALS

- A. Refer to individual piping system specification sections in Division 23 for special joining materials not listed below.
- B. Pipe flange gasket materials: Suitable for the chemical and thermal conditions of the piping system contents.
 - 1. ASME B16.21, non metallic, flat asbestos-free, 1/8 inch maximum thickness, except where thickness or specific material is indicated.
 - a. Full –Face Type: For flat-face, Class 125 cast-iron and cast –bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
 - 2. ASME B16.20 for grooved, ring-joint, steel flanges.
 - 3. AWWA C110, rubber flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
- C. Flange Bolts and Nuts: ASME B18.21 carbon steel, except where other material is indicated.
- D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.
- E. Solder Fill Material: ASTM B32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95percent) and silver (approximately 5 percent), having 0.10-percent lead content.
 - 2. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20 –percent maximum lead content.
- F. Brazing materials material: Comply with SFA-5.8, Section II, “ASME Boiler Pressure Vessel Code” for brazing filler metal materials appropriate to the materials being joined. Copper-phosphorus alloy brazing filler metal; BcuP-5 (Staysilv), containing 15% silver (Ag) 5% phosphorus (P), remaining elements are copper (CU).
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer’s standard solvents complying with the following:
 - 1. Acrylonitrile-Butadiene-Styrene (ABA); ASTM D 2235.
 - 2. Chlorinated Poly (Vinyl Chloride) (CVPC): ASTM F 493.
 - 3. Poly (Vinyl Chloride) (PVC); ASTM D 2564.
 - 4. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.
- I. Plastic Pipe Seals: ASTM F 477, Elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.
- K. Couplings for buried piping: Iron body sleeve assemble, fabricated to match outside diameters of plan-end, pressure pipes.
 - 1. Sleeve: ASTM A 126. Class B, gray iron.
 - 2. Followers: STM A 47, Grade 32510 or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.03 PIPING SPECIALITIES

- A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.
 - 1. Inside Diameter: Closely fit around pipe, tube, and insulation of insulated piping,
 - 2. Outside Diameter: Completely cover opening.
 - 3. Cast Brass: Split casting, with concealed hinge and set-screw, polished chrome finish.
- B. Unions: Malleable-iron, Class 150 for steel piping systems and low pressure service; cast bronze, 125 wsp for copper piping systems and low-pressure service, hexagonal stock, with ball-and socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Fittings: Assembly of fitting having insulation material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
 - 1. Description: Combination of copper alloy and ferrous metal; threaded, solder, plain, and weld neck end types and matching piping system materials.
 - 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 - 3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg. F. temperature.
 - 4. Dielectric Flanges: Factory fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
 - 5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Provide separate companion flanges and steel bolts and nuts for 150 or 300-psig minimum working pressure to suit system pressures.
 - 6. Dielectric waterway fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
- D. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened. Coordinate seals with prefabricated pipe manufacturer for application of mechanical seals with prefab pipe and end seals and wall penetration requirements. Provide a water-tight seal to all pipe penetrations regardless of system used (mechanical seal and /or prefab pipe seal assembly).
- E. Pipe Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet Metal: 24 gage or heavier, galvanize sheet metal, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM A 53, Type E, Grade A Schedule 40, galvanized, plain ends.
 - 3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
 - 4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
 - a. Penetrating Pipe Defection; 5 percent without leakage.
 - b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
 - c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
 - d. Housing-to Sleeve: Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

2.04 GROUT

- A. Non-shrink, Nonmetallic grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000 psi, 28-day compression strength.
 - 3. Packaging: Premixed and factory-packaged.

2.05 MECHANICAL EQUIPMENT NAMEPLATE DATA

- A. Nameplate: for each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances and similar essential data. Locate nameplates in an accessible location. See Section 23 0553.

2.06 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars and bar grating: ASTM A 500.
- B. Cold-formed Steel Tubing: ASTM A 500.
- C. Hot rolled steel tubing: ASTM A 501.
- D. Non-shrink, nonmetallic grout; Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.
- E. Fasteners: Zinc-coated, type, grade, and class as required.
- F. Provide necessary supplemental sell or strut-type framing systems for equipment, ductwork, and pipe support requirements.

2.07 FIRE STOPPING

- A. General: Fire stopping caulk, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application. All products shall be installed by manufacturer trained and licensed installers in the manner determined by the manufacturer as tested by an independent testing laboratory.
- B. Manufacturers: Subject to compliance with requirements, provide factory-engineered products by one of the following:
 - 1. 3M Fire Protection Products.
 - 2. Spec. Seal (Specified Technologies Inc.)
 - 3. Hilti.

2.08 ELASTROMERIC JOINT SEALERS

- A. General: Joint sealers, joint fillers and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. General Duty: One-part, neutral core silicone sealant of formulation indicated that is recommended for exposed applications on exterior and interior joints in vertical and horizontal surfaces of concrete, masonry, glass, aluminum, and steel.
- C. Wet locations: Provide manufacturer's standard one part, mildew resistant, paintable silicone sealant that is recommended for exposed locations on interior ceramic tile, masonry, and metals in bathroom and shower room locations.

PART 3 EXECUTION

3.01 PIPING SYSTEMS- COMMON REQUIREMENTS

- A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Section in Division 23 specify piping installation requirements unique to the piping system.
- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are accepted on coordination drawings.
- C. Install piping at indicated slope.
- D. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, ¾" ball valve with hose connection, cap and chain. Install vents at high points. Pitch water piping upward in direction of flow and arrange fittings to permit air to be vented to system high points or to expansion tank, and to permit complete drainage to low points. Use eccentric fittings where necessary.
- E. Install components having pressure rating equal to or greater than system operating pressure.
- F. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- G. Install piping free of sags and bends.
- H. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- J. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- K. Locate group of pipes parallel to each other, spaced to permit valve servicing.
- L. Install fittings for changes in direction and branch connections.
- M. Install couplings according to manufacturers printed instructions.
- N. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
 - 1. Cut sleeve to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 - 2. Build sleeves into new walls and slabs as work progresses.
 - 3. Install large enough sleeves to provide 1/4 -inch annular clear space between sleeve and pipe or pipe insulation.
- P. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals: sixe sleeve installation of mechanical seals per manufacturer's requirements.
 - 1. Install steel pipe for sleeves smaller than 6 inches.
 - 2. Install cast-iron wall pipes for sleeves 6 inches and larger.
 - 3. Assemble and install mechanical seals according to manufacturer's printed instructions.

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- Q. Below Grade, Exterior Wall, Pipe Penetrations: Install mechanical wall penetrations system sleeves according to manufacturer's printed installation instructions. Coordinate with piping system requirements for mechanical seals.
- R. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stopping sealant material.
- S. Verify final equipment locations for rough in.
- T. Refer to equipment specifications in other sections of these specifications for rough-in requirements.
- U. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification sections.
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS Soldering Manual, Chapter 22 The Soldering of Pipe and Tube.
 4. Brazed Joints: Construct joints according to AWS Brazing Manual, Chapter 28 Pipe and Tube.
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Adjoin pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly,
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 6. Welded Joints: Construct joints according to WS D10.12 Recommended Practices and Procedures for Welding Low Carbon Steel Pipe using qualified processes and welding operators according to Quality Assurance Article.
 - a. All welders shall be certified by an independent AWS certifying agency for welding the piping material, system type, and system pressures for each pipe joint.
 - b. Comply with ASME Boiler and Pressure Vessel Code Section IX.
 - c. Failure to utilize certified welders shall require the removal and replacement of the piping joint/joints/system at no additional cost to the State.
 7. Flanged joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install a gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible.
 - a. Use lubricants on bolt threads suitable and applicable for bolt threads.
 - b. Tighten bolts gradually and uniformly using torque wrench.
 8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
 - a. Comply with ASTM F 402 for safe handling practice of solvent-cement and primers.
 - b. Acrylonitrile-Butadiene-Styrene (ABS); ASTM C 2235 and ASTM D 2661.

- c. Chlorinated Poly(Vinyl Chloride) (CPVC); ASTN D 2846 and ASTM F 493.
 - d. Poly (Vinyl Chloride) (PVC) Pressure Application: ASTM D 2672.
 - e. Poly (Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2885.
 - f. PVS to ABS (Non Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.
- V. Piping Connections: Except as otherwise indicated make piping connections as specified below.
- 1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.
 - 2. Install flanges, in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - 3. Wet Piping system (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.01.1 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated.
- B. Install equipment according to accepted submittal data. Refer conflicts to the State Project Manager.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment, giving right-of-way to piping system installed at a required slope.

3.02 CONCRETE BASES

- A. Coordinate the construction of the concrete equipment bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit does. Follow supported equipment manufacturers setting templates for anchor bolt and tie locations.

3.03 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1 Structural Welding Code – Steel.

3.04 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceiling, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.05 GROUTING

- A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base pates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout, completely filling equipment bases,
- F. Place grout on concrete bases to provide a smooth-bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturers printed instructions.

3.06 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment, and debris not indicated to be salvaged, and deliver materials and equipment to the location designated for storage by the State Project Manager.
- C. Disposal and Cleanup: Remove for the site and legally dispose of demolished material, equipment, and debris not indicated to be salvaged. Broom –sweep all floors and clean all windows within construction areas.

3.07 COORDINATION OF ACCESS DOORS PROVIDED BY THIS DIVISION

- A. General: The Contractor must coordinate the installation of mechanical work with the installation of access doors. Mechanical equipment must be laid out so that the access panels as designed can serve their purpose.
- B. Coordinate installation of access doors at all locations and with adequate door size to provide the required access to mechanical system components including but not limited to, fire dampers, smoke dampers, volume dampers, valves, steam traps, controls devices and components, and equipment filters.
- C. Provide all access doors. Fire-rated access doors and frames shall be provided for all locations where the doors are to be installed in a rated assembly.
- D. Responsibility for access to all mechanical items is with the Contractor. Obtain approval from the Contract Administrator before installation of access doors. Failure to obtain this approval may necessitate rework at the Contractors expense.

END OF SECTION

**SECTION 23 0516
EXPANSION FITTING FOR PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Flexible Expansion loops.
- C. External Pressurized Expansion Compensator.

1.02 RELATED REQUIREMENTS

- A. Section 22 1005 – Plumbing Piping.
- B. Section 23 2113 – Hydronic Piping.
- C. Section 23 2213 – Steam and Condensate Piping.

1.03 REFERENCE STANDARDS

- A. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.
- B. ASME B16.5 – Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard; 2013.
- C. ASME B16.11 – Forged Fittings, Socket-welding and Threaded; 2011.
- D. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing.
- F. EJMA – EJMA Standards; Expansion Joint Manufacturers Association; 2003.

1.04 REGULATORY REQUIREMENTS

- A. Conform to UL requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS – STEEL PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. Metraflex Company: www.metraflex.com
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Single braided, stainless steel or bronze.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.
- G. Maximum offset: ¾ inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS – COPPER PIPING

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. Metraflex Company: www.metraflex.com

- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi and 450 degrees F.
- E. Joint: As specified for pipe joints.
- F. Size: Use pipe sized units.
- G. Maximum offset: $\frac{3}{4}$ inch on each side of installed center line.
- H. Application: Copper piping.

2.03 FLEXIBLE EXPANSION LOOP

- A. Manufacturers:
 - 1. Mercer Rubber Company: www.mercer-rubber.com.
 - 2. Metraflex Company: www.metraflex.com
- B. Provide flexible expansion joints of size and type noted on drawings. Flexible joints shall consist of two flexible sections of hose and braid, two 90 degree elbows, and a 180 degree return assembled in such a way that the piping does not change direction, but maintains its course along a single axis.
- C. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180 degree return, and a drain/air release plug.
- D. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be installed in a neutral, pre-compressed, or pre-extended condition as required for the application.
- E. Install and guide per manufacturer's recommendations.
- F. Materials of construction and end fitting type shall be consistent with pipe materials and equipment/pipe connection fittings.

2.04 EXTERNALLY PRESSURIZED EXPANSION COMPENSATOR

- A. Manufacturers:
 - 1. Metraflex Company; model HPG3: www.metraflex.com.
- B. Expansion compensators to be of the packless, externally pressurized type. Pressure rating of 175 psi at 750 degrees F. Axial movements to be rated for 3" compression and $\frac{1}{2}$ ' extension. Compensator has a maximum operating temperature of 750 degrees F and a maximum operating pressure of 175 psi.
- C. Compensators to be all welded construction, with grooved ends, compatible for Victaulic OGS-200 roll groove for Schedule 80 steel piping.
- D. Constructed of multiple-ply 304 stainless steel bellows, carbon steel shroud, integral guide rings, and internal liner, System line pressure to be external to the bellows to minimize squirm.
- E. All materials of construction, pressure ratings, and end fittings shall be appropriate for the application.
- F. Piping must be properly guided and anchored per the recommendations of the Expansion Joint Manufacturers Association.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Install flexible connector at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Provide support and equipment required to control expansion and contraction of piping. Provide flexible expansion joints where required.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.
- D. Duct Markers.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 – Scheme for Identification of Piping Systems; The American Society of Mechanical Engineers; 2015.
- B. ASTM D709 – Standard Specification for Laminated Thermosetting Materials; 2016.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Boilers, Deaerator, Surge Tank, and Pumps: Nameplate.
- B. Automatic Controls; Tags. Key to control schematic.
- C. Control Panels: Nameplates.
- D. Terminal Heating Equipment: Nameplates.
- E. Instrumentation: Tags.
- F. Major Control Components: Nameplates.
- G. Piping: Pipe Markers.
- H. Split System Heat Pump Indoor Unit and Condensing Unit: Nameplates.
- I. Relays: Tags.
- J. Small-sized Equipment: Tags.
- K. Water Treatment Equipment: Nameplates.
- L. Valves: Tags.
- M. Ductwork: Duct Markers.
- N. Domestic Water heater and Automated Trap Primer. Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic engraving: www.advancedgraphicengraving.com
 - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com
 - 3. Seton Identification Products: www.seton.com
- B. Interior nameplates. Plastic nameplates conforming to ASTM D709, 1/116 inch thick, background color white, letter color black and letter height is ½ inch.
- C. Exterior nameplates. Engraved aluminum anodized nameplates, 1/32 inch thick, background color black, letter color white, and letter height is ½ inch.

2.03 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com
 - 2. Brady Corporation: www.bradycorp.com
 - 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com
 - 4. Seton Identification Products: www.seton.com.
- B. Metal Tags: Brass with stamped letters; tag size 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:
 - 1. Seton Identification Products: www.seton.com
 - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 - 3. MIFAB, Inc.: www.mifab.com.
- B. Color: Conform to ASME A13.1.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Markings shall identify the fluid being conveyed and shall have arrows indicating the direction of flow.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.04 DUCT MARKERS

- A. Manufacturers:
 - 1. Seton Identification Products: www.seton.com
 - 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com
 - 3. Brady Corporation.: www.bradycorp.com
 - 4. Brimar Industries: www.pipemarker.com
- B. Self-adhesive vinyl; duct markers which identify type of airflow (supply, return, exhaust, relief, or outside air) and have directional arrows.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

- E. Install tracer wire 12" above the underground piping system.
- F. Use tags on piping 3/4 inch diameter and smaller,
 - 1. Identify service and flow direction.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Install ductwork duct markers. Locate identification at mechanical equipment, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 0555

PENETRATION FIRESTOPPING FOR MECHANICAL AND PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENT

- A. 07 8400 Firestopping

1.02 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations of the passage of duct, piping (HVAC and Plumbing) and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

1.04 REFERENCES

- A. Test Requirement: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Test of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through –Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops.
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- G. All current State of New Hampshire building codes and NFPA 101 – Life Safety Code.

1.05 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures on-site. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop System do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult with a structural engineer prior to penetrating any load bearing assembly. Calculations to determine structural capacity of the wall shall be carried and paid for by the Contractor.
- E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction (AHJ) for their review and approval prior to installation. The project's Engineer of Record will not review or comment on applications. Engineering, judgment drawings must follow requirements set forth by the International Firestop Council.

1.06 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified and /or licensed by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility; assign installation of through –penetration firestop system and fire-resistant joint systems in Project to a single sole source firestop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:
 - FM 4991 Approved Contractor
 - UL Approved Contractor
 - Firestop Manufacturer-Accredited Fire Stop Specialty Contractor
- D. Firm with not less than 3 years' experience with fire stop installation.
- E. Successfully completed noted not less than 3 comparable scale projects using similar systems.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.08 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents. Provide temporary ventilation as required to prevent fume migration to adjacent occupied areas.
- B. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- C. Weather Conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

- D. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.
- E. The Contractor shall fully remove and replace existing fire-stopped penetrations that are being re-used or enlarged; do not reuse existing firestopping – complete removal is required by the Contractor. Existing or new firestopping damaged by the work of the Contractor shall be fully removed and replaced.

PART 2 PRODUCTS

2.01 FIRESTOPPING-GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer base on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Provide and install additional wall framing, blocking, masonry, and similar to match existing conditions as required to comply with the manufacturer's rated assembly detail and system.
- D. Penetrations of Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- E. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Minimum of 1-hour rating, but no less than the fire-resistance rating of the floor construction being penetrated.
 - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
- F. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- G. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.
- H. Where necessary based on existing conditions and limited accessibility, provide manufacturer or contractor engineered one –sided firestop assemblies.

2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc.
 - 2. Specified Technologies, Inc.
 - 3. Nelson Firestop Products, Inc.
 - 4. Additional manufacturers accepted equal in all performance ratings, listing and experience. Field conditions and applications may warrant a combination of manufacturers.

2.03 MATERIALS

Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls the following products are acceptable:
 - 1. Hilti Cast-In Place firestop Device (CP680-P) for use with combustible penetrants.
 - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - 3. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
 - 4. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - 5. Hilti Firestop Block (CFS-BL)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - 2. Hilti Fire Foam (CP 620)
 - 3. Hilti Flexible Firestop Sealant (CP 606)
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti Flexible Firestop Sealant (P 606)
 - 2. Hilti Intumescent Firestop Sealant (FS-ONE Max)
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE-MAX)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE-MAX)
 - 2. Hilt Fire Foam (CP 620)
 - 3. Hilti Flexible Firestop Sealant (CP 606)
- G. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Firestop Putty Stick (CP 618)
 - 2. Hilti Firestop Plug (CFS-PL)
- H. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping system), the following products are acceptable:
 - 1. Hilti Firestop Collar (CP 643N)
 - 2. Hilti Firestop Collar (CP 644)
 - 3. Hilti Wrap Strips (CP 648E/648S)
- I. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti Firestop Mortar (CP637)

2. Hilti Firestop Block (CFS-BL)
 3. Hilti Fire Foam (CP 620)
 4. Hilti Firestop board (CP 675T)
- J. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Hilti Firestop Block (CFS-BL)
 2. Hilti Firestop Board (CP 657T)
- K. For blank opening made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
1. Hilti Firestop Block (CFS-BL)
 2. Hilt Firestop Plug (CFS-PL)
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Verify penetrations are properly sized and in suitable condition for application of materials.
 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 5. Repair, rebuild, and provide additional wall framing and finish wall materials as required to provide proper and adequate wall assembly at the top and bottom of walls for proper installation and adherence of the firestopping system.
 6. Remove existing firestopping material as required from both sides of the penetration to permit proper installation of new system.
 7. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instruction: Comply with manufacturer's instruction for installation of through – penetration joint materials.
1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 2. Protect materials from damage on surfaces subjected to traffic.

3.03 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

-
- B. Keep areas of work accessible until reviewed by the State Project Manager.

3.04 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location of the entire project.
- B. The Documentation Form for through penetrations is to include:
1. A Sequential Location Number.
 2. The Project Name.
 3. Date of Installation.
 4. Detailed description of the penetrations location.
 5. Tested System of Engineered Judgment Number.
 6. Type of assembly penetrated.
 7. A detailed description of the size and type of penetrating item.
 8. Size of opening.
 9. Number of sides of assemblies addressed.
 10. Hour rating to be achieved.
 11. Installers Name.
- C. Copies of these documents are to be provided to the State Project Manager at the completion of the project.
- D. Identify through –penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Permanently attach identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeing to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to identify quickly the penetration attributes. Attach labels permanently to surfaces to on both sides of wall.
- E. Include the following information on labels:
1. The words: "Warning-Through penetration Firestop System- Do Not Disturb. Notify Building Management of Any Damage."
 - 2 Contractor's Name, address, and phone number.
 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of Installation.
 5. Through-Penetration firestop system manufacturer's name.
 6. Installer's Name.

3.05 ADJUSTING AND CLEANING

- A. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

**SECTION 23 0719
PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. HVAC and plumbing piping insulation.
- B. Jackets and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.
- C. ASTM C534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
- D. ASTM C585 – Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.
- E. ASTM E84, UL 723 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2016.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723.
- B. Fittings shall be insulated with die-cut and formed insulation.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation; www.certainteed.com.
- B. Insulation: ASTM C547; rigid molded, noncombustible.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
 2. Maximum service temperature: 850 degrees F.
 3. Maximum moisture absorption: 0.2 percent by volume.
 4. Comply with State of New Hampshire energy code requirements.
- C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
 2. Maximum service temperature: 650 degrees F.
 3. Maximum moisture absorption: 0.2 percent by volume.
 4. Comply with State of New Hampshire energy code requirements.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.
- G. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
1. Armacell LLC; www.armacell.us
 2. Aeroflex USA, Inc.; www.aeroflex.com.
 3. K-Flex US LLC; www.kflexusa.com.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
1. Minimum Service Temperature: -40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Jacket: None.

2.04 JACKETS

- A. PVC Plastic.
1. Manufacturers:
 - a. Speedline Corporation; www.speedline.com
 - b. Johns Manville Corporation; Zeston 2000 Series Color PVC: www.jm.com.
 2. Jacket: One piece molded type fitting covers and sheet material. Color: See below.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 per inch, maximum per ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum.
1. Manufacturers:

- a. Pabco-Childers Metals
2. Jacket: 3105/3003 Aluminum alloy roll or sheet jacketing with 3 mil polysurlyn moisture barrier; matching 2-piece fitting covers complete with vapor barrier and strapping hardware.
3. Stucco embossed finish; Color: See below.

2.05 INSERTS AND SHIELDS

- A. Manufacturers:
 1. Thermal Pipe Shields Inc: www.thermalpipeshields.com.
- B. Insulation: ASTM C-553 Type 1; calcium silicate.
 1. 'K' value: 0.38 at 75 degrees F.
 2. Temperature range: +40 to +1200 degrees F.
- C. Jacket: ASTM A-527, 360 degree galvanized G90 steel all around insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and NAIMA National Insulation Standards.
- B. Sleeves: Provide welded 14GA sheet metal or Schedule 10 pipe sleeves through new or existing masonry block and/or brick walls. Core drill new or existing concrete walls or floors.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, and flexible connections.
- E. For hot piping conveying fluids 120 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation. For hot piping conveying fluids over 120 degrees F, insulate flanges and unions at equipment. Fittings shall be insulated with die-cut and formed insulation.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Fittings shall be insulated with die-cut and formed insulation. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Inserts and Shields:
 1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under the finish jacket.
 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Interrupt insulation as required to maintain wall assembly rating and to comply with fire caulking requirements. Finish ends at supports, protrusions, and interruptions.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Unions, flanges, mechanical couplings, and dielectric connections.
- C. Valves:
 - 1. Gate valves.
 - 2. Ball valves.
 - 3. Plug valves.
 - 4. Butterfly valves.
 - 5. Check valves.
- D. Flow controls.

1.02 RELATED REQUIREMENTS

- A. Section 23 0516 - Expansion Fittings for Piping.
- B. Section 23 0719 - Piping Insulation.
- C. Section 23 2213 – Steam and Steam Condensate Piping.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 – Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2010).
- D. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM B32 - Standard Specification for Solder Metal; 2008.
- G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.
- C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.
- D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.
- E. Coupling Manufacturer:
 - 1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
 - 2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.

3. A distributor's representative is not considered qualified to perform the training.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen. Provide dry and heated conditions as required to install piping.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings and supports as required, as indicated, and as follows
 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
 3. Grooved mechanical joints may be used in accessible locations only. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as accepted by State Project Manager.
 - b. Grooved mechanical connections and joints comply with AWWA C606.
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
 - 2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
 - c. Use gaskets of molded synthetic rubber with central cavity, pressure responsive configuration and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
 - d. Provide steel coupling nuts and bolts complying with ASTM A183.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- D. Valves: Provide valves where indicated:
 1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
 2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
4. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.
5. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

E. Welding Materials and Procedures: Conform to ASME (BPV IX).

2.02 FEEDWATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1 welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88, Type L, drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.
 2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, non-toxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Grinnell Mechanical Products, a Tyco International Company: www.grinnell.com.
 - 2) Viega LLC: www.viega.com.

2.03 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Under:
1. Ferrous Piping: 150 psig malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 Inches:
1. Ferrous Piping: 150 psig forged steel, slip-on.
 2. Copper Piping: Bronze.
 3. Gaskets: 1/16 inch thick preformed neoprene.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
 2. Mechanical Couplings: Comply with ASTM F1476.
 3. Housing Material: Ductile iron complying with ASTM A536.
 4. Gasket Material: EPDM suitable for operating temperature range from -30 degrees F to 230 degrees F.
 5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 7. Manufacturers:
 - a. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
 - b. Victaulic Company: www.victaulic.com.
- D. Dielectric Connections:
1. Waterways:

- a. Water impervious insulation barrier capable of limiting galvanic current to 1 per cent of short circuit current in a corresponding bimetallic joint.
 - b. Dry insulation barrier able to withstand 600 volt breakdown test.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
2. Flanges:
- a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 per cent of short circuit current in a corresponding bimetallic joint.
 - c. Dry insulation barrier able to withstand 600 volt breakdown test.
 - d. Construct of galvanized steel with threaded end connections to match connecting piping.
 - e. Suitable for the required operating pressures and temperatures.

2.07 GATE VALVES

- A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
 2. Milwaukee Valve Company: www.milwaukeevalve.com.
 3. Nibco, Inc: www.nibco.com.
 4. Tyco Flow Control: www.tycoflowcontrol.com.
- B. Up To and Including 2 Inches:
1. Bronze body, bronze trim, screwed or union bonnet, non-rising stem, handwheel, inside screw with back seating stem, solid or split wedge disc, alloy seat rings, solder ends.
- C. Over 2 Inches:
1. Iron body, bronze trim, bolted bonnet, non-rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.08 BALL VALVES

- A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
 2. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
 4. Nibco, Inc: www.nibco.com.
 5. Tyco Flow Control: www.tycoflowcontrol.com.
 6. Victaulic Company: www.victaulic.com.
- B. Up To and Including 2 Inches:
1. Bronze two piece body, full port, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
- C. Over 2 Inches:
1. Cast steel body, chrome plated stainless steel ball, teflon seat and stuffing box seals, lever handle, flanged or grooved ends, rated to 800 psi.

2.09 PLUG VALVES

- A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
 2. Milwaukee Valve Company: www.milwaukeevalve.com.
 3. Nibco, Inc: www.nibco.com.
- B. Up To and Including 2 Inches:
1. Bronze body, bronze tapered plug, 40 percent port opening, non-lubricated, teflon packing, threaded ends.
 2. Operator: One plug valve wrench for every ten plug valves minimum of one.

- C. Over 2 Inches:
 - 1. Cast iron body and plug, 40 percent port opening, pressure lubricated, teflon packing, flanged ends.
 - 2. Operator: Each plug valve with a wrench with set screw.

2.10 BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Crane Co.: www.cranevalve.com.
 - 2. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
 - 3. Hammond Valve: www.hammondvalve.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
 - 5. Tyco Flow Control: www.tycoflowcontrol.com.
 - 6. Victaulic Company: www.victaulic.com.
- B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or grooved ends, extended neck.
- C. Disc: Construct of ductile iron with EPDM encapsulation.
- D. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.
- E. Operator: Infinite position lever handle with memory stop.

2.11 SWING CHECK VALVES

- A. Manufacturers:
 - 1. Grinnell Mechanical Products, a Tyco International Co: www.grinnell.com.
 - 2. Hammond Valve: www.hammondvalve.com.
 - 3. Milwaukee Valve Company: www.milwaukeevalve.com.
 - 4. Nibco, Inc: www.nibco.com.
 - 5. Tyco Flow Control: www.tycoflowcontrol.com.
 - 6. Victaulic Company: www.victaulic.com.
- B. Up To and Including 2 Inches:
 - 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
- C. Over 2 Inches:
 - 1. Iron body, bronze trim, bronze swing disc, renewable disc and seat, flanged, or grooved ends.

2.12 FLOW CONTROLS

- A. Manufacturers:
 - 1. Griswold Controls: www.griswoldcontrols.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Taco, Inc: www.taco-hvac.com.
 - 4. Tyco Flow Control: www.tycoflowcontrol.com.
 - 5. Victaulic Company: www.victaulic.com.
- B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet.
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, and clean systems.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating hot water and drain piping to ASME B31.9 requirements.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and to avoid interference with use of space.
- E. Group piping whenever practical at common elevations.
- F. Slope piping and arrange to drain at low points.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.
 - 1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
- H. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.
 - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
- I. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
- J. Pipe Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as specified.

END OF SECTION

**SECTION 23 2213
STEAM AND STEAM CONDENSATE PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Pipe hangers and supports.
- C. Valves and accessories.
- D. Steam piping system.
- E. Steam condensate piping system.

1.02 RELATED REQUIREMENTS

- A. Section 33 4614 – Precast Concrete Manholes and Structures
- B. Section 23 0500 – Basic Mechanical Requirements
- C. Section 23 0719 - Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; The American Society of Mechanical Engineers; 2011.
- B. ASME B31.1 – Power Piping; 2016.
- C. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2014 (ANSI/ASME B31.9).
- D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; American Society of Mechanical Engineers; 2015.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless; 2012.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- H. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011-AMD 1.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2015.
- K. ASME Section I, ASME Boiler and Pressure Vessel Code (BPVC), Section I: Rules for Construction of Power Boilers (2017).
- L. ASME Section IX, ASME Boiler and Pressure Vessel Code (BPVC), Section IX: Welding and Brazing Qualifications (2017).

1.04 SYSTEM DESCRIPTION

- A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.
- B. Use unions downstream at valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct threaded connections.

- C. Provide flanges at valve and equipment connections; do not use direct welded or threaded connections
- D. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section, with minimum three years of documented experience.
- C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping systems.
- B. Provide to the Contract Administrator a certificate of compliance from the Authority Having Jurisdiction indicating approval of welders.
- C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

2.02 MEDIUM AND HIGH PRESSURE STEAM PIPING (150 PSIG (1034 KPA) MAXIMUM)

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel welding type.
 - 2. Joints: Threaded (up to and including 2" diameter); AWS D1.1/D1.1M welded (greater than 2" diameter).
 - 3. Provide weld-neck style flanges equal to and greater than 4" diameter for piping connections for the boilers, boiler room equipment, and valve bodies in all areas.

2.03 LOW PRESSURE STEAM PIPING (15 PSIG (103 KPA) MAXIMUM)

- A. Steel Pipe (up to 1½" Piping): ASTM A53/A53M, Schedule 40, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel welding type or Viega MegaPress fittings with EPDM sealing element.
 - 2. Installation: Fittings shall be installed using a Rigid MegaPress tool only. All installers must be trained by the manufacturer on proper installation.
- B. Steel Pipe (2" to 6" Piping): ASTM A53/A53M, Schedule 40, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel welding type.

2.04 MEDIUM AND HIGH PRESSURE STEAM CONDENSATE PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.

1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel.
2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.05 LOW PRESSURE STEAM CONDENSATE PIPING AND PRESSURE RELIEF VALVE VENT PIPING

- A. Condensate Steel Pipe (½" to 1½" Piping): ASTM A53/A53M, Schedule 80, black.
 1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel, or Viega MegaPress fittings with EPDM sealing element.
 2. Joints: Threaded, or AWS D1.1/D1.1M welded, or Viega MegaPress.
 - a. Installation: Fittings shall be installed using a Rigid MegaPress tool only.
 - b. Installers must be personally trained by the manufacturer on proper installation.
- B. Condensate Steel Pipe (2" to 6" Piping): ASTM A53/A53M, Schedule 80, black.
 1. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234/A234M wrought steel.
 2. Joints: Threaded, or AWS D1.1/D1.1M welded.
- C. Pressure Relief Valve Steel Pipe (all sizes/locations): ASTM A53/A53M, Schedule 80, black.
 1. Fittings: ASTM A234/A234M wrought steel
 2. Joints: AWS D1.1/D1.1M welded.
 - a. Installation: Welded joints and fittings only; no exceptions; full length of discharge piping.

2.06 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches (50 mm) and Under:
 1. Ferrous Piping: 150 psig (1034 kPa) galvanized malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 Inches (50 mm):
 1. Ferrous Piping: Class 150, ANSI forged steel flanges (cast not permitted).
 - a) Provide weld neck flanges for steam piping that is 4" diameter and greater regardless of steam system operating pressure.
 - b) Provide socket-type flanges for high pressure steam pipe (greater than 15PSI) that is less than 4" diameter.
 - c) Slip-on flanges are not permitted for high pressure steam service regardless of diameter (systems operating at greater than 15PSI).
 - d) Slip-on flanges shall be permitted for low pressure steam systems (systems operating less than 15PSI) on piping that is less than 4" diameter.
 2. Copper Piping: Bronze.
 3. Gaskets: Preformed non-asbestos graphite fiber manufactured for high pressure steam service; match flange rating and bolt dimensions.
 - a) Garlock Sealing Technologies
 - b) Thermoseal / Klingersil
 - c) APG.
 4. Bolts / Studs: Grade 8, Coarse Thread. Threaded rod for use as studs is not permitted. Provide anti-seize thread compound specifically manufactured for the application.
Do not use thread compound as gasket lubricant or sealant.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.07 GATE and GLOBE VALVES

- A. Manufacturers:

1. Conbraco Industries: www.apollovalves.com.
 2. NIBCO, Inc: www.nibco.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 2 Inches (50 mm):
1. Bronze body, bronze trim, screwed bonnet, non-rising stem, lock shield stem, rising stem or outside screw & yoke, solid wedge disc, alloy seat rings, solder ends. Class 250.
- C. Over 2 Inches (50 mm):
1. Iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, rising stem or outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Class 250.
- D. Factory handle or gear drive hand-wheel (see below).

2.08 BALL VALVES

- A. Manufacturers:
1. Conbraco Industries: www.apollovalves.com.
 2. NIBCO, Inc: www.nibco.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 2 Inches (50 mm):
1. Bronze one piece body, chrome plated ball, Teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
- C. Over 2 Inches (50 mm):
1. Flanged; Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals
 2. Lever handle or gear drive hand-wheel (see below).

2.09 SWING CHECK VALVES

- A. Manufacturers:
1. Hammond Valve Company: www.hammondvalve.com.
 2. NIBCO, Inc.: www.nibco.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 2 Inches (50 mm):
1. Bronze or iron body, bronze trim, bronze rotating swing disc with composition seat, solder ends.
- C. Over 2 Inches (50 mm):
1. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.10 STRAINERS

- A. Manufacturers:
1. Spirax/Sarco: www.spiraxsarco.com
 2. Mueller Steam Specialty: www.muellersteam.com
 3. Armstrong Company: www.armstronginternational.com.
- B. Up To and Including 2 Inches (50 mm):
1. Cast iron body, stainless steel strainer; flanged or threaded. Class 250.
 2. Provide with full-size, full port blow down valve and cap.
- C. Over 2 Inches (50 mm):
1. Cast iron body, stainless steel strainer; flanged or Threaded, Class 250
 2. Provide with full-size, full port blow down valve and cap.

2.11 CHAINWHEEL OPERATORS

- A. Manufacturers:

1. Babbitt Chainwheels
 2. Roto-Hammer
 3. Trumbull Manufacturing
- B. Aluminum chainwheel, guide arm and cap, and zinc plated carbon steel attachment set for clamping to the valve hand wheel
- C. Provide for valves that are mounted at 8'-0" AFF or higher.

2.12 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
1. GPT Industries; Link-Seal: www.gptindustries.com.
 2. The Metraflex Company; MetraSeal: www.metraflex.com.
- B. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide watertight seal between pipe and wall/casing opening.
 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
- E. After completion, fill and clean systems.
- F. Mechanical Couplings: Contractor's personnel performing the work shall be factory-trained and certified in the fabrication and installation of mechanical couplings for steam and condensate piping in the materials and diameters of the project.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- F. Provide clearance for installation of insulation and access to valves and fittings.

- G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- H. Slope steam piping one inch in 40 feet (0.25 percent) in direction of flow. Use eccentric reducers to prevent puddling of condensate in the pipeline. Use eccentric reducers at pressure reducing valves and control valves – flat on top; pitch piping away from valve on entering and exit to prevent puddling of condensate within the valve body.
- I. Slope steam condensate piping one inch in 40 feet (0.25 percent) unless defined on the drawings. Provide drip trap assembly at low points, before control valves, and as noted on the drawings. Pipe condensate from trap to nearest condensate receiver. Provide loop vents over trapped sections.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds. Paint to match structural building framing.
- K. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.
- L. Install valves with stems upright, diagonal, or horizontal, not inverted.
- M. Install globe body valves in direction of flow.

3.03 TESTING OF PIPE

- A. The mechanical contractor shall be solely responsible to perform all testing required by this specification. All tests shall be witnessed and signed off by the State Project Manager, the Owner, and/or the Owner's representative or Agent. Testing and re-testing (where required) until a satisfactory result is achieved is at the sole cost of the Contractor.

- B. A test of just the underground piping system shall be done earlier as described by Section 23 2115.

The piping shall be tested at one and one-half times the normal system operating pressure (75 psig) for not less than four hours. This test may be done by sections of piping. The installing contractor shall repair all leaks by re-welding, re-installing mechanical couplings, or replacing mechanical fittings; and the system shall be retested.

Test to zero leakage; leaks are not acceptable.

- C. When testing and if necessary re-testing, has been completed, and no leaks are remaining, provide written confirmation of testing and successful completion with no remaining leaks, to the Contract Administrator.

Do not insulate joints or backfill prior to acceptance of all tests.

END OF SECTION

SECTION 31 2316

EXCAVATING, TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.1 DESCRIPTION

A. Work covered by this Section includes excavating, trenching and backfilling for the installation of underground lines, structures and foundations.

B. Related work specified elsewhere includes:

1. Section 31 1000 – Clearing and Grubbing
2. Section 31 2323.23 – Soil Compaction
3. Section 31 9211 - Restoration of Surfaces.

C. Definitions:

1. Earth – Clay, loam, sand, gravel, topsoil and other materials not classified as solid rock or loose rock.
2. Common Earth – Clay, loam, sand, gravel, topsoil and similar materials which may contain some stones, pebbles, lumps and rock fragments up to 6” in largest dimension, but does not contain debris and frozen material.
3. Select Earth – Sand, gravel and similar materials which may contain small amounts of stones, pebbles, or lumps over 1” in largest dimension, but none over 2” in largest dimension, but does not contain clay, loam organic material, debris and frozen material.
4. Crushed stone – Approved imported aggregate, ASTM 33, Size 67 (3/4” – No. 4).
Gradation Passing 2” Sieve = 100%
 Passing 1” Sieve = 90-100%
 Passing ¾” Sieve = 0-30%
 Passing #4 Sieve = 0-5%
5. Select Fill – Consists of Select Earth, imported sand or other granular materials as approved by State Project Manager.
6. Sand Bedding – Sand conforming to ASTM C33. Fine aggregate
Gradation Passing #4 Sieve = 100%
 Passing #200 Sieve = 0-12%
7. Earth Overburden – Earth overlying solid rock and in place during blasting operations or earth no classified as Select or Common Earth.

8. Unstable Material – Debris, frozen materials, topsoil, quicksand and all wet, soft or loose materials which does not provide sufficient bearing capacity to satisfactorily support pipes or other work.
9. Unsuitable Material – Excavated material which does not meet requirements for back filling purposes and includes solid and loose rock, earth overburden an unstable material.
10. Topsoil – Surface layer of soil and sod suitable for use in seeding and planting and not containing debris, subsoil, stumps, roots, brush, stones, clay lumps and similar objects greater than 2” in largest dimension and material toxic to plant growth.
11. Solid Rock, Loose Rock, Common Excavation and Rock Excavation.
12. Common Excavations – Removal and disposition of all materials, except solid rock, which are encountered within the required widths and depths of excavations.
13. Paved Areas – The area which lies directly under a paved surface, whether it be asphalt, concrete, or other paving materials.
14. Bank Run Gravel – Satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from silt, loam, clay and organic matter.

Gradation:	Passing 6” Sieve	=	95-100%
	Passing #4 Sieve	=	25-70%
	Passing #100 Sieve	=	5-20%
	Passing #200 Sieve	=	4-8%
	(Maximum size of 6”)		

15. Screened Gravel - Uniformly graded, clean, hard, and durable particles free from an excess of soft, thin, elongated, laminated, or disintegrated pieces and be free from silt, loam, clay or organic matter.

Gradation:	Passing 2” Sieve	=	100%
	Passing 3/4” Sieve	=	90-100%
	Passing 3/8” Sieve	=	0-30%
	Passing #4 Sieve	=	0-5%

16. Crushed Gravel/Granular Fill – Uniformly graded and free of silt, loam, clay or organic matter.

Gradation	Passing 2” Sieve	=	100%
	Passing #4 Sieve	=	40-70%
	Passing #100 Sieve	=	5-20%
	Passing #200 Sieve	=	4-8%
	(Max 5% passing #200 sieve for material designated as “frost free”)		

1.2 QUALITY ASSURANCE

- A. Unless otherwise specified, or approved by the State Project Manager in writing, tunneling is not permitted.
- B. Moisten or dry backfill to the proper moisture content as determined in accordance with ASTM D1557, Method C.
- C. All subgrades shall be approved by the State Project Manager before pipes or structures are installed or concrete is placed.
- D. Do not restrict access to any private road or driveway from more than one hour. Provide and maintain suitable temporary crossing over open ditches where required to meet this condition.
- E. When excavating in or adjacent to the traveled portion of highways, take whatever measures are necessary to protect the road surfaces from becoming undermined.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store topsoil separately from all other excavated materials on the site and preserve for reuse.
- B. Store excavated materials meeting the requirements for backfill in an orderly manner at a sufficient distance away for banks of excavations and trenches to avoid overloading and to prevent slides or cave-ins. Do not store materials on, over or adjacent to structure or utilities which may collapse or become damaged due to promptly and dispose of away for the site.
- C. Promptly remove materials not specified to be stored or reused.
- D. Obstruction of roads, driveways, sidewalks or interferences with drainage along gutters, ditches or drainage channels with stored material is not permitted. If materials cannot be stored at the site to avoid such obstruction s and interference. They shall be stored away from the site and brought back when and as needed.
- E. No construction activity, access, storage or other use shall take place beyond the construction easement boundaries. The State Project Manager may require the Contractor to install and maintain snow fences along the boundaries, where such boundaries could be violated.

1.4 JOB CONDITIONS

- A. Maintain excavations and trenches free of groundwater, sewage, stormwater, ice and snow during the progress of the work and until the finished work is safer from injury.
- B. Protect subgrades against freezing by means of insulated blankets, salt hay, or other methods
- C. Backfilling with frozen materials or when materials already in place are frozen is not permitted.

1.5 SCHEDULING AND SEQUENCING

A. Do not backfill until the following conditions are met:

1. Concrete – See Division 3 Site Concrete and Reinforcing.
2. Manholes – See Section 33 4614 which requires that specific manholes be given and pass leakage tests prior to backfilling.
3. Manhole Joints – Joints must be filled in accordance with the requirements of Section 33 4614.
4. Mortar Plaster and Masonry – Mortar has set, but no sooner than three days after the mortar was applied.
5. Damp proofed, Waterproofed, and Coated Surfaces – Only after materials have properly cured.
6. Work in General – State Project Manager and testing laboratory have completed all inspections and tests.

B. Except as noted above, or required by other Sections, or when approved or directed by the State Project Manager, back fill pipe and cable excavations within one day after installation. Backfill other excavations as soon as possible after all inspections and test have been completed.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Wood Sheeting and Bracing – Sound timber, free from defects which might impair its strength and effectiveness.
- B. Steel Sheeting and Bracing – ASTM A328.
- C. Backfill – General – to the extent suitable materials are available, backfill shall consist of excavated material. Where excavation does not provide sufficient approved material, import additional material from off-site.
- D. Backfill – Trenches- Select Fill from pipe bedding material up to minimum of 12” over the top of pipe or top of sand encasement: Common Earth, Select Earth, or Select Fill for the remainder of the trench. Select Fill, or better materials may be required at the discretion of the State Project Manager, for the full depth.
- E. Backfill – Around Structures- In paved areas, Select Fill, or a better material when required by the State Project manager, for the full depth. In un-paved areas, Select Fill of the full depth.
- F. Concrete for Cradles and Encasement – Class C concrete.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to work of this Section, become thoroughly familiar with the site conditions and all portions of the work covered by this Section.
- B. Verify that topsoil has been striped to its full depth and stockpiled for subsequent reuse.
- C. Ascertain and verify the locations and character of structures underground lines and subsurface conditions and verify that the work will not adversely affect them.

3.2 TRENCHING

- A. Excavate to the widths and depths specified or directed by the State Project Manager.
- B. Where it is necessary for pipes to be laid in fill, place Select Fill in uniform horizontal layers not over 6” in compacted thickness. Compact each layer in accordance with Section 31 2323.23. Carry fill up to an elevation at least two feet above the elevation of the top of the pipe to be laid and then excavate the trench.
- C. Limit each day’s trench excavation to the length of pipe that will be installed that day, and then to no more than 100’ ahead of the pipe laying.

3.3 TRENCH BOTTOMS

- A. General- The bedding required for each type of pipe is specified in Section 33 4111, and the various beddings are described below.
- B. Class A – Concrete and Concrete Encasement – Excavate trench to the required subgrade elevation to receive concrete. Rest pipe on concrete brick or sacks of lean concrete. Keeping support to a minimum but sufficient to support the pipe and to retain the pie at the required line and grade. Install forms and reinforcing where required. Exercise extreme care in placing concrete so as not to move the pipe. Work concrete under and around the pipe. Other supports may be acceptable.
- C. Class B- First Class Bedding – Excavate trench to the required subgrade elevation. Place Select Fill bedding layers not exceeding 6” in compacted thickness. Compact bedding and shape to the configuration of the pipe and then hand dig depressions just large enough to accommodate pipe joints. When using Stone Bedding, place stone to the elevation of the bottom of the pipe and firmly tamp. Add additional stone so as to form a shaped bed for the pipe barrel to rest on. After the pipe has been set, add the additional stone along the sides of the pipe and firmly tamp into place.
- D. Class B – Rock – All pipes shall be bedded in this manner when rock is encountered in the trenches. Place bedding material as described in “Class B – First Class Bedding” above.
- E. Class C – Ordinary – Excavate the bottom of the trench by hand and form and shaped bed which will firmly support the lower quadrant of the pipe. Hand excavate depressions just large

enough to accommodate pipe joints. The pipe shall rest on undisturbed soil. If the trench is over excavated, provide a bedding as directed by the Sate Project Manager.

- F. Sand Bedding or Encasement – Excavate trench to the required subgrade elevation. For pipes, install bedding as required for “Class B – First Class Bedding.” For cables and remainder of sand encasement, place sand in layers not exceeding 6” in compacted thickness.

3.4 EXCAVATING

- A. Excavate for structures to the elevations required and extend a sufficient distance from foundation walls, piers and footings to provide adequate clearances for construction operations, including sheeting and bracing, if required and for inspections purposes.
- B. Trim approximately the last four inches of foundation subgrades, in earth, by hand just prior to the placement of concrete or concrete reinforcement.

3.5 SHEETING AND BRACING

- A. Provide and maintain adequate sheeting and bracing as required for the safety and protection of the work, persons and adjacent property and structures in accordance with Federal, State, and Local laws, codes ordinances and standards.
- B. The State Project Manager may, at his or her discretion, order sheeting and bracing to be cut-off and left-in-place. Where, in the opinion of the Contractor, damage may result from withdrawing sheeting, they shall immediately notify the State Project Manager for verification. Sheeting ordered left-in-place adjacent to piping shall be cut off not less than 12” over the top sheeting and bracing.
- C. Contractor is fully responsible for the design and construction of all sheeting and bracing used and for all damages resulting for the improper quality, strength, placing, maintenance or removal of sheeting and bracing.

3.6 UNSTABLE MATERIALS

- A. Remove unstable materials in excavations and trench bottoms, which are incapable of supporting pipes or structures, to the extent and depths directed by the State Project Manager, and properly dispose of off-site. Refill and compact the excavation or trench as required, with Granular Fill, Stone Fill or concrete, as directed by the State Project Manager.
- B. Whenever the material encountered is, in Contractor’s opinion, incapable of providing adequate support, they shall immediately notify the State Project Manager for verification.

3.7 DISPOSAL OF EXCAVATED MATERIALS

- A. Excavated materials which meet the requirements for embankment fill or backfill may be used for constructing embankments and backfilling, as applicable. Remove excess excavated materials and dispose off-site.

- B. Load and remove unsuitable materials and dispose off-site. The storing or stockpiling of unsuitable material is not permitted and such material shall be loaded directly from the excavation onto trucks.

3.8 PREPARING OR BACKFILLING

- A. Immediately prior to backfilling, remove all rubbish, debris, forms and similar materials from the excavation.
- B. Do not backfill until the conditions of 1.5 are met.

3.9 BACKFILLING TRENCHES

- A. 12" Over Pipes- Provide 12" of Select Fill over the top of the pipe. Place fill by hand in not greater than 6" layers. Bring Select Fill up evenly on both sides of pipes and carefully and thoroughly compact under the pipe haunches. Do not displace pipe.
- B. 12" Over Sand Encasement – Provide 12" of Select Fill over the top of the sand. Place fill by hand in not greater than 8" compacted layers.
- C. Remainder of Trench – Paved Areas – Select Fill, Select Earth, or Common Earth, placed in not greater than 6" compacted layers.
- D. Remainder of Trench – Other Areas – Select Earth, or Common Earth, placed in not greater than 12" compacted layers.

3.10 BACKFILLING AROUND STRUCTURES

- A. Uniformly spread and deposit backfill in horizontal layers, not over 8" in compacted thickness. Take special precautions to prevent wedging actions against the walls.
- B. In paved areas, backfill with Select Fill, or better material where required by the State Project Manager, for the full depth. In unpaved areas, backfill with Select Fill, Select Earth, or Common Earth.

3.11 GRANULAR FILL UNDER SLABS & FOOTINGS

- A. Prior to placing granular fill, all organic material, topsoil, debris and any other deleterious material shall be removed.
- B. Place material in maximum 8" lifts and compact to 95% of maximum density at optimum moisture content as determined by ASTM D1557, Modified Proctor.
- C. If the materials density tests less than 95%, corrective action and additional testing will be required. The additional testing and corrective action will be paid for by the Contractor.
- D. Place materials in such a way as not to damage concrete foundations and footings.

3.12 TOP OF BACKFILL

- A. Paved Areas – Carry backfill up to pavement subgrade, ready to receive pavement. If paving is to be done at a later date, carry backfill up so as to provide slightly mounded surface with edges flush with the existing pavement surface.
- B. Unpaved Areas – Carry back fill up to adjacent finished grade, minus the depth of any required topsoil or topsoil and sod finish, and so as to provide a finished surface slightly mounded over the trench.
- C. Cover over Pipe – Immediately notify state Project Manager when the depth of cover over any pipe is less than 5”.

3.13 COMPACTION REQUIREMENTS

- A. See Section 31 2323.23.

3.14 FIELD QUALITY CONTROL

- A. Soils testing shall be performed by the approved independent testing laboratory in accordance with Section 31 2323.23 Soil Compaction.
- B. The State Project Manager will establish the date, time, location, number, and types of soils test required.

3.15 ADJUST AND CLEAN

- A. Any trenches or excavations which have been backfilled and show any evidence of settlement of being improperly backfilled, or have been tested and failed, shall be re-excavated to the depth required for proper compaction and then properly refilled and compacted.
- B. Replace or repair any pipe or structure which has been damaged or displaced.

END OF SECTION

SECTION 31 2319

DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION

A. Work covered by this Section includes the maintenance of trenches and excavations of water, snow, ice and other liquids.

B. Related work specified elsewhere includes:

Excavating, Trenching & Backfilling	31 2316
Erosion Control	31 2500

C. Definition: Liquids, as used in this Section, means sewage, water, storm water, groundwater, or other liquid or fluid material.

1.2 QUALITY ASSURANCE

A. Conduct operations in a manner which will keep the work free of standing and flowing liquids, snow, and ice, and dispose of these materials in an approved manner so as not to damage or create a nuisance to the work, the public, surface and ground waters, and adjacent properties.

B. The accumulation of liquids, ice and snow in excavations, trenches, areas to be graded and adjacent areas during construction is not permitted.

C. Unless otherwise noted or approved by the State Project Manager, the placement of work in a liquid is not permitted.

D. The use of installed pipes, or pipes under construction, to drain excavations, trenches and adjacent areas is prohibited, except in the case of drainage pipes where it is necessary to maintain flow from watercourses.

E. Obtain all discharge and water quality permits from the State or Federal applicable agencies. Fines resulting from noncompliance with the statutes, regulations and permit conditions set by the applicable will be the sole responsibility of the Contractor.

PART 2 -PRODUCTS

2.1 MATERIALS

Provide all equipment and materials necessary to perform dewatering operations in a safe and satisfactory manner.

PART 3 EXECUTION

3.1 PERFORMANCE

- A. Perform all ditching, diking, pumping, well pointing and bailing, and construct all drains and channels necessary to keep all work areas clear of liquids, ice and snow during the progress of the work and until the finished work is safe from injury.
- B. Do not permit any liquid to rise over any work in place until such work is adequately protected.
- C. Locate noise producing dewatering equipment as far from residences, businesses, and the public in general, as to minimize noise pollution. When required, or directed by the State Project Manager, provide acoustical enclosures or barriers to reduce noise to an acceptable level.

3.2 DISPOSAL

- A. Dispose of all liquid, ice and snow in a manner which will not create a hazard to public health, nor cause injury to public or private property, lives, work installed or in progress, or public streets, nor cause any interference in the use of streets and roads by the public, nor cause erosion.
- B. Do not permit liquids containing sewage, sludge, gas, oil sediments and other deleterious, poisonous, toxic or oxygen demanding substances to enter streams, lakes other surface waters or into the groundwater.
- C. Secure written permission from the appropriate agency before utilizing a storm drain for the disposal of liquids. Do not overload sewers. Terminate the use of storm drains during any storm where the combined runoff and dewater will result in flooding.
- D. Dispose of all liquids directly into settling ponds when directed by the State Project Manager.

3.3 PROTECTION

- A. Provide adequate protection from the effect of possible uplift due to storm or groundwater where buoyancy might lift installed work or cause joint or structure failure during construction.
- B. Protect the interior of installed work from the entering and accumulation of liquids, ice and snow. Immediately remove and dispose any accumulation which may occur.

3.4 ADJUST AND CLEAN

- A. Adjust, repair, replace or clean all work, surfaces and property which may have been damages as a result of any dewatering operation.

END OF SECTION

SECTION 33 1116

UNDERGROUND PRESSURE PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of underground pressure piping where specified.

B. Related work specified elsewhere includes:

Restoration of Surfaces	32 9211
Buried Pipe and Fittings	33 4111
Buried Valves and Stops	33 1216

1.02 QUALITY ASSURANCE

A. Provide at least one person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the types of materials being installed, pipe loadings and the material manufacturer's recommended methods of installation and who shall direct all work performed under this Section.

B. Pipe installation shall be done by skilled workers and each pipe laying crew shall have a pipe laying foreman.

C. Accurately install pipe to the lines, grades and depths as specified. If no cover or grade is designated, the absolute minimum cover to finished grade shall be 5½' in unpaved areas and 6' in paved areas.

D. Deflections at joints, if approved by State Project Manager, shall be no more than one-half the manufacturer's recommended deflection.

1.03 HANDLING

A. Carefully handle pipes and fittings when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock and damage to the pipe.

B. Use derricks, ropes or other suitable equipment for lowering pipe into trenches where required due to weight of material and for the safety and protection of workmen, materials, equipment, property and the Work.

1.04 VERIFICATION OF EXISTING PIPING

A. Due to the uncertainty of exact locations and depths of existing underground pressure pipes, it is a condition of this Contract that each proposed point of connection to an existing pipe be excavated to verify the data.

B. Prior to the installation of any piping in the vicinity of a required connection, carefully excavate in the area of the connection, locate the existing pipe, determine the centerline elevation of the pipe, and make measurements to adjacent valves and other items which may be in conflict with the Work.

-
- C. If the information found differs from that specified, submit the data to the State Project Manager at least 10 days prior to the anticipated date for making the connection and do not proceed with the connection until State Project Manager issues a Modification.

1.05 JOB CONDITIONS

- A. Obtain permission from the Water Utility prior to shutting off water service in a main. Coordinate with the Water Utility and take adequate precautions to insure maximum fire protection for the affected areas when water service is shut off.
- B. Obtain permission from private owners prior to shutting off a water service.
- C. In the event that a water main or water service must be shut off because of an accidental interruption, immediately notify State Project Manager and the Water Utility or private owner, as applicable, to make arrangements to restore service and to provide temporary service, if required.
- D. Verify pipe sizes and locations of all piping, manholes, structures and appurtenances. Immediately notify State Project Manager of any discrepancies or conflicts.
- E. Approval of State Project Manager is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without a written consent from State Project Manager.
- F. All installed piping shall form completely connected systems including connections to valves, equipment, structures, existing facilities and appurtenances specified in other Sections to result in a satisfactorily operating installation.

1.06 PROTECTION OF WATER LINES

- A. Water and wastewater lines located in the same area shall be installed in accordance with "Ten State Standards" for Water and Sewage Works.
- B. Parallel Water and Sewer Lines - Potable water lines and pipelines carrying sewage, sludge or other wastewaters, whether treated or not, shall not be installed any closer than 10' horizontally from one another. If it is not absolutely possible to maintain this separation, the lines may be located as close as 3' horizontally from each other, provided that written approval has been obtained from the City of Concord Water Department and there is at least an 18" clear, vertical separation, with the sewer being below the water line.
- C. Water and Sewer Line Crossings - Whenever water and sewer lines must cross, the sewer must be situated below the water line with at least an 18" clear, vertical separation.
- D. Special Conditions - Parallel Lines - When it is impossible to achieve the requirements of Paragraph 1.07.B., immediately notify State Project Manager. If State Project Manager concurs, he may order the reconstruction of the existing sewer with ductile iron, mechanical joint pipe. The new line and the reconstructed line shall be pressure tested for leakage in accordance with the requirements of local or applicable plumbing or building codes as well as AWWA Standard C-600 for the water main and the leakage standards for sewer mains found in the State of New Hampshire Wastewater Engineering Bureau's Wastewater Rules, Env-Wq 700.
- E. Special Conditions - Crossing Lines - When it is impossible to achieve the requirements of Paragraph 1.07.C., immediately notify State Project Manager. If State Project Manager concurs, he will order 1) the water line raised, 2) the reconstruction of the sewer with ductile iron, mechanical joint pipe or, 3) the sewer line to be concrete encased.

- F. Water Lines Crossing Below Sewer - When it is impossible to achieve the requirements of any of the preceding paragraphs, immediately notify the State Project Manager. If State Project Manager concurs, he will order 1) the reconstruction of the sewer with ductile iron, mechanical joint pipe 2) the lowering of the water line to obtain a vertical separation of 18" between the bottom of the sewer and the top of the water line 3) the sewer line supported by the concrete cradle and 4) the water line be centered under the sewer to maximize the distance from the sewer to the nearest joint. The sewer and water lines shall be pressure tested for leakage in accordance with the requirements of local or applicable plumbing or building codes as well as AWWA Standard C-600 for the water main and leakage standards for sewer mains found in the State of New Hampshire Wastewater Engineering Bureau's Wastewater Rules, Env-Wq 700.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

- A. Materials are specified in Section 33 4111.

2.02 VALVES AND VALVE BOXES

- A. Types are listed in Section 33 1216.

2.03 CONCRETE FOR PIPE ENCASEMENTS AND CRADLES

- A. Class C concrete (2,000 psi) as specified in Division 3.

2.04 PIPE BEDDING

- A. Specified in Part 2 of Section 31 2316.

2.05 CONNECTIONS TO EXISTING PIPELINES

- A. Use fittings and adapters as specified. Where no details of the connections are shown, submit a proposal, for acceptance, showing all fittings, adapters and procedures to be used.

2.06 PIPE ADAPTERS

- A. Join pipes of different materials with adapters specially manufactured for that purpose and acceptable to State Project Manager.

2.07 UNDERGROUND WARNING TAPE

- A. Tape - Inert plastic film or bonded layer plastic with a metallized foil core. Brightly colored.
- B. Markings - Imprint identifying the type of line buried below.
- C. Manufacturers - Griffolyn Company, Inc., P.O. Box 33248, Houston, Texas; Lineguard Manufacturer, P.O. Box 426, Wheaton, Illinois, or approved equal.

2.08 TIE ROD PIPE JOINT RESTRAINT SYSTEM

- A. Tie rod system shall consist of galvanized, high-strength, low-alloy, heat treated steel - ASTM A242.

2.09 CONDUCTIVITY SYSTEM

-
- A. Electric conductivity shall be provided for ductile iron pipe and fitting by means of bronze wedges, retainer glands or conductivity strips. Pipe 4-inch and less, two (2) bronze wedges at opposite sides of the pipe. Larger pipe, install four (4) bronze wedges, in pairs.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that points of connections to existing pipes have been excavated, elevations taken and given to State Project Manager, and State Project Manager has issued an authorization to proceed with the work as shown, or with modifications.
- B. Verify that trench conditions and pipe bedding are properly provided in accordance with Section 31 2316.
- C. All pipe and fittings shall be in full compliance with these Specifications.
- D. Reinspect each length of pipe, fittings and joints and remove from the Project site any damaged or defective materials.
- E. Do not install pipe until conditions are satisfactory.

3.02 PREPARATION

- A. Thoroughly clean interiors of pipes, fittings and appurtenances, joint surfaces, and gaskets prior to installation.

3.03 PIPE INSTALLATION - GENERAL

- A. Carefully lower pipes and fittings into the trench. Apply joint lubricant in accordance with the approved manufacturer's recommendations. Join pipe section and fittings.
- B. Select pipe and fittings so that there will be as small a deviation as possible at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted.
- C. Use only mechanical cutters for cutting pipe.
- D. Install pipes to the required lines and grades using an accepted method of control. State Project Manager reserves the right to disallow a method of control, including those previously accepted, if, in State Project Manager's opinion, the method of control is not providing the accuracy required under the Contract.
- E. Maintain cleanliness of installed pipe and fitting interiors throughout the Work. Plug ends when pipe installation is not in progress so that dirt, foreign matter, water, animals and people do not enter the pipe. Drainage of construction excavations through installed pipes is not permitted.
- F. Make connections between pipes of different materials with approved adapters. The encasement of adaptor made connections with concrete is not permitted.
- G. Install pipe with plain ends pointing in the direction of the flow.
- H. Dead ended lines shall be fitted with approved watertight plugs or caps specially manufactured for that purpose.
- I. Commence pipe laying at the lowest point, with the spigot ends pointing in the direction of flow.

- J. Install "underground warning tape", at a depth of 40" below finished grade. Position marker directly above and parallel with the pipe with the printed side up.

3.04 ASP, CUP, PVC, ST AND WSS INSTALLATION

In addition to the requirements of this Section, comply with the following:

- A. PVC - ASTM D2774.
- B. Steel Pipe - Install flange insulation sets to electrically insulate underground steel pipe from the balance of the pipe run where it enters into a structure and where it leaves the ground. Provide suitable flanged adapters between steel pipe and interior piping of different materials as required.
- C. Copper Piping - Carefully cut piping square, remove burrs, and clean pipe ends and fitting sockets. For soldered joints, properly flux before assembly and solder joint in a manner to assure a uniform flow of solder down to shoulder of fitting and completely around joint. Use multiple tip ring torch in making joints 1¼" and larger. Remove excess solder. For flared joints, use special flaring tool.

3.05 ANCHORING PRESSURE PIPES

Anchor all tees, dead ends, hydrants and bends deflecting 22½ or more. Anchor by means of any of the following:

- A. Concrete reaction blocking, as specified.
- B. Mechanical joint retainer at fitting and all pipe joints within three pipe lengths on each side of fitting.
- C. Locked mechanical joints at fittings and all pipe joints within three pipe lengths on each side of fitting. In addition, the class of pipe shall be increased so that the required class of pipe specified is achieved under the groove.
- D. Metal harness and tie rods at fittings and all pipe joints within three pipe lengths on each side of fitting. Complete harness assembly shall be given two (2) brush coats of approved asphaltum paint after assembly and tightening.
- E. Where push-on, restrained joints are used install in accordance with the manufacturer's recommendation and printed instructions.

3.06 CONNECTION TO EXISTING PIPELINES

- A. Connect to existing pipelines as specified or subsequently issued Modifications.
- B. Do work at such times and in a manner to cause a minimum of interruption to existing services.
- C. Provide necessary adapters and specials required to make the connections.

3.07 WATER SERVICE TAPS

- A. Provide water service taps to all buildings specified unless noted otherwise. Service taps shall be as herein specified for appropriate pipe materials.
- B. Ductile Iron Pipe - In accordance with AWWA C151.

- C. PVC Pipe - 1-inch and less, bronze tapping saddles, with stops, made especially for tapping PVC. Greater than 1-inch use tee or wye with reducer.

3.08 PIPE CONNECTIONS TO STRUCTURE

- A. All pipes connecting to manholes or other structures shall be connected as specified or as specified in other Sections.
- B. Where not specifically shown on the Drawings or specified, all pipes shall be installed so that a flexible pipe joint is located 12" from the outside face of the structure.

3.09 CONCRETE ENCASEMENT AND CRADLES

- A. Encase pipe in concrete as specified.
- B. Encase pipe in concrete at utility crossings where required and as specified.
- C. Provide concrete cradles as specified.
- D. Provide additional concrete encasements and cradles where directed by State Project Manager.
- E. The State Project Manager will provide information regarding the configuration, dimensions and limits of concrete.

3.10 DISINFECTION

- A. Disinfect all water lines, services, valves, hydrants and appurtenances installed under this Section.
- B. Disinfect all existing water lines, services and appurtenances which were broken, damaged, contaminated or suspected of being contaminated.
- C. Disinfection shall comply with Section 33 1300.

3.11 FIELD QUALITY CONTROL

- A. Afford Engineer access to the Work so that he may spot check the installations, or check each length of pipe immediately after it has been installed, or check it at any time after installation.
- B. Inspect pipe joints and verify that they have been properly installed and made up, and free from sags, high spots, and excessive deflections.
- C. Perform leakage tests in accordance with AWWA C-600, and make any repairs and replacements necessary to meet the stipulated limits.

3.12 ADJUST AND CLEAN

- A. Any section of piping that is found defective in material, alignment, grade, joint or otherwise, shall be corrected.
- B. In the event that dirt, debris or any other foreign material has entered any portion of the piping, flush the piping with clean water. Continue the flushing process until the piping is clean, as determined by State Project Manager.

3.13 WATER SERVICE CONNECTION RECORDS

- A. Install building connections at all buildings indicated by a symbol on the plan and/or profile as specified. The State Project Manager will determine the actual location of building connections in the field on the basis of the most convenient and economical location to provide water service to each structure or lot to be serviced. When locations are determined in the field, they will be provided to the Contractor in advance of the pipe laying.
- B. Horizontal Ties - Measure and record 3 ties to the curb stop and to the end of each water service. When possible, these ties shall be to the building to be served by the service; otherwise, to permanent, physical objects on the same side of the street as the end of the water service.
- C. Vertical Ties - Measure the depth of each water service and record. Depths shall be measured from the pipe centerline to ground surface. Also, provide centerline elevations, using the same datum as that used on the Drawings. Accuracy of vertical measurements shall be plus or minus 1".
- D. Corporation and Curb Stops - Record the pipe station for each corporation stop installed.
- E. Other Recordings - Record length of each water service and other pertinent information, as required on the sketch of water service connections.
- F. Records - Clearly and legibly record the above data on a sketch of water service. Submit duplicate copies of records to State Project Manager within 48 hours after water services are installed.

END OF SECTION

SECTION 33 1216

BURIED VALVES AND STOPS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the furnishings and installation of underground corporation stops, curb stops, gate and other valves, valve and service boxes, and hydrants, as specified.
- B. Related work specified elsewhere includes:
 - Site Work Division 31, 32, and 33
- C. Provide all valves and auxiliary equipment required for complete and proper operation of all systems, whether or not they are specifically described.
- D. Definitions:

Valve - for purposes of this Section, valve means curb stop, corporation stop, and any other valve specified in Part 2.

1.02 QUALITY ASSURANCE

- A. Similar types of valves and hydrants shall each be the product of a single manufacturer and the same models shall be identical, with all parts interchangeable.
- B. Acceptable products are specified in Part 2. Equivalent products of other manufacturers will be acceptable.
- C. Valves and hydrants shall be of ample strength to withstand and operate satisfactorily under the specified pressures.
- D. Unless otherwise specified, perform shop tests with a hydrostatic water pressure equal to twice the rated pressure. Any valve or hydrant which leaks or shows sign of defects is not permitted.

1.03 DELIVERY, STORAGE AND HANDLING

- A. During delivery, storage and handling, keep valves and hydrants tightly closed to prevent foreign matter from damaging seat faces.
- B. Store valves and hydrants in dry, enclosed areas, off the ground. If there is a likelihood of freezing, move materials to a warm area, or remove potentially dangerous moisture.
- C. Verify compliance with Specifications at time of delivery.

1.04 GUARANTEE

- A. For a period of 10 years from date of Substantial Completion, manufacturer shall repair or replace any resilient wedge gate valve which has been found defective in materials of workmanship under normal conditions of use and maintenance. Guarantee need not cover

alterations made by Owner, damage from accidents, abuse, and vandalism, nor Acts of God. Manufacturer's liability shall be limited to the initial cost of valves and installation.

PART 2 - PRODUCTS

2.01 VALVES - GENERAL

- A. Products - The types, sizes, acceptable manufacturers, and catalog numbers of required valves are specified in this Part. Where valves are required for proper operation or control, or where required by pertinent codes, regulations or ordinances, or where shown on the Drawings, yet not included, they shall be furnished and installed and shall be of the proper type, size, and construction, and of a quality equivalent to that established by the valves which are specified.
- B. End Connections - Conform to the following:
 - 1. Bell & Spigot - ANSI A21.10
 - 2. Mechanical Joint - ANSI A21.11
 - 3. Flanged Cast Iron - ANSI B16.1
 - 4. Flanged Ductile Iron - ANSI B16.42
 - 5. Fire Hose Threads - ANSI B16.42
 - 6. Hose Threads - ANSI B2.4
- C. Pressure Rating - 150 psig (min.), non-shock W.O.G., unless otherwise noted.

2.02 BUTTERFLY VALVES

- A. Construction - High strength, cast iron or ductile iron valve body; 18-8 Type 304 stainless steel body seat; full circle rubber seats without shaft penetrations; 304 stainless steel journals; reinforced Teflon bearings; rubber packing, designed for permanent underground service; shall meet or exceed AWWA C504, Class 150B.
- B. Operator:
 - 1. Unless otherwise indicated, the operator shall be the travelling nut type, totally enclosed and lubricated. It shall withstand an overload input torque of 450-foot pounds.
 - 2. Valves shall be operable by one man using a standard valve key.
 - 3. Valves shall be turned counterclockwise to open, unless those presently in use in the community open clockwise.
 - 4. Operating nuts shall be standard 2-inch AWWA type.
 - 5. Provide extension rods to bring the operating nut to within one foot of finish grade.
- C. Test - Test the assembled valve at a pressure of up to 300 psi, as directed.

-
- D. Valve Boxes - Provide each buried valve with a valve box unless otherwise specified or required.

2.03 CORPORATION STOPS

- A. Construction - Corporation stops shall conform to AWWA C800 and shall be of solid brass or bronze construction suitable for compression type connections. Corporation stops shall be Mueller Company Type H-15008, Red Hed Mfg. Co., Fig. 226, or approved equal.
- B. Tap Size Limitations - Do not drill taps larger than those permissible for the size, material, and thickness of pipe being tapped. Permissible size shall be those established by the appropriate pipe standard, or by the pipe manufacturer in the absence of a standard. The appropriate standard for ductile iron pipe is AWWA C151. Where a required tap size exceeds a pipe's capabilities, use one of the following:
1. A tapped tee.
 2. Ford Meter Box Co. Style 101N or 202N, nylon coated ductile iron saddle with stainless steel bands, as applicable for the pipe being used.

2.04 CURB STOPS

- A. Curb stops shall be of brass or bronze. Inlet and outlet connections shall be as required to suite the type of pipe or tubing connected. The curb stops shall not have a drain and shall be the approved equal of those made by Mueller Company or Red Hed Mfg. Company.

2.05 GATE VALVES

- A. Construction - Non-rising stem, iron body, bronze mounted gate valves conforming to AWWA C509-87, standard for Resilient Seated Gate Valves. Valves shall be 150 pound unless the pipe to which the valve is attached has a higher class rating. Waterous Series 500 with cast ductile iron wedge encased in a bonded styrene butadiene (SBR) elastomer covering which forms the sealing surface, or approved equal. Coat valve body, inside and outside with epoxy coating.
- B. Operators:
1. Provide 2-inch by 2-inch operating nuts.
 2. Unless those presently in service in the Community open clockwise, operating nuts shall be turned counterclockwise to open valves.
 3. Provide extension rods to bring the operating nut to within one foot of finish grade.
- C. Valve Boxes - Provide each buried valve with a valve box unless otherwise specified or required.
- D. Indicators:
1. General - Buried valves with post indicators are specified or shown on the drawings, they shall be post indicator type valves and shall conform to the general requirements as listed above.
 2. Valves - Post indicator valves shall be figure #27MP as manufactured by American Valve Co., the equivalent as manufactured by Stockham Valves & Fitting Co., or approved equal.

3. Indicator Posts - Posts shall be as manufactured by Kennedy, Stockham, Clow, or approved equal. The indicator post shall be supplied with handwheel operator.

- E. Packing - Valves shall be capable of being repacked under pressure.

2.06 TAPPING VALVES

- A. Use - For tapping existing pressure mains which are in service.
- B. Ratings - Tapping valves and sleeves for valve sizes two through twelve inches shall be rated for 200 psi; and for sizes fourteen through twenty-four inches shall be rated 150 psi.
- C. Ductile Iron - Kennedy Valve Mfg. Co. "Squareseal" tapping sleeve. Kennedy Valve Mfg. Co. Fig. 950X cast iron, double disc gate valve (F-MJ) with operating nut, conforming to AWWA C500. Open counter-clockwise. Also, equivalent by Clow Corporation, Mueller Co., or other approved equal.
- D. Polyvinyl Chloride - Branch lines and service connections 1-inch or smaller shall be made using bronze tapping saddles made for use with PVC pipe and having stops to prevent over-tightening of the clamp saddles. Connections larger than 1-inch shall be made using the appropriate tee, wye and/or reducer.

2.07 VALVE BOXES

- A. Valve boxes are required on all buried valves.
- B. Box - Two-piece, cast iron, slide type with at least 4½" shafts, recessed cover, upper section and lower section, Clow F-2452 or F-2450 (greater than 10"), Tyler Series 6855 and 6865 (greater than 12"), or approved equal.
- C. Cover - Cast in the cover the words, "WATER", "SEWER" or "GAS", as applicable for water lines, lines carrying sanitary sewage or sludge and gas lines, respectively. In addition, where a valve designation is shown on the Drawings, (eg. SV-1), stamp the valve designation on the top surface of the cover.
- D. Seals - Seal valve box covers and each slide section to exclude surface water and the entrance of dirt. Use rubber "O" ring gaskets or a "rope impregnated with a non-hardening tar compound equal to E-Z Rise Seal Pack.
- E. Spare Seals - Furnish spare seals in a quantity equal to 5% of the total number, or footage, used in the Work.
- F. Coatings - Two coats of asphaltic varnish, inside and outside, applied by manufacturer.

2.08 SERVICE/CURB STOP BOXES

- A. Box - Boxes including stationary rods and pins shall be the approved equal of those furnished by Mueller Company, Decatur, Illinois, or Clow Corporation. Boxes shall be adjustable and shall be installed as specified and as directed by the State Project Manager.
- B. Coatings - Two coats of asphaltic varnish, inside and outside, applied by manufacturer.

2.09 T-HANDLE WRENCHES

- A. For underground valves, provide two T-handle socket wrenches of 5-foot length.

- B. Apply two coats of asphaltic varnish to all wrenches.

2.10 SHUTOFF KEYS

- A. General - Furnish shutoff keys for underground curb stops, meter valves, service valves and the like. The number of keys required equals 2% of the number of valves provided, but not less than 3 nor more than 10.
- B. Length - Length shall be such that the top of the key shall be from 3' - 4' above grade.
- C. Coatings - Two coats of asphaltic varnish.

2.11 HYDRANTS, FIRE

- A. Type - 5¼" Dry-Barrel, compression type with safety breakable section - AWWA C502. The fire hydrants shall be model _____ as manufactured by _____ or approved equal.
- B. Nozzles, Operating Nuts, and Direction To Open - One (1) 4½" steamer and two (2) 2½" outlets. Threads on nozzles and caps, operating nuts, and direction to open shall conform to Owner's standards. In the absence of standards, provide National Fire Hose Coupling Screw Threads, 1½" point to flat pentagon operating nuts, and the direction to open shall be left (counterclockwise). A direction to open arrow shall be cast in hydrant adjacent to operating nut. Furnish chains for outlet caps.
- C. Pipe Connection - 6" mechanical joint.
- D. Pressure Rating - 150 psig working pressure, 300 psig test pressure.
- E. Depth of Bury – As specified.
- F. Coatings and Color - Provide two coats of asphalt varnish on the standpipe interior and the exterior portion below grade, and two coats of weatherproof paint on the exterior portion above grade. Paint standpipe red and bonnet a reflective white.
- G. Drain Feature:
1. Hydrants shall not have a drain feature by furnishing a drain ring without drain holes or a special ring with threaded drain outlet which must be plugged. The method shall be at the Contractor's option, as accepted by the State Project Manager.
- H. Accessories - Provide the following:
1. One complete set of tools needed to remove hydrant main valve and seat ring.
 2. Two spanner wrenches (for removing hose couplings and nozzle caps and for operating the main hydrant valve).
 3. Two safety flange repair kits.
 4. Hydrant lubricating oil, in a quantity which hydrant manufacturer recommends for the proper maintenance of the total number of hydrants provided for a period of 2 years.

2.12 HYDRANTS, FLUSHING WATER

- A. Hydrants shall be 1½" antifreezing, compression hydrants operated with wheel handles, equal to Zurn No. Z-1390, the equivalent model as manufactured by Josam Company or approved equal. The outlets shall have hose thread conforming to American Standard iron pipe hose thread.
- B. Vacuum breaker shall be Watts Regulator Co., No. 288A or approved equal. Provide when specified.

2.13 MISCELLANEOUS FITTINGS

- A. Miscellaneous fittings include saddles, service clamps adapters, or other fittings required to provide an adequate service connection. Saddles or service clamps shall be used on all distribution piping requiring such fittings and shall have a minimum working pressure of 250 psi. A single or double strap shall be used as manufactured by Mueller, Red Hed Manufacturing Company or approved equal.
- B. All adapters and miscellaneous fittings shall provide an adequate seal at the working pressure of the water main and shall be for commercial use.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that all valves may be installed at the locations where required, and that proper operation of the valves will be possible after installation.
- B. In the event of interferences, immediately notify State Project Manager.
- C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

- A. Clean all valves and hydrants of foreign material, inside and out, with emphasis placed on bearing, machined and sliding surfaces.
- B. Operate valves and hydrants several times over the full range from wide open to completely closed. Make adjustments, as required, to attain smooth, easy and proper operation.
- C. Adjust packings where required to insure a tight seal and proper operation. Replace defective packings.
- D. Replace defective and poorly operating valves.

3.03 VALVE INSTALLATIONS

- A. General - Install valves where required, or where directed by State Project Manager. Install in accordance with manufacturer's recommendations.
- B. Underground Installations - Install valves in pipelines with operating nuts pointed vertically upward. Install valve and service boxes plumb and straight, taking extra care in maintaining alignment during backfilling. Install seals in each box joint and cover to exclude surface water and infiltration of dirt, silt, and other debris. Boxes which are out of plumb by more than 1" in 6' in any direction, or are misaligned, or make it difficult or impossible to operate a valve, are not permitted.

3.04 TAPPING

- A. General - Where the size of the connection exceeds that allowed by Part II for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping valve, all as indicated or approved.
- B. Ductile Iron - All drilling and tapping of ductile iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

3.05 FIRE HYDRANT INSTALLATION

- A. Hydrant Locations - Install each hydrant at location determined by Contractor and State Project Manager prior to excavation for hydrant installation.
- B. Installation:
 - 1. Follow hydrant manufacturer's recommended installation instructions. Maintain a set-back of at least 2 feet from the curb line and 1 foot from any sidewalk to the nearest point on the hydrant. The steamer nozzle, shall face the street unless otherwise directed by the State Project Manager. Each hydrant installation shall include an auxiliary valve between the hydrant and its supply main to permit isolation of the hydrant for maintenance purposes. The distance between the auxiliary valve and the hydrant body shall be uniform for all installations and shall conform to the system presently in use in the community. All connections at hydrant installations shall be mechanical joint connections.
 - 2. The hydrants shall be set upon a slab of stone or 3,000 psi concrete as specified in Section 02706, not less than 4" thick and 15" square. Each hydrant shall be thrust blocked against the undisturbed vertical face of the trench with a concrete thrust block as indicated on the drawings. When using concrete, coat hydrant with a grease or wrap in polyethylene, and place concrete in such a manner that the hydrant drain holes are not obscured and so that the hydrant can be removed without removing the concrete blocking.
 - 3. Should soil and/or trench conditions preclude the use of a concrete thrust block, tie rods, installed as indicated on the drawings may be used. Tie rods shall be of the size, material, and construction indicated on the drawings and as specified by the National Fire Underwriters Codes.
 - 4. The Contractor shall take special care to insure that all hydrants are set plumb. Keeping hydrant plumb, backfill with "Select Fill" and thoroughly compact to a minimum density of 95%. When hydrant installation has been completed, including surface restoration of the area immediately surrounding the hydrant, the Contractor shall paint the hydrant as specified
 - 5. Hydrants installed without automatic drains shall have the letters "ND" painted on the hydrant barrel in 2-inch letters just below the outlet nozzle facing the street; the letters shall be black.

6. The installation of those hydrants with an automatic drain feature shall include approximately 1/3 cu. yd. of clean crushed stone placed around the hydrant base to a level several inches above the drain openings.

3.06 FLUSHING WATER HYDRANT INSTALLATION

- A. Hydrants shall be set on 4 cubic feet of ½ to 1-inch clean, thoroughly tamped, rock or gravel on which shall be placed a suitable flat stone to support the hydrant. The hydrant shall be set plumb and backfill of the same material used in the bedding placed up to 6 inches above the hydrant drip.

3.07 CLEAN AND ADJUST

- A. After systems are pressurized, operate valves and hydrants several times over the full range from wide open to completely closed. Make adjustments, as required, to attain smooth, easy, and proper operation.
- B. Adjust packings where required to stop leakage and to secure proper operation.
- C. Test hydrants for proper drainage. If the drainage rate is not sufficient to create a suction, then reinstall the drainage material and do whatever else may be necessary to increase the rate to the point where a suction is created.
- D. Replace valves and hydrants which are defective or do not operate properly, easily, and smoothly.
- E. Lubricate valves, hydrants, operators, and appurtenances which require lubrication.

3.08 FIELD TESTING

- A. Upon completion of installation, all valves shall be tested in the presence of the State Project Manager and in accordance with the requirements of local or applicable plumbing or building code.
- B. All materials, equipment, tools, and labor for testing shall be furnished by the Contractor.
- C. Valves which carry water or liquid under pressure shall be filled with water and subjected to a pressure of 100 psig or 1½" the normal working pressure, whichever is greater, for a period of two hours or longer as may be necessary to examine the valve for leaks.
- D. Should leaks be found, faulty joints shall be repaired, even to the extent of disassembling and remaking the joint. Caulking of threads or the use of chemical compounds to correct leaks will not be permitted. Defective valves shall be replaced by the Contractor and the tests shall be repeated until test requirements are met to the satisfaction of the State Project Manager.

END OF SECTION

SECTION 33 1300

DISINFECTION OF WATER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines, site fire water lines, and relocated municipal water mains specified in other sections.
- B. Testing and reporting results.

1.02 RELATED SECTIONS

- A. Section 33 4111 – Buried Pipe and Fittings.

1.03 REFERENCES

- A. AWWA B300 – Hypochlorites; American Water Works Association; 2004 (ANSI/AWWA B300).
- B. AWWA B301 – Liquid Chlorine; American Water Works Association; 2004 (ANSI/AWWA B301).
- C. AWWA C651 – Disinfecting Water Mains; American Water Works Association; 1999 (ANSI/AWWA C651).

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of New Hampshire.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code or regulation for performing the work of this Section.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals; AWWA B300, Hypochlorite and AWWA B301, Liquid Chlorine.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system has been cleaned, inspected.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 EXECUTION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Inject treatment disinfectant into piping system.
- C. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- D. Replace permanent system devices removed for disinfection.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing as specified.
- B. Test samples in accordance with AWWA C651.

END OF SECTION

SECTION 33 4111

BURIED PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section includes the material and bedding requirements for all pipe and pipe fittings for underground pressure and non pressure piping.
- B. Related work specified elsewhere includes:

General Requirements

Site Work Division 31, 32, and 33

- C. Abbreviations: (Also, see PIPE SCHEDULE 33 4614-1)

ABS	-	Acrylonitrile-Butadiene-Styrene
ACCGMP	-	Asph Coated, Corrugated Galv Metal Pipe
ASP	-	Alloy Steel Pipe
CISP	-	Cast Iron Soil Pipe
CMP	-	Corrugated Metal Pipe
CUP	-	Copper Pipe
DI	-	Ductile Iron Pipe
HDPE	-	High Density Polyethylene
PVC	-	Polyvinyl Chloride
PCCP	-	Prestressed Concrete Cylinder Pipe
RCP	-	Reinforced Concrete Pipe
VCP	-	Extra Strength Vitrified Clay Pipe

1.02 QUALITY ASSURANCE

- A. Pipe and pipe fittings shall be produced in a plant of recognized reputation that is regularly engaged in the production of pipe conforming to the specified standards. Pipe and pipe fittings of the same type shall be the product of a single manufacturer.
- B. All pipe shall be manufactured in a plant of a member of the following organizations:

Pipe	Organization
-----	-----
CISP	Cast Iron Soil Pipe Institute
DI	Ductile Iron Pipe Research Association
CMP	National Corrugated Steel Pipe Assoc
PVC & HDPE	Plastics Pipe Institute
RCP	American Concrete Pipe Association
VCP	National Clay Sewer Pipe Institute

- C. Furnish the services of a competent field representative of the manufacturer at the start-up of installation of each type of pipe to instruct Contractor and State Project Manager in installation and inspection procedure. The representative, Contractor and State Project Manager shall inspect the first shipment or shipments of pipe and check dimensional tolerances prior to the installation of the first section of each type of pipe. The representative shall make periodic schedule visits to the project as the work progresses and be present during leakage testing, when requested by the State Project Manager.

1.03 SOURCE QUALITY CONTROL

- A. General – The manufacturers shall test and furnish copies of certificates covering all pipe and fittings supplied under this Section. Select test samples from the run of pipe proposed to be furnished to the project. Unless State Project Manager elects to witness such testing, the manufacturer shall select the samples for testing. Advise State Project Manager at least two weeks in advance of the time and location of the testing.
- B. Alloy-Steel – Certification outlined under ASTM A53.
- C. Acrylonitrile-Butadiene-Styrene – Inspect and test ABS pipe in accordance with:
 - 8” and larger = ASTM D2680
 - Less than 8” = ASTM D2751
- D. Black Steel Pipe – Certification outlined under ASTM A53.
- E. Cast Iron Soil Pipe – Inspect and test CISP in accordance with ASTM A74.
- F. Copper pipe – Inspect and test CU in accordance with ASTM B88.
- G. High Density Polyethylene Pipe – Inspect and test HDPE Pipe in accordance with ASTM D1248.
- H. Polyvinyl Chloride Pipe - Test as follows:

Test	In Accordance with
-----	-----
Quick Burst	ASTM D1599
Sustained Pressure	ASTM D1598
Acetone Immersion	ASTM D2152
- I. Ductile Iron Pipe – Inspect and test DIP in accordance with AWWA C51.
- J. Reinforced Concrete Pipe and Prestressed Concrete Cylinder Pipe – Test RCP and PCCP by plant load bearing tests, material test, concrete cylinder or core tests and inspect completed product.
- K. Vitrified Clay Pipe – Test VCP for crushing strength, absorption and acid resistance in accordance with ASTM C301.
- L. Additional Testing - In addition to the test required above, State may perform additional testing on pipe delivered to the project site.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Each length of pipe delivered to the site shall be clearly marked with the name of the manufacturer, class of pipe and pipe diameter, PVC sewer pipe shall be marked with the legend “Type PSMR 35 PVC Sewer Pipe.” Store in accordance with manufacturer’s approved instructions.

- B. Carefully handle all pipe and fittings when loading and unloading. Lift pipes and fittings by hoists or lower on skid-ways in a manner to avoid shock. Lower pipe into trench with derricks, rope or other suitable equipment.
- C. Do not dump or drop pipe and fittings. Those that are dumped or dropped are subject to rejection by State Project Manager.
- D. Ship and store vitrified clay pipe on unit pallets.
- E. Store PVC pipe under canvas or other opaque material which will allow air circulation but will eliminate the direct rays for the sun.
- F. Apply one coat of primer and solvent cement to all butt ends of ABS pipe when pipe arrives.
- G. Comply with all other recommendations of the manufacturers.

PART 2 PRODUCTS

2.01 ALLOY STEEL PIPES

- A. Pipe – ASTM A53, nickel copper alloy steel, standard weight, galvanized.
- B. Fittings – ANSI B16.3, 150 psi, galvanized, malleable iron,
- C. Unions – AAR Standard, 300 psi, galvanized, malleable iron with bronze to iron seat.
- D. Electrical Insulation – Flange insulation sets with full length sleeves, double washers and asbestos gaskets.
- E. Pipe Bedding – Ordinary, class C bedding as specified in Section 31 2316, except otherwise specified or when directed by State Project Manager.

2.02 ACRYLONITRILE-BUTADIENE-STYRENE PIPE

- A. Pipe – 8” and larger – ASTM D2680, less than 8” ASTM D2751.
- B. Fittings – ASTM D2680, Solid wall ABS.
- C. Joints:
 - 1. Solvent Cement.
 - 2. Push –on–“O-ring” gasket – ASTM C443.
- D. Pipe Bedding – First Class, Class B bedding as specified in Section 31 2316 except in projection conditions, rock, where otherwise specified or when directed by State Project Manager.

2.03 BLACK STEEL PIPE

- A. Pipe – ASTM 53, Black Steel, Schedule 80.
- B. Couplings – ANSI B2.1, Steel threaded.
- C. Pipe Bedding – Ordinary Class C as specified in Section 31 2316, except in projection conditions, where otherwise specified or when directed by State Project Manager.

2.04 CAST IRON SOIL PIPE

- A. Pipe and Fittings – ASTM A74, extra heavy.
- B. Joints – Factory fabricated rubber compression-type connections with removable gaskets conforming to ASTM C564.
- C. Pipe Bedding – Ordinary Class C as specified in Section 31 2316, except in projection conditions, where otherwise specified or when directed by State Project Manager.

2.05 COPPER PIPE

- A. Tubing – ANSI H23.1.
 - 1. Underground installations – Soft annealed, Type K.
 - 2. Interior and above –ground installation – Hard drawn domestic Type L.
- B. JDWV Drainage Tube – ANSI H23.6.
- C. Fittings
 - 1. Wrought copper solder type – ANSI B16.22.
 - 2. Cast bronze flared tube fittings – ANSI B16.26.
 - 3. Cast bronze solder type – ANSI B16.23.
- D. Joints
 - 1. Soldered – Solid string or wire solder composed of 95-5 tin and antimony. Use noncorrosive flux.
 - 2. Flared – Flare pipe ends using proper size flaring tool specially manufactured for the flaring of pipe ends.
- E. Pipe Bedding – Ordinary, Class C bedding as specified in Section 31 2316, except in rock, where otherwise specified or when directed by sate Project Manager.

2.06 CORRUGATED METAL PIPE

- A. Pipe and Fittings – Galvanized and bituminous coated and lined in accordance with AASHTO M36, helical corrugations with continuous lock or welded seams.
- B. Joints – Galvanized steel, bolted coupling bands, with rubber O-rings or neoprene gaskets when required to meet the leakage requirements found in State of New Hampshire Wastewater Management Division’s Wastewater System and Potable Water Supply Rules.
- C. Pipe Bedding
 - 1. Ordinary, Class C bedding as specified in section 31 2316, except in rock, where otherwise specified or when directed by State Project Manager.
 - 2. Building Underdrain – 6” envelope, ½” – 1” crushed stone.
 - 3. Lagoon Underdrain – 6” sand envelope.

2.07 DUCTILE IRON PIPE

- A. Pipe – AWWA C151, laying lengths, except for closures and specials, shall be a minimum of 18’.
- B. Fittings – AWWA C110, grey cast iron or ductile iron rated at 250 psi, unless otherwise noted.
- C. Joints:
 - 1. Mechanical – AWWA C111.
 - 2. Push – on AWWA C111.
 - 3. Flanged – Specially designed long hub screw flanges, face drilling to ANSI B.16.1, Class 125 template for use with AWWA C110 fittings. Flange shall be shop assembled. Pipe barrels shall be threaded and flanges power-tightened on. Flange faces and pipe ends shall be refaced after assembly, plain face, and smooth finish. All pipe threads shall be covered by the flange. Gaskets shall be factory cut, 1/16” thick, flat ring, cloth inserted rubber conforming to ANSI B16.221, 125 pound cast iron joint. Bolts shall be carbon steel,

- ASTM A307, Grade A, square head machine bolts with heavy steel hexnut. Bolt size and length shall conform to ANSI B16.1 for 125 pound cast iron joints, plain face, and smooth finish.
4. Mechanical, Restrained – AWWA C106, except, provide mechanical joint retainer gland with set screws in lieu of follower gland.
 5. Ball and Socket – ANSI A21.10, maximum 151 deflection.
 6. Restrained, flexible, push-on joints and fittings – AWWA C111/A21.51. US Pipe, HP LOK Restrained Joint or approved equal.
- D. Couplings
1. Sleeve type coupling – Cast iron coupling for plain end ductile iron pipe. Style 53 by Dresser Manufacturing.
- E. Lining – See PIPE SCHEDULE 33 4614-1.
1. Bituminous per AWWA C151.
 2. Cement Mortar with bituminous seal cost per AWWA C104.
- F. Coatings – Bituminous per AWWA C151.
- G. Pipe Bedding – Ordinarily, Class C bedding as specified in Section 31 2316, except in projection conditions, rock, or where otherwise specified or when directed by the State Project Manager.

2.08 POLYETHYLENE PIPE (PE)

- A. Pipe and Fittings – ASTM D1248.
- B. Joints – Thermal butt-fusion in accordance with the pipe manufacturer's recommendations.
- C. Pipe Bedding – First Class, Class B bedding as specified in Section 31 2316, except in projection conditions, rock, or where otherwise specified or when directed by the State Project Manager.

2.09 POLYVINYL CHLORIDE PIPE

- A. NSF Seal – Pipe shall bear National Sanitation Foundation Seal of approval.
- B. Pipe and Fittings:
 1. ASTM D2241 and ATM D1784, Type 1, Grade 1 PVC. Laying lengths, except for closures and specials, shall be a minimum of 20 feet, plus or minus one inch.
 2. ASTM D1785, Type 1, Schedule 80 pipe – ASTM D2464 threaded fittings – ASTM D2467 socket type fittings.
 3. ASTM F789, TypePS-46, ASTM D3212 elastomeric gaskets. Laying lengths not greater than 12.5 feet, plus or minus one inch.
 4. ASTM D3034, Type PSM, ASTM D3212 elastomeric gaskets. Laying lengths not greater than 12.5 feet, plus or minus one inch.
 5. AWWA C900, ASTM D3139 elastomeric gaskets. Laying lengths, except for closures and specials, shall be a minimum of 20 feet, plus or minus one inch.
 6. AWWA C950, with elastomeric gaskets. Laying lengths, except for closures and specials, shall be a minimum of 20 feet, plus or minus one inch.
- C. Joints: See PIPE SCHEDULE 33 4614-1.
 1. Rubber sealing ring allowing expansion and contraction at each joint and supplied by the pipe manufacturer. Bell joint integral with the pipe shall be wall thickened so that standard dimension ratios are mainlined or exceeded.
 2. Solvent Cement – ASTM D2564.
 3. Screwed - ASTM D1785 and D2464.

4. Flanged – Flanges shall be screwed, with smooth or O-ring grooved faces as required to match companion flange, complete with gasket and bolts.
- D. Pipe Bedding – Six-inch minimum sand shield all around.

2.10 REINFORCED CONCRETE PIPE

- A. Circular Pipe and Fittings – ASTM C76, Wall B – elliptical reinforcement is prohibited.
- B. Elliptical Pipe and Fittings – ASTM C507.
- C. Joints – Circular Pipe.
1. For any sanitary sewers, pipes shall have bell and spigot ends with joints formed of steel joint rings sealed with a round rubber “o” ring gasket conforming to AWWA C302. Field performance and acceptance tests shall be as specified in ASTM C425. After joints are made and inspected, fill inside and outside of joint with a fibrated asphalt mastic.
 2. For storm drains, pipes shall have bell and spigot or tongue and groove ends with joints sealed with a round rubber “o” ring gasket. Design of joints and physical requirements for rubber gaskets shall conform to ASTM C4432, except that the Shore durometer hardness shall be 40-55.
- D. Joints – Elliptical Pipe – Completely fill inside and outside of joints with fibrated asphalt mastic.
- E. Fibrated Asphalt Mastic – Trowel mastic conforming to Federal Specification SS-C-153, Type 1, as manufactured by Flintkote, Barrett, Koppers, or an approved equal.
- F. Minimum Laying Lengths – 6’ for 12” and 15” pipe and 8’ for 18” and larger pipe. Equivalent diameters apply to elliptical pipe.
- G. Class – As specified.
- H. Pipe Bedding – First Class, Class B as specified in Section 31 2316 except in projection conditions, where otherwise specified or when directed by the State Project Manager.

2.11 PRESTRESSED CONCRETE CYLINDER PIPE

- A. Pipe and Fittings – In accordance with AWWA Specifications C-301, latest revision; and designed for ASTM C-76 equivalent class.
- B. Joints – Bell and Spigot ends. Line Spigot end with concrete on its interior surface. Cover Bell Ring with mortar on its exterior surface. Each pipe shall be constructed with a self-centering expansion joint sealed with a rubber gasket.
- C. Pipe Bedding – First Class, Class B as specified in section 31 2316 except where otherwise specified or when directed by the State Project Manager.

2.12 VITIFIED CLAY PIPE

- A. Pipe and Fittings – ASTM C700, extra strength, unglazed, except pipe shall be full diameter, maximum absorption shall be 6%, laying lengths, except for closures and specials, shall be 5”. Minimum crushing strength shall be 2,400 pounds/linear foot.
- B. Joints – Factory fabricated rubber or plastic compression type connections with gaskets conforming to ASTM C425. Clay or PVC bells are acceptable.
- C. Joint Lubricant – As recommended by the manufacturer.
- D. Pipe Bedding – First Class, Class B as specified in Section 31 2316, except in project conditions, where otherwise specified or when directed by State Project Manager.

2.13 COUPLINGS/FLEXIBLE CONNECTIONS

- A. Sleeve Type Coupling – Style 38 by Dresser Manufacturing Division, Dresser Industries, Inc., or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Apply a second coat of primer and solvent cement to all butt ends of ABS pipe prior to installation.

3.02 FIELD QUALITY CONTROL

- A. In the presence of the State Project Manager, inspect each length of pipe delivered to the job for flaws, cracks, dimensional tolerances and compliance with applicable specifications.
- B. Provide State Project Manager with suitable templates, calipers, feeler gauges and other equipment of rechecking pipes and fittings. Only pipes and fittings accepted by the State Project Manager, and so marked, shall be installed in the work.

PIPE SCHEDULE 33 4614-1

PIPE			MATERIALS			
USE	SIZE	STRENGTH	PIPE/JOINT	LINING	COATING	FITTINGS/JOINT
WATER MAINS	4" +	Cl. 52	DI / PO	CM	BIT	CI OR DI / MJ
		SDR 18	PVC / PO	--	--	CI OR DI / MJ
	< 4"	SDR 26	PVC / PO	--	--	CI OR DI / MJ
WATER SERVICES	< 2.5"	SDR 26	CU / FL	--	--	CB / FL
SEWER MAINS	ALL	ES	VC / PO	--	--	VC / C
		SDR 35	PVC / PO	--	--	PVC / PO
		STD	ABS / PO	--	--	ABS / SOL
		DTL	AC / PO	--	--	AC / PO
		Cl. 52	DI / PO	CM	BIT	CI OR DI / MJ
		> 15" (*)	PCCP / BS	--	--	PCCP / BS
FORCE MAINS	3"+	Cl. 52	DI / PO	CM	BIT	CI OR DI / MJ
		SDR 18	PVC / PO	--	--	CI OR DI / MJ
	< 3"	SDR 26	PVC / PO	--	--	CI OR DI / MJ
BRIDGE CROSSINGS	ALL	Cl. 52	DI / MJ	CM	BIT	CI OR DI / MJ
		3/8"	ST / W	--	BIT	--/ W

CROSSING CASING	ALL	3/8"	ST / W	--	BIT	--/W
CULVERTS & STORM DRAINS	ALL	LOAD RATED (*), HS-20	CM / CB	GAL	GAL	CM / CB
	ALL	LOAD RATED (*), HS-20	RCP / BS	--	--	--
	ALL	LOAD RATED	HPE / PO	--	--	HDPE / PO
DRAINS	ALL	SDR 35	PVC / PO	--	--	PVC / PO
	ALL		HDPE / PO	--	--	HDPE / PO
RIVER CROSSINGS	ALL	CI. 52	DI / BAS	CM	BIT	--

Pipe strengths shown are minimum. Stronger pipe may be used. Abbreviations used in this SCHEDULE are defined below.

- Design for maximum trench loading which will be applied after backfill is in place.

PIPING ABBEVIATIONS

Strength		Linings and Coatings	
CI	Class	A	Asphalt
EH	Extra Heavy	BIT	Bituminous
ES	Extra Strength	CM	Cement Mortar w/Bituminous Seal Coat
Sch	Schedule	CT	Coal Tar Pitch Galvanized
SDR	Std Dim RatioGal		

Materials		Joint Types	
AS	Alloy Steel	BAS	Bell and Socket
BS	Black Steel	BS	Bell & Spigot
CB	Cast Bronze	C	Compression
CIS	Cast Iron Soil	CB	Coupling Band
CM	Corrugated Metal	F	Flanged
CU	Copper	FI	Flared
DI	Ductile Iron	LO	Lead & Oakum

MI	Malleable Iron	MF	Mastic Filled
HDPE	High Density Polyethylene	MJ	Mechanical
PVC	Polyvinyl chloride	MR	Mechanical, Restrained
RC	Reinforced Concrete	PO	Push-on
ST	Steel	S	Solder
VC	Vitrified Clay	Sc	Screwed
WCU	Wrought Copper	SCL	Sleeve Coupling
WSS	Welded Seamless Steel	Sol	Solvent Cement
ABS	Acrylonitrile-Butadiene- Styrene	W	Welded

EN OF SECTION

SECTION 33 4600.20

UNDERGROUND NON-PRESSURE PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of underground non-pressure piping, as specified.

B. Related work specified elsewhere includes:

Restoration of Surfaces	32 9211
Buried Pipe and Fittings	33 4111

1.02 QUALITY ASSURANCE

A. Provide at least one person who shall be present at all times during the execution of this portion of the work and who shall be thoroughly familiar with the types of materials being installed, pipe loadings and the material manufacturers' recommended methods of installation and who shall direct all work performed under this Section.

B. Pipe installation shall be done by skilled workers and each pipe laying crew shall have a pipe laying foreman.

C. Accurately install pipe to the lines and grades as specified or as directed by State Project Manager, so that inverts are smooth and do not permit any water to be trapped or pond between structures or within manholes.

D. A full circle shall be visible at the far end, when looking through pipes running from structure to structure.

E. Deflections at joints are not permitted without the written consent of the State Project Manager and then shall be no more than one-half the manufacturer's recommended allowable deflection.

1.03 HANDLING

A. Carefully handle all pipes and fittings when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock and damage to the pipe.

B. Use derricks, ropes or other suitable equipment for lowering pipe into trenches where required due to weight of material and for the safety and protection of workmen, materials, equipment, property and the Work.

1.04 JOB CONDITIONS

A. Obtain permission from the Water Utility prior to shutting off water service in a main. Coordinate with the Water Utility and take adequate precautions to insure maximum fire protection for the affected areas when water service is shut off.

B. Obtain permission from private owners prior to shutting off a water service.

-
- C. In the event that a water main or water service must be shut off because of an accidental interruption, immediately notify State Project Manager and the Water Utility or private owner, as applicable, to make arrangements to restore service and to provide temporary service, if required.
 - D. Approval of State Project Manager is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without a written consent from State Project Manager.
 - E. All installed piping shall form completely connected systems including connections to valves, equipment, structures, existing facilities and appurtenances specified in other Sections to result in a satisfactorily operating installation.

1.05 PROTECTION OF WATER LINES

- A. Water and wastewater lines located in the same area shall be installed in accordance with "Ten State Standards" for Water and Sewage Blocks.
- B. Parallel Water and Sewer Lines - Pipelines carrying sewage, sludge or other wastewaters, whether treated or not, shall not be located any closer than 10' horizontally from a potable water pipeline. If it is not absolutely possible to maintain this separation, the lines may be located no closer than 3' horizontally from each other, provided that written approval has been obtained from the Department of Health and that there is at least an 18" clear vertical separation, with the sewer line being below the water line.
- C. Water and Sewer Line Crossings - Whenever water and sewer lines must cross, the sewer must be situated below the water line with at least an 18" clear vertical separation.
- D. Special Conditions - Parallel Lines - When it is impossible to achieve the requirements of Paragraph 1.05.B., immediately notify State Project Manager. If State Project Manager concurs, he will order the construction of the sewer with ductile iron, mechanical joint pipe and may order the reconstruction of the existing water line. The sewer line and the reconstructed water line shall be pressure tested for leakage in accordance with in accordance with the State of New Hampshire Wastewater Management Division's Wastewater System and Potable Water Supply Rules.
- E. Special Conditions - Crossing Lines - When it is impossible to achieve the requirements of Paragraph 1.06.C., immediately notify State Project Manager. If State Project Manager concurs, he or she will order 1) the water line raised, 2), the construction of the sewer with ductile iron, mechanical joint pipe or, 3) the sewer line to be concrete encased.
- F. Water Lines Crossing Below Sewers - When it is impossible to achieve the requirements of any of the preceding paragraphs, immediately notify the State Project Manager. If State Project Manager concurs, he or she will order 1) the construction of the sewer with ductile iron, mechanical joint pipe, 2) the lowering of the water line to obtain a vertical separation of 18" between the bottom of the sewer and the top of the water line, 3) the sewer line supported by concrete cradle and 4) the water line be center under the sewer to maximize the distance from the sewer to the nearest joint. The sewer line and reconstructed water line shall be pressure tested for leakage in accordance with the State of New Hampshire Wastewater Management Division's Wastewater System and Potable Water Supply Rules.

1.06 VERIFICATION OF EXISTING PIPING

-
- A. Due to the uncertainty of exact locations and depths of existing underground pressure pipes, it is a condition of this Contract that each proposed point of connection to an existing pipe be excavated to verify the elevation of the pipes.
 - B. Prior to the installation of any piping in the vicinity of a required connection, carefully excavate in the area of the connection, locate the existing pipe, determine the centerline elevation of the pipe, and make measurements to adjacent valves and other items which may be in conflict with the Work.
 - C. If the information found differs from that which was specified, submit the data to the State Project Manager at least 5 days prior to the anticipated date for making the connection and do not proceed with the connection until directed by the State Project Manager.

PART 2 - PRODUCTS

2.01 PIPE, PIPE FITTINGS AND PIPE BEDDING

- A. Materials are specified in Section 33 4111.

2.02 PIPE ADAPTERS

- A. Join pipes of different materials with adapters specially manufactured for that purpose, and acceptable to State Project Manager.

2.03 CONCRETE FOR PIPE ENCASEMENTS AND CRADLES

- A. Class C concrete (2,000 psi) as specified.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that trench conditions and pipe bedding are properly provided in accordance with Section 31 2316.
- B. Verify that pipe and fittings are in full compliance with these Specifications.
- C. Reinspect each length of pipe, fittings, and joints and remove from the Project site any damaged or defective materials.
- D. Do not install pipe until conditions are satisfactory.

3.02 PREPARATION

- A. Thoroughly clean pipe and fitting interiors, joint surfaces and gaskets prior to installation. Maintain pipes and fittings clean.

3.03 PIPE INSTALLATION - GENERAL

- A. Carefully lower pipes and fittings into the trench. Apply joint lubricant in accordance with the manufacturer's recommendations. Join pipe sections and fittings.

-
- B. Select pipe and fittings so that there will be as small of a deviation as possible at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted.
 - C. Use only mechanical cutters for cutting pipe. All cut ends shall be examined for possible cracks caused by cutting.
 - D. Install pipes to the required lines and grades using an accepted method of control. State Project Manager reserves the right to disallow a method of control, including those previously accepted, if, in State Project Manger's opinion, the method of control is not providing the accuracy required under the Contract.
 - E. Install underdrain pipe with perforation down.
 - F. Maintain cleanliness of installed pipe and fitting interiors throughout the Work. Plug ends when pipe installation is not in progress so that dirt, foreign matter, water, animals and people do not enter the pipe. Drainage of construction excavations through sanitary sewers is not permitted.
 - G. Make connections between pipes of different materials with approved adapters. The encasement of adaptor made connections with concrete is not permitted.
 - H. Commence pipe laying at the lowest point, with the spigot ends pointing in the direction of flow.

3.04 PIPE CONNECTIONS TO STRUCTURES

- A. All pipes connecting to manholes or other structures shall be connected as specified.
- B. Where not specifically specified, install pipes so that a flexible pipe joint is located 2' from the outside face of the structure.

3.05 CONCRETE ENCASUREMENT AND CRADLES

- A. Encase pipe in concrete as specified.
- B. Encase pipe in concrete at utility crossings where required as specified.
- C. Provide concrete cradles as specified.
- D. Provide additional concrete encasements and cradles where directed by State Project Manager.

3.06 FIELD QUALITY CONTROL

- A. Afford State Project Manager access to the Work so that he may spot check the installations, or check each length of pipe immediately after it has been installed, or check it at any time after installation.
- B. Inspect pipe joints and verify that they have been properly installed and made up and free from sags and deflections.
- C. Perform leakage tests in accordance with in accordance with the State of New Hampshire Wastewater Management Division's Wastewater System and Potable Water Supply Rules, and make any repairs and replacements necessary to meet the stipulated limits.
- D. Check piping to determine if any displacement of the pipe has occurred, after trench has been backfilled to full depth, by flashing a light between structures. If the illuminated interior of the

pipe line shows poor alignment, displaced pipe, or any other defects, remove and reinstall piping until all requirements are met.

- E. Check flexible pipe for deflection 30 days after final backfilling using a rigid ball or mandrel of 95% of the inside diameter of the pipe. No mechanical pulling devices permitted.

3.07 ADJUST AND CLEAN

- A. Correct any section of piping that is found defective in material, alignment, grade, joints or damaged.
- B. In the event that dirt, debris or any other foreign material has entered any portion of the piping, flush the piping with clean water. Continue the flushing process until the piping is clean, as determined by State Project Manager.

END OF SECTION