



State of New Hampshire

DEPARTMENT OF ADMINISTRATIVE SERVICES

25 Capitol Street - Room 100
Concord, New Hampshire 03301
Office@das.nh.gov

199^{mle}

Charles M. Arlinghaus
Commissioner
(603) 271-3201

Catherine A. Keane
Deputy Commissioner
(603) 271-2059

Sheri L. Rockburn
Assistant Commissioner
(603) 271-3204

May 31, 2022

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the Department of Administrative Services to enter into a contract with R. H. White Construction Co., Inc., (VC# 174482) Auburn, MA, for a total price not to exceed \$560,678 for excavation services. The term of the contract shall begin on August 1, 2022 or upon approval of the Governor and Executive Council whichever is later, through July 31, 2024, a period of approximately two (2) years with an option to renew for an additional year subject to Governor and Council approval.

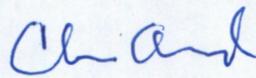
Funds are anticipated to be available through various individual Department of Administrative Services budgeted class 048 contract maintenance line expenditures for Fiscal Years 2023, 2024 and 2025, upon the availability and continued appropriation of funds in the future operating budget, with the authority to adjust encumbrances between fiscal years within the price limitation through the Budget Office, if needed and justified.

EXPLANATION

In accordance with RSA 21-I:12, II B, the Department of Administrative Services, Division of Plant and Property Management is responsible to "provide for the general maintenance of state-owned buildings and grounds, except as otherwise provided by law." The Division of Plant and Property Management maintains 91 state owned buildings located throughout the state. This contract will be utilized to provide excavation services to complete repairs to underground utilities including electric, gas, oil, steam, petroleum, communications, water, sewer, storm water and irrigation lines for state buildings located in Concord and Laconia.

A request for bids was issued and placed on the State of New Hampshire, Bureau of Purchase and Property website on April 18, 2022. In addition to posting the bid on our website, we also notified sixty-eight (68) contractors that are registered with the Bureau of Purchase and Property regarding the bidding opportunity. Two bids were received. R. H. White Construction Co., Inc. was the low bidder. Attached is a copy of the bid summary.

Respectfully Submitted,

A handwritten signature in blue ink, appearing to read "Ch Arlinghaus", is placed over a light blue rectangular background.

Charles M. Arlinghaus
Commissioner

RFB DAS 2022-286 Excavation Services

Bid Award Summary

5/10/2022

Raymond's Landscaping LLC

Location	Excavation Services Monday through Friday 7:00 AM to 5:00 PM	Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59	Totals
Concord Totals	\$464,534	\$76,230	\$540,764
Laconia Totals	\$56,184	\$38,936	\$95,120
Grand Total	\$520,718	\$115,166	\$635,884

R.H. White Construction Co., Inc.

Location	Excavation Services Monday through Friday 7:00 AM to 5:00 PM	Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59 AM	Totals
Concord Totals	\$420,036	\$58,670	\$478,706
Laconia Totals	\$49,696	\$32,276	\$81,972
Grand Total	\$469,732	\$90,946	\$560,678

R.H. White Construction Co., Inc. apparent low bidder. Contract award pending upon approval of NH Governor and Council.

RFB DAS 2022-286 Excavation Services

Bid Award Summary

5/10/2022

Raymond's Landscaping LLC

Laconia

Description	Excavation Services Monday through Friday 7:00 AM to 5:00 PM			Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59 AM		
	Hours	Rate	Total	Hours	Rate	Total
Labor Foreman	48	\$79.00	\$3,792.00	16	\$118.50	\$1,896.00
Labor Laborer	96	\$59.00	\$5,664.00	32	\$88.50	\$2,832.00
Mini Excavator	16	\$155.00	\$2,480.00	8	\$209.50	\$1,676.00
35,000 lb. Excavator	16	\$205.00	\$3,280.00	8	\$259.50	\$2,076.00
Bucket Loader	16	\$160.00	\$2,560.00	8	\$214.50	\$1,716.00
Bull Dozer	8	\$130.00	\$1,040.00	8	\$184.50	\$1,476.00
Compacting Roller	16	\$95.00	\$1,520.00	8	\$154.50	\$1,236.00
Skid Steer	16	\$80.00	\$1,280.00	8	\$129.50	\$1,036.00
Backhoe	48	\$120.00	\$5,760.00	16	\$174.50	\$2,792.00
Dump Truck	48	\$100.00	\$4,800.00	16	\$152.50	\$2,440.00
Sweeper	16	\$89.00	\$1,424.00	8	\$142.50	\$1,140.00
Jackhammer	24	\$79.00	\$1,896.00	8	\$134.50	\$1,076.00
Jackhammer for Excavator	24	\$200.00	\$4,800.00	8	\$281.00	\$2,248.00
Trench Box	24	\$37.00	\$888.00	8	\$37.00	\$296.00
Materials and Subcontractor Work			\$15,000.00			\$15,000.00
Laconia Totals			\$56,184.00			\$38,936.00

Basis of Award

Location	Excavation Services Monday through Friday 7:00 AM to 5:00 PM	Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59 AM	Totals
Concord Totals	\$464,534	\$76,230	\$540,764
Laconia Totals	\$56,184	\$38,936	\$95,120
Grand Total	\$520,718	\$115,166	\$635,884

RFB DAS 2022-286 Excavation Services

Bid Award Summary

5/10/2022

R.H. White Construction Co., Inc.

Concord

Description	Excavation Services Monday through Friday 7:00 AM to 5:00 PM			Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59 AM		
	Hours	Rate	Total	Hours	Rate	Total
Labor Foreman	520	\$183.50	\$95,420.00	56	\$200.00	\$11,200.00
Labor Laborer	1040	\$58.50	\$60,840.00	112	\$73.00	\$8,176.00
Mini Excavator	60	\$96.00	\$5,760.00	8	\$120.50	\$964.00
35,000 lb. Excavator	60	\$149.00	\$8,940.00	8	\$202.00	\$1,616.00
Bucket Loader	60	\$129.00	\$7,740.00	8	\$176.50	\$1,412.00
Bull Dozer	41	\$190.50	\$7,810.50	8	\$251.00	\$2,008.00
Compacting Roller	200	\$65.00	\$13,000.00	24	\$81.50	\$1,956.00
Skid Steer	100	\$96.00	\$9,600.00	16	\$120.50	\$1,928.00
Backhoe	520	\$96.00	\$49,920.00	56	\$119.00	\$6,664.00
Dump Truck	520	\$86.00	\$44,720.00	56	\$107.50	\$6,020.00
Sweeper	200	\$6.00	\$1,200.00	24	\$6.00	\$144.00
Jackhammer	267	\$5.00	\$1,335.00	28	\$5.00	\$140.00
Jackhammer for Excavator	267	\$36.50	\$9,745.50	28	\$36.50	\$1,022.00
Trench Box	267	\$15.00	\$4,005.00	28	\$15.00	\$420.00
Materials and Subcontractor Work			\$100,000.00			\$15,000.00
Concord Totals			\$420,036.00			\$58,670.00

RFB DAS 2022-286 Excavation Services

Bid Award Summary

5/10/2022

R.H. White Construction Co., Inc.

Laconia

**Excavation Services Monday through
Friday 7:00 AM to 5:00 PM**

**Excavation Services Saturday, Sundays, Holidays
& Monday through Friday 5:01 PM to 6:59 AM**

Description	Hours	Rate	Total	Hours	Rate	Total
Labor Foreman	48	\$183.50	\$8,808.00	16	\$200.00	\$3,200.00
Labor Laborer	96	\$58.50	\$5,616.00	32	\$73.00	\$2,336.00
Mini Excavator	16	\$96.00	\$1,536.00	8	\$120.50	\$964.00
35,000 lb. Excavator	16	\$149.00	\$2,384.00	8	\$202.00	\$1,616.00
Bucket Loader	16	\$129.00	\$2,064.00	8	\$176.50	\$1,412.00
Bull Dozer	8	\$190.50	\$1,524.00	8	\$251.00	\$2,008.00
Compacting Roller	16	\$65.00	\$1,040.00	8	\$81.50	\$652.00
Skid Steer	16	\$96.00	\$1,536.00	8	\$120.50	\$964.00
Backhoe	48	\$96.00	\$4,608.00	16	\$119.00	\$1,904.00
Dump Truck	48	\$86.00	\$4,128.00	16	\$107.50	\$1,720.00
Sweeper	16	\$6.00	\$96.00	8	\$6.00	\$48.00
Jackhammer	24	\$5.00	\$120.00	8	\$5.00	\$40.00
Jackhammer for Excavator	24	\$36.50	\$876.00	8	\$36.50	\$292.00
Trench Box	24	\$15.00	\$360.00	8	\$15.00	\$120.00
Materials and Subcontractor Work			\$15,000.00			\$15,000.00
Laconia Totals			\$49,696.00			\$32,276.00

Basis of Award

Location	Excavation Services Monday through Friday 7:00 AM to 5:00 PM	Excavation Services Saturday, Sundays, Holidays & Monday through Friday 5:01 PM to 6:59 AM	Totals
Concord Totals	\$420,036	\$58,670	\$478,706
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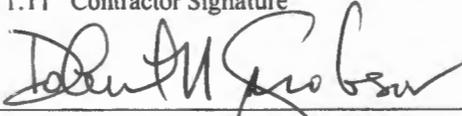
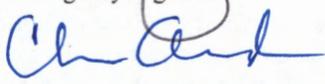
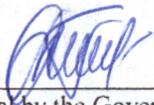
Notice: This agreement and all of its attachments shall become public upon submission to Governor and Executive Council for approval. Any information that is private, confidential or proprietary must be clearly identified to the agency and agreed to in writing prior to signing the contract.

AGREEMENT

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

GENERAL PROVISIONS

1. IDENTIFICATION.

1.1 State Agency Name Department of Administrative Services		1.2 State Agency Address 25 Capitol Street, Room 417 Concord, NH 03301	
1.3 Contractor Name R. H. White Construction Co., Inc.		1.4 Contractor Address 41 Central Street, Auburn, MA 01501	
1.5 Contractor Phone Number 508-832-3295	1.6 Account Number Various	1.7 Completion Date July 31, 2024	1.8 Price Limitation \$560,678.00
1.9 Contracting Officer for State Agency Michael P. Connor		1.10 State Agency Telephone Number (603) 271-6899	
1.11 Contractor Signature  Date: 5/19/22		1.12 Name and Title of Contractor Signatory Robert N. Jacobson, Chief Financial Officer	
1.13 State Agency Signature  Date: 6.6.22		1.14 Name and Title of State Agency Signatory Charles M. Arlinghaus, 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: 6/10/22			
1.17 Approval by the Governor and Executive Council (if applicable) G&C Item number: _____ G&C Meeting Date: _____			

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

Contractor Initials AJ
Date 5/19/22

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

1. No Special Provisions.


5/19/22

EXHIBIT "B"

SCOPE OF SERVICES

1. The Contractor shall provide "Excavation Services" to facilitate the timely repair of underground facilities including but not limited to electric, gas, oil, steam, petroleum, communications, water, sewer, storm water and irrigation lines for State buildings located in Concord and Laconia, NH as listed below. The State of New Hampshire reserves the right to add or delete locations within that geographical Region.

Concord		
Name/Facility	Address	Town
Bridges House	21 Mountain Road	Concord
Brown Building	129 Pleasant Street	Concord
Dolloff Building	117 Pleasant Street	Concord
DOT Mechanical Services	226 Sheep Davis Road	Concord
DOT Materials and Research	5 Hazen Drive	Concord
Grounds Shop	79 South Fruit Street	Concord
Health & Human Services	27-29 Hazen Drive	Concord
Homeland Security	224 Sheep Davis Road	Concord
Johnson Hall	107 Pleasant Street	Concord
Dept of Justice	33 Capitol Street	Concord
Laundry Building	127 Pleasant Street	Concord
Legislative Office Building	33 North State Street	Concord
Liberty House	119 Pleasant Street	Concord
Londergan Hall	101 Pleasant Street	Concord
Main Building	105 Pleasant Street	Concord
Medical & Surgical Building	109 Pleasant Street	Concord
Morton Building	7 Hazen Drive	Concord
Motor Vehicle	23 Hazen Drive	Concord
NH Hospital Annex	115 Pleasant Street	Concord
NH Hospital Warehouse	131 Pleasant Street	Concord
Old Labor Building	19 Pillsbury Street	Concord
Old Revenue Building	64 South Street	Concord
Paint and Carpentry Shop	65 South Fruit Street	Concord
Records and Archives	71 South Fruit Street	Concord
Safety Building	33 Hazen Drive	Concord
Spaulding Hall	95 Pleasant Street	Concord
State House	107 North Main Street	Concord
State House Annex	25 Capitol Street	Concord
State Library	20 Park Street	Concord
Storrs Street Garage	90 Storrs Street	Concord
Thayer Building	97 Pleasant Street	Concord
Transportation Garage	133 Pleasant Street	Concord
Upham Walker House	18 Park Street	Concord
Warehouse	12 Hills Avenue	Concord

Laconia		
Name/Facility	Address	Town
Laconia Circuit Court	26 Academy Road	Laconia
Lakes Region Campus	1 Right Way Path	Laconia

2. The Contractor shall provide all supervision, labor, materials, transportation, tools, equipment, construction equipment and machinery necessary to satisfactorily complete the excavation services as identified herein.
3. The Excavation services shall include the following:
 - a) Excavation, complete debris removal and offsite disposal; fill and paving and or concrete work in order to return the disturbed work areas in proper and safe condition;
 - b) Repair of water, sewer and storm water systems including piping, manholes, frames, hand holes, catch basins, grates, covers and outfalls and all culverts;
 - c) Testing of completed piping work;
 - d) Other general excavation related services as requested by the State;
 - e) Paving services either in house or through a sub contractor as requested by the State; and
 - f) Catch basin cleaning services either in house or through a sub contractor as requested by the State.
4. The term of this non-exclusive contract shall begin on August 1, 2022 or upon approval of the Governor and Executive Council whichever is later, through July 31, 2024, a period of approximately two (2) years. The contract may be extended for one additional year at terms and conditions agreed upon by both parties. Any such extension shall be subject to NH Governor and Council approval.
5. The State has the right to terminate the contract at any time by giving the Contractor a thirty-day written notice.
6. Individual projects shall not exceed \$25,000 including all costs associated with any individual project, including supervision, labor, material, equipment, construction equipment, machinery and supplies, etc., unless a waiver is granted by the Director of Plant and Property Management.
7. The Contractor shall submit not to exceed quotes for individual projects at rates established in this contract. For emergency projects requiring immediate attention, the Contractor shall work on a Time and Materials basis at rates detailed in Exhibit C, subject to review and approval by the State Project Manager.
8. All work performed under this contract shall be scheduled by the State Project Manager from the Department of Administrative Services.
9. Unless the Contractor is directed differently by the State Project Manager, all materials, parts, and work shall comply with DOT specifications as detailed in Appendix A.

10. The Contractor's typical working hours will range from 7:00 AM and 5:00 PM Monday through Friday, but occasions may arise which will 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 where work is being performed, and will be established at the beginning of each project.

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

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

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

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

15. The Contractor shall notify the State Project Manager of any maintenance related issues that are discovered while performing the work.

16. The Contractor shall secure any permits, schedule inspections and be on site during inspections. The Contractor shall ensure that inspections are made by the appropriate State and or local authority having jurisdiction.

17. 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.

18. The Contractor shall initiate, maintain and supervise all safety precautions and programs in connection with the work.

19. 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.

20. 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.
21. 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.
22. The Contractor shall provide and maintain; as required any traffic control measures to ensure safety to employees and the public.
23. 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.
24. 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 State 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.
25. 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.
26. The Contractor shall premark areas of 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.
27. The Contractor shall grade site to drain and maintain excavations free of water. The Contractor shall provide, operate and maintain the necessary pumping equipment.
28. The Contractor shall protect the project site from puddling and running water. They shall provide water barriers as required to protect the project site from soil erosion.
29. 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.
30. The Contractor shall execute the work with methods to control surface drainage from cuts and fills and from borrow and waste disposal areas. The Contractor shall prevent erosion and sedimentation.

31. The Contractor shall minimize surface area of bare soil exposed at one time.
32. The Contractor shall provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.
33. The Contractor shall construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
34. The Contractor shall periodically inspect earthwork to detect evidence of erosion and sedimentation and promptly apply corrective measures as required.
35. The Contractor shall provide methods, means, and facilities to minimize noise from demolition and noise produced by construction operations.
36. 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.
37. The Contractor shall comply with pollution and environmental control requirements of authorities having jurisdiction.
38. The Contractor equipment shall be the size and type appropriate for completing the various types of excavation work. The Contractor shall ensure that any equipment considered by the State Project Manager to be improper or inadequate for the purpose is removed from the site and replaced with satisfactory equipment.
39. 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 Excavation Services shall be good quality free from faults and defects.
40. The Contractor shall ensure that all supplies, equipment and machines shall be kept free of traffic lanes or other areas that may be hazardous. The Contractor shall further ensure that all dirt and debris resulting from the work under any resulting contract shall be disposed of at the end of each day or at the completion of work.
41. The Contractor shall, at no additional cost to the State, repair furnishings, equipment, facilities or other property of the State damaged by the Contractor(s), its officers, employees, agents, contractors, sub contractors and invitees.
42. 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.

43. 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.

44. The Contractor shall perform all the work and furnish all the materials, tools, equipment and safety devices necessary to perform in the manner and within the time hereinafter specified. The Contractor shall complete the entire work to the satisfaction of the State and in accordance with the specifications herein mentioned, at the price herein agreed upon and fixed therefore. All the work furnished under this contract, shall be done and furnished strictly pursuant to, and in conformity with the specifications described herein, and the directions of the State representatives as given from time to time during the progress of the work, under the terms of this Contract.

45. The Contractor shall take all responsibility for the work under the contract; for the protection of the work; and for preventing injuries to persons and damage to property and utilities on or about the work. They shall in no way be relieved of their responsibility by any right of the State to give permission or issue orders relating to any part of the work; or by any such permission given on orders issued or by failure of the State to give such permission or issue such orders. The Contractor shall bear all losses resulting to him or to the State on account of the amount or character of the work, or because of the nature of the area in or on which the work is done is differed from what was estimated or expected, or account of the weather, elements or other causes.

46. The Contractor agrees that any damage or injury to buildings, materials, and equipment or to other property by the Contractor during the performance of this service shall be repaired at their own expense.

47. 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 this Contract.

48. 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.

49. 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.

50. The Contractor shall take photographs of the project site and construction throughout the progress of the work. The pictures shall be provided to the State with the related invoice.

51. 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.

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

53. 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.

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

55. All Contractor correspondence and submittals shall be sent to:

State of New Hampshire
Department of Administrative Services
Michael Connor
25 Capitol Street, Room 417
Concord, N.H. 03301

EXHIBIT "C"

PAYMENT TERMS

1. The Contractor hereby agrees to provide "Excavation Services" at the rates listed below for a not to exceed total of **\$560,678.00** (herein after referred to as the contract price) in return for the services described in Exhibit "B."

2. **Scheduled Excavation Services**
The Contractor shall submit not to exceed quotes for individual projects at rates established in this Contract. 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.

3. **Emergency Excavation Services**
For emergency projects requiring immediate attention, the Contractor shall work on a Time and Materials basis at the rates stated below subject to review and approval of the State Project Manager.

4. **Hourly Labor and Equipment Rates**
The hourly labor rates are inclusive of all expenses including all overhead, profit, superintendence, insurances, training, travel and taxes. The equipment hourly rates are also fully inclusive as described above and include the hourly rate of the respective equipment operators. The hourly rate shall start when the Contractor's personnel arrive at the work site and when the personnel leave the work site.
The hourly labor and equipment rates shall include all fees including any travel time and or mileage expenses. Special charges, surcharges, processing charges, or fuel charges of any kind (by whatever name) may not be added on at any time.

5. **Materials and Supplies**
All materials and supplies shall be invoiced at a markup not to exceed 10% over Contractor's cost.

6. **Subcontractor Rates**
Subcontractor's work shall be invoiced at a markup not to exceed 10% over contractor's cost.



5/19/22

7. Rate Schedule

Concord

Description	Hourly Rate Monday through Friday 7:00 AM to 5:00 PM	Hourly Rate Saturday, Sundays, Holidays and Monday through Friday from 5:01 PM o 6:59 AM
Labor Foreman	\$183.50	\$200.00
Labor Laborer	\$58.50	\$73.00
Mini Excavator	\$96.00	\$120.50
35,000 lb. Excavator	\$149.00	\$202.00
Bucket Loader	\$129.00	\$176.50
Bull Dozer	\$190.50	\$251.00
Compacting Roller	\$65.00	\$81.50
Skid steer	\$96.00	\$120.50
Backhoe	\$96.00	\$119.00
Dump Truck	\$86.00	\$107.50
Sweeper	\$6.00	\$6.00
Jackhammer	\$5.00	\$5.00
Jackhammer for Excavator	\$36.50	\$36.50
Trench Box	\$15.00	\$15.00

Laconia

Description	Hourly Rate Monday through Friday 7:00 AM to 5:00 PM	Hourly Rate Saturday, Sundays, Holidays and Monday through Friday from 5:01 PM to 6:59 AM
Labor Foreman	\$183.50	\$200.00
Labor Laborer	\$58.50	\$73.00
Mini Excavator	\$96.00	\$120.50
35,000 lb. Excavator	\$149.00	\$202.00
Bucket Loader	\$129.00	\$176.50
Bull Dozer	\$190.50	\$251.00
Compacting Roller	\$65.00	\$81.50
Skid steer	\$96.00	\$120.50
Backhoe	\$96.00	\$119.00
Dump Truck	\$86.00	\$107.50
Sweeper	\$6.00	\$6.00
Jackhammer	\$5.00	\$5.00
Jackhammer for Excavator	\$36.50	\$36.50
Trench Box	\$15.00	\$15.00

[Handwritten Signature]
 5/19/22

8. **For Excavating 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 State Project Manager;

Provide supporting documentation of material costs and or subcontractor costs, not to exceed 10% mark up.

9. **For Emergency Excavating 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 or costs incurred as a result of the scope of work.

10. **Permit or Inspection Fees**

The Contractor shall invoice the State for the cost of any permit or inspection fees, at no markup, as part of the Excavation Services. The permit or inspection cost will be itemized on the detailed invoice at the completion of the work.

11. Invoices must be submitted to the State by the Contractor at the rates quoted in this Contract. If additional equipment is required beyond the excavation equipment listed in this Contract, they must be procured and billed to the project at rates subject to prior approval of the State Project Manager.

12. Invoices shall be submitted after completion of work to the requesting agency. Payment shall be paid in full within thirty (30) days after receipt of invoice and acceptance to the State's satisfaction. Payments shall be made via ACH unless otherwise specified by the State.

13. The Contractor shall submit invoices to the State to the following addresses:

Bureau of General Services
State of New Hampshire
Department of Administrative Services
Kristin Glover
25 Capitol Street, Room 112
Concord, NH 03301

Bureau of Facilities and Assets Management
State of New Hampshire
Department of Administrative Services
Sherri Senechal
129 Pleasant Street
Concord, NH 03301

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice to ensure transparency and accountability.

In addition, the document outlines the procedures for handling discrepancies. If there is a difference between the recorded amount and the actual amount received or paid, it is crucial to investigate the cause immediately and rectify the error as soon as possible.

The second part of the document provides a detailed overview of the accounting system used. It describes the various accounts maintained, including assets, liabilities, and equity, and explains how they are classified and recorded.

Furthermore, the document discusses the process of preparing financial statements. It highlights the importance of reviewing the accounts regularly to ensure that the statements accurately reflect the financial position of the organization at any given time.

Finally, the document concludes by reiterating the commitment to high standards of financial reporting. It states that the organization is dedicated to providing clear, concise, and reliable information to all stakeholders.

The following table provides a summary of the key financial metrics for the period covered by this report. It includes details on revenue, expenses, and net income, along with a breakdown of the major components of each category.

Overall, the financial performance for the period was strong, with a significant increase in revenue and a decrease in expenses. This was primarily due to the successful implementation of the new marketing strategy and the efficient management of resources.

State of New Hampshire

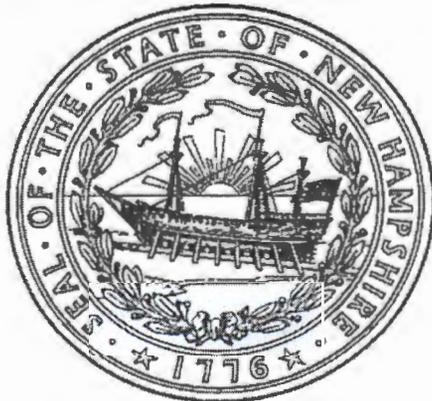
Department of State

CERTIFICATE

I, David M. Scanlan, Secretary of State of the State of New Hampshire, do hereby certify that R.H. WHITE CONSTRUCTION CO., INC. is a Massachusetts Profit Corporation registered to transact business in New Hampshire on July 18, 1979. 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: 4152

Certificate Number: 0005784546



IN TESTIMONY WHEREOF,

I hereto set my hand and cause to be affixed
the Seal of the State of New Hampshire,
this 31st day of May A.D. 2022.

A handwritten signature in black ink, appearing to read "David M. Scanlan".

David M. Scanlan
Secretary of State

SECRETARY'S CERTIFICATE

R. H. WHITE CONSTRUCTION CO., INC.

I, Mark L. Donahue, Secretary of R. H. WHITE CONSTRUCTION CO., INC., herein certify that the following is a true copy of a resolution adopted at the annual meeting of the Board of Directors of the Corporation duly called and held on July 15, 2021:

VOTED: To authorize and empower David H. White, Chairman, Treasurer and Assistant Secretary; James E. McCarthy, President and Chief Executive Officer; and, Robert N. Jacobson, Chief Financial Officer; or any one acting singly, to execute all contracts and bonds on behalf of the Corporation.

I further certify that the foregoing resolution and authority vested thereby has not been amended or rescinded and is still in force and effect as of the date hereof.

I further certify that the officers set forth in the resolution are duly elected and acting officers of R. H. WHITE CONSTRUCTION CO., INC.

Witness my hand and seal of the Corporation this 19th day of MAY, 2022.



Mark L. Donahue, Secretary

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AGENCY CUSTOMER ID: _____

LOC #: _____



ADDITIONAL REMARKS SCHEDULE

AGENCY Willis Towers Watson Northeast, Inc.		NAMED INSURED R. H. White Construction Company, Inc. 41 Central Street Auburn, MA 01501	
POLICY NUMBER See Page 1		EFFECTIVE DATE: See Page 1	
CARRIER See Page 1	NAIC CODE See Page 1		

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,
FORM NUMBER: 25 **FORM TITLE:** Certificate of Liability Insurance

contract.

Certificate Holder is included as an Additional Insured as respects to Auto Liability.
 Auto Liability policy shall be Primary and Non-contributory with any other insurance in force for or which may be purchased by Additional Insured.
 Waiver of Subrogation applies in favor of Certificate Holder with respects to Auto Liability.

Waiver of Subrogation applies in favor of Certificate Holder with respects to Workers Compensation where required by contract and as permitted by law.

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:

$$L = (S)(D)^2P \text{ where: } 133,200$$

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

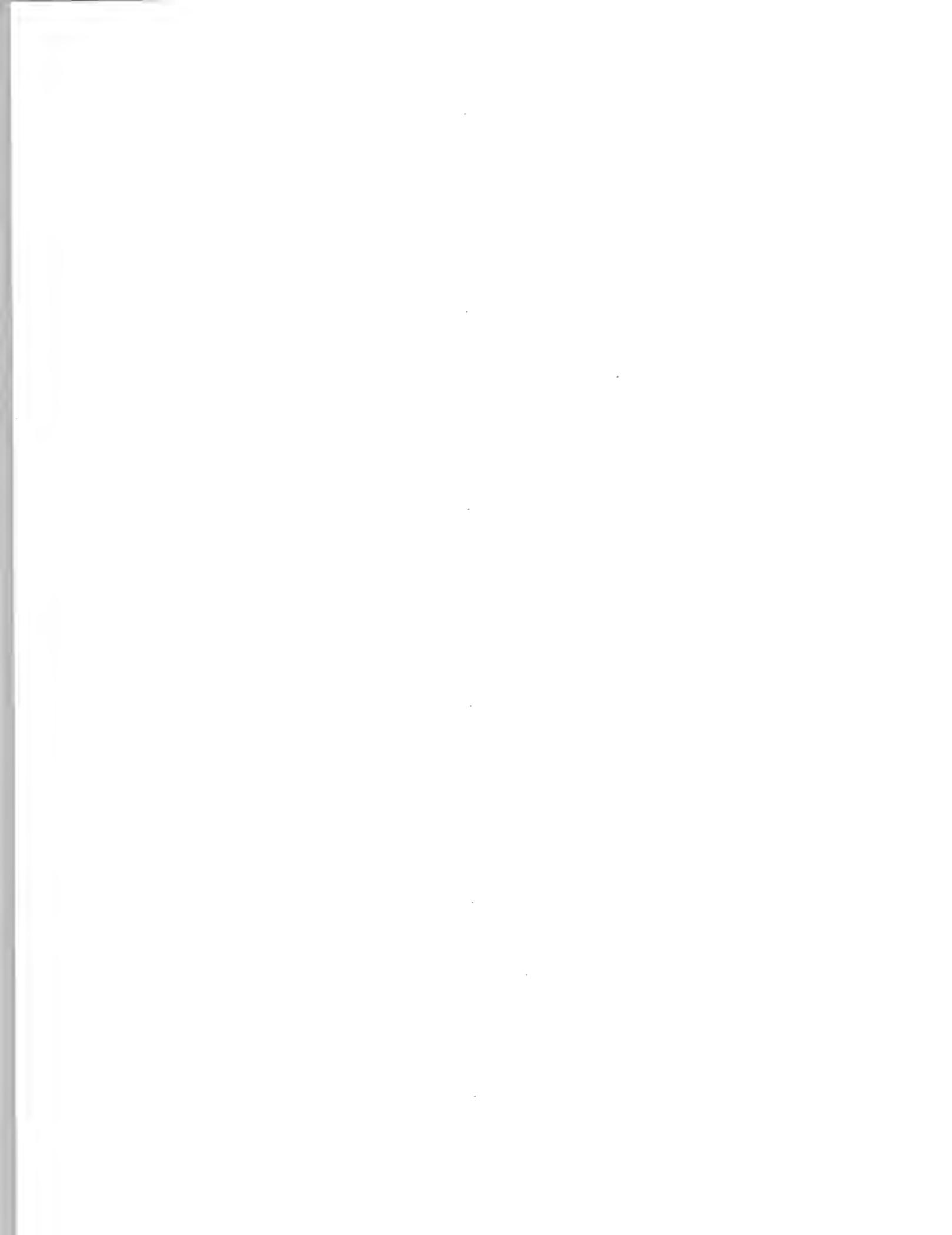
system free from visible drips, streams, and leaks. Therefore, even if a portion of the system meets the requirements for allowable leakage, visible leaks are not permitted and shall be stopped.

- 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 03 0110

SITE CONCRETE & REINFORCING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the furnishing and installation of site cast-in-place concrete and reinforcing, where specified.

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 trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.

1.03 SOURCE QUALITY CONTROL

- A. Procure concrete from a single approved central commercial batching plant conforming to "Concrete Plant Standards" of the Concrete Manufacturer's Association.
- B. To further insure uniform consistency, coloring, finish, and quality, all aggregates, cement, water and other ingredients shall each be secured from the same source for the duration of the Project.
- C. The concrete batching plant, and the raw material, will be subject to inspections and tests performed by the State.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Transport concrete batches from the central plant to the site in approved truck mixers. Mixers shall conform to the requirements of the Truck Mixer and Agitating Standards of the Truck Mixer Manufacturer's Bureau, with attached manufacturer's plate stating capacity and drum speeds, and a drum revolution counter.
- B. Store reinforcement off the ground, under cover, and protected from rust, oil, paint, grease, dirt, and other deleterious materials, and from distortion.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Only place concrete when environmental conditions are satisfactory. Do not place concrete when conditions may adversely affect the placing, finishing or curing of concrete, or its strength.
- B. Do not place concrete when the ambient temperature is below 40°F or when the concrete temperature exceeds 85°F. Under certain circumstances, the State Project Manager's may approve the placement of concrete under the above conditions, provided the procedures of ACI 305 and ACI 306 are strictly adhered to.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. Unless otherwise specified, all concrete shall be Class B.
- B. Classes of concrete are:

Class A

Class B

Class C

28 Day			
Compressive Strength (psi)	4,000	3,000	2,000
Max. Water-Cement Ratio (lb/lb)	0.50	0.50	0.50
Min. Cement Factor (Sacks/C.Y.)	6.5	5.75	5.0
Entrained Air Content	4-6	4-6	2-5
Slump (Inches)	3-5	3-5	3-5

2.02 CEMENT

- A. Portland Cement – ASTM C150, Type II unless otherwise specified.

2.03 AGGREGATES

- A. Fine Aggregate – ASTM C33.
- B. Coarse Aggregate – ASTM C33, 3/4" maximum size for structural concrete.

2.04 ADMIXTURES

- A. Air Entraining - "Darex AEA", by W.R. Grace, "Pozzolith MB-VR" by Master Builders or approved equal. Use of air entraining cement is prohibited. Air entrain concrete which will remain exposed to freezing and thawing. Other concrete may be air entrained at Contractor's option.
- B. No other admixtures are permitted without the prior acceptance of the State Project Manager.

2.05 MIXING WATER

- A. Water shall be fresh, clean and potable.

2.06 REINFORCEMENT

- A. Reinforcing Bars – ASTM A-615, Grade 60. Stirrups and ties shall be Grade 40.
- B. Reinforcing Wire – ASTM A-82.
- C. Wire Fabric – ASTM A-185.
- D. Supporting Devices – Galvanized or non-rusting type. Use plastic tipped accessories in concrete exposed to weather, water or view.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect the formwork and verify that it has been properly set and is ready for the receipt of concrete.

-
- B. Verify that all reinforcing has been properly set and secured and that items to be embedded in, built-in, or pass through concrete are at their proper locations and elevations.

3.02 PLACING CONCRETE

- A. Weather Conditions – Do not place concrete when weather conditions are not suitable for the proper placing, finishing, or curing of the concrete. Unless otherwise accepted by the State Project Manager, place concrete only during dry weather.

3.03 CURING CONCRETE

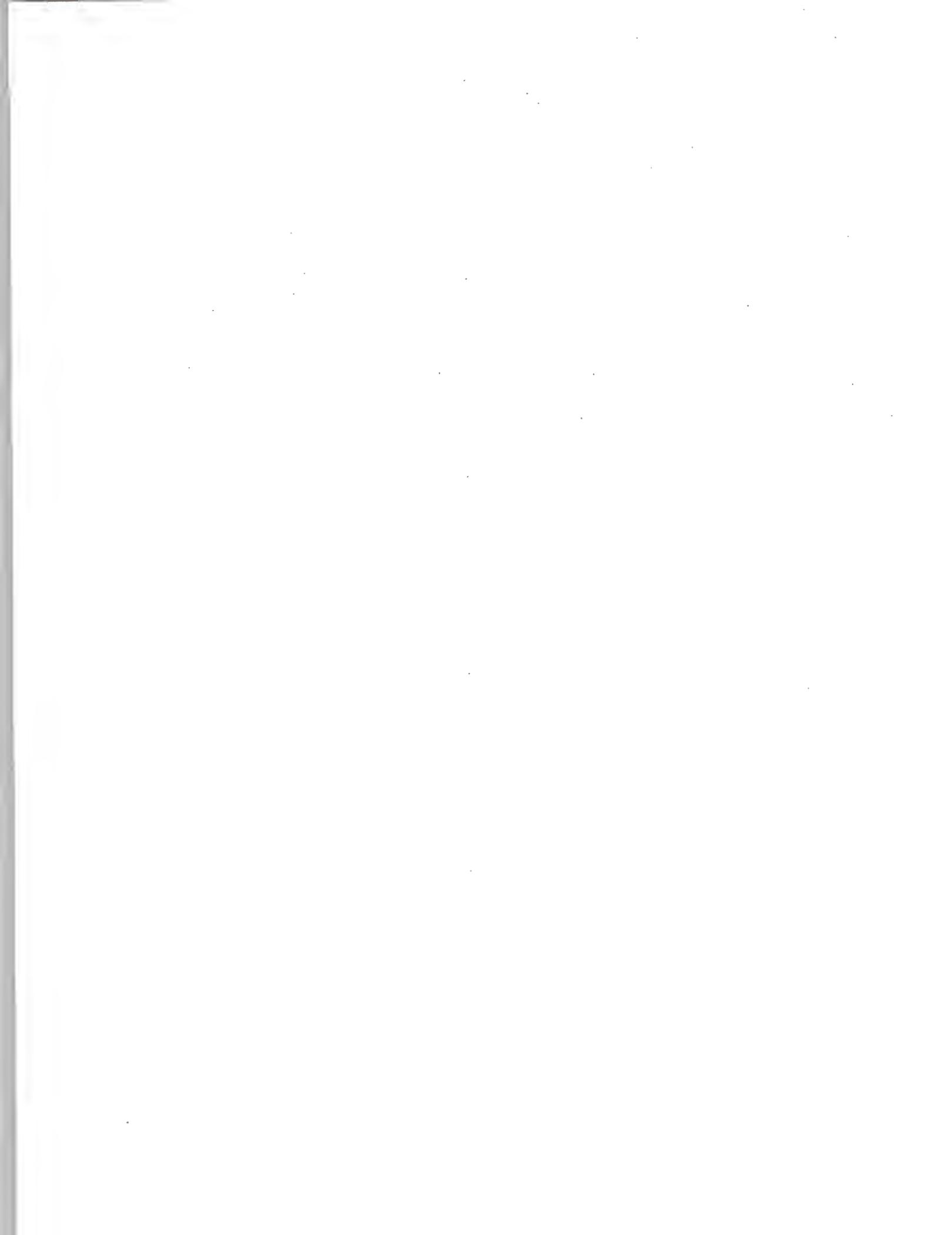
- A. General – Cure concrete by any of the following methods or combinations thereof. Modify or augment these methods, or adopt additional protective measures, when required to compensate for changes in humidity, temperature, wind, or other conditions. Minimum curing period shall be 5 days.

1. Water Curing – Water curing during cold weather concreting is not permitted. Water curing is mandatory for all channels, tanks and structures which will contain a liquid. Continuously keep concrete surfaces wet by covering with water, by continuous fog spraying, or by covering with burlaps, cotton mats, or other approved material thoroughly saturated with water and kept wet by intermittent hosing. Protect water cured concrete against freezing for the full curing period specified.
2. Waterproof Paper and Sheeting – Slabs, mats and other horizontal surfaces may be covered with non-staining reinforced Kraft paper, polyethylene sheeting not less than 0.004 inch thick, or Kraft paper coated with not less than 0.002 inch thick polyethylene sheeting. Completely cover surfaces, with edges and ends lapped at least 4 inches and sealed with a mastic or pressure-sensitive tape. Secure sheeting to avoid displacement. Immediately repair tears or holes appearing during the curing period.

3.04 FINISHING CONCRETE

- A. Finish formed and unformed surfaces as indicated as recommended by ACI 301 and ACI 302 respectively.

END OF SECTION



SECTION 22 1005

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping 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-Stub 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 coper 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. Coper 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.

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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.cranevalve.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 0500
BASIC MECHANICAL REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Any general provisions of the Contract.

1.02 SECTION INCLUDES

- A. This section includes general administrative and procedural requirements for mechanical installations and repairs. The following administrative and procedural requirements are included in this Section to expand the requirements specified in the Contract.
 - 1. Quality Assurance.
 - 2. Painting.
 - 3. Cutting and Patching.

1.03 REGULATORY REQUIREMENTS

- A. Conform to the latest edition of the international Building Code and International Plumbing code adopted by the State of NH.
- B. Conform to latest edition of the International Mechanical Code adopted by the State of NH and ASME requirements for steam boiler and piping systems.
- C. Conform to latest edition of the International Energy Conservation Code adopted by the State of NH.
- D. Obtain City and State permits and request inspections from the authority have jurisdiction and/or as directed by the State Project Manager.
- 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. Equipment and appurtenances shall be designed in conformity with ANSI, ASME, IEEE, NEMA, OSHA, AGMA and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation and all other conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings and or other accepted means.
- B. Ample clearance shall be provided for repairs, inspection and adjustment. Protruding members such as joints, corners and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and corners of structural shapes shall be rounded or chamfered.
- C. All mechanical work shall be performed by mechanics who are qualified to do such work and who are normally engaged in this type of work. Because of the complexity of the mechanical work, unskilled labor is not permitted.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials and equipment shall be new and of the best quality and shall conform to standards and carry labels in every case where standards have been established.
- B. To the maximum extent possible all mechanical equipment for any one system shall be the product of a single manufacturer, unless specifically dictated otherwise in the Contract. The State Project Manager reserves the right to disapprove and reject equipment from various manufacturers when acceptable components can be secured from fewer manufacturers and to require that source of materials be unified to the maximum extent possible.

2.02 PAINTING

- A. All pumps, motors, tanks, heat exchangers and all other factory manufactured and assembled apparatus shall be factory coated with manufacturer's standard shop coated, except where special finishes are specified. Contractor shall touch up all scratched or damaged equipment with paint supplied by the equipment manufacturer. Clean and paint to match original finish, all items scratched or otherwise damaged.
- B. Contractor shall paint all steel brackets, supports stands, hangers, etc. Paint with one coast rust inhibitive paint, compatible with all other paints and matching adjacent colors.

Contractor shall paint supplemental steel that is attached to the building structural steel. The supplemental steel shall be painted to match the structural steel color. Hangers, guides and similar equipment that cannot be completely painted after installation shall be painted before installation.
- C. Shop-painted structural steel that has been scratched, marred, or damaged by the installation of hangers and /or supplemental steel shall be touched-up to match the original shop paint.

PART 3 EXECUTION

3.01 MECHANICAL INSTALLATIONS

- A. General Sequence, coordinate and integrate the various elements of mechanical system, materials and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical systems, equipment and materials installation and report with other building components.
 - 2. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
 - 3. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 4. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installation. Extend grease fittings to an accessible locations.

3.02 CUTTING AND PATCHING

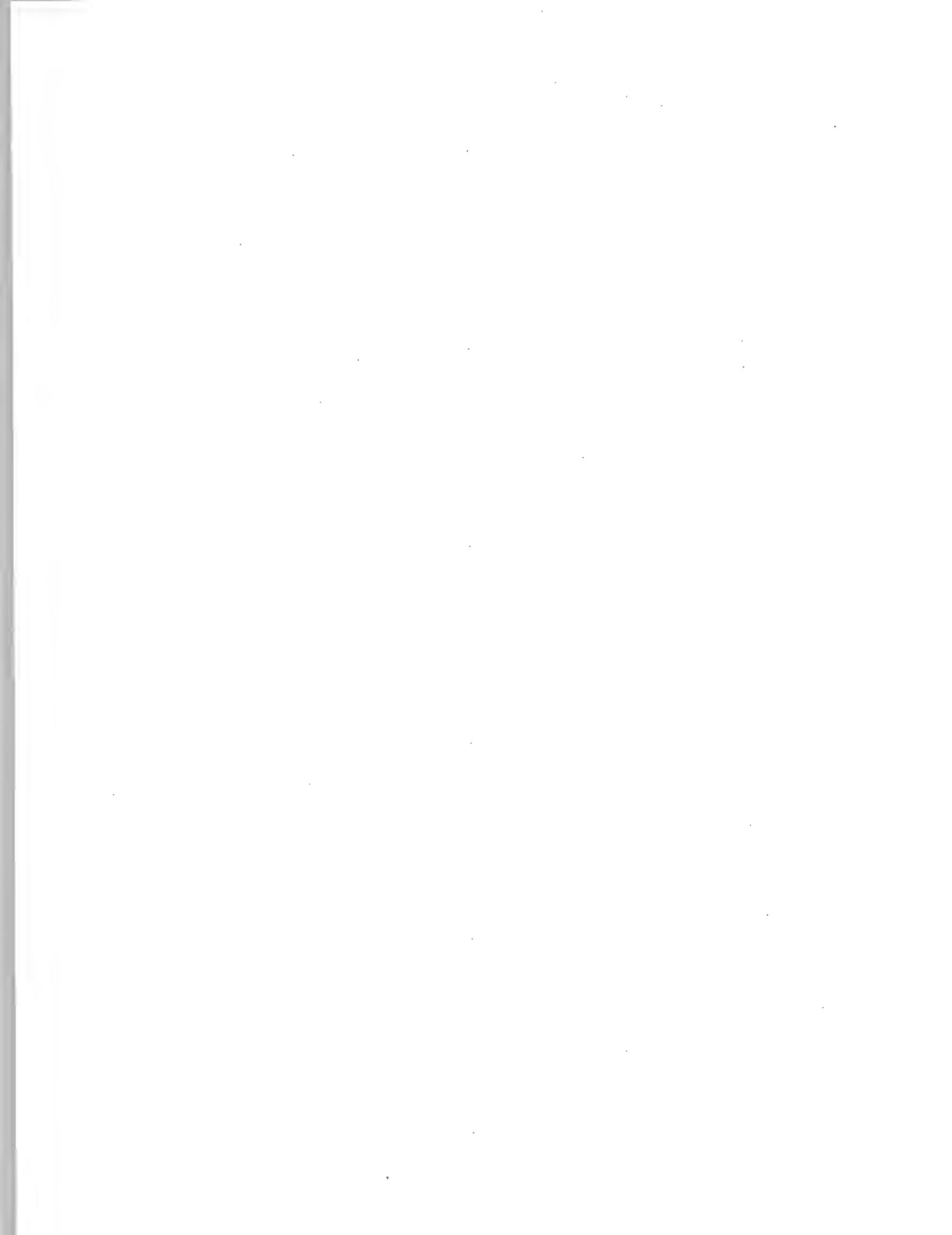
- A. General: Perform cutting and patching in accordance with the following requirements and as directed by the State Project Manager.
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

-
- C. Perform cutting, fitting, and patching of mechanical equipment and materials required to :
1. Remove and replace defective work.
 2. Remove and replace work not conforming to requirements of the Contract.

3.05 INSTALLATION OF EQUIPMENT AND PIPING

- A. All equipment shall be installed true and level. Precision gauges and levels shall be used in setting all equipment and piping.
- B. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports.
- C. The equipment shall be brought to a proper level by wedges and shims. After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bond the machine firmly into place against the wedges or shims.
- D. Furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenance required to the installation of the equipment. These shall be of ample size and strength for the purpose intended.
- E. Anchor bolts shall be provided for equipment mounted on concrete pads.
- F. All equipment shall be installed in such a manner as to provide access for routine maintenance, including lubrication.
- G. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping shall be provided and installed by the Contractor. See also painting above.
- H. All foundations, anchor pads, piers, thrust blocks, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.

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: ¼ 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 as required. 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.

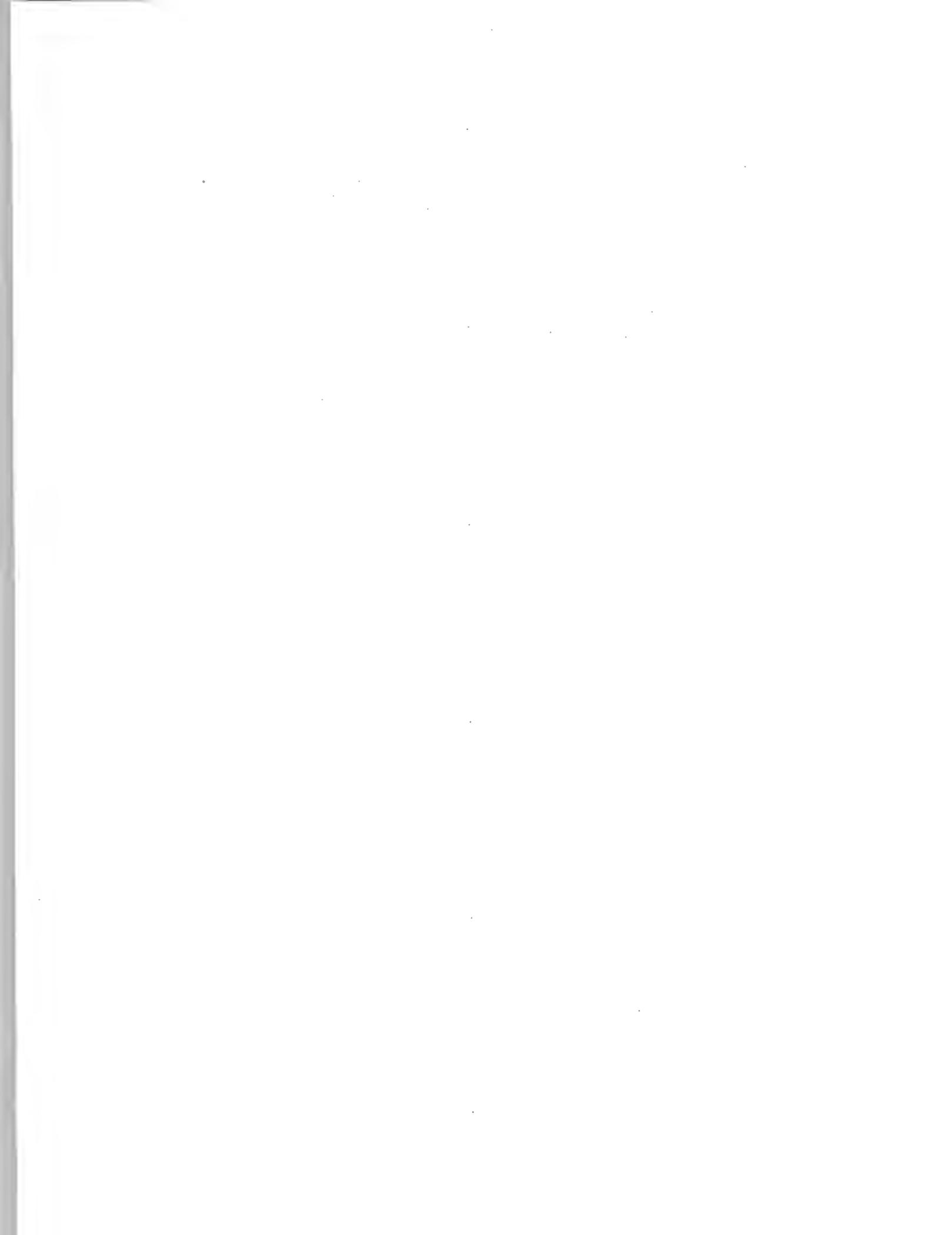
PART 3 EXECUTION

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 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

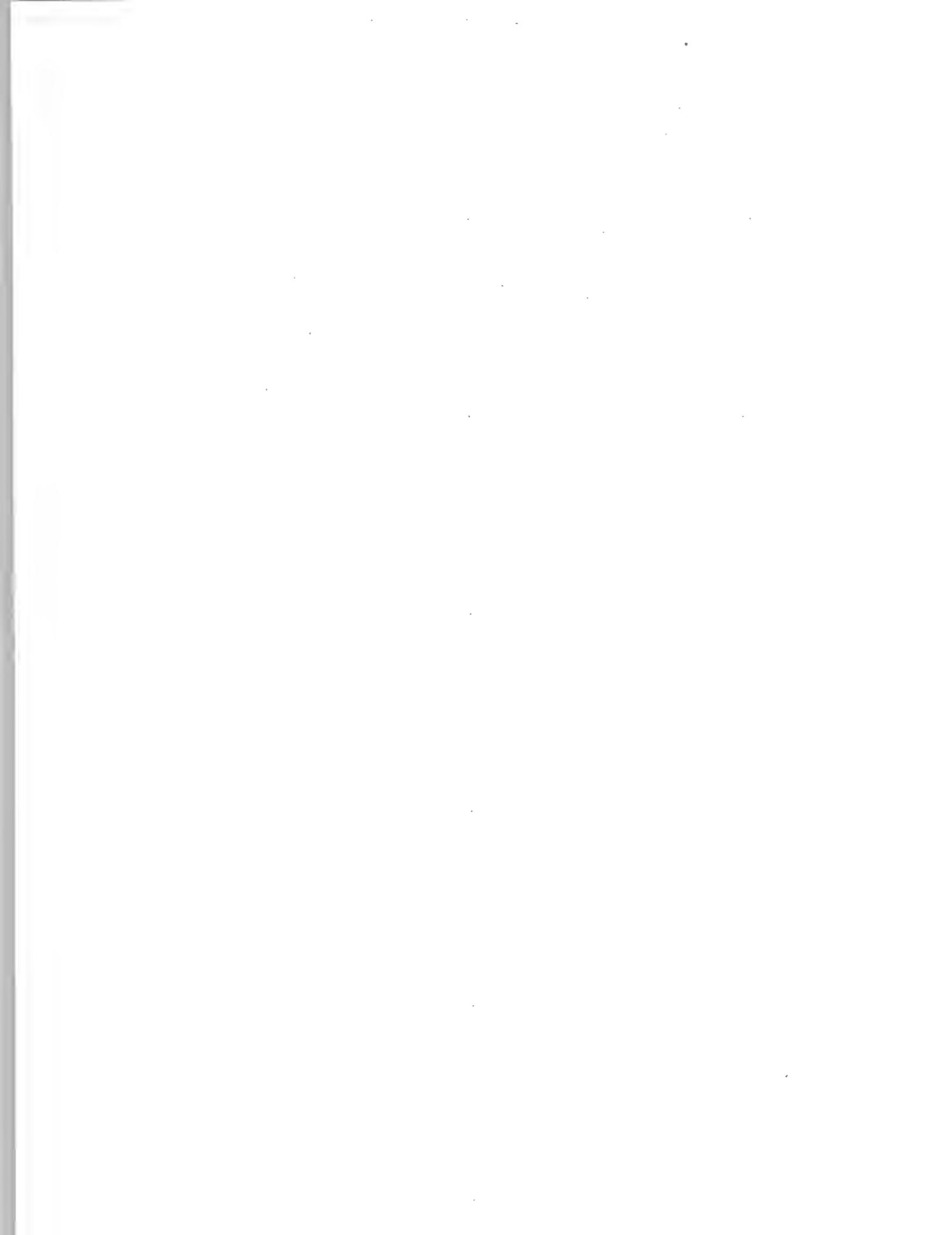
3.01 EXAMINATION

- 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 rails 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.

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- 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 1000
CLEARING & GRUBBING

PART 1 GENERAL

1.1 DESCRIPTION

A. Work covered by this Section includes clearing and grubbing as required to perform the work.

B. Related work specified elsewhere includes:

Excavating, Trenching & Backfilling	31 2316
Erosion Control	31 2500

C. It is the intent of this Section to limit the area of clearing and grubbing to the minimum area possible to allow for the proper installation of the work and preserve all plantings, trees, shrubs, grass and natural vegetation to the maximum possible extent.

1.2 QUALITY ASSURANCE

A. Confine clearing and grubbing operations to within the following limits:

1. All areas where work is required to be done, but, to the minimum extent possible to properly install the work.
2. Within the property lines of lands owned by the State.
3. Within the easement of the State.

B. No trees, plant, shrubs, flowers or vegetables shall be removed or trimmed without the prior permission of the State Project Manager, except where otherwise specified.

C. Provide at least one person who shall be present at all times during clearing and grubbing operation who shall be thoroughly familiar with the following:

1. The type of trees and plantings encountered.
2. The proper procedures and methods for taking-up and preserving trees and plantings.
3. The proper procedures and methods for felling, trimming, pruning and caring for trees and plants and their roots.
4. Such person(s), form(s) or subcontractor(s) must be totally familiar with this type of work and shall be responsible for directing all work affecting existing trees, plantings and vegetation.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store trees, plants and shrubs in protected areas and give ample water to keep them in a thriving condition for subsequent replanting.

- B. Store slate and flagstone sidewalk sections, granite and stone curb, fences, signs, guardrails and other items at approved locations for subsequent reinstallation.
- C. Obstruction of roads, driveways, sidewalks, gutters and drainage ditches, swales and channels with stored materials is not permitted.

1.4 JOB CONDITIONS

- A. Burning of materials at the site is not permitted without the proper authorization of the appropriate local and state agencies.
- B. Materials not specified to be stored or reused shall be promptly removed and disposed of off-site.
- C. Use all means necessary to protect existing objects designated to remain and, in the event of damage, immediately make all necessary repairs and replacements.

1.5 SCHEDULING

- A. Avoid interference with the use of, and passage to and from, adjacent buildings, facilities, driveways, walks, drainage systems and road.
- B. Pavements which are required to be removed, including highways, driveways and walks, may be saw cut in advance, but do not remove until the work is ready to be installed.
- C. Do not remove highway signs, guardrails and all other control, safety and warning devices until just prior to the installation of the work.
- D. Do not remove fences until the property owners affected are notified at least four days in advance of such removal. Unless written permission from a fence owner is received, do not remove a fence more than 48 hours in advance of the installation of the work affecting the fence.
- E. It is the intent of this Section that all items affecting traffic, safety, lives and the containment of humans and animals and all items essential to the protection of property or the operation of a business be left in place as long as possible and replaced as soon as possible when such items must be removed.
- F. Traverse the site and indicate the trees and plantings which you determine to be necessary to remove and obtain the State Project Managers approval in advance of any removal activities.

PART 2 -MATERIALS

2.1 PRUNING PAINT

Asphalt base paint specially formulated for horticultural application to cut or damaged plant tissue.

2.2 EXPLOSIVES

Explosives are not permitted for clearing and grubbing operations.

2.3 OTHER MATERIALS

All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the approval of the State Project Manager

PART 3 - EXECUTION

3.1 INSPECTIONS

- A. Verify that all limiting boundaries such as permanent and temporary easement, property lines, rights-of way and grading limits have been accurately and clearly marked.
- B. Verify that pipeline routings and other items of work have been accurately located and clearly marked.

3.2 PREPARATION

- A. Mark all trees, plantings and other objects which are deemed necessary to be removed, trimmed, cut or take-up and preserved,
- B. Notify and accompany state Project Manager through the site to inspect the items mark under Paragraph A, above. Describe which are to be trimmed, removed, and replanted and secure the State Project Managers' approval.

3.3 CLEARING AND GRUBBING

- A. Clearing consists of cutting and disposing of al trees, down timber, stubs, brush, bushes, snags, rubbish, debris, and other objectionable matter and materials and the removal and storage of fences, signs, walks, guardrails, curbs and other items to be restored.
- B. Grubbing consists of the removal and disposal of all stumps, roots, duff, foundations and other objectionable matter and materials.
- C. All operations shall be done in a manner so that present growth will blend with the limits of construction and a natural appearance will be attained.
- D. Employ whatever measures are necessary to avoid erosion.

3.4 TREES AND PLANTINGS

- A. In grassed, planted and open areas do not remove or trim trees or plantings without the prior permission of the State Project Manager. Take-up and preserve small trees, plantings, flowers and similar vegetation for reuse.
- B. In wooded area, trees may be removed and /or trimmed, as required, for the proper installation of the work. Gross and unnecessary removal of trees is not permitted.
- C. If it is impractical to fell trees as a whole, remove them in sections according to standard practices of professional tree removal. Fall trees to the center of the area being cleared to minimize damage to trees that are to be left standing.
- D. Immediately after felling a tree, remove branches, cut trunk and limbs and remove all materials from the site.
- E. All trees to remain shall not come in contact with any machine or appliances that will in any manner injure, sear, or kill them.
- F. The State shall have the right to cut and remove any wood in advance of the Contractor's operations. All other timber and wood which is removed shall become the property of the Contractor.
- G. All trees left standing which have been trimmed or become scarred by Contractors' operations shall be promptly repaired by properly cutting, smoothing and painting.
- H. Trees to be trimmed shall evenly cut to achieve neat severance with the least possible damage to the tree.
- I. Where roots are cut or damage, apply wet burlap to prevent drying out.

3.5 PAVEMENT, WALKS, CURBS & RAILS

- A. Remove existing pavements, walks and curbs to the minimum extent possible.
- B. Saw cut asphalt and concrete paved surfaces before removal. Use a saw which will cut a neat, straight joint line.
- C. Carefully remove slate and flagstone walks, granite and stone curbs and guardrails to the minimum extent possible. Terminate removals at a joint or guardrails post. Store and protect for reuse.

3.6 WALLS, FENCES AND OTHER OBSTRUCTIONS

- A. All walls, fences, signs sheds and other obstructions encountered shall be carefully taken-up and stored for subsequent replacement.

- B. Do not disturb property markers unless absolutely necessary. If it becomes necessary to disturb or remove a property marker, have a qualified surveyor provide four (4) ties to the marker. The qualified surveyor shall replace the marker as soon as possible.
- C. Remove and dispose of all other obstructions which will affect the work or which are specifically designated to be removed.

3.7 DISPOSAL

- A. Burning at the site is not permitted without the proper authorization of the appropriate local and state agencies.
- B. Burial of materials at the site is not permitted.
- C. All materials shall be promptly removed and disposed of away from the site.
- D. Methods of disposal shall conform to the requirements of all federal, State and Local Laws and Ordinances.
- E. Leave site in a neat and orderly condition.

3.8 PROTECTION

- A. Carefully protect and guard all trees, shrubs and vegetation and take every precaution to avoid damage to utilities, buildings and other property.
- B. Injured or damaged trees shall be repaired in accordance with TREES and PLANTINGS.
- C. All trees, shrubs or plantings which are taken-up for subsequent reuse, and die, shall be replaced with first class balled and burlap.

END OF SECTION

SECTION 31 2200

SITE GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes site grading, filling, riprapping and the construction of embankments.
- B. Related work specified elsewhere includes:

Clearing and Grubbing	31 1000
Excavating, Trenching & Backfilling	31 2316
Soil Compaction	31 2323.23
Erosion Control	31 2500
Restoration of Surfaces	32 9211
Topsoil and Seeding	32 9219

1.02 QUALITY ASSURANCE

- A. All finished grades shall be as specified. Use a qualified surveyor to set all grade stakes and to ensure that the resulting final grades are those which are required.
- B. When placing fill or constructing embankments, moisten or dry fill material to the proper moisture content as determined by ASTM D1557, Method C.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Delivery of borrow materials to the site or removal of spoil from the site shall be done in a manner which will not cause any nuisance or allow spillage of materials from the transporting vehicle.
- B. Store topsoil separately from all other excavated materials and preserve for reuse.
- C. Materials which are required to be stored shall be stored in an orderly manner and at a sufficient distance away from banks of excavations and trenches to avoid overloading and prevent slides or cave-ins. Do not store materials on, over or adjacent to structures or utilities which may collapse due to the added weight.
- D. Promptly remove materials not specified to be stored or reused.
- E. Obstruction of roads, driveways, sidewalks or interference 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 obstructions and interferences, they shall be stored away from the site and brought back when and as needed.

1.04 JOB CONDITIONS

- A. Keep ground surface well drained, but avoid erosion. Do not place fill in water or over ice or snow.
- B. Filling with frozen materials or when materials already in place are frozen, is not permitted.

1.05 SCHEDULING AND SEQUENCING

- A. Schedule the Work with State Project Manager and afford him or her adequate time and space to make all required inspections.
- B. Schedule work and coordinate operations with the approved testing laboratory. If the laboratory cannot be available to perform required tests, grading and filling operations may have to be delayed in order to accomplish certain field tests.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

- A. Unless otherwise specified or directed by State Project Manager, all fill material shall be Common Earth or Select Earth, as defined in Section 31 2316.
- B. To the extent it is available, fill material shall consist of approved on-site materials. When there are insufficient approved materials on-site, import approved additional material from off-site.

2.02 RIPRAP

- A. Stone for riprap shall be approved, rough, unhewn quarry stone, as nearly rectangular in section as practicable. The stones shall be hard, sound and resistant to the action of water and weathering. They shall be of a rock type other than serpentine rock containing the fibrous variety chrysotile (asbestos) and suitable in every respect for the purpose intended.
 - 1. Heavy Type. The individual stones shall have a depth equal to the thickness of the course of riprap. At least 75 percent of the volume of the riprap, complete in place, shall consist of stones that have a minimum volume of 16 cubic feet.
 - 2. Light Type. The individual stones shall have a depth equal to the thickness of the course of riprap. The riprap, complete in place, shall consist of stones that have a minimum volume of 2 cubic foot.

2.03 STONE SLOPE PROTECTION

- A. Two inch to three inch nominal sized angular, hard, durable stone with sufficient smaller sized stones to produce a reasonably well graded and stable mass.

2.04 GRAVEL PAVEMENT

A. Clean, hard gravel meeting the following gradation:

===== % Passing =====		Sieve
<u>Total Sample</u>	<u>Sand Portion</u>	<u>Desig.</u>
100	--	1"
90-100	--	1/2"
45-65	100	# 4
--	0 - 18	#100
--	0 - 8	#200

2.05 GRAVEL SUBBASE

A. Clean, hard gravel meeting the following gradation:

===== % Passing =====		Sieve
<u>Total Sample</u>	<u>Sand Portion</u>	<u>Desig.</u>
27 - 52	100	# 4
	0 - 18	#100
	0 - 8	#200

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that all boundaries of temporary and permanent easements and property lines are clearly marked in the field and that the Work will not violate these boundaries.
- B. Verify that the clearing and grubbing operations have been completed.
- 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.
- D. Verify that grade stakes have been properly and accurately set.
- E. Do not begin operations until conditions are satisfactory.

3.02 STRIP AND STOCKPILE TOPSOIL

- A. Strip topsoil to its full depth within all areas to be excavated or graded and in areas to receive pavements, fills or embankments except where existing ground is to be left undisturbed.
- B. Store topsoil on-site, in storage piles. Keep topsoil separated from all other excavated materials and store free of roots and other undesirable materials.

3.03 DISPOSAL OF MATERIALS

- A. Use approved on-site materials to the extent they are available. Promptly dispose of any excess material, off-site.
- B. Remove from the site all unsuitable material. Do not store or stockpile unsuitable material at the Project site and do not incorporate into the Work.

3.04 SITE GRADING

- A. Rough grade the portions of the site which must be raised or lowered in order to properly execute the work under other Sections.
- B. Uniformly grade the site to the lines, grades and elevations as specified. Finished surfaces shall be reasonably smooth, compacted and free from irregular surface changes. Unless otherwise specified, the finish shall be equivalent to that ordinarily obtainable from either blade grader or scraper operations.
- C. In unpaved areas, except those to be ripped, lined or specially treated, smooth the surface sufficiently for application of topsoil. The finished topsoil subgrade shall not be more than 1" above or below the established grade or cross section.
- D. In unpaved areas, the finished grades include a layer of topsoil. The thickness of the topsoil is specified in Part 3 of Section 32 9219.

3.05 EMBANKMENT CONSTRUCTION

- A. Level off surfaces upon which embankments are to be constructed. Where existing ground is left undisturbed, plow or disk the Surface and mix it in with the first layer of embankment material to provide a satisfactory bond.
- B. Ground surfaces sloped steeper than 1 vertical to 4 horizontal shall be plowed, stepped or broken up to permit bonding of the embankment with the existing surface.
- C. Uniformly place and spread fill in successive horizontal layers not more than 1 foot in compacted depth.
- D. Compact each layer of fill to a minimum density of 90%.

3.06 BOTTOMS OF AERATED LAGOONS, PONDS AND RESERVOIRS

- A. Strip bottom and grade as required to remove all materials above the bottom elevation specified. Leave bottoms reasonably level and free from bumps and depressions in excess of 12".
- B. After leveling, thoroughly roll and compact the bottom with heavy compaction equipment until no further consolidation is apparent.

3.07 PREPARATION OF PAVEMENT SUBBASES

- A. Shape the entire subbase to the required line, grade and cross section. Remove and dispose of all soft and unsuitable material and replace with an approved material. Remove and dispose of all boulders and ledge rock. Break off to a depth of not less than 6" below the subbase. Fill resulting depressions with an approved material.
- B. Roll subbase to achieve the required compaction densities specified in Section 32 1216.2 Bituminous Concrete Paving. Reshape, wet and aerate subbase, as required. Compact the entire width of the area to receive pavement, plus the areas within 5' of and parallel and adjacent to the edges of the pavement. Compact the full depth of embankments to the required density. Where cuts are encountered, thoroughly roll and compact until no further consolidation is apparent.
- C. When pavements cannot be placed immediately after the preparation of the subbase, the entire subbase shall be reshaped and compacted to the required line, grade and cross section.

-
- D. After rolling, the surface of the subbase shall not show any deviation in excess of 3/4" when tested with a 10' straightedge applied both parallel to and at right angles to the centerline of the area. The elevation of the finished subbase shall not vary more than 0.05' from the established grade and cross section.
 - E. Do not disturb the finished subbase by traffic or other operations and protect and maintain in a satisfactory condition until the overlaying pavement is placed.

3.08 SUBBASE AND EMBANKMENT PROTECTION

- A. Keep the embankments and excavations shaped and well drained. Where ruts or erosion occur, add additional fill and reshape and recompact before placing paving materials.
- B. The storage or stockpiling of material on prepared subbases is not permitted.
- C. All subbases will be inspected by State Project Manager and paving materials shall not be placed prior to receipt of State Project Manager's approval. The placing of paving materials on a muddy, spongy, weaving or frozen subbase is not permitted.

3.09 DITCHES - SWALES

- A. Accurately cut ditches and swales to the required cross sections and grades. Cut off all roots, stumps, rock and foreign matter, in the sides and bottoms of ditches and swales, to conform to the required slope, grade and shape.
- B. Maintain ditches and swales at all times so that they effectively drain. Refill, reshape and recompact where ruts or erosion occurs.

3.10 DUMPED RIPRAP

- A. Place riprap in a manner so as to produce a reasonably well graded mass of rock with the minimum practicable percentage of voids. The finished stone surface shall be free from objectionable pockets of smaller stones and clusters of larger stones.
- B. Placing stones in layers or dumping by methods likely to cause segregation of the various sizes is not permitted. Obtain the desired distribution of the various sized stones by selective loading, controlled dumping of successive loads or by other approved means.
- C. Completely fill voids with fine stone or gravel. Rearrange stones by mechanical equipment or by hand to the extent necessary to obtain a reasonably well graded distribution.
- D. The final stone surface shall not exceed 3", plus or minus, from the required grades and elevations. Leave riprap in a first stable mass.

3.11 STONE SLOPE PROTECTION

- A. Place stone to the depth, grade, line and cross section as specified. The finished stone surface shall be free from objectionable pockets of smaller stones and clusters of larger ones.
- B. Carefully dump and grade stone to the extent necessary to obtain a reasonably smooth, stable and well graded distribution with the minimum practicable percentage of voids.

3.12 GRAVEL PAVEMENTS

-
- A. Place gravel to the depth, grade and cross section as specified. Uniformly spread in horizontal layers not exceeding 6" in compacted thickness. Compact to a density of 95%.
 - B. Maintain pavement as required.

3.13 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. State Project Manager will establish the date, time, location, number, and types of soils tests required.

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 not 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 from 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 from 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 obstructions 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 State 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 Fil 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 31 2323.23

SOIL COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section covers the requirements for soil compaction.
- B. Related work specified elsewhere includes:
 - Section 31 2316 Excavating, Trenching, and Backfilling

1.02 QUALITY ASSURANCE

- A. The taking of samples and the performing of field compaction density tests shall be done by an independent testing laboratory.
- B. Provide at least one person who shall be present at all times during the soil compaction operations and who shall be thoroughly familiar with the various types of compaction equipment, proper compacting techniques and methods, and soils behavior, and who shall direct the compaction operations.

1.03 JOB CONDITIONS

- A. Compaction shall not take place in freezing weather or when materials to be compacted are frozen, too wet or moist, or too dry.
- B. Schedule the Work to allow ample time for laboratory tests and to permit the collecting of samples and the performing of field density tests during the back-filling and compaction operations.
- C. Protect pipes, structures and all other subsurface work from displacement or injury during compaction operations.

PART 2 - PRODUCTS

2.01 COMPACTION

Utilize the proper compaction methods and equipment to suit the soils and conditions encountered.

2.02 LABORATORY TEST REPORTS

- A. As a minimum, the laboratory moisture-density testing reports shall contain the following:
 - 1. Laboratory's name.
 - 2. Date, time and specific location from which sample was taken and name of person who collected the sample.
 - 3. Moisture - Density Curve plotted on graph paper to as large a scale as is practical with all points used to derive the curve being clearly visible.
 - 4. Designation of the test method use.
 - 5. The optimum density and moisture content.

-
6. A description of the sample.
 7. The date the test was performed and the person who performed the test.
 8. The Project name, identification and Contractor's name.
 9. The signature of a responsible officer of the Testing Laboratory certifying to the information contained in the report.
- B. As a minimum, the field compaction density testing reports shall contain the following:
1. Laboratory's name.
 2. Date, time, depth and specific location at which the test was made and the person's name who performed the test.
 3. Designation of the test method used.
 4. Designation of the material being tested.
 5. Test number.
 6. In place dry density and moisture content.
 7. Optimum density and moisture content.
 8. Percentage of optimum density achieved.
 9. The Project name, identification and Contractor's name.
 10. The signature of a responsible officer of the Testing Laboratory certifying to the information contained in the report.

2.03 OTHER MATERIALS

All other materials which are required to achieve adequate compaction shall be as selected by Contractor subject to approval of State Project Manager.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that layers of material are no thicker than the maximum thicknesses specified in other Sections.
- B. Verify that moisture content is nearly optimum.
- C. Do not begin compaction operations until conditions are satisfactory.

3.02 PERFORMANCE

- A. Compaction densities shown are percentages of the maximum density obtainable at optimum moisture content as determined by ASTM D1557, Method C (Modified Proctor).
- B. Moisten or dry each layer of material to achieve optimum moisture content. Unless otherwise specified or directed by State Project Manager, compact each layer of material to the following required densities:

Location	Density
Under concrete slabs, foundations and footings	95%
Backfill around Structures.....	90%
Embankments.....	90%
Paved Areas	95%
All Other Areas	
Select Fill *	95%
Remainder of Trench.....	90% **

* Bedding, around pipes, over pipes and over sand encasements.

** Or density consistent with existing conditions.

3.03 FIELD QUALITY CONTROL

- A. Perform a laboratory moisture density test for each type of soil proposed for use or encountered in the Work. Determine optimum moisture content in accordance with ASTM D1557, Method C.
- B. The State Project Manager will designate the time, date and exact location of all field compaction density tests. Field density tests may be ordered by Engineer in accordance with the following average frequencies:
 - 1. Under Structures - One test for every 400 square foot area of each layer of compacted granular fill.
 - 2. Outside of Structures - One test for each foot of backfill at intervals of approximately 50' around the structure.
 - 3. Trenches - One test for each foot of backfill at intervals of approximately 200' along the trench.
 - 4. Embankment - Six tests for each foot of compacted fill.
 - 5. Roads - One test for each layer of compacted fill and base material at intervals of approximately 200' along the roadway.
 - 6. Parking Areas and Sidewalks - One test for every 750 square foot area at parking areas and one test at intervals of 100' along sidewalks.
- C. Testing frequency indicated in Paragraph 3.03.B is at the discretion of the State Project Manager, and may be decreased as the Project progresses.
- D. Field density and moisture testing shall conform to the requirements of ASTM D1556 or D2922 and ASTM D3017. Soils shall be described in accordance with ASTM D2488, Visual-Manual Procedure.

3.04 COORDINATION

- A. Provide all assistance and cooperation during testing and coordination operations to allow ample time for the required sampling and testing.

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- B. See Section Quality Requirements for requirements as they apply to making arrangements with the approved testing laboratory.

3.05 ADJUST AND CLEAN

- A. Replace or repair any pipe, structure or other Work which has been displaced, damaged, or injured.
- B. Compacted soils not meeting compaction densities shall be re-excavated, recompacted and retested at the contractor's expense until all requirements are met.

END OF SECTION

SECTION 31 2500
EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the control of erosion, siltation, and sedimentation.
- B. Related work specified elsewhere includes:

Clearing & Grubbing	31 1000
Site Grading	31 2200
Excavating, Trenching, and Backfilling	31 2316
Dewatering	31 2319

1.02 PROJECT REQUIREMENTS

- A. Take every reasonable precaution and do whatever is necessary to avoid any erosion and to prevent silting of rivers, streams, lakes, reservoirs, impoundments, and drainage ditches and swales.
- B. The exposure of uncompleted cut slopes, embankments, trench excavations, and site graded areas shall be kept as short as possible. Initiate seeding and other erosion control measures on each segment as soon as reasonably possible.
- C. Should it become necessary to suspend construction for any length of time, shape all excavated and graded areas in such a manner that runoff will be intercepted and diverted to points where minimal erosion will occur. Provide and maintain temporary erosion and sediment control measures, such as berms, dikes, slope drains, silt stops, and sedimentation basins, until permanent drainage facilities or erosion control features have been completed and are operative.
- D. Fine material placed or exposed during the work shall be so handled and treated as to minimize the possibility of its reaching any surface waters. Use diversion channels, dikes, sediment traps, or any other effective control measures.
- E. Provide silt stops wherever erosion control measures may not be totally capable of controlling erosion, such as in drainage channels and where steep slopes may exist.
- F. Before water is allowed to flow in any ditch, swale, or channel, install the permanent erosion control measures in the waterway so that the waterway will be safe against erosion.
- G. Take special precautions in the use of construction equipment to minimize erosion. Do not leave wheel tracks where erosion might begin.
- H. Unless specifically required in the Contract Documents, the operation of mechanized equipment in watercourses is not permitted. Where work is required in watercourses, minimize the movement of equipment in the waters and remove falsework, pilings, debris, and other temporary work as soon as construction will allow.
- I. Wherever crossings of live streams are necessary, provide temporary culverts or bridges to allow equipment to cross them without fording them. Disturbance of lands and waters outside

the limits of construction is prohibited, except as may be found necessary and approved by Engineer.

- J. The requirements of this Section also apply to project related construction activities away from the project site, such as at borrow pits, off-site storage areas, and haul and work roads.
- K. Mulching shall follow the seeding operation by not more than 24 hours.
- L. Should any protective measures employed indicate any deficiencies or erosion taking place, immediately provide additional materials or employ different techniques to correct the situation and to prevent subsequent erosion.
- M. Continue erosion control measures until the permanent measures have been sufficiently established and are capable of controlling erosion on their own.
- N. Comply with all Federal, State, and Local laws, ordinances, rules, and regulations.

1.03 QUALITY CONTROL

- A. Provide at least one person who shall be present at all times during erosion control operations and who shall be thoroughly familiar with the types of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.
- B. Material manufacturers and vendors shall be reputable, qualified firms regularly engaged in producing the required types of materials.
- C. Protect and maintain all areas disturbed by the work, such that erosion is adequately controlled and silt and sediments are not allowed to flow into any watercourse, onto adjacent properties, or into storm drains.

PART 2 - PRODUCTS

2.01 HAY AND STRAW MULCH

- A. General - Hay and straw mulches shall be reasonably free from swamp grass, weeds, twigs, debris and other deleterious material, and free from rot, mold, primary noxious weed seeds, and rough or woody materials. Mulches containing mature seed of species which would volunteer and be detrimental to the permanent seeding, or would result in overseeding, or would produce growth which is aesthetically unpleasing, is not permitted.
- B. Hay Mulch - Properly aired native hay, Sudan grass hay, broomsedge hay, legume hay, or similar hay or grass mowings. When air-dried in the loose state, the contents of the representative bale shall lose not more than fifteen (15) percent of the resulting air-dry weight of the bale. Apply at the rate of 2 to 3 tons/Ac., or at 1.5 tons/Ac. when a net or a mulch stabilizer is used with the mulch.
- C. Straw Mulch - Threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Apply at the rate of 2 to 3 tons/Ac., or at 1.5 tons/Ac. when a net or a mulch stabilizer is used with the mulch.
- D. Mulch Stabilizers - "Curasol" applied at the rate of 40 gal./Ac., Dow "Mulch Binder" applied at the rate of 45 gal./Ac., or asphalt binder, AASHTO M140, Type SS-1 or RS-1 as applicable, applied at the rate of 400 gals./Ac.
- E. Temporary Type Mulch Nets - Paper yarn, approximately 0.05" in diameter, woven into a net with approximate openings of 7/8" by 1/2" and weighing about 0.20 lbs./SY.

- F. Permanent Type Mulch Nets - "Vexar" or "Erosion-Net" plastic or nylon mesh netting with approximate openings of 3/8" or 3/4".

2.02 MATTING/BLANKETS

- A. Nomenclature - The various materials under this Paragraph are sometimes referred to as "matting" and "blankets". These words are interchangeably used throughout this Section, but the meanings shall be the same.

- B. Jute Matting - Undyed and unbleached jute yarn woven into a uniform open, plain weave mesh, furnished in rolled strips conforming to the following physical requirements:

Width - 48", plus or minus 1"
- 78 warp ends per width of cloth
- 41 weft ends per yard

Weight - 1.22-1.80 lbs./LY, plus or minus 5%

- C. Excelsior Matting - Uniform web of interlocking wood excelsior fibers with a backing of mulchnet fabric on one side only. The mulchnet shall be woven of either twisted paper chord or cotton cord. Excelsior matting shall be furnished in rolled strips and shall conform to the following physical requirements.

Width - 36", plus or minus 1"
Weight - 0.80 lbs/SY, plus or minus 5%

- D. Soil Erosion Matting - "Enkamat Type 7020" by American Enka Company, or approved equal.
- E. Erosion Control Mulching Blanket - "Hold/Gro" by Gulf States Paper Corp., or approved equal.
- F. Staples - No. 11 (or heavier) plain iron wire, made from at least 12" lengths of wire bent to form a "U" of 12" to 2" in width. Use longer staples for loose soils or where otherwise required.

2.03 SEED AND SOD FOR EROSION CONTROL

- A. For Temporary Control Use - annual or perennial ryegrass.
- B. For Permanent Control - See Section TOPSOIL AND SEEDING.

2.04 HAY BALES FOR EROSION CONTROL

- A. Rectangular shaped bales of hay or straw, weighing at least 40 pounds per bale, free from primary noxious weed seeds and rough or woody materials.
- B. See Attached Drawing.

2.05 SILT FENCES

- A. "Geofab Silt Fence" by Mercantile Development, Inc., "Mirafi 100X" by Celanese Fibers Marketing Co., or an approved equal.

PART 3 - EXECUTION

3.01 HAY AND STRAW MULCHING

- A. Install hay or straw mulch immediately after each area has been properly prepared. When permanent seed or seed for temporary erosion control is sown prior to placing the mulch, place mulch on seeded areas within 24 hours after seeding. State Project Manager may authorize the blowing of chopped mulch provided that 95% of the mulch fibers will be 6 inches or more in length and that it can be applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants. Hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see the ground through the mulch. Remove matted mulch or branches.
- B. Where mild winds may blow the mulch, or when ground slopes exceed 15%, or when otherwise required to maintain the mulch firmly in place, apply a system of pegs and strings, a chemical stabilizer, or temporary type netting to the mulch. Unless otherwise directed, remove the strings and netting prior to the acceptance of the Work.
- C. Where high winds exist, or heavy rainstorms are likely, or where ground surfaces are steep, or where other conditions require, apply temporary type netting over the mulch and take whatever measures are necessary to maintain the mulch firmly in place.
- D. Unless otherwise specified, the use of permanent type netting is not permitted without the prior approval of Engineer.

3.02 MATTING/BLANKETS - GENERAL

- A. The use of mulch with matting is not permitted, however, a 4" to 6" overlap of mulch over the edge of matting is permissible.
- B. Prepare surfaces of ditches and slopes to conform to the grades, contours and cross sections shown on the Drawings and finish to a smooth and even condition with all debris, roots, stone, and lumps raked out and removed. Loosen the soil surface to permit bedding of the matting. Unless otherwise noted, place seed prior to the placement of the matting.
- C. Unroll matting parallel to the direction of flow of water and loosely drape, without folds or stretching, so that continuous ground contact is maintained.
- D. In ditches and swales, and on slopes, each upslope and each downslope end of each piece of matting shall be placed in a 6 inch trench, stapled at 12 inches on center, backfilled, and tamped. Similarly, bury edges of matting along the edges of catch basins and other structures. Engineer may require that any other edge, exposed to more than normal flow of water, be buried in a similar fashion.
- E. Tightly secure matting to the soil by staples driven approximately vertically into the ground, flush with the surface of the matting. In driving the staples, take care not to form depressions or bulges in the surface of the matting.
- F. Decrease the specified spacing of staples when varying factors, such as the season of the year or the amount of water encountered or anticipated, requires additional anchoring.
- G. Refer to the following paragraphs for additional requirements on the placement and stapling of matting.

3.03 JUTE MATTING

-
- A. Where strips are laid parallel or meet, as in a tee, they shall be overlapped at least 4". Overlap ends at least 6", shingle fashion.
 - B. Space check slots, built at right angles to the direction of flow of water, so that one check slot or one end occurs within each 50' of length of slope. Construct check slots by placing a tight fold of matting at least 6" vertically into the ground. These shall be tamped the same as the upslope ends.
 - C. Press jute matting onto the ground with a light lawn roller or other satisfactory means.
 - D. On slopes flatter than 4:1, place staples not more than 3' apart in three rows, for each strip, with one row along each edge and one row alternately spaced down the center. On grades 4:1 or steeper, place staples in the same three rows, but spaced 2'. On lapping edges, double the number of staples, with the spacing halved. Ends of matting and all required check slots shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples.
 - E. Spread additional seed over jute matting, particularly those locations disturbed by the building of slots.

3.04 EXCELSIOR MATTING

- A. Where strips of excelsior matting are laid end to end, butt the adjoining ends.
- B. When adjoining rolls of excelsior matting are laid parallel to one another, butt the matting snugly.
- C. On slopes flatter than 4:1, place staples not more than 3' apart in three rows, for each strip, with one row along each edge and one row alternately spaced down the center. On grades 4:1 or steeper, place staples in the same three rows, but spaced 2'. Ends of matting shall have staples placed every foot. Matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples.

3.05 EROSION CONTROL MULCHING BLANKET

- A. Where one roll ends and a second roll begins, the upslope piece shall be brought over the end of the downslope roll so that there is a 12" overlap, placed in a 4" deep trench, stapled at 12" on center, backfilled and tamped.
- B. On slopes where two or more widths of blanket are applied, the two edges shall be overlapped 4" and stapled at 12" intervals along the exposed edge of the lap joint.
- C. Staple the body of the blanket in a grid pattern with staples 3' on center, each way.

3.06 SEED FOR EROSION CONTROL

- Seeding for permanent erosion control shall be carried out in accordance with Section TOPSOIL AND SEEDING.
- Areas which will be regraded or otherwise disturbed later during construction may be ordered to be seeded with rye grass to obtain temporary control. The seed shall be sown at the rate of approximately one pound per 1,000 square feet, on the pure live seed basis.

3.07 HAY BALES AND SILT FENCES

-
- A. Provide hay bales or silt fences, as required, for the temporary control of erosion and to stop silt and sediment from reaching surface waters, adjacent properties, or entering catch basins, or damaging the Work.
 - B. Stake the hay bales to hold them firmly in place. Use a sufficient number of bales to accommodate runoff without causing any flooding and to adequately store any silt, sediment and debris reaching them.
 - C. Erect silt fences and bury bottom edge in accordance with the manufacturer's recommended installation instructions. Provide a sufficient length of fence to accommodate runoff without causing any flooding and to adequately store any silt, sediment, and debris reaching it.
 - D. Leave hay bales and silt fences in place until permanent erosion control measures have stopped all erosion and siltation.

3.08 MAINTENANCE

- A. If any staples become loosened or raised, or if any matting becomes loose, torn, or undermined, or if any temporary erosion and sediment control measures are disturbed, repair them immediately.
- B. If seed is washed out before germination, repair any damage, refertilize, and reseed.
- C. Maintain mulched and matted areas, silt stops, and other temporary control measures until the permanent control measures are established and no further erosion is likely.

END OF SECTION

SECTION 32 0116
PAVEMENT REPLACEMENT

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the furnishing and installation of pavement and subbase materials.
- B. Related work specified elsewhere includes:
 - Site Work Division 31, 32, and 33
- C. Definitions:
 - 1. NHDOT – NH Department of Transportation, "Standard Specifications for Construction", Latest Edition, including all addenda.
 - 2. Highway Department – City of Concord, NH, 41 Green St Concord, NH 03302.

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 trained and experienced in the placing of the type of pavement specified and who shall direct all work performed under this Section.
- B. Use only personnel thoroughly trained and experienced in the skills required for installing and finishing, and in operating the required equipment.
- C. Comply with the referenced portions of NHDOT Standard Specifications.
- D. All testing shall be performed by the approved testing laboratory. State Project Manager may use the testing laboratory for inspection services.

1.03 SCHEDULING

- A. Coordinate work with the work of other Sections to avoid delays and damage.
- B. Notify State Project Manager at least 24 hours in advance of the placing of any materials under this Section.
- C. Schedule work and operations to allow ample time for testing and inspection. Cooperate with State Project Manager and the testing laboratory and provide access to all phases of the Work.
- D. Place temporary pavement as specified or directed within 2 days after backfilling and compaction has been completed.
- E. Do not construct permanent pavement until after trenches have set a minimum of thirty (30) days.

1.04 JOB CONDITIONS

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- A. Remove any pavement, pavement foundation, or appurtenances damaged by construction operations to the extent ordered by the State Project Manager so that the whole roadway will have a true and uniform surface and will conform to the proper grade and cross sections.
 - B. Neatly saw cut all pavements to be removed, creating as little damage as possible to the adjoining pavement.
 - C. Comply with the requirements concerning weather limitations as specified in NHDOT Division 400.
 - D. Install permanent pavements between April 15th and November 15th, and then only when environmental conditions are satisfactory
 - E. Restore all disturbed gutters and curbs to a condition at least equal to that in which they were found immediately prior to beginning of operations.

1.05 REPLACING STATE HIGHWAY PAVEMENTS

Nothing contained herein shall relieve the Contractor from carrying out all orders given by State Highway Officials in connection with the replacement of pavement which is part of the State Highway System or State Aid Roads. Prior to doing any work which will affect a State Highway, a permit shall be obtained from the State of New Hampshire Agency of Transportation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Pavement - Minimum 1" thickness of Bituminous Concrete, Type III, PG 58-34, NHDOT 403.
- B. Bituminous Concrete Pavement - Conforming to materials and construction of Bituminous Concrete, Type II and Type IV, PG 58-34, NHDOT 403.
- C. Portland Cement Concrete Pavement
 - 1. Concrete - Class B (minimum 28 day compressive strength of 3000 psi).
 - 2. Reinforcing Bars - Conforming to ASTM A-615, Grade 60, Use #4 bars spaced at maximum 8" O.C. perpendicular to the line of excavation.
- D. Double Tack Coat - Conforming to materials and construction of NHDOT Item 410.22, Type I, with cutback asphalt.
- E. Gravel Subbase – As specified by State Project Manager.

2.02 MIXES

Bituminous concrete shall be mixed by the approved asphalt mixing plant in accordance with NHDOT Section 400.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete, tested and approved by State Project Manager and to the point where this installation may be properly performed. Particular attention shall be given to items such as pipelines so as to avoid excavating pavements at a later date.

3.02 PREPARATION FOR PAVEMENT REPLACEMENT

- A. Backfill trench as specified in Section 31 2316.
- B. Gravel base course shall be constructed in conformance with the detail provided by the State Project Manager. In absence of a detail the pavement subbase shall have a thickness equal to the existing base course or a minimum of 12" thick, whichever is greater, after compaction to a minimum density of 95%.
- C. Place base course in maximum 6" lifts and compact with a mechanical tamper as described in NHDOT Section 300.
- D. Remove all loose or damaged material in the existing pavement and trim back existing surface course as directed by the State Project Manager.

3.03 INSTALLATION OF TEMPORARY PAVEMENT

- A. Install temporary pavement in areas specifically designated by the State Project Manager in writing.
- B. Comply with NHDOT Section 403.

3.04 INSTALLATION OF BITUMINOUS CONCRETE PAVEMENT

- A. Remove and dispose of Temporary Pavement if utilized.
- B. Replace existing Bituminous Pavement per the plans. In absence of a detail replace existing pavement greater than 4" thick with 2-1/2" thick Binder Course, and 1 -1/2" thick Wearing Course.

3.05 INSTALLATION OF BITUMINOUS CONCRETE PAVEMENT OVERLAYMENT

- A. Seal cracks between 3mm (1/8") and 6 mm (1/4") with an acceptable crack filler. Repair wider cracks using a method that provides a level surface. All holes shall be filled with hot asphalt and compacted level with adjacent surfaces.
- B. Surfaces shall be mechanically cleaned by sweeping and vacuuming and be free of oil, vegetation, sand, dirt, water, gravel, and other contaminants prior to placement of interlayer reinforcing.

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- C. If subgrade preparation is the responsibility of others, notify State Project Manager of unsatisfactory preparation. Do not begin work until unsatisfactory conditions have been rectified.
 - D. Apply emulsified asphalt tack coat prior to installing bituminous pavement shim course in ¾" minimum lifts compacted to required specifications to provide level surface for pavement overlay.
 - E. Apply emulsified asphalt tack coat to existing pavement surfaces immediately prior to installation of Bituminous Pavement Wearing Course per pavement section detail as shown on the plans, 1 1/2" thick minimum.

3.06 INSTALLATION OF PORTLAND CEMENT CONCRETE PAVEMENT

- A. Remove and dispose of Temporary Pavement if utilized.
- B. Secure approval of trench preparation by the State Project Manager prior to placement of pavement.
- C. Tie new reinforcing bars to existing bars or, where necessary or as directed by the State Project Manager, drill holes not less than 18" deep into original pavement and dowel with an approved non-shrink grout.
- D. Pour concrete to a depth of the existing Portland cement concrete pavement but not less than 6 inches.
- E. If the existing Portland Cement Concrete Pavement has a bituminous surface course, replace it in accordance with Paragraph 3.04.

3.07 INSTALLATION OF DOUBLE-TACK COAT

- A. Remove and dispose of Temporary Pavement if utilized.
- B. Place two applications of approved bituminous material to the completed subbase, followed by a seal coat of pea stone, bituminous material, sanding, and satisfactory rolling. (NHDOT Item 410.22).

3.08 PAVEMENT MARKINGS

- A. Pavement markings shall be installed using a Low VOC Chlorinated Rubber Based Paint using standard line striping colors or as specified on the drawings. Paint shall be installed in accordance with NHDOT 632.

3.08 MAINTENANCE OF PAVEMENT

- A. Temporary Pavements - Maintain in a satisfactory condition until permanent pavement is constructed by repairing any damaged or deteriorated sections promptly as directed by the State Project Manager.
- B. Permanent Pavements - Maintain in a satisfactory condition until the expiration of the guarantee period by filling all depressions and holes with similar materials and keeping the pavement in a safe and satisfactory condition for traffic.

END OF SECTION

SECTION 32 1216.2

BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of bituminous concrete paving.

B. Related work specified elsewhere includes:

Site Work Division 31, 32, and 33

C. Definitions:

1. NHDOT – NH Department of Transportation, "Standard Specifications for Construction", Latest Edition, including all addenda.
2. Highway Department – City of Concord, NH, 41 Green St Concord, NH 03302.

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 trained and experienced in the placing of the type of bituminous pavement specified and who shall direct all work performed under this Section.
- B. Use only personnel thoroughly trained and experienced in the skills required for installing and finishing bituminous concrete pavements and in operating the required equipment.
- C. Comply with the referenced portions of NHDOT.
- D. All testing shall be performed by the approved testing laboratory. State Project Manager may use the testing laboratory for inspection services.
- E. Use only the materials and job-mix formula(s) approved by the State Project Manager. Failure to consistently meet the approved job-mix formula(s) shall be sufficient cause for State Project Manager to prohibit the use of the asphalt supplier.
- F. All work on public roads shall meet the approval of the Highway Department(s). Secure and pay for all permits.

1.03 SOURCE QUALITY ASSURANCE

- A. All materials and the asphalt plant will be subject to inspections and tests by State Project Manager and by the approved testing laboratory. Provide all equipment, materials, facilities and labor as specified in NHDOT 400.

1.04 JOB-MIX FORMULA

- A. Do not commence paving until a job-mix formula(s) has been submitted, and approved by State Project Manager. The required job-mix formula(s) shall be prepared by the approved testing laboratory and shall comply with NHDOT. Provide all testing as required to clearly show that materials meet Specification requirements.

1.05 SCHEDULING

- A. Coordinate work with the work of other Sections to avoid delays and damage.
- B. Notify State Project Manager at least 48 hours in advance of the placing of any materials under this Section.
- C. Schedule work and operations to allow ample time for testing and inspection. Cooperate with State Project Manager and the testing laboratory and provide access to all phases of the Work.

1.06 JOB CONDITIONS

- A. Comply with the requirements concerning weather limitations as specified in NHDOT Division 400.
- B. Install permanent pavements between April 15th and November 15th, and then only when environmental conditions are satisfactory.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sub-Base Course - Gravel, NHDOT 304.2.
- B. Base Course – Crushed Gravel, NHDOT 304.3.
- C. Binder Course - Bituminous Concrete, Type II, AC-20, NHDOT 403.11.
- D. Wearing Course - Bituminous Concrete, Type IV, AC-20, NHDOT 403.11.
- E. Shoulders - Gravel, NHDOT 304.32.

2.02 MIXES

Bituminous concrete shall be mixed at the approved asphalt mixing plant in accordance with NHDOT Section 400.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete, tested and approved by State Project Manager and to the point where this installation may be properly performed. Particular attention shall be given to items such as pipelines so as to avoid excavating pavements at a later date.

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- B. Verify that subgrades have been properly prepared.
 - C. Do not proceed with installations until conditions are satisfactory.

3.02 INSTALLATION OF GRAVEL BASE COURSE

- A. Comply with NHDOT Section 304.
- B. Daylight base course to afford positive drainage of water out of the base course material.
- C. Compact to a minimum density of 95%.

3.03 INSTALLATION OF BINDER AND WEARING COURSES

Comply with NHDOT Section 400.

3.04 INSTALLATION OF GRAVEL SHOULDERS ON ROADWAYS

- A. Comply with NHDOT Section 400.
- B. Shoulder shall rest upon the gravel base course and shall not block the flow patch of water through the gravel base.
- C. Compact to a minimum density of 95%.

3.05 FIELD QUALITY CONTROL

- A. Except where otherwise specified, State Project Manager will select the date, time, location, number and type of tests required. Coordinate all testing, as required and provide full cooperation and assistance. All sampling and testing shall be done in the presence of State Project Manager.
- B. Run gradations of gravel base and gravel shoulders. Provide additional gradations when previous gradations do not meet Specification requirements and when a new source of material is proposed.
- C. Laboratory maximum density tests and field compaction density tests will be made in accordance with Section 31 2323.23.
- D. Thickness tests shall be conducted on the base, binder and wearing courses. Hand dig holes, not less than 3" in diameter, through the base course at locations designated by State Project Engineer. State Project Manager will measure the thickness and if it is found deficient, the base course shall be removed, the subgrade lowered, and refilled and compacted to the required thickness. These tests may be conducted on an average of one test every 200'. In the case of the binder and wearing courses, core samples shall be taken by the testing laboratory in accordance with AASHTO T168. If deficiencies in thickness are found, submit a proposal for correcting the deficiencies to State Project Manager for approval.
- E. The taking of an average of one sample for every 15 tons of asphaltic concrete, or a minimum of one for each day's placement, may be ordered by State Project Manager. Samples shall be cored in accordance with AASHTO T168. These samples will be used to check thicknesses and, when ordered by State Project Manager, they shall be used for running extraction, specific gravity and gradation tests.

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- F. Provide, for State Project Manager's use, a sturdy shank dial thermometer, an armored thermometer, straight-edge, 4' level, and a ruler.
 - G. Additional testing or retesting may be required by State Project Manager when the original test result shows noncompliance.

3.06 ADJUST AND CLEAN

- A. When specified conditions and tolerances are not met, do all work required to correct the deficiencies in a manner approved by State Project Manager.
- B. If any irregularities or defects remain after compaction is completed, the entire affected area of the surface course shall be promptly removed and sufficient new material placed to form a true and even surface. Roll all minor surface projections, joints and minor honeycombed areas to a smooth finish. The final surface shall be of uniform texture conforming to the line, grade and cross section specified.
- C. If settlement occurs, do all work required to eliminate the settlement.
- D. Replace all bituminous concrete where cores and samples were taken and blend in with surrounding pavement.
- E. Clean all paved surfaces of dirt, stones and other debris and remove and dispose of off-site all discarded mix, boards, trash and all other debris.

3.07 PROTECTION

- A. Protect all work from damage.
- B. Remove and replace any portion of the pavement or shoulder that has become loose, broken, damaged or is found defective.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall construct the cast-in-place sidewalks, curbs, trash enclosure pads, and civil site only to the dimensions, and at the locations, as specified. The minimum sidewalk width shall be 6 feet unless otherwise shown on site plans. Sidewalks shall meet existing widths and grades.

1.02 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to construct or restore sidewalks.
- B. In cases where part of an existing walk has been damaged by the Contractor, the entire width of the walk shall be removed and replaced as specified below. Patch work will not be accepted.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Base of crushed gravel NHDOT Item 304.3.

2.02 PORTLAND CEMENT CONCRETE SIDEWALKS

- A. Preformed cork joint filler shall be:
 - 1. No. 4323 Standard Cork Expansion Joint Filler as manufactured by Construction Products Division – W.R. Grace and Company.
 - 2. Sealtight Cork Expansion Joint as manufactured by W.R. Meadows or Pennsylvania, Inc.
 - 3. Or equal.
- B. Asphalt treated felt joint filler shall conform to the requirements of ASTM D 994.

PART 3 - EXECUTION

3.01 GENERAL

- A. The subgrade shall be properly shaped and thoroughly compacted. The subbase of approved gravel, placed to a minimum depth as specified, shall be rolled with a two-axle roller at minimum 5 ton weight.
- B. Prior to a sidewalk being opened for general use, the space on each side of the walk shall be backfilled to the required elevation with suitable material, firmly compacted and neatly graded, then topsoiled, seeded and mulched.

3.02 PORTLAND CEMENT CONCRETE SIDEWALKS, TRASH ENCLOSURE PAD AND OTHER CIVIL SITE ITEMS

- A. Forms: approved forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight or curved as required, free from warp, of sufficient strength to resist the pressure of the concrete without springing and shall be cleaned and oiled before

installing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

- B. The concrete shall be thoroughly compacted and struck off to the desired grade before finishing.
- C. Concrete shall be Class A 4000 psi (28 day compressive strength). Maximum water-cement ratio – 0.44. Air content 5-7%. Aggregate to be 100% regionally sourced as per LEED definitions.
- D. Finishing:
1. The surface shall be finished with a wooden float. No plastering will be permitted. The edges shall be rounded with an edger having a radius of ¼ inch. Before the concrete has taken its set, it shall be tested for waves or irregularities, with a straightedge 10 feet long and any unevenness of ¼ inch or more, either above or below the general contour of the surface shall be immediately remedied.
 2. The surface of the concrete, after the floating and screening process is completed, shall be finished with one of the following options.
 - a. Type I Concrete Finish
 3. Surface retardant shall be applied where Type I concrete finish is specified on site plan. Use Sika Rugasol-S or approved equal. Follow manufacturer's specifications.
 - a. Type III Concrete Finish (Typical unless otherwise noted)
 - b. "Broom Finish"
 4. Broom finish concrete, trowel joints.
- E. Joints:
1. Unless otherwise indicated on the plans or directed by the State Project Manager, expansion joints shall be placed every 20 feet. Contractor shall provide shop drawing with expansion joints and score pattern for approval.
 2. Expansion joints shall be formed around all appurtenances such as manholes, utility poles and other obstructions extending into and through the sidewalk. Preformed cork joint filler ¼ inch thick shall be installed in these joints. Expansion joint filler of the thickness indicated shall be installed between concrete sidewalks and fixed structures such as building or bridge. This expansion joint material shall extend for the full depth of the walk.
 3. Between the expansion joints, the sidewalk shall be divided at intervals of 5 feet or as shown on the plans by dummy joints formed by a jointing tool, or other acceptable means as directed to provide grooves approximately 1/8 inch wide and at least ½" of depth.
 4. When the sidewalk is constructed next to a concrete or granite curb, asphalt treated felt shall be placed between sidewalk and curb for the depth of the sidewalk.
- F. Curing:
1. Concrete shall be cured for 4 days with moistened sand or burlap covering before subjecting to general use. The surface of the concrete shall be swept clean of any sand or dirt before opening for use. Use Everclear VOC sidewalk sealant on all "site" concrete.

PART 4 – REFERENCE

4.01 GENERAL

- A. All work related to the preceding specifications, unless otherwise noted, shall be accomplished in accordance with the State of NH DOT "standard specifications for construction.

END OF SECTION

SECTION 32 9211

RESTORATION OF SURFACES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the restoration of surfaces damaged or disturbed as a result of Contractor's operations.
- B. Related work specified elsewhere included:

Site Work

Division 31, 32, and 33

1.02 QUALITY ASSURANCE

- A. Provide at least one person who shall be present at all times during this portion of Work and who is thoroughly familiar with the types of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.
- B. Grades and surfaces shall be restored so as to be equal to or better than the original conditions which existed at the time they were damaged or disturbed, except as otherwise specified.
- C. Restoration of surfaces under the jurisdiction of Village, Town, County, State or other public authorities or public utilities shall be in accordance with the requirements of such authorities. Ascertain these requirements, procure necessary permits, arrange for required inspections, and pay all fees, deposits and other charges which may be required by the authorities.
- D. Existing pavements and walks to be restored shall be replaced with new pavement equivalent to or superior to the existing in quality, thickness, bearing capacity and surface finish, except where otherwise specified.
- E. Slate and flagstone sidewalk sections shall not move or rock when pressure is applied on any portion.
- F. Replacement curbs shall have the same dimensions and cross-section as the existing adjoining curbs and the same texture, finish, and appearance.
- G. Replaced pavements shall be free from all noticeable sags, settlements, bumps, humps, cracks or other defects. Other than possibly color, the replaced pavement shall be unnoticeable from the existing pavement.

1.03 SCHEDULING

- A. It is the intent of this Section to restore all surfaces as soon as possible so as to cause the least amount of inconvenience to all people and animals, to provide an aesthetically pleasing construction site, to protect lives, to ensure safety, to avoid property damage and to provide for orderly and safe traffic conditions.

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- B. Rough grade all areas to be seeded or planted within 48 hours after installation of the work; finish grade within one week after installation of the work, topsoil within three weeks after installation of the work and seed as soon as conditions are satisfactory. Replant trees, shrubs and other vegetation as soon as possible.
 - C. Replace traffic and business signs as soon as possible, but no later than 24 hours after installation of the work.
 - D. Replace guardrails as soon as possible, but no later than 72 hours after installation of the work.
 - E. Replace all items as soon as possible, with special attention directed at those which control traffic, protect property and lives, are essential to a person's livelihood, create hazards when not in place, or are otherwise deemed essential.
 - F. The phrase "after installation of the work" means after the installation of the work which necessitated the removal of an item or items.

1.04 MAINTENANCE AND GUARANTEE

- A. The maintenance and guarantee requirements of other applicable Sections are required under this Section.
- B. Maintain and care for all restoration work.
- C. Continually maintain all areas where pavement has been removed to provide a smooth surface by adding fill and grading daily, or more frequently when required.
- D. Provide dust control with water or calcium chloride as the conditions require.

PART 2 MATERIALS

2.01 MATERIALS

- A. Public Property - Comply with the requirements of the authorities having jurisdiction over the materials being restored, and with the requirements of other Sections of the Specifications for new work. The more stringent requirements apply.
- B. Private Property - Comply with the requirements of other Sections of the Specifications for new work.
- C. Water for dust control shall be reasonably clear and free of harmful amounts of oil, salt, acids, alkalies, sugar, organic matter or other substances injurious to the finished product, plant life, or the establishment of vegetation.
- D. Calcium chloride shall conform to the requirements of AASHTO M144. Either regular flake, Type 1, or concentrated flake, Type 2 may be used.

2.02 REUSE OF EXISTING MATERIALS

Curbs, walks, fences, walls, signs and other items which have been removed, knocked down, or displaced shall be replaced with existing materials when, in the opinion of State Project Manager, such materials are in acceptable condition. Where such materials have been damaged, marred, broken, or are otherwise in an unacceptable condition, provide replacements of equal or better quality, appearance, size and type.

PART 3 EXECUTION

3.01 INSPECTION

- A. Carefully inspect the work installed under other Sections and verify that all such work is complete to the point where restoration of surfaces may properly commence and to insure against the unnecessary disturbance of restored surfaces at a later date.
- B. Verify schedule of work for conformance to allowable planting times.
- C. Do not begin restoration work until conditions are satisfactory.

3.02 GRASS AND LAWNS

- A. Comply with Section 32 9219 Topsoil and Seeding.

3.03 PLANTS AND REPLANTING

- A. As soon as possible after construction operations have moved ahead, replant plants, shrubs, trees, and other vegetation which was taken up in their original locations, provided that they survived and show indications of continued life.
- B. Replace with the same kind and size, any plantings, trees, shrubs or other vegetation that fails to survive the moving operation.

3.04 BITUMINOUS CONCRETE PAVEMENT

- A. All work and materials shall conform to Section 32 1216.
- B. Cut back undisturbed pavement surfaces and binder course at least 12" beyond the walls of the backfilled excavations and trenches, with straight and vertical edges, to form an undisturbed ledge of base course under the new pavement.
- C. Thoroughly roll finished surfaces and match existing adjacent surfaces as nearly as practicable. If approved by State Project Manager, surfaces may be left slightly mounded to allow for possible future settlement.
- D. Replace all pavement markings as they originally existed.
- E. Nothing contained herein shall relieve the Contractor from carrying out all orders given by State Highway Officials in connection with the replacement of pavement which is part of the State Highway System or State Aid Roads. Prior to doing any work which will affect a State Highway, a permit shall be obtained from the State Department of Highways.

END OF SECTION

**SECTION 32 9219
TOPSOIL AND SEEDING**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work covered by this Section includes providing topsoil, seeding, fertilizing and liming unpaved areas within approved limits as directed by the State Project Manager.
- B. Related work specified elsewhere includes:
 - 1. Section 32 9211 – Restoration of Surfaces

1.2 QUALITY ASSURANCE

- A. Provide at least one person who shall be present at all times during the topsoiling and seeding operations and who shall be thoroughly familiar with the types of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.
- B. Establish a good stand of grass of uniform color and density.
- C. Sod may be used in lieu of seed, and shall be provided where specified, in areas where the establishment of grass may be difficult due to steep slopes or drainage flows, and where required to prevent erosion.
- D. Protect, maintain and care for all grassed areas.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Seeding and sodding shall be done during the following times, and then only when conditions are satisfactory:

Seeding: When the ground becomes workable in the spring to June 1st, and between August 15th, and October 1st.

Sodding: May 1st to October 15th.

1.4 GUARANTEE

- A. All work shall be guaranteed for a minimum of one year from the date of first acceptance of the work or from the date when the State Project Manager determines that the Contractor has established a good, vigorous and healthy stand of grass of uniform color and density, whichever date is later.
- B. Final acceptance will be given by the State after established grassed and sodded areas have been in place for one year in a vigorous and health condition.

PART 2 -MATERIALS

2.1 TOP SOIL

- A. Approved topsoil as designed in Section 31 2316, obtained from excavation and grading work or, if insufficient material is available, it shall be imported:

2.2 LIME

- A. Calcic or dolomitic ground limestone.
B. Total carbonates – 85% minimum content.
C. Magnesium oxide – 10% minimum content for dolomitic and high magnesium lines.

2.3 FERTILIZER

- A. Standard Commercial Grade – dry free-flowing type suitable for common spreader application- or – finely-ground, water soluble type suitable for power spray application – or granular or pellet type suitable for application by blower equipment.
B. Minimum content – 10% total nitrogen
-6% available phosphoric acid
-10% water-soluble potash

2.4 SEED MIXTURES

- A. Grade A quality, fresh and re-cleaned and proven to produce satisfactory growth in the locality of the project.
B. In existing grass areas, mixtures shall be comparable to existing grasses and, when established, shall match as nearly as practicable the existing undisturbed grass.
C. In new grass areas designated as lawn, mixtures shall be:

<u>% byWgt. Seed</u>	<u>Species</u>	<u>P.L.S.</u>	<u>Max Weed</u>
60-70	Creeping Red Fescue	90%	0.5%
20-30	Kentucky Blue Grass	85%	0.5%
10	Perennial Rye Grass	85%	0.5%

P.L.S = Purity times germination (U.S.D.A., Bulletin No. 480.)

2.5 SOD

- A. Firm, dense, evenly textured and showing good root development. Grasses shall be of the type required for the intended use, suitable for climatic conditions at the project site, and as approved by the State Project Manager.
- B. Sod shall have a compact growth and shall be reasonably free from weeds, plants, large stones and other objectionable or detrimental materials.
- C. All sod shall be living, healthy and showing signs of vigorous growth.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that all underground and above ground work has been completed to the point where topsoiling, seeding and/or sodding operations may properly commence without unnecessary disturbances at a later date.
- B. Do not commence work under this Section until conditions are satisfactory.
- C. Loosen all ground surfaces to a minimum depth of 2 inches to facilitate bonding of the topsoil to the subgrade. Use discs, spike-tooth harrows, or other approved means.
- D. Clean surface of subgrade of all stones, sticks and rubbish larger than 2 inches in size and all litter and detrimental materials.
- E. After spreading, break large, stiff clods and hard lumps, and rake off all stones and rocks larger than 1 inch in size, roots, litter, foreign matter, poisonous materials, and other materials which may be detrimental to the work. Dispose of all such materials off-site.
- F. Remove all topsoil spilled on highways, shoulders, sidewalks, driveways and other surfaces for which topsoil is not specified or required.

3.2 LIMING

- A. Apply separately at the rate of 50 pounds/1,000 square feet, prior to fertilizing, seeding, and sodding. Lime may be applied dry spreader or as an aqueous solution by spraying.
- B. After application, work lime into the top 3 inches of soil and redness surface to a smooth finish.

3.3 FERTILIZING

- A. Uniformly spread fertilizer at the rate of 25 pound/1,000 square feet with a cyclone or broadcasting type spreader.

3.4 SEEDING

- A. Sow seed uniformly with a cyclone or broadcasting type spreader at a rate recommended by the seed vendor and as approved by the State Project Manager. The rate shall be based upon "new lawn" requirements and shall not be less than 5 pounds per 1,000 square feet.
- B. Sow seed when soils are moderately dry and when wind does not exceed five miles per hour.

3.5 ROLLING

- A. Where rolling is required, compact soil lightly with a lawnroller, immediate after seed is sown.

3.6 MULCHING - GENERAL

- A. In grass areas, use a mulch, matting, or a blanket to protect the seeded areas. Apply within 24 hours after seed operation is completed.
- B. In open and wooded areas, mulching is optional, except with it is required for erosion control.

3.7 MAINTENANCE

- A. Properly maintain all turfed areas by watering, cultivation, weeding, mowing, reseeding, filling eroded areas and other repairs and replacements until final acceptance of the work.
- B. Reseed all areas where seed has failed to germinate and where seeded areas have been damaged by erosion, people, vehicular traffic of other causes.
- C. After sod has started to grow, resod any areas or portions failing to show life. Resod as often as necessary in order to establish a health, growing sod.

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.

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- 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

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- 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.

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- 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.

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- 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:
- 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:
- One complete set of tools needed to remove hydrant main valve and seat ring.
 - Two spanner wrenches (for removing hose couplings and nozzle caps and for operating the main hydrant valve).
 - Two safety flange repair kits.
 - 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.

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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

- 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 maintained 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 laws, 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.

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- 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

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- 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.

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- 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 ENCASEMENT 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

SECTION 33 4614

PRECAST CONCRETE MANHOLES & STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work covered by this Section includes the furnishing and installation of precast concrete manholes and structures at locations as specified.
- B. Related work specified elsewhere includes:
 - 1) 31 2316 Excavating, Trenching & Backfilling
 - 2) 23 0500 Basic Mechanical Requirements

1.02 QUALITY ASSURANCE

- A. All precast concrete sections and all castings shall each be the product of a single manufacturer who can furnish evidence of satisfactory experience in the production of high quality products of the type indicated and specified.
- B. Provide at least one skilled mason who shall be present at all times during execution of this portion of the Work and who shall personally direct all work performed under this Section.
- C. Use only skilled masons, who are thoroughly experienced with the materials and methods specified and thoroughly familiar with the design requirements, for the actual cutting and placing of masonry units.
- D. State Project Manager reserves the right to prohibit the use of precast bases if, in State Project Manager's opinion, installations are not being properly made or the requirements of FIELD QUALITY CONTROL are not being met.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Carefully load, deliver and unload all materials in order to avoid any damage.
- B. Store all materials so that they can be easily inspected and so that they will not be damaged prior to installation.
- C. Deliver cement, lime and hydraulic cement in manufacturer's sealed containers, clearly marked with the name of the product and manufacturer. Store in a weatherproof enclosure off the ground.

1.04 JOB CONDITIONS

- A. Do not erect masonry when the ambient temperature is below 35 degrees F. Do not build upon work which is frozen nor use any materials containing ice or snow. Protect masonry from freezing for 72 hours after placement.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE

- A. Conform to ASTM C478.
- B. Length x Width - As specified.
- C. Height - As required to attain the proper elevation of the frame and cover or grate.
- D. Joints - As specified.
 - 1. Butyl Rubber - Kent-Seal No. 2 by Hamilton-Kent, Butyl-Tite by Blue Ridge Rubber Co., or approved equal.
 - 2. Round rubber, compression type conforming to ASTM C443 and ASTM C361.
 - 3. Mortar.
- E. Precast concrete riser and cone sections shall conform to ASTM Standard C478 with the following exceptions and additional requirements:
 - 1. The barrel shall not be less than five inches thick.
 - 2. Type II cement shall be used, except as otherwise approved.
 - 3. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.
 - 4. No more than two lift holes may be cast or drilled in each section.
 - 5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of the barrel.
 - 6. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
 - 7. Precast bases shall be constructed so that the floor slab shall be an integral part of and poured monolithically with walls of the base. The base may extend six inches beyond the outside diameter of the walls.
 - 8. The tops of the precast manhole bases shall be properly shaped, by means of accurate bell-ring forms, to receive the barrel sections and to accommodate the type of joint to be used.

2.02 CONCRETE

- A. All cast-in-place concrete shall be Class B (28-day compressive strength of 3,000 psi) as specified.

2.03 CONCRETE MASONRY UNITS

- A. Conform to ASTM C90, Grade A.
- B. Units shall be well cured before delivery and shall include all closers, corners and special shapes and sizes required to complete the work.
- C. Units shall be selected, smooth faced with uniform surfaces, no broken corners and with edges clean and sharp.

2.04 BRICK

- A. Clay Brick - ASTM C32, Grade MS, first quality, sound, hard burned brick, regular and uniform in shape and size and of compact texture.

2.05 MORTAR

- A. Conform to ASTM C270, Type M or S.
- B. Mix in a suitable mixer or watertight mixing box. Thoroughly mix dry materials and then add sufficient water to bring the mixture to a workable consistency. The use of mortar that has begun to set, and the retempering of the mortar, are prohibited.
- C. Water shall be clean, fresh and potable.
- D. Antifreeze compounds and liquids are not permitted in mortar.

2.06 HYDRAULIC CEMENT

- A. "Sikaplug" by Sika Chemical Corp., "Waterplug" by Standard Dry Wall Products, Inc., or equivalent.

2.07 FRAMES, COVERS AND GRATES

- A. Cast Iron - ASTM A48, Class 30.
- B. Aluminum - ASTM B26.
- C. Ductile Iron - ASTM A536, Alloy 65-45-12 or 80-55-06.
- D. Cast Steel - ASTM A27, Alloy 60-3 or 65-35.
- E. Acceptable manufacturers are Neenah Foundry Co., Flockhart, Campbell or an approved equal.

2.08 ALUMINUM RUNGS

- A. New Jersey Aluminum Extrusion Co., Inc. F-14-2-B, Alcoa No. 12653B, or an approved equal.

2.09 REINFORCEMENT STEEL

- A. Reinforcing Bars - ASTM A615, Grade 60.
- B. Supporting Devices - Galvanized or approved non-rusting type.

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- C. Joint Reinforcement - Trussed design by Dur-O-Wal, Inc., Cumberland Corp., Hohmann and Barnard, Inc. or approved equal. Standard weight, galvanized.

2.10 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for the complete and proper installation of precast concrete manholes and structures.

2.11 FABRICATION - PRECAST CONCRETE

- A. Fabricate all precast concrete sections in accordance with ASTM C478.
- B. Reinforce flat top sections as specified. Precast base slabs, when used, shall be reinforced as specified for cast-in-place concrete bases.
- C. Rungs, if required, shall be integrally cast into the precast riser sections. Apply a heavy coat of alkali-resistant bituminous paint to the portions of aluminum rungs which will be embedded in concrete. Space rungs at 12", center to center, to within plus or minus 1/2". The lowest rung shall be within 18" of a solid footing (e.g. structure bench) upon which a person descending the rungs would normally step. The uppermost rung shall be set within 18" of the rim of the structure frame to act as a handhold. If this rung must be set in the brick corbell, it shall be set so as to extend 3" from the face of the brick to facilitate easy passage. Make every effort to locate rungs on a wall with no pipe penetrations.
- D. Openings in precast riser sections to receive pipes shall be accurately cast, both vertically and circumferentially. Where openings are incorrectly cast, the riser section shall be removed from the Project site and replaced with a satisfactory section. Cost for replacements, whether attributed to improper manufacturing, field changes or for any other reason, shall be borne by the Contractor.

2.12 FABRICATION - CAST IRON, DUCTILE IRON AND STEEL CASTINGS

- A. Castings shall be true to pattern in form and dimensions without sharp, un-filleted angles or corners, and free from pouring faults, sponginess, cracks, blow holes, porosity, hard spots, shrinkage distortion and other defects in positions affecting their strength and value for service intended.
- B. Castings shall further be free from scale, lumps, blisters and other defects.
- C. Fabricate frames, covers, and grates so that covers and grates fit in any position without rocking. Mill horizontal fitting surfaces to a true and even surface to insure uniform bearing. Units and portions of units shall be interchangeable. Provide one (1) lifting hole in covers.
- D. Stamp or cast the word "STORM", in letters not less than 2" in height, into all solid covers so as to be plainly visible.
- E. After casting and prior to shipping, smooth and clean all surfaces by sandblasting.
- F. Coat castings with at least one coat of coal-tar-pitch varnish applied in a manner to yield a smooth coating which is tough, tenacious, non-brittle and not subject to scaling off.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that excavation is in the proper location, that pipes have been installed at the correct elevations and that the subgrade has been prepared in accordance as specified.
- B. Do not install structures until conditions are satisfactory.

3.02 ORIENTATION OF COVERS, GRATES AND RUNGS

- A. General - The intent of this paragraph is to secure covers in a position which provides for the safety of all, during and after construction of the Work, provides for convenient ingress and egress, and to minimize adverse visual impacts. Unless otherwise specified or directed by State Project Manager, orient the location of covers and rungs by using the following criteria, with precedence given in the order presented.
- B. Safety - Give primary concern to safety considerations and for providing convenient access to structure interiors.
- C. Covers and Pavements - To avoid future problems with snow removal or street cleaning, orient covers to lie completely outside of paved surfaces, including walks and roadways. If this cannot be accomplished, locate cover completely in pavement. Covers partially within pavements are not permitted without the prior approval of State Project Manager. When covers occur in paved areas, locate entirely within a single traffic lane and as near to the edge of pavement as is possible, but no closer than 8" from the edge of pavement.
- D. Covers and Grates in Unpaved Areas - Avoid gardens and the like which may upset the present use of the area.
- E. Ingress/Egress - Coupled with the above, convenient and safe access to within the structure must be evaluated. Coordinate cover location with pipe openings, structure benches and inverts, safety landings and the like. Make every effort to locate rungs on a wall with no pipe penetrations and, where rungs are not specified to be provided, consideration shall be given to the safest means of seating the feet of ladders which will be used for access to structure interiors.
- F. Noncompliance: Noncompliance with the requirements of this paragraph may result in State Project Manager's rejection of the entire structure. When requested, State Project Manager will assist in determining the optimum location of covers, grates and rungs.

3.03 INSTALLATION

- A. Cast-in-Place Bases: Cast bases in place at the locations as specified.
- B. Precast Bases: Place bedding, level and tamp firmly in place. When absolutely necessary, pea stone may be used for minor adjustments in final leveling, but the depth shall not exceed 3". Carefully lower precast base in place, taking extra care not to shift the stone bedding, and align all openings with the pipes to be connected. Leveling of the base by

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- tamping or pounding on the top of the precast product is prohibited. If base is not level, lift it out, readjust bedding and reset base. Continue this procedure until base is level.
- C. Precast Risers and Top Sections: Thoroughly clean all joints of precast sections and install jointing material. Carefully set precast sections in place, making sure that jointing material is not displaced and that a good seal is attained. Fill all lifting holes with hydraulic cement.
 - D. Openings in Precast Sections: Where any opening in a precast section has been incorrectly cast, remove the section from the Project site and replace it with a satisfactory section. Cost for replacements, whether attributed to improper manufacturing, field changes, or for any other reason, shall be borne by the Contractor.
 - E. Refabricated Bases: If precast bases must be refabricated for any reason, the excavation at the structure location shall be immediately backfilled, if directed by State Project Manager. Lack of compliance is sufficient grounds to terminate the future use of precast bases.
 - F. CMU Walls:
 - 1. Lay up all walls plumb, level and true to the lines and dimensions as specified with level courses accurately spaced and with each course breaking joints with the course below. Keep bond pattern plumb throughout and corners plumb and true.
 - 2. Build in all pipes as masonry work progresses. Cut all masonry units with masonry saws to yield smooth, clean, sharp edges.
 - 3. Bed reinforcement in horizontal joints, continuous for full length of joint and not narrower than 2" less than the width of wall. Lap splices and corners by at least 6" and accurately frame around corners.
 - G. Chimney - Cull brick of all irregular, unsound or damaged brick. Construct chimney as detailed on the Drawings and to a height which will permit the setting of the frame at the proper elevation. Set frame on a bed of mortar as specified. Keep mortar wet for a period of not less than 48 hours, protect from the weather and do not permit freezing of the mortar to occur.
 - H. Masonry Joints: Completely fill all joints, both horizontal and vertical, with mortar so that joints are continuous and free of voids. Tool exposed joints to a smooth, slightly concave surface.
 - I. Filling Precast Section Joints - Fill interior and exterior joints with hydraulic cement.
 - J. Inverts (Channels and Benching) - Construct inverts to the general configuration shown on the Drawings and more specifically, to conform to the following requirements:
 - 1. Construct channels to produce free, uniform, unobstructed and non-turbulent flows, without ponding, from each inlet pipe to the outlet pipe, and in a manner which will not produce free-falls, splashing or spraying onto structure benches or walls.
 - 2. Completed inverts shall allow for easy, visual observations into pipes and readily permit the insertion of pipe plugs and cleaning equipment.
 - 3. The bottom half of all channels shall be smooth semi-circles. When all pipes entering and leaving the structure are the same size, the radius of each channel semi-circle shall equal the radius of the pipes. When there are only two pipes connected to the structure, and the outlet pipe is larger than the inlet pipe, the channel shall uniformly increase in cross section across the full width of the structure so that the radius of the channel semi-circle varies from the radius of the smaller pipe at the inlet to the radius of the

larger pipe at the outlet. When two or more pipes enter a structure and the outlet is larger than either inflowing pipe, the primary channel shall uniformly increase in cross section across the full width of the structure and the secondary channel(s) shall maintain the cross section of the secondary pipe(s). Construct inverts for other combinations of pipes and pipe sizes along these lines.

4. Construct inverts with curves of the longest possible radii, tangent to the centerline of the pipes.
 5. Construct the benching by solidly filling in the area between the channel and the structure walls. Slope the top surface of the benching towards the channel, at a pitch of approximately 3" per foot so that the liquid on the bench will easily drain into the channel. Provide as much bench area as is possible for standing on and make surface slightly roughened to attain a skid resistant finish.
 6. Where the top of benching intersects the channel, the resulting edge shall be rounded to a radius of approximately 1/2" - 3/4". Where channels meet to form an acute angle, provide a rounded intersection with a radius of about 1".
- K. Penetrations through Concrete: Only where absolutely necessary, penetrations shall be made through concrete by core drilling or by other approved means which will produce a hole of the minimum possible size and in a manner which will not affect the structural integrity of the concrete. After inserting the item which is penetrating the wall, carefully and neatly fill the annular spaces with hydraulic cement.

3.04 FIELD QUALITY CONTROL

All structures shall be in satisfactory condition. The following is a partial list of unacceptable conditions which are not permitted.

- A. Structure plumbness shall not exceed 1" (inch) in 8 feet.
- B. Defects in concrete surfaces including voids, honeycombs, cracks, patches, broken pieces and exposed reinforcement.
- C. Poorly formed, cracked or broken sections and joints.
- D. Incorrect location or elevation of pipe openings.
- E. Incorrect location, spacing or alignment of rungs.
- F. Rungs found loose, inserted after casting of concrete, broken, cracked and when area around rungs has been patched in any way.
- G. Voids in the mortar joints or in the hydraulic cement joint filler.
- H. Defects in castings or in casting coatings. Covers or grates which rock or do not fully or properly seat with the frame.
- I. Precast bases not bearing on at least 80% of the bedding. State Project Manager reserves the right to require the removal of precast bases from the excavation to inspect the bearing surfaces.

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- J. Casting painting, joint filling, or other required work which has not been completed or has not been done properly or neatly.
 - K. Inverts improperly shaped, not well rounded and not smooth.
 - L. Ponding water in the invert and less than a 0.02' rise in inverts across the structure.
 - M. Covers set at wrong elevations or settlement of structure or surrounding ground.
 - N. Any other defect or deficiency in materials or workmanship and any condition which may adversely affect the functioning of the structure or system or its structural integrity.

3.05 ADJUST, REPAIR AND REPLACE

- A. Adjust all frames, covers and grates, as required. Frames, covers and grates which have become marred or scratched shall be repainted with coal-tar-pitch varnish.
- B. Repair or replace defective work at no additional cost to the Owner.

END OF SECTION