PUBLIC WORKS AND UTILITIES COMMITTEE

12-0329R

RESOLUTION ADOPTING STANDARD CONSTRUCTION SPECIFICATIONS.

CITY PROPOSAL:

RESOLVED, that the council hereby adopts the 2011 edition of the City of Duluth Public Works/Utilities Department Engineering Division Standard Construction Specifications booklet and 2012 Addendum, a copy of which is on file in the office of the city clerk as Public Document No. _____, to be used for the construction, reconstruction and repair of all city streets and utilities.

Approved:

Department Director

Approved for presentation to council:

Chief Administrative Officer

Approved as to form:

Attorney

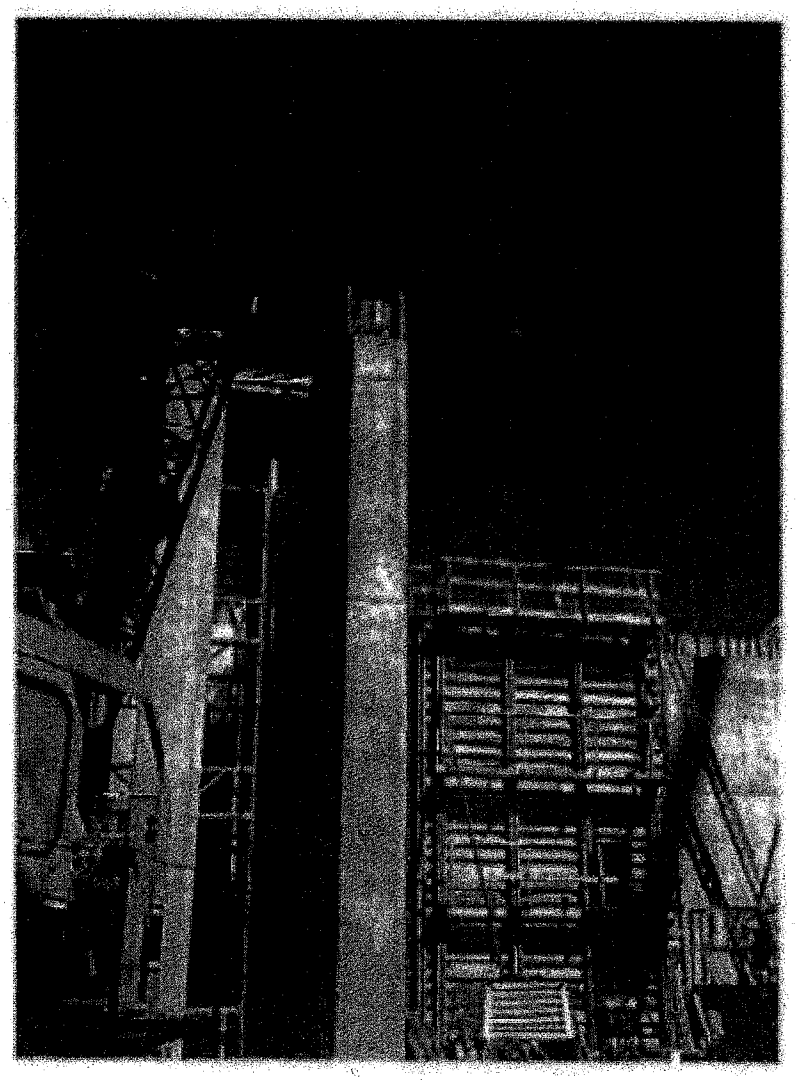
Approved:

Auditor

ENG/ATTY CV:REA:cjk 6/26/2012

STATEMENT OF PURPOSE: This resolution adopts the 2011 edition of the city of Duluth Public Works/Utilities Department Division Standard Construction Specifications booklet and 2012 amendment to be used as the standard construction specifications for construction and reconstruction of city streets and utilities. These specification have been in place and in use for several years but have not yet been formally adopted. The adoption of this resolution will serve as formal notice to contractors, developers and to the general public of the city's requirements.

2012



Public Works & Utilities
Engineering Division
Duluth, MN
March 1, 2012

TABLE OF CONTENTS

S-1 INSURANCE PROVISIONS....1
S-2 PUBLIC WORKS AND UTILITIES REGULATIONS....2
S-3 MATERIALS AND WORK TO BE FURNISHED BY THE PUBLIC WORKS & UTILITIES DEPARTMENT....2
S-4 INSPECTION OF MATERIALS....3
S-5 USE OF WATER FROM CITY HYDRANTS....3
S-6 DRUG AND ALCOHOL TESTING FOR GAS WORK....3
S-7 OPERATOR QUALIFICATION FOR GAS WORK....3
S-8 CORRECTION PERIOD....4
S-9 MEETINGS....4
S-10 PROJECT LABOR AGREEMENT....5
S-11 GOVERNING SPECIFICATIONS....5
S-12 DAMAGE TO CITY UTILITIES....5
1213 DISQUALIFICAITON OF BIDDERS....6
1302 AWARD OF CONTRACT....6
1305 REQUIREMENT OF CONTRACT BOND....6
1306 EXECUTION AND APPROVAL OF CONTRACT....7
1404 MAINTENANCE OF TRAFFIC AND 2563 TRAFFIC CONTROL....7
1502 PLANS AND WORKING DRAWINGS....9
1507 UTILITY PROPERTY AND SERVICE....9
1508 CONSTRUCTION STAKES, LINES AND GRADES....10
1604 PLANT INSPECTION - COMMERCIAL FACILITY....11
1706 EMPLOYEE HEALTH AND WELFARE....11
1710 TRAFFIC CONTROL DEVICES....11
1803 PROSECUTION OF WORK....11
1807 FAILURE TO COMPLETE WORK ON TIME....15
1904 EXTRA AND FORCE ACCOUNT WORK....15
1906 PARTIAL PAYMENTS....15
1908 FINAL PAYMENT....16
2101 CLEARING AND GRUBBING....16
2104 REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES....17
2105 ROCK BLASTING....18
2105 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES....23
2105 EXCAVATION AND EMBANKMENT....33
2105 GEOTEXTILE FOR SEPARATION (STABILIZATION)....33
2211 AGGREGATE BASE....35
2301 CONCRETE PAVEMENT....35
2355 BITUMINOUS LONGITUDAL JOINT FOG SEALING TREATMENT....35
2357 BITUMINOUS TACK COAT....37

2360 PLANT MIXED ASPHALT PAVEMENT 37
2399 PAVEMENT SURFACE SMOOTHNESS 39
2411 MODULAR BLOCK RETAINING WALL 39
2451 STRUCTURE EXCAVATION AND BACKFILLS 44
2502 SUBSURFACE DRAINS 44
2503 PIPE SEWERS - GRAVITY 44
2503 PIPE SEWERS - PRESSURE 53
2503-2504 LOCATING WIRE FOR WATER AND SANITARY SEWER 71
2503 CIRED-IN PLACE PIPELINING 73
2504 WATER MAIN AND SERVICE LINE INSTALLATION 81
2505-2503-2404 HORIZONTAL DIRECTIONAL DRILLING 118
2505 GAS MAIN 126
2506 MANHOLES AND CATCH BASINS 127
2506 MANHOLE FRAME SEAL (INTERNAL/EXTERNAL) 129
2506 MANHOLE VACUUM TESTING 131
2511 RIPRAP 132
2521 WALKS 132
2531 CONCRETE CURBING 132
2531 PEDESTRIAN CURB RAMP - TRUNCATED DOME SYSTEMS 133
2533 CONCRETE MEDIAN BARRIERS 133
2540 CONSTRUCT SURVEY MONUMENT 133
2540 PARKING METER POST/BRACKET INSTALLATION 134
2564 TRAFFIC SIGNS AND SIGN POST INSTALLATION 134
2564 STREET NAME SIGNS, CONCRETE FOOTING, SIGN POST AND BRACKET ASSEMBLY 135
2564 SIGNS - REMOVE AND REINSTALL 136
2571 PLANT INSTALLATION 137
2572 PROTECTION AND RESTORATION OF VEGETATION 150
2573 STORM WATER MANAGEMENT 150
2575 TURF ESTABLISHMENT 151
3138 AGGREGATE FOR SURFACE AND BASE COURSES 152
3139 GRADED AGGREGATE FOR BITUMINOUS MIXTURES 154
3760 INSULATION BOARD (Polystyrene) 161
3861 PLANT STOCK 163

Appendix A Standard Specification for High Pressure Gas Mains, Transmission Line and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe
Appendix B ..... Schedule for Materials Testing

Appendix C ..... Project Labor Agreement

CITY OF DULUTH GENERAL REQUIREMENTS

S-1 INSURANCE PROVISIONS

A. The Contractor will be required to carry insurance of the kinds and in the amounts hereinafter specified. The Contractor shall not commence work under the Contract until he has obtained all the insurance required by these specifications and until such insurance has been approved by the City Attorney, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor shall have been so obtained and approved.

B. Insurance

Contractor shall provide Public Liability and Automobile Liability Insurance with limits not less than $1,500,000 Single Limit and twice the limits provided when a claim arises out of the release of a hazardous substance; shall be written by a company approved by the City of Duluth and licensed to do business in the State of Minnesota; and shall provide for the following: Liability for Premises, Operations, Completed Operations, Independent Contractors, and Contractual Liability. Property damage coverage for explosion, collapse, and underground "XCU" to be included.

City of Duluth shall be named as Additional Insured under the Public Liability, or as alternate, Contractor may provide Owners-Contractors Protective policy, naming himself and City of Duluth. Contractor shall provide evidence of Statutory Minnesota Workers' Compensation Insurance. Contractor to provide Certificate of Insurance evidencing such coverage with 30-day notice of cancellation, non-renewal or material change provisions included. The use of an "Accord" form as a certificate of insurance shall be accompanied by two forms – 1) ISO Additional Insured Endorsement (CG2010 pre-2004) and 2) Notice of Cancellation Endorsement (IL 7002) – or equivalent, as approved by the Duluth City Attorney's Office.

C. Comprehensive Owner's Protective Insurance

If a certificate of insurance is provided, the form of the certificate shall contain an unconditional requirement that the insurer notify the City without fail not less than 30 days prior to any cancellation, non-renewal or modification of the policy or coverages evidenced by said certificate, and shall further provide that failure to give such notice to the City will render any such change or changes in said policy or coverages ineffective as against the City. In the cancellation provisions, the words "endeavor to" must be deleted in reference to the 30-day notice of cancellation, non-renewal or material change provisions included. As an additional insured under the contract, the City of Duluth has contractual rights for exceeding that of a certificate holder. Therefore, additional named insured endorsement shall read as follows: This policy insures the named insured and the city of Duluth and will be primary and not contributory with city of Duluth coverage. The City of Duluth is an additional insured not subject to the "other insurance" condition or other policy terms which conflict with the agreement between the named insured and the City of Duluth.

D. Subcontractor's Insurance

In the event any work contemplated by the Contract is subject, the Contractor shall be responsible to see that the subcontractors provide insurance in accord with the minimum requirements herein above imposed on the Contractor.

E. Indemnification

The Contractor shall defend, indemnify and save harmless the City and all of its officers, agents, and employees from all suits, actions, or claims of any character, name, and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property, by or from the act or acts of said Contractor, or by or in consequence of any negligence in safeguarding the work, or through the use of unacceptable materials in constructing the work, or by or on account of any act or omission, neglect or misconduct of said Contractor, or from any claims or amount arising or recovered under the Workmen's Compensation Law or any other bylaw, ordinance, order or decree, and so much of the money due the said Contractor under and by virtue of his contract, as shall be considered necessary by the City, may be retained for the use of the City or in case no money is due, his surety shall be held until such suit or suits, action or actions, claim or claims, for injuries or damages as aforesaid, shall have been settled and suitable evidence to that effect furnished to the City. The Contractor shall indemnify and save harmless the City from any and all losses caused by or an account of any claims or amounts recovered for any infringement of patent, trademark or copyright.

The unauthorized use by the Contractor of public or private property for any purpose may be considered an injury or damage to the property so used.

S-2 PUBLIC WORKS AND UTILITIES REGULATIONS

Prior to beginning work, the contractor shall acquaint himself with all regulations and requirements of the City of Duluth Public Works & Utilities Department that may apply to the proposed work. All work shall be open at all times to inspection by the Public Works & Utilities Department. The Contractor shall notify the Engineer not less than two working days before beginning construction. The operation of all valves on the existing distribution systems shall be performed only by the Public Works & Utilities Department. The Contractor shall give 24 hours notice to the Public Works & Utilities Department prior to the need for the operation of any existing water valves or the need for any water main shutdowns by contacting 730-5200.

S-3 MATERIALS AND WORK TO BE FURNISHED BY THE PUBLIC WORKS AND UTILITIES DEPARTMENT

The Public Works & Utilities Department will furnish the following materials and work on this project at no cost to the Contractor. Contractor is to excavate and backfill in order to allow the Department to perform said work.

A. Shut down water and gas mains and services as necessary to allow contractor to furnish and install water and gas connections.
B. Sample and test for bacteria for new public water mains.
C. In the case of a failed bacteria test, the City reserves the right to charge the Contractor for retests.
D. Supply curb box materials as shown on details W-5 and W-5A.

S-4 INSPECTION OF MATERIALS

All pipes, fittings, valves, hydrants and other materials to be used in the construction shall be inspected by the Engineer prior to installation. The Contractor shall furnish any necessary labor or equipment requested by the Engineer for the inspection. No pipe, fittings, valves, hydrants or other material shall be placed until they have been inspected and approved.

S-5 USE OF WATER FROM CITY HYDRANTS

All water taken from City hydrants, except for that water related to water main construction shall be metered and a charge will be made for the amount used. The Contractor must make arrangements with the Public Works and Utilities Department at 730-5200 to get the necessary permit, valve and meter, prior to using the hydrant for drawing water.

S-6 DRUG AND ALCHOL TESTING FOR GAS WORK

This contract will require compliance with Federal regulations which requires pre-employment, post accident, and reasonable cause drug and alcohol testing of employees, contractors and other workers. Random drug testing shall also be required under this contract.

Prior to the commencement of construction, contractors/vendors performing work covered by the DOT drug and alcohol testing rules as set forth in 49 CFR Part 199 and Part 40, shall provide the following documentation for review for compliance with RSPA/DOT regulations:

A. Anti-Drug Plan and any addenda issued thereto.
B. Alcohol Misuse Prevention Plan and any addenda issued thereto.
C. Minnesota Office of Pipeline Safety Intrastate Anti-Drug and Alcohol Misuse Prevention Self-Assessment Form.
D. The name and job title of the employees performing any work or functions covered by Part 199.
E.

S-7 OPERATOR QUALIFICATION FOR GAS WORK

This contract may require contractor personnel to perform covered tasks on the City of Duluth's natural gas system. To work on the natural gas system, the contractor's personnel must be qualified to perform any of the covered tasks identified in the City of Duluth Operator Qualification Plan. Prior to the issuance of the Notice to Proceed,

contractors, sub-contractors or vendors performing any of these covered tasks shall submit their Operator Qualification Plan and a list of employees' names, job titles and covered tasks to be performed under this contract to the Engineer for approval.

S-8 CORRECTION PERIOD

The provisions of MN/DOT 1307 are changed to include the following:

If within one year after the date which the contractor signs the final estimate for payment (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with written instructions:

A. Repair such defective land or areas; or
B. Correct such defective work; or
C. If the defective work has been rejected by owner, remove it from the project and replace it with work that is not defective, and
D. Satisfactorily correct or repair or remove and replace any damage to other work, to the work of others or other land or areas resulting there from.

S-9 MEETINGS

A Preconstruction Meeting will be scheduled and conducted by the Engineer and shall be attended by representatives of the Owner, Contractor and all subcontractors as deemed required by the Engineer. The purpose of the meeting will be to identify all project participants, review project requirements and specifications, establish the method of making pay requests and other matters that may be deemed necessary to be discussed. At this meeting, the Contractor shall submit the proposed construction schedule for review, consensus by the parties and approval. The Contractor shall also submit a schedule of values for the work to be used as the accounting format for all progress payments.

Brief weekly Construction Progress meetings, as deemed necessary by the Engineer, will be held and shall be attended by all Contractors. The purpose of the meeting will be to coordinate work schedules, review the project progress and other matters that may be deemed necessary to be discussed. A construction progress meeting agenda shall be prepared as deemed necessary by the Engineer. All construction progress meeting attendees shall be fully prepared prior to the meeting and shall be ready to discuss issues raised as they relate to their work. This shall include, but not be limited to, providing revised schedules, milestone activities, specific requirements for subordinate construction and any proposed or completed changes required for their work.

S-10 PROJECT LABOR AGREEMENT

In accordance with Duluth City Code, Chapter 2, Article IV, Section 2-29, a Project Labor Agreement will be required for projects of $150,000 or greater. The Contractor and all direct subcontractors of the Contractor--of whatever tier--who have been awarded contracts for this Project shall accept and be bound by the terms and conditions of the Project Labor Agreement. The Contractor shall be signatory to the Project Labor Agreement; a copy of which, in its substantial form, is included in Appendix C of this specification.

S-11 GOVERNING SPECIFICATIONS

A. State of Minnesota Department of Transportation "Standard Specifications for Construction", 2005 Edition as supplemented
B. December 2011 Minnesota MUTCD, including the field manual dated February, 2011.
C. Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, (Most current version).

S-12 DAMAGE TO CITY UTILITIES

Section 48-224 through Section 48-228 of the Duluth City Code allows for the City to collect damages and penalties from any person that damages a City owned utility (water, sanitary sewer, storm sewer and natural gas) during excavation activities. In addition, the City may refuse to issue excavation permits or may reject bids from any contractor found to have violated this ordinance more than twice within the preceding twelve months.

Minnesota statutes 216D.06 also specifies that any excavator who knowingly damages an underground facility, and who does not notify the City as soon as reasonably possible or who backfills the excavation is guilty of a misdemeanor. It also states that it is prima facie evidence of the excavator's negligence in a civil court action if damage to the underground facilities of the City resulted from excavation, and the excavator failed to give an excavation notice under the Gopher State One Call rules.

The City of Duluth will act on all cases where an excavator violates City Code or State Statutes in the course of excavating.

SUPPLEMENTS TO MINNESOTA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR CONSTRUCTION", 2005 EDITION

The State of Minnesota Department of Transportation "Standard Specifications for Construction", 2005 Edition shall apply on this Contract except as modified or altered in the following Supplemental Specifications. The number preceding the Supplemental Specifications refer to the section of the MN/DOT specification. Contractor shall note that there are

specifications that are independent and specific to individual projects as indicated in the bid packet.

1213 DISQUALIFICAITON OF BIDDERS

Contractors who are debarred or suspended under M.S. Section 161.315 will not be eligible for award of this contract or to act as a subcontractor to any contractor under this contract.

1302 AWARD OF CONTRACT

The provisions of MN/DOT 1302 are changed to read as follows:

The award of Contract, if to be awarded, will be made by City Council Resolution after the opening of proposals to the lowest responsible bidder who complies with all prescribed requirements. The successful bidder will be notified by a "Letter of Intent", mailed to the address shown on his/her proposal, that his/her bid has been accepted subject to execution and approval of the Contract as required by law.

The Letter of Intent will identify the date on which the City Council is expected to approve the Resolution awarding the Contract. Included with the Letter of Intent will be:

A. Four (4) copies of the pending Contract covering the Project.
B. A copy of the City of Duluth Performance Bond form.
C. A copy of the City of Duluth Payment Bond form.
D. Notice of whether an annual Certificate of Insurance is on file or whether Proof of Insurance is needed.

As a condition precedent to approval of a Contract, a corporation to whom a Contract is awarded shall furnish proof that it has met all legal requirements for transacting business in the State of Minnesota.

As a condition precedent to approval of a Contract, a sworn statement shall be filed with the City stating that the persons, firm, association, or corporation to whom the Contract is awarded has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the Contract. This sworn statement shall be in the form of an affidavit executed by, or on behalf of, the successful bidder and sworn to by him before a person who is authorized by the laws of this State to administer oaths. The forms for this affidavit will be furnished to the successful bidder and they shall be properly executed and returned within the period prescribed.

1305 REQUIREMENT OF CONTRACT BOND

The provisions of MN/DOT 1305 are changed to read as follows:

At the time of the execution of the Contract, the successful bidder shall furnish "Performance Bond" and a "Payment Bond" on City of Duluth forms. Both bonds shall be in amounts equal to the full amount of the contract price.

1306 EXECUTION AND APPROVAL OF CONTRACT

The provisions of MN/DOT 1306 are changed to read as follows:

The four (4) copies of the Contract shall be signed by the successful bidder and returned, together with the Performance Bond and the Payment Bond, non-collusion affidavit, EEO affidavit, and Proof of Insurance, within ten (10) calendar days after the date the "Letter of Intent" has been mailed advising the bidder that his/her bid has been accepted subject to execution and approval of the Contract as required by law.

Notice of approval or disapproval of the Contract and Bonds will be given to the successful bidder by means of a "Notice to Proceed" letter after award by City Council Resolution.

Contract Time shall start ten (10) calendar days after the date of award by City Council resolution or on the date specified in the Special Provision modifying 1806, whichever is later. Failure of the bidder to properly execute and return all pertinent items within the prescribed period shall not change the start of Contract Time.

If return of the executed forms within the specified time is impossible due to the absence of one or more of the required signers, an extension of time may be granted by the City, provided that satisfactory evidence is furnished that the forms will be executed.

All members of a partnership, and the President or Vice President and the Secretary or Treasurer of each corporation shall sign the Contract and Bonds. In the case of joint ventures, signature requirements shall apply to each firm represented.

1404 MAINTENANCE OF TRAFFIC AND 2563 TRAFFIC CONTROL

A. The streets shall be kept open to traffic including pedestrians at all times in accordance with the "Minnesota Manual on Uniform Traffic Control Devices", the provisions of MN/DOT 1710 and the provisions of MN/DOT 1404, except as modified below:
   1. The Contractor is advised that Part VI of the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD) has been revised, and Appendix B is eliminated and is replaced with the "Field Manual for Temporary Traffic Control Zone Layouts – February 2011. All traffic control devices and methods shall conform to this updated Part VI.

   2. The Contractor shall furnish, install, maintain, and remove all traffic control devices in accordance with the Traffic Control Layouts\Typical Traffic Control

Layouts on the Contract Drawings, the Special Provisions, the MMUTCD and the Field Manual, for the life of the Contract or until approved by the Engineer, whichever is longer. The Engineer will have the right to modify the requirements for traffic control as deemed necessary due to existing or changed field conditions.

B. Traffic Control

The Contractor shall be responsible for traffic control on this Project and the Contractor shall furnish, erect, and maintain all traffic control devices in accordance with the provisions of MN/DOT 1404, 1710, the "Minnesota Standard Signs Manual", the Contract Drawings, and the following:

1. The Contractor shall furnish, erect, and maintain all necessary traffic control devices required to provide safe movement of vehicular and pedestrian traffic through the Project during the entire period from the start of the Contractor's operations to the final completion thereof. Traffic control devices include, but are not limited to, barricades, warning signs, trailers, flashers, cones, drums, pavement markings, and flaggers as required and sufficient barricade weights to maintain barricade stability.
2. The Contractor shall be responsible for the immediate repair or replacement of all traffic control devices that become damaged, moved, or destroyed, of all lights that cease to function properly, and of all barricade weights that are damaged, destroyed, or otherwise fail to stabilize the barricades. The Contractor will further provide sufficient surveillance of all traffic control devices at least once every 24 hours. The Contractor shall furnish the Engineer names, addresses, and phone numbers of at least two local persons responsible for all traffic control devices after normal working hours.
3. At least five days prior to the start of construction the Contractor shall submit his/her proposed traffic control layout to the Engineer for approval. At least 24 hours prior to placement, all traffic control devices shall be available on the Project for inspection by the Engineer to insure conformance with the Minnesota Manual on Uniform Traffic Control Devices and the State of Minnesota Standard Signs Manual. The Contractor shall modify their proposed traffic control layout and/or devices as deemed necessary by the Engineer.
4. The Contractor shall notify the Engineer in writing at least 72 hours prior to the start of any construction operation that will necessitate lane closure or internal traffic control signing.
5. No measurement will be made of the various items that constitute Traffic Control, but all such work will be construed to be included in the single Lump Sum for which payment is made.

C. The Contractor will respond within one (1) hour to any request from the Engineer or the Engineer's designated representative to improve or correct traffic control devices. If the Contractor does not correct any deficiencies within one (1) hour of being notified, the Contractor will subject to the hourly charge set forth in 1807 FAILURE TO COMPLETE THE WORK ON TIME, of these Specifications.

D. Payment for furnishing, installing, maintaining, relocating, and subsequently removing traffic control devices (including flaggers) as required will be made as a lump sum under Item 2563.601 (Traffic Control) and according to the following schedule:
   1. When 5 percent of the Contract amount is earned, 50 percent of the amount bid for traffic control will be paid.
   2. When 10 percent, or more, of the Contract amount is earned, an additional 25 percent of the amount bid for traffic control will be paid.
   3. When 50 percent, or more, of the Contract is earned, an additional 20 percent of the amount bid for traffic control will be paid.
   4. The remaining 5 percent bid for traffic control will be paid when all work has been completed and accepted.
   5. In all items above, the original Contract amount shall be the total value of all Contract items including the traffic control item, but the percentage earned in each case shall be exclusive of the traffic control item.

1502 PLANS AND WORKING DRAWINGS

The contractor shall submit shop drawings for products supplied on the project. The list of required shop drawings will be reviewed and confirmed at the pre-construction meeting. The Contractor shall review all shop drawings for compliance with the contract documents and identify any deviations or mark shop drawings as "reviewed and approved."

1507 UTILITY PROPERTY AND SERVICE

Construction operations in the proximity of utility properties shall be performed in accordance with the provisions of MN/DOT 1507, except as modified below:

A. Bidders are advised that the following utility companies have existing facilities in the construction area that may be affected by the work under this Contract.

WATER, GAS, STORM and SANITARY SEWER
City of Duluth--Public Works & Utilities
211 City Hall
411 West 1st St.
Duluth, MN 55802
(218) 730-3601

STREET LIGHTS & TRAFFIC SIGNALS
City of Duluth - Traffic Operations
1532 West Michigan St.
Duluth, MN 55806
(218) 730-4420

GAS (in Bayview Heights)
Minnesota Energy Resources
(800) 889-9508

TELEPHONE
Qwest Communications
322 West 1st St
Duluth, MN 55802
(218) 723-4210 (Manager)

POWER
Minnesota Power
30 West Superior St
Duluth, MN 55802
(218) 722-2641

STEAM
Duluth Steam Coop Association
One Lake Place Drive
Duluth, MN 55802
(218) 723-3601

SANITARY INTERCEPTOR SEWERS
Western Lake Superior Sanitary District
2626 Courtland St
Duluth, MN 55806
(218) 722-3336

CABLE TELEVISION
Charter Communications
602 Garfield Ave
Duluth, MN 55802
(218) 529-8000

B. The City's Contractor shall coordinate their work and cooperate with the foregoing utility owners and their forces in a manner consistent with the provisions of MN/DOT 1507 and the applicable provisions of MN/DOT 1505.

1508 CONSTRUCTION STAKES, LINES AND GRADES

The provisions of MN/DOT 1508 are supplemented to include the following:

The primary line and grade for utility installation will be established by the Engineer. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset as will best serve the Contractor's operations wherever practical. For tunnel or directional drilling installation, line and grade stakes will be set directly above the proposed pipeline setting. Grade and stakes will be set at appropriate intervals along the pipeline and at appurtenances and service lines.

For sanitary or storm sewer installation, the Contractor shall use a "laser beam" instrument to maintain line and grade.

The Contractor shall arrange his operations as will avoid necessary interference with the establishment of the primary line and grade stakes and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall be responsible for preservation of the primary stakes and shall bear the full cost of any restaking necessitated by his negligence. The Contractor shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the Engineer.

1604 PLANT INSPECTION – COMMERCIAL FACILITY

The provisions of MN/DOT 1604 are supplemented as follows:

All costs of shop inspection at plants outside the United States shall be borne by the Contractor. Such costs shall be deducted from monies due or to become due the Contractor.

1706 EMPLOYEE HEALTH AND WELFARE

The Contractor shall not use any motor vehicle equipment on this Project having an obstructed view to the rear unless:

A. The vehicle has a reverse signal alarm which is audible above the surrounding noise level; or
B. The vehicle is backed up only when an observer signals that it is safe to do so.
C. The first incident of non-compliance observed on the project site shall subject the Contractor to a $50.00 penalty for failure to comply with these backup requirements. The second incident of non-compliance observed on the Project shall subject the Contractor to a $500.00 penalty for failure to comply with these backup requirements. Subsequent to the second incident, each additional incident of non-compliance observed on the Project shall subject the Contractor to a $1000.00 penalty for failure to comply with these backup requirements.
D. None of the penalty (penalties) listed above shall be considered by the Contractor as allowance of non-compliance incidents of these backup requirements on this Project. The Contractor is advised that at any time the Contractor is not in compliance, the Engineer may take additional remedial measures which may include, but not be limited to, contacting the Contractor's insurance company and/or MN/OSHA.

1710 TRAFFIC CONTROL DEVICES

All traffic control devices and methods shall conform to the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD), Minnesota Standard Signs Manuals Parts I, II, and III, the Traffic Engineering Manual, Chapter 8 Appendixes 8.2-1 and 8.3-1

1803 PROSECUTION OF WORK

The provisions of MN/DOT 1803 are hereby modified in accordance with the following:

A. In addition to the work restrictions already outlined in this section, no work shall be performed except between 7:00 am and 9:00 pm Central Standard Time unless specifically specified or authorized by the Engineer
B. A "Progress Schedule" (Bar Chart or Critical Path Diagram), referred to in MN/DOT 1803.1 will be required on this Project. The Contractor shall furnish the Engineer with the schedule at or before the preconstruction conference.
C. **SPECIAL PROJECT ADA REQUIREMENTS**

All pedestrian facilities and shared trails on this Project must be constructed according to Public Rights-of-Way Accessibility Guidelines (PROWAG) which can be found at: http://www.access-board.gov/prowac/draft.htm.

1. The Contractor must designate a responsible person familiar with PROWAG to assess proposed sidewalk layouts at each site before work begins. Any time work the Contractor is performing concerns pedestrian facilities, the Contractor's representative shall be on site.

2. Pedestrian facilities must be constructed to meet the following criteria:
   a. Pedestrian Access Routes (PAR) must be constructed to meet the following:
      - Minimum 4 feet width.
      - A maximum cross slope of 2.0%.
      - Vertical discontinuities must be less than 0.25 inches.
      - Must provide positive drainage without allowing any ponding.
   b. Landings are part of the PAR and must be constructed to meet the following:
      - 4 feet by 4 feet minimum width.
      - Maximum slope of 2.0% in all directions.
      - Required at all locations where the PAR changes directions.
      - Must be connected to the PAR.
   c. Ramps are part of the PAR and must be constructed to meet either of the following criteria:
      - Longitudinal slopes less than 5% in the direction of travel requires no landing at the top of the ramp (unless the PAR changes direction).
      - Longitudinal slopes between 5 - 8.3% in the direction of travel require a landing at the top of the ramp.

3. If the Contractor constructs any pedestrian or shared-use trail facilities that are not per Plan, do not meet the above requirements, or do not follow the agreed upon resolution, the Contractor shall be responsible for correcting the deficient facilities with no compensation paid for the corrective work. To ensure that the pedestrian facilities are constructed in compliance with PROWAG, the Contractor shall follow the following three steps:
   a. The Contractor shall use the appropriate ramp details in the Plan and identify the removal limits for the sidewalk and curb and gutter. If Contractor determines the removal limits are not adequate to meet PROWAG, the Contractor shall stop work immediately and consult the Engineer to determine the best solution. Once the Engineer and the Contractor reach agreement on how to proceed, the Contractor may finish the removals.
   b. Prior to pouring each curb and gutter segment, the Contractor must verify the zero height curb and curb transitions will be located as shown in the Plans and will provide an adequate detectable edge as described in MN/DOT 2531 (CONCRETE CURBING). The Contractor shall also verify the proposed curb flow lines will provide positive drainage as well as maintain

existing gutter inflows/outflows. The curb and gutter shall be constructed as detailed in the Plan with a defined flowline and no vertical discontinuities. The Contractor shall consult with the Engineer to determine a resolution if any of these conditions cannot be met. Once the Engineer and the Contractor reach agreement on how to proceed, the Contractor may proceed with pouring the curb and gutter.

c. After the curb has been correctly poured, the Contractor has set the sidewalk forms, and prior to placing the concrete curb ramps/sidewalks, the Contractor shall verify the ADA requirements above will be achieved. If any of these requirements cannot be met the Contractor shall meet with the Engineer to determine the best solution. Once the Engineer and the Contractor reach agreement on how to proceed, the Contractor may proceed with the curb ramp/sidewalk pour.

4. It shall be the responsibility of the Contractor, or Contractor's Surveyor if applicable, to layout all proposed work at each intersection in accordance with the Plan and requirements listed in this Special Provision. The Contractor may confer with the Engineer for guidance in laying out the proposed work, but it will be the Contractor's responsibility to ensure the proposed work meets all the requirements of this Special Provision. This layout includes, but is not limited to placement of grade breaks, curb transitions, gutter flow lines, truncated dome placement, crosswalk marking placement, flares, landing limits, and ramp limits. It is important that the Contractor layout this work properly to achieve the construction of a compliant pedestrian facility. This layout work shall be incidental with no extra compensation paid.

5. The Contractor shall utilize measures and methods when working near existing buildings that will avoid damaging the building's face or structure. The contractor will be responsible for any damage to the building's face or structure, both below and above ground. Any damage resulting from Contractor operations will be repaired at the Contractor's expense to the satisfaction of the Engineer.

6. The Contractor shall round all joints and edges of the walk with a ¼ inch radius edging tool, contraction joints shall extend to at least 30 percent of walk thickness and shall be approximately 1/8 inch wide as per MnDOT 2521. The Contractor shall also have the option of providing saw cuts to construct the sidewalk joints. This work shall be considered incidental and no extra compensation paid.

7. If pedestrian signal system work is included in the project, all pedestrian signal systems should be installed as shown in the Plan and must be constructed to meet the following criteria. The Contractor shall verify that the proposed push button locations will meet all of the following criteria before proceeding with the installation of the pedestrian push button system:

- Pedestrian push buttons shall be oriented with the button facing towards the intersection and the button face placed parallel to the outside edge of the crosswalk.
- Pedestrian push buttons shall be a minimum of 4 feet and a maximum of 10 feet from the back of curb/edge of roadway, but may be placed 1.5 feet to 4 feet from the back of curb/edge of roadway if mounted on a signal pole as indicated in the Plan or as approved by the Engineer.
- Pedestrian push buttons shall be located at the outside crosswalk edge and shall be no more than 5 feet offset from the projected outside edge of the crosswalk/outside edge of detectable warnings.
- Pedestrian push buttons shall be a minimum of 10 feet apart, except in islands and medians, where the minimum separation is 5 feet.
- Each pedestrian push button shall have a landing immediately adjacent to the push button face with minimum dimensions of 4 feet by 4 feet and a maximum slope of 2.0% in all directions. Center the push button on the landing if possible to do so without violating any of the requirements listed in this Special Provision. The landing must be connected to the Pedestrian Access Route.
- A 6-foot wide clear distance between obstructions shall be maintained wherever it is possible to do so for snow removal purposes.
- The push buttons shall be mounted at a height of 42 inches as indicated in the Plan.
- If it is possible to mount a push button on a signal pole and meet all the criteria listed in this Special Provision, then the push button shall be mounted on signal pole and the unused push button station components shall be considered surplus materials and delivered to the City of Duluth Traffic Operations Office at 1532 N Michigan Street.
- Crosswalks shall be striped in a straight alignment between the outside edges of the detectable warnings with no kinks unless the crosswalks are shown as kinked in the Plan.
- The Contractor shall maintain all working points marked by the surveyor and use the working points to layout push button locations in accordance with the Plans and Special Provisions. The Engineer will verify the proposed push button locations are acceptable prior to construction.

If any of these conditions cannot be met, the Contractor shall consult with the Engineer to determine a resolution. Once the Engineer and the Contractor reach an agreement on how to proceed, the Contractor may proceed. If the Contractor constructs any pedestrian push button systems or pedestrian facilities which do not meet the criteria or the agreed upon resolution, the Contractor will be responsible for correcting the deficiencies with no compensation paid for the corrective work.
To help ensure signal systems are properly constructed the Contractor must adhere to the following practices:

- All push button station bases shall be poured either concurrently with or after the adjacent sidewalk pour.
- Signal pole foundations which are being constructed in or adjacent to sidewalk shall be constructed in accordance with the applicable MnDOT Standard Plate 8120 or 8126. If a push button is proposed to be mounted on a signal pole, the Contractor shall determine the finished grade of the top of proposed sidewalk prior to pouring the signal pole foundation. The signal pole foundation shall not be more than 8 inches above the finish grade of the sidewalk and must still meet the vertical clearance requirements of the applicable MnDOT Standard Plates 8120 or 8126. If this is not possible, the Contractor shall consult with the Engineer to determine the appropriate solution.

1807 FAILURE TO COMPLETE WORK ON TIME

In addition to the charges specified in MN/DOT 1807 for failure to complete all the work on time, the City will deduct from any monies due or coming due the Contractor an amount equal to the following:

A. Traffic Control

The Contractor will be subject to an hourly charge for failure to maintain the traffic control devices as set forth in 1404 MAINTENANCE OF TRAFFIC AND 2563 TRAFFIC CONTROL, of these Specifications. Non-compliance charges, for each incident, will be assessed at a rate of $50.00 per hour, for each hour or any portion thereof which the Engineer determines that the Contractor has not complied. However, no charge will be made if the deficiency is corrected within one (1) hour of notification.

The liquidated damages as set forth above may apply equally, separately, and may be assessed concurrently.

1904 EXTRA AND FORCE ACCOUNT WORK

The provisions of MN/DOT 1904 are supplemented as follows:

Prior to the commencement of Extra Work, the Engineer and the Contractor's representative shall negotiate and agree upon the payment provision or prices stipulated and the scope of the work to be performed. Upon completion of the Extra Work, the Engineer shall present the completed Extra Work documents to the Contractor for his approval. If, after ten working days, a signed Extra Work Order has not been returned to the Engineer, the Extra Work Order will be considered accepted by the Contractor and processed accordingly.

1906 PARTIAL PAYMENTS

Partial Payments shall be made in accordance with the provisions of MN/DOT 1906 and the following:

A. The first sentence of Paragraph Three shall be amended to read as follows: "From the total of the amounts ascertained as payable, five percent (5%) will be deducted and retained by the City for the protection of its interests as hereinafter provided.

The balance, less all previous payments, will be certified for payment." The City will withhold eight percent (8%) from out of state contractors unless a waiver has been granted from the State of Minnesota, Department of Revenue by submitting Form SDE, Exemption from Surety Deposits for Non-Minnesota Contractors.

B. All provisions for partial payments shall apply to domestic materials only. No payments shall be made to the Contractor for materials manufactured outside of the United States until such materials have been delivered to the job site.

1908 FINAL PAYMENT

Final Payment shall be made in accordance with the provisions of MN/DOT 1908 and the following:

The final estimate will show the balance due the Contractor after making all legal and specified forfeitures and deductions. This balance will then be paid by the City to the Contractor within thirty (30) days after such estimate is presented to and accepted by the Contractor or within forty-five (45) days after such estimate is presented to and not acted upon by the Contractor, less five percent (5%) of the total value of work on the final estimate. At such time, the paid final estimate shall be considered valid with no further compensation due the Contractor. The City shall withhold and retain up to five percent (5%) of the final estimate for a period of up to one year after the contract completion date.

Condition for Release of Five Percent (5%) of Retainage:

The Contractor and all of its subcontractors shall comply with Minnesota Statutes, Section 290.92. Pursuant to Minnesota Statutes, Section 270C.66, the City will not release the five percent (5%) retainage or any portion thereof to the Contractor prior to receipt of an "Affidavit For Obtaining Final Settlement of Contractor With the State of Minnesota and Any of its Political or Governmental Subdivisions" (Form IC-134) from the Contractor and from each of the Contractor's subcontractors (if any). The Contractor and subcontractors shall submit to the City original copies of Form IC-134 already fully executed by the Commissioner of Revenue of the State of Minnesota. It shall be the responsibility of the Contractor to ensure that all of the Affidavits herein required are submitted to the City.

2101 CLEARING AND GRUBBING

Clearing and grubbing shall be performed in accordance with the provisions of MN/DOT 2101 and the following:

The City Forester has reviewed this project for possible plant material salvage. All transplanting will be done by City Maintenance forces prior to the Contract starting date. All remaining plant material necessary to be removed shall be removed and disposed of according to the Standard Specifications. Only those trees, branches, or brush necessary for proposed construction will be cut. Cutting trees, branches, or brush to clear additional area beyond proposed construction limits will not be permitted on this project.

2104 REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES

Abandoned structures and other obstructions shall be removed from the Right-of-Way and disposed of in accordance with the provisions of MN/DOT 2104, except as modified below:

A. Measurement and payment for the removal and disposal of materials will be made only for those items of removal work specifically included for payment as such in the Proposal and as listed in the Contract Drawings. The removal of any unforeseen obstruction requiring, in the opinion of the Engineer, equipment or handling substantially different from that employed in excavation operations, will be paid for as Extra Work as provided in MN/DOT 1403.

B. The Contractor shall maintain in place all "Stop" and "Yield" signs until the street is closed to traffic with barricades and "Road Closed" signs. The Contractor may remove and store, if necessary, "Stop" and "Yield" signs only when the street is closed to traffic. Before the street is re-opened to any traffic, the Contractor shall properly re-install the "Stop" and "Yield" signs.

C. In 1998, the City of Duluth street name signs were replaced. The signs are in place to guide emergency vehicles, deliveries, and visitors. The signs need to remain visible at all times. If necessary to relocate, the new foundation shall be completed prior to removing pole and sign in order to conduct the relocation in one move. If a temporary relocation is necessary and approved, the sign must remain visible at all times and not touch the ground during the move. Any damage to the sign or any sign installation shall be replaced or repaired at the Contractor's expense.

D. Drainage structure castings shall be removed and may be stockpiled on site. The Contractor shall coordinate and deliver the castings to the City of Duluth Sewer Division storage facility at 40th Avenue West. It shall be the Contractor's responsibility to unload the castings. Payment will be incidental to Item 2104.509 Remove Manhole or Catch Basin. Upon completion of the unloading, the castings will become the property of the City of Duluth.

E. All materials removed during one working day that are scheduled for disposal shall be disposed of during the same working day. Job site stockpiling of removal items will not be permitted.

F. Both the upgrade and downgrade ends of all drainage or sewer pipes leading from abandoned basements, manholes, or similar structures shall be plugged with concrete or masonry.

G. Crushing or processing of pavement materials or rock on the project site shall not be permitted except as stated in the Special Provisions.

2105 ROCK BLASTING

The provisions for rock blasting, as covered herein, are applicable to all uses of explosive materials in the fragmentation of rock for the purpose of excavation of rock materials. These provisions cover the usage of explosives, project documentation, safety, public relations and vibration controls, required for the types of rock excavation listed below. Construction details for these items are found elsewhere in these specifications.

A. Definitions

1. (2105.601) Blast Monitor/Survey refers to preparatory work and operations for rock removal, including but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site, blasting plan submittal, maintaining appropriate records, safety, public relations, vibration control and monitoring, and insurance.
2. (2105.503) Rock Excavation refers to the main fragmentation blasting resulting from appropriately spaced production holes drilled throughout the rock excavation area. This includes rock excavated outside the normal roadway grading section as defined under Rock Channel Excavation.
3. (2451.501) Structure Excavation, Class R refers to removal of rock materials (bedrock, boulders, detached rock) where the excavation will be used for the placement of bridges, retaining walls, culverts, pipe sewers, drainage structures, subsurface drains, etc.

B. General Requirements

1. Use of Explosives

   The regulatory requirements of OSHA Safety and Health Standards 29 CRF, Part 1926, Subpart U, "Blasting and Use of Explosives" shall apply. All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in accordance with the applicable provisions of the Standard Specifications and all other pertinent federal, state, and local regulations. Whenever explosives are used, they shall be of such character and in such amount as is permitted by state and local laws and ordinances and all respective agencies having jurisdiction over them. The person(s) responsible for the use of explosive materials shall be knowledgeable and experienced in their use and handling. Blasting will be limited to a period between 8:00 a.m. and 5:00 p.m. or as otherwise approved by the Engineer.

2. Blasting Plan Submittal

   Not less than three weeks prior to commencing drilling and blasting operations or at any time the Contractor proposes to change the drilling and blasting methods, the Contractor shall submit a "Blasting Plan" to the Engineer for review. The blasting plan shall describe in full details, the drilling and blasting patterns the Contractor proposes to use for the types of blasting required by the Contract. The blasting plan shall include (at a minimum):

a. Name and experience of Blaster(s).
b. Type of explosives, primers and initiators including manufacturer's data sheets for all explosive products.
c. General blasting configurations including hole size, spacing, loading pattern, detonation procedure, anticipated maximum pounds of explosive per delay, powder factor, number of lifts, and limits of blasting.
d. Procedures to inform and protect the public and adjacent property (e.g., signs, horns, letters, personal visits, etc.).
e. Flyrock control plan.
f. Proposed "Shot Log" for individual blasts.

The blasting plan submittal is for quality control and record keeping purposes. Review of the blast plan by the Engineer shall not relieve the Contractor of his responsibility for the accuracy and adequacy of the plan when implemented in the field. When the contract requires the Contractor to retain a blasting consultant to assist with the blast design, all blasting plan submittals must be approved by the blasting consultant.

3. Shot Log

The Contractor is required to submit records (shot logs) for each individual shot on forms approved by the Engineer. The shot log shall be maintained by the Contractor and submitted to the Engineer at the end of each day. No blasting will be allowed until the shot log from the preceding day has been submitted to the Engineer. The shot log shall include the following information (at a minimum);

a. Location of the shot by station and offset.
b. Plan view of the drill pattern including free face, burden, hole spacing, diameters and angles.
c. Section view showing type and amount of explosives, primers, initiators, location and depth of stemming, lift height, and subdrill depth.
d. Initiation sequence of holes including cumulative delay times and delay system.
e. Maximum peak particle velocity measured at the closest (or most critical receptor), location of monitoring station, and scaled distance.

4. Scaling and Stabilization

All rock on the excavated face that is loose, hanging, or which creates a potentially dangerous situation shall be removed or stabilized to the Engineer's satisfaction during or upon completion of the excavation in each lift. Drilling of the next lift will not be allowed until this work has been completed.

Exposed rock slopes shall be scaled throughout the span on the Contract and at such frequency as required to remove all hazardous loose rock or overhangs. The slopes shall be hand scaled using a suitable standard steel mine scaling rod. Subject to the Engineer's approval, other methods such as machine scaling, hydraulic splitters, or light blasting may be used in lieu of or to supplement hand scaling. Payment for scaling and removal of scaled rock from outside the excavation limits shall be incidental to the Contract unit price for rock excavation.

If in-place stabilization of backslope rock is required due to defects inherent in the bedrock structure or weathering, as determined by the Engineer, rock bolting or other Engineer-approved stabilization techniques will be used and paid for as extra work. Stabilization necessitated, in the opinion of the Engineer, by the Contractor's blasting or excavation operations shall be performed at the Contractor's expense.

5. Safety

The Contractor shall observe the entire blast area for a minimum of five minutes following a blast to guard against rock fall before commencing work in the cut. The Contractor is responsible for the safety of workers and the public in general.

The Engineer shall, at all times, have the authority to prohibit or halt the Contractor's blasting operations if it is apparent that, through the methods being employed, the required slopes are not being obtained in a stable condition or the safety, convenience, or property of the public is being jeopardized.

The Contractor is advised that structures may be located close to the proposed work and that noise and vibration producing activities shall be conducted so as to preclude damage to these structures and undue annoyance to their occupants. The Contractor shall be responsible for all damage caused by his activities.

6. Public Relations

The Contractor is required to have both letter and personal contact with residents or owners of buildings that are adjacent to the construction area or near enough to it for ground vibrations from construction operations (including blasting) to affect the structure, personal property, or water wells. This contact will be made prior to the beginning of any blasting or other vibration producing activity. The Contractor will furnish a list of those contacted to the Engineer, as part of the blasting plan.

The Contractor will identify a contact person for complaints from the public and will maintain a log of such complaints and any action taken by the Contractor. This log shall be available to the Engineer at his request. The Contractor shall make an initial reply to complaints within 24 hours.

C. Flyrock Control

Before the firing of any blast in areas where flying rock may result in personal injury or damage to property or the work, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material to prevent flyrock. Flyrock control procedures shall be approved by the Engineer.

D. Vibration Control and Monitoring

Whenever vibration damage to adjacent structures is possible, the Contractor shall monitor each blast with an approved seismograph located, as approved, between the blast area and the closest (or most critical) structure subject to blast damage. The seismograph shall be capable of recording peak particle velocity for three mutually perpendicular components of vibration in the range generally found in construction blasting.

The peak particle velocity of each component shall not be allowed to exceed the safe limits, as established below, for all adjacent structures subject to vibration damage.

1. Ground Vibration Control Limit

Measurements for this limit will be made at external ground locations adjacent to affected buildings or structures. This vibration criteria will be measured in peak particle velocity. No controls have been established for in place utilities and the Contractor shall conduct operations to prevent damage to same.

The maximum single component peak particle velocity resulting from construction activity shall not exceed the values given in the table below:

Frequency of the Peak Particle Velocity (Hz)	Allowable Peak Particle Velocity [(mm per second (ips)]
40 or less	25 (1.00)
50	32 (1.25)
60	38 (1.50)
70	44 (1.75)
80	51 (2.00)
90	51 (2.00)
100	51 (2.00)
110	51 (2.00)
120 or greater	51 (2.00)

The frequency and peak particle velocity shall be analyzed for each of the three components and the velocity limit shall apply to each component. The frequency is defined as that associated with peak particle velocity pulse of the ground motion and is calculated as the inverse of twice the time interval between the two zero crossings of that pulse.

2. Air Blast Control Limit
The maximum air blast resulting from blasting shall not exceed the values given in the table below:

Frequency Range of Instrumentation	Maximum Air Blast (dB)	Maximum Air Blast [kPa (psi)]
0.1-200 Hz, flat response	134	0.103 (0.015)
2.0-200 Hz, flat response	133	0.090 (0.013)
6.0-200 Hz, flat response	129	0.055 (0.008)

3. Vibration Monitors
The amplitude/frequency vibration monitor shall be an Instantel Blastmate DS677 or equivalent, available from Sobie & Associates, 1200 Pratt Ave, Elk Grove Village, IL 60003, phone (708) 473-7333. This instrument shall be capable of measuring, recording, and producing a hard copy of the frequency and peak particle velocity in three mutually perpendicular axes ("vector sum" instrumentation is not allowed). The instrument shall be capable of measuring Linear Scale air blast pressure (other weighting systems, such as A- or C-scale are not allowed). The instrument must also be capable of plotting the measured vibration level against the OSM criteria or be capable of reporting the frequency and displacement of each vibration event.

When blasting near buildings, structures, or utilities which may be subject to damage from blast induced ground vibrations, the ground vibrations shall be controlled by the use of properly designed delay sequences and allowable charge weights per delay. Allowable charge weights per delay shall be based on vibration levels which will not cause damage. The allowable charge weights per delay shall be established by carrying out trial blasts and measuring vibration levels. The trial blasts shall be carried out in conformance with the blasting test sections described elsewhere in these provisions, modified as required to limit ground vibrations to a level which will not cause damage.

E. Supplement Material

Common Borrow material, MN/DOT 2105.2B, shall be used to supplement backfill materials for utility trenches outside of the roadway where the quantity of rock removed is greater than the quantity of materials to be installed. Common Borrow material shall meet the requirements for Suitable On-Site Backfill Material as specified in 2105 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES.

F. Method of Measurement

Structure excavation and backfill shall be constructed in accordance with the provisions of MN/DOT 2451 except as modified below.

The volume of "Structure Excavation, Class R" measured in a pipe trench will be as defined on the Standard Details, Contract Drawings or in the Special Provisions.

Where additional material is required as backfill due to rock removal, Common Borrow material shall be used. Supply and installation of Common Borrow is incidental to Structure Excavation, Class R and therefore no measurement or payment shall be made.

G. Basis of Payment

On the first partial estimate that shows 10 percent or more of the original Contract amount has been earned, payment will be made under Item 2105.601 (Blast Monitor/Survey) for 50 percent of the amount bid. When either the rock removal items are completed or 75 percent of the original Contract amount has been earned, the remaining 50 percent of the amount bid for Blast Monitor/Survey will be paid.

Payment will be made under Item 2105.503 Rock Excavation and 2451.501 Structure Excavation, Class R at the Contract price per cubic yard which shall be payment in full for all costs incidental to rock removal except those costs paid under 2105.601 Blast Monitor/Survey. There shall be adjustment for increased or decreased quantities of rock removal items.

2105 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES

This work shall consist of furnishing all materials, labor, equipment, and other services as are necessary for preparing the site for work, the excavating, preparing the trench for the utility pipeline to be altered or installed, the backfilling and compaction.

A. Materials

1. Suitable On-Site Backfill Material

Suitable materials shall be defined as a mineral soil reasonably free of foreign materials (rubbish, debris, etc.), frozen clumps, aggregate larger than 1 ½ inches, rock, concrete or bituminous chunks, and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks

of after settlement unnecessarily as described in MN/DOT 2105.3E(6) and 2451.3D. The Engineer shall determine if any material is suitable.

2. Imported Granular Materials
Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, crushed stone, that shall meet gradation requirements specified on the Standard Details, the Contract Drawings and the Special Provisions.

B. Construction Requirements
1. General Provisions
a. Protection of Surface Structures. All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas which are indicated in the Contract Drawings as being saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the Engineer. Within the construction limits, as required, the removal of improvements such as paving, curbing, walks, turf, etc., shall be subject to acceptable replacement of underground work, with the expense of removal and replacement being borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstruction such as street signs, traffic control signs, guard posts, small culverts, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the Engineer and that nonessential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be replaced in their proper setting at the sole expense of the Contractor.

b. Interference of Underground Structures. When any underground structure interferes with the planned placement of the pipeline or appurtenances to such an extent that alterations in the work are necessary to eliminate the conflict or avoid endangering effects on either the existing or proposed facilities, the Contractor shall immediately notify the Engineer and the Owner of the affected structure. When any existing facilities are endangered by the Contractor's operations, he shall cease his operations at the site and take such precautions as may be necessary to protect the in-place structures until a decision is made as to how the conflict will be resolved.

The City of Duluth gas utility must be notified 2 working days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas

main. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 730-5200 to coordinate this inspection.

Any time a steel natural gas main smaller than 6 inches is exposed within an excavation; the Engineering Division shall be notified at 730-5200 to coordinate an inspection of the exposed main.
Without specific authorization from the Engineer, no essential utility service shall be disrupted, nor shall any change be made in either the existing structures or the planned installations to overcome the interference. Alterations in existing facilities will be allowed only to the extent that service will not be curtailed unavoidably and then only when the encroachment or relocation will satisfy all applicable regulations and conditions.

Whenever alterations are required as a result of unforeseen underground interferences not due to any fault or negligence of the Contractor, the Engineer will issue a written order covering any additional or extra work involved and specifying the revised basis of payment, if any. Any alterations made strictly for the convenience of the Contractor shall be subject to prior approval. If an alteration diminishes the Contractor's responsibilities under the Contract in providing services or materials, a deduct will be made from the Contractor's final payment by a change order. No extra compensation will be allowed for delays caused by the interference of underground structures.

c. Temporary Surface Measures. While any open excavations are maintained, the Contractor shall have available a supply of steel plates suitable for temporary bridging of open trench sections where either vehicular or pedestrian traffic must be maintained. Use of the plates shall be as directed or approved by the Engineer and where installed they shall be secured against possible displacement and be replaced with the permanent structure as soon as possible.

2. Excavation and Repair of Trench
   a. Operational Limitations and Requirements. Excavating operations shall proceed only so far in advance of pipe laying as will satisfy the need for coordination of work and permit advance verification of unobstructed line and grade as planned. At no time shall over 400 lineal feet of excavated trench be open at one time. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connection to in-place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring, directional drilling, jacking, insertion in existing pipe or tunnel construction methods shall be employed where so specifically required by the Contract Drawings or Special Provisions. Installation of pipe through tunnel excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer.

The excavating operations shall be conducted so as to carefully expose all in-place underground structures without damage. Wherever the excavation extends under or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand, vacuum, or other non-evasive methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipe and power or telephone cables.

The Engineer shall be notified of any need for blasting to remove materials which cannot be broken up mechanically, and there shall be no blasting operations conducted until the Engineer's approval has been secured. All blasting shall be performed in accordance with 2105 ROCK BLASTING specifications.

b. Classification and Disposition of Materials. Rock will be paid for separately from other unclassified materials, either as a separate Contract Item or as an Extra Work Item when no bid price is applicable. All other materials encountered in the excavations, with the exception of items classified for payment as structure removals, will be considered as Unclassified Excavation. Unclassified materials shall include muck, rubble, wood debris, and boulder stone, masonry, or concrete fragments less than one quarter cubic yard in volume, together with other miscellaneous matter that can be removed effectively with power operated excavators without resorting to drilling and blasting.

For water, sanitary sewer and storm sewer, Rock Excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder, stone, masonry or concrete fragments exceeding one cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation.

For natural gas pipe installation, Rock Excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock. Boulder Excavation shall be defined to include any boulder, stone, masonry or concrete fragments exceeding one-quarter cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation or Boulder Excavation.

Excavated materials will be classified for reuse as being either Suitable or Unsuitable for other specified use as determined by the Engineer. All suitable materials shall be reserved for backfill where allowed and to the extent needed as called for on the Contract Drawings or in the Special Provisions, and any surplus remaining shall be utilized for other construction on the project as may be specified or ordered by the Engineer. To the extent practicable, granular materials and topsoil shall be segregated from other materials during the excavating and stockpiling operations so as to permit best use of the available materials at the time of backfilling.

All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavations as would create hazardous conditions, nor shall any material be placed so as to block the access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, shall be immediately removed from the project and disposed of as arranged for by the Contractor.

c. Excavation Limitations and Requirements—Open Trench. Trench excavating shall be to a depth that will permit preparation of the trench bottom as shown on the Contract Drawings and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be as shown on the Standard Details and Contract Drawings and shall be sufficient to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheathing and shoring, to accommodate placement of appurtenances, or to make connections. No payment will be made for extra width required for the contractors shoring. The contractor shall notify the engineer prior to excavating any additional material outside the standard trench width.

Excavations shall be extended below the bottom of structure grade only if necessary to accommodate any required bedding material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the Engineer to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six inches below the bottom surface of the pipe barrel.

Minimum and maximum width of utility trenches shall be as shown on the Standard Details or Contract Drawings.

Maximum allowable trench width for combined utilities shall be the maximum required separation between pipelines plus the outside diameters of each pipe plus 24 inches.

The maximum allowable trench widths shown on the Standard Details or Contract Drawings shall be used to establish maximum payment volume for granular backfill and rock excavation. Where the trench width was exceeded due to conditions which the Contractor could have controlled using reasonable methods to secure a trench, no additional payments for granular backfill will be made.

Where no other grade controls are indicated or established for the pipeline, the excavation and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least six inches of clearance on each side of the joint hubs. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures.

d. Sheathing and Braced Excavations. All excavations shall be sheathed, shored and braced as will meet all requirements of OSHA; shall comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damages to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheathing, shoring or bracing or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor at his expense and without delay.

Where conditions warrant extreme care, the Contract may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety

measures be taken as he deems necessary. Failure of the Engineer to order correction of improper or inadequate sheathing, shoring, or bracing shall not relieve the Contractor of his responsibilities for protection of life, property, and the work. The contractor shall assume full responsibility for proper and adequate placement of sheathing, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in-place structures to any extent that may cause damage.

Sheathing, shoring and bracing materials shall be removed only when and in such a manner as will assure adequate protection of the in-place structures and prevent displacement of supported grounds. Sheathing and bracing shall be left in place only as required by the Contract or ordered by the Engineer. Otherwise, sheathing and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheathing and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Engineer may direct.

All costs of furnishing, placing and removing sheathing, shoring and bracing materials, including the value of materials left in place as required by the Contract, shall be included in the prices bid for pipe installation and will not be compensated for separately. When any sheathing, shoring or bracing materials are left in place by written order of the Engineer, in the absence of specific requirements of the Contract to do so, payment will be made for these materials as an Extra Work Item, including waste material resulting from upper cut-off requirements.

e. Preparation and Maintenance of Foundations and Bedding. Foundation preparations shall be conducted as necessary to produce a stable foundation and provide continuous and uniform pipe bearing between bell holes. Over excavation shall be performed as necessary to allow installation of bedding where called for on the Standard Details, Contract Drawings or Special Provisions. The initial excavation or bedding operations shall produce a subgrade level slightly above finished grade as will permit hand shaping to finished grade by trimming of high spots and without the need for filling of low spots to grade. Bell hole excavations shall be made at each joint as will permit proper joining of pipe and fittings.

Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special requirements

therefore in the Contract. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be provided for in an Extra Work order.

Care shall be taken during the final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, which shall have optimum moisture content and be compacted thoroughly. The finished subgrade shall be maintained free of water and shall not be disturbed once established. Where pipe lowering operations are to occur, excavation may be required as necessary to remove pipe slings.

All costs of excavating below grade and placing foundation or bedding materials as required shall be included in the unit price bid for the related utility. Any excavation below grade and any foundation or bedding aggregates required by order of the Engineer in the absence of Contract requirements therefore will be compensated for separately as Extra Work items.

f. Dewatering

All excavation for utility pipe or structures shall be dry and free from water as necessary to provide a stable foundation. The Contractor shall provide all necessary dewatering equipment and all necessary equipment or materials for water quality treatment when necessary. Discharge from dewatering operations shall meet all federal, state and city standards prior to entering any water course or storm sewer.

3. Backfilling Operations

a. General Requirements. Sequence of operations necessary prior to commencing final backfilling may be governed by the Standard Details, Contract Drawings, Special Provision, or the Specifications. Backfilling prior to completing other requirements will, at the option of the Engineer, result in removal of backfill as necessary at no extra cost to the City. Elevations and measurements of existing or new exposed utilities are of primary importance prior to backfilling.

All pipeline excavations shall be backfilled as will restore pre-existing conditions as the minimum requirement, and fulfill all supplementary requirements indicated in the Standard Details, Contact Drawings and Specifications. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity in subsequent operations and restore normal public service as soon as practicable on a section-by-section basis.

Trench surfaces which are to be restored with concrete or bituminous pavements by others, shall have the top 18 inches backfilled to the surface with MN/DOT Specification 3138 Class 5 aggregates, except for high pressure gas line trenches, in which the entire trench shall be backfilled with Class 5. The temporary surface shall be opened to traffic where necessary and maintained by the Contractor until immediately prior to paving. At such time, the surface shall be excavated to provide for the depth of the permanent pavement.

b. Backfill Materials. As provided on the Standard Details, Contract Drawings or Special Provisions.

c. Placement Procedure. Initial backfill and pipe encasement materials shall be installed immediately following pipe installation. The pipe encasement area shall include all backfill up to 12 inches above the top of pipe for water and sanitary sewer and 6 inches for natural gas lines. The pipe shall be secured in place with backfill materials to the mid-point prior to covering the pipe or compacting. Compaction of materials placed within the pipe bedding and encasement zones shall be accomplished with portable or hand equipment methods, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe. The backfill at this level shall be thoroughly compacted with a mechanical compactor to 95% of maximum standard proctor density.

Above the pipe encasement zone, backfill materials shall be carefully placed in relatively uniform depth layers spread over the full width and length of the trench section and as will provide simultaneous support on both sides of the excavation. Trench backfill materials shall be compacted in accordance with MN/DOT 2105.3F1, Specified Density Method.

Required compaction for utility trenches is 100% around manholes: 100% in the top 3 feet measured from subgrade elevation down within streets or 3 feet from the surface outside of streets and 95% below the top 3 feet. The minimum sampling and testing for compaction shall be in accordance with Appendix B included in these specifications. Additional testing may be performed as determined by the Engineer.

Compaction of the in-place layer shall be acceptably completed before placing material for a succeeding layer thereon. The manner of placement, layer thickness, compaction equipment, and procedure effectiveness shall be subject to approval of the Engineer. The use of heavy roller type compaction equipment shall be limited to safe pipe loading.

The maximum loose thickness of each backfill layer shall be 8 inches, except that 12 inches will be permitted for Granular Materials placed above an elevation one foot above the top of pipe, and with the provision that, by authority of the Engineer in consideration of the demonstrated capability of special type vibratory compactors, these maximums may be increased at his discretion.

No compaction will be required in those areas as designated by the Engineer in the Contract Drawings or Special Provisions.

Until final acceptance of the project, the Contractor shall assume full responsibility and expense for all backfill settlement and shall refill and restore the work as directed to maintain an acceptable surface condition. All additional materials required shall be furnished without additional cost to the City.

d. Surplus and Waste Material. All surplus or waste materials remaining after completion of the backfilling operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the Engineer; otherwise, disposal shall be accomplished outside the project limits at the Contractor's discretion. The backfilling and surplus or waste disposal operations shall be a part of the work required under the pipeline installation items, not as work that may be delayed until final cleanup. No additional payments will be made for disposal of surplus or waste material.

H. Method of Measurement and Payment

1. Excavation, Backfill and Compaction for Utilities, General

All costs of excavating to foundation grade, preparing the foundation and bedding, dewatering, placing encasement materials, placing and compacting suitable on site backfill materials and other work necessary for prosecution and completion of the work as specified, shall be included for payment as part of the specified utility and utility appurtenance items without any direct compensation being made therefore.

2. Granular Materials

Granular materials for bedding and encasement are incidental to the specified utility being installed and as such no measurement or payment will be made.

Imported granular backfill materials shall be measured as defined in the Standard Details, on the Contract Drawings or in the Special Provisions. Payment shall be made per the unit bid price per cubic yard, compacted in place volume.

Where additional foundation material is required by the engineer, it will be measured by weight or volume. Only material placed by the Contractor within the defined limits will be compensated for. Unless otherwise specified, volume will be determined by vehicular measure (loose volume) at the point of delivery. Load ticket must be given to inspector upon delivery which indicates either volume (loose) or weight.

3. Rock Excavation
   Rock excavation will be paid for in accordance with 2105 ROCK BLASTING SPECIFICATIONS.

2105 EXCAVATION AND EMBANKMENT

Roadway excavation and embankment construction shall be performed in accordance with the provisions of MN/DOT 2105, except as modified below:

Compaction of all embankment, utility pipe and structure construction, including culvert backfills, shall be obtained by the Specified Density Method described in MN/DOT 2105.3F1. The minimum sampling and testing for compaction shall be in accordance with Appendix B included in these specifications. Additional testing may be performed as determined by the Engineer.

Select Granular Borrow (MN/DOT 3149.2B2) shall be modified so that of the portion passing a 1 inch sieve, not more than 7 percent by weight will pass a No. 200 sieve.

Adjustment of the water service shutoff standpipes will be incidental to Item 2105.501 Common Excavation. After restoration has been completed, the Contractor will adjust curb boxes to the correct elevation. Work will include, but not be limited to, cutting the standpipe, furnishing and installing a 2-inch diameter extension and cap.
The City of Duluth gas utility must be notified 2 working days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 730-5200 to coordinate this inspection.

Any time a steel natural gas main smaller than 6 inches is exposed within an excavation, the Engineering Division shall be notified at 730-5200 to coordinate an inspection of the exposed main.

2105 GEOTEXTILE FOR SEPARATION (STABILIZATION)

This work shall consist of placing geotextile below the fill material (may be underwater) at the location(s) shown in the Plan, or as directed by the Engineer. The work shall be accomplished according to MN/DOT 2105, these Special Provisions, or as directed by the

Engineer. The purpose of the geotextile layer is to provide separation between the fill and underlying softer soils, to prevent mixing, to provide stability during compaction, to provide some reinforcement and to minimize differential movement. The Contractor's proposed construction sequence for geotextile and fill placement shall be submitted to the Engineer for review at least 21 days prior to beginning of this element of construction.

A. Material Requirements

Geotextile shall conform to the requirements of MN/DOT 3733, Type V, and be non-woven.

B. Construction Requirements

The prepared surface shall be relatively smooth and free of stones, sticks, or other debris or irregularities that would tend to puncture or tear the geotextile. Unless otherwise directed or approved by the Engineer, the geotextile shall be placed with the highest strength direction (usually the "machine" or roll direction) oriented in the direction of the greatest expected field stress. (This will usually be at right angles to the centerline of the construction.)

If multiple pieces of geotextile are required, adjacent strips shall be field or factory sewn with the seams to have a strength as specified in MN/DOT 3733/2B3. All seams shall be sewn using a "double spool" machine capable of sewing a Federal Type 401 locking stitch. Seam Type "J," thread strength (25-lbs minimum), number of rows of stitching (1 or 2), and stitches per inch (typically, 5 to 7) shall be consistent with

achieving the required seam strength and as recommended by the geotextile manufacturer.

The geotextile shall be adequately secured so that it is not displaced during subsequent construction. No traffic or construction equipment will be permitted to operate directly on the geotextile. Any damaged geotextile shall be repaired to the satisfaction of the Engineer by patching and sewing or, when appropriate, a 36-inch overlap on all sides without sewing.

Fill shall be placed onto the fabric in uniform lifts as required by the applicable specification and approved by the Engineer, but in no case shall lifts in excess of 12-18 inches be used, unless required to bring the fill above water level or provide stability. Fill material shall be as shown in the Plan or as directed by the Engineer. For placement underwater and for two (2) feet above water level, granular materials shall be used unless otherwise provided in the Contract Drawings or approved by the Engineer.

C. Measurement and Payment

Measurement will be made of the number of square yards of satisfactorily installed geotextile approved by the Engineer. No allowance will be made for seams. Payment will be made under Item 2105.604 Geotextile Fabric Type V at the Contract bid price per square yard, and shall include but not be limited to, geotextile, seaming, placement, anchoring, and any needed repairs.

2211 AGGREGATE BASE

Aggregate base courses shall be constructed in accordance with the provisions of MN/DOT 2211 except as modified below:

Aggregate for base construction shall conform to the requirements of MN/DOT 3138 and may be sampled, tested, and inspected by the City at any time prior to being incorporated permanently in the work.

Compaction shall be achieved by the Specified Density Method described in MN/DOT 2105.3F1. The minimum sampling and testing for compaction shall be in accordance with Appendix B included in these specifications. Additional testing may be performed as determined by the Engineer.

2301 CONCRETE PAVEMENT

The provisions of MN/DOT Specification 2301, Concrete Pavement, shall apply to this contract except where otherwise defined in the Contract Special Provisions, and as amended below:

Protection against Cold Weather

If the national weather service forecast for the construction area predicts air temperatures of 34 °F [1 °C] or less within the next 24 h and the Contractor wishes to place concrete, submit a cold weather protection plan.

Protect the concrete from damage including freezing due to cold weather. Should any damage result, the Engineer will suspend operations until corrective action is taken and may subject the damaged concrete to 1503 and 1512.

Cold Weather Protection Plan

Submit proposed time schedule and plans for cold weather protection of concrete in writing to the Engineer for acceptance that provides provisions for adequately protecting the concrete during placement and curing. Do not place concrete until the Engineer accepts the cold weather protection plans.

2355 BITUMINOUS LONGITUDAL JOINT FOG SEALING TREATMENT

A. Description

This work consists of treating the longitudinal construction joint with a light application of bituminous material to seal the surface. This treatment is

recommended for use on newly constructed Hot Mix Asphalt (HMA) longitudinal joints and can also be used to maintain an existing longitudinal joint. The fog seal must be applied before permanent pavement markings are placed or before re-striping of an existing pavement.

B. Materials

The bituminous material for fog sealing will be limited to emulsified asphalt grades CSS-1 or CSS-1h. Emulsified asphalt shall be diluted 1 part emulsion to 1 part water. All dilution must be done at the supplier. Dilution of asphalt emulsion in the field is not allowed. Only Certified Sources are allowed for use. MN/DOT's certified Source List is located that following link: Http://www.dot.state.mn.us/;products/index.html.

C. Construction Requirements

1. Restrictions

   The fog seal shall not be applied when the road surface or weather conditions are unsuitable as determined by the Engineer.

2. Equipment
   a. Apply bituminous material with a distributor meeting the requirements of 2321.3C1
   b. Motorized brooms shall have a positive means of controlling vertical pressure and be capable of cleaning the road surface prior to applying fog seal bituminous material.
3. Road Surface Preparations

   At the time of applying the bituminous fog seal material the road surface shall be clean and dry. If necessary, sweep the pavement with motorized broom. All objectionable foreign matter on the road surface shall be removed and disposed of by the Contractor as the Engineer approves.

   Cover manholes, valve covers, sensors, etc. to prevent adherence of the bituminous material. Suitable covering includes plywood disks, sand, wax paper, roofing felt or other approved methods. Remove the protective coverings prior to opening the road to traffic.

4. Application of Bituminous Fog Seal Material

   Unless otherwise indicated in the plans or provisions, the bituminous fog seal shall be applied within the application rates shown below in Table 1. Limit the initial application to a test strip of approximately 100 feet in length to evaluate the application rate for uniform coverage and run-off. Make adjustments as necessary and continue to make additional adjustments, as needed, during the project. The Engineer shall approve the time and rate of application.

Apply the fog seal at a width of 18-inches evenly distributed over the longitudinal joint. Do not allow traffic on the fog seal until it has cured.

Table 1
Fog Seal Application Rates

Pavement Type or Condition	Application Rate, gallons/sy
	Diluted Emulsion (1 part Emulsion to 1 part water) CSS-1, CSS-1H
New HMA	0.06 – 0.10
Aged HMA	0.10 – 0.15

D. Method of Measurement
   1. Bituminous Material
      Bituminous material used for longitudinal joint fog seal will measured by volume at 60 degrees Fahrenheit when a quantity for payment is provided. When no quantity is provided, it shall be considered incidental.

E. Basis of Payment
   1. When FOG sealing treatment is required and no quantity is provided, all costs of furnishing and applying bituminous longitudinal joint fog seal material will be incidental with no direct compensation being made therefore.
   2. Payment for the accepted quantity of asphalt emulsion shall be at the Contract price per unit of measure for diluted asphalt emulsion.

2357 BITUMINOUS TACK COAT

This work shall consist of treating a new or existing bituminous or concrete surface and the surface of each life or course constructed except the final life or course in accordance with provisions of MN/DOT 2357 except as modified here: The bituminous material used tack coat shall be placed in accordance with MN/DOT 2360 and shall be incidental to work associated with MnN/DOT 2360 for which no direct compensation will be paid.

2360 PLANT MIXED ASPHALT PAVEMENT

MN/DOT 2350 and MN/DOT 2360 are hereby deleted from the MN/DOT Standard Specifications and replaced with the (2360) Plant Mixed Asphalt Pavement Specification dated February 4, 2011. This specification is available on MN/DOT's website at www.dot.state.mn.us/materials/bituminous.html. The 2360 specification is hereby modified with the following:

A. The provisions of MN/DOT 2360.2E.5.a(1) are modified with the following:
   Scrap shingles, as an asphalt binder source, shall not be included in any wear or non wear layer.

B. The provisions of MN/DOT 2360.2G.4.b Sampling and Testing are modified with the following:
   1. The Contractor will take the first QC sample from the second, third or fourth truck on the construction job. Thereafter, the Contractor shall ensure that all QC samples are taken at random locations.
   2. The Contractor shall store and retain mixture bulk samples and companion samples for the city for a period of 30 working days.

C. The provisions of MN/DOT 2360.2G.5 are modified with the following:
   1. Divide the planned production by 500.
   2. During production, mixture volumetric property tests will not be required when mix production is less than 100 metric tons (110 tons). However, production tests will be required when the accumulative tonnage on successive days exceeds 100 metric tons (110 tons).

D. The provisions of MN/DOT 2360.2G.6.a are modified with the following:
   1. Where 500 tons is indicated, revise to 250 tons. Where 1000 tons is indicated, revise to 500 tons.

E. The provisions of MN/DOT 2360.2G.8 are hereby modified with the following:
   Delete "District Materials Laboratory" and replace with "City of Duluth, 218-730-5907." The City will assess monetary deductions in the amount of $250.00 each day that the Contractor fails to comply.

F. The provisions of MN/DOT 2360.3E are hereby modified with the following:
   The sentence "In addition to the list the above pavement surface must meet requirements of 2399 (Pavement Surface Smoothness) requirements." is deleted.

G. The provisions of MN/DOT 2360.4 Method of Measurement are hereby modified:
   The following sentences are added: Asphalt mixtures paid by the square yard per inch will be for areas where it is impractical for a paving machine to pave driveways and other areas not on the mainline. If areas behind the curb and gutter can be paved with a paving machine, then that quantity will be paid for under the unit price per ton of asphalt placed.

H. The provisions of MN/DOT 2360.5 Basis of Payment are hereby modified as follows:
   Payment for the accepted quantities of asphalt mixture used in each course at the Contract prices per unit of material shall be compensation in full for all costs of constructing the asphalt surfacing and providing or incorporating asphalt binder, tack coat, mineral filler, hydrated lime, and anti-stripping additives that may be permitted or required.

   The provisions of MN/DOT 1903 are modified to the extent that the city will not make

a price adjustment in the event of increased or decreased quantities of asphalt mixture items.

2399 PAVEMENT SURFACE SMOOTHNESS

Pavement surface smoothness requirements will not apply.
However, surface requirements as part of 2360.3.E **will** apply.

2411 MODULAR BLOCK RETAINING WALL

This work shall consist of furnishing and constructing modular block retaining walls in accordance with the applicable specifications of MN/DOT 2411 and the following:

A. Approved combinations of modular block unit and soil reinforcement products list with MBW reinforcement class noted are held and maintained by the foundations unit and posted at www.mrr.dot.state.mn.us/geotechnical/foundations.asp under foundations unit. Only approved product combinations, including block produced from approved sources meeting durability and quality control requirements, may be used in standard designs.

The walls should be constructed in the location and configuration as shown on the Contract Drawings. The Engineer reserves the right to alter this alignment to improve construction and aesthetics.

Shown in the Contract Drawings are plan and elevation views, including all horizontal and vertical controls. It shall be the responsibility of the Design Engineer to obtain soil information.

If a fence is required along the top of the wall, the wall shall be designed to include the additional loading. The geogrid shall be designed and reinforced around the openings for fence footings. When the longitudinal slope of the footing is greater than 10:1, the footing may be stepped.

Utilities shall be located outside the construction limits of the retaining wall. Any utilities needing to be located within this area shall be installed as the wall is being constructed. Once the geotextile layers are installed, neither the geotextile nor the utility shall be disturbed at any time.

When the exposed height of the wall is less than 2 feet the following shall apply:

The wall system shall be constructed in accordance with the manufacturer's recommendations upon approval of the design methodology by the Engineer.

When the exposed height of the wall is greater than or equal to 2 feet and less than 6 feet and does not support a roadway or structure, the following shall apply:

The wall system shall be designed and the detailed drawings prepared by a Professional Engineer experienced in retaining wall design that is registered in the State of Minnesota. The design computations and the plans shall be certified by the Engineer and submitted to the wall Owner for their permanent record.

When the exposed height of the wall is greater than or equal to six feet, or will support a roadway or structure within a distance from the top of the wall equal to the design height of the wall the following shall apply:

1. The wall shall be designed and the detailed drawings prepared by a Professional Engineer experienced in retaining wall design that is registered in the State of Minnesota. The design computations and the plans shall be certified by the Engineer and submitted to the wall Owner for their permanent record. The design shall be per AASHTO and the MN/DOT Road Design Manual.

2. The detailed drawings shall contain all the necessary information for the construction of the wall. Included shall be typical section detailed excavation limits, geotextile locations, block embedment, leveling pad dimensions, backfill, etc. Include as many sections and other views necessary for the construction and inspection of the wall. The information on embedment, geotextile locations, and geotextile lengths as they relate to wall heights may be shown in tabular form. Also included shall be the pertinent information on the individual blocks, the geotextile material and compaction requirements.

2. All plan sheets shall clearly identify the name of the responsible engineering firm and the name of the person certifying the plan. Each sheet shall be certified.

   When the exposed height of the wall is greater than or equal to 10 feet, or will support a roadway or structure, the final certified retaining wall plan must be approved by State Aid Bridge Office prior to the construction of the modular block retaining wall for all State-Aid or Federal-Aid Projects only.

B. Segmental Masonry Retaining Wall Units
   1. Scope
      This specification covers segmental masonry units for use in the construction of mortarless retaining walls (SRW's).
   2. Requirements
      Each manufacturing facility shall provide the State Materials Engineer with a copy of their quality control plan and procedures, including testing rates and material sources. Each manufacturing facility shall also supply test reports and documentation to verify compliance with this specification.

      The units shall conform to ASTM C 1372, except that:

a. The minimum compressive strength requirements shall be 38 Mpa (5500 Psi) for any individual unit, and 40 Mpa (5800 Psi) for the average of three units.
b. The freeze/thaw durability of wall units tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
   i. The weight loss of each of five test specimens at the conclusion of 90 cycles shall not exceed 1% of its initial weight; or
   ii. The weight loss of 4 out of 5 test specimens at the conclusion of 100 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen to not exceed 10%.
c. The freeze/thaw durability of the cap units tested in accordance with ASTM 1262 in a 3% saline solution shall be the minimum of the following:
   i. The weight loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1% of its initial weight; or
   ii. The weight loss of 4 out of 5 test specimens at the conclusion of 50 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen to not exceed 10%.
d. Cap units must meet the requirements of (1) and (3) above and have a top surface sloped at a minimum of 1 inch fall per 10 inch run (1 mm fall per 10 mm run) front to back or be crowned at the center.
e. ASTM C 1262 test results shall be recorded and reported in 10 cycle intervals.
   Note: It is the intention of this testing that 100% of the wall units and cap units meet the weight loss requirements for (2a) and (3a) respectively or that a minimum of 80% of the wall units and cap units tested meet the weight loss requirements for (b2) and (c2) respectively. If a manufacturer chooses to increase the sample size tested beyond the 5 units required for each block tested, a minimum of 6 must meet the weight loss requirements of (b2) or (c2). If a sample size of 10 blocks is tested, a minimum of 8 must meet the weight loss requirements.

3. <u>Sampling and Testing</u>
   Shall conform to ASTM C 140, except that:
   a. Section 62.4 shall be deleted and replaced with: "The specimens shall be coupons cut from a finished side or back shell of each unit and sawn to remove any face shell projections. The coupon size shall have a height to thickness ratio of 2 to 1 before capping and a length to thickness ratio of 4 to 1. The coupon shall be cut from the unit such that the coupon height dimension is in the same direction as the unit height dimension. Compressive testing of full size units will not be permitted. The compressive strength of the coupon shall be assumed to represent the net area compressive strength of the whole unit."

   b. Cap units and wall units shall be sampled and tested as separate block types.

c. Each manufacturing facility is required to sample and test each block type at the rate of one sample per 5,000 units of continuous production or fraction thereof (if production is interrupted) as part of their overall quality control testing.

   Example: If 12,000 wall units are produced in a continuous production run, this would constitute 3 lots and 3 sets of samples would be required. If 6,000 units are produced in each of two production runs (12,000 total) then 2 sets of samples would be required from each separate production run or lot (4 sets of samples total).

d. Minimum manufacturer testing shall include 5 randomly selected units and the following testing:
   i. Compressive strength (average of 3 units)
   ii Freeze/thaw durability (average of 5 units)

   Test results from each lot of production shall be provided to the MN/DOT Foundations Unit within 30 days of the completion of testing and prior to the incorporation of any material into a project. The test report will clearly state the production lot number represented by the test results. This lot number shall correspond with the lot number supplied with the block on the certificate of compliance as outlined below.

4. Acceptance and Use

   All block manufacturers complying with the requirements of the specification above shall submit test results supporting this compliance to the MN/DOT Foundations Engineer, 1400 Gravis Ave., Maplewood, MN 55109. Upon review of the test results the product and manufacturing facility will be placed on an approved products list that will be on file in the MN/DOT Foundations Unit and can be viewed at the MN/DOT website at: www.mrr.dot.state.mn.us/geotechnical/foundations/foundations.asp.

   Block types and manufacturing facilities not on this list shall not be allowed for use on MN/DOT, Federal-Aid or City of Duluth projects.

   All block submitted for use on MN/DOT, Federal-Aid or City of Duluth projects shall be accompanied by a certificate of compliance attached to each pallet of block (MN/DOT 1603). The certificate of compliance shall include the name and address of the manufacturing facility and date of manufacture in addition to all other required information.

Any block that has not been tested by the manufacturer as required under Section C above, or has not had these test results submitted to MN/DOT prior to its incorporation into a project, shall be deemed Unacceptable and Unauthorized work and shall be subject to the provisions of MN/DOT 1512.

Project personnel shall submit samples for testing as specified in the Schedule of Materials Control. Final acceptance and payment shall be based on testing of field samples.

5. Segmental Masonry Retaining Wall Surface Sealing
All segmental masonry retaining walls shall have their surfaces sealed.

Segmental masonry retaining wall surface sealing shall consist of preparation, furnishing, and applying the surface sealer to the top, exposed front face, and back side of the upper three courses of all walls.

Surface sealers shall meet the requirements on file in the MN/DOT Concrete Engineering Unit (651-779-5572). The list may also be viewed on the MN/DOT website at: www.mrr.dot.state.mn.us/pavement/concrete/products.asp

Due to the hazardous ingredients contained in sealer formulations extreme care must be exercised in their handling and use, and the manufacturer's recommendations shall be closely followed.

Construction Requirements

a. The Contractor shall comply with the manufacturer's written instructions for preparing, handling, and applying the surface sealer.
b. The surface to be treated shall receive a light water-blast to the extent that the surface is clean and free of oils
c. Before the surface sealer is applied, the surface to be sealed shall be dry and free of all dust, debris, and frost.
d. Surface sealers shall be applied at the heaviest application rate specified by the manufacturer.

6. The segmental masonry units must be of the color and type of face indicated in the Special Provisions.

7. All materials and work performed as specified above will be incidental to construction of the wall.

C. Measurement and Payment
Measurement will be made by the actual fascia unit vertical front face area constructed including embedded rocks. Payment will be made under item 2411.604

Modular Block Retaining Wall, at the Contract bid price per square yard (square meter), which shall be compensation in full for all costs involved.

2451 STRUCTURE EXCAVATION AND BACKFILLS

Item 2451/503 Granular Backfill is to be used as backfill material as directed by the Engineer. Granular Backfill (MN/DOT 3149.2D) shall be modified so that of the portion passing a 1-inch sieve, not more than 7 percent by weight, will pass a No. 200 sieve. Payment shall be made at the bid item unit price and shall include the excavation, removal, and disposal of unsuitable existing trench spoils, furnishing and installing the selected granular material.

2502 SUBSURFACE DRAINS

Subsurface drain construction shall be performed in accordance with the provisions of MN/DOT 2502, the detailed drawing in the Contract Drawings, and the following:

4-inch or 6-inch perforated Poly-Vinyl Chloride (PVC) Sewer Pipe, SDR 35, ASTM D 3034 shall be used. Type 1 geotextile conforming to MN/DOT 3733 shall be used.

Payment for drain pipe and connection to storm structures, at the appropriate Contract price per foot, shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified including excavation, granular materials and geotextile.

2503 PIPE SEWERS - GRAVITY

Gravity sanitary sewer and storm sewer construction and reconstruction shall be performed in accordance with the provisions of MN/DOT 2503, except as modified below:

This work shall consist of the construction of gravity sanitary and storm sewer main and building services utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of wastewater and storm water. The work includes the relocation or adjustment of existing facilities as may be specified in the Contract.

All references to Specifications of MN/DOT, AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

A. Materials

1. General Requirements

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided

for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the City may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

2. Reinforced Concrete Pipe and Fittings
   Reinforced concrete pipe, fittings, and specials shall conform to the requirements of 3236 and Standard Plate 3000 for the type, size and strength class specified. Rubber O-ring gasket joints conforming to Standard Plate 3006 shall be used.

3. Poly-Vinyl Chloride Pipe and Fittings
   Smooth-walled poly-vinyl chloride pipe and fittings shall conform to the requirements of ASTM D-3034 for the size, standard dimension ratio (SDR), and strength requirements indicated on the Contract Drawings, Specifications, and Special Provisions. The grade used shall be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543. Unless otherwise specified, all pipe and fittings shall be SDR 35 and connections shall be push-on with elastomeric gasketed joints which are bonded to the inner wall of the gasket recess of the bell socket. Schedule 40 pipe with glued joints shall not be used.

4. Corrugated Polyethylene Pipe
   This work shall consist of furnishing and installing dual-wall corrugated polyethylene pipe and fittings in accordance with the Contract Drawings, MN/DOT
   2503, AASHTO M294, Design Section 18 of the AASHTO Standard Specifications for Highway Bridges and the following:

   Corrugated polyethylene pipe and fittings shall be manufactured from high density polyethylene (HDPE) virgin compounds. Clean reworked HDPE materials from the manufacturer's own production may be used by the manufacturer of HDPE pipe, provided that the pipe and fittings produced meet all requirements of these Special Provisions and in AASHTO M294 and Design Section 18 of the AASHTO Standard Specifications for Highway Bridges. The polyethylene compounds shall conform to the requirements of ASTM D 3350 Cell Class 335420C. Pipe shall be new or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage.

Pipe couplings shall meet the watertight performance requirements of ASTM 2306. Watertight couplings must be capable of meeting a 10 psi laboratory test per ASTM 3212 and utilize a bell and spigot design with a gasket meeting the requirements of ASTM F 477.
Wall thickness shall be the thickness of the inner liner measured between corrugation valleys of the outer rib wall. The wall thickness shall equal or exceed the minimum wall thickness values in Table 1.

The pipe stiffness shall be determined in accordance with AASHTO M294 at 5 percent deflection. The average pipe stiffness shall equal or exceed the minimum pipe stiffness value for each size of pipe listed in Table 1.

TABLE 1
DUAL WALL CORRUGATED POLYETHYLENE PIPE
NOMINAL DIAMETER (IN.)

Properties	12	15	18	24	30	36
Min. I.D. (in.)	11.8	14.8	17.7	23.6	29.5	35.5
Max. O.D. (in.)	14.7	18.0	21.5	28.7	36.4	42.5
Min. Wall Area ($in.^2/ft.$)	1.50	1.91	2.34	3.14	3.92	4.50
Min. C (in.)	0.35	0.45	0.50	0.65	0.75	0.90
Min. I ($in.^4/in.$)	.024	.053	.062	.116	.163	.222
Min. Pipe Stiffness (psi)	46	42	40	34	28	22
Min. Wall Thickness (in.)	.035	.035	.050	.050	.080	.100

5. Connections to Polyethylene Pipe
   Private sump pump discharge connections to HDPE storm pipe must have soil tight connections and meet manufacturers recommendations for Tee connections. Inserta Tee, ADS UNI-T Tapping Tee, and other proprietary connections may be used with the project engineer's prior approval.

6. Flexible Couplings
   Flexible couplings and adapters shall be made from elastomeric polyvinyl chloride. Couplings shall be resistant to chemicals, ultraviolet rays, fungus growth, normal sewer gases and unaffected by soil conditions. Couplings shall be water tight. Couplings shall be attached to pipe utilizing stainless steel bands.

B. Construction Requirements
   1. General Provisions

Requirements for excavation, preparing trench, backfilling and restoration are contained in 2105 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and State of Minnesota Department of Transportation "Standard Specifications for Construction" 2005 Edition, and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the Contract Drawings or the Special Provisions.

2. Handling and Inspection

Proper and adequate implements, tools, and facilities satisfactory to the Engineer

shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All materials shall be handled carefully, as to prevent damage and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers.

Do not dump pipe from conveyance. Unload pipe with ropes and skids or with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

3. Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper laying and joining of the units at the prescribed

line and grade.

The bedding shall provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing upgrade and the laying shall start at the downgrade end and proceed upgrade.

As each length of pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. All pipe and fitting joints shall fit tightly and be fully closed. The pipe shall be secured in place with backfill material to mid-point of pipe, and backfilled to 1 foot over the top of the pipe as specified in 2105 EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES and as shown on the standard details and the contract drawings.

4. Pipes to be Cleaned
   The interior of all pipes shall be carefully freed from all dirt, stones, sand silt, mud, concrete and superfluous material of every description as the work progresses. If, in the opinion of the Engineer, the pipe contains an excess of material, the pipe shall be cleaned by the Contractor at no additional expense to the Owner.

5. Locating Wire
   Locating wire shall be installed in accordance with 2503 LOCATING WIRE of these specifications and the Standard Details and the Special Provisions.

6. Inside Drops
   Where a sanitary sewer main line connects to a manhole more than 2 feet above the invert of the outgoing sewer, the connection shall be made by means of an Inside Drop Connection installed per the Standard Details. Outside drops shall not be used except where approved by the City Engineer.

7. PVC Sewer Service Pipe
   Sewer service connections shall be installed as provided for in the contract and as may be directed by the Engineer. The sewer service connections and pipelines shall be installed in conformance with all applicable requirements of the main sewer installation. The Engineer, with the assistance of the Contractor, shall keep accurate records of all service installations as to the type, location, and elevation at the point of connection (wye), property line and termination, etc. The service installation shall not be backfilled until all required information has been obtained and recorded. Unless otherwise specified, service pipe shall be installed at right

angles to the main sewer and at a straight line and grade to the property line. The standard and minimum grade shall be a uniform rise of 1 inch in 4 feet (2%) for sanitary service lines. Pipe bends shall be provided as necessary to bring the service lines to the proper location and grade. Pipe bends shall not exceed 22-½ degrees without approval of the Engineer.

All pipe and fittings shall be SDR 35 and connections shall be push-on elastomeric joints which are bonded to the inner wall of the gasket recess of the bell socket.

All wyes, tees or the end of lateral service lines shall be closed with a stopper until all testing has been completed. Plugs/caps shall be tested against with the maximum air pressure to be used in testing.

All sanitary sewer service pipes must be insulated if the depth of cover is 6'-0" or less.

PVC sewer service pipe for existing private building services shall match the size of the existing sewer service, typically 6". In no case shall the sewer pipe reduce in size between the building and the sewer main. Four-inch service pipe may be used in new developments with new sewer main and new sewer services for residential homes. All service pipe installation shall meet the requirement of the State of Minnesota Plumbing Code.

8. Continuous Sewer Service

   The Contractor shall provide adequate equipment and facilities to provide bypass pumping for all elements of work requiring interruption to flow in the sanitary sewer. Provide backup or standby capabilities satisfactory to the City. The Contractor shall be responsible for damages to private or public property due to sewer backup while controlling sewage flow.

   Under no circumstances will bypassing of untreated wastewater to any storm drainage facility or surface water course be allowed.

   All costs for flow control, temporary pumping, etc., shall be inclusive to the unit price bid for sanitary sewer.

9. Dewatering of Trench

   Dewatering of the trench shall be considered incidental work for which no separate payment will be authorized.

10. Flexible Couplings

    Flexible couplings and adapters shall be used to connect new pipe to existing PVC or clay pipes.

11. Bulkheads

All pipe and fitting ends left open for future connection shall be bulkheaded with prefabricated caps of the same material as the pipe material. They shall be installed with watertight seals as required for the pipeline joints. Plugs/caps shall be tested against with the maximum air pressure to be used in testing.

12. Infiltration

The infiltration shall not exceed 50 gallons per inch diameter of pipe per mile per day.

13. Television Inspection

After the sewer is completed, the City may inspect all or any portion of the sewer with closed-circuit television. The Contractor shall be responsible for leaving the sewer in a clean condition for televising.

14. Air Test

All sanitary sewer lines, including service connections, shall be watertight and shall be tested for excessive leakage upon completion and before connections are made to the service by others. Each test section of the sewer shall be subjected to exfiltration testing by air test method as described below and at the Contractor's option. The requirements set forth for maximum leakage shall be met as a condition for acceptance of the sewer section represented by the test. The sewer pipe section under test shall be clean at the time of testing but the pipe may be wetted. Pneumatic balls shall be used to plug the pipe ends at manholes. Low pressure air shall be introduced into the plugged line until the internal air pressure reaches 27.58 kPa (4.0 psi) greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two minutes shall be allowed for the air temperature to stabilize before readings are taken and the timing started. During this time the Contractor shall check all plugs with soap solution to detect plug leakage. If plugs are found to leak, air shall be bled off, the plugs shall be re-tightened, and the air shall be reintroduced into the line.

The sewer section under test will be accepted as having passed the air leakage test if it does not lose air at a rate to cause the pressure to drop from 24.82 to 20.68 kPa (3.6 to 3.0 psi) in less time than one-half minute per one inch in diameter of the pipe tested.

All testing shall be performed by the Contractor without any direct compensation being made therefore, and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

15. Deflection Testing

Deflection testing shall be performed by the Contractor using a nine point mandrel approved by the Engineer. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe.

Mandrel testing shall be done no less than thirty (30) days after installation or upon completion of construction of the roadway to the finished subgrade, whichever occurs first. The mandrel must be pulled through the pipe by non-mechanical means. Pipe through which the mandrel does not pass will be considered unacceptable. New pipe or deformed pipe which is not damaged shall be re-laid. The re-laid pipe shall be retested for deflection after no less than five (5) calendar days.

Sanitary Sewer Pipe and Mandrel Diameter		
Pipe Diameter, Nominal (inches)	Pipe Diameter, Actual, SDR 35 (inches)	Mandrel Diameter (inches)
4	3.895	3.60
6	5.742	5.45
8	7.665	7.28
10	9.563	9.08
12	11.361	10.79
15	13.898	13.20
18	16.976	16.13
21	20.004	19.00
24	22.48	21.36
27	25.327	24.06
30	29.132	27.68
36	34.869	33.13

C. Basis of Measurement and Payment

1. All payment for Pipe Sewers- Gravity and related items within this section shall include all incidental work specified under 2503 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES including backfill with suitable onsite materials where specified.
2. Sanitary Sewer or Storm Sewer

Measurement for Pipe Sewers – Gravity shall be per lineal foot of the specified diameter and material installed. Payment shall be made for Pipe Sewers – Gravity at the unit bid price for the specified diameter and material installed. Payment for pipe sewer-gravity shall include, in addition to the Basis of Payment in 2503.5, bedding, backfill to 1 foot over the pipe, adapters and construction joints, and all testing.

3. PVC Wye

   Measurement will be made by the number of each size PVC wye furnished and installed as specified.

   Payment for wyes of each size will be made under item 2503.602 at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the wye complete in place as specified.

4. Connect Sewer Service

   This work shall consist of furnishing and installing a connection to a Pipe Sewer complete in place including all fitting, elbows, adapters, etc. from the wall of the pipe sewer to 4 feet beyond the main in accordance with the applicable provisions of MN/DOT 2503.

   Measurement will be made by the number of each sewer service connections furnished and installed as specified.

   Payment for each connection will be made under Item 2503.602 Connect Sewer Service, at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the connection complete in place as specified.

5. PVC Sewer Service Pipe

   This work shall consist of furnishing and installing PVC Sewer Pipe (SDR 35) complete in place including fittings, adapters, and construction joints from 4 feet beyond the wall of the pipe sewer to a termination point or connection to an existing service as the Inspector designates in accordance with the applicable provisions of MN/DOT 2503. Measurement will be made by length along the line of the sewer service pipe to the nearest 0.5 feet. Payment for sewer service pipe will be made under Item 2503.603, (size) inch PVC Sewer Service Pipe, at the Contract price per foot, which shall be compensation in full for all costs of furnishing and installing the sewer service pipe complete in place as specified.

6. Construct Inside Drop

   This work shall consist of furnishing and installing an Inside Drop Connection in accordance with the Standard Details, Contract Drawings and Special Provisions. Inside Drop Connections will be measured separately by the number of complete units installed, in addition to measured Contract pay items under MN/DOT 2503 and 2506. Payment for inside drop connections will be made under Item 2503.601 Construct Inside Drop at the Contract bid price per each, which shall be compensation in full for all costs of furnishing and installing the inside drop connection complete in place as specified.

2503 PIPE SEWERS - PRESSURE

Pressure sanitary sewer and forcemain construction and reconstruction shall be performed in accordance with the provisions of MN/DOT 2503 except as modified below: This work shall consist of the construction or reconstruction of pressure sanitary sewer and forcemain and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of wastewater. The work includes the relocation or adjustment of existing facilities as may be specified in the Contract.

All references to Specifications of MN/DOT, AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

A. Materials

1. General Requirements

   All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

   All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the Department may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

2. Ductile Iron Pipe

   Ductile Iron Pipe shall conform to the latest requirements of ANSI A-21.51. In addition, the pipe shall comply with the following supplementary provisions:

   a. All pipe shall be furnished with cement mortar lining meeting the latest requirements of ANSI A-21.4 for standard thickness lining. All interior and exterior surfaces of the pipe shall have an asphaltic coating at least one mil thick.
   b. All buried pipe shall be furnished with push-on type joints. All exposed pipe shall be furnished with flanged type joints. All joints shall conform to ANSI A-21.11.
   c. All buried pipe shall be furnished in 18 or 20-foot nominal lengths.
   d. Minimum ANSI thickness class furnished shall be Class 52 for bell and spigot pipe. Minimum ANSI thickness class furnished for flanged pipe shall be Class 53.
   e. Pipe shall be provided with provisions to maintain electrical continuity.

e. All exposed pipe shall have standard bituminous coating unless specified otherwise on the plans, in the Special Provisions or in the technical specifications.
f. A Certificate of Compliance shall be furnished stating that the materials furnished have been tested and are in compliance with the requirements of this Specification.

3. Ductile Iron Fittings

Fittings shall conform to the latest requirements of ANSI A-21.10 (Gray Iron and Ductile Iron Fittings), or ANSI A-21.53 (Ductile Iron Compact Fittings), all with ductile iron glands and cement lining.

a. Buried fittings shall have Cor-Ten or similar low corrosion bolts and nuts, zinc anode caps conforming to ASTM B-418 for regular anode size, mechanical joint ends, and rubber gaskets.
b. Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets. Fittings to be installed in any areas where wastewater is present shall have stainless steel flange bolt and full face gaskets. All interior and exterior surfaces of the fittings shall have an asphaltic coating at least one mil thick.
c. Fittings shall be provided with provisions to maintain electrical continuity.
d. Fittings shall be manufactured in North America or preapproved by the Engineer.

4. HDPE Pipe and Fittings

a. HDPE pressure sewer and forcemain pipe 4 inches and greater shall be polyethylene pipe conforming to ASTM D3035 and AWWA C906-99, Polyethylene (PE) Pressure Pipe and Fittings, 4" through 63", for Water Distribution. Pipe furnished shall be marked with a continuous green stripe. Pipe and fittings shall be PE4710, HDPE Pressure Class 200, SDR 11, and have outside diameters similar to ANSI A-21.51 ductile iron pipe. Joints and fittings shall be butt heat fusion type, ASTM D3261. Ends shall be plain for butt fusion joining as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. All 45 and 90 degree bends and all tees shall be molded polyethylene fused-type suitable for sizes 4 through 12 inch for use on ductile iron pipe size (DIPS) HDPE pipe. Twenty-two and ½ degree bends and reducers may be fabricated.
b. Pressure sewer pipe less than 4-inch shall be polyethylene pipe conforming to the requirements of ASTM D2239 or D3035 and shall have a minimum working pressure of 200 psi at 73 deg. F., DR11. Joints and fittings shall be butt heat fusion type, ASTM D3261.

c. Pipe shall be new or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage.
d. The DR number and pressure rating specified above shall be considered a minimum. Provide stronger class pipe if required by loads imposed by directional drilling pulling operation.
e. Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.
f. Reference Standards - American Society for Testing and Materials (ASTM)
    1. ASTM D638 – Tensile Method for Tensile Properties of Plastics
    2. ASTM D790 – Test Materials for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
    3. ASTM D3035 – Polyethylene (PE) Plastic Pipe (DR-PE) Based on Controlled Outside Diameter
    4. ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
    5. ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material
    6. ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

6. Stainless Steel Pipe

Stainless steel pipe materials shall meet the requirements of ASTM A53 schedule 40 with threaded joints meeting the requirements of ASTM A865. All couplings and fittings shall be the same material as the host pipe.

7. HDPE Transition Couplings and Adapters
    a. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company or equal. The adapter shall comply with AWWA C906 and be manufactured for use on pipe conforming to ASTM D2513, D3035 and F-714. The adapter shall be molded from a PPI and NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a cell classification of 34F464C and be compatible for heat fusion with any pipe manufactured from a like or similar resin. Adapters shall be tested according to ASTM D1599 and ASTM D1598. HDPE Adapters shall be sized for use with ductile iron pipe size HDPE pipe. Adapters shall provide joint restraint. Adapters shall be used for all transitions from HDPE to valves or ductile iron pipe.
    b. The HDPE to cast iron transition couplings shall be furnished and installed from new HDPE pipe to existing cast iron pipe. The transition couplings shall be Smith Blair model 441 or equal. HDPE pipe stiffeners shall also be provided and installed to prevent compression of the HDPE pipe. Pipe stiffeners shall be Smith Blair or equal. Stiffeners shall be designed to prevent over insertion.

c. Transition couplings 2-inch and smaller shall consist of HDPE by threaded stainless steel connections. The coupling shall include a stainless steel transition compression ring with o-ring seal. Adapters shall have a pressure rating equal to that of the mating pipe. HDPE shall be plain end for butt fusing. Coupling shall be manufactured by Central Plastics, Inc. or equal.
d. All bolts to be used on adapters and couplings shall be supplied with zinc anode caps conforming to ASTM B-418 for regular anode size.

8. Transition Couplings

Cast transition couplings for 4 inch through 12 inch shall be furnished with ductile iron sleeves, ductile iron followers and stainless steel bolts. Gaskets shall be natural or synthetic vulcanized rubber recommended for water system use. The finish shall be fusion bonded epoxy meeting ASTM C213. Couplings shall have a size range to connect cast iron to cast iron or cast to ductile iron, or ductile iron to ductile iron as necessary for the application. Estimated pipe outside diameters are shown in the table below. Latter dimension is maximum for pit cast end requirement. Contractor shall verify all pipe dimensions prior to ordering couplings. All couplings shall be rated for 250 psi minimum.

4"	4.80" to 5.10"
6"	6.90" to 7.20"
8"	9.05" to 9.45"
10"	11.10" to 11.50"
12"	13.20" to 13.50"

Couplings shall be Smith Blair 441, JCM 210, Ford FC1 or approved equal.

9. Gate Valves

Gate valves shall be manufactured and furnished in accordance with an approved pattern and shall conform to the requirements of AWWA C509 or C515 for resilient seated gate valves, and all gate valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof. Unless otherwise specified, the valves furnished shall comply with the following supplementary requirements.

a. Gate valves shall be solid disc with resilient seating.
b. All valves shall be furnished with O-Ring stem seals.
c. Valves shall have a 2-inch square operating nut opening counter-clockwise.
d. All valves shall be of the non-rising stem type.
e. Gate valves shall be designed with adjustable packing that can be maintained or removed without removing the valve bonnet.
f. All exterior exposed bolts and nuts shall be stainless steel.

g. Buried valves shall have mechanical joint ends complete with gasket, gland, and bolts. Exposed valves shall have flanged ends conforming to ANSI B16.1, Class 125 with full face gaskets. Bolts or valve flange shall be provided with means for preventing the bolt from slipping in the slotted holes.
h. All buried gate valves shall be furnished with extension stems which extend to within one foot of the finished grade elevation. The extension stem shall have a 2-inch operating nut and be mechanically connected to the valve operator.
i. All valves within structures or vaults shall have extension stems that extend to within 6 inches of the top of slab or other designated elevations shown on the drawings. Stem guides shall be provided for all valves within wet wells, vaults or other inaccessible locations.
j. The exterior of the valve shall be supplied with an epoxy coating. Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular. Bolts for flanged valves exposed to wastewater shall be stainless steel.

9. Valve Boxes

Valve Boxes shall be 5 1/4" cast iron screw-type, consisting of the following parts:

Cover	Stay-put type, "SEWER" cast thereon, with solid edges (no grooves or flutes on edge)
Top Section	26" length
Extension Section	30" length
Bottom Section	30" length
Base	#6 Round Base

All parts must be interchangeable with Bingham and Taylor #4906 and Tyler #6860. Valve box assemblies shall be manufactured in Northern America or preapproved by the Engineer.

10. Check Valves

Check valves shall be provided with cast iron or ductile body with top opening for disc replacement without requiring valve body removal. Valve body shall provide a clear waterway in the fully opened position. Trip shall be grade A bronze. Valves shall be furnished with outside lever and weight to assist rapid closure. Disc shall be of cast or ductile iron construction, bronze-mounted. Valves shall be furnished with flanged ends conforming to ANSI B16.1, Class 125. Valves shall meet the general requirements of AWWA C508. Check valves shall be Clow, Henry Pratt or pre-approved equal.

11. Ball Valves

Ball valves up to 2-inches shall be bronze or stainless steel one piece body,

chrome plated brass ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends. PVC ball valves are not acceptable.

12. Pressure Gauges

Pressure gauges shall be 2 ½ inch minimum diameter, silicone filled, stainless steel case and basel, and spiral tube with a polycarbonated lens and ¼ NPT male center back connection. The gauge shall be rated for a maximum pressure of twice the rated pump capacity unless called for otherwise in the Special Provisions or on the Plans.

13. Pressure Sewer Services and Fittings

a. Pressure sewer services shall conform to the same requirements for HDPE pipe and fittings.
b. Tapping Tees with Electrofusion Saddle shall be manufactured by Central Plastics Company or equal and shall conform to the requirements for Water Pipe Materials and Fittings as specified.
c. Curb Stop shall have threaded connections for use with HDPE adapters.
d. Curb Boxes shall be magnetized locator wire boxes as specified elsewhere shall be adjustable up and down for a minimum of 7 feet of cover.

14. Wall Sleeves and Wall Pipes

Wall sleeves and wall pipes shall conform to the requirements of the process piping as indicated on the contract drawings and as specified as follows:

Cast Iron: ASTM A48, Class 30B
Ductile Iron: ASTM A536, Grade 60-40-18
Mechanical Joint: ANSI/AWWA C111/A21.11
Integral cast or welded intermediate wall collar

Wall pipes shall be used at all locations where pipes penetrate new cast in place concrete walls.

15. Modular Rubber Seals

Modular rubber wall seal shall be mechanical type, consisting of inter-locking synthetic rubber links. The elastomeric element shall be sized and selected per manufacturer's recommendation and have the following properties as designated:

Standard service application (-40 degrees F to 250 degrees F) EPDM:
ASTM D2000 M3BA510.

Hydrocarbon service application (-40 degrees F to 210 degrees F) Nitrile:
ASTM D2000 M1BF510

High temperature or fire seal application (-67 degrees F to 400 degrees F)
Silicone: ASTM D2000 M1GE505

Assembly of synthetic rubber links connected with stainless steel bolts. When the bolts are tightened, pressure plates shall compress the rubber links to fill the annular space between the pipe and the wall sleeve to form a watertight seal.

Modular rubber wall seals shall be used where pipes penetrate existing concrete walls or precast walls and as otherwise indicated on the contract drawings. Use of modular rubber seals in any other locations shall require written approval of the Engineer.

Modular rubber wall seal shall be Link-Seal, manufactured by Thunderline Corporation or equal.

16. Pipe Supports and Pipe Hangers

Pipe supports bearing on concrete surfaces shall consist of a base flange, support rod with threaded ends for height adjustment and a saddle type or stanchion type support. Provide floor-mounted type support stands where wall or ceiling mount are not feasible and maintenance access will not be interrupted.

Wall mounted support brackets shall be constructed of angle iron and include a u-bolt attachment, roller or pipe saddle above the bracket. Wall mounted pipe support brackets are permitted the pipe is within 2 feet of the wall.

Ceiling installed hangers and supports shall conform to the American Standard Code for Pressure Piping, ANSI B31.1.

All pipe supports installed in above ground building without the presence of wastewater shall be painted steel. All pipe supports installed below ground or in any room where exposed wastewater is present shall be 316 stainless steel.

B. Construction Requirements

1. General Provisions

Requirements for excavation, preparing trench, backfilling and restoration are contained in (2105) EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and State of Minnesota Department of Transportation "Standard Specifications for Construction" 2005 Edition, and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the Standard Details, Contact Drawings, or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with (2503/2504/2505) HORIZONTAL DIRECTIONAL DRILLING of these specifications.

2. Handling and Inspection

Proper and adequate implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient

prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection. Any pipe with scratches, cuts or scrapes deeper than 10% of the wall thickness shall be used unless the damaged section if cut out.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers. Cover pipe ends to prevent dirt, debris, wildlife and weather from entering. HDPE pipe stored for more than 3 weeks should be covered for protection from sunlight and weather.

Do not dump pipe from conveyance. Unload pipe 12 inch (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inch (300 mm) or pipe bundles with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

3. Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every reasonable precaution shall be taken to prevent foreign materials from entering the pipe and fittings while they are being placed in the line. The sewer materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connection, but they shall be no larger than would be adequate. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing in the direction of laying.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is affected.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

4. Aligning and Fitting of Pipe

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Cast iron or ductile iron pipe shall be cut with approved mechanical cutters. The electric-arc cutting method, using carbon or steel rod, will be approved for use on the larger size pipe where mechanical cutters are not available. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

When necessary to deflect the pipe from a straight line either in the vertical or horizontal plane to avoid obstructions, or produce a long radius curve, the amount of deflection allowed at each joint shall not exceed the allowable limits established in the following tables:

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT FOR DUCTILE IRON PIPE					
Pipe Size	Max. Angle	MAX OFFSET PER PIPE		Approx. Radius	
		18' length	20' length	18' length	20'length
3" to 12"	5°	19"	21"	205'	230'
16" to 24"	3°	11"	12"	340'	380'
30" to 36"	2°	7.5"	8"	510'	570'

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING MECHANICAL JOINT FOR DUCTILE IRON PIPE			
Pipe Size	Max. Angle	MAX. OFFSET PER PIPE 18' length	20' length
4"	8.3°	31"	35"
6"	7.1°	27"	30"
8" to 12"	5.3°	20"	22"
16"	3.5°	13"	15"
18" & 20"	3.0°	11"	12"
24" & 30"	2.3°	9"	10"
36"	2.0°	8"	9"

Connection and assembly of joints shall be accomplished during the setting, aligning and fitting operations, in accordance with the provisions of this specification to the extent that the jointing requirements will permit.

5. Blocking and Anchoring of Ductile Iron Pipe

   All plugs, caps, tees, bends and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, in accordance with the requirements listed below and the Standard Details.

   a. All horizontal bends, plugs, caps and branch tees shall be provided with concrete buttresses.
   b. For 16" and smaller diameter, precast concrete blocks may be used in lieu of cast in place concrete when used in conjunction with "Mega-lug" joint restraints. Precast blocks shall be stepped out as installed to provide similar surface area as the cast in place thrust blocks. Use of "Mega-lug" restraints only without blocking is only acceptable if adjacent pipe is restrained as described below.
   c. All vertical bends exceeding 11-1/4 degrees deflection shall be provided with concrete buttress blocking at the low points with metal tie rod or strapping restraints at the high points.

d. Offset bends made with standard offset fittings need not be strapped or buttressed, unless installed in combination with another fitting.

All necessary fittings, bands, tie rods, nuts, and washers, and all labor and excavation required for installation of reaction restraints shall be furnished by the Contractor at his expense and without direct compensation.

Concrete blocking shall be at least 2 inches nominal thickness.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Type 3 Grade B of MN/DOT 2461. Buttress dimensions shall be as indicated on the Standard Detail Drawing.

All metal parts of tie rod or strap type restraints shall be galvanized.

"Megalug" joint restraints by Ebba Iron, Inc., or Uni-Flange Series 1400 "Block Buster" by Ford, may be substituted for rodding and blocking. Retainer (set screw type) glands may not be used in lieu of approved restraints or buttresses. "Megalug" and "Blockbuster" restraints may only be used on ductile iron pipe and shall not be used on any existing cast iron pipe.

When using "Megalug" type restraints in lieu of blocking, the pipe shall be restrained in each direction from the fitting a sufficient distance to prevent joint separation upstream or downstream. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction or restain a minimum of 36 feet in each direction.

6. Blocking of HDPE Pipe

All plugs, caps, tees, bends and other thrust points shall be provided with concrete blocking if there is an unstrained joint within 36 feet of the thrust point. Blocking is not required when all joints within 36 feet are restrained.

When required, concrete blocking shall be install per the Standard Details.

7. Locating Wire

Locating (tracer) wire shall be installed on all HDPE pressure sewers, forcemains and services.

8. Electrical Continuity in Ductile Iron Pipe

   Provisions shall be made to insure electrical continuity between all joints, fittings, and valves. Two serrated brass wedges shall be inserted for 3 inch to 12 inch push-on joints on ductile iron pipe or cable bond may be used. Four wedges per joint shall be used for larger pipe. Continuity for mechanical joints may be provided using copper clips inserted in the gasket by the manufacturer, armored tipped gaskets, copper strap, or cable bond. Megalug joint restraints shall not be used for electrical continuity.

9. Connection and Assembly of Joints

   a. General

      Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

      Immediately before making the connection, the inside of the bell or socket and the outer surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Insertion of spigot ends into the socket or bell ends shall be accomplished in a manner that will assure proper centering and insertion to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

      No open ends of water main pipe will be allowed for more than one hour on any pipe section. Caps shall be mechanically attached to the end of the pipe. Taping and bagging the end of the pipe will not be allowed.

   b. Push-On Joints

      The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the ball socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment. Spigot ends which do not have depth marks shall be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot edge to resemble the manufacturer's fabricated detailing.

c. Mechanical Joints

The last eight inches of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution after being thoroughly cleaned. The gland shall then be slipped on the spigot end with the lip extension toward the socket or bell end. The rubber gasket shall be painted with soap solution and be placed on the spigot end with the thick edge toward the gland. An approved lubricant provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 45 to 60 for 5/8" bolts; 75 to 90 for 3/4" bolts; 100 to 120 for 1" bolts, and 120 to 150 for 1-1/4" bolts.

d. Qualifications for Joining HDPE Sewer Pipe

Before being permitted to make joints on the HDPE water main pipe, all joiners shall be qualified and successfully complete a qualification test as required in accordance with Qualifications for Joining PE Pipe, of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

e. Fusion Joining of HDPE Sewer Pipe

All HDPE water main pipe and fittings shall be joined by butt fusion or electrofusion procedures as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. Water branch or tap service pipe of any diameter shall be joined by butt fusion.

10. Pipe Support Spacing

Contractor shall provide pipe supports as necessary to adequately support exposed piping. At a minimum, one support shall be provided for every 4 feet of PVC pipe installed or for every 10 feet of steel or ductile pipe installed, at each direction change and at each valve.

11. Pressure Gauge Installation

Pressure gauges shall be installed on each City-owned pump discharge within the valve vault or as shown on the Contract Drawings. Provide an isolation ball valve

at each installation to allow for gauge removal.

12. Pressure Sewer Service Installation

Pressure sewer service facilities consisting of 1 ¼ service lines, complete with all required appurtenances, shall be installed as required by the Contract, in accordance with all pertinent requirements for main line installations together with the provisions hereof.

It shall be the responsibility of the Contractor to keep work exposed so the Engineer may obtain an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings.

Pressure sewer service lines shall normally be installed by trenching or directional drilling and be subject to the same requirements as prescribed for the main pipeline installation, except for those which may not be pertinent or applicable. Where water service lines are installed alongside of pressure sewer services, installation shall be such as to maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances.

Unless otherwise specified, installation of pressure sewer service lines shall be such as to provide for not less than seven feet of cover over the top of the pipe and for not less than 18 inches of clearance between pipelines. Also, at least three inches of clearance shall be maintained in crossing over or under other structures except that 12-inches shall be maintained when crossing water mains. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the pipe shall be insulated as directed by the Engineer.

HDPE pressure sewer service piping shall be installed in one piece without intermediate butt fusion or electrofusion joint couplings between the tapping tee with electrofusion saddle at the pressure sewer and the curb stop. Transition couplings shall be used to connect to the curb stop.

Connection of HDPE pressure sewer service lines to the pressure sewer shall be made with an approved tapping tee with electrofusion saddle on HDPE mains.

Unless otherwise indicated, service lines shall be installed on a straight line at right angles to the pressure sewer or property lines as directed by the Engineer. Service lines shall extend for such distance beyond the curb stop as may be specified in the Contract. In the absence of specific requirements, the service line shall be terminated at the curb stop, where it shall be connected to an existing

line or, in the case of undeveloped property, capped or plugged, as approved by the Engineer.

The service pipe and curb stop coupling depth shall be such as to maintain not less than the specified minimum cover and provide for a standard service box installation where practicable. Curb stop shall be set on a concrete block. The service box shall be threaded over the curb stop coupling. Service boxes shall be installed plumb and be braced effectively to remain vertical during and after completion of backfilling. The service boxes shall be brought to existing surface grade when the final grade has not been established. When the final grade has been established, the Contractor shall extend the service box to finished grade.

13. Furnish and Install Gate Valve and Box

This work shall consist of furnishing and installing a gate valve and valve box in accordance with the applicable MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth as detailed in the Plan, and the following: Prior to installation, the valve shall be cleaned of all foreign matter.

Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular.

14. Testing Pressure Sewer and Forcemain and Service

Pressure sewer and forcemains shall be subjected to the pressure and leakage tests prescribed herein and in conformance with the pipe manufacturer's recommendations. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct observation of the Engineer.

The Contractor may test each valved section, larger sections, or the entire pressure sewer or forcemain so long as the elevation differential between the highest and lowest point does not exceed 110 feet.

All air must be expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner.

For ductile iron mains, pressure shall be maintained for a minimum duration of 2 hours. No drop in pressure will be allowed for acceptance of the main. Any defective joints, pipe, fittings, or valves revealed during the testing, or before final acceptance of the work, shall be satisfactorily corrected and the test shall be repeated until the specified requirement has been met.

For flanged pipe, no visible leakage shall be allowed during the test.

For HDPE mains, a monitored makeup water test will be used. This will consist of the initial expansion and test phases. During the expansion phase the main is pressurized to 150 psi and then enough clean water is added each hour for three hours to return to 150 psi. The test phase follows immediately. Using the values in the table below, the engineer will determine the amount of make up water allowed during a 2 hour test period. If less water is used than allowed, the test will pass. Air pressure will not be allowed for testing.

2 Hour HDPE Pressure Test Make Up Water Amount	
Nominal Pipe Size (inches)	**Make-up Water Allowance for 2 hour test (gallons per 100 feet of pipe)**
1 ¼	0.10
1 ½	0.10
2	0.11
3	0.15
4	0.25
5	0.38
6	0.6
8	1.0
10	1.3
12	2.3
14	2.8
16	3.3
18	4.3
20	5.5
22	7.0
24	8.9
26	10.0
28	11.1
30	12.7
32	14.3
34	16.2
36	18.0
42	23.1
48	27.0
54	31.4

The connection of pressure sewer services to HDPE pressure sewers with an electrofusion corp saddle and corporation stop or a tapping tee with electrofusion

saddle shall be soap tested and tested with air and accepted if it maintains 100 psig for 5 minutes. Accepted electrofusion corp saddle or tapping tee with electrofusion saddle can then be tapped to the main and the tap or punch tee cap reinstalled. Pressure sewer pipes shall be pressure tested either jointly or separately from pressure sewer main testing. Test pressure shall be 150 psi.

15. Testing Tracer Wire Continuity
    Test tracer wire continuity after installation of pipe.

C. Method of Measurement
All items will be measured separately according to the Pay Item name and as detailed and defined in the Contract Drawings, Specifications, standard details or Special Provisions. Pipe will generally be designated by size (nominal diameter), strength class, kind or type, and laying conditions. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Items.

1. Pressure Sewer, Pressure Sewer Service or Forcemain
   Mainline pipe and service pipe of each kind and size will be measured separately per linear foot by the overall length along the axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves, intersecting centers of tee or wye branch service connections, and center of main to center of curb stop. Linear measurement of piping will include the running length of any special fitting (tees, wyes, bends, gates, etc.) installed within the line of measure between specified terminal points. No additional measurement will be made for extra pipe installed due to extra depth required for direction drilling applications.

2. Valves
   Valves of each size and type will be measured separately per each as complete units, including the required valve box setting.

3. HDPE Tapping Tee with Electrofusion Saddle
   HDPE tapping tee and electrofusion corp saddle of each size and type will be measured separately per each by the number of complete units installed.

4. HDPE Service Tees
   This work shall consist of furnishing and installing service tees in the Pressure Sewer Pipe in accordance with the applicable provisions of MN/DOT 2503.

   Measurement will be made by the number of each size tee furnished and installed as specified.

Payment for tee of each size will be made under item 2503.602 at the Contract price per each, which shall be compensation in full for all costs of furnishing and installing the tee complete in place as specified.

5. Tracer Boxes
   Tracer Boxes of each type will be measured separately per each by the number of complete units installed.

6. Air Vents
   Air vents of each type and size will be measured separately per each by the number of complete units installed, including the required manhole or valve box setting.

7. Access Structures
   Access structures, such as Manholes and Vaults, will be measured for payment separately per each, except when included as a component part of an air vent. When applicable, measurement will be by the number of complete individual units installed of each type and design, including the required manhole or vault castings, and covers.

8. Pressure Sewer and Forcemain Fittings
   All fittings for pressure sewer and forcemain installations shall be incidental to pipe installation and no measurement shall be made.

D. Basis of Payment
Payment for Pressure Sewer and Forcemain of each size and kind at the appropriate Contract prices per linear foot of installation, shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified, including all costs of pipe installation as may not be specifically covered under other Contract Items. All costs of pipeline leakage testing, pipe jointing materials, dead facilities, blocking and anchorage materials, and other work necessary for installation of pipe as specified shall be included for payment as part of the pipe item, without any direct compensation being made thereafter.

Payment will be made under Item 2503.603 (size) DIP Forcemain at the contract bid price per linear foot which shall be compensation in full for all costs of furnishing and installing ductile iron forcemain between the locations shown on the Contract Drawings, including all materials, labor, equipment, ductile iron forcemain pipe, appurtenances, zinc anode caps, testing and incidentals.

Payment will be made under Item 2503.603 (size) HDPE Pressure Sewer or Forcemain SDR 11 at the contract bid price per linear foot which shall be compensation in full for all costs of furnishing and installing HDPE pressure sewer or force main between the locations shown on the Contract Drawings, including all materials, labor, equipment,

HDPE pressure sewer or forcemain pipe and fittings, appurtenances, HDPE by MJ adapters, HDPE to cast iron transition couplings, zinc anode caps, locating wire, testing and incidentals. All costs of furnishing and installing electrofusion flex restraints and concrete collars on the HDPE pressure sewer or forcemain shall be considered incidental to the main. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Payment will be made under Item 2503.603 (size) HDPE SDR 11 Pressure Sewer Service Pipe at the Contract bid price per foot, which shall be compensation in full for all labor and equipment necessary to complete the work as described herein including the tracer wire for HDPE pressure sewer service pipe. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Payment will be made under Item 2503.602 (size) Tapping Tee with Electrofusion Saddle at the Contract bid price per each, which shall be compensation in full for all material, labor and equipment necessary to complete the work as described herein including tapping the pressure sewer, furnishing and installing the connection fitting on the main and butt fusing the HDPE pressure sewer service pipe to the tapping tee with electrofusion saddle.

Payment will be made under Item 2503.602 (size) Pressure Sewer Curb Stop and Box at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to install the curb box and furnish and install the curb stop and any transition fittings necessary to connect new HDPE pressure sewer service pipe to the curb stop.

Payment will be made under Item 2504.602 (size) Gate Valve and Box at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto to furnish and install the gate valve and valve box complete and in place, including but not limited to the gate valve and valve box, blocking, MJ to HDPE adapters, zinc anode caps and crushed stone. No additional payment will be made for valves installed where new mains are deeper than the minimum depth.

2503/2504 LOCATING WIRE FOR WATER AND SANITARY SEWER

Locating wire shall be installed on all HDPE and PVC water and sanitary sewer mains and services. Refer to natural gas specifications for locating wire requirements for natural gas installations.

A. Locating Wire for Open Cut installations

Locating (tracer) wire shall be #12 solid copper with "HMWPE" 30 mil insulation. Insulation for sanitary sewer applications shall be green. Insulation for water main installations shall be blue. To minimize splices, wire shall be supplied on spools of not less than 500 feet.

B. Locating Wire for Directional Drilled Installations.
Locating wire shall annealed 49-strand braided 302 alloy stainless steel. The conductors shall be insulated with 45 mil high-density polyethylene (HDPE) jacketing. Insulation for sanitary sewer applications shall be green. Insulation for water main installations shall be blue. The wire shall be tested in accordance with ASTM B-1 and D-1248 and spark tested at 7500 VAC. The breaking strength of the wire shall be at least 1150 pounds; wire that has less than this breaking strength shall be accepted. To minimize splices, wire shall be supplied on spools of not less than 500 feet.

C. Locating Wire Splices
Tracer wire shall remain continuous to the greatest extent possible. Splices in the copper tracer wire should be made with solder, split bolt type connectors or other type approved by the engineer. Splices in the stainless steel tracer wire should be made with split bolt type connectors or other type approved by the engineer. Wire nuts or clip type connectors shall not be used. All connections shall be protected to make them watertight. Waterproofing material shall be 3M 2200 or equal.

D. Locating (Tracer) Boxes
Locating Boxes for sewer applications in turfed areas shall be the Snake Pit Lite Duty Box Model LD14GTP for installations in turf, the Snake Pit Roadway Box Model RB14GTP in bituminous pavements or the Snake Pit Concrete/Driveway Box Model CD14GTP in concrete pavement or sidewalk or an approved equal.

Locating Boxes for water applications shall be the Snake Pit Lite Duty Box Model LD14BTP in turf, the Snake Pit Roadway Box Model RB14BTP in bituminous pavements or the Snake Pit Concrete/Driveway Box Model CD14BTP in concrete pavement or an approved equal.

The tracer box shall have a green cast iron cover for sewer or a blue cast iron cover for water and direct connection hook-up for a locator transmitter.

The Contractor may also use Snake Pit Style boxes with an adjustable top as an acceptable equal. All other substitutions must be approved by the City prior to bidding.

E. Installation Requirements
The locating wire for sewer and water shall be brought to the ground surface at locations shown on the Standard Details, Contract Drawings or the Special Provisions through a locating box. The wire shall be connected to the tracer box terminal.

Locating wire installed on new services on existing mains where no locating wire is currently present shall be connected to a minimum 1 pound magnesium anode installed at the main. Anodes shall also be installed at all dead ends on tracer wire.

The locating wire shall be laid directly over the utility. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length.

F. Measurement and Payment

All locating wire installed shall be tested for continuity at the completion of the installation. No payment shall be made for pipe with a tracer wire that has not passed the continuity test.

Tracer wire and boxes shall be supplied by the Contractor. There shall be no measurement or payment for tracer wire. The cost of furnishing and placing locating wire shall be considered incidental to the utility.

Payment will be made under Item 2503.602 or 2504.602 (type) Tracer Box at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box where specified in the Standard Details, Contract Drawings or Special Provisions.

2503 CURED-IN-PLACE PIPE LINING

Furnish all labor, materials, equipment, and incidentals required to install and test cured-in-place (CIPP) pipe lining and appurtenances complete as shown on the Drawings and as specified herein. Cured-in-place pipe lining is an acceptable procedure for lining the sewers where specified on the Drawings.

A. Definition

Cured-in-place pipe lining is a trenchless rehabilitation method for buried pipelines, typically used to rehabilitate cracked, leaking, and deteriorating sewers.

B. System Description

Cured-in-place pipelining is typically installed in an inversion-type process that is inserted into the existing pipe at a manhole. The lining is a resin-impregnated flexible felt tube that is inserted into an existing pipe utilizing a vertical standpipe and hydrostatic head. The standpipe is erected with scaffolding over the manhole.
During the inversion process, the lining material is turned inside out so the tough, but smooth polyurethane side becomes the interior surface of the new pipe. Hydrostatic head is used to insert the liner and provide a continuous tight fitting liner after the cure process is complete.

C. Submittals

1. Product Data
   a. Shop drawings of all cured-in-place pipe lining (CIPP) materials including resin, felt, and catalysts.

b. Engineering calculations specifying the design and required thickness for each installation that are signed and sealed by a Registered Professional Engineer.
c. Prior to mobilization, submit a table of all inside diameter measurements of all sewers scheduled to be lined.
d. Detailed wet-out, storage, shipping, and installation procedures.
e. Certified test reports that the CIPP for this Contract was manufactured and tested in accordance with all ASTM Standards specified and referenced herein.
f. Lining production schedule with locations, lengths and sizes.

2. The Contractor shall submit the following information to the Engineer for review and approval before any CIPP lining work is performed:
   a. The number of years of experience installing CIPP lining.
   b. The name of the CIPP lining manufacturer and supplier for this work and previous work listed below.
   c. The Contractor shall submit a certified statement from the manufacturer that he/she is a certified and/or licensed installer of the CIPP lining.
   d. A list of municipal clients that the Contractor has performed this type of work for, including names, phone numbers, linear footage, and a description of the actual work performed. Provide a sufficient number of references to total 20,000 feet or more of lining work to date.
   e. A list of all completed CIPP projects within the past three years.
3. Equipment and Construction Procedures
4. Certificates of Compliance
5. Reference Standards
   a. American Society for Testing and Materials (ASTM)
      ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials
      ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
      ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
   b. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

D. Qualifications of the Cured-in-Place Pipe Lining Contractor
   1. The Contractor performing the CIPP lining work shall be fully qualified, experienced, and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by the CIPP manufacturer. There shall be no exceptions to these requirements.
      a. The Contractor shall have successfully installed a minimum of 20,000 feet of the proposed liner as documented by verifiable references.
      b. The proposed Superintendent shall have successfully installed a minimum of 10,000 feet of the proposed liner as supported by Owner references.

2. The Contractor shall also be capable of providing crews as needed to complete the work without undue delay and shall begin work within 10 days from the authorized Notice to Proceed.
3. The Owner shall approve or disapprove the Contractor and/or manufacturer based on the submitted information and a follow up interview.
4. Submit references for any subcontractor that may be used on site.

E Delivery, Storage, and Handling

1. Care shall be taken in shipping, handling, and storage to avoid damaging the liner. Extra care shall be taken during cold weather construction. Any liner damaged in shipment shall be replaced as directed by the Engineer.
2. Any liner showing a split or tear, or which has received a blow that may have caused damage, even though damage may not be visible, shall be marked as rejected and removed at once from the job site.
3. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. The liner shall be protected from UV light prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the site immediately.

F. Guarantee

1. All CIPP lining placed shall be guaranteed by the Contractor and manufacturer for a period of one year from the date of final acceptance. During this period, all serious defects discovered in the CIPP lining, as determined by the Owner's Engineer, shall be removed and replaced in a satisfactory manner by the Contractor at no cost to the Owner. The Owner may conduct an independent television inspection, at his own expense, of the lining work prior to the completion of the one year guarantee period.

G. Quality Assurance

1. All liner to be installed under this Contract may be inspected at the plant for compliance with this Section by the Engineer or an independent testing laboratory provided by the Owner at his own expense. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection will be the responsibility of the Owner.
2. Inspection of the liner may also be made by the Engineer or other representative of the Owner after delivery. The liner shall be subject to rejection at any time on account of failure to meet any of the requirements specified, even though sample liner may have been accepted as satisfactory at the place of manufacture. Liner rejected after delivery shall be marked for identification and shall be removed from the job site at once.

H. Safety

1. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.
2. The Contractor shall also perform all of the Work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and working with steam or hot water.
3. The Contractor shall provide traffic control meeting MUTCD standards.
4. The safety of pedestrians and the traveling public is the Contractor's responsibility.

I. Materials

1. CIPP Lining
   a. CIPP lining shall be Insituform by Insituform Technologies, Inc., Inliner by Inliner USA, Inc., National Liner by National Envirotech, Inc., or Engineer approved equal.
   b. The liner shall be composed of tubing material consisting of one or more layers of a flexible non-woven polyester complying with ASTM F-1216, Section 5.1. The felt tubing shall be impregnated with a thermosetting polyester resin complying with ASTM F-1216, Section 5.2 and catalyst, vinyl ester and catalyst or epoxy resin and hardener. The liner material and resin shall be completely compatible. The outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric.
   c. Design Criteria - The following design parameter values shall be based upon the following physical condition of the existing pipe to be rehabilitated.
      - Pipe Deterioration: All sections of the pipe shall be considered Fully Deteriorated.
      - Soil Parameters: Soil density, 120 lbs/cu.ft.; soil modules, 700 psi
      - Live Loads: All pipes beneath roadways shall be assumed to carry HS 20 live loads.
      - Ovality: The existing pipe shall be assumed to have an ovality of 2 percent.
      - A factor of safety of 2.0 shall be used.
      - Groundwater: At the surface.
      - Soil Depth: Depth of cover will be determined by field measurements.
      - Short Term Flexural Modulus: 250,000 psi.
      - Design Life: 50 years
   d. The liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline.
   e. The liner shall be able to cure in the presence of water at a temperature of 180 degrees F or less.

f. When inverted and cured, the liner shall form a continuous, tight fitting, hard, impermeable liner that is resistant to chemicals found in domestic sewage.
g. The liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to the sewer pipe to be lined.
h. The liner shall be fabricated to a size that will tightly fit the sewer being rehabilitated after being installed and cured. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing the liner. All dimensions shall be field verified by the Contractor prior to installation of the liner. Field measurements shall be used to ensure maximum closure between the new liner and the existing sewer pipe.
i. The application of the resin to the felt tubing (wet-out) shall be conducted under factory conditions and the materials shall be fully protected against UV light, excessive heat and contamination at all times.
j. The length of the liner shall be the length deemed necessary by the Contractor to effectively carry out the insertion of the liner and sealing of the liner at the outlet and inlet manholes. The required length of liner shall be verified in the field by the Contractor prior to fabrication.
k. The CIPP liner shall be watertight.
l. The cured liner shall have the following minimum structural properties:

Property (psi)	Test Method	Minimum Standard (psi)
Flexural Strength	ASTM D790	4,500
Flexural Modulus	ASTM D790	250,000
Tensile Strength		3,000

J. Preparation
1. Clean each length of pipe to be lined and dispose of any resulting material.
2. The Contractor shall conduct a color VHS videotape television inspection of each length of pipe after it is cleaned for the purpose of determining if existing conditions are suitable for the installation of the proposed lining process and to document the location of all service lateral connections and confirm point repair locations. Submit video tapes and logs to Engineer for review and approval prior to proceeding with liner installation.
3. Contractor shall dye test all service connections prior to lining to determine all active service connections and shall plug inactive service connections.
4. All service connections protruding 1-inch or more into the sewer to be lined shall be internally cut or ground down with a robotic cutter so as to be flush with the pipe to be lined prior to liner installation. The robotic cutter shall be monitored by closed circuit television equipment to verify proper cutting and shall be capable of cutting VCP, PVC, DIP, or CIP pipe. Equipment specifically designed for cutting roots from sewers (such as a chain cutter) shall not be allowed. The cost of this work shall be included in the unit cost of the liner installation.

5. The Contractor shall provide bypass pumping of sewage flows where the pipe rehabilitation work is being performed.
6. The Contractor shall notify all property owners who discharge sewage directly into the sewer to be lined that their sewage service will be interrupted and discontinued while the liner is being installed, cured, and active service connections re-opened. The Contractor shall notify each affected property owner at least 24 hours in advance of commencement of the work, giving the date, start time and estimated completion time for the work being performed.
7. Furnish and install the liner in the full length of sewer as shown on the Drawings. The installation of the liner shall be in complete accordance with the applicable provisions herein and the manufacturers' installation requirements and a representative of the manufacturer shall be present during the actual installation of at least 2,000 feet at the start of the work.
8. If, in the opinion of the CIPP liner manufacturer, the rate of infiltration in the sewer segment is high enough to risk washout of the resin, then the contractor shall perform measures, as required, to minimize the infiltration prior to pipe lining.

K. Installing CIPP

1. Inversion Using Hydrostatic Head

   The resin impregnated tube shall be inserted through an existing manhole by means of an inversion ring or standpipe, capable of applying the hydrostatic head required to fully extend the tube to the next designated manhole or termination point. The tube shall be inserted into the inversion standpipe and the tube shall be turned inside out and attached to the standpipe so that a watertight connection is made. The inversion head shall be adjusted to a sufficient height to invert the tube from the starting manhole to the ending manhole and to hold it tight against the existing pipe wall, producing dimples at side connections and flared ends at the manholes. Care shall be taken not to overstress the felt tube at the elevated curing temperatures, which may cause damage or failure prior to cure.

L. Curing

After the inversion process is completed, the Contractor shall supply a suitable heat source of water and steam throughout the section to uniformly raise the water temperature above the temperature to affect a cure of the resin. The heat source shall be fitted with suitable monitors to gauge temperature of the incoming and outgoing water supply. Another gauge shall be placed between the layers of the impregnated felt tube in the upstream, downstream, and intermediate manholes to determine the temperature during curing. Water temperature in the line during the curing period shall not be less than 140°F or more than 200°F as measured at the heat source return line. Initial cure may be considered complete when the remote sensing device indicates the temperatures and curing time to be adequate, as

recommended by the resin/catalyst system manufacturer. The contractor shall maintain a log of the temperature at each sensor during the entire curing process.

A HOT WATER CURE MUST BE USED FOR ALL PIPES GREATER THAN TEN (10) INCHES.

M. Cooling Time

1. Cooling Down
   The Contractor shall cool the hardened cured-in-place-pipe to a temperature below 100°F before relieving the water column. Cool water may be added to the water column while draining hot water from a small hole at the end of the cured-in-place-pipe so that a constant water column height is maintained until cool down is completed. Careful attention should be taken not to cool too quickly to eliminate the possibility of thermoshock. Care should be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed liner.

N. Sealing and Cutting of Lining at Manhole

1. Contractor may line multiple sewer segments at one time where possible as determined by the Contractor. Where this is done, the top one-half of the liner in the intermediate manhole shall be neatly removed, and the void behind the liner shall be filled with non-shrink grout. The channel in the manhole shall be a smooth continuation of the pipe (s) and shall be merged with other lines or channels, if any. Channel cross section shall be U-shaped and sides of channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel.
2. All cutting and sealing of the liner at manhole connections shall provide watertight pipe and manhole seals with the use of a quick set cement grout or approved equal.
3. CIPP and the existing pipe must be sealed as indicated above before proceeding on to the next manhole section, and all manholes shall be individually inspected for liner cut-offs, benches, and sealing works.

O. Service Connections

1. Reopen all of the existing active service connections in each length of sewer following reformation and cooling of the liner. The exact number and location of service connections shall be determined from the CCTV tapes of the dye testing. It shall be the Contractor's responsibility to accurately field locate all existing action service connections. The service connections shall be reopened from inside the sewer by means of a television camera controlled cutting device appropriate for the liner material and the rehabilitated sewer pipe. All openings

shall be clean, smooth and neatly cut and shall be flush with the lateral pipe. The bottom of the openings shall be flush with the bottom of the lateral pipe to remove any lip that could catch debris. Openings shall be at least 75 percent of the service lateral pipe if the lateral is to be replaced and at least 95 percent if the lateral is only to be reinstated. All of the liner penetrations or openings shall be watertight. If a cleanout is already available, a mini-camera from the cleanout shall be used to assist the operator with trimming. All service cut-out coupons shall be collected at the nearest downstream manhole.

P. Quality Control

1. For every 1,000 feet of liner installed, remove specimens of at least 18 inches in length for testing of thickness and flexural properties specified above. The Contractor shall collect the samples using a section of PVC pipe or other device approved by Engineer. The number of tests required may be reduced as approved by the Engineer after sufficient tests are performed to verify the CIPP design, production and installation procedures. Likewise, the frequency of tests may be increased by the Engineer and performed by the Contractor at no additional cost to the Owner when the required tests show that the installed lining does not meet the specifications. The specimens shall be cut from a section of installed and reformed line at an intermediate point or the termination point of the installation. All testing shall be paid for by the Contractor and shall be performed by an independent testing laboratory. Results of the tests for each liner shall be submitted within 30 days after the liner is installed.
2. For every segment of liner installed, the Contractor shall generate a report that documents installation, including date, time, temperature, curing temperature, curing time, etc. The reports shall be submitted to the Engineer prior to requesting payment.
3. Following installation of the linter and re-opening of the service connections and replacement and re-connection of laterals to the liner, Contractor shall conduct a final video-taped color television inspection of the completed work. Copies of these tapes and the videotapes made prior to the liner installation shall be submitted to the Engineer for approval and shall be retained by the Owner. The Contractor shall submit two tapes: one copy of the post installation immediately after the installation of the liner and a second tape that includes tapes of all of the installations for the project after installation of the new service laterals.

   The contractor shall submit tapes a minimum of 10 days in advance of any payment request to provide the Engineer ample time to review the tapes. There shall be no dry spots, lifts, wrinkles, ridges, splits, cracks, delaminations or other type defects in the CIPP lining. Defective lining will be removed and pipe re-lined at no additional cost to the Owner. If during the removal process, the pipe is damaged, Contractor will perform a point repair at Contractor's own expense.
4. Groundwater infiltration of the liner shall be zero.

5. All service connections shall be open, clear and watertight.
6. The Contractor is required to maintain the work site in a neat and orderly condition throughout the period of work and after completing the work at each site, remove debris, surplus material and temporary structures erected by the Contractor.
7. All work areas shall be restored to their original condition.
8. Acceptance of CIPP lining shall be based on the Engineer's evaluation of the installation and curing data, results of air testing where required, review of the certified test data of the installed liner, and review of the TV videotapes and manhole inspections.

Q. Measurement and Payment

1. All costs of furnishing and installing cured-in-place pipe of the respective diameter, including television inspection and taping, cleaning, testing, bypass pumping, connections to existing manholes/structures and all other Work required to complete the items shall be paid for at the contract unit price per linear foot of pipeline actually required and installed, measured along the centerline of the pipeline from center to center of all manholes or to the inside wall of structures as CIPP (size) Main Lining.
2. All costs of furnishing and completing the remote cutting and reconnection of the sanitary service lines into the main sewer line, including the use of the remote television camera and remote cutting tool and all work required to complete the item shall be paid for at the contract unit price each connection actually required to be cut and reinstalled as Remote Cut and Reconnect Sanitary Service.

2504 WATER MAIN AND SERVICE LINE INSTALLATION

This work shall consist of the construction of water main and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of potable water. The work includes the relocation or adjustment of existing facilities as may be specified in the Contract.

Service installations will be designed as either Branch Service or Tap Service in accordance with the standards set forth herein.

Tap Service installations shall include all water service lines smaller than three inches nominal diameter pipe. The component parts of a tap service installation shall include a corporation stop, complete with water main tap and saddle where required; a curb stop complete with service box; and piping extending from the corporation stop to the curb stop. Three fourths (3/4) inch tap service lines shall be installed as the minimum standard wherever another size is not specified in the Contract.

Branch Service installations shall include all water service lines of three inches nominal diameter pipe and larger. The component parts of a branch service installation shall

include a tapping sleeve and valve or a branch 3-way tee and gate valve complete with valve box, and ductile iron piping extending from the water main connection to the limits specified and established by the Engineer.

All references to Specifications of MN/DOT, AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition or supplement available on the date of advertisement for bids.

A. Materials

1. General Requirements

   All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract. Unless otherwise indicated, all required material shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Drawings or Specifications.

   All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Drawings. Otherwise, the City may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

   All pipe furnished for water main and branch line installations shall be of the type, kind, size and class indicated for each particular line segment as shown on the Contract Drawings and designated in the Contract Items. Wherever connection of dissimilar materials or designs is required, the method of joining and any special fittings employed shall be subject to approval of the Engineer.

2. Ductile Iron Pipe

   Ductile Iron Pipe shall conform to the latest requirements of ANSI A-21.51. In addition, the pipe shall comply with the following supplementary provisions:

   a. All pipe shall be furnished with cement mortar lining meeting the latest requirements of ANSI A-21.4 for standard thickness lining. All interior and exterior surfaces of the pipe shall have an asphaltic coating at least one mil thick.
   b. All pipe shall be furnished with push-on type joints conforming to ANSI A-21.11.
   c. All pipe shall be furnished in 18 or 20-foot nominal lengths.
   d. Minimum ANSI thickness class furnished shall be Class 52 for all pipe through 16" pipe. For pipes larger than 16" the appropriate class shall be called out in the Special Provisions.

e. Pipe shall be provided with provisions to maintain electrical continuity for thawing purposes, except for 16" and larger pipe, which need not comply.
f. A Certificate of Compliance shall be furnished stating that the materials furnished have been tested and are in compliance with the requirements of this Specification.

3. Ductile Iron Fittings

Fittings shall conform to the latest requirements of ANSI A-21.10 (Gray Iron and Ductile Iron Fittings), or ANSI A-21.53 (Ductile Iron Compact Fittings), all with ductile iron glands and cement lining.

a. Buried fittings shall be mechanical joint with rubber gaskets.
b. Exposed fittings shall be flanged conforming to ANSI B16.1, Class 125 and have full face gaskets.
c. Exposed fittings shall be shop primed for painting.
d. Fittings shall be provided with provisions to maintain electrical continuity.
e. Fittings shall be manufactured in North America or preapproved by the Engineer.
f. Mechanical joint bolts shall be as specified elsewhere in this section.

4. Steel Pipe and Fittings

Steel Pipe shall conform to the requirements of AWWA C202. The grade of steel used in making the pipe and fittings shall be Grade B as covered in AWWA C201 and C202. Joints shall be as specified on the contact drawings or in special provisions. Pipe coating interior and exterior shall conform to AWWA C203. Scotchkote 202 (3M) or approved equal is also acceptable.

Fittings shall meet the same coating requirements and conform to AWWA C207 and C208. Steel weld flanges shall be installed on the pipe for connecting to valves and flanged appurtenances.

5. HDPE Pipe and Fittings

a. Water main and service pipe 4 inches and greater shall be polyethylene pipe conforming to ASTM 3035 and AWWA C906-99, Polyethylene (PE) Pressure Pipe and Fittings, 4" through 63", for Water Distribution. Pipe furnished shall be approved for potable water and marked to indicate so with a continuous blue stripe. Pipe and fittings shall be PE4710, HDPE Pressure Class 200, SDR 11, and have outside diameters similar to ANSI A-21.51 ductile iron pipe. Joints and fittings shall be butt heat fusion type, ASTM D3261. Ends shall be plain for butt fusion joining as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. Molded fittings shall be used for all applications where a molded fitting is available including all 45 and 90 degree elbows and tees in sizes 4 through 12 inch. If a molded fitting

is not available, fabricated fittings may be used. The City reserves the right to reject any fabricated fittings made with poor quality workmanship or of questionable pressure rating. All fabricated fittings shall be made from HDPE rated at SDR 9 minimum. All fittings shall be rated for 200 psi.

b. Water main and service pipe less than 4-inch shall be polyethylene pipe conforming to the requirements of AWWA C901, current edition, "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), For Water Service" and ASTM D2239 or D3035. Pipe and fittings shall be PE4710, DR 11, shall have a minimum working pressure of 200 psi at 73 deg. F. and have outside diameters similar to iron pipe size. Joints and fittings shall be butt heat fusion type, ASTM D3261. Ends shall be plain for butt fusion joining as specified the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. All fittings shall be molded polyethylene fused-type suitable for use on iron pipe size (IPS) HDPE pipe.
c. Couplings used for water mains and branch services shall be electrofusion type. Couplings used for tap services may be electrofusion or socket type.
d. Pipe shall be new or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage.
e. The DR number and pressure rating specified above shall be considered a minimum. Provide stronger class pipe if required by loads imposed by directional drilling pulling operation.
f. Shop drawings for HDPE pipe must specify minimum allowable pipe deflection radius.
g. Reference Standards - American Society for Testing and Materials (ASTM)
   ASTM D638 – Tensile Method for Tensile Properties of Plastics
   ASTM D790 – Test Materials for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   ASTM D3035 – Polyethylene (PE) Plastic Pipe (DR-PE) Based on Controlled Outside Diameter
   ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
   ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material
   ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

6. HDPE Transition Couplings and Adapters
   a. The HDPE by MJ Adapters shall be manufactured by Central Plastics Company or equal. The adapter shall comply with AWWA C906 and be manufactured for use on pipe conforming to ASTM D2513, D3035 and F-714. The adapter shall be molded from a PPI and NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a cell

classification of 34F464C and be compatible for heat fusion with any pipe manufactured from a like or similar resin. Adapters shall be tested according to ASTM D1599 and ASTM D1598. HDPE Adapters shall be sized for use with ductile iron pipe size HDPE pipe. Adapters shall be used for all transitions from HDPE to valves, hydrants or ductile iron pipe. Adapters for use with butterfly valves shall be designed not to interfere with valve operation.

b. The HDPE to cast iron transition couplings shall be furnished and installed from new HDPE pipe to existing cast iron pipe. The transition couplings shall be Smith Blair model 441 or equal. HDPE pipe stiffeners shall also be provided and installed to prevent compression of the HDPE pipe. Pipe stiffeners shall be Smith Blair or equal. Stiffeners shall be designed to prevent over insertion. This transition coupling shall only be used where approved by the engineer.

c. Transition couplings 2-inch and smaller shall consist of HDPE by flared brass connections or threaded stainless steel connections. Stainless steel transitions shall include a compression ring with o-ring seal and shall be used with an adapter from threaded to flare. Adapters shall have a pressure rating equal to that of the mating pipe. HDPE shall be plain end for butt fusing. Coupling shall be manufactured by Poly-Cam, Central Plastics, Inc. or equal.

d. Mechanical joint bolts shall be as specified elsewhere in this section.

7. Transition Couplings

a. Cast Transition Couplings – 4" through 12"

Cast transition couplings shall be furnished with ductile iron sleeves, ductile iron followers and stainless steel bolts. Gaskets shall be natural or synthetic vulcanized rubber recommended for water system use. The finish shall be fusion bonded epoxy meeting ASTM C213. Couplings shall have a size range to connect cast iron to cast iron or cast to ductile iron, or ductile iron to ductile iron as necessary for the application. Estimated pipe outside diameters are shown in the table below. Latter dimension is maximum for pit cast end requirement. Contractor shall verify all pipe dimensions prior to ordering couplings. All couplings shall be rated for 250 psi minimum.

4"	4.80" to 5.10"
6"	6.90" to 7.20"
8"	9.05" to 9.45"
10"	11.10" to 11.50"
12"	13.20" to 13.50"

Couplings shall be Smith Blair 441, JCM 210, Ford FC1 or approved equal.

b. Cast Transition Couplings – 16"
Cast transition couplings (16" size) shall meet the above requirements. Estimated pipe diameters for transition are 17.40" cast or ductile iron pipe to 17.80" cast iron pipe. Contractor shall verify all pipe dimensions prior to ordering couplings. Minimum working pressure shall be 150 psi. Couplings shall be Smith Blair 441 or Ford FC2 or approved equal.

c. Steel Transition Couplings
Steel transition couplings (18" CI through 48" CI) shall be rated for 150 PSI working pressure. Components shall consist of a steel sleeve and follower coated with 12 mils of 3M epoxy #206N. Bolts shall be stainless steel. Gasket shall be Grade 30 rubber. The couplings shall be designed to connect ductile iron pipes to old cast iron pipes, sizes as follows:

Nominal Pipe Size	Ductile Iron O.D.	Cast Iron O.D. (Range)
18"	19.50" to	19.50" – 19.92"
20"	21.60" to	21.60" – 22.06"
24"	25.80" to	25.80" – 26.32"
36"	38.30" to	37.96" – 38.70"
42"	44.50" to	44.20" – 44.50"
48"	50.80" to	50.50" – 50.80"

More than one gasket shall be furnished if necessary to allow connection over the entire cast iron O.D. range. If the gaskets furnished are not interchangeable for all the connection pipe size, then each gasket must be clearly labeled or its container labeled to indicate its applicable pipe O.D. range.

Couplings shall be JCM 203, Rockwell #413 or approved equal.

8. Bell Joint Leak Clamps (3" through 36")
Clamps shall fit AWWA sand cast pipe classes A, B, C, and D and centrifugally cast pipe diameters. Bell and spigot rings shall be ductile iron, Cor-Ten or similar low corrosion type bolts, with gaskets suitable for water service.
9. Band Type Repair Clamps
Clamps shall be single band full circle type with a gridded, tapered, overlapping Buna-N Grade 60 gasket designed for repair of water mains. Clamp shall have a stainless steel band and bridge plate, ductile iron glands, and stainless steel bolts spaced not more than 2.5 inches c-c. Provisions shall be provided for electrical continuity which will withstand a 10 minute-400 amp current (water filled pipe condition) with no harmful effects. This specification is for band clamps ranging

in size from 2" through 16" and widths approximately 7-1/2" to 15". Clamp shall be Rockwell #225, #238 or approved. Band Type Repair Clamps must fit the following O.D. range:

Pipe Size	Steel OD (In.)	Ductile or Cast Iron OD (In.)
2"	2.35 – 2.63	-
3"	3.36 – 3.60	3.73 – 4.00
4"	4.45 – 4.73	4.80 – 5.10
6"	6.56 – 6.96	6.90 – 7.20
8"	8.54 – 8.94	9.05 – 9.45
10"	10.64 – 11.04	11.10 – 11.40
12"	12.60 – 13.00	13.20 – 13.50
16"	-	17.13 – 17.90

10. Tapping Sleeves

(4" though 10" tap on 6" through 30" cast iron, ductile iron or steel mains.) Sleeves shall consist of two sections of heavy welded steel which bolt together on a main pipe and seal against a gasket around the top opening. Flange shall be AWWA C207 Class D, ANSI 150 pound and have recess cavity for mating to a standard tapping valve. Outlet body shall have a 3/4 inch NST test plug. Fitting shall be coated with 12 mil fusion bonded epoxy. Bolts and nuts shall be Type 304 stainless steel. Fitting shall be similar or equal to Rockwell 622 or Ford FTSC Tapping Sleeve, and in the sizes and O.D. ranges specified.

An approved alternate tapping sleeve shall consist of two sections of heavy welded stainless steel which bolt together on a main pipe and seal against a full encirclement gasket. Flange shall be AWWA C207 Class D, ANSI 150 pound suitable for mating to a standard mechanical joint gate valve. Outlet body shall have a 3/4 inch NST test plug. Fitting shall be stainless steel. Bolts and nuts shall be Type 304 stainless steel. Fitting shall be similar or equal to PowerSeal 3490MJ Tapping Sleeve and in the sizes and O.D. ranges specified.

11. Fire Hydrants

Fire Hydrants shall be Waterous Pacer Traffic Model WB67-250 or Mueller Super Centurion 250 conforming to the requirements of AWWA C502 and the following supplemental requirements:

a. Main Valve Opening – 5 1/4 inches nominal diameter.
b. Bury Depth – 7 1/2 feet measured from the bottom of the branch pipe connection to the finished ground line at the hydrant.
c. Upper Standpipe Length –22 inches or 16 inches with an extension

d. Nozzles – One steamer connection, 4 1/2 inch (ID), City of Duluth Standard threads, 7 threads per inch and two hose nozzles, 2 1/2 inch (ID), with National Standard Fire Hose Coupling Screw Threads.
e. Hydrant operating mechanisms shall be provided with Buna-N "O" ring seals preventing entrance of moisture and shall be lubricated through an opening in the operating nut or bonnet.
f. The exterior of the hydrant base shall be supplied with an epoxy coating.
g. Connection shall be a 6 inch mechanical joint with an anchoring tee, tapping tee or tee complete with gland, Cor-Ten or similar low corrosion type bolts, and harnessing lugs. Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular.
h. Operating and nozzle cap nuts shall be a pentagon, 1-1/2 inches point to face. Operating nut shall have an O-ring or seal ring to keep water and dirt from entering the bonnet. Opening shall be counterclockwise.
i. Design of hydrant shall allow for removal of the main and waste valve seats without excavating or disturbing the ground.
j. Portions of City owned hydrants above the ground line shall be primed and painted chrome yellow. Privately owned hydrants shall be primed and painted blue. Coating below the ground line shall be according to standards.
k. A traffic flange and operating rod coupling shall be located not more than 2 inches above the ground line and be designed so that in the event of an accident or breaking of the hydrant above the ground line, the main valve will remain closed.
l. Lower flange on the nozzle section shall be the swivel type.
m. Hydrants drains are not required. Any drains on hydrants shall be plugged. Hydrant shall have a permanently affixed tag stating "NO DRAIN – Pump After Using."
n. All hydrant bolts and nuts below grade shall be stainless steel. Mechanical joint bolts shall be as specified elsewhere in this section.

12 Valves

Valve sizes ten inches (10") and smaller shall be gate type. Valves twelve inches (12") and larger shall be butterfly type exclusively.

13. Gate Valves (10" and smaller only)

Gate valves shall be manufactured and furnished in accordance with an approved pattern and shall conform to the requirements of AWWA C509 or C515 for resilient seated gate valves, and all gate valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof.

Unless otherwise specified, the valves furnished shall comply with the following supplementary requirements.

a. Gate valves shall be solid disc with resilient seating.
b. All valves shall be furnished with O-Ring stem seals.
c. Valves shall have a two inch square operating nut opening counter-clockwise.
d. All valves shall be of the non-rising stem type.
e. Each valve shall have mechanical joint ends complete with gasket, gland, and bolts. Bolts or valve flange shall be provided with means for preventing the bolt from slipping in the slotted holes.
f. The exterior of the valve shall be supplied with an epoxy coating.
g. All exposed bolts on the valve, including stuff box and bonnet bolts shall be stainless steel.
h. Mechanical joint bolts shall be as specified elsewhere in this section.

14. Butterfly Valves (12" and larger sizes only)

Butterfly valves shall conform to the requirements of AWWA C504, Class 150B and all butterfly valves must meet such supplementary requirements as may be stipulated in the Contract Drawings or Special Provisions and the provisions hereof.

Unless otherwise specified, valves furnished shall comply with the following supplementary requirements:

a. Manual actuator equipped with standard 2-inch square operating nut, split V type or O-ring stem seal and enclosed in a lubricating gear box. For buried installations, valves shall be equipped with a side-mounted actuator designed to accept a valve box.
b. Valve disc shall be cast iron conforming to ASTM 126, Class B or ASTM A48, Class 40, alloy cast iron conforming to ASTM A436 or A439, or ductile iron conforming to ASTM A536.
c. Valves shall open counter-clockwise.
d. The exterior of the valve shall be supplied with an epoxy coating.
e. Valves shall be furnished with mechanical joint ends.
f. All exposed bolts, screws, washers or nuts on the valve shall be stainless steel.
g. Mechanical joint bolts shall be as specified elsewhere in this section.

15. Valve Boxes

Valve Boxes shall be 5 1/4" cast iron screw-type, consisting of the following parts:

Cover	Stay-put type, "WATER" cast thereon, with solid edges (no grooves or flutes on edge)
Top Section	26" length
Extension Section	30" length
Bottom Section	30" length
Base	#6 Round Base

All parts must be interchangeable with Bingham and Taylor #4906 and Tyler #6860. Valve box assemblies shall be manufactured in Northern America or preapproved by the Engineer.

Water valve pavement adjustment rings shall be ESS Brothers pavement adjustment ring or equal. Rings shall be cast iron.

16. Water Service Pipe and Fittings
    a. Branch Service Pipe of 3 inches or larger nominal diameter shall conform to the requirements of this specification. Valves shall conform to the same requirements as water main valves. Tapping tee shall be included as required.
    b. Tap Service Pipe less than 3 inches nominal diameter shall conform to the requirements of ASTM B88 for Seamless Copper Water Tube, Type K, Soft Annealed temper or High Density Polyethylene (HDPE) Water Pipe conforming to the requirements for HDPE Pipe and Fittings as specified.
    c. Fittings for Copper Tubing shall be cast brass, having uniformity in wall thickness and strength, and shall be free of defects affecting serviceability. All threads for underground service line fittings shall conform to the requirements of AWWA C800. Unless specified, the fittings furnished shall comply with the following requirements:
        1) Quarter (90°) bend corporation stop couplings and eighth (45°) bend corporation stop couplings shall be Mueller H-15068 and H-15063 respectively, or an approved equal. Couplings shall be provided with an inside copper service flare thread on one end and a copper tube flare nut on the other end.
        2) Three-part union couplings for connecting copper tubing to copper tubing shall be Mueller H-15400 or an approved equal. Couplings shall be provided with copper tube flare nuts on both ends.
        3) Pack joint straight couplings for connecting copper tubing to copper tubing if specified, shall be Ford C44-XX (as appropriate for the required size) or an approved equal. Both ends of couplings shall be pack joints, with split clamp joint nuts with stainless steel set screws.
        4) Lead pack couplings for connecting extra strong lead pipe (excess) to flared copper tubing shall be Ford Q22-XX (as appropriate for the required size) or an approved equal. Couplings shall be provided with a split clamp joint nut with a stainless steel set screw on one end and a copper tube flare nut on the other end.

d. Corporation Stops shall be Mueller H-15000 or an approved equal. Inlet connection shall be a male tap end and shall have Mueller (cc) tapered threads conforming to AWWA Standard. Outlet connection shall be a copper service thread straight coupling connection suitable for use with ASTM B88 Type K copper service tubing and shall be provided with a copper tube flare nut.
e. Electrofusion Corp Saddles and Tapping Tees with Electrofusion Saddle shall be manufactured by Central Plastics Company or equal and shall conform to the requirements for HDPE Pipe and Fittings as specified.
f. Curb Stop shall be Minneapolis Pattern with AWWA standard flared copper pipe connections on both ends. Where threaded connections are necessary for HDPE adapters, a flare by threaded adapter shall be used.
g. Curb Box shall be magnetized tracer box style as specified in 2503 LOCATOR WIRE, furnished and installed by the Contractor. Iron pipe for curb box shall be supplied by the City and installed by the Contractor as shown on the Standard Details.

17. Polyethylene Encasement Material
Polyethylene encasement material shall conform to the requirements of AWWA C105 and ANSI A-21.5 for tube type installation and 8 mil nominal film thickness.

18. Mechanical Joint Bolts
All mechanical joint bolts used on all buried fittings, valves and hydrants shall have Cor-Ten or similar low corrosion bolts and nuts and 6 ounce zinc anode caps conforming to ASTM B-418.

B. Construction Requirements
1. General Provisions
Requirements for site clearing, excavation, preparing trench, backfilling and restoration are contained in (2105) EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES of these specifications and State of Minnesota Department of Transportation "Standard Specifications for Construction" 2005 Edition and shall govern the execution of work where the specifications therein are not in conflict with more specific requirements contained in this section, the Standard Details, Contract Drawings or the Special Provisions.

All horizontal directional drilling shall be performed in accordance with (2503/2504/2505) HORIZONTAL DIRECTIONAL DRILLING of these specifications.
2. Handling and Inspection
Proper and adequate implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Unloading, distribution and storage of pipe and appurtenant materials on the job site shall be as approved by the Engineer. All

materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage or unsound conditions that may need corrective action or be cause for rejection. Inspection procedure shall be as approved by the Engineer, with special methods being required as he deems necessary to investigate suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection. Any HDPE pipe with scratches, cuts or scrapes deeper than 10% of the wall thickness shall not be used unless the damaged section is cut out.

Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

Store pipe on level surface. Pipe may be placed in pyramidal stacks provided the number of courses recommended by manufacturer is followed and pipe is chocked on each side to prevent roll out of the layers. Cover pipe ends to prevent dirt, debris, wildlife and weather from entering. HDPE pipe stored for more than 3 weeks should be covered for protection from sunlight and weather.

Do not dump pipe from conveyance. Unload pipe 12 inch (300 mm) and smaller by hand with ropes and skids. Unload pipe larger than 12 inch (300 mm) or pipe bundles with mobile unloading equipment. Use wide slings for hoisting large pipe with boom trucks, cranes or lifts. Reinforced web slings are acceptable; chains, wire ropes or fiber ropes are not acceptable slings. Use of hooks for unloading is also unacceptable.

3. Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every reasonable precaution shall be taken to prevent foreign materials from entering the pipe and fittings while they are being placed in the line. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connection, but they shall be no larger than would be adequate. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing in the direction of laying.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is affected.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

4. Aligning and Fitting of Pipe

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Cast iron or ductile iron pipe shall be cut with approved mechanical cutters. The electric-arc cutting method, using carbon or steel rod, will be approved for use on the larger size pipe where mechanical cutters are not available. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

When necessary to deflect the pipe from a straight line either in the vertical or horizontal plane, to avoid obstructions, or produce a long radius curve, the amount of deflection allowed at each joint shall not exceed the allowable limits established in the following tables:

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT FOR DUCTILE IRON PIPE					
Pipe Size	Max. Angle	MAX OFFSET PER PIPE		Approx. Radius Minimum	
		18' length	20' length	18' length	20'length
3" to 12"	5°	19"	21"	205'	230'
16" to 24"	3°	11"	12"	340'	380'
30" to 36"	2°	7.5"	8"	510'	570'

MAXIMUM PERMISSIBLE DEFLECTION IN LAYING MECHANICAL JOINT FOR DUCTILE IRON PIPE			
Pipe Size	Max. Angle	MAX. OFFSET PER PIPE 18' length	20' length
4"	8.3°	31"	35"
6"	7.1°	27"	30"
8" to 12"	5.3°	20"	22"
16"	3.5°	13"	15"
18" & 20"	3.0°	11"	12"
24" & 30"	2.3°	9"	10"
36"	2.0°	8"	9"

Connection and assembly of joints shall be accomplished during the setting, aligning and fitting operations, in accordance with the provisions of this specification to the extent that the jointing requirements will permit.

5. Blocking and Anchoring of Ductile Iron Pipe

All plugs, caps, tees, bends and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, in accordance with the requirements listed below and the Standard Detail Drawing.

a. All horizontal bends, plugs, caps and branch tees shall be provided with concrete buttresses.
b. For 16" and smaller diameter, precast concrete blocks may be used in lieu of cast in place concrete when used in conjunction with "Mega-lug" joint restraints. Precast blocks shall be stepped out as installed to provide similar surface area as the cast in place thrust blocks. Use of "Mega-lug" restraints only without blocking is only acceptable if adjacent pipe is restrained as described below.
c. All vertical bends, except welded steel joints, exceeding 11-1/4 degrees deflection shall be provided with concrete buttress blocking at the low points with metal tie rod or strapping restraints at the high points.
d. Offset bends made with standard offset fittings need not be strapped or buttressed, unless installed in combination with another fitting.

All necessary fittings, bands, tie rods, nuts, and washers, and all labor and excavation required for installation of reaction restraints shall be furnished by the Contractor and included in the contract unit price for the pipe installation.

Concrete blocking shall be at least 2 inches nominal thickness.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Type 3 Grade B of MN/DOT 2461. Buttress dimensions shall be as indicated on the Standard Details.

All metal parts of tie rod or strap type restraints shall be galvanized.

"Megalug" joint restraints by Ebba Iron, Inc., or Uni-Flange Series 1400 "Block Buster" by Ford, may be substituted for rodding and blocking. Retainer (set screw type) glands may not be used in lieu of approved restraints or buttresses. "Megalug" and "Blockbuster" restraints may only be used on ductile iron pipe and shall not be used on any existing cast iron pipe.

When using "Megalug" type restraints in lieu of blocking, the pipe shall be restrained in each direction from the fitting a sufficient distance to prevent joint separation upstream or downstream. The minimum length of restrained pipe required shall be as shown on the contract drawings or as specified in Special Provisions. If no minimum length for restrained joints is specified, the Contractor shall submit the restrained joint calculations to the Engineer for review prior to construction or restrain a minimum of 36 feet in each direction.

6. Blocking of HDPE Pipe
   All plugs, caps, tees, bends, and other thrust points shall be provided with concrete blocking if there is an unstrained joint within 36 feet of the thrust point. Blocking is not required when all joints within 36 feet are restrained or fused. When required, concrete blocking shall be installed per the Standard Details.

7. Locating Wire
   Locating (tracer) wire shall be installed on all plastic water mains and services.

8. Polyethylene Encasement of Pipeline
   Wherever so required by the Standard Details, Contract Drawings, or Special Provisions, the pipeline, including valves, fittings, and appurtenances, shall be fully encased in polyethylene film of a minimum 8 mil nominal thickness. The film shall be furnished in tube form for installation on pipe and all pipe-shaped

appurtenances such as bends, reducers, off-sets, etc. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as valves, tees, crosses, etc.

The polyethylene tubing shall be installed on the pipe prior to being lowered into the trench. Tubing lengths shall be sufficient to provide a minimum overlap at all joints of one foot or more. Overlap may be accomplished with a separate sleeve tube placed over one end of the pipe prior to connecting another section of pipe, or by bunching extra overlap material at the pipe ends in accordion fashion. After completing the pipe jointing and positioning the overlap material, the overlap shall be secured in place with plastic adhesive tape wrapped circumferentially around the pipe not less than three turns.

After encasement, the circumferential slack in the tubing film shall be folded over at the top of the pipe to provide a snug fit along the barrel of the pipe. The fold shall be held in place with plastic adhesive tape applied at intervals approximately three feet along the pipe length. Also, any rips, punctures, or other damage to the tubing shall be repaired as they are detected. These repairs shall be made with adhesive tape and overlapping patches cut from sheet or tubing materials.

At odd-shaped appurtenances such as valves, the tubing shall overlap the joint and be secured with tape, after which the appurtenant piece shall be wrapped with a flat film sheet or split length of tubing by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice and taping down. Wherever encasement is terminated, it shall extend for at least two feet beyond the joint area.

Openings in the tubing for branches, service taps, air valves and similar appurtenances shall be made by cutting an X-shaped slit and temporarily folding back the film. After installing the appurtenance, the cut tabs shall be secured with tape and the encasement shall be completed as necessary for an odd-shaped appurtenance.
Unless otherwise specified in the Contract Drawings or Special Provisions, hydrants encased in polyethylene tubing shall have plugged drain outlets.

9. Electrical Continuity in Ductile Iron Pipe
Provisions shall be made to ensure electrical continuity between all joints, fittings, and valves. Two serrated brass wedges shall be inserted for 2 inch to 12 inch push-on joints on ductile iron pipe or cable bond may be used. Four wedges per joint shall be used for larger pipe. Continuity for mechanical joints may be provided using copper clips inserted in the gasket by the manufacturer, armored

tipped gaskets, copper strap, or cable bond. Megalug joint restraints shall not be used for electrical continuity.

10. Connection and Assembly of Joints

a. General

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

Immediately before making the connection, the inside of the bell or socket and the outer surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Insertion of spigot ends into the socket or bell ends shall be accomplished in a manner that will assure proper centering and insertion to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

No open ends of water main pipe will be allowed for more than one hour on any pipe section. Caps shall be mechanically attached to the end of the pipe. Taping and bagging the end of the pipe will not be allowed. The Contractor shall weight the pipe as necessary to prevent floatation.

b. Push-On Joints

The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the ball socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment. Spigot ends which do not have depth marks shall be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot edge to resemble the manufacturer's fabricated detailing.

c. Mechanical Joints

The last eight inches of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution after being thoroughly cleaned. The gland shall then be slipped on the spigot end with the lip extension toward the socket or bell end. The rubber gasket shall be painted with soap solution and be placed on the spigot end with the

thick edge toward the gland. An approved lubricant provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 45 to 60 for 5/8" bolts; 75 to 90 for 3/4" bolts; 100 to 120 for 1" bolts, and 120 to 150 for 1-1/4" bolts.

d. Welded Joints for Steel Pipe

All steel pipeline welding shall be done by Certified Pipeline Welders in accordance with AWWA C206. Contractor shall furnish the Department with evidence of certification at or prior to the contract award date unless a current certification is presently on file with the Department. Pipe and fittings shall be joined with a butt weld. Valves and other control devices shall be connected to the pipe with a steel flange welded to the pipe. Any exposed metal surface, weld or damaged coating shall be prepared and coated with an approved rust preventative prior to backfilling.

e. Qualifications for Joining HDPE Water Main Pipe

Before being permitted to make joints on the HDPE water main pipe, all joiners shall be qualified and successfully complete a qualification test as required in accordance with the Qualifications for Joining PE Pipe, of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

f. Fusion Joining of HDPE Water Main and Service Pipe

All HDPE water main pipe and fittings shall be joined by butt fusion or electrofusion procedures as specified in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe. Water branch or tap service pipe of any diameter shall be joined by butt fusion except where approved by the Engineer. Socket couplings may also be used on tap service pipe where approved the Engineer.

The use of electrofusion couplings shall be minimized. Electrofusion couplings may not be installed directly on HDPE fittings. All fittings must have a

minimum of 2'-0" of HDPE pipe butt fused directly to the fitting prior to installation of an electrofusion coupling.

11. Connect to Existing Water Main

This work consists of connecting the new water main to the existing water main.

Connections to existing water main shall be measured by the number of connections made to the existing water mains as specified and shall be paid for as Item 2504.602 Connect to Existing Water Main at the Contract bid price per each, which price shall be compensation in full for all costs incidental thereto including, but not limited to, all labor, equipment and materials for locating the existing water main and furnishing and installing the proper fittings and adapters or transition couplings needed to make a complete connection. Valves at connections will be paid for under a separate bid item.

12. Water Service Installation

a. General Provisions

Water service facilities consisting of Tap Service Lines and Branch Service Lines, complete with all required appurtenances, shall be installed as required by the Contract, in accordance with all pertinent requirements for main line installations together with the provisions hereof.

It shall be the responsibility of the Contractor to keep work exposed so the Engineer may obtain an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe ends.

Water service lines shall normally be installed by trenching and be subject to the same requirements as prescribed for the main pipeline installation. Where water service lines are installed alongside of sanitary, or storm sewer service lines, installation shall be such as to maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances. Subject to minimum clearances, the water service may be laid in a common trench excavated principally for sewer installation, either by widening the trench as necessary or by providing a shelf in the trench wall where ground stability will permit.

Unless otherwise specified, installation of water service lines shall be such as to provide for not less than seven feet of cover over the top of the pipe and for not less than 18 inches of clearance between pipelines. Also, at least three inches of clearance shall be maintained in crossing over or under other structures except that 12 inches shall be maintained when crossing sewer mains. Where the service pipe may be exposed to freezing due to insufficient

cover or exposure from other underground structures, the water pipe shall be insulated as directed by the Engineer.

b. Branch Service Lines

Branch service piping shall be Ductile Iron Water Pipe or High Density Polyethylene (HDPE) Water Pipe of the size and wall thickness specified. The ductile iron pipe and appurtenances shall have rubber gasketed push-on or mechanical joints. The HDPE pipe and appurtenances shall be joined by butt fusion or electrofusion procedures. Minimum pipe size for branch service installations shall be 3 inches nominal diameter. Unless otherwise indicated, hydrant service pipe shall be 6 inches in diameter. A larger than minimum size branch service shall be provided if required by the Contract Drawings or Special Provisions.

Installation of branch service facilities shall be in accordance with all applicable requirements of these specifications as pertain to the mainline installation.

c. Tap Service Lines

Tap service piping shall be of the size and type specified in this specification for Water Service Replacement or Water Service Installation or in the Contract Special Provisions. Minimum pipe size for tap service installations shall be 3/4 inch nominal diameter. Larger size pipe will be specified for commercial and industrial tap service and for some domestic service as specifically identified.

Installation of tap service facilities shall be in accordance with the Standard Detail Drawing and all applicable requirements of these specifications and Special Provisions as they pertain to the mainline installations.

Unless otherwise indicated, tap service piping may be laid directly on any solid foundation soil that is relatively free of stones and hard lumps. However, when specified or ordered, aggregate materials shall be furnished and placed as necessary to secure proper foundation drainage, pipe covering, or backfill support.

Seamless copper service piping of 3/4 inch to and including 1-1/4 inches in diameter shall be installed in one piece without intermediate joint couplings between the corporation stop at the water main tap and the curb stop. Larger pipe may be furnished in standard cut-lengths of 20 feet or longer and be joined with approved couplings, provided that the installation of pipe less than full standard length in any run be limited to the needs for closure. All pipe and appurtenances shall be joined by means of approved flared type threaded couplings.

High Density Polyethylene (HDPE) tap service piping of 3/4 inch to and including 2 inches in diameter shall be installed in one piece without intermediate butt fusion, socket or electrofusion joint couplings between the tapping tee with electrofusion saddle at the main and the curb stop transition. Larger pipe may be furnished in standard cut-lengths of 40 feet or longer and be joined by butt fusion, socket or with approved electrofusion couplings, provided that the installation of pipe less than full standard length in any run be limited to the needs for closure. All pipe and appurtenances shall be joined by means of butt fusion or approved socket or electrofusion couplings.

Connection of seamless copper service lines to the water main shall be made with an approved corporation stop and saddle if specified on ductile iron mains or with an approved electrofusion corp saddle and corporation stop on HDPE mains. The water main tap shall be made at an angle of not more than 45 degrees from the horizontal. Service pipe may have a 45 degree bend connected to the corporation stop to bring the pipe to horizontal.

Connection of HDPE service lines to the water main shall be made with an approved tapping tee with electrofusion saddle on HDPE mains. The water main tap shall be made at an angle of 90 degrees from the horizontal. Service pipe shall be butt fused to the tapping tee with electrofusion saddle.

Unless otherwise indicated, tap service lines shall be installed on a straight line at right angles to the water main or property lines as directed by the Engineer. Service lines shall extend for such distance beyond the curb stop as may be specified in the Contract. In the absence of specific requirements, the service line shall be terminated at the curb stop, where it shall be connected to an existing line or, in the case of undeveloped property, capped or plugged, as approved by the Engineer.

The flaring of copper tubing ends shall be accomplished only with the use of proper size and type of tools as designed for the purpose, such as will provide accurate sizing and rounding of the ends. Tubing shall be cut squarely and all roughness shall be removed prior to flaring. All couplings shall be tightened securely, so the flared end fits snugly against the bevel of the fitting without leakage. The flared joint couplings shall be made up without the use of joint compound.

The service pipe and curb stop coupling depth shall be such as to maintain not less than the specified minimum cover and provide for a standard service box installation where practicable. Curb stop shall be set on a concrete block. The service box shall be threaded over the curb stop coupling. Service boxes shall

be installed plumb and be braced effectively to remain vertical during and after completion of backfilling. The service boxes shall be brought to existing surface grade when the final grade has not been established. When the final grade has been established, the Contractor shall extend the service box to finished grade.

1) Water Service Replacement

This work shall consist of excavation of trenches and the installation or moving of water service lines. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

The Contractor will furnish all materials except for the iron pipe, which will be furnished by the City of Duluth Department of Public Works and Utilities. The Contractor shall be responsible for picking up the iron pipe at the City of Duluth Department of Public Works and Utilities facility located at 520 Garfield Avenue. The Contractor will perform all plumbing work. The Contractor shall notify property owners of the upcoming service shutdown at least 24 hours prior to the shutdown.

Plumbing work shall include, but not be limited to, shut down of the corporation at the main, removal of existing lead service and curb stop, furnishing and installation of the proper fitting for the new service, furnishing and installation of a continuous component of pipe to the curb stop location, furnishing and installation of a new curb stop and box, connection to existing private service with the proper fitting, open corporation and check for leaks, backfill and compact backfill material.

Disposal of excavated water service materials shall be the responsibility of the contractor.

2) Water Service Installation

This work shall consist of excavation of trenches and the installation of water service lines. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

The Contractor will furnish all materials except for the iron pipe, which will be furnished by the City of Duluth Department of Public Works and Utilities as shown on the Standard Details. The Contractor shall be responsible for picking up the iron pipe at the City of Duluth Department

of Public Works and Utilities facility located at 520 Garfield Avenue. The Contractor will perform all plumbing work. The Contractor shall notify property owners of any upcoming service shutdown.

Water service pipe shall be seamless Type K copper or HDPE, SDR 11 of the size indicated in the Contract Drawings. Copper water service pipe shall be connected to the HDPE water main after an electrofusion corp saddle and corporation stop of the size indicated are installed and the main is tapped. The electrofusion corp saddles shall be as manufactured by Central Plastics Company or an approved equal. The electrofusion corp saddles shall be suitable for the installation of corporation stops as specified.

HDPE water service pipe shall be butt fused to the tapping tee with electrofusion saddle as shown in the Contract Drawings. The tapping tee with electrofusion saddle shall be as manufactured by Central Plastics Company or an approved equal.
Plumbing work shall include, but not be limited to, furnishing and installation of the proper electrofusion corp saddle (for copper service pipe and HDPE main) or tapping tee with electrofusion saddle (for copper or HDPE service pipe and HDPE main), corporation stop and fittings for new copper services, tapping the new water main, furnishing and installation of a continuous component of new copper or HDPE service pipe to the curb stop location, furnishing and installation of a new curb stop and box, open corporation stop or tapping tee with electrofusion saddle and check for leaks, reconnect existing water service, backfill and compact backfill material.

Tapping of HDPE mains shall be performed using a tapping tool designed specifically for that purpose. Use of an electric drill for tapping an HDPE main is not allowed.

Reconnecting existing water service shall be required when installing a new water service and connecting it to an existing water service. The contractor shall confirm the size of each existing water service and provide necessary fittings to adapt from the new service pipe to the existing service pipe.

13. Setting of Valves, Hydrants, Fittings and Specials

Valves, hydrants, fittings and specials shall be provided and installed as required by the Contract Drawings, Standard Details and Special Provisions, with the exact locations and setting being as directed by the Engineer, and with each installation being accomplished in accordance with the requirements for installation of

mainline pipe to the extent applicable. Support blocking, reaction backing, and anchorage devices shall be provided as required by the Standard Details and this specification.

Hydrants shall be installed plumb, with the height and orientation of nozzles as shown in the Contract Drawings or as directed by the Engineer. Unless otherwise specified, the hydrants shall be connected to the mainline pipe with 6-inch diameter branch pipe, controlled by an independent gate valve, and tied back to the tee with a hydrant holding tee or rodding as shown on the Standard Details.

All hydrants and valves shall have a 3 pound magnesium anode attached to one of the mechanical joint bolts.

Valve boxes shall be centered over the wrench nut of the valve and be installed plumb, with the box cover 3/8" below the surface of the finished pavement or at such other level as may be directed. Valve boxes shall not be installed so as to transmit shock or stress to the valve.

Masonry valve pit structures for valves, air vents or meters shall be constructed in accordance with the Standard Detail Drawing or plan details and with the applicable provisions of MN/DOT 2506.

Drainage branches, blowoffs, air vents, and other special appurtenances shall be closed with approved plugs or caps and shall be equipped with suitable blowoff facilities when specified.

a. Furnish and Install Hydrant Branch Service Pipe
   This work shall consist of excavation of trenches and the furnishing and installation of hydrant lines and disposal of excavated water related materials. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

   Contractor will furnish all materials and will perform all plumbing work.

b. Furnish and Install Hydrant Assembly
   This work shall consist of excavation of trenches, and furnishing and installing hydrant and hydrant valve and box after extending the hydrant lead as shown on the Contract Drawings or at a location as directed by the Engineer. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular. The connection at the water main will be performed by the Contractor. The Contractor will furnish all materials and perform all plumbing work related to the connection at the water main.

Prior to its installation, the hydrant, gate valve and all related piping shall be cleaned of all foreign matter and after installation shall be disinfected in accordance with the procedures described in paragraphs No.'s 1227 and 1228 of Section XII "Manual of Water Supply Sanitation" of the Minnesota Department of Health.

c. Remove Existing Hydrant

This work shall include removing existing hydrants as shown on the Contract Drawings or as directed by the Engineer. The Contractor shall close the hydrant valve, install an end cap on the main and remove the hydrant and valve box. The hydrants to be removed are shown on the Contract Drawings or shall be identified by the Engineer in the field.

d. Relocate Hydrant

This work shall consist of relocating hydrants after extending the hydrant leads as shown on the Contract Drawings or at a location outside of the roadbed as directed by the Engineer. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth, and the following:

Hydrant construction requiring a new connection at the water main will be performed by the Contractor. The Contractor will furnish all materials and perform all plumbing work related to the new connection at the water main. Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular.

All additional materials furnished under this specification shall be new and like in kind to that in place.

Prior to relocation, the hydrant, gate valve and all related piping shall be cleaned of all foreign matter and after installation shall be disinfected in accordance with the procedures described in paragraphs No.'s 1227 and 1228 of Section XII "Manual of Water Supply Sanitation" of the Minnesota Department of Health.

Prior to reinstalling, the hydrant drain valve shall be plugged if it is currently open and a tag affixed which states "NO DRAIN – Pump After Using."

e. Furnish and Install Hydrant

This work shall consist of furnishing and installing a hydrant after extending the hydrant lead as shown on the Contract Drawings or at a new location outside the roadbed as directed by the Engineer. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications and the current Standard Practices and Specifications of the City of Duluth. Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular. Hydrant construction requiring a new connection at the water main will be performed by the Contractor. The Contractor will furnish all materials and perform all plumbing work related to the new connection at the water main.

Prior to its installation, the hydrant, gate valve and all related piping shall be cleaned of all foreign matter and after installation shall be disinfected in accordance with the procedures described in paragraphs No.'s 1227 and 1228 of Section XII "Manual of Water Supply Sanitation" of the Minnesota Department of Health.

f. Furnish and Install Hydrant Valve and Box

This work shall consist of furnishing and installing a gate valve and box in accordance with the applicable MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth as detailed in the Plan, and the following: Prior to installation, the valve shall be cleaned of all foreign matter and after installation shall be disinfected in accordance with the standard procedures of the Minnesota Department of Health.

Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular.

g. Furnish and Install Butterfly Valve or Gate Valve and Box

This work shall consist of furnishing and installing a butterfly valve or gate valve and valve box in accordance with the applicable MN/DOT Standard Specifications, the current Standard Practices and Specifications of the City of Duluth as detailed in the Plan, and the following: Prior to installation, the valve shall be cleaned of all foreign matter and after installation shall be disinfected in accordance with the standard procedures of the Minnesota Department of Health.

- Zinc anode caps conforming to ASTM B-418 shall be installed on the bolts on all mechanical joint fittings. The anode size shall be regular.

14. Adjust Valve Box

This work shall consist of adjusting existing water valve boxes to new surface elevations without changing the elevation of the valves. The work shall be performed in conformance with the applicable provisions of MN/DOT Standard Specifications, and the current standard practices and Specifications of the City of Duluth.

- No adjusting rings shall be used unless approved by the Engineer. Adjustments shall be made prior to placing the final surfacing course unless otherwise approved by the Engineer.
- Pavement adjustment rings will only be allowed on pavement overlay projects where approved by the engineer. Where used on projects, only one may be used per valve box. All pavement adjustment rings shall be glued into place with a manufacturer recommended adhesive. The Contractor shall measure all valve boxes to determine the appropriate size of each adjustment ring.

When bituminous wearing course is to be held over to the next construction season, all valve boxes shall be adjusted to conform to 3/8 inch below the adjacent surface of the bituminous base or binder course prior to winter suspension.

15. Disinfection of 4 inch to 12 inch Ductile Iron Water Mains

Water mains 4" to and including 12" shall have chlorine tablets fixed in each pipe. While the water main is being laid, Calcium Hypochlorite tablets shall be attached to the inside top of each pipe using inorganic adhesive equal or similar to Permatex No. 1. Number of tablets per pipe segment shall be according to the table below to obtain at least a 25 ppm solution.

Pipe Length	Number of 5-Gram Tablets Required* Diameter of Pipe				
	4"	6"	8"	10"	12"
Less than 13'	1	1	1	2	3
18'	1	1	2	3	4
20'	1	1	2	3	4

***Based on 3.25 grams of available chlorine per tablet.**

All pipe and fittings which must be disinfected prior to installation shall be thoroughly swabbed and brushed with a 1% hypochlorite (chlorine) solution or undiluted household bleach.

Procedure for Disinfection and Testing shall be as follows:

a. Contractor shall fill the main under the direct observation of the Inspector or Engineer after notifying the Public Works and Utilities Department. Filling

shall proceed slowly and stop when water begins to come out the end. Do not flush test. Filled main shall sit for 24 hours to allow chlorine to work, or 48 hours if water is less than 41°F.

b. Contractor shall flush main, hydrant branches, and any Blowoffs under the direct observation of the Inspector or Engineer. Department will arrange to have the City take chlorine test when flushing begins, and a bacteria-turbidity sample when flushing is complete.
c. Upon passing a bacteria-turbidity test, the Contractor may arrange for a pressure test. The order of the bacteriological test and then the pressure test may be reversed only if the new section is completely disconnected from the city water system.
d. Engineer will order main opened to system only after bacteria-turbidity test and pressure test pass. At all times prior to this, the new main shall be isolated by valving or other means except for filling, flushing, or taking samples. To insure against possible non-flow contact to the water system, it shall always be necessary to open the hydrant or Blowoff before allowing system water to enter the new section.
e. In the case of failed tests, the City reserves the right to charge the Contractor for retests.

16. Disinfection of 16 inch and Larger Ductile Iron Water Mains

Water mains with nominal diameters 16 inches and larger shall be disinfected by the Contractor. Procedure followed will be in accordance with AWWA C651-Section 5.2 whereby a constant flow of water is introduced simultaneously with a calculated and constant feed of chlorine solution into the main. When at least 25 ppm chlorine is measured at the opposite end, both water and chlorine feed shall be discontinued and the solution allowed to set in the pipe at least 24 hours. The Contractor will work intermediate valves and hydrants during the setting period, and will operate valve to introduce the water into the main under the supervision of the Department.

17. Disinfection of HDPE Water Mains

HPDE water mains shall be disinfected in accordance with the procedure outlined above for 16 inch and larger ductile iron mains.

18. Alternate Disinfection Procedures

When conditions preclude disinfection stated above, the Contractor shall use the alternate procedure for disinfecting mains and branch services which consists of thoroughly swabbing pipe and brushing fittings with a 1% hypochlorite solution prior to installation.

19. Testing Water Main and Services

a. Pipe Cleaning prior to Testing

All HDPE water mains shall be pigged with a foam pipe prior to pressure or bacteriological testing to remove dirt, HDPE chips, curls and shavings. Water mains and branch lines less than 100 feet in length and water services are exempt from this requirement.

b. Bacteriological Test

Sampling and testing for bacteria will be performed by the City. A test result will be provided after both 24 and 48 hours. Both tests must be passed. The Contractor shall be responsible for rechlorination of the water main in the event the test result fails.

c. Pressure and Leakage Test

Following a passing bacteria test, the water mains shall be subjected to the pressure and leakage tests prescribed herein and in conformance with the pipe manufacturer's recommendations. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct observation of the Engineer.

The order of the bacteriological test and then the pressure test may be reversed only if the new section is completely disconnected from the city water system.

The Contractor may test each valved section, larger sections, or the entire water main so long as the elevation differential between the highest and lowest point does not exceed 110 feet.

All air must be expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump water container, and water used shall be disinfected prior to injecting water into the section of main.

For ductile iron mains, pressure shall be maintained for a minimum duration of 2 hours. No drop in pressure will be allowed for acceptance of the main.

For HDPE mains, a monitored makeup water test will be used. This will consist of the initial expansion and test phases. During the expansion phase the main is pressurized to 150 psi and then enough clean water is added each hour for three hours to return to 150 psi. The test phase follows immediately. Using the values in the table below, the engineer will determine the amount of make up water allowed during a 2 hour test period. If less water is used than allowed, the test will pass. Air pressure will not be allowed for testing.

2 Hour HDPE Pressure Test Make Up Water Amount	
Nominal Pipe Size (inches)	Make-up Water Allowance for 2 hour test (gallons per 100 feet of pipe)
1 ¼	0.10
1 ½	0.10
2	0.11
3	0.15
4	0.25
5	0.38
6	0.6
8	1.0
10	1.3
12	2.3
14	2.8
16	3.3
18	4.3
20	5.5
22	7.0
24	8.9
26	10.0
28	11.1
30	12.7
32	14.3
34	16.2
36	18.0
42	23.1
48	27.0
54	31.4

Any defective joints, pipe, fittings, valves, or hydrants revealed during the testing, or before final acceptance of the work, shall be satisfactorily corrected and the test shall be repeated until the specified requirement has been met.

Tap valves and sleeves to be pressure tested before cutting out coupon.

Unless otherwise specified, Branch and Tap Services shall be tested for pressure and leakage by inspection of all exposed joints while under system pressure. If specified for pressure testing, Branch Service Pipe may be tested at the time of the pressure test of the main, at the Contractor's option. Pressure testing of Branch Service Pipes may also be completed as a separate operation from main pressure testing by applying a test pressure of 150 PSI.

The connection of Tap Services to HDPE water mains with an electrofusion corp saddle and corporation stop or a tapping tee with electrofusion saddle shall be soap tested and tested with air and accepted if it maintains 100 psig for 5 minutes. Accepted electrofusion corp saddle or tapping tee with electrofusion saddle can then be tapped to the main and the tap or punch tee cap reinstalled.

d. Electrical Continuity Test
For ductile iron pipe systems, the Contractor shall perform a continuity test between hydrants or any accessible point of the backfilled system. If the test shows no continuity, the Contractor shall find and repair the broken circuit. Megalug joint restraints shall not be used for electrical continuity.

e. Testing Locator Wire Continuity
Test tracer wire continuity after installation of pipe.

f. Retesting
In the case of failed tests, the City reserves the right to charge the Contractor for retests.

C. Method of Measurement
All items will be measured separately according to the Pay Item name and as detailed and defined in the Standard Details, Contract Drawings, Specifications or Special Provisions. Pipe will generally be designated by size (nominal diameter), strength class, kind or type, and laying conditions. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Item.

1. Water Pipe
Mainline pipe, branch service pipe, and tap service pipe of each kind and size will be measured separately per linear foot by the overall length along the horizontal axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves or hydrants, intersecting centers of tee or wye branch service connections, and center of main to center of curb stop. Linear measurement of piping will include the running length of any special fitting (tees, wyes, bends, gates, etc.) installed within the line of measure between specified terminal points. No additional measurement will be made for extra pipe installed due to extra depth required for horizontal direction drilling applications.

Measurement for water service replacement or installation will be the horizontal distance, in feet, from the center of the water main to the new curb stop.

2. Valves
   Valves of each size and type will be measured separately per each as complete units, including the required valve box setting. Hydrant branch valves will also be measured on a per each basis when not included with Hydrant Assemblies.

3. Electrofusion Corp Saddles and Corporation Stops
   Electrofusion corp saddles and corporation stops of each size and type, except when furnished and installed by the City, will be measured separately per each by the number of complete units installed, including the water main tap, electrofusion corp saddle and corporation stop.

4. Tapping Tees with Electrofusion Saddle
   Tapping tees with electrofusion saddle of each size and type, except when furnished and installed by the City, will be measured separately per each by the number of complete units installed, including the water main tap and tapping tee with electrofusion saddle.

5. Corporation Stops
   Corporation stops of each size and type, except when furnished and installed by the City or included in the Electrofusion Corp Saddle and Corporation Stop bid item, will be measured separately per each by the number of complete units installed, including the water main tap and saddle.

6. Curb Stops
   Curb stops of each size and type, except when furnished and installed by the Department, will be measured separately per each by the number of complete units installed, including the required curb box.

7. Tracer Boxes
   Tracer boxes of each type will be measured separately per each by the number of of complete units installed.

8. Hydrants
   Hydrants will be measured per each by the number of complete units installed, including blocking and drainage stone, as indicated in the Standard Detail Drawing.

   Hydrant assembly installation will be measured per each by the number of hydrant assemblies furnished and installed as specified including the tee, branch service pipe and valve.

9. Air Vents

   Air vents of each type and size will be measured separately per each by the number of complete units installed, including the required manhole or valve box setting.

10. Access Structures

    Access structures, such as Manholes and Vaults, will be measured for payment separately per each, except when included as a component part of an air vent. When applicable, measurement will be by the number of complete individual units installed of each type and design, including the required manhole or vault castings, and covers.

11. Insulation

    Insulation will be measured separately by the area in square yards of polystyrene insulation board furnished and installed to the thickness specified on the Contract Drawings, Special Provisions or Standard Detail Drawings. Compensation for insulation shall include all costs of extra trench excavation, overlap of insulation board, furnishing and placing granular backfill, and removal and disposal off the site of excess excavated material.

12. Polyethylene Encasement

    Polyethylene encasement of pipe will be measured separately by the overall length of pipe encased of each specified size, and without regard to material overlaps at pipe joints.

13. Water Main Fittings

    Ductile iron fittings will be measured separately by the pound without joint accessories, and shall be the standard weight of fittings as published in AWWA C110. If the Contractor chooses to use compact ductile iron fittings in accordance with AWWA C153, the fittings shall be measured separately by the pound without joint accessories, and shall be the weight of fittings as published in AWWA C153.

    Ductile iron fittings may also be measured on a per each basis as installed for each type of fitting used.

    HDPE fittings are incidental to pipe installation and as such no measurement will be made.

14. Reconnect Existing Water Service

    Measurement for reconnecting a new water service to an existing water service will be made on a per each basis.

15. Rearrangement of In-place Facilities

The removal, relocation, extension or adjustment of in-place facilities such as hydrants, valves, curb stops, pipe, fittings, etc., will be measured, as indicated in the Proposal, by the number of complete units of each item, on a lump sump basis, or by the length in linear feet of each item such as pipe.

Hydrant removal will be measured by the number of existing hydrants removed as specified.

Hydrant relocation will be measured by the number of hydrants relocated as specified.

Adjusting valve boxes will be measured by the number of boxes adjusted.

16. Blowoff for Water Main

Blowoffs of each size and type installed for the purpose of flushing a water main, except when furnished and installed by the Department, will be measured separately per each by the number of complete units installed, including the water main tap and saddle.

D. Basis of Payment

Payment for construction of water distribution facilities will be made only under the items of Water Main, Branch Service, and Tap Service Pipe; the items of Valves, Corporation Stops, Curb Stops, Hydrants, Air Vents, Access Structures, Insulation, Polyethylene Encasement, Water Main Fittings, Blowoffs and Specials as identified by Contract Item; and the items of Relocate, Extend, Adjust, Reconnect or Remove existing facilities as identified by Contract Item; with all other costs of constructing the complete facility as required by Contract being incidental thereto the extent that the work does not qualify as an Extra Work Item.

Payment for Water Main Pipe, Branch Service Pipe, and Tap Service Pipe, of each size and kind at the appropriate Contract prices per linear foot of installation, shall be compensation in full for all costs of furnishing and installing the pipe complete in place as specified, including all costs of pipe installation as may not be specifically covered under other Contract Items. All costs of pipeline disinfection, leakage testing, pipe jointing materials, dead facilities, blocking and anchorage materials, and other work necessary for installation of pipe as specified shall be included for payment as part of the pipe item, without any direct compensation being made thereafter.

Payment will be made under Item 2504.603 (size) DIP Water Main at the contract bid price per linear foot which shall be compensation in full for all costs of furnishing and installing ductile iron water main between the locations shown on the Contract Drawings, including all materials, labor, equipment, ductile iron water main pipe, appurtenances, zinc anode caps, testing and incidentals.

Payment will be made under Item 2504.603 (size) HDPE Water Main SDR 11 at the contract bid price per linear foot which shall be compensation in full for all costs of furnishing and installing HDPE water main between the locations shown on the Contract Drawings, including all materials, labor, equipment, HDPE water main pipe and fittings, appurtenances, HDPE by MJ adapters, HDPE to cast iron transition couplings, zinc anode caps, HDPE and DI nipples and required fusion on the water main, locating wire, testing and incidentals. All costs of furnishing and installing electrofusion flex restraints and concrete collars on the HDPE Water Main shall be considered incidental to the water main. All costs of furnishing and installing water main DI mechanical joint sleeves for reconnecting the HDPE water main to the existing CI water main shall be considered incidental to Item 2504.602 Connect to Existing Water Main. No payment shall be made for an HDPE water service pipe with a tracer wire that has not passed a continuity test.

Payment will be made under Item 2504.603 Furnish and Install Hydrant Branch Service Pipe at the Contract bid price per foot, which shall be compensation in full for all labor and equipment necessary to complete the work specified.

Payment for Water Service Replacement will be made under Item 2504.603 (size) (material) Water Service Replacement at the Contract bid price per foot, which shall be compensation in full for all labor and equipment necessary to complete the work as specified.

Payment for Water Service Installation will be made under Item 2504.603 (size) Type K Copper Tap Service Pipe or Item 2504.603 (size) HDPE SDR 11 Tap Service Pipe at the Contract bid price per foot, which shall be compensation in full for all labor and equipment necessary to complete the work as described herein including the tracer wire for HDPE water service pipe. No payment shall be made for an HDPE water service pipe with a tracer wire that has not passed a continuity test.

Payment for Corporation Stops, Curb Stops, and Blowoffs, except when furnished and installed by Department, and Valves, Hydrants, Air Vents, Access Structures, Insulation, Polyethylene Encasement, Ductile Iron Water Main Fittings, and other specially identified appurtenant Items, at the appropriate Contract prices per unit of measure for each size and type of kind, shall be compensation in full for all costs of furnishing and installing the necessary materials complete in place as specified, including all costs of furnishing and installing or constructing the required access structures for valves, curb stops and air vents and necessary adapters or transition couplings. Access structures such as Manholes and Vaults will be paid for as separate items except when included as a component part of an air vent.

Payment will be made under Item 2504.602 (size) Corporation Stop, Item 2504.602 (size) Electrofusion Corp Saddle and (size) Corporation Stop or Item 2504.602 (size) Tapping Tee with Electrofusion Saddle at the Contract bid price per each, which shall be compensation in full for all material, labor and equipment necessary to complete the work as described herein including tapping the water main, furnishing and installing the connection fitting on the main and butt fusing the HDPE water service pipe to the tapping tee with electrofusion saddle.

Payment will be made under Item 2504.602 (size) Curb Stop and Box at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to install the curb box and furnish and install the curb stop and any transition fittings necessary to connect new HDPE water service pipe to the curb stop.

Payment will be made under Item 2504.602 (type) Tracer Box at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to furnish and install the tracer box where specified on the Standard Details, Contract Drawings or Special Provisions.

Payment will be made under Item 2504.602 (size) Butterfly Valve and Box or Item 2504.602 (size) Gate Valve and Box at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto to furnish and install the butterfly valve or gate valve and valve box complete and in place, including but not limited to the butterfly valve or gate valve and valve box, blocking, MJ to HDPE adapters, zinc anode caps and crushed stone. No additional payment will be made for valves installed where new mains are deeper than the minimum depth.

Payment will be made under Item 2504.602 Furnish and Install Hydrant Valve and Box at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto to furnish and install the gate valve and box complete and in place, including but not limited to the gate valve and box, blocking, MJ to HDPE adapters, zinc anode caps and crushed stone.

Payment will be made under Item 2504.602 Furnish and Install Hydrant at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto including, but not limited to any additional ductile iron pipe or HDPE hydrant leads, drain pits, blocking, crushed stone, extensions, risers, MJ to HDPE adapters, zinc anode caps, main line tee or fittings necessary to complete the new installation.

Payment will be made under Item 2504.602 Furnish and Install Hydrant Assembly at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto including, but not limited to the hydrant, 6" gate valve and valve box, ductile iron pipe or HDPE hydrant lead, drain pits, blocking, crushed stone,

extensions, risers, MJ to HDPE adapters, zinc anode caps, main line tee or fittings necessary to complete the installation.

Payment will be made under Item 2504.604 3 inch Polystyrene Insulation at the Contract bid price per square yard, which shall be compensation in full for all costs incidental thereto including, but not limited to the extra trench excavation, furnishing and placing granular backfill and removal and disposal off the site of excess excavated material.

Payment will be made under Item 2504.602 Reconnect Existing (size) (material) Water Service at the Contract bid price per each, which shall be compensation in full for all materials, labor and equipment necessary to make the connection from the new copper or HDPE water service to the existing water service including locating existing water service, removing and disposing of existing curb stop and curb box, furnishing and installing the necessary transition fittings and making the final connection to an existing service.

Payment for rearrangement of in-place facilities under specially named items indicating Relocation, Extension, Adjustment, or Removal, at the appropriate Contract prices per unit of measure shall be compensation in full for all costs of performing the work specified.

Payment will be made under Item 2504.602 Remove Existing Hydrant at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto including, but not limited to, excavation and backfill, cap installation and disposal or salvaging the hydrant.
Payment will be made under Item 2504.602 Relocate Hydrant at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto including, but not limited to, any additional ductile iron pipe or HDPE hydrant leads, drain pits, blocking, crushed stone, extensions, risers, MJ to HDPE adapters, zinc anode caps, main line tee or fittings necessary to complete the relocation.

Payment will be made under Item 2504.602 Adjust Valve Box at the Contract bid price per each. Such payment shall in each instance be compensation in full for all costs incidental thereto, including but not limited to furnishing extensions as required and replacing any materials damaged by the Contractor's operations.

Payment for water main and building service construction will generally be made on the basis of the following schedule. Consult the proposal for actual payment items.

2503/2504/2505 HORIZONTAL DIRECTIONAL DRILLING

A. General

This work shall consist of the installation of an underground pipe using the horizontal directional drilling method indicated on the Contract Drawings. Products installed under this section include Pressure Sewer Pipe and Forcemain, Pressure Sanitary Sewer Services, Water Main Pipe and Fittings, Water Services, Gas Main Pipe and Fittings, Gas Service Pipe and Fittings, and Special Connections.

1. Definitions

   a. Horizontal Directional Drilling (HDD)

      Method of trenchless construction producing continuous bores, using a surface launched, remotely steerable, electronically monitored drilling tool controlled from a mobile drilling frame, and including a field power unit, mud mixing, storage and recycling system, and mobile spoils extraction system.

   b. HDD Subcontractor

      Firm engaged in the construction of underground sanitary sewer, water or gas lines and with demonstrated competency using HDD methods of installation of pipe.

2. System Description

   The drilling system differs from the micro-tunneling, auger boring or pipe jacking equipment in that operations are performed from the surface; large pits to place and align equipment are not necessary. The drilling frame is sited and aligned to bore a pilot tunnel that conforms to the planned line and grade of pipe. The drilling frame is typically set back from an access pit that has been dug at the location of a tie-in, connection, manhole (or other appurtenance), or other location; and a high pressure/low volume fluid-jet toolhead that uses an inert, environmentally acceptable mixture of bentonite clay and water is launched and guided to the correct invert elevation and line required at the manhole (or other appurtenance). This is called the pilot hole. A real-time guidance system is attached behind or within the toolhead to measure inclination, roll and azimuth. Upon reaching the receiving pit, the toolhead is removed and a reamer with the product pipe attached is joined to the drill string and pulled back through the tunnel created by the pilot hole. For some pipe sizes and soil conditions, the Contractor may also introduce cement into the stabilizing mud mix. A vacuum spoils extraction system removes any excess spoils generated during the installation.

3. Performance Requirements

   a. Contractor shall provide a horizontal directional drilling system compatible with the subsurface conditions and the size, type, depths and lengths of pipe to be installed.

b. Contractor shall provide all labor, materials, equipment and incidentals necessary to install pipe by horizontal directional drilling as shown on the Drawings and as specified herein.
c. Contractor shall provide all survey layout, inspection and record-keeping incidental to the drilling pipe installation.
d. This procedure is applicable to the installation of sanitary sewer and sewer services, water main and water services and gas main and gas services.

4. Submittals
   a. Submit product data for the drilling fluid including a description of the following items:
      - Manufacturer
      - Components
      - Special Precautions
      - Manufacturers recommended method of mixing and application
      - Manufacturers recommendation for storage and handling
      - Material Safety Data Sheet (MSDS)

   b. Certificate of Compliance
      Submit Certificates of Compliance for products and materials.

   c. Equipment and Construction Procedures
      Submit working drawings, manufacturer's data sheets and written procedures describing in detail the equipment, tools and materials to be used along with the proposed method of product pipe staging and installation. This will include, but not be limited to, size, capacity and setup requirements of equipment; location and sizing of drilling and receiving pits; dewatering if applicable; type of cutting tool head; backreaming tool types and sizes; method of monitoring and controlling line and grade; locations and sizes of product jointing and staging areas; type of equipment for joining pipe; and time requirements of joint fusion. The Contractor shall detail a description of line and grade control and a viable method to eliminate accumulative error due to the inclinometer (pitch or accelerometer) and demonstrate that method in the field prior to commencing drilling operations.
      - Grouting techniques to be used for over-excavation, if any, including equipment, pumping procedures, grout types and mixtures.
      - Proposed procedures, materials and equipment for lubricating the exterior of the pipe during pulling.
      - Details of spoil removal system, including equipment type, number and disposal location.
      - Proposed methods, materials and equipment for removing and clearing obstructions so that the HDD can advance forward.

- Furnish compliance submittals showing all fabrication and construction details for the directional drilling installation of the pipe.

The Contractor shall submit a construction schedule with starting and completion dates for each of the procedure tasks.

If the Contractor determines that modifications to the methods and equipment as stated in the submittal are necessary during construction, the Contractor shall submit a revised plan.

d. Contractor Qualifications
   - Submit the documentation showing five years of HDD and references for at least three jobs of similar magnitude and detail completed within the past five years. Information must include, but is not limited to, date and duration of work, location, pipe information, project owner information (including a name and phone number), and the contents of the pipeline.
   - Submit references for any subcontractors that may be used on site.

e. Record Drawings:
   After completion of pilot hole drilling, submit tabulation of pilot hole coordinates as required under "Pilot Hole" paragraph below.

5. Qualifications of the Directional Drilling Contractor
   The HDD contractor shall be trained and certified to operate the Horizontal Directional Drilling equipment with at least five years experience in directional drilling, obtained over the last five years. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The supervisor shall have supervised directional drilling and a minimum of 10,000 linear feet of pipe. Submit a list of field supervisory personnel and boring machine operator(s) and their experience with HDD operations. At least one of the field supervisors listed must be at the site and responsible for all work at all times when HDD operations are in progress, and both that person and the HDD machine operator shall have been employed with the HDD specialty contractor for a minimum continuous period of one year immediately prior to this work. HDD specialty subcontractor shall not mobilize to the site until the resumé of the Contractor's field supervisory personnel and boring machine operator have been reviewed by the Engineer.

6. Delivery, Storage and Handling
   Check the materials upon delivery to assure that proper material has been received. Store drilling fluid components in accordance with manufacturer's recommendations and out of the effects of inclement weather.

7. Materials
   Bentonite for drilling fluid shall be high quality Wyoming bentonite composed primarily of sodium montmorillonite.

8. Drilling Site
   Additional work space and access may be acquired by Contractor only with approval of Owner and applicable property owners. Expense of acquiring additional work space shall be borne by Contractor. Site access, clearing, grading, and preparation necessary for construction operations shall be performed as required.

9. Quality Assurance
   Fusing of polyethylene pipe shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

10. Drilling Equipment
    For natural gas installations, the drilling head must be equipped with a sonde which meets the requirements of the Minnesota Office of Pipeline Safety when drilling near sanitary sewer laterals.

B. Products
   1. Carrier Piping
      Carrier piping shall be as specified in 2503 PRESSURE SEWER AND FORCEMAIN, 2504 WATER MAIN AND SERVICE LINE INSTALLATION or the 2007 Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe.

      The pressure rating specified for the carrier pipe in their respective specifications sections shall be considered a minimum. Provide a higher class of pipe if required by the loads imposed by pulling operation.

   2. Drilling Fluids
      Drilling fluid composition shall meet permit requirements and environmental regulations.

   3. Water
      Contractor shall procure, transport, and store water as required for his operations.

   4. Locating Wire
      Locating (tracer) wire shall be as specified in 2503 LOCATING WIRE.

C. Execution

1. Joining Pipe

Pipe fusing shall be done by qualified fusers. Certification of personnel and fusing of pipe shall comply with the requirements for gas lines in the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications. All sanitary sewer main and water main shall be butt fused. Sanitary sewer and water branch or tap service pipe of any diameter shall also be butt fused.

2. Monitoring

Contractor shall at all times provide and maintain instrumentation which will accurately locate pilot hole position in X, Y, and Z axis relative to ground surface. Drilling fluid flow rate and pressure shall also be monitored. Engineer and Owner shall have access to this data at all times during the operation.

The City of Duluth gas utility must be notified 2 working days prior to any excavation or directional drilling within 6 feet of a 6 inch or larger natural gas main. Department personnel will be on site to monitor excavation and inspect any exposed steel main 6 inches or larger. Notify the Engineering Division at 730-5200 to coordinate this inspection.

Any time a steel natural gas main smaller than 6 inches is exposed within an excavation, the Engineering Division shall be notified at 730-5200 to coordinate an inspection of the exposed main.

Prior to the start of any directional drilling, the Contractor shall pothole all proposed gas line crossing locations to confirm the depth of the main. The Contractor shall maintain the excavation or reopen the excavation to verify drilling operations did not interfere with any gas main or gas service.

3. Pilot Hole

A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:

a. Elevation: Plus 0.5 feet, minus 0.5 feet for low pressure sanitary sewer and plus 0 feet, minus 1 foot for water main and gas main.
b. Alignment: Plus or minus 1 foot for low pressure sanitary sewer and plus or minus 2 feet for water main and gas main.
c. Curve Radius: minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.
d. Entry Point: At the location shown on Drawings.

e. Exit Point: Pilot hole shall penetrate ground surface within plus or minus 10 feet of alignment shown on Drawings and within plus 20 feet and minus 0 feet of length shown on Drawings. In all cases, pipe shall remain within easement and right-of-way areas.

Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 25 feet for low pressure sanitary sewer and 50 feet for water main and gas main. This "as-built" plan and profile shall be updated as pilot bore is advanced.

In all cases, right-of-way restrictions shall take precedence over the tolerances listed above. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of pipeline being installed in violation of right-of-way restrictions. In all cases, concern for adjacent utilities and structures shall take precedent over the tolerances listed above. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to Engineer, referenced to drilling entry point, which accurately describes location of pilot hole.

4. Reaming and Casing Pipe Pull-Back Operation

General: Upon completion of pilot hole drilling, hole shall be enlarged by reaming and preassembled pipeline pull section shall be installed in hole. Pipeline shall be preassembled to provide one continuous pulling operation. Pipeline shall be temporarily capped before pulling operations to prevent any drilling fluid, water, or debris from entering pipeline.

Prereaming: Prereaming operations shall be conducted at discretion of Contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.

Backreaming: Backreamer must be of large enough diameter to insure a competent tracer wire can also be pulled back with the pipe.

Pulling Loads: The maximum allowable tensile load imposed on the pipeline pull section and used for setting weak-link devices for polyethylene pipe shall be in accordance with ASTM F 1804 "Standard Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation." The maximum allowable tensile loads for polyethylene pipe shall be within the values shown in the following table for pull durations of 1 to 12 hours. For longer pull durations, these values will be recalculated by the Engineer. If more than one

value is involved for a given pull section, the lesser value shall govern. The Contractor shall maintain accurate records of pull forces at all times for review by the Engineer.

MAXIMUM ALLOWABLE TENSILE LOAD FOR MDPE AND HDPE PIPE

NATURAL GAS PIPE (MDPE)			WATER & SEWER PIPE (HDPE)				
SIZE	SDR	LBS.	SIZE	SDR	LBS.	SDR	LBS.
1/2" CTS	7.0	149	3/4" IPS	11.0	348		
1" CTS	9.3	377	1" IPS	11.0	546		
2" IPS	11.0	1,447	1 1/4" IPS	11.0	870		
3" IPS	11.5	3.019	1 1/2" IPS	11.0	1,140		
6" IPS	11.5	10,816	2" IPS	11.0	1,781		
8" IPS	11.5	18,332	3" IPS	11.0	3,868		
			4" DIPS	11.0	7,274		
			6" DIPS	11.0	15,031		
			8" DIPS	11.0	25,858		
			10" DIPS	11.0	38,900		
			12" DIPS	11.0	55,011	9.0	65,741
			14" DIPS	11.0	73,906	9.0	88,323
			16" DIPS	11.0	95,587	9.0	114,232
			20" DIPS	11.0	14,307	9.0	176,304
			24" DIPS	11.0	210,154	9.0	251,147

Torsional Stress: A swivel shall be used to connect pipeline pull section to reaming assembly to minimize torsional stress imposed on section.

Pull Section Support: Pull section shall be supported as it proceeds during pull-back so that it moves freely and pipe is not damaged.

External Collapse Pressure: Pull section shall be installed in reamed hole in such a manner that external pressures are minimized. Any damage to pipe resulting from external pressure during installation shall be the responsibility of Contractor.

Buoyancy Modification: Buoyancy modification shall be used at the discretion of Contractor. Any buoyancy modification procedure proposed for use shall be submitted to Engineer for acceptance. No procedure may be used which has not been reviewed by Engineer. Contractor will be responsible for any damage to the pipeline resulting from buoyancy modification.

5. Drilling Fluids

General: Drilling fluids shall be in compliance with environmental regulations.

Recirculation: Contractor shall employ his best efforts to minimize excess drilling fluid by recirculating surface returns. This shall include, but not be limited to, provision of a solids control system sized and configured to remove spoil from drilling fluid surface returns so that fluid may be returned to active system without hindering drilling progress.

Inadvertent Returns: Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than entry and exit points shall be minimized. In the event that annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand placed barriers (hay bales, sandbags, silt fences, etc.), and collected using pumps, where practicable. If amount of surface return is not great enough to be collected, affected area shall be flushed with fresh water and fluid shall be allowed to dry and dissipate naturally. If amount of surface return exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used. If amount of surface return exceeds that which can be contained and collected in small sumps, drilling operations shall be suspended until surface return volumes can be brought under control. Clean-up of inadvertent returns shall be the responsibility of Contractor.

Disposal: Disposal of excess drilling fluids and spoil shall be the responsibility of Contractor and shall be conducted in compliance with environmental regulations, right-of-way and workspace agreements, and permit requirements. Drilling fluid and spoil disposal procedures proposed for use shall be submitted to Engineer for acceptance. No procedure may be used which has not been reviewed by Engineer.

6. Locating Wire

   The locating wire shall be pulled along with the pipe. The Contractor should consider pulling multiple wires in the event one locating wire does not pass the continuity test. The Contractor shall be responsible for the installation of a locating wire with electrical continuity throughout the entire length. The locating wire shall be made accessible as shown on the Standard Details or the Contract Drawings. The cost of furnishing and placing locating wire shall be considered incidental to the pipe.

D. Testing

1. Pressure and Leakage Test

   Pressure and leak test of carrier piping shall be as specified in 2503 PRESSURE SEWER AND FORCEMAIN, 2504 WATER MAIN AND SERVICE LINE INSTALLATION or the 2007 Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications.

2. Testing Locating Wire Continuity
   Test locating wire continuity after installation of each section of continuous tracer wire. The Contractor shall be responsible for the installation of at least one locating wire with electrical continuity throughout the entire length. No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

E. Measurement and Payment
   Pipe placed by horizontal directional drilling shall be paid for under the applicable utility. No payment shall be made for a pipe with a tracer wire that has not passed a continuity test.

2505 GAS MAIN

Gas main construction shall be performed in accordance with the provisions of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications, except as modified herein.

A. Work by Contractor
   The Contractor can perform the following work under this contract if the Contractor can provide operator qualification documentation for the individuals performing these covered tasks:
   1. Tapping polyethylene mains not in service.
   2. Tapping polyethylene mains in service with branch connections less than 2 inches in diameter.
   3. Squeezing off polyethylene mains and services.

B. Construction Requirements
   1. Adjust Valve Box
      This work shall consist of adjusting existing gas valve boxes to new surface elevations without changing the elevation of the valves. The work shall be performed in conformance with the water main Section 2504 WATER MAIN AND SERVICE LINE INSTALLATION of these specifications.
   2. Testing Gas Main
      Pressure testing of gas main shall comply with Section 04.13.9, Testing High Pressure Gas Mains and Services, of the Standard Specifications for High Pressure Gas Mains, Transmission Line, and Service Installation, Welding Qualifications and Qualifications for Joining PE Pipe, included in these specifications.
   3. Testing Tracer Wire Continuity
      Test tracer wire continuity after installation of pipe. The Contractor shall be responsible for the installation of at least one locating wire with electrical continuity throughout the entire length.
   4. Insertion Method
      Where called for in the Plans, pipeline shall be installed into new or existing pipeline. Procedures and conditions, including the necessary excavations, shall be

complied with as indicated in the Plans or Special Provisions and, where applicable, to these standard specifications.

C. Measurement and Payment

All costs of furnishing and installing gas main between the locations shown on the Contract Drawings or as directed by the Engineer; including gas main pipe, appurtenances, bedding and cover, locating wire, and testing; shall be paid for at the contract unit price per linear foot for (size) PE Gas Main SDR 11.5.

2506 MANHOLES AND CATCH BASINS

Manhole and Catch Basin construction and reconstruction, both storm and sanitary, shall be performed in accordance with the provisions of MN/DOT 2506, except as modified below:

A. Materials

1. Manholes

All sanitary manholes, air release manholes and cleanout manholes shall meet the requirements of City Standard Detail San-11. The Contractor shall be responsible for providing openings in the manhole section at the proper locations according to the contract drawings. No steps will be allowed in the manholes. All manholes must have integral concrete base.

Sectional concrete manhole units for storm water shall conform to the requirements of MN/DOT 3622 and Standard Plate 4005L, Design F, 4006L, Design G or Standard Plate 4020J. "O" ring gaskets shall be used in the joints in the barrel sections. The cone sections shall be concentric (Type A). No steps will be allowed in the manholes.

2. Catch Basins

Catch basins shall conform to Design G on Standard Plate 4006L. Catch basin frame castings shall be as shown on the Standard Details. Catch basin grate castings shall be 816 on Standard Plate 4154B. Catch basin curb box castings shall be 823A on Standard Plate 4160D. Catch basin castings shall be supplied by the Contractor.

3. Manhole Castings

Manhole Casting Assemblies with lids shall conform to Standard Detail for sanitary and storm manholes.

4. Non-Shrink Grout or Cement-Base Polymer Modified Patching and Repair Mortar

Non-shrink grout shall be a non-metallic type grout which is durable in wetting and drying, freezing and thawing conditions and shall conform to the requirements set forth in ASTM C 1107-01. Cement-based polymer modified patching mortar shall conform to the requirements set forth in ASTM C 109

ASTM C 490-77, and ASTM C 807-83 (modified).

5. A round cone with a 27 inch nominal diameter opening shall be used for catch basins and manholes.

6. Casting Extensions
   Casting Extensions shall be Neenah R-1979 or ESS Brothers paving adjustment ring. Extensions shall be cast iron.

7. Manhole Adjustment Rings
   The manhole adjusting rings shall be molded from high-density polyethylene as defined in ASTM D-1248. The complete adjustment system utilizing the HDPE rings shall consist of the rings, sealed to the manhole structure, casting and one another by means of an approved butyl sealant. Concrete adjustment rings shall not be used.

B. Construction Requirements
   1. Manholes and Catch Basins shall be bedded on 6-inches of Aggregate Bedding (MN/DOT 3149.2H).
   2. When using plastic pipe, manhole water stops supplied by the manufacturer shall be installed.
   3. All annular wall space surrounding the in place pipes shall be completely filled with mortar or concrete and the inside bottom of each manhole shall be shaped with fresh concrete to form free flow through invert troughs as directed. The troughs shall be as deep as a half-pipe and the shelves shall slope up 3 inches from the trough to the wall.
   4. When a sewer connects with an existing manhole or catch basin, the Contractor shall make a suitable connection through the wall of the manhole or catch basin and shall reshape the invert to assure a smooth and unobstructed flow line through. All pipe connections to existing manholes shall be water tight.
   5. Non-shrink grout or cement-based polymer modified patching mortar shall be used to patch lifting holes in manholes and catch basins.
   6. The Contractor shall utilize a combination of flat and sloping manhole adjustment rings to adjust the casting to the slope and grade as specified below.
   7. Manhole casting assemblies with lids shall be installed 3/8 inch lower than adjacent pavement as measured by a straightedge. The straightedge will be placed across the center of the casting and will touch both sides of the pavement. The measurement will be taken at the center of the casting. Castings that are measured at more than 3/8 inch below the pavement prior to final acceptance of the project will be raised to the prescribed depth of 3/8 inch. All costs associated with this corrective action will be assumed by the contractor.

8. Casting Extensions shall only be used where approved by the engineer on pavement overlay projects. Casting extensions shall not be used to adjust incorrectly installed manhole castings. Where casting extensions are installed, only one may be used per casting to achieve the proper height adjustment. All casting extensions shall be glued into place with a manufacturer recommended adhesive. The Contractor shall measure all manhole castings to determine the appropriate size of each casting extension.
9. All sanitary manholes must pass a vacuum test as specified elsewhere in this specification. Any manholes which do not pass the vacuum test or have visible leakage within the manhole will not be accepted.
10. All storm manhole castings and catch basin castings shall be wrapped with geotextile fabric as shown on the standard details.

C. Basis of Payment

Payment for Drainage Structures, Manholes and Catch Basins shall be at the contract unit price per each and shall include, in addition to the Basis of Payment in MN/DOT 2506.5: Granular materials for bedding and backfill.

2506 MANHOLE FRAME SEAL (INTERNAL/EXTERNAL)

Internal or External type manhole seals with stainless steel compression bands shall be used.

A. General

1. Work Required

An internal or external flexible rubber frame seal, and where allowed by the Engineer, a interlocking extension or extensions, meeting the requirements of this section, shall be used to seal the entire chimney section of sanitary manholes, air release manholes, clean out manholes and all other structures identified on the Contract Drawings or in the Special Provisions. The seal and extension or extensions shall extend from the frame down to the top of the cone.

2. System Description

Performance Requirements - The frame seal shall be capable of repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than ½ inch after installation and throughout its design life.

3. Quality Assurance

Acceptance Testing - Manhole frame seals shall be visually inspected after installation to insure that the seal is properly positioned, tight against the manhole and frame surfaces, that no voids or leakage points exist and that the bands are securely locked in place. Any seals failing this test shall be reworked as necessary and retested at no additional cost to the owner.

Any seals not passing this visual inspection may, at the Contractor's option, be tested for leakage using a method approved by the Engineer.

B. Products

An internal or external manhole frame seal, as shown on the Standard Details, with extensions where needed to cover the entire chimney area, shall be installed on all sanitary manholes air release manholes, clean out manholes and all other structures identified on the Contract Drawings or in the Special Provisions in accordance with the manufacturer's instructions.

Frame seals shall consist of a flexible rubber sleeve, interlocking extensions and stainless steel expansion bands as manufactured by Cretex Specialty Products or a pre-approved equal conforming to the following requirements.

The seal shall remain flexible throughout a 25 year design life, allowing repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movement of not less than ½ inch. The sleeve portion of the seal shall be either double or triple pleated with a minimum unexpanded vertical height of either 8 inches or 10 inches respectively. The sleeve and extension shall have a minimum thickness of 3/16 inches and shall be made from a high quality rubber compound conforming to the applicable requirements of ASTM C-923, with a minimum 1500 psi tensile strength, a maximum 18% compression set and a hardness (durometer) of 48+5. The bands shall be integrally formed from 16 gauge stainless steel conforming to ASTM A-240, Type 304, with no welded attachments, shall have a minimum adjustment range of 2 diameter inches and a positive locking mechanism. Any screws, bolts or nuts used for this mechanism shall be stainless steel conforming to ASTM F-593 and 594, Type 304.

C. Equipment

The contractor shall have a manufacturer's recommended installation tool and all other equipment/tools necessary to install the frame seals.

D. Execution

1. Field Measurements

   The Contractor shall measure the manhole to determine the information required on the manufacturer's "Sizing and Ordering" procedure. This information is needed to obtain the proper size of bands, the size and shape of the rubber sleeve and the need for and size of any extensions.

2. Surface Preparation for Seals

   All sealing surfaces shall be reasonably smooth, clean, and free of any form offsets or excessive honeycomb. All loose and protruding mortar and brick that would interfere with the seal's performance shall be removed and the

areas of the manhole frame, chimney and/or cone/corbel cleaned by wire brushing. All sealing surfaces shall be reasonably smooth and circular, clean and free of any loose material or excessive voids. Repair mortar, Non-Shrink Grout or Cement-Base Polymer Modified Patching and Repair Mortar shall be used to prepare a uniformly vertical 3" - 4" wide surface for the sleeve and extensions to seal against, if any adequate surface does not exist.

Detail surface preparation, including providing a vertical surface on a cone when none exists, shall be in accordance with the frame seal manufacturer's instructions.

The top portions of the cone shall have a minimum 2 inch high vertical surface. The preparation of this vertical surface when none exists shall be in accordance with the frame seal manufacturer's instructions.

3. Installation of Frame Seal
   The frame seals and extensions shall be installed in accordance with the manufacturer's instructions.

4. Frame Seal Type
   All manholes specified to have chimney seals located within the roadway shall have internal type seals. All manholes specified to have chimney seals located outside of the roadway shall have external style seals.

E. Measurement and Payment
All costs for furnishing and installing a frame seal and where allowed by the Engineer, an extension or extensions, shall be included in the unit price bid for manhole frame seals.

2506 MANHOLE VACUUM TESTING

A. Description
Conduct vacuum testing on manholes using vacuum testing equipment acceptable to Engineer.

Isolate manhole to be tested by plugging inlet and outlet pipes with inflatable stopper or other suitable test plugs. Securely brace plugs to avoid plugs being drawn into manhole. Plug lift holes with a non-shrink grout.

Place vacuum test equipment inside of top cone section and conduct vacuum test in accordance with manufacturer's recommendations. Operate vacuum pump until 10 in. of mercury is obtained.

Shut off vacuum pump and measure time for vacuum to drop from 10 to 9 inches of mercury. Manhole test is acceptable if the time exceeds the values in the table below:

Minimum Test Time for 48-inch Diameter Manhole

Depth/Feet	Test Time/Seconds	Depth/Feet	Test Time/Seconds
8	20	20	50
10	25	22	55
12	30	24	59
14	35	26	64
16	40	28	69
18	45	30	74

If test fails, repair or seal manhole using non-shrink grout or other materials that are approved. Retest until an acceptable test is obtained. Test may be conducted before or after backfilling.

B. Basis of Payment

All costs for furnishing and installing the equipment, maintenance, and labor necessary to perform the testing shall be included in the unit price for Manhole Vacuum Testing where a bid item is included. Where no bid item is included, manhole vacuum testing shall be incidental.

2511 RIPRAP

Riprap shall be furnished and placed in accordance with the provisions of MN/DOT 2511 except as modified below:

All riprap shall have a minimum of two fractured faces.

2521 WALKS

Walks shall be constructed in accordance with the provisions of MN/DOT 2521 and the following:

Payment for 4 inch Concrete Walk shall include all costs of root cutting, excavation, disposing of excavated materials, grading, furnishing, placing and compacting the 4 inch Class 5 Aggregate base.

The Protection against Cold Weather and the Cold Weather Protection Plan requirements specified under Section 2521 of this Special Provision shall apply to Section 2521 Walks.

2531 CONCRETE CURBING

Concrete curbs, curb and gutter, medians, and driveway pavement, shall be constructed in accordance with the provisions of MN/DOT 2531 except as modified below:

Payment for driveway pavement shall include excavating, grading, and furnishing and placing 12 inches of Class 5 Aggregate Base.

All concrete gutters shall be stamped at the junction with all catch basins with a "NO DUMPING, LEADS TO LAKE" stamp provided by the City.

2531 PEDESTRIAN CURB RAMP – TRUNCATED DOME SYSTEMS

This work consists of constructing pedestrian curb ramps with Truncated Dome Systems (detectable warning surfaces) in compliance with the ADA Accessibility Guidelines (ADAAG). This work shall be performed in accordance with the applicable MN/DOT Standard Specifications, the details in the Plan, and the following:

The Contractor shall select a truncated dome product from the approved products list at http://www.mrr.dot.state.mn.us/materials/materials.asp. Only approved products are allowed. Stamped concrete is not allowed. All curb ramps shall be uncoated.

All truncated dome systems shall be installed in strict accordance with the recommendations of the manufacturer. The installation protocol shall include details regarding product specific construction requirements and how the system will be sealed to mitigate freeze/thaw damage through moisture intrusion. The Contractor shall provide this information to the Engineer for approval two weeks prior to commencement of work.

The entire truncated dome area, typically 2 feet x 4 feet, shall contrast visually from the adjacent walking surfaces. The entire truncated dome area shall be a light color (light gray or buff typically) when the adjacent side walk is a dark color. The entire truncated dome area shall be a dark color (red or dark gray typically) when the adjacent sidewalk is a "white" or light gray cement color. The Engineer will determine the colors when the pavement is dry (everything looks dark when it rains). Other colors may also provide a dark on light or light on dark contrast and may be used with approval of the Engineer.

At the time of construction, all Truncated Dome Systems are specified to be in dimensional and alignment compliance with the requirements of the ADAAG as detailed in the Plan.

The truncated domes will be measured and paid under Item 2531.618 Truncated Domes at the contract bid price per square feet, which shall be compensation in full.

2533 CONCRETE MEDIAN BARRIERS

The Protection against Cold Weather and the Cold Weather Protection Plan requirements specified under Section 2521 of this Special Provision shall apply to Section 2533 Concrete Median Barriers.

2540 CONSTRUCT SURVEY MONUMENT

The City of Duluth will supply the monument casting. Contractor shall supply rebar. The

Engineer will set the 1" rebar. The contractor shall supply and set the PVC tube and the concrete around the rebar as detailed in the plan set. The contractor shall notify the Engineer 48 hours prior to setting the monument.

2540 PARKING METER POST/BRACKET INSTALLATION

The size of all material and posts shall be approved by the City of Duluth. All parking meter posts shall be inserted into soil at a minimum depth of 36 inches and surrounded by six inches of concrete. All parking meters installed in sidewalks or other areas of concrete surfaces shall use an installation bracket and comply with Standard Detail T-1. All traffic meter upright posts when used, shall have a minimum height of 4 feet above surface level.

2564 TRAFFIC SIGNS AND SIGN POST INSTALLATION

A. General

The size of all traffic signs, materials, and posts shall be approved by the Engineer.

B. Material Requirements

All sign faces shall consist of 3-M brand, Diamond Grade DG^3 reflective sheeting or approved equal, unless authorized by the City of Duluth.

All traffic signs shall be fastened to sign posts with stainless steel bolts, washers, and Nyloc nuts. The washer shall be separated from sign sheeting by a nylon washer.

All traffic sign posts inserted into soil shall have a weight of three pounds per foot and shall be manufactured of galvanized steel with a minimum length of six feet.

All traffic sign upright posts shall have a minimum weight of two pounds per foot and shall be manufactured of galvanized steel with a minimum length of eight feet.

C. Post Installation

All traffic signs shall be installed to a minimum height of seven feet to the bottom of the sign, with highest priority signage at the top on posts with more than one sign.

All traffic posts installed in sidewalks or concrete surfaces must be inserted into a four inch PVC collar, in concrete with the use of approved Telspar posts. All collars shall be located in an area clear of utilities to a distance of two feet in all directions, and a minimum of two feet behind the face of curb.

D. Basis of Payment

Payment for the installation of traffic signs and devices shall be made at the contract price per unit of measure per MnDot Specification 2564.5.

2564 STREET NAME SIGNS, CONCRETE FOOTING, SIGN POST, AND BRACKET ASSEMBLY

A. General

The concrete footing and sign post shall conform to Standard Detail T-3. The street sign unit E-250 shall conform to Standard Detail T-4. The street sign unit E-450 shall conform to Standard Detail T-5. The street sign unit E-650 shall conform to Standard Detail T-6.

B. Material Requirements

1. Reflective sheeting shall be 3-M brand, Diamond Grade V.I.P. or approved equal.

2. Length and Width

Mounted name signs shall have a standard width of 9 inches. The length of the face and blade shall be determined by the number of letters in the street name, including the prefixes and suffixes. The nameplate shall have a minimum length of 30 inches or as requested by the Engineer. Where extra length is required, it shall be provided in 6 inch increments.

Unmounted street name faces to be mounted on flat metal sign blades shall have sufficient width and length to permit application and trimming to the finished sign blank 9 inches wide by 30 inches, 36 inches or 42 inches in length.

All 9 inch street name sign plates shall be notched to properly fit the brackets shown on Standard Details T-4, T-5 and T-6; and punched on each end for either stainless bolts (1" long x 1/4" x 20) with nylon and stainless washers and stainless locking nuts, or rivets as approved by the Engineer. The bolts or rivets shall be furnished and installed on each sign unit.

3. Bracket Assembly

The street name bracket assembly shall consist of a post top cap, center rod welded to the post top cap, center clip spacers, and vandal resistant top finial nut.

The post top cap shall be cast iron and of a design which shall fit a round post. The post top cap designed for round posts shall weigh not less than 2.15 pounds each. The post top cap for round post installations shall fit a 2-3/8" O.D. post and shall have two 3/8" x 3/8" Allen set screws capable of providing a secure bond to the post. Post top caps shall have a smooth surface and be painted black.

A 5/8" square steel center tie rod shall be inserted 7/8" into the post cap then welded into the post top cap. The tie rod shall be of the proper length to accommodate either two, four, or six, nine-inch notched street name signs. The tie rod bolt shall be threaded at the top with a standard 5/8"-11 thread with a maximum diameter of .625" and a minimum diameter of .61". The tie rod shall be galvanized after threading to ensure a rust free thread operation.

The sign support holders shall be 18 gauge galvanized steel formed to hold two sign plates within notches formed in the sign plates and fitting over the center tie rod. Sign holders shall be six inches wide and at least 1-1/4" high, providing ample space between the upper and lower sets of sign plates. Each holder shall have a star hole to prevent turning on the center tie rod and shall allow alignment of 45, 90, 135, and 180 degrees. Sign support holders shall be free of burrs and painted black.

Top finial nut shall be cast iron, bored and threaded to fit the 5/8" center tie rod. The finial nut shall have a hole bored on the exterior, 13/64" diameter and 1/4" deep to accommodate a spanner wrench for attachment and removal. The nut shall have a hole drilled and threaded to accommodate a 1/4"- 20 x ½" stainless steel Allen set screw which will be used as a vandal resistant device. The finial nut shall have a smooth and burr free surface and be painted black. Anti-seize coating shall be applied to all threaded fittings.

C. Basis of Payment

Payment for furnishing and installing concrete footings, sign post design special and street sign units E-250, 450, and 650 complete with brackets at the contract price per each will be compensation in full for all costs of furnishing and installing the concrete footing, sign post and street sign.

2564 SIGNS-REMOVE AND REINSTALL

This work shall consist of removal, storage, protection and reinstallation of signs in accordance with the provisions of MN/DOT 2564, and the following:

A. General

All signs that are removed to be reinstalled at a later date will be stored in such a manner as to prevent any damage to the sign and the post. The sign will be installed in the same condition that it was removed. Any traffic sign or street name sign within the project limits that is damaged by construction operations shall be replaced with a new sign by the Contractor at the Contractor's expense.

B. Measurement

Measurement will be made by each pole for removal and reinstall signs as specified. Multiple pole signs will be measured as a single unit. If more than one sign is attached to a single pole, the pole and signs will be paid as a single unit.

C. Basis of Payment

Payment will be made under Item 2564.602 Signs - Remove and Reinstall at the Contract bid price per each pole, which shall be compensation in full for all costs incidental thereto, including but not limited to: removing and installing the signs; mounting hardware; excavation for footings; concrete and rebar for footings if required; and protecting and storing the signs.

2571 PLANT INSTALLATION

The provisions of Mn/DOT 2571 are deleted and replaced with the following:

A. Description

This work consists of furnishing, planting and establishing trees, shrubs, vines, and perennials of the species, variety, grade, size, or age, and root category specified, at the locations designated in the Plan. It may include planting or transplanting plants furnished by the Department.

The Contractor shall comply with the current edition of the "Inspection and Contract Administration Manual for MN/DOT Landscape Projects", published by the MN/DOT Landscape Architecture Unit, as the measurable minimum and maximum criteria and standard for plant installation and establishment operations.

B. Materials

1. Nursery Plant Stock 3861

   Plants of the species specified shall be furnished in the variety, grade, and size, or age indicated.

2. Investigations and Supply of Planting Stock and Materials

   By submitting a Proposal and accepting award of the Contract, in accordance with 1205 (Examination of Plans, Specifications, Special Provisions, and Site of Work), the Contractor assures familiarity with the Project site and Contract documents, commitments from suppliers, and delivery of the plant stock and materials required to complete the Contract.

3. Plant Stock and Materials Documentation

   The required documentation shall verify that the plants are in conformance with the Project requirements.

   a. At or prior to the Preconstruction Conference, the Contractor shall furnish the Engineer with a MN/DOT preliminary Certificate of Compliance for Plant Stock, Landscape Materials, and Equipment.

   b. At least one week prior to plant stock delivery to the Project, the Contractor shall furnish the Engineer with:

      1) A copy of a valid nursery stock (dealer or grower) certificate registered with the Minnesota Department of Agriculture and/or a current nursery certificate/license from a state or provincial Department of Agriculture for each plant stock supplier.
      2) A copy of the most recent Certificate of Nursery Inspection for each plant stock supplier.
      3) Documentation certifying that all plant material shipped from out-of-state nursery vendors subject to state and federal quarantines (including but not limited to Emerald Ash Borers, Gypsy Moths and Japanese Beetles) is free from currently regulated pests. To determine if Minnesota vendors

are subject to quarantines, call the MDA Supervisor of Nursery Inspection and Export Certification at 651-201-6388.

4) An updated Certificate of Compliance that is signed by the Contractor's authorized representative.

c. Upon plant stock and materials delivery to the Project, the Contractor shall furnish the Engineer with:
   1) Bills of lading or shipping documents for all plant stock and landscape materials delivered to the Project.
   2) An updated and signed Certificate of Compliance, if necessary, to reflect any further deviations from Project requirements.

d. As a condition for authorization of payments, the Contractor shall furnish the Engineer with vendor invoices or billing statements for all plant stock and materials used on the Project. Work performed with plant stock, materials, and equipment that has been misrepresented in the documentation will be considered unauthorized work. If required documentation is not supplied as specified, subsequent work may be unauthorized and MN/DOT may assess a daily charge of $200.00, on a calendar day basis, until the Contractor is in compliance.

4. Substitutions

   Substitutions may be allowed in accordance with 1605 (Substitute Materials). Before requesting substitutions, the Contractor shall provide written documentation that specified plants are not available (wholly or partially in sufficient quantities to meet Contract requirements) from the individual suppliers on the Partial List of Nursery Dealers and Growers in the most current "Inspection and Contract Administration Manual for MN/DOT Landscape Projects". The Engineer, in consultation with the project designer, may authorize specific substitute plants or may extend the Contract time to ensure availability of the specified plants. The general requirements for substitutions will be equal to or better than the initially specified materials.

5. Department Furnished Stock and Transplant Stock

   Department furnished stock and transplant stock shall be obtained from sources designated in the Plan or Special Provisions.

6. Incidental Materials and Work

   Materials and work (whether specified, non-specified, replacement, or miscellaneous) that is considered incidental to payment for the individual plant installation pay items and for which no direct payment is made.

7. Specified Incidental Materials and Work

   The Contractor shall supply, install, and maintain specified incidental materials as required for plant installation and establishment in accordance with the Special Provisions, Plan and Standard Planting Details.

8. Non-specified Incidental Materials and Work

   The Contractor may supply, install, and maintain non-specified incidental materials for plant installation and establishment success in accordance with

product labeling, manufacturer's instructions, and all applicable laws, regulations and ordinances.

9. Replacement Materials and Work

   Replacements consist of materials and work required in replacing unacceptable or missing plants, materials and incidental items in accordance with the Special Provisions, Plan and Standard Planting Details. Replacement materials and work shall be equal to or better than the initially specified materials and work.

10. Miscellaneous Incidental Materials, Equipment and Work

    Miscellaneous incidental materials, equipment, and work include mobilization, traffic control, protection and restoration of vegetation and property, layout and staking, soil cultivation, temporary erosion control, mowing, and application of herbicides, insecticides, fungicides, water and anything else necessary to install, maintain and establish the plants as specified and in a healthy, vigorous, and weed-free condition.

C. Construction Requirements

1. Landscape Specialist, "Certified" by MN/DOT, shall be on the Project site at all times to perform or directly supervise plant installation and establishment work. "Certified Landscape Specialist" documentation shall be supplied at or prior to the Preconstruction Conference. The "Certification" is obtained by completing a 1-day MN/DOT Landscape Project Inspection and Administration training class and passing a written test administered by the MN/DOT Landscape Architecture and Forestry Units. Full certification is valid for a period of 3 years and provisional certification may be obtained for a period of 1 year by passing a test without completion of a training class.

2. Notices by Contractor

   The Contractor shall notify the Engineer at least 3 days prior to any planned deliveries of initial and replacement planting stock to the Project site to allow for inspection scheduling. The Contractor shall notify the Engineer at least 24 hours in advance of beginning or changing any distinct operations. The Contractor's notice must include the Project number, Engineer's name, notification date, intended dates and times for the operation(s), and the approximate location(s) where work is intended to begin. The Contractor shall provide notifications in writing by confirmable e-mail or facsimile transmission.

3. Unauthorized Work and Penalties for Non-compliant Operations

   Work performed without required and acceptable documentation and notifications, without supervision by a "Certified Landscape Specialist", without conducting required and acceptable competency tests, or in conflict with the working hours of 1803 (Prosecution of Work) will be considered as unauthorized work. In the case of non-compliant operations, the Agency may assess a daily charge of $200.00, on a calendar day basis, until the Contractor is in compliance.

4. Required Equipment

   The Contractor shall provide equipment conforming to 1805 (Methods and Equipment) and shall have the following available on the Project at all times:

   a. At least one portable compaction tester capable of measuring compaction in the soil to a minimum depth of 450 mm (18 inches).
   b. At least one soil recovery probe for assessment of soil moisture conditions.
   c. At least one tree caliper with measurement readings in inches.

5. Preconstruction Work

   Preconstruction Work involves:

   a. Attending a Preconstruction Conference
   b. Submitting all required preconstruction documentation.
   c. Mobilizing for work on the site including the movement of equipment and supplies to the Project.
   d. Protecting existing vegetation, resources, and property in accordance with the Plan, Special Provisions and 1712 (Protection and Restoration of Property), 2031 (Field Office and Laboratory), 2557 (Fencing), and 2572 (Protection and Restoration of Vegetation)

6. Staking Planting Holes and Beds

   The planting locations and layouts shown in the Plan are approximate. The Contractor shall stake the exact locations and layouts for the Engineer's approval. To remedy unanticipated localized problems and seasonal conditions that may hinder plant establishment, the Contractor may request the Engineer's approval to relocate plantings, to make plant substitutions, or to modify soil or drainage characteristics in accordance with the Standard Planting Details and options shown in the Plan.

   The Contractor shall locate plantings so that:

   a. A minimum clear sight distance of 150 feet exists in front of all traffic control signs and extends 50 feet beyond the signs.
   b. Trees remain outside of the safety clear zones and safety sight corners and lines shown in the Plan.

7. Preparing Planting Holes and Planting Beds

   The Contractor shall not work in planting hole and bed areas when soil moisture is greater than field capacity to prevent site compaction and damage.

8. Utilities

   The Contractor shall conform to 1507 (Utility Property and Service) before cultivating soil or excavating holes on the Project. The Contractor may request the Engineer's approval to relocate plantings to avoid unanticipated conflicts with utilities.

9. Weed Control and Soil Cultivation

   Herbicide application may begin in spring or fall and shall be applied to actively growing vegetation. Before cultivating individual planting hole and bed areas, the

Contractor shall kill all turf and weed growth within the limits of all planting areas that will receive mulch in accordance with the following steps.

Step 1. Mow existing vegetation to no less than 75 mm (3 inches) at least one week prior to any herbicide spraying. Remove the cuttings. The vegetation shall be allowed to re-grow to a height of at least 100 mm (4 inches) and not more than 200 mm (8 inches) prior to applying herbicide.

Step 2. At least 3 days prior to herbicide application, submit labels of all intended herbicides and a copy of a valid MN Pesticide Applicator License (Categories A & J are required) to the Engineer.

Step 3. Spray and kill all turf and weeds (top growth and roots), within designated areas only, using a non-selective, non-residual post emergence herbicide containing 41% glyphosate as the active ingredient. Personnel licensed by the Minnesota Department of Agriculture and experienced in the use of chemical pesticides shall perform the work in accordance with the manufacturer's instructions and recommendations. The herbicide shall be applied to dry foliage on actively growing vegetation. The application shall be made in August or early September preceding a specified fall or spring Plant Installation Period (PIP), or in late April or early May if August or September application is not possible for the spring PIPs that are typically specified. If precipitation occurs within 6 hours after herbicide application, the Contractor may need to re-apply herbicide.

Step 4. Prior to proceeding with soil cultivation work and to the satisfaction of the Engineer, the Contractor shall schedule and perform a "Competency Test". A satisfactory "Competency Test" must demonstrate acceptable soil cultivation, incorporation of soil additives, compaction levels, and soil drainage in one planting bed area and one individual tree planting area.

Step 5. Prior to placing specified soil additives, deep cultivate the planting hole and bed areas by thoroughly loosening the soil to a minimum depth of 300 mm (12 inches) and a compaction level of not more than 1400 kPa (200 psi) to this depth, as measured from the finished grade elevation of the soil. Use of a spading machine shall typically be required to uniformly de-compact, loosen, and cultivate roadside planting soils to the required thresholds without causing differential zones of hardpan and excessively compacted soil. Planting hole cultivation will not be required for machine moved tree transplanting (hydraulic spade-type) other than loosening the soil outside the soil ball perimeter in accordance with the Standard Planting Details in the Plan.

Step 6. Unless otherwise specified, add 100 mm (4 inches) of Grade 2 compost, in accordance with 3890 (Compost) and other specified soil additives, over the cultivated planting hole and bed areas and thoroughly incorporate it to a minimum depth of 300 mm (12 inches) as measured from the finished grade elevation of the soil.

Step 7. Use a compaction tester to ensure that compaction, in the planting hole and bed areas, does not exceed 1400 kPa (200 psi) to a minimum depth of 400 mm (16 inches). If it becomes evident that the Contractor's operations have resulted in zones of hardpan or excessively compacted soil, the Contractor shall repeat the deep cultivation step or shall de-compact the subsoil in accordance with 2105.3G (Finishing Operations, Compaction Correction) and specific to requirements for turf establishment areas. This work shall be provided at no expense to the Department.

Step 8. The Contractor shall be responsible for ensuring adequate drainage in the planting hole and bed areas. When the Contractor has reason to suspect a drainage problem, they shall perform a percolation test by filling a 400 mm (16") deep planting hole with water and measuring the time it takes for the water to drain from the hole. Adequate drainage will be considered equal to or greater than a percolation rate of 12 mm (1/2") per hour. In the case of inadequate drainage, the Contractor shall be responsible for requesting approval from the Engineer to either relocate or delete affected planting locations or to proceed with Extra Work by using one or a combination of the Planting Details for Poorly Drained Soils as shown in the Plan.

Step 9. Temporary erosion control measures shall be applied in accordance with the NPDES permit, SWPPP notes, and 2573 (Storm Water Management). Type 6 wood chip mulch may be used at a depth of no more than 25 mm (1 inch) for temporary erosion control in prepared planting bed areas.

10. Wet Soils, Rock, and Debris

    If excessively wet soils, bedrock, or excessive quantities of boulders and construction debris are encountered, the Contractor may request the Engineer's approval to relocate or delete plantings or to modify soil or drainage characteristics in accordance with the alternative options in the Standard Planting Details shown in the Plan.

11. Delivery and Storage of Plants

    The Engineer will provide for inspection and acceptance of plant stock delivered to the Project in accordance with the "Inspection and Contract Administration Manual for MN/DOT Landscape Projects" and 3861 (Plant Stock) prior to installation. Plant stock shall be installed on the day of delivery to the Project site

unless temporary storage methods are employed. Prior to being installed, the roots of all plants shall be kept completely covered with a moisture-holding material (wood chips, straw, sawdust, moss, or soil) that is kept thoroughly and continuously moist and protect from drying winds, direct sunlight, excessive heat, freezing, low humidity, inadequate ventilation, and animal or human harm. Plants with damage, that has occurred or has been discovered during temporary storage, will become unacceptable. Plants shall not remain stored from one planting season to the next.

12. Pruning - Top Growth and Roots

    Immediately prior to planting, the Contractor shall prune, as necessary, the roots of bare root plants (except seedlings) and the top growth of deciduous plants. Broken or badly bruised roots and dry root tips shall be cut back to sound, healthy tissue. Pruning shall be employed to remove dead, rubbing, damaged, diseased and suckering branches and to improve plant symmetry, structure, and vigor. Coniferous trees and shrubs shall be pruned only to the extent of removing damaged growth or a competing leader. The Contractor shall use good horticultural practices in accordance with the "Inspection and Contract Administration Manual for MN/DOT Landscape Projects" and the Standard Planting Details in the Plan. The Contractor shall not prune oak trees during the oak wilt season (April, May, June, and July) to prevent the spread of oak wilt disease. Any accidental cuts or wounds to oaks shall be immediately treated with a wound dressing in accordance with the Standard Planting Details in the Plan. The Contractor shall have wound dressing material on the Project at all times during the oak wilt season.

13. Buried Root Flares

    Container grown and balled and burlapped plant stock will be considered unacceptable if furnished with more than 100 mm (4 inches) of soil depth above the root flare. Plants furnished with 100 mm (4 inches) or less excess soil above the root flare may be acceptable if the excess soil can be removed without damaging the root system of the plants.

14. Excessive Roots

    Reject containerized or balled and burlapped plants with roots extending 4 inches or more beyond the container or burlap.

15. Installation of Plants

    a. Prior to proceeding with plant installation work and to the satisfaction of the Engineer, the Contractor shall schedule and perform a "Competency Test" demonstrating acceptable plant installation methods (in accordance with the Plan and Standard Planting Details) for each plant pay item and root category applicable to the Project. The test shall include handling plants, digging holes and beds, installing plants, initial watering, installing applicable protection materials, and mulching.

    b. Prior to digging planting holes, the Contractor shall rake temporary erosion control wood chip mulch off all prepared planting areas to prevent wood chip

contamination of the planting soil in the holes. Wood chip mulch, used as temporary erosion control, may be re-spread around plants in up to a 25 mm (1 inch) depth following plant installation if newly provided and acceptable Type 6 mulch is applied over the top to the depth specified in the Standard Planting Details in the Plan.

c. The Contractor shall dig all planting holes to the configuration and minimum dimensions shown in the Standard Planting Details in the Plan but shall not work in planting holes and beds when soil moisture is greater than field capacity.

d. The Contractor shall be responsible for ensuring adequate drainage in the planting hole and bed areas. When the Contractor has reason to suspect a drainage problem, they shall perform a percolation test by filling a 400 mm (16") deep planting hole with water and measuring the time it takes for the water to drain from the hole. Adequate drainage will be considered equal to or greater than a percolation rate of 12 mm (1/2") per hour. In the case of inadequate drainage, the Contractor shall be responsible for requesting approval from the Engineer to either relocate or delete affected planting locations or to proceed with Extra Work by using one or a combination of the Planting Details for Poorly Drained Soils as shown in the Plan.

16. Individual Plant Stock Types and Installation Requirements

The Contractor shall install plants in conformance with the steps and requirements shown in the Standard Planting Details in the Plan and specific to each individual Plant Stock type.

17. Watering

At all times during the Plant Installation Period, the Contractor shall have sufficient watering equipment and forces available to completely water all plants as often as necessary to maintain adequate but not excessive soil moisture in the root zones. Within 2 hours of installation, each plant's backfill soil will be thoroughly saturated with water. After settling, the Contractor will provide additional backfill as needed to fill in the voids.

18. Mulch

Planting bed soils shall be fine graded and leveled with hand tools prior to placing mulch. Mulch material shall be placed as shown in the Standard Planting Detail in the Plan no later than seven days after plant installation. Placement of mulch that is contaminated with soil or other materials and inconsistent with the requirements of MN/DOT 3882 (Mulch Materials) will be considered unacceptable and shall be removed from the Project.

19. Protection of Installed Trees

The Contractor shall use protective materials to better ensure healthy growth and survival of installed trees.

20. Staking and Guying

a. Unless staking and guying is required in the Plan, the Contractor shall only stake and guy trees when necessary to maintain the trees in a plumb

condition. Circumstances that may warrant staking and guying include excessive soil moisture, light-textured soil, steep slopes, exposure to excessive wind, and the likelihood of vandalism. Staking and guying shall be installed in accordance with the Standard Planting Details in the Plan.

b. The Contractor shall remove all staking and guying within 1 year of initial installation.

21. Rodent Protection

The Contractor shall place rodent protection around all deciduous, pine and larch trees in accordance with the Standard Planting Details in the Plan unless specified otherwise.

22. Tree Planting

The Contractor shall plant trees in accordance with the Standard Planting Details in the Plan.

23. Tree Shelters

The Contractor shall install tree shelters in accordance with the Plan and Standard Planting Details.

Type	Height	Diameter	White Oak Stake Size
Tree Shelters	4'	4" average	1"x 1" x 60"
Shrub Shelters	24"	5" average	1"x 1" x36"
Seedling Shelters	24"	3.5" Min.	1" x 1" x 36"

24. Tree Mats

Tree mats shall be 3' x 3' x 2.5 mils thick. Mat shall have microfunnel holes at a minimum of 400 holes per square inch to allow moisture and rainfall through the mat. After securing tree shelter, slide mat over plant and shelter, with microfunnels pointing down and secure with 6" x 1" x 6" 12 gauge wire staples according to manufacturer's instructions.

25. Cleanup and Restoration Work

Cleanup and restoration work shall be accomplished on an ongoing basis and as the final step of the initial planting operations. The Contractor shall:

a. Remove all excess materials and debris from the Project.

b. Repair turf in all disturbed areas or with seed mixes as specified in the Plan or to match in place turf.

1) Immediately prior to sowing seed or laying sod, prepare soil as specified in 2575.3B (Soil Preparations). Use a compaction tester to verify soil compaction does not exceed 1400 kPa (200 psi) to a minimum depth of 300 mm (12 inches). If the Contractor's operations create a hardpan or excessively compacted soil, the Contractor shall conduct subsoiling operations in accordance with 2105.3G (Finishing Operations, Compaction Correction) to reduce the compaction. This work shall be provided at no expense to the Department.

2) Uniformly broadcast a Type 4 Natural Base fertilizer (3881.2B4) at a rate so Nitrogen is applied at a rate of 43 pounds per acre.
3) Lay sod or uniformly broadcast seed at 1.5 times the rate specified in Table 2575-1, Seed Mixture Application Rates. Seed shall be in accordance with the requirements of 3876 (Seed) and seeding shall occur in accordance with Table 2575-2, Season of Planting.
4) Rake and firm the seeded areas to ensure seed/soil contact.
5) Broadcast or disc anchor Type 1 mulch in all seeded areas.

c. Install erosion control measures as necessary to prevent erosion.

26. Plant Establishment Period

A Plant Establishment Period (PEP), of at least 1 (one) calendar year, begins on the date on which all of the initial planting operations on the Project have been satisfactorily completed and continues until final acceptance of the Project, unless specified otherwise.

27. Establishment Work

The Contractor shall keep plants in a healthy growing condition, using good horticultural practices, continuously throughout the establishment period and shall submit MN/DOT Landscape Contractor Scouting reports in accordance with K2a(1). Plant establishment work shall be performed regularly throughout the growing seasons (April through October) and as necessary during the dormant seasons (November through March). The Engineer may use random inspection throughout the Plant Establishment Period to verify compliance. If plants are not maintained as required and/or the reports are not submitted as required, the Contractor will be considered non-compliant.

The Engineer may assess a daily charge of $200.00 for non-compliance, on a calendar day basis, until the Contractor achieves compliance.

28. All Plants

In plant establishment work, the Contractor shall:

a. Scout to assess the condition of the plants and the planting site and any factors that may influence a plant's health, vigor, and establishment success. The Contractor shall scout these conditions at least every two weeks during the growing season and at least every month during the dormant season.
b. The Contractor shall submit a written scouting report to the Engineer, via e-mail, by the 1st and 15th of each month during the growing season (April through October) and by the 1st of each month during the dormant season (November through March). The report frequency and content will be used by the Engineer to assess plant establishment compliance. The report shall include the Project number; Engineer's name; name of Contractor's responsible scout or representative; date(s) any work was performed; work location(s); work completed; prevailing weather conditions; soil moisture assessments; insect, animal, vehicular, weather or other damage; disease problems; treatment recommendations and assessment of overall plant

conditions including weed competition and control. The report may include scanned copies of the Plan sheets with the Contractor's notes and/or copies of the report form found in the "Inspection and Contract Administration Manual for MN/DOT Landscape Projects".

c. Maintain adequate (but not excessive) soil moisture in conformance with 2571.3G and watering guidelines shown in the Plan's Standard Planting Details.

d. Repair, adjust, or replace staking and guying, mulch material, planting soil, rodent protection, seedling tree shelters, tree paint, and other incidental items in conformance with the Plan.

e. Maintain healthy, vigorous plants free from harmful insects, fungus, and disease.

f. Remove dead, dying, and unsightly plants. Furnish and install replacement plants in accordance with 2571.2K2b

g. Maintain plants in a plumb condition at the appropriate planting depth.

h. Maintain all planting areas in a weed-free condition.

1) Remove all weeds (top growth and roots) within the mulch limits by hand pulling (pre-watering is advised). Ensure weeding operations do not contaminate the mulch or project with weed seed, weed-laden soil or propagating weed parts. Remove all State and County-regulated noxious weeds to at least 900 mm (3 feet) beyond the mulch limits. Remove all weed parts or weed-laden materials from the Project in such a manner as to avoid the spread of weed infestations.

2) Spray application of chemicals for weed control in the mulched planting areas will not be permitted during the plant establishment period. A non-selective, non-residual post emergence herbicide containing 41 percent glyphosate, as the active ingredient, may be applied with a surfactant on a spot treatment basis with a brush or wick applicator. A broad-spectrum dichlobenil based granular (pre-emergent) herbicide may also be applied, in conformance with product labeling and manufacturer's recommendations, to try and further residual weed control.

3) Weed whipping and weed clipping will not be accepted as weed control.

4) Mow turf bands around and to at least 900 mm (3 feet) beyond the mulch limits and to a height no shorter than 100 mm (4 inches) whenever turf height exceeds 230 mm (9 inches) adjacent to the mulched planting areas.

5) Mow all areas of turf that are installed as part of the Project requirements when the growth exceeds a height of 500 mm (18 inches). Mow to a height of 150-300 mm (6 -12 inches). It is anticipated that mowing may be necessary as early as June and as late as September. The Contractor shall control State and County-listed noxious weeds at all times.

g. Prune to remove dead, rubbing, damaged or diseased branches, unwanted suckers, and to improve plant form and structure.

h. Prevent or repair rutting and any other damage that may lead to soil erosion and weed infestation.
i. Perform plant establishment operations consistent with proper plant care and horticultural practices.
j. Remove all excess material, obsolete temporary erosion control devices, and debris from the Project.

29. Replacement Requirements

At the end of the one year plant establishment period, the Contractor is responsible for determining which plants need to be replaced based upon compliance with Project requirements. At least one week prior to anticipated plant replacements, the Contractor shall submit a summary report of proposed plant replacements to the Engineer. The report shall include, by attachment, copies of plan sheets with the proposed replacement quantities and locations clearly identified and a MN/DOT Certificate of Compliance for all Plant Stock, Landscape Materials, and Equipment. The Contractor shall also clearly mark the plants to be replaced with brightly colored paint in the field. The Contractor shall, at no extra expense to the Department replace dead, defective, or missing plants and all incidental materials in accordance with initial installation requirements, including those lost due to accidents, vandalism, theft, rodent damage, damage caused by Contractor, or as ordered by the Engineer. Replacement plants and incidental materials shall be equal to or better than the initially specified material. When less than a full year remains in the plant establishment period, the Contractor shall not replace plants unless the plant establishment period is extended by a Supplemental Agreement or Change Order to provide for at least one full year of establishment care.

30. Acceptance of Work

For acceptance at full payment, each plant shall meet all specified requirements, including the criteria listed in the current edition of the "Inspection and Contract Administration Manual for MN/DOT Landscape Projects".

31. Acceptance of Preconstruction Work

The Engineer will accept the preconstruction work after the Contractor has: secured commitments for required materials (MN/DOT Certificate of Compliance for Plant Stock, Landscape Materials, and Equipment), participated in a Preconstruction Conference, obtained the Engineer's approval for the progress schedule, moved equipment and supplies to the Project site, and provided for protection of existing plants if necessary.

32. Acceptance of Preparation of Planting Holes and Beds

The Engineer will accept the preparation of planting holes and beds after the Contractor has satisfactorily completed a competency test and all other specified staking, initial weed control, soil cultivation with incorporation of additives, and temporary erosion control work.

33. Acceptance of Initial Planting Operation

The Engineer will provisionally accept initial planting operations based upon

1) satisfactorily completed competency test,
2) installation of all individual plants,
3) all incidental material and work items (initial watering, tree protection materials, mulching, etc.) required as part of the initial planting operation.

35. Final Acceptance
    a. As a condition for terminating the plant establishment period and conducting the final inspection, the Engineer may require the Contractor to bring the plant establishment work into compliance. On or about the date on which the plant establishment period is terminated, the Engineer will make a final inspection of the Project. The Engineer will make a determination as to which plants will be accepted for payment at the Contract unit prices, at a reduced payment, or at no payment. Upon final acceptance, the Contractor will not be required to provide any further care for the plantings.
    b. Final acceptance will be made upon completion of the 1 year plant establishment period and a final inspection of the completed Project.

D. Method of Measurement
All plants will be measured separately by the number of acceptable plants for each bid item as listed in the Payment Schedule.

1. Payment Schedule
Payment for plant installation and establishment will be made on the basis of the following schedule:

Item No.	Item	Unit
2571.501	Coniferous tree (size & root category)	tree
2571.502	Deciduous tree (size & root category)	tree
2571.503	Ornamental tree (size & root category)	tree
2571.504	Coniferous shrub (size & root category)	shrub
2571.505	Deciduous shrub (size & root category)	shrub
2571.506	Vine (age or size & root category)	vine
2571.507	Perennial (age or size & root category)	plant
2571.541	Transplant tree (spade size (1))	tree
2571.544	Transplant shrub	shrub
2571.546	Transplant vine	vine
2571.547	Transplant perennial	plant
NOTE: State Root Category: -Seedling, -Bare Root, -Machine Moved – Container Grown - Balled & Burlapped		
(1) Spade size 1.1 m (42 inch), 1.5 m (60 inch), 1.9 m (78 inch), 2.1 m (85 inch), 2.3 m (90 inch).		

E. Basis of Payment
Upon Completion of planting and prior to final inspection, the Contractor shall be paid 90% of the contract unit price. The City will hold 10% of the unit price until after the final walk-thru inspection by the Engineer.

2572 PROTECTION AND RESTORATION OF VEGETATION

The provisions of MN/DOT Specification 2572, Protection and Restoration of Vegetation, shall apply to this contract except where otherwise defined in the Contract Special Provisions, and as amended below:

Contractor shall consult with the City Tree Inspector, or designee, prior to beginning any construction activities to identify, verify, and establish concurrence with plan of tree removal, preservation, and protection.

Preserved trees shall be protected from direct damage and soil compaction in accordance with MN/DOT Standard Specifications for Construction, 2572.3A Protecting and Preserving.

The provisions of MN/DOT Specification 2572.3A8, Destroyed or Disfigured Vegetation, is amended below:

Damage to preserved trees on public property by contractors through negligence or non-compliance with the City's Standard Construction Specifications may be subject to a fine established by the Tree Inspector per the *Council of Tree and Landscape Appraisers – Guide for Plant Appraisal*. A copy of this guide is available for review in the City Engineering Office, 211 City Hall.

Payment shall be at the unit prices listed in MN/DOT 2572.5B.

2573 STORM WATER MANAGEMENT

Storm water management shall be performed in accordance with the provisions of MN/DOT 2573, except as modified below:

The Contractor is required to be a co-permittee on the MPCA Stormwater for Construction Activity NPDES permit and shall be fully familiar with the current permit (www.pca.state.mn.us/water/stormwater/stormwater-c.html) and be able to comply with all conditions of the permit and the project's Storm Water Pollution Prevention Plan (SWPPP).

MN/DOT Section 1717 Air, Land, and Water Pollution and Section 2573 Storm Water Management of the MN/DOT Standard Specifications for Construction 2005 Edition shall apply except as modified below:

A. Slope Protection
On all exposed slopes 1v:3h, or steeper, temporary or permanent erosion protection must be installed within 3 days of being worked. For all other exposed slopes, temporary or permanent erosion protection must be installed within 7 days of being worked.

B. Direct Connection to an Inlet
Ditches/swales/channels that direct water from the construction site to any storm water or surface water inlet shall have the ditch bottom stabilized the same day as connection to the inlet occurs. Same day stabilization shall be done using a 3 foot (minimum) width of Erosion Control Blanket (ECB) securely anchored in accordance with the manufacturer's recommendation and extend the full length of the channel. The type of ECB shall be selected in accordance with MN/DOT 3885 depending on channel slope and expected velocity but must be Category 3 or better.

C. Materials Required at the Construction Site
As a spill and contingency measure a minimum of 5 rock logs (MN/DOT 3897.2 Type 7) shall be always available on the jobsite in addition to absorbent pads and other materials to contain spills and prevent migration to the storm water system.

D. Construction Entrance
In addition to the MN/DOT approved materials list, Mudmat© Reusable Matting shall also be considered an acceptable construction entrance (minimum length of 45 feet). Maintenance of either Mudmat or Stone Construction Entrance is required to prevent tracking offsite.

2575 TURF ESTABLISHMENT

Turf establishment shall be performed in accordance with the provisions of MN/DOT 2575, except as modified below:

A. Lawn type sod shall be placed on all disturbed turf areas in well established lawns and around all culvert ends and storm sewer inlets and outlets as directed by the Engineer.

B. Where the new sod meets the existing, a sod cutter shall be used to make the new sod level with the existing and to eliminate the ragged appearance of the existing sod caused by excavation.

C. Areas of disturbed soil located on private property will be topsoiled and sodded immediately after the underlying work is completed. No additional compensation will be made for this early sodding.

D. Topsoil salvage material shall be placed to a thickness of 4 inches on all disturbed turf areas to be sodded in accordance with the provisions of MN/DOT 2105.

E. Turf establishment on disturbed turf areas not designated for sodding shall consist of topsoiling, seeding, fertilizing and hydromulching.

F. Seed mixture No. 250 as specified in MN/DOT 3876, shall be applied at the rate of 125 pounds per acre.

G. Commercial fertilizer, analysis 10-10-10 as specified in MN/DOT 3881 shall be applied at the rate of 400 pounds per acre.

H. Hydromulch, Type 5 as specified in MN/DOT 3884 shall be applied at the rate of 2,100 pounds per acre.

I. Topsoil salvage material shall be placed to a thickness of 4 inches on all disturbed turf areas to be seeded in accordance with the provisions of MN/DOT 2105.

J. Seed and hydromulch shall be placed with a hydroseeder.

K. Final acceptance of turf establishment will not be made until area restored has a satisfactory stand of grass established. Project retainage will be held until final acceptance of turf establishment.

L. Payment for sodding at the contract price per square yard shall include importing or salvaging and placing 4 inches of topsoil, shaping, or otherwise preparing the ground, cutting as required, furnishing, laying the sod on the areas designated to be covered, and pressing the sod into the underlying soil by rolling or tamping, and staking or stapling as necessary for sloped areas.

M. Payment for turf establishment shall include importing or salvaging and placing 4-inches of topsoil, shaping, or otherwise preparing the ground, seeding, fertilizing and hydromulching the disturbed turf areas not designated for sodding. Final acceptance of turf establishment will not be made until the area restored has a satisfactory stand of grass established. A satisfactory stand of grass shall be defined as a consistent root of growth 3-inches or more. Root growth shall be determined on a random sample basis of plugs taken by the engineer when the contractor determines that the root growth has been obtained. Acceptance of the turf will not occur until the minimum root growth has been obtained.

N. Delete Mn/DOT 2575.3 O3. "Upon satisfactory placement of the sod, the Engineer may authorize partial payment not exceeding 80 percent of the Contract bid price. The remaining percentage shall not become due and payable until expiration of the sod maintenance period, and then only as otherwise provided for in the Contract.

Upon expiration of the sod maintenance period on individual areas or sections of the Project, the Engineer will make an inspection of the work and will accept all sod that is in normal, healthy growing condition. No payment will be made for sod that is not in acceptable condition at the time of the final inspection an amount will be deducted from any moneys due or that may become due the Contractor equal to 100 percent of the Contract bid price per unit of measure of unacceptable sod. Sod that is within 3 m (10 feet) of the shoulder or is directly abutting a roadway surface that is acceptably maintained, but dies out due to salt or winter maintenance activities beyond the Contractor's control, may be paid for at 100 percent of Contract price provided that the sod has been maintained for at least 20 calendar days prior to December 1."

3138 AGGREGATE FOR SURFACE AND BASE COURSES

The provisions of MN/DOT 3138 are modified as follows:

The second paragraph of MN/DOT 3138.2B Gradation Tables 3138-1 and 2 is revised to read as follows:

If Class 7 is substituted for Classes 1, 3, 4, 5, or 6, it shall meet the gradation requirements of the substituted class (Table 3138.1); except that for Class 5 and 6, up to 5 percent by mass **(weight)** of the total composite mixture may exceed 25.0 mm **(1 inch)** sieve; however, 100 percent must pass the 37.5 mm **(1.5 inch)** sieve. Surfacing aggregate mixtures containing salvaged materials shall meet the gradation requirements of the mixtures specified in the Plan. All gradations will be run on the composite mixture

before extraction of the bituminous material.

TABLE 3138-1 BASE AND SURFACING AGGREGATE Total Percent Passing						
Sieve Size	Class 1 (A)	Class 2	Class 3 (A)	Class 4 (A)	Class 5 (A) (B)	Class 6 (A) (B)
75 mm (3 inches)	--	--	--	--	--	--
50 mm (2 inches)	--	--	100	100	--	--
37.5 mm (1 ½ inches)	--	--	--	--	--	--
25.0 mm (1 inch)	--	---	--	--	100	100
19.0 mm (3/4 inch)	100	100	--	--	90-100	90-100
9.5 mm (3/8 inch)	65-95	65-90	--	--	50-90	50-85
4.75 mm (No. 4)	40-85	35-70	35-100	35-100	35-80	35-70
2.00 mm (No. 10)	25-70	25-45	20-100	20-100	20-65	20-55
425 µm (No. 40)	10-45	12-30	5-50	5-35	10-35	10-30
75 µm (No. 200)	8.0-15.0	5.0-13.0	5.0-10.0	4.0-10.0	3.0-10.0	3.0-7.0

(A) When salvaged materials are substituted for another class of aggregate, it shall meet the gradation requirements of the class being replaced except as amended in MN/DOT 3138.2 B.

(B) The gradation requirements for aggregates containing 60% or more crushed quarry rock may be amended with the concurrence of the Project Engineer and the Grading and Base Engineer.

The fifth paragraph of MN/DOT 3138.3 Sampling and Testing is revised to read as follows:

The stockpile shall be sampled at the rate of one field gradation test per 1,000 tons **(tons)** of aggregate used on the Project.

3139 GRADED AGGREGATE FOR BITUMINOUS MIXTURES

Mn/DOT 3139 is hereby deleted and replaced with the following:

3139 Graded Aggregate for Bituminous Mixtures

3139.1 Scope

Provide graded aggregate for use in bituminous mixtures.

3139.2 PLANT MIXED ASPHALT Requirements

A Composition

- Provide graded aggregate composed of any combination of the following sound durable particles as described in 3139.2B.
- Do not use graded aggregate containing objectionable materials including:
  (1) Metal,
  (2) Glass,
  (3) Wood,
  (4) Plastic,
  (5) Brick, or
  (6) Rubber
- Provide coarse aggregate free of coatings of clay and silt.
- Do not add soil materials such as clay, loam, or silt to compensate for a lack of fines in the aggregate.
- Do not blend overburden soil into the aggregate.
- Feed each material or size of material from an individual storage unit at a uniform rate.
- Do not place blended materials from different sources, or for different classes, types, or sizes together in one stockpile unless approved by the Engineer as a Class E aggregate.

B Classification

B.1 Class A

Provide crushed igneous bedrock consisting of basalt, gabbro, granite, gneiss, rhyolite, diorite, and andosite. Rock from the Sioux Quartzite Formation may contain no greater than 4.0 percent non-Class A aggregate. Do not blend or add non-Class A aggregate to Class A aggregate.

B.2 Class B

Provide crushed rock from other bedrock sources such as carbonate and metamorphic rocks (Schist).

B.3 Class C

Provide natural or partly crushed natural gravel obtained from a natural gravel deposit.

B.4 Class D

Provide 100 percent crushed natural gravel produced from material retained on a square mesh sieve with an opening at least twice as large as Table 3139-2 allows for the maximum size of the aggregate in the composite asphalt mixture. Ensure the amount of carryover, material finer than the selected sieve, no greater than 10 percent of the Class D aggregate by weight.

B.5 Class E

Provide a mixture consisting of at least two of the following classes of approved aggregate:

(1) Class A,
(2) Class B, and
(3) Class D.

B.6 Steel Slag

Steel slag cannot exceed 25% of the total mixture aggregate and must be free from metallic and other mill waste. The Engineer will accept stockpiles if the total expansion is no greater than 0.5 percent as determined by ASTM D 4792

B.7 Taconite Tailings

Obtain taconite tailings from ore mined westerly of a north-south line located east of Biwabik, Minnesota (R15W-R16W) or from ore mined in southwestern Wisconsin.

B.8 Recycled Asphalt Shingles (RAS)

Provide recycled asphalt shingles manufactured from waste scrap asphalt shingles (MWSS) or from tear-off scrap asphalt shingles (TOSS). Consider the percentage of RAS used as part of the maximum allowable Recycled Asphalt Pavement (RAP) percentage. See Table 3139-3.

B.8.A RAS Gradation..... MN/DOT Laboratory Procedure 1801

Provide RAS in accordance with the following gradation requirements:

Table 3139-1
RAS Gradation

Sieve size	Percent passing
½ in [12.5 mm]	100
No. 4 [4.75 mm]	90

B.8.B Binder Content

Determine the binder content using chemical extraction meeting the requirements of MN/DOT Lab Procedure 1851 or 1852.

B.8.C Bulk Specific Gravity

The Contractor may use an aggregate bulk specific gravity (Gsb) of 2.650 in lieu of determining the shingle aggregate Gsb in accordance with MN/DOT Lab

Procedure 1205.

B.8.D Waste Materials

Do not allow extraneous materials including metals, glass, rubber, nails, soil, brick, tars, paper, wood, and plastics greater than 0.5 percent by weight of the graded aggregate as determined by material retained on the No. 4 [4.75 mm] sieve as specified in MN/DOT Laboratory Procedure 1801.

B.8.E Stockpile

Do not blend an RAS stockpile with other salvage material. Do not blend MWSS and TOSS. The Contractor may blend virgin sand material with RAS to minimize agglomeration if the Contractor accounts for the blended sand in the final mixture gradation.

B.8.F Certification

Ensure the processor provides RAS certification on the following Department form "Scrap Asphalt Shingles from Manufacture Waste" or "Tear-Off Scrap Asphalt Shingles" at www.dot.state.mn.us/materials/bituminous.html

B.9 Crushed Concrete and Salvaged Aggregate

The Contractor may incorporate no greater than 50 percent of crushed concrete and salvaged aggregate in non-wear mixtures. Do not use crushed concrete in wearing courses.

B.10 Ash

Sewage sludge ash and waste incinerator ash are allowed as an aggregate source at a maximum of 5% of the total weight of the mixture. Only use sewage sludge ash meeting the requirements of the Tier II hazard evaluation criteria as approved by the Engineer with concurrence with MN/DOT's Environmental Assessment Engineer in the mixture. Only use waste incinerator ash sources approved by the Engineer with concurrence with MN/DOT's Environmental Assessment Engineer.

B.11 Recycled Asphalt Pavement (RAP)

B.11.A Aggregate Angularity

Provide combined RAP and virgin aggregates that meet the composite coarse and fine aggregate angularity for the mixture being produced.

B.11.B Objectionable Material

Do not use RAP containing objectionable materials including metal, glass, wood, plastic, brick, or rubber.

B.11.C Asphalt Binder Content

Determine the asphalt binder content using the MN/DOT Lab Manual Method 1851 and 1852.

B.11.D Bulk Specific Gravity

Determine the bulk specific gravity in accordance with MN/DOT Laboratory Procedure 1205 or 1815.

C Quality

C.1 Los Angeles Rattler Test..... MN/DOT Laboratory Procedure 1210

Ensure a coarse aggregate loss no greater than 40 percent.

C.2 Soundness (Magnesium Sulfate)..... MN/DOT Laboratory Procedure 1219

Maximum loss after 5 cycles on the coarse aggregate fraction (material retained on No. 4 [4.75 mm] sieve for any individual source within the mix) as follows:

(1) Percent passing the ¾ in [19 mm] sieve to percent retained on the ½ in [12.5 mm] sieve, ≤ 14%,

(2) Percent passing the ½ in [12.5 mm] sieve to percent retained on the ⅜ in [9.5 mm]sieve, ≤18%,

(3) Percent passing the ⅜ in [9.5 mm] sieve to percent retained on the No. 4 [4.75 mm] sieve, ≤ 23%,

(4) For the composite if all three size fractions are tested, the composite loss ≤ 18%, and acceptance will be granted if:

(4.1) If the Contractor meets the composite requirement, but fails to meet at least one of the individual components, the Engineer may accept the source if each individual component is no greater than 110 percent of the requirement for that component.

(4.2) If the Contractor meets each individual component requirement, but fails to meet the composite, the Engineer may accept the source if the composite is no greater than 110 percent of the requirement for the composite.

Coarse aggregate that exceeds the requirements in this section for material passing the No. 4 [4.75 mm] sieve cannot be used.

C.3 Spall Materials and Lumps..... MN/DOT Laboratory Procedure 1219

Stop asphalt production if the percent of spall or lumps measured in the stockpile or cold feed exceeds the values listed in Table 3139-3. Determine lump compliance by dry batching.

C.4 Insoluble Residue Test ..... MN/DOT Laboratory Procedure 1221

If crushed carbonate quarry rock (limestone or dolostone) is used the minus 75 µm [**#200**] sized portion of the rock insoluble residue shall not exceed 10% by weight. The insoluble residue test procedure is on file in the MN/DOT Materials Laboratory.

Blending of sources and/or beds with an insoluble residue up to 15% is allowed to meet the 10% insoluble residue requirement. Individual beds thinner than 150 mm [**6 inches**] up to 5% of the total face height, are exempt from the 15% maximum insoluble residue requirement. However, the aggregate producer shall practice good quality control at all times and exclude poor quality stone to the extent practical, regardless of the bed thickness and/or pocket size and location.

No carbonate quarry rock from the Platteville Geological Formation is allowed.

D Gradation

Ensure the aggregate gradation broad bands meet the following requirements in accordance with AASHTO T-11 (passing the No. 200 [75 µm] wash) and AASHTO T-27:

Table 3139-2
Aggregate Gradation Broad Bands (percent passing of total washed gradation)

Sieve size	A	B	C	D
1 in [25.0 mm]	—	—	100	—
¾ in [19.0 mm]	—	100*	85 – 100	—
½ in [12.5 mm]	100*	85 – 100	45 – 90	—
⅜ in [9.5 mm]	85 – 100	35 – 90	—	100
No. 4 [4.75 mm]	25 – 90	30 – 80	30 – 75	65 – 95
No. 8 [2.36 mm]	20 – 70	25 – 65	25 – 60	45 – 80
No. 200 [0.075 mm]	2.0 – 7.0	2.0 – 7.0	2.0 – 7.0	3.0 – 8.0

* The Contractor may reduce the gradation broadband for the maximum aggregate size to 97 percent passing for mixtures containing RAP, if the oversize material originates from the RAP source. Ensure the virgin material meets the requirement of 100 percent passing the maximum aggregate sieve size.

Table 3139-3
Mixture Aggregate Requirements

Aggregate Blend Property	Traffic Level 2	Traffic Level 3	Traffic Level 4	Traffic Level 5
20 year Design ESAL's	<1 million	1 - 3 million	3 - 10 million	10 – 30 million
Min. Coarse Aggregate Angularity (ASTM D5821) (one face / two face), %- Wear (one face / two face), %- Non-Wear	 30/- 30/-	 55 / - 55 / -	 85 / 80 60/ -	 95 / 90 80 / 75
Min. Fine Aggregate Angularity (FAA) (AASHTO T304, Method A) %- Wear %-Non-Wear	 40 40	 42 40	 44 40	 45 40
Flat and Elongated Particles, max % by weight, (ASTM D 4791)	-	10 (5:1 ratio)	10 (5:1 ratio)	10 (5:1 ratio)
Min. Sand Equivalent (AASHTO T 176)	-	-	45	45
Max. Total Spall in fraction retained on the #4 [4.75mm] sieve – Wear Non-Wear	 5.0 5.0	 2.5 5.0	 1.0 2.5	 1.0 2.5
Maximum Spall Content in Total Sample – Wear Non-Wear	 5.0 5.0	 5.0 5.0	 1.0 2.5	 1.0 2.5
Maximum Percent Lumps in fraction retained on the #4 [4.75mm] sieve	0.5	0.5	0.5	0.5
Class B Carbonate Restrictions				
Maximum% -#4 [-4.75mm] Final Lift/All other Lifts	 100/100	 100/100	 80/80	 50/80
Maximum% +#4 [+4.75mm] Final Lift/All other Lifts	 100/100	 100/100	 50/100	 0/100
Max. allowable scrap shingles–MWSS[1] Wear/Non Wear	 5/5	 5/5	 5/5	 5/5
Max. allowable scrap shingles –TOSS[1] Final Lift/All other Lifts	 5/5	 5/5	 0/5	 0/0

(1) MWSS is manufactured waste scrap shingle and TOSS is tear-off scrap shingle.

3139.3 Permeable Asphalt Stabilized Stress Relief Course (PASSRC) and Permeable Asphalt Stabilized Base (PASB) Requirements

A. Restrictions

Do not use recycled materials including glass, concrete, bituminous, shingles, ash, and steel slag.

B. Gradation

The Gradation limits are also considered the Job Mix Formula (JMF) limits.

B.1 PASB

Table 3139-4
PASB Aggregate Gradation

Sieve Size	Percent Passing
1 ½ inch [37.5 mm]	100
1 inch [25.0 mm]	95 - 100
¾ inch [19.0 mm]	85 - 95
3/8 inch [9.5 mm]	30 - 60
No. 4 [4.75 mm]	10 - 30
No. 8 [2.36 mm]	0 - 10
No. 30 [600 µm]	0 - 5
No. 200 [75 µm]	0 - 3

B.2 PASSRC

Table 3139-5
PASSRC Aggregate Gradation

Sieve Size	Percent Passing
5/8 inch [16.0 mm]	100
1/2 inch [12.5 mm]	85 - 100
3/8 inch [9.5 mm]	50 - 100
No. 4 [4.75 mm]	0 - 25
No. 8 [2.36 mm]	0 - 5

C. Quality

Requirements will meet all of 3139.2.C. (see table next page)

Mixture Quality Requirements

Table 3139-6 Mixture Aggregate Requirements for PASSRC & PASB	
Aggregate Blend Property	
Coarse Aggregate Angularity (ASTM D5821) (one face/two face) % PASSRC (1) PASB (1)	 95/- -/65
Fine Aggregate Angularity (FAA) (AASHTO T304, Method A) %	NA
Flat and Elongated Particles, max(2) % by weight, (ASTM D 4791)	NA
Clay Content (2) (AASHTO T 176)	NA
Total Spall in fraction retained on the 4.75mm [**#4**] sieve	3.0
Maximum Spall Content in Total Sample	5.0
Maximum Percent Lumps in fraction retained on the 4.75mm [**#4**] sieve	0.5

(1) Carbonate Restrictions: If Class B (as defined in 3139.2.B.2), crushed carbonate quarry rock (limestone or dolostone), is used in the mixture, or if carbonate particles in the material retained on the 4.75 mm [**No. 4**] sieve exceeds 55 percent, by weight, the minus 0.075 mm [# **200**] sieve size portion of the insoluble residue shall not exceed 10 percent.

3139.4 Ultra Thin Bonded Wearing Course (UTBWC) Requirements.

A. Restrictions

Do not use recycled materials including glass, concrete, bituminous, shingles, ash, and steel slag.

B. Coarse Aggregate

Provide a Class A aggregate, as defined in 3139.2.B.1, in accordance with the following requirements: (see table next page)

Table 3139-7 UTBWC Coarse Aggregate Requirements		
Tests	MN/DOT Laboratory Manual Method	Limit, %
Flat and elongated ratio at 3:1	1208	≤ 25
Los Angeles Rattler Test (LAR)	1210	≤ 40
Bulk Specific Gravity	1204	

C. **Fine Aggregate**
Provide fine aggregate, passing the No. 4 [4.75 mm] sieve in accordance with the following requirements:

Table 3139-8 Fine Aggregate Requirements		
Tests	Method	Limit, %
Sand equivalent*	AASHTO T 176	≥ 45
Uncompacted void content	MN/DOT Laboratory Manual 1206	≥ 40
Bulk Specific Gravity	MN/DOT Laboratory Manual 1205	

3139.5 SAMPLING AND TESTING
Perform sampling, sieve analysis, lumps, crushing, and shale testing meeting the requirements of the MN/DOT Laboratory Manual.

3760 INSULATION BOARD (Polystyrene)
The provisions of MN/DOT 3760 are changed to read as follows:

A. Polystyrene Insulation
Polystyrene Insulating Board in this specification shall be rigid expanded polystyrene conforming to the material requirements of MN/DOT 3760 and intended for below grade installation. Insulation shall meet the following minimum requirements:

Compressive Strength at 10% Deformation
3.5 psi Min.

Water Absorption (ASTM C272) less than 0.5% volume

Water Vapor Permeability (ASTM C355) less than 1.0 Perm – inch

Thickness specified may be made up by layering 1 inch, 1-1/2 inch or thicker sheets provided the overlaying joints are offset from those below.

Insulation board shall be similar or equal to "DOW Styrofoam HI 40" or "Certifoam 40."

B. Placement of Polystyrene Insulation

This work shall consist of furnishing and installing 3 inch thick insulation board at the locations designated on the Contract Drawings. This work shall be performed in accordance with the Standard Details, the Contract Drawing and the Special Provisions, the applicable MN/DOT Standard Specifications, and the following:

Rigid insulation board shall be placed within the pipe encasement zone, 6 inches above the pipe. Prior to placement of the insulation, encasement material shall be compacted until there is no further evidence of increased consolidation or the density of the compacted layer conforms to the density required in the Special Provisions, then leveled and lightly scarified to a depth of 1/2 inch. Encasement zone material placed below the insulation shall be free of rock or stone fragments measuring 1-1/2 inches or greater.

Insulation boards shall be furnished in panels 1 inch thick, 1-1/2 inch thick or thicker, and shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards placed in a single layer shall be overlapped at least 6 inches on all sides to eliminate continuous joints for the full depth of the insulation. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints of the layer immediately below with an overlap of at least 6 inches. The edges shall be trim and square. A minimum of two (2) wood skewers per board in each layer driven flush with the surface of the material shall be utilized to hold the insulation material in-place during the backfill operations.

The Contractor shall exercise precaution to ensure that all joints between boards are tight during placement and backfilling with only extruded ends placed end to end or edge to edge.

The placement of the backfill material over the insulation board and compaction thereof shall be accomplished in a manner that will preclude damage to the insulation material. The first layer of material placed over the insulation shall be 6 inches in depth, free of rock or stone fragments measuring 1-1/2 inches or greater. The material shall be placed in such a manner that construction equipment of any kind does not operate directly on the insulation and shall be compacted with equipment which exerts a contract pressure of less than 80 psi. Sections of insulation board damaged by the Contractor's construction operations shall be replaced at the Contractor's own expense. The first layer shall be compacted until there is no further evidence of increased consolidation or the density of the compacted layer conforms to the requirements of 2105 EXCAVATION, BACKFILL AND COMPACTION FOR UTILITIES.

C. Measurement and Payment

Insulation will be measured separately by the area in square yards of polystyrene insulation board furnished and installed to the thickness specified on the Contract Drawings, Special Provisions or Standard Details. Compensation for insulation shall include all costs of extra trench excavation, overlap of insulation board, furnishing and placing granular backfill, and removal and disposal off the site of excess excavated material.

Payment will be made under Item 2504.604 3 inch Polystyrene Insulation at the Contract bid price per square yard, which shall be compensation in full for all costs incidental thereto including, but not limited to the extra trench excavation, furnishing and placing granular backfill and removal and disposal off the site of excess excavated material.

3861 PLANT STOCK

The provisions of MN/DOT 3861 are modified as follows:

Delete the 4th paragraph of MN/DOT Provision 3861.3 and insert:

During the spring planting season, coniferous plants that have candled out (put out new growth) while being stored in a holding bin may be planted; however, coniferous plants that are dug after candling out will be rejected. Coniferous trees not fully branched from bottom to top will be rejected. Only coniferous trees with buds or new growth at the terminal ends of branches shall be accepted if tree meets the dimensional requirements defined in MN/DOT's Inspection and Contract Administration Manual for MN/DOT Landscape Projects. Pine trees shall have a terminal leader bud and terminal leaders shorter than 500 mm (18 inches) in length. A new central leader must be trained in conifers delivered with multiple or missing leaders.

City of Duluth, Minnesota

Public Works & Utilities Department - Engineering Division

2011 Edition

Standard Construction Specifications

APPENDIX A

2011 STANDARD SPECIFICATIONS FOR HIGH PRESSURE GAS MAINS, TRANSMISSION LINE AND SERVICE INSTALLATION, WELDING QUALIFICATIONS, AND QUALIFICATIONS FOR JOINING PE PIPE

Table of Contents

14.01 General 1

14.02 General Material Requirements 1

14.03 High Pressure Gas Pipe. 1

14.03.01 Steel Gas Main Pipe (2"-16") and Fittings 2
14.03.02 Polyethylene Pipe (1/2", 1", 2", 3") and Fittings. 3
14.03.03 Polyethylene Pipe (6"& 8") and Fittings 4

14.04 Valves 5

14.04.01 Steel Gate Valves. 5
14.04.02 Steel Ball Valves. 6
14.04.03 Polyethylene Valves. 7
14.04.04 Meter Stop Valves (3/4" and 1" sizes). 7
14.04.05 Plug Valves. 7
14.04.07 Meter Stop Valves for Multiple Meters. 7
14.04.08 Miscellaneous Transmission Valves. 8

14.05 Miscellaneous Fittings and Materials 8

14.05.01 Locating Wire. 8
14.05.02 Service Riser (3" and larger services) 8
14.05.03 Service Risers (1/2" CTS x 3/4" IPS and 1" CTS x 1" IPS and 2" IPS). 8
14.05.04 Transition Fittings (PE to Steel). 9
14.05.05 Valve Box. 9
14.05.06 Casing Seals 9
14.05.07 Strainers. 9
14.05.08 Bolt-Type Couplings. 10
14.05.09 Steel Weld Flanges 10
14.05.10 Gaskets. 10
14.05.11 Bolts. 10
14.05.12 Amp-Fit Couplings (no longer used). 11
14.05.13 Mechanical Plastic Pipe Coupling - (1/2" and 1"). 11
14.05.14 Electrofusion Plastic Pipe Coupling (1/2", 1", 2", 3", 6", 8"). 11
14.05.15 Service Tees for 3-inch & Smaller PE Services on Steel Mains 11
14.05.16 Expansion Joints 12
14.05.17 Steel Extrube or Copper to P.E. Coupling - 5/8" OD. 12
14.05.18 Rock Shield 13

14.06 Cathodic Protection Materials 13

14.06.01 Anodes. 13
14.06.02 Test Terminal Box 13
14.06.03 Insulators 14
14.06.04 Field Coatings (Below Grade). See Section 25.06 for appropriate application. 14
14.06.05 Field Coatings (Above Grade). See Section 25.07 for appropriate application. 15

14.01 General

This section of the Standard Specifications establishes requirements and policies for the materials of construction of high pressure gas distribution systems operating at pressures ranging from 1 psig to 275 psig and a transmission line which operates at a pressure ranging from 550 psig to 974 psig. Low pressure gas mains and services, the remaining systems of which were abandoned in 1992, are only specified to the extent of involvement with high pressure construction, such as conflicts in location, abandonments, etc.

All excavation, backfilling and restoration and horizontal direction drilling required for the construction of high pressure gas distribution systems shall be performed in accordance with the City of Duluth, Minnesota Public Works & Utilities Department – Engineering Division, Standard Construction Specifications, most current edition.

For contracted projects, these specifications also establish responsibilities between the Contractor and the Department for supplying materials and providing labor and equipment for installations. The Plans and Special Provisions may change these responsibilities for particular projects; therefore, it is essential that those parts of the documents be carefully reviewed for each project, since they take precedence over this Standard Specification.

14.02 General Material Requirements

All materials required for this work shall be new material conforming to requirements of the referenced specifications for the class, kind, type, size, grade, and other details indicated in the Contract. Unless otherwise indicated, all required materials shall be furnished by the Contractor. If any options are provided for as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Proposal, or Special Provisions.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Plans. Otherwise, the Department may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

14.03 High Pressure Gas Pipe.

All pipe furnished for gas main and branch line installation shall be of the type, kind, size, and class indicated for each particular line segment as shown in the Plans and designated in the Contract Items.

Normal pressure range is 10 psig to 275 psig for distribution and 550 to 974 psig for transmission.

Minimum number of samples taken for acceptance/rejections testing by the Department will be based on the current Military Standard 105 D entitled SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES. The sampling plan consists of: General Inspection Level II, Single Sampling, Normal Inspection, and an Acceptable Quality level of 2.5; failure to pass this inspection is the minimum basis for rejection of lot. Rejected material shall be returned to supplier at supplier's expense.

Supplier shall certify with each shipment that the material shipped has been inspected by the supplier and conforms to the Material Specification.

14.03.01 Steel Gas Main Pipe (2"-16") and Fittings

Steel gas main pipe shall be class 1; grade B, X42, or X52; seamless, electric weld or submerged-arc weld steel pipe, conforming to the 42nd Edition of API Standard 5 L Specifications for Line Pipe and as specified herein.

Pipe shall be in double random lengths. Ends beveled 30°, +5°, -0° for butt weld joining.

Wall thickness shall conform to the following table unless specifically specified otherwise (see O&M Section 03.04(A) for other wall thicknesses):

Nominal Size Inches)	OD (Inches)	Least Nominal Wall Thickness (Inches)
2	2.375	0.154
3	3.500	0.154
4	4.500	0.188
6	6.625	0.188
8	8.625	0.188
10	10.750	0.219
12	12.750	0.250
16	16.000	0.250

Exterior pipe coating shall be factory applied thin film epoxy or fusion bonded epoxy (FBE). Thin film epoxy shall be from manufacturer's chart below. Thin film epoxy shall be applied according to the manufacturer's standards and recommendations, and conforming to the National Association of Pipe Coating Applicator's Specification 12-78-90. Coating thickness shall be 12 mils with a maximum tolerance of minus 2 mils.

Any pipe installed by directional drilling shall be coated with a sacrificial or abrasive top coat. The top coat is required to be minimum thickness of 0.020" (20 mils). Coating shall be factory applied unless approved by Engineer. This coating shall be from manufacturer's chart below.

Manufacturer	Base FBE	Abrasive Top Coat
Lilly Industries	2000	2040
3M Scotchkote	206N or 6233	6352
NapGuard	2500	2610
Power Lone Star		Powercrete

For field applied coatings and sleeve information see 14.06.04 & 14.06.05.

Exterior coating shall be cutback on pipe ends as follows:

For nominal sizes thru 12" - 1" cutbacks

Markings indicating the standard to which the pipe was manufactured shall be applied to the coated pipe.

Manufacturer, when requested, shall furnish ladle and check analysis of all heats used to make this pipe. For butt weld Class I pipe, supplier shall certify that the material furnished has been analyzed and meets the chemical requirements of API STD 5 L.

Steel Pipe for Gas Plumbing. Pipe 2" and less in diameter shall be black or galvanized, standard weight, Schedule 40, conforming to the requirements of ASTM A106 or A53, and manufactured by a domestic supplier.

14.03.02 Polyethylene Pipe (1/2", 1", 2", 3") and Fittings.

Polyethylene pipe shall be made from Phillips TR-418, "Gulf" HID 9300-T, Plexco P23BC resins (orange or yellow). Materials shall conform to ASTM 1248, Type II, Grade B, PE2306 or PE2406. Pipe and fittings shall conform to ASTM Specification D-2513 "Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings."

Pipe weights and thicknesses shall be as follows:

Size	OD	SDR No.	Minimum Wall Thickness	Lbs/Ft
1/2" CTS	0.625"	7	0.090"	0.06
1" CTS	1.125"	11.5	0.099"	0.14
1" CTS	1.125"	9.3	0.121"	0.17
2" IPS	2.375"	11.0	0.216"	0.63
3" IPS	3.500"	11.5	0.304"	1.33

Pipe shall be marked as shown in the current ASTM D-2513 standard; and in addition, the resin manufacturer's material designation shall be marked on the pipe. If any data marked on the pipe is coded, the supplier shall furnish the code key. Pipe shall be new

or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage.

Polyethylene fittings shall be the socket fusion type conforming to the current ASTM D-2683 Specification "Socket Polyethylene Fittings for SDR 11 Polyethylene Pipe, or Butt Fusion pipe conforming to the current ASTM D-3261 specification."
A mechanical type fitting may be substituted. This fitting shall be a "Continental Con-Stab Type 52,53 or 56" or a "lycofit by RW Lyle" for 1/2" and 1" diameter pipe, or 1/2" PE to steel or copper, Chicago fitting M785DCZ3S090 shall be permitted for temporary services.

An electrofusion type coupling or saddle fitting may be substituted upon approval of the Engineer. This fitting shall be electrofusion type by Central Plastics or Lycofuse.

Polyethylene service tee fittings shall be saddle fusion type or electrofusion type by Central Plastics or Lycofuse conforming to the current ASTM D-2513 standard.

Cutter punch size for 1" CTS service taps shall be 11/16" or larger.

Straight lengths of 2" or 3" pipe will only be permitted when specified or with approval of the Engineer, where it is determined to be most suitable for a particular installation.

Coiled pipe or tubing delivered to the work site shall have the ends capped.

Pipe Size	Minimum Coil ID	Maximum Coil OD	Maximum Coil Width
1/2"	30"	44"	6"
1"	44"	48"	12"
2"	48"	78"	41"
3"	70"	102"	44"

Pipe strapping shall be made of plastic or other non-metal material. Coils shall have strapping around the interior portions of the coil to prevent partial coils from collapsing, as well as a sufficient number of straps around the completed coil. Polyethylene pipe and fitting shall be Plexco, Continental or Phillips or approved equal.

14.03.03 Polyethylene Pipe (6"& 8") and Fittings

Polyethylene pipe shall be made from "Phillips TR-418" (orange or yellow), "Gulf HID 9300-T" (orange or yellow), or "Plexco P23BC" (orange or yellow) resins. Material shall conform to ASTM D1248, Type II, Grade B, PE2306 or PE2406. Pipe and fittings shall conform to ASTM Specification D-2513 "Standard Specification for Thermo-plastic Gas Pressure Pipe, Tubing and Fittings".

Pipe weights and thicknesses shall be as follows:

Size	OD	SDR No.	Minimum Wall Thickness	Lbs/Ft
6"	6.625±.011	11.5	0.581"	4.7
8"	8.625±.011	11.5	0.750"	7.99

Pipe shall be marked as shown in the current ASTM D-2513 standard, and, in addition, the resin manufacturer's material designation shall be marked on the pipe. If any data marked on the pipe is coded, the supplier shall furnish the code key. Pipe shall be new or stored for a period of time that does not exceed the manufacturer's recommended maximum period of exposure, regardless of the method of storage.

Polyethylene fittings shall be the butt fusion type conforming to the current ASTM D-3261 Specification "Butt Heat Fusion (PE) Plastic Fittings for (PE) Plastic Pipe and Fittings". Electrofusion fittings are an acceptable alternative.

Pipe shall be furnished in straight lengths. Length shall be in a minimum of 40 foot lengths. Straight lengths shall have plain ends without couplings unless otherwise specified.

Straight lengths of pipe shall be strapped with a sufficient number of non-metallic straps so the bundle will remain intact during shipping and warehousing.

Only with the Engineer's approval, pipe may be furnished by the contractor in coils. Contractor shall be responsible for the straightening of the pipe according to the manufacturer's instructions.

14.04 Valves

14.04.01 Steel Gate Valves.

Valve shall be a non-lubricating full port, steel body valve with a single disc which, when closing, results in a wedging action against the double seats, or compression of an elastomer against the seating area. Valve shall have a non-rising stainless steel stem, and the following features:

Pressure Rating:	275 WOG
Ends:	150# ANSI Flat Face Flanges (except when specified otherwise)
Operator:	2" Square and open Counter-clockwise
Coating:	"Scotchkote" #306 resin - 9 mils min.

Each valve shall have attached label indicating brand name or manufacturer, model number, pressure rating, and standard by which it was manufactured, such API #, MSS-SP#, ANSI#, etc.

Valve shall be Kerotest Model M-1, 1F2, or Kerotest Model EV-11, or approved equal.

When specified, locking devices (not including the lock) shall be provided by the valve manufacturer and shall consist of a two-part unit, a cap and a swivel nut which fits onto the stem and over the operating nut. Device shall be equal or similar to Kerotest's Model 1 Locking Device.

14.04.02 Steel Ball Valves.

A. Steel Valves – Trunnion Mounted Ball Valves. Valves shall be non-lubricating with emergency sealant ports, full port, double block and bleed, steel body, non-rising carbon steel nickel plated stem and the following features:

Pressure rating:	ANSI 150,300,600
Ends:	150#, 300#, 600# ANSI raised face flanges
Operator:	2"–4" valves to be lever operated except when specified otherwise (2" square operating nut) 6" and larger valves to be gear operated with hand wheel except when specified otherwise (2" operating nut)
Coating:	Below ground valves to be tar-set coated-30 mils thick.

Each valve shall have attached label indicating manufacturer, model & serial number, pressure rating and standard by which it was manufactured. Valves shall be Cooper Cameron type 41 or 31 or Grove B4-D, B-5 or approved by the engineer.

B. Steel Valves – Floating Ball Valves. Valves shall be non-lubricating, full port, steel body, non-rising stem and the following features:

Pressure rating:	ANSI 150#-Flat face flanges (except when specified otherwise)
Operator:	2"-4" to be lever operated with locking plate (open or close) 6" and larger to be gear box operated

Each valve shall have attached label indicating manufacturer, model number, pressure rating. Valve shall be Balon series "F" (Valve System, Inc., VSI 111 is no longer used).

14.04.03 Polyethylene Valves.

Valves shall be Nordstrom, Kerotest, Lyco by R. W. Lyle, Perfection Corporation, Broen (1-inch to 3-inch) or approved equal, with PE2406 (orange or yellow) polyethylene body, and 2-inch square operator conforming to the following requirements.

All valves shall be fully ported unless approved otherwise by the Chief Engineer of Utilities. Size 6-inch shall have a bore of at least 3.5" diameter. Size 8-inch shall have a bore of at least 4.75" diameter. Ends shall be sufficiently long to fit into fusion machines for butt fusion to SDR 11.5 (6-inch and 8-inch) pipe.

Sizes 1", 2" and 3" shall be ball type with ends for socket fusion to SDR 9.3 (1" CTS), SDR 11 (2" IPS) and SDR 11.5 (3" IPS) pipe. Connecting end shall be straight pipe not less than 3.25 or more than 6 inches long.

Each valve shall be clearly marked or labeled to show: the standard such as B16.40 to which it was manufactured; the manufacturer's name or trademark; the size; the pressure rating; SDR number and material standard, i.e. PE2306, 2406 of connecting end material.

14.04.04 Meter Stop Valves (3/4" and 1" sizes).

Meter stop valves shall be 175 psi, black iron body, brass or bronze key, stem nut and stem washer, tamperproof, lubricating type, lockwing with 1/2" hole. Inlet and outlet to have iron pipe inside threads. Outlet to have insulated union. Valves shall be one of or an approved equal to Eclipse PNP-203, McDonald 6276B, or Mueller E-11179.

14.04.05 Plug Valves.

Plug valves shall be rated for minimum WOG 175, with high strength cast iron body conforming to ASTM A 126-42, Class B. Valve shall have a lubricating fitting centered on top of the stem where lubricant will travel through the stem, a double ball check, and to sealant grooves to the well at the base of the plug.

Valves shall be short pattern with 125# ANSI flanges and have a 2-inch square operating nut. Valve shall be Walworth 1797F, Nordstrom 143, Homestead 602 or 612, or an approved equal.

14.04.07 Meter Stop Valves for Multiple Meters.

Meter stop valves shall be 175 psi, black iron body, brass or bronze key, stem nut and stem washer, tamperproof, lubricating type, lockwing with 1/2" hole. Inlet and outlet to have iron pipe inside threads. Valves shall be one of or an approved equal to Eclipse PNP-201, McDonald 560-B, Mueller H-11175, or Dresser Style 275.

14.04.08 Miscellaneous Transmission Valves.

These valves are located at the Pig Launch, Pig Receiver, and GL Regulator Station, 1/2", 3/4", and 1". The ball valves shall be either 3000# WOG black iron body type or 1000# WOG Stainless Steel, type CF8M/316, threaded end, full port, Kingdom Model KV-020.

14.05 Miscellaneous Fittings and Materials

14.05.01 Locating Wire.

Locating (tracer) wire shall be #12 solid copper with "HMWPE" 30 mil yellow insulation. Wire shall be supplied on spools of not less than 500 feet. If main and locate wire are to be placed by horizontal directionally drilling, tracer wire shall be #6 hard drawn copper (ASTM B-1) or annealed 49-strand braided 302 alloy stainless steel. The conductors shall be insulated with 45 mil yellow high-density polyethylene (HDPE) jacketing. The wire shall be tested in accordance with ASTM B-1 and D-1248 and spark tested at 7500 VAC. The breaking strength of the wire shall be at least 1280 pounds.

14.05.02 Service Riser (3" and larger services).

Riser shall be welded steel, length 30" vertical x 12" horizontal, 150# flange on top, coated up to flange per Specs., Sec. 14.13.07(E) and provisions made for anode attachment. Steel pipe shall be in conformance ASTM A106, ASTM 53, or API 5L, all Grade B.

14.05.03 Service Risers (1/2" CTS x 3/4" IPS and 1" CTS x 1" IPS and 2" IPS).

Riser shall be anodeless angle type with Phillips TR-418 plastic carrier pipe encased in a galvanized or a fusion bonded epoxy coated metal casing.

Vertical rise shall be 30 inches of which the top 15 inches shall be centered in the casing so that air or a heat resistant material occupies the space between. Carrier pipe to casing shall be sealed in the upper end by means of insert stiffener and compressed O-Rings or rubber seals. Horizontal leg shall be steel casing a minimum of 12 inches and a maximum of 20 inches plus a 12" pigtail of plastic pipe not encased. Below grade, end of casing shall be effectively sealed against water intrusion. The 2" anodeless riser may be installed in a 66 PSI system.

	1/2 CTS x 3/4 IPS	1" CTS x 1" IPS	2" IPS
Carrier Pipe Wall	0.090"	0.121"	0.216"
Top Connection	3/4" IP outside	1" IP outside	2" I.P. threads

Riser shall be one of or an approved equal to Perfection, Dresser, or R W Lyle and Company.

14.05.04 Transition Fittings (PE to Steel).

Transitions shall be resin coated Schedule 40 steel pipe connected to the polyethylene pipe with a factory-made permanent type compression joint meeting the requirements of ASTM D-2513 and ANSI B-31.8. Steel end shall be for weld type connection. Plastic portion shall conform to the minimum requirements for PE pipe as indicated below.

Size	Wall	Material	Type of Connection
1" CTS	SDR 9.3	Phillips or Gulf	Socket
2" IPS	SDR 11.0	Phillips or Gulf	Socket
3" IPS	SDR 11.5	Phillips or Gulf	Socket
6" IPS	SDR 11.5	Phillips or Gulf	Butt
8" IPS	SDR 11.5	Phillips or Gulf	Butt

14.05.05 Valve Box.

Box shall be two section, screw type with a cast iron top section and a plastic bottom section with a 5-1/4 inch ID, threaded shaft integral with a 9 inch diameter bonnet or bell. Heights of the sections shall be selected to fit the installation depth when the base is over the operating nut, but not closer than 2 inches to the valve flange. Plastic may be sawed off as required. Refer to Detail Drawing G-5 in the Appendix.

Cover shall be the stay-put type cast iron having 2 recessed lift holes. The identification "GAS" shall be cast into the cover.

14.05.06 Casing Seals.

For PE carrier pipe, casing seals shall be the pull-on "S" or "U" type made of oil and water resistant rubber, complete with stainless steel thumb screw clamps. Casing seals shall be P.S.I., Type S, F.H. Maloney Multiflex, T.D. Williamson U-Seal or approval equal.

For steel carrier pipe, casing seal shall be link seal type similar or equal to Link-Seal manufactured by Thunderline Corp., Wayne, MI.

14.05.07 Strainers.

Strainers shall be self-cleaning "Y" type, ductile iron or cast-steel body-125# ASA rating with screwed ends for up to 2 inch sizes and 150# ANSI flanged ends for sizes 2 inch and larger. Screen shall be monel or stainless steel wire, 30 mesh, with openings 1/50". Effective screen ratio shall be at least 2:1 or greater. Screen access cover shall be tapped FI PT for blowoff. Strainer for transmission is a 6" with 600# ANSI flanges and body, 100 mesh liner, simplex style. Strainer for the Stora Enso Flow Control regulator is an 8" 150# Ansi body, 100 mesh, simplex style (tee).

14.05.08 Bolt-Type Couplings.

Use was discontinued by or before 1993. Couplings no longer used on gas systems include Dresser Style 39-62, Style 38, Style 40, Style 711 and CS1 CLa Maxi-Grip.

14.05.09 Steel Weld Flanges.

Flanges shall be either welding neck or slip-on, flat face unless specified otherwise, 150# or 300# ANSI B16.5, and conforming to the ASTM Specification A181, except for transmission which are 600# ANSI, raised face.

14.05.10 Gaskets.

Gaskets for Flanged Connections shall be PSI Linebacker Sealing gasket with phenolic retainer and nitrile sealing element or non asbestos that are in stock (phasing out). Transmission line gaskets shall be 600# Flexitallic, PSI Linebacker Sealing gasket with G-10 retainer and Teflon or Viton sealing element or approved equal.

14.05.11 Bolts.

Bolts for flanged connections shall be ASTM449 medium carbon steel, SAE Grade 5, medium carbon quenched-tempered and the head marked with a "Y" to indicate grade. B7 stud is an acceptable alternative when bolts do not fit the application. Bolts for transmissions will be ASTM A193 B7 grade, 600# ANSI.

BOLTS FOR FLANGED CONNECTIONS (150# CLASS)

Size	No of Bolts Per Flange	Diameter of Bolts*	Bolt Length*	Stud Length	ID and OD Inches	Suggested Torque Ft-Lbs **
2"	4	5/8"	2-1/4"	3-1/2"	2" x 4-1/8"	80
3"	4	5/8"	2-1/2"	3-3/4"	3" x 5-3/8"	110
4"	8	5/8"	2-3/4"	3-3/4"	4" x 6-7/8"	100
6"	8	3/4"	3-1/4"	4-1/4"	6" x 8-3/4"	130
8"	8	3/4"	3-1/2"	4-1/2"	8" x 11"	130
10"	12	7/8"	3-3/4"	5-0"	10" x 13-3/8"	215
12"	12	7/8"	3-3/4"	5-0"	12" x 16-1/8"	220
16"	16	1"	4-1/2"	5-7/8"	16" x 20-1/4"	320

* Use bolts or studs ½" longer with insulating flanges. No stud or bolt shall have less than two (2) exposed threads on the nut end.
**Torque is based on lubricated bolt and bolt stress of 45 ksi.

On Transmission system, Engineering must be contacted prior to work for approval of diameters, length, number, and recommended torque.

14.05.12 Amp-Fit Couplings (no longer used).

Amp-Fit Transition Couplings (1/2" CTS PE to 5/8" OD Copper). Fitting was designed to connect 1/2" CTS - .09" wall polyethylene to 5/8" OD - Type K Copper. Fitting was Amp-Fit Part No. 332643-1.

Amp-Fit Repair Coupling (1" CTS, 1" CTS, 2" IPS - PE to PE). Fitting was designed to connect the following polyethylene pipe sizes:

1/2" CTS PE - .09" wall - SDR 7 - Part No. 332629-2
1" CTS PE - .121" wall - SDR 9.3 - Part No. 561414-1
2" IPS PE - .216" wall - SDR 11 - Part No. 561124-2

14.05.13 Mechanical Plastic Pipe Coupling - (1/2" and 1").

Coupling shall have a plastic body with plastic end sleeves designed to compress the pipe over plastic barbed ends with a metal stiffener that extend the length of the coupling or couplings shall have a plastic body with two internal seals, a fixed stiffener, self-locking gripper and a moisture lip. Couplings shall be tested to conform to ASTM D2513. Coupling shall be labeled to indicate a pipe size and wall thickness as follows:

1/2" CTS - 0.09" Wall - SDR 7
1" CTS - 0.121" Wall - SDR 9.3

Coupling shall be "Lycofit" by RWL Pipeline Products, "Con-Stab Type 52, 53 or 56" by Continental Industries or approved equal.

14.05.14 Electrofusion Plastic Pipe Coupling (1/2", 1", 2", 3", 6", 8").

Couplings shall be compatible with an approved electrofusion unit. Electrofuse coupling shall be Lycofuse or Central Plastics designed to connect all PE 2306 or 2406 (orange or yellow or tan) medium density plastic pipe of the following sizes:

1/2" CTS PE pipe
1" CTS PE pipe
2" IPS PE pipe
3" IPS PE pipe
6" IPS PE pipe
8" IPS PE pipe

14.05.15 Service Tees for 3-inch & Smaller PE Services on Steel Mains

Service tee shall be steel, designed for at least 100 psi working pressure with a weld-on inlet end, incorporate an internally-contained tap, and have an outlet designed to connect polyethylene pipe, PE2306 or PE2406. The connection to the polyethylene

pipe shall be designed so that the pullout resistance exceeds the strength of the pipe in accordance with D.O.T. Pipeline Safety Regulations, Part 192.283(b). An insert stiffener shall be attached to each compression end.

Service Tee for 1/2-inch and 1-inch services shall be equal or similar to the table below:

Compression Outlet	Weld Inlet	Tap Size	Model
½" CTS PE, 0.090" Wall	3/4-inch	3/8-inch	Mueller 18702 Mueller 18104
½" CTS PE, 0.090" Wall *	1/2-inch	3/8-inch	Mueller 18198 Mueller 18104
1" CTS PE, 0.121" Wall	3/4-inch	1/2-inch	Dresser 501 Mueller 18104

* For connection on steel mains sizes 2-inch and smaller.

Service Tee for 2-inch and 3-inch services shall be equal or similar to the table below:

Weld Outlet	Weld Inlet	Tap Size	Model
2-inch	2-inch	1-1/2 inch	Mueller H-17650

14.05.16 Expansion Joints

Expansion Joint-Bellows Type. Joint used for special application, for pipelines unrestricted by surrounding earth, and where expansion/contraction exceeds limits of the Bolt Type Joint. Must not be direct buried.

Bellows type shall be stainless steel expansion, with pressure rating of not less than 50 psi, with weld ends.

Joints shall be similar or equal to "Flexonics" Free-Flexing Expansion Joint standard low pressure unit or a Badger Standard Service Rated Type W.

14.05.17 Steel Extrube or Copper to P.E. Coupling - 5/8" OD.

Coupling shall be designed to connect either 5/8" OD steel or copper tube to 1/2" (5/8" OD) - 0.090" wall or SDR7 polyethylene tube. Coupling shall be brass or bronze and have a built-in stiffener in one end. The connecting ends must be designed so that the P.E. pipe will fail before the pipes could be pulled out of either end of fitting.

Markings on coupling shall show manufacturer, OD of connecting pipes, and wall thickness for P.E. connection.

Coupling shall be Chicago fitting, Part No. M785DC23S090 or approved equal.

14.05.18 Rock Shield.

Rock shield will be three eighths (3/8") inches thick and double wrapped around pipe. "Tuff N Nuff" or approved equal.

14.06 Cathodic Protection Materials

14.06.01 Anodes.

Anodes for gas main and structure protection shall be the packaged type consisting of a cast magnesium anode having a silver soldered #12 TW lead wire at least 10 feet long attached to a steel core. Anode shall be encased with cloth bag containing a prepared backfill mixture of: hydrated gypsum, bentonite, and sodium sulphate. Weight of magnesium anode shall be as specified.

Anodes, when specified to protect service risers or isolated fittings, shall be magnesium weighing at least one pound with at least 5 feet copper THNN wire. Anode shall be effectively attached to the protected material with a stainless steel base clamp.

Anodes shall be similar or equal to Galvomag by Harco or Maxmag by Federal Metals.

14.06.02 Test Terminal Box.

Grade mounted box for use in nonpaved locations shall be ABS or PVC plastic, at least 17 inches long with slight flare at the base. Inside diameter shall be at least 2-3/8 inches. Cap shall be of the same material as the box with a rim which extends over the top of the box to prevent entry of foreign materials. Cap shall lock by a wedging action when the center steel bolt is turned. Bolt shall be magnetic for easy locating. Attached to the inside of cap shall be a 5 bolt terminal block which will bring the wires out of the box with the cap. Cap shall be impressed with the letters "TEST STATION". Box shall be "Handley Industries" Model TP-5B, "Flush Fink" by Cott Industries, or an approved equal.

Free standing test stations/markers shall be "Carsonite Perma-Post" test stations or an approved equal.

Pole mounted test stations shall be Crouse-Hines condulet E-27 with 3/4" threaded outlet attached to a minimum 24 inches of 3/4" galvanized conduit with plastic end protector.

Face plate shall be Crouse-Hines No. 2770, terminal plate supplied with No. E type of terminal connection as specified. The grade mounted, pole mounted, and free standing

test stations to be supplied by Public Works & Utilities Department, Utility Operations, 520 Garfield Avenue, unless otherwise specified.

14.06.03 Insulators

Flange insulators for ANSI 150# through 300# full face flanges shall be phenolic retainers with nitrile sealing elements, complete with full length Mylar sleeves and glass clad phenolic washers for insulating bolts on one side of flange. Flange insulators for ANSI 600# full face flanges shall be G-10 retainers with Teflon or Viton sealing elements, complete with full length G-10 sleeves and G-10 washers for insulating bolts on one side of flange. Gasket shall be Type E faced, 1/8 inch thick, for ANSI 150# through 600# full face flanges, as manufactured by Pipe Seal and Insulator Company (PSI), Central Plastics Company, or an approved equal.

Casing insulators shall be two or more segments of molded polyethylene bolted together so the segments fit tightly around the carrier pipe. Insulator shall be "Pipeline Seal and Insulator" Model PE, F H Mahoney Pipeline Products, Model 60, or T D Williamson, Inc., Model N-2, or approved equal.

Pipe support insulators shall be molded fiberglass shaped to conform to fit over specified pipe sizes, one or two pieces as specified, complete with epoxy seam sealer which fills all voids between pipe and insulator. Pipe support insulators shall be similar or equal to "Glas Mesh Type 180, Type 240, or Type 220/240.

Pipeline insulators for electrically isolating sections of steel gas lines shall be one piece weld end spools, fabricated with API 5L Grade B Steel, rated for ANSI 150# or 300#, coated internally and externally with epoxy resin coating except for weld end cutbacks. Dielectric materials shall be compatible with natural gas.

Size (OD)	Wall Thickness	Size (OD)	Minimum Wall Thickness
4.500"	0.188"	10.75"	0.219"
6.625"	0.188"	12.75"	0.250"
8.625"	0.188"	16.00"	0.250"

Pipeline insulators shall be "IsoJoint" by Advance Products & Systems, Inc.; "PSI Electro-Stop Isolators" by Pipeline Seal & Insulator Inc.; Kerotest "Zunt" Type 1-A, or pre-approved equal.

14.06.04 Field Coatings (Below Grade). See Section 25.06 for appropriate application.

A. Cold Type Applications. Cold applied coatings shall be one of the following approved commercial types or approved equals:

- Polyken 930-35 mill tape with #927 brush primer or #935 spray primer

- Tapecoat H-35G mill tape.
- Scotchkote Corrosion Protection Tape #50 with Scotchrap pipe primer.
- Royston Greenline Tape with 747 Primer
- T C Mastic
- Wax Tape by Trenton Corporation or approved equal for irregular fittings.
- Fusion bonded epoxy only by Engineering approval.

B. Hot Type Applications. Hot applied coatings shall be one of the following tape-prime combinations or approved equal:

- Tapecoat 20 with T C Omniprime.
- Thermofit (shrink) pipe sleeves by Raychem (Ultratec Division) or T C Omniprime

C. Directional boring pipe (shrink) sleeves shall be Dirax (by Raychem)

14.06.05 Field Coatings (Above Grade). See Section 25.07 for appropriate application.

A. Rust-O-Leum Primer #678 or 769, Rustex, Derusto, shall be used when specified in Section 15.08(F). Color shall be gray unless otherwise specified.

B. Polyamide epoxy, high build, two part, one coat, similar or equal to Pittsburgh "Pit Guard" DTR or Rust-O-Leum High Performance Epoxy 9100V shall be used when specified. Color shall be gray unless otherwise specified.

C. Acrylic Urethane enamel with a compatible primer similar or equal to Pitthane Acrylic Urethane enamel with Medalhide 1001 inorganic zinc rich primer, or Aquapon Polymide-epoxy organic primer shall be used when specified. Color shall be gray unless otherwise specified. An approved equal is Devthane 379 Top Coat with Devoe Bar Rust 235. Primer shall be Devoe.

D. Tape coating, when specified for above grade applications, shall be similar or equal to Tapecoat H35 grey. Tapecoat H50 grey shall be used where abrasion from street grit is evident. System shall be resistant to ultraviolet light, shrinkage, ambient temperature changes.

Wax Tape by Raychem (Ultatec Divison) or Polymide epoxy, (see 2 above) in color white, shall be applied to irregular fittings when tape coating is not practical.

Table of Contents

15.01 General 1

15.02 Excavation and Backfill Standards 1

15.03 Clearance Requirements 1

15.04 Alignments for mains 3

15.05 Grade for mains and services 3

15.06 Backfill for trenches 3

15.07 Certification of Welders and Fusers. 4

15.08 Load Considerations. 4

15.09 Installation of Protective Barriers. 4

15.10 Casing Requirements 5

SECTION 15: GENERAL CONSTRUCTION REQUIREMENTS FOR HP GAS PIPELINES

15.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of high pressure gas distribution systems operating at pressures ranging from 1 psig to 275 psig and a transmission line which operates at a pressure ranging from 550 psig to 974 psig. Low pressure gas mains and services, the remaining systems of which were abandoned in 1992, are only specified to the extent of involvement with high pressure construction, such as conflicts in location, abandonments, etc.

All excavation, backfilling and restoration and horizontal direction drilling required for the construction of high pressure gas distribution systems shall be performed in accordance with the City of Duluth, Minnesota Public Works & Utilities Department – Engineering Division, Standard Construction Specifications, most current edition.

For contracted projects, these specifications also establish responsibilities between the Contractor and the Department for providing labor and equipment for installations. The Plans and Special Provisions may change these responsibilities for particular projects; therefore, it is essential that those parts of the documents be carefully reviewed for each project, since they take precedence over this Standard Specification.

15.02 Excavation and Backfill Standards

Requirements for site clearing, excavation, preparing trench, backfilling and restoration are contained in the Standard Specification, Section 14 and shall govern the execution of work where they are not in conflict with more specific requirements contained in the Plans, the Special Provisions, or in this section.

15.03 Clearance Requirements

A. Clearance requirements between underground gas mains and non-associated mains, utilities, structures, or rock shall be maintained at least as follows:

General Clearance -	6" - for rock, non-metallic pipe, structures, etc.
Special Clearances -	12" - for metallic pipe, structures, electrical conductor wires, etc
	30" - between plastic gas pipe and steam lines

Where these clearances cannot be maintained, the Contractor shall notify the Engineer, who will determine the method or materials required to protect the gas main.

B. Required Procedures to Maintain Clearances When Moling or Horizontal Directional Drilling across Sewers

1. Sanitary Main

Remove nearest manhole lid and measure depth to sewer. If the proposed crossing is within 50' to manhole, then inspection of only one manhole is adequate; If the manhole is further than 50 feet away, the manhole at the other end shall also be inspected.

If sewer is greater than 7' deep, no additional precautions are necessary.

If sewer is between 4.5' to 7' deep, keep track of mole or drill distance and reject if exit depth is more than 4'. After crossing sewer, call Engineering Division for scheduling video inspection.

If sewer is less than 4.5' deep, excavate in street over sewer and mole or drill each way.

2. Storm Main or Inlet Lead

Remove manhole lids and determine depth to sewer.

If 4' to 5' deep to top of sewer pipe, keep track of mole distance and its rate of travel as it crosses sewer or depth of drill rod. Also listen at manhole or inlet. Visually check inside pipe to insure no damage. Reject crossing if exit depth is more than 4'.

If less than 4' deep to top of sewer pipe, excavate at pipe and mole or drill each way either over or under whichever is suitable for the situation.

The six-inch general clearance requirement in the Standard Specifications is intended to apply when the clearance can be verified. When making judgment for short shots, where sewer is 10' or less from mole launch hole, at least 12 inches of clearance should be aimed for.

3. Sanitary Sewer Services

Remove manhole lids and measure depths at each end of sewer.

Where main sewer is more than 8' deep and terrain to house is flat (also no raised basements) no special precautions are necessary. If terrain rises to house or basement is raised, then excavate over service and mole or drill either way. Contact Engineering office to determine sewer wye location.

Where main sewer is less than 8', locate and excavate over service and mole or drill each way.

Where sewer service lies under stairs, walk or paved driveway, bushes or other obstruction, special judgment will be exercised by the inspector to determine if digging is necessary or other means are reasonable to lessen risk of conflict.

15.04 Alignments for mains

Alignments for mains shall be as indicated on the Plans. The Department will establish exact alignment prior to construction, and reserves the right to make minor changes as work progresses at no additional compensation. Major changes may be considered for extra payment only to the extent where: They are major deviations from Plan alignment; the Contractor informs the Department and obtains a written understanding for the basis of payment for extra work prior to construction of that portion. Fittings necessary to fit the Plan, whether indicated on the Plan or not, shall be considered incidental to the pipeline.

15.05 Grade for mains and services

Grade shall be established by the depth of cover, except where indicated on the Plans or specifically established by the Engineer.

Table 15-1
Minimum and Maximum Depth of Cover

Type	Minimum Cover (inches)	Maximum Cover (inches)
Transmission Main	48	72
Main – general	36	48
Main – rock trench	24	48
Service – less than 2"	18	48
Service – 2" and larger	36	48
Service – under driving surface	36	48
Service – rock trench	12	48

When these depths cannot be maintained, the Contractor shall notify the Engineer, who will determine the method or material required to protect the main.

15.06 Backfill for trenches

All excavation, backfilling and restoration and horizontal direction drilling required for the construction of high pressure gas distribution systems shall be performed in accordance with the City of Duluth, Minnesota Public Works & Utilities Department –

Engineering Division, Standard Construction Specifications, most current edition and any supplements or addenda.

For gas mains and services installed under the following conditions:

A. Under a driving surface, including graveled shoulders, driveway, parking lots
B. Under a sidewalk
C. To provide a base for undercut foreign utilities, curbs, walks, etc.

Class 5 granular material conforming to MnDOT 31328 shall be used.

15.07 Certification of Welders and Fusers

All pipeline welding shall be done by qualified Welders in accordance with Section 27 of these Standards.

All pipeline fusing shall be done by qualified fusers in accordance with Section 28 of these Standards.

15.08 Load Considerations

Special protection shall be provided to avoid direct extraordinary loads or external forces on the pipe. The Engineer will determine if and what kind of special protection shall be provided. A pipeline must be designed and installed so that each joint will sustain longitudinal pullout or thrust forces caused by the contraction or the expansion of the piping or by anticipated external and internal loading.

15.09 Installation of Protective Barriers

The Department or Contractor, when specified, shall install protective barriers to protect gas pipeline facilities from traffic or other hazards.

Gas mains above grade, or service risers, regulators, or meter sets, when exposed to potential traffic hazards in an alley, street or parking lot, shall be protected with one of the following:

A. Welded pipe barrier lagged to the building and painted in safety yellow.
B. Steel pipes set in the ground, or set in concrete bases. This barrier must only be used where traffic speed is less than 10 mph, unless pipes are less than 4" in diameter or are set in ground but not concrete. Pipes shall be painted in safety yellow.
C. Welded channels, angle iron, or plates lagged to the building.
D. Cages constructed from angle iron and expanded metal screening. Paint may be green or yellow, depending on exposure.
E. Guard rails meeting MNDOT standards.

District Regulator Stations shall be protected according to Detail Drawing G-30 in the Appendix. Additional traffic protection, when deemed necessary by the Engineer, shall consist of guard rails meeting MNDOT Standards or other special protection specified in a plan.

15.10 Casing Requirements

Casings which will contain a gas main or service shall be installed subject to the following requirements:

A. The type of material, weight or thickness, grade shall be sufficient to withstand trench load and anticipated live loads, including impact.

B. Casings which will contain steel gas pipes shall have approved end seals that electrically insulate casing from gas pipe and provide a water-tight seal to prevent groundwater from entering the casing annulus.

C. Casings which contain plastic gas pipes shall have special protection such as injected sealant foam or other material where plastic pipe exits the casing to prevent earth backfill load from pressing plastic against the casing. Also, 2" and larger plastic mains shall be provided with anchorage where main exits a casing.

D. One or two vents shall be installed on each casing installed under highways, railroads, buildings and runways or taxiways. Vents must terminate in a manner which prevents rain or surface waters from entering the casing. Vents are not required on wall sleeves or short casings used for special (shallow main) protection. Vent to outdoors is required if casing runs through a habitable enclosed space.

E. Approved casing insulators must be installed when a steel gas line runs through a steel casing.

F. For plastic gas pipe installed in casings within the 5-foot frost zone, the casings must not exceed the size permitted in 15.06.

Table of Contents

16.01 General 1

16.02 Handling of Pipe and Fittings 1

16.03 Inspection of Pipe and Fittings 1

16.04 Cleaning Pipe Interior 2

16.05 Steel Pipe Installation 2

16.06 Repair of Damaged Steel Pipe (192.307) 3

16.06.01 Transmission Main 3
16.06.02 Distribution 3

16.07 Joining Pipe and Fittings 5

16.07.01 General 5
16.07.02 Welded Joints 5
16.07.03 Flanged Connections 8
16.07.04 Steel (Extrube) to PE Repair Coupling, 5/8" ST to 1/2" PE Installation 8

16.08 Branch Main Connections, 2" and Larger 9

16.08.01 Connections to mains not in service 9
16.08.02 Connections to mains in service 9
16.08.03 Branch Connection Policy To Steel Mains In Service 10

16.09 Hot Taps on Gas Main - Procedures, Training and Qualifications 10

Table 16-1: Steel to Steel Joints 5

Table 16-2: Plastic Pipe to Steel Pipe or Copper Risers 5

Table 16-3: Hot Taps, Tool, Instructions, Qualification 11

16.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of steel gas distribution systems and a transmission line.

16.02 Handling of Pipe and Fittings

The Contractor shall have adequate equipment on the site for unloading, supporting, and lowering pipe and fittings into trench. Pipe shall not be rolled, dragged, dropped, or allowed to contact sharp or hard objects which could cause injury to the pipe or coating. Fabric slings or soft padded devices shall be used so as to protect the pipe or coating. Pipe and fitting should be adequately secured to limit movement during transporting. Pipe stored outside shall have ends capped to prevent entry of water or debris, except when it is possible to visually determine that the pipe is clean before installation.

16.03 Inspection of Pipe and Fittings

Before installation, all fittings, lengths, and sections of pipe shall be thoroughly cleaned inside and inspected for defects. Steel pipe shall be inspected for damaged ends, coating defects, and other abnormalities (192.461) (b).

Upon completion of the welds, they shall be visually inspected to insure compliance with the qualifying weld procedure.

Steel pipeline sections, after being welded and the joints coated, shall be electrically inspected by the Contractor in the Inspector's presence immediately before lowering the pipeline section into the trench. Each section of pipe must also be protected from damage resulting from adverse ditch conditions or damage from supporting blocks. Holiday inspection shall be performed on all pipe and fittings with an electronic holiday detector, supplied by the Contractor, and operated in such a manner as to audibly and visually detect the presence of all holidays. The inspection shall be performed as outlined in the latest revision of NACE Standard RP 0490-2001 with a certified holiday detector. This inspection shall occur on all buried piping. This shall be done by use of a "geeper" which detects coating defects. Coatings found defective shall be immediately repaired and geeped again. Correct geeper voltage (1800 volts for 12-mil 3M Coating) shall be verified with the inspector for the particular pipe coating before starting operation. Salvaged pipe to be reinstalled, which has wrapped bitumastic coating, shall have geeper voltage set at 7200 V for 3/32" and 9600 V for 1/8" coating thickness. If a jeep voltage is not specified by the manufacturer then the holiday detection voltage shall be determined by $V = 525\sqrt{T}$, where T = coating film thickness in mils. Proper voltage settings shall be confirmed by detecting three artificial holidays placed in the initial pipe joint. For fabrication inspection, the electrode shall be a wet sponge detector supplied by the Contractor. For pipe inspection, the electrode size shall be the pipe OD and consist of a rolling spring composed of square stainless steel wire. The spring

length shall fit securely to the surface of the pipe. The holiday detector manufacturers approved by the Department are:

A. D. E. Stearns Company
B. Spy Holiday Detectors
C. Tinker & Rasor

Upon completion of the pipeline construction prior to final clean up, the Department may conduct a Pearson Survey to detect coating holidays. The Contractor shall uncover all of the holidays detected. The coating shall be cleaned, dried, geeped and uncovered coating defects shall be repaired. Any uncovered Pearson indications that do not require coating repair will be at the Department's expense and limited to the excavation, inspection, backfill and final clean up. In either instance, all costs associated with the repair, including the excavation, coating repair, backfill and final clean up will be born by either the Contractor or the Department.

16.04 Cleaning Pipe Interior

Before joining, all fittings, lengths, and sections of pipe shall be inspected and thoroughly cleaned to remove all rust scale, dirt, snow, ice, water, or any other foreign material.

The Contractor shall install mechanical caps on the ends of all partially constructed mains and services for overnight periods or other periods of extended inactivity to prevent soil, water, and other materials from entering the pipe.

The completed pipeline shall be cleaned in the presence of the Inspector as follows:

A. Steel pipe, 2" and smaller, shall be cleaned by blowing with air
B. Steel pipe, 3" and larger, shall be cleaned by blowing through a pig with air

Alcohol shall be introduced in mains tested between September 1 and May 15. This shall be done prior to pigging. Contractor shall be furnished alcohol by the Department at 520 Garfield Avenue in amounts not to exceed the following per 1,000 feet:

2" - 0.4 Gallons	6" - 2.0 Gallons
3" - 0.6 Gallons	8" - 4.0 Gallons
4" - 1.0 Gallons	10" - 6.0 Gallons

16.05 Steel Pipe Installation

A. Expansion joints shall be furnished and installed in accordance with Sections 14.02.04(P) at locations indicated on the Plans or designated by the Engineer in the distribution system.

B. Bends in steel gas mains shall be made with weld fittings, approved bending equipment, except where deflections do not exceed 12-1/2 degrees, miter bends are permitted.

Wrinkle bends are not permitted.

No attempt shall be made to bend pipe except with bending equipment designed specifically for bending. Bending shall be within the allowable limits and meet the requirements of DOT Regulation, Section 192.313.

C. Damaged sections of pipe shall be removed and replaced by cutting the section out as a cylinder applying half sole patch, or a full encirclement closure. Damage shall include dents, scratches, gouges, grooves, or arc burns which, in the opinion of the Engineer, could cause stress concentrations. Refer to Section 15.03.03(F) for more information.

D. A directionally drilled pipe that is installed which has the sacrificial coating partially or completely missing and the FBE coating intact shall be considered a successful bore. The contractor shall provide means of internal inspection (geometry pig or approved alternate) to insure that the installed pipe is free of deleterious dents before tying the bore into the pipeline, as required by the Engineer.

E. Pipe in open trench shall be installed as shown on Detail Drawing EX-2 unless indicated otherwise on the plan. Where it is impossible or impractical to use encasement materials, rock shield (double wrapped around the circumference of the pipe and supplied by the contractor) may be used as determined by the Engineer.

F. Before backfilling, the pipe must be geeped with a holiday detector to confirm that no coating defects remain. Short replacement pieces or repairs to steel pipe need not be geeped.

16.06 Repair of Damaged Steel Pipe (192.307)

16.06.01 Transmission Main

Any repair on the transmission pipeline will require a procedure prepared by Engineering prior to any work. The pipeline will be taken out of service and pressure reduced below 20% of SMYS before any repair is made.

16.06.02 Distribution

Damaged steel pipe which must be corrected includes:

A. Dent which in addition contains a stress concentrator such as a weld joint, an arc burn, scratch, or gouge.

B. Dent which exceeds twice the wall thickness.
C. A scratch, gouge, or groove deeper than 12-1/2% of the wall thickness.
D. Arc burn

A gouge, groove, arc burn or dent may not be repaired by insert patching or by pounding out. If these defects are removed, they may only be removed by cutting out the damaged portion as a cylinder.

Each segment of generally corroded distribution pipe with a remaining wall thickness less than that required for the MAOP of the pipeline, or a remaining wall thickness less than 30% of the nominal wall thickness must be replaced or permanently repaired.

Repairs requiring correction during construction should be accomplished by cutting the damaged section out as a cylinder unless an alternate method is approved by the Engineer.

Temporary repairs may be made with band clamps, sleeves or couplings, provided they are appropriately rated by manufacturer for pressure, size and suitability for use on steel gas lines. The permanent repair should be made within nine (9) months of temporary repair.

Permanent repairs required on a damaged steel pipeline which is in service may include:
A. Cutting out and replacing portion as a cylinder.
B. Complete full encirclement weld sleeve.
C. On 6" and larger pipe, halve sole weld on patch.
D. Alternative repair composite reinforcement sleeve as approved by the Engineer.

All repairs of transmission and distribution steel gas pipe which require the replacement of pipe will be made using sections of pre-tested pipe that has been pressure tested to MAOP x 1.5 (Section 19) or at least 100 psi, whichever is greater. Repaired or replaced portions shall be rewrapped and/or coated in accordance with Section 25.

16.07 Joining Pipe and Fittings

16.07.01 General

Approved joints to be used for assembly of underground pipelines shall be according to the following tables unless detailed otherwise:

Table 16-1
Steel to Steel Joints

Jointing Between	Type of Joint
Steel Pipe Sections	Welded
Steel Pipe and Fittings	Welded
Steel Pipe and Plastic (1", 2", 3", 6", 8")	Weld End Transition Fitting
Steel Pipe and Valves	Weld Flanges, 150# or 300# or weld end
Steel Pipe Insulators	Weld Flanges, 150# or 300#
Steel Pipeline Expansion Joint within long casings	Stainless Steel Bellows Type in manhole

Table 16-2
Plastic Pipe to Steel Pipe or Copper Risers

Jointing Between	Type of Joint
5/8" Steel Service replaced with 1/2"plastic and 1"P.E. service replaced with P.E.	Existing old style Dresser 88 service tees must be refitted with new lock insert gasket, retainer cup & follower nut to conform to pullout resistance regulations. Otherwise, the tee must be abandoned & new 1" tees installed per 14.05.15 & Detail G-2.
5/8" O.D. steel or copper tube to 1/2" P.E.	Chicago Fitting

16.07.02 Welded Joints

Welders must be qualified according to the requirements of Section 27-Welding Qualifications.

A. Cutting — The edges or surfaces of parts to be joined by welding must be prepared by machining, grinding, flame cutting, or with a sanding disk. Edges prepared by flame cutting shall be dressed with a file, grinder, or sanding disk to produce a reasonably smooth and uniform surface. A flame cutting beveling machine shall be used to cut all 2" and larger pipe except that, where a beveling machine

cannot be used, the pipe may be cut with a wheel pipe cutter and grinder beveled. The inside edge of pipe cut with a wheel cutter must be filed or reamed to remove the cutting burr.

B. Cleaning — All surfaces within 1" of the weld area must be dry, cleaned of all rust, scale, primer, oil, or other foreign material. The parts to be welded shall be free from greasy or oily matter at least 2" from the weld edge or surface.

C. Mitering — Miter joints may be made but not to exceed a total pipe deflection of 3° on the transmission gas line and 10° on the distribution gas mains. Increasing the deflection by using multiple miter bends properly spaced is permitted but discouraged in favor of cutting a standard bend fitting. If multiple miter joints are used, the minimum distance measured at the crotch from joint to joint must not be less than 1-1/2 pipe diameter.

D. Alignment — Line up clamps shall be maintained in place until at least 50% of the root bead is deposited at uniform spacing around the joint.

E. Protection — Tents or shields must be used when necessary to protect the weld area from rain, snow, or high winds. Liquid must not be permitted to come in contact with the weld area.

F. Preheat — The environment or weld material shall be preheated to at least 50°F.

G. Clearance — **At least 24 inches of clearance under and around a joint should be provided for proper working space.**

H. Configuration — See Standard Detail No. G-4.

I. Gas Vapors — Welding must be done only under controlled conditions in the presence of gas. A controlled flame at the weld or removing the combustible mixture from the weld area are the alternatives to be selected. Air movers or other means must be employed if gas is to be kept from the area. Gas detection instruments must be used to measure environment to insure any method employed to keep gas away is effective.

J. Cleaning Between Passes — Scale and slag shall be removed from each bead and grove between passes by grinding, brushing, or chipping.

K. Inspection

Acceptability of a weld that is nondestructively tested or visually inspected is determined according to API 1104, Section 9. All welds must be visually inspected to ensure compliance with the welding procedure.

Each person responsible for inspecting welded joints must be qualified by training or experience to ensure that the welding is performed to the procedure in this manual.

The inspector reserves the option and without notice to have weld radiographed or to have test coupon cut as a supplement to visual examination. Cost of testing will be charged to Contractor if welds are not acceptable.

L. Inspection of Transmission Welds

All welds must be visually inspected to ensure compliance with the welding procedure. Inspection of welds on the transmission line will normally be doneby a third party. The Department will keep on file and accept the NDE procedures utilized by the third party of their methods.

The welds on a pipeline to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS must be nondestructively tested in accordance with § 192.243, except that welds that are visually inspected and approved by a qualified welding inspector need not be nondestructively tested if:
1. The pipe has a nominal diameter of less than 6 inches (152 millimeters); or
2. The pipeline is to be operated at a pressure that produces a hoop stress of less than 40 percent of SMYS and the welds are so limited in number that nondestructive testing is impractical.

M. Repair of Welds

Welds found unacceptable according to API Standard 1104, Section 9, must be removed or repaired. Weld must be removed if it has a crack that is more than 8% of the weld length. Rejected welds on lines not in service shall be removed. Rejected welds on lines in service may be repaired or encapsulated. Welds which are permitted to be repaired must have the defect removed down to sound metal and the segment to be repaired must be preheated if conditions would adversely affect the quality of weld repair. The repair of a previously repaired weld will not be permitted and shall be removed.

16.07.03 Flanged Connections

Flange faces must be similar. Flat face flanges may not connect to a raised face flange.

Alignment of the flanges to be joined shall be done before bolting. Bringing unaligned pipelines together by tightening, resulting in a permanently sprung connection, is prohibited. Bolts or studs shall be long enough that, with the gasket or insulator installed, they will extend completely through the nut with not less than two (2) exposed threads when tightened. Bolts or studs shall be tightened gradually and alternately so as to bring the flanges together with uniform and increasing pressure on all parts of the face.

See section 14.05 for torque requirements.

16.07.04 Steel (Extrube) to PE Repair Coupling, 5/8" ST to 1/2" PE Installation

The following procedure shall be used to connect 5/8" OD Steel or copper tube to 1/2" CTS (5/8" OD) PE pipe.

Installers of this fitting must be qualified according to Section 28.

A. Cut plastic square and deburr O.D. and I.D. Clean exposed plastic line with a clean, dry, grease-free cloth.

B. Mark tubing to stab depth at 1 1/2" from end with felt pen or suitable marker. Make sure not to scratch surface of plastic tubing with marker. Loosen nut 1 to 2 turns. Stab stiffener end of fitting over plastic service until plastic is bottomed. Flush with mark.

C. Tighten body onto nut using suitable wrenches until body meets nut shoulder, that is, "metal to metal."

D. Cut steel tube square, remove 1 1/2" of coating from end and deburr O.D. and I.D.

E. Loosen nut one to two turns.

F. Stab fitting over tubing until tube is bottomed and flush with edge of coating.

G. Tighten nut onto body using suitable wrenches, until nut shoulder meets body, that is, "metal to metal. "Steel end connection must have bitumastic applied and then taped.

16.08 Branch Main Connections, 2" and Larger

16.08.01 Connections to mains not in service

Connections to mains not in service may be made by the Contractor. Weld tees shall be installed where the branch and main are the same size or one size under. For branches more than one size under, saddles or tees and reducers may be used.

16.08.02 Connections to mains in service

Connections to mains which are in service (live) shall be done by the Department. The Department shall furnish and install saddles, nipples, and tapping valves, if required. The Department will furnish and install no-blo tees, stop off fittings, or bottom out fittings, if required.

Excavation, backfill and restoration shall be included as the Contractor's responsibility for all planned connections.

Hot tapping shall be performed only by trained & qualified personnel according to Section 16.09.

Department will furnish tools, machines, and personnel for any required operation as follows:

A. Operate gas valves.

B. Line stopper, bottom out connections, or by-pass operations.

C. All tapping, drilling, cutting of mains.

Branch connections to mains in service (live) will follow these policies.

16.08.03 Branch Connection Policy to Steel Mains in Service
(Refer to Detail Drawing G-3 or as spec on plan)

Branch Size	Main Size	
	Same as Branch	Larger than Branch
2"	1-1/4" or 2" No-Blo Valve Tee Weldolet w/Tap Valve	1-1/4" or 2" No-Blo Valve Tee Weld Saddle w/Tap Valve Weldolet w/Tap Valve
3"&4"	One Size Reduced Weld Saddle w/Tap Valve One Size Reduced Weldolet w/Tap Valve Bottom Out Stop (2" No-Blo Valve Tee for 3" PE Branch)	Weld Saddle w/Tap Valve Weldolet w/Tap Valve Bottom Out Stop (2" No-Blo Valve Tee for 3" PE Branch)
6"-12"	One Size Reduced Full Encirclement Tap Tee w/Tap Valve Bottom Out Stop	Full Encirclement Tap Tee w/Tap Valve Bottom Out Stop

16.09 Hot Taps on Gas Main - Procedures, Training and Qualifications

Tap fittings shall be connected to mains only by qualified welders or fusers. No hot taps will be allowed on the transmission line without taking it out of service, pressure reduced and a procedure developed.

Tap fitting connection must be pressure tested for leakage before tapping begins.

Operators performing hot taps shall be restricted to trained personnel listed in "Table of Hot Taps, Tools, Instructions and Qualifications". The operator (or at least one operator in the crew) shall have had the minimum training or certification listed in the schedule for each respective type of tap.

Instruction reference manuals or procedures shall be made available on the job site for each respective tap, except the self-tapping tees.

Table 16-3
Hot Taps, Tool, Instructions, Qualification

Type of Tap	Size	Detail	Machine Used	Operator(s)	Instruction Ref. & Qual.
3/4"x 5/8"Tap-N-Valve 1/2" x 5/8" mini-tee 3/4"x 1 1/8" Style 501	3/4" 1/2" 3/4"	G-2 G-2 G-2	None - self tap w/tool " "	Certified U.O. Personnel	Manuf. Manual " " Apprentice Program
Weldolet or Weld Saddle & Valve Weldolet or Weld Saddle & Valve Full Encirclement Tap Tee	2" & 3" 4" 6",8",10",& 12"	G-3 G-3 G-3	D-5 Mueller C1-36 Mueller C1-36 Mueller	Certified U.O. Personnel Certified U.O. Personnel Certified U.O. Personnel	Operating Instructions, Form 8513 Apprentice Program and Mueller Sch
No-Blo Valve Tee (Completion plug for No-blo &drill nipples)	1¼" & 1½" & 2" 1", 1¼", 1½" & 2"	G-4	D-5 Mueller H 17145 Mueller	Certified U.O. Personnel Certified U.O. Personnel	Apprentice Program & Mueller Sch
Stop (Completion Plugs)	1¼" & 2"		D-5 Mueller H 17145	Certified U.O. Personnel Certified U.O. Personnel	Low Pressure Line - Stopper Fitting Training Manual by Apprentice Program & Mueller Sch
Stop (Completion Plugs)	All Sizes 3", 4", 6" & 8" 10" & 12"		C1-36 Mueller 3SW Mueller 4SW Mueller	Certified U.O. Personnel Certified U.O. Personnel Certified U.O. Personnel	Operating Instructions, Form 8513 Operating Instructions, Form 8834 Apprentice Program & Mueller Sch

Table of Contents

17.01 General 1

17.02 Handling of Pipe, Fittings, etc. 1

17.03 Inspection of Pipe and Fittings. 1

17.04 Cleaning Pipe Interior 1

17.05 Plastic Pipe Installation 2

17.06 Repair of Damaged Plastic Pipe 4

17.07 Joining Pipe and Fittings 4

17.08 Fusion Joining of Plastic Pipe. 5

17.09 Socket Fusion Joint Procedure 6

17.10 Saddle Fusion Joint Procedure -Yellow or Orange Pipe 7

17.11 Butt Fusion Joint Procedure 10

17.12 Procedure for Fusion Joining of Fittings and Pipe Having a Different Base Plastic 12

17.13 Cold Weather Fusion Procedures 13

17.14 Plastic Pipe Couplings, LYCOFIT Installation Procedure, 1" SDR 9.3 and 1/2" SDR 7 Pipe 14

17.15 Plastic Pipe Stab Couplings, Con-Stab Installation Procedure, 1" SDR 9.3 and ½" SDR 7 Pipe 14

17.16 Electrofusion Couplings (1/2", 1",2", 3", 6", 8") Installation using an Approved Electrofusion Unit. 15

17.17 Electrofusion Tapping Tees (2",3" ,6",8") Installation Using an Approved Electrofusion Unit 17

17.18 Re-Fusion of Electrofusion Fittings 18

17.19 Branch Main Connections, 2" and Larger 18

17.20 Branch Connection Policy to Plastic Mains in Service 19

17.21 Hot Taps on Gas Main - Procedures, Training and Qualifications 19

Table 17-1: Plastic to Plastic Pipe Joints 4

Table 17-2: Plastic to Plastic Repair (Department Only) 5

Table 17-3: Plastic to Plastic Service Tee 5

Table 17-4: Socket Fusion Time Cycles - Yellow or Orange Pipe 7

Table 17-5: Service Tap Tee and Service Saddle Fusion Time Cycles.....8

Table 17-6: Branch Saddle Fusion Time Cycles - with 2" Outlet 8

Table 17-7: Butt Fusion Time Cycles for Orange or Yellow Pipe.....11

Table 17-8: Butt Fusion for Dupont Aldyl "A" (Tan) Pipe 11

Table 17-9: Bead Diameter after Fusion.....12

Table 17-10: Fusion Time Cycles for Tan Dupont Aldyl "A" Pipe and Yellow or Orange Saddle Fittings.....13

Table 17-11: Hot Taps, Tool, Instructions, Qualification.....19

Figure 17-1: Socket Fusion.....7

Figure 17-2: Saddle Joint.....**Error! Bookmark not defined.**

Figure 17-3: Butt Joint 12

17.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of plastic gas distribution systems.

17.02 Handling of Pipe and Fittings

The Contractor shall have adequate equipment on the site for unloading, supporting, and lowering pipe and fittings into trench. Pipe shall not be rolled, dragged, dropped, or allowed to contact sharp or hard objects which could cause injury to the pipe or coating. Fabric slings or soft padded devices shall be used so as to protect the pipe or coating. Pipe and fitting should be adequately secured to limit movement during transporting. Pipe stored outside shall have ends capped to prevent entry of water or debris, except when it is possible to visually determine that the pipe is clean before installation.

Care shall be exercised at all times to protect plastic material from fire, excessive heat or harmful chemicals.

Plastic pipe and tubing shall be adequately supported during storage. Thermoplastic pipe, tubing, and fittings shall be protected from long term exposure to direct sunlight.

Extra care shall be taken when handling plastic pipe in cold weather below 40°F to avoid damage to the pipe ends caused by impact with hard surfaces such as frozen earth or concrete. Pipe shall not be dropped. Coils of pipe shall be warmed before pipe is uncoiled and shall be mounted on a device which rotates to permit a straight pipe when unreeled. Sprung or spiraled pipe shall be straightened by hand.

17.03 Inspection of Pipe and Fittings
Error! Bookmark not defined.
Before installation, all fittings, lengths, and sections of pipe shall be thoroughly cleaned inside and inspected for defects. Plastic pipe shall be inspected for cuts, scratches, gouges, kinks, severe out-of-roundness, and other imperfections.

17.04 Cleaning Pipe Interior

Before joining, all fittings, lengths, and sections of pipe shall be inspected and thoroughly cleaned to remove all rust scale, dirt, snow, ice, water, or any other foreign material.

The Contractor shall install mechanical or fusion caps on the ends of all partially constructed mains and services for overnight periods or other periods of extended inactivity to prevent soil, water, and other materials from entering the pipe.

The completed pipeline shall be cleaned in the presence of the Inspector as follows:

A. Plastic pipe, 1" and smaller, shall be blown with air.

B. Plastic pipe, 2" and larger, shall have a foam pig blown through with compressed air.

Alcohol shall be introduced in mains tested between September 1 and May 15. This shall be done prior to pigging. Contractor shall be furnished alcohol by the Department at 520 Garfield Avenue in amounts not to exceed the following per 1,000 feet:

2" - 0.4 Gallons	6" - 2.0 Gallons
3" - 0.6 Gallons	8" - 4.0 Gallons
4" - 1.0 Gallons	10" - 6.0 Gallons

17.05 Plastic Pipe Installation

A. Plastic pipe shall be laid with uniform support on undisturbed or well compacted soil. Pipe bed shall not contain large rocks, blocks, or any other material which could injure the pipe or result in non-uniform support.

B. Plastic pipe shall be laid and backfilled with its natural slack in trenches. Excessive tension to straighten out pipe is not permitted.

C. Locating wire shall be laid on or within 3 inches of every plastic gas pipe.

Service locating wire shall be connected to main locating wire. Approved method of connection includes: soldered, split bolt type electrical connector, or other as may be approved by the Engineer. All connections shall be protected to make them watertight except the ends where they are brought up in valve boxes or at service risers. Waterproofing material shall be 3M 2200 pads or approved equal.

Locating wire, at valves, shall be brought up in valve box using 1/2" PE section to enclose the wire.

Locate wire and connectors placed during directional boring must be approved prior to work being performed.

D. Bending plastic pipe is permitted up to the radius of its shipping coil. Pipes 4 inch and larger may be deflected to a minimum radius of 125 times pipe diameter at joints and 20 times the pipe diameter otherwise.

E. Pulling plastic pipe through auger and bore holes may be done with power equipment only if a "weak link" section, approved by the Engineer, is used in the pulling assembly. Every effort should be made to pull and/or push the inserted pipe through by hand. If winch or machine power is required, a "weak link" designated by the Engineer shall be used in the pulling assembly. Weak link may be a pulling head or next smaller diameter pipe than that being pulled.

F. Pipe shall not be installed in cold weather (40°F or less) except in a special arrangement and with approval of the Engineer.

G. Installation of plastic pipe by plowing is permitted provided the pipe is not stretched at any time in the operation. Plow chute shall not bend pipe more than a radius of 15 times pipe diameter.

H. Installation of plastic pipe by pull plug is not permitted.

I. Installation by insertion in casing pipes or abandoned mains shall be preceded by proper preparation. Obstructions such as old service taps, bends, drips, etc., shall be cut out and the leading pipe ends padded as necessary to prevent scratching the inserted pipe. Locating wire shall be laid to and attached to casing but not laid inside casing. Pipe inserted through more than 100' of casing will require anchors at each end to restrain the plastic main. The Engineer will provide an anchor detail. Openings at casing ends where pipe is inserted through less than 100 feet of casing and without anchors shall be sealed with injected sealant foam.

When plastic gas pipe is inserted through a steel casing, the tracer wire shall be attached by cadweld to each end of the casing prior to pipe insertion.

Ends of casing or cut pipe shall be at least 12 inches from any connecting service with branch tee.

Plastic pipe installed through casings which are in the 5-foot frost zone are subject to being squeezed off by ice. Casings subject to these conditions must be sized as follows:

1/2" PE Gas Pipe	3/4" or 1" Casing
1" PE Gas Pipe	1 1/4" or 1 1/2" Casing
2" PE Gas Pipe	2 1/2", 3", 4" Casing
3" PE Gas Pipe	4", 6" Casing
6" PE Gas Pipe	8", 10" Casing

Larger than 6" P.E. gas pipe must be approved by the Engineer.

J. Pneumatic tunneling (moling) shall be done with caution to avoid damage to foreign utilities. When it is not clear that elevation or location clearance can be maintained, the Contractor shall expose the foreign utility before tunneling. The Engineer may further limit lengths between excavations to insure that depth limitations are not either excessive or insufficient. Follow procedure in Section 15.03 for sewer main or service crossing.

K. Plastic gas mains 6" or larger in size and in open trench shall always be installed as shown on Detail Drawing number EX-2 unless otherwise indicated on the plans. This shall not apply when pipe is inserted through bored holes. Cost of bedding and cover shall be included in unit bid price for pipe installation.

17.06 Repair of Damaged Plastic Pipe

Damaged pipe requiring repair or replacement include scratches or gouges which have a depth of 10% or more of the wall thickness, pipe which has been stretched or kinked beyond the elastic limit; i.e., will never recover original shape or length, except for a squeeze off location.

Repair of defects during the construction of plastic pipelines should be accomplished by cutting out the defective parts and replacing section by using the same materials and methods for new construction.

After a plastic pipeline has been in service, a number of approved fittings (Section 16.07) may be used to repair or replace defects. Repairs must also be made to plastic pipe using sections of pipe that has been pre-tested to 100 psi.

Whenever plastic pipe is squeezed or pinched off for any reason, the location of the squeeze or pinch must be permanently marked with wraps of electrical tape or a split plastic clamp so the location will not be used for another squeeze-off in the future.

When repairs have been made, the tracer wire must be reconnected for continuity. Connections are to be made with 3M type connectors or approved equivalent and must be made waterproof by the use of 3M 2200 pads or approved equivalent. Tracer wires are not to be attached to the steel gas main, steel services, or service tees.

17.07 Joining Pipe and Fittings - General

Approved joints to be used for assembly of underground pipelines shall be according to the following tables unless detailed otherwise:

Table 17-1
Plastic to Plastic Pipe Joints

Jointing Between	Type of Joint
1/2" and 1"	Socket Fusion, Electrofusion or Mechanical fitting (by Department only) (Con-Stab or lycofit,) or
2" and 3"	Socket, Butt Fusion, or Electrofusion
6"	Butt Fusion & Electrofusion
8"	Butt Fusion & Electrofusion

Table 17-2
Plastic to Plastic Repair (Department only)

Jointing Between	Type of Joint
1/2" and 1"	Socket Fusion Coupling or "Lycofit" Type Plastic Pipe Repair Coupling- or "Con-Stab type 52, 53 or 56"
2" and 3"	Electrofusion coupling, socket fusion coupling, or butt fusion
6" and 8"	Butt fusion and electrofusion coupling
6" & 8"(temporarily)	Band clamp may be used for temporary repairs. Permanent repairs must be scheduled

Table 17-3
Plastic to Plastic Service Tee

Jointing Between	Type of Joint
1/2", 1", 2", 3", 6" and 8"	Saddle & Electrofusion

17.08 Fusion Joining of Plastic Pipe

All fusion joining shall be done only by persons currently certified by the Public Works and Utilities Department according to these Standards.

Skillful application of techniques and the use of proper materials and equipment in good condition are required to achieve sound joints in plastic piping by the heat-fusion method. Inspection provisions shall be adequate to assure that sound joints are being made. The quality of the joints shall be checked visually. If there is any reason to believe the joint is defective, it shall be removed and replaced.

No fusion joining shall be done unless the proper and full quantity of tools are used.

Fusion joining between different types of plastics shall only be made to connect a service tee or branch saddle to the tan Dupont Aldyl "A" 6" pipe. Respective heating cycles for each type of plastic are listed in Table 17-10.

Direct application of heat with a torch or other flame is prohibited.

Special procedures outlined below shall be applied for fusion joining in cold weather. No work shall be done when it is below 0°F, raining, sleeting, or snowing, unless an artificial shelter is provided to enclose the work sufficiently to maintain an environment to comply with these specifications.

17.09 Socket Fusion Joint Procedure

A. End Preparations

1. Using a pipe cutter, cut off damaged or oval ends of pipe squarely.

2. Using chamfering tool to remove about 1/16" of the sharp corner at the pipe end on the outside surface of pipe. Remove burrs and chips inside pipe ends.

3. To prepare pipe for correct penetration into socket, place depth gauge down flush on end of pipe.

4. Place cold ring clamp around pipe, adjacent to depth gauge. After securing cold ring clamp, remove depth gauge.

5. Fitting surfaces should be clean and dry--wipe with cloth--do not touch with hands. Clean surfaces with alcohol and lint free material.

6. The socket faces of the heating tool should be at 500° ±10°F and clean.

7. First, firmly seat the socket fitting on the male face of the heating tool. Then place the female face on the end of the pipe firmly against the cold ring clamp. Heating time starts now.

B. Heating

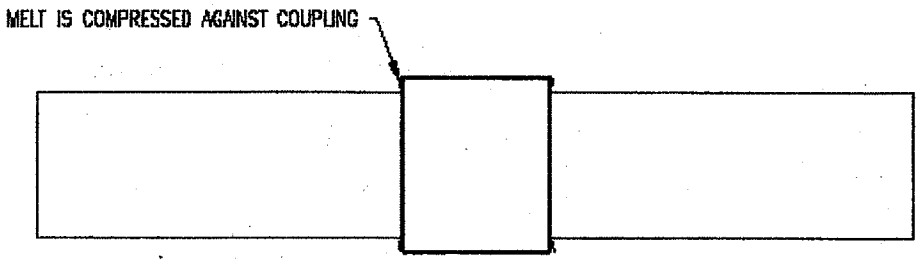
1. While holding the fitting firmly in a fixed position, rotate heating tool slightly to feel the melt, and promote uniform heating of pipe and fitting.

2. Snap the heating tool and fitting from the melted pipe by holding upper part of tool handle with one hand and rapping sharply on the handle with the free hand. Immediately remove fitting from heating tool.

3. The heated parts are inspected quickly to make sure all surfaces have been melted. See Figure 17-1.

4. If melt is not complete, cut off melted pipe end, use a new fitting, and repeat fusion process from the beginning.

Figure 17-1
Socket Fusion



C. Fusion and Cooling

1. Within 3 seconds after the heating tool has been removed, firmly push the melted fitting squarely onto the pipe and until it makes firm contact with the cold ring clamp. DO NOT TWIST. Hold the fitting firmly in place for total cooling time shown in Table 17-4 to insure proper alignment.
2. After waiting 3 additional minutes cooling time, remove the cold ring clamp and inspect the joint. A good joint will have a uniform melt ring that is flat against the socket and perpendicular to the pipe. There should be no cavity between the fitting and the pipe.
3. Wait an additional 10 minutes to complete cooling before the pipe joint is tested or stressed during burial.

Table 17-4
Socket Fusion Time Cycles – Yellow or Orange Pipe

Pipe Size (inches)	*Heating Time Cycle (seconds)	Cooling Time Cycle (seconds)
1/2" CTS	6	20
1" CTS	9	20
2" IPS	16	30
3" IPS	20	30

* Guidelines only, exact time depends on environmental conditions and condition of fusion equipment.

17.10 Saddle Fusion Joint Procedure -Yellow or Orange Pipe

The use of application tool is required for installing service tap tees and service saddles. An application tool is required for installing branch saddles. Assemble application unit according to manufacturer's instructions and position on pipe.

A. Surface Preparation

1. Remove surface skin from the melt areas of the clean, dry pipe and saddle fitting by roughening with medium grit emery or garnet cloth.

2. Brush away residue with dry rag after roughening. Clean area with alcohol and lint free material.

B. Heating

1. With the heating surfaces of the tool at $500^{\circ} \pm 10^{\circ}$F place the tool in position on pipe. Place fitting against heater faces and apply pressure.

2. Heat for time shown in Table 17-5 or 17-6.

3. With experience, the iron can be rotated slightly and slowly as the melt forms--do not rotate excessively as this will enlarge the melt pattern on the pipe.

Table 17-5
Service Tap Tee and Service Saddle Fusion Time Cycles

IPS PIPE SIZE (INCHES)	*HEATING TIME CYCLE (SECONDS)	COOLING TIME CYCLE (SECONDS)
2	40	60
3	40	60
6	40	60
8	40	60

Table 17-6
Branch Saddle Fusion Time Cycles - with 2" Outlet

IPS PIPE SIZE (INCHES)	*HEATING TIME CYCLE (SECONDS)	COOLING TIME CYCLE (SECONDS)
2	60	120
3	70-80	120
6	80-90	180
8	80-90	180

* Guidelines only, exact time depends upon environmental conditions and conditions of fusion equipment.

4. After proper melt time, raise fitting and remove heater from pipe. DO NOT displace melt on pipe and fitting surfaces. Check melt pattern on pipe and fittings--heated surfaces on fitting and pipe should be 100% melted with no cold spots. (Use a mirror to check the melt on the under surface of the saddle base.)

C. Fusion and Cooling

1. If melt patterns are satisfactory, press the fitting on the pipe quickly (within 3 seconds) with a pressure of 60-80 psi until a melt bead of the following size appears around the entire base of the fitting:

PIPE SIZE	BEAD THICKNESS
2"	1/8"
3" & larger	larger than 1/8"

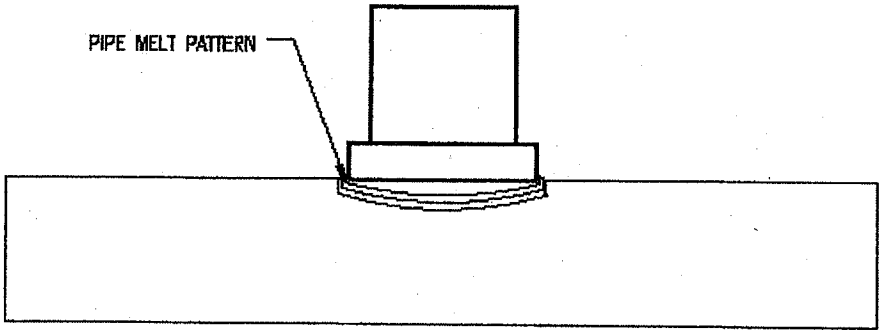
Adjust fusion unit to maintain pressure of fitting on pipe. Allow fusion joint to cool for at least the times indicated in Table 17-5 or 17-6 before releasing pressure. If melt pattern on fitting or pipe is unsatisfactory after heating, apply fitting to pipe and let cool. Remove cutter from tapping tee and cut off fitting top to avoid misuse later. Repeat procedure from Step (a).

2. After letting joint cool 3 minutes beyond that shown in the tables, remove application unit from pipe.

3. Visually check fitting for fusion melt bead around entire fitting base. See Figure 17-2 for visual parameters of proper Saddle Fusion. If fusion joint quality is unacceptable or doubtful, cut off fitting top and apply a new fitting to a new section of pipe.

4. Let fusion cool an additional 10 minutes prior to pressure testing and tapping the main.

Figure 17-2
Saddle Joint



17.11 Butt Fusion Joint Procedure

A. End Preparation

1. Clean each pipe end with alcohol using lint free materials.

2. Insert facing unit between pipe ends and lock onto guide rods. Face ends of pipe to be fused.

3. Check alignment of pipe ends. Adjust high-low if necessary. If adjustment is made, reinsert facing unit and give several additional turns without repositioning the pipes in the clamps.

4. Check heater plate for temperature and wipe surface clean.

B. Heating

1. Insert heater plate between aligned ends and bring ends firmly in contact with plate, but DO NOT APPLY PRESSURE.

2. Heat for times shown below.

Table 17-7
Butt Fusion Time Cycles for Orange or Yellow Pipe

IPS PIPE SIZE (INCHES)	*HEATER AT 500°(+)10°F	*HEATER AT 440°(+)10°F	COOLING TIME CYCLES (SECS.)
2	15	40	60
3	20	50	60
6-SDR 21	25	60	120
6-SDR 11.5	40	90	150
8-SDR 11.5	62	100	240

Table 17-8
Butt Fusion for Dupont Aldyl "A" (Tan) Pipe

IPS PIPE SIZE (INCHES)	*HEATER AT 340(+)5°F	COOLING TIME CYCLE (SECONDS)
6" - SDR 21	120	120
6" - SDR 11.5	150	150

* Guidelines only, exact time depends upon environmental conditions and conditions of fusion equipment.

C. Fusion and Cooling

1. Remove heater plate after achieving proper melt bead.

2. Bring melted ends together rapidly. DO NOT SLAM. Apply enough force to achieve a double roll back of each bead onto the pipe.

3. Allow the butt fusion to cool, under pressure, for the time shown in Table 4.

4. DO NOT remove the fused joint from the equipment for an additional 3 minutes after cooling time.

   DO NOT test, stress, pull or lay in ground for 10 minutes after removal from fusion unit.

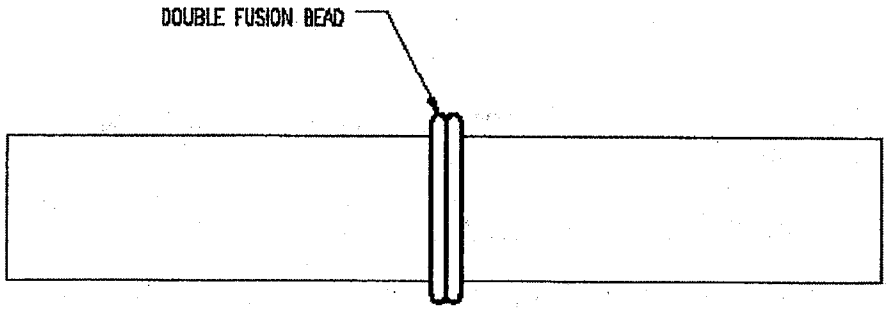
5. See Figure 17-4 for visual parameters of a proper fusion.

   Each bead after fusion should have approximately the following diameters:

Table 15-9
Bead Diameter after Fusion

PIPE SIZE	SDR NO.	BEAD THICKNESS
2" IPS	11	1/16" TO 1/8"
3" IPS	11 - 11.5	1/8"
6" IPS	11 - 11.5	3/16"
8" IPS	11 - 11.5	1/4"

Figure 17-3
Butt Joint



17.12 Procedure for Fusion Joining of Fittings and Pipe Having a Different Base Plastic

Orange and yellow pipe and fittings are of the same base plastic and require no differential time for fusion joining.

Orange or yellow fittings, when being fusion joined to tan colored Dupont Aldyl "A" pipe, require a differential in the required heating times. The tool temperature (500°F ± 5°) does not change for orange/yellow or tan material when making saddle type fusions.

The heating tool shall be first placed on the yellow or orange saddle fitting, which requires a longer heating time; then after the difference in heating time has lapsed between the materials, the companion heating tool is applied to the tan pipe. Both tools are to be removed simultaneously when the remaining time expires. Tables 15-1 and 15-2 shall be used for the orange or yellow heating cycles and the following Table 15-6 for tan colored Dupont Aldyl "A" material.

Table 17-10
Fusion Time Cycles for Tan Dupont Aldyl "A" Pipe and Yellow or Orange Saddle Fittings

*HEATING TIME ON TAN DUPONT ALDYL PIPE YELLOW SADDLE (SECONDS)	*HEATING TIME ON ORANGE OR COOLING TIME (SECONDS)	CYLCLE (SECS)
Service Tap Tee/ Service Saddle 20	40	120
Branch Saddle 35-45	60	120

DO NOT remove the fused joint from the equipment for an additional 3 minutes after cooling time.

*Guidelines only, exact time depends upon environmental conditions and conditions of fusion equipment.

17.13 Cold Weather Fusion Procedures

Cold weather fusion procedures established below shall be used when temperature is between 0^{O}F and 40^{O}F.

1. All traces of frost, ice, and water shall be removed from both the joining and clamping surfaces. Heating tools shall not be used for this purpose.

2. Cold ring clamps shall be used to check ends of pipe to be joined. If ends of pipe are damaged or distorted, they shall be cut off.

3. Two cold ring clamps may be necessary (one behind the usual location of the first clamp) to prevent slipping due to pipe construction. Shim material of paper or tape must only be inserted in the secondary cold ring, allowing room for expansion of the pipe in the first cold ring during heating cycle.

4. Socket Fusions. The fitting shall be placed on the tool before stabbing the pipe into the tool. Time, in the following table, begins when the pipe is completely on tool. When time is up, snap the pipe from the tool first, followed by the fitting.

5. For cooling times, see Procedures A through D.

FUSION TIME (SECONDS) - COLD WEATHER

Temperature	40°	30°	20°	10°	0°
1" & 2" Sockets	21	22	23	27	28
3" Sockets	22	23	24	28	29

Saddle Fusions. Apply the heating cycle in the above table, substituting main size. If melt is not satisfactory, begin at new location and increase time by not more than 3 seconds per trial.

Butt Fusions. Apply the same heating cycle as in warm weather. If good joint is not obtained, cut out joint, repeat procedure increasing heating cycle. Do not increase pressure on joint to compensate low temperatures.

17.14 Plastic Pipe Couplings, LYCOFIT Installation Procedure, 1" SDR 9.3 and 1/2" SDR 7 Pipe

A. Make sure size and wall thickness or SDR marked on LYCOFIT matches those of pipe to be joined. Refer to illustration package with each fitting.

B. Make sure inside and outside of pipe and LYCOFIT are clean and dry. **DO NOT LUBRICATE PIPE, TUBING OR LYCOFIT!**

C. Slide LYCOFIT SLEEVES onto pipe first.

D. Position pipe jaw vise grip on pipe. Use only the LYCOFIT assembly tool, insert LYCOFIT spigot into pipe until pipe covers last barb on spigot. DO NOT INSERT AGAINST PIPE STOP.

E. Remove vise grip, advance the LYCOFIT sleeve over the pipe until it meets the flange on the spigot.

F. Pressure test to comply with Construction Specifications.

17.15 Plastic Pipe Stab Couplings, Con-Stab Installation Procedure, 1" SDR 9.3 and ½" SDR 7 Pipe

A. Verify the pipe or tubing being assembled is the correct size.

B. Cut pipe ends square.

C. Clean piping thoroughly to assure there is **no dirt, grease or oil in assembly area.**

D. Chamfer end of pipe using the Continental O.D./I.D. chamfering tool.

E. Mark the stab depth using one of the methods listed below.

1. Holding the piping against the collar on the fitting, mark the pipe at the entrance of fitting.

2. O.D./I.D. chamfering tool is also a depth gauge. Insert pipe into tool until it stops, mark pipe at entrance of tool.

3. Measure stab length, which is 1-7/8" from chamfered end of piping.

F. Stab pipe completely into fitting so that the mark on the pipe is within 1/8" from the fitting entrance.

G. Pressure test to comply with Construction Specifications.

17.16 Electrofusion Couplings (1/2", 1",2", 3", 6", 8") Installation using an Approved Electrofusion Unit.

A. Electrofusion Joining Procedures:

1. Clean the pipe ends by removing dirt, mud, and other debris, with a clean, disposable lint free material. Clean water can be used for initial cleaning prior to scraping and isopropyl alcohol is recommended after scraping.

2. Check pipe for out-of-round condition. If fusion area is found to be out-of-round, take appropriate steps to bring fusion area back within required tolerances.

3. When installing a coupling, it is necessary for the pipe ends to be cut. This can be accomplished by various methods below:

- for sizes 3" or less, using a blade type of pipe cutter, or a tubing cutter
- for sizes 3" or larger, a sawsall or hand using a clamp as a guide
- for 6" and larger, a chain saw (without bar oil) may be also used

4. Measure the stab depth on both pipe ends by placing the coupling next to the pipe as required by the manufacturer and marking the depth with a non-greasy marker.

5. Check the pipe surface for any embedded debris that may cause damage to the scraping tools and once more make sure that the outer pipe surface is clean and free of any dirt or mud that could contaminate the scraped pipe surfaces.

6. Scrape the outside of the pipe surface to remove oxidation and other contaminates. Use an appropriate scraping tool, as recommended by the pipe or fitting manufacturer and approved by the Public Works and Utilities Department. Scrape the pipe surface until the outer layer or "skin" of the pipe has been removed to expose a clean, virgin pipe material as per pipe manufacturer's recommendation. Inspect the entire scraped area to ensure total scraping coverage. For pipe smaller than 6-inch, if a coupling is to be pushed completely over one pipe end, scrape the pipe end for the entire length of the coupler to prevent contamination of the coupler by sliding over un-scraped pipe. **Do not use abrasives, grinding wheels, or other devices that do not cleanly remove the contaminated material.**

7. Clean scraped area thoroughly with a clean, lint free towel and isopropyl alcohol and allow to dry before assembly. Avoid touching the scraped pipe surface or the inside of the coupler as body oils and other contaminates can affect fusion joint performance. If the surfaces become contaminated, repeat cleaning procedure. Do not use alcohol with any additives other than water.

8. Place the fitting on the area to be fused and restrain using an approved restraint device.

9. Attach processor leads to the fitting and proceed with fusion as described for standard joining, per manufacturer's instructions.

10. Disconnect and remove processor leads when fusion cycle is complete.

11. Allow fitting to cool in accordance with recommended cooling time before pressure testing or rough handling.

B. Electrofusion Couplings:

1. For New Installation:

   Slide coupling half-way over one pipe end. Slide mating pipe into other half of coupling so that the coupling lines up between the marks made in step 4 of **Electrofusion Joining Procedures.**

2. For Repair:

   Slide one coupling over each end of repair section of pipe. Position repair section of pipe in place between existing pipe ends. Slide couplings over the joints to line up between the marks made in Step (d) of **Electrofusion Joining Procedures.**

17.17 Electrofusion Tapping Tees (2",3" ,6",8") Installation Using an Approved Electrofusion Unit

Electrofusion Tapping Tee Procedures

1. Clean the area of the pipe to be fused by removing dirt, mud, and other debris, with a clean, disposable lint free material from pipe ends. Clean water can be used for initial cleaning prior to scraping and isopropyl alcohol is recommended after scraping.

2. Check pipe for out-of-round condition. If fusion area is found to be out-of-round, take appropriate steps to bring fusion area back within required tolerances

3. Identify the location of the fitting to be installed on the pipe, as recommended by the manufacturer, by marking the area with a non-greasy marker.

4. Check the pipe surface for any embedded debris that may cause damage to the scraping tools and once more make sure that the outer pipe surface is clean and free of any dirt or mud that could contaminate the scraped pipe surfaces.

5. Scrape the outside of the pipe surface to remove oxidation and other contaminates. Use an appropriate scraping tool, as recommended by the pipe or fitting manufacturer and approved by the Public Works and Utilities Department. Scrape the pipe surface until the outer layer or "skin" of the pipe has been removed to expose a clean, virgin pipe material per pipe manufacturer's recommendation. Inspect the entire scraped area to ensure total scraping coverage. **Do not use abrasives, grinding wheels, or other devices that do not cleanly remove the contaminated material.**

6. Clean scraped area thoroughly with a clean, lint free towel and isopropyl alcohol and allow to dry before assembly. Avoid touching the scraped pipe surface or the inside of the coupler as body oils and other contaminates can affect fusion joint performance. If the surfaces become contaminated, repeat cleaning procedure. Do not use alcohol with any additives other than water.

7. Remove the fitting from the bag. Clean fitting with alcohol and lint free towel if needed, then place it in the area to be fused.

8. Without moving the fitting, slide the under clamp onto the base of the fitting.

9. Make sure the fitting is centered in the under clamp and then pull the cantilever into the secure position.

10. Attach processor leads to the fitting and proceed with fusion as described for standard joining, per manufacturer's instructions

11. Disconnect and remove leads when fusion cycle is complete.

12. Allow fitting to cool in accordance with recommended cooling time before pressure testing or rough handling.

17.18 Re-Fusion of Electrofusion Fittings

Central Plastics electrofusion fittings can be re-fused (Engineering or welders approval needed) only in the event of an input power interruption, i.e. fusion leads were detached during fusion, generator runs out of gas, processor malfunction, or other circumstance that results in processor input power interruption.

The recommended procedure for re-fusing fittings is:

a. Fitting should remain in clamped position and be allowed to cool to ambient temperature.

b. The fitting should be reconnected to the processor and fused for the entire fusion time.

This re-fusion procedure should be used for fusions that terminated due to input power reasons only.

Fittings that fault for any other reason should be cut out and replaced.

17.19 Branch Main Connections, 2" and Larger

Connections to mains not in service may be made by the Contractor. Fused tees shall be installed where the branch and main are the same size or one size under. For branches more than one size under, saddles or tees and reducers may be used.

Connections to mains which are in service (live) shall be done by the Department. The Department shall furnish and install saddles, high volume tees and valves, if required.

Excavation, backfill, and restoration shall be included as the Contractor's responsibility for all planned connections.

Hot tapping shall be performed only by trained & qualified personnel according to Section 17-21.

Department will furnish tools, machines, and personnel for any required operation as follows:

A. Operate gas valves.

B. Squeeze off plastic mains.

Branch connections to mains in service (live) will follow these policies.

17.20 Branch Connection Policy to Plastic Mains in Service

Plastic branch connections to live plastic mains will be made with branching saddles or electrofusion high volume tapping tee. Saddle shall be the same plastic type and grade as the live plastic main. Different plastics shall join at socket joints when necessary.

17.21 Hot Taps on Gas Main - Procedures, Training and Qualifications

Tap fittings shall be connected to mains only by qualified welders or fusers.

Tap fitting connection must be pressure tested for leakage before tapping begins.

Operators performing hot taps shall be restricted to trained personnel listed in "Table of Hot Taps, Tools, Instructions and Qualifications". The operator (or at least one operator in the crew) shall have had the minimum training or certification listed in the schedule for each respective type of tap.

Instruction reference manuals or procedures shall be made available on the job site for each respective tap, except the self-tapping tees.

Table 17-11
Hot Taps, Tool, Instructions, Qualification

Type of Tap	Size	Detail	Machine Used	Operator(s)	Instruction Ref. & Qual.
PE Service Tees	½" & 1"	G-10 G-11	None - self tap w/hex tool	Certified U.O. Personnel Contractor	Manuf. Manual Fusion School & Qualifications
PE Branch Saddles	2" & 3"		Dupont 2" B.S. Tapping Tool	Welders	Instruction in Tool Box
Electrofusion High Volume Tee	2"		Self-Tap w/Hex Tool	Certified U.O. Personnel	Fusion School Certification

Table of Contents

18.01 General 1

18.02 Valves 1

18.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of both steel and plastic gas distribution and transmission valves.

18.02 Valves

Flanged valve shall be installed where indicated on the Plans. Valves shall be set upright, on blocks to undisturbed earth and backfill tamped around and up to a point 4 to 6 inches below the top of operating nut.

The box, as specified in Section 14.05.05, shall be adjusted to proper height by first cutting the top stem of the plastic bottom section. If necessary, the bonnet portion may be trimmed to shorten the height. Bottom section shall be set on 2 inch wood blocking and uniformly backfilled to keep the box plumb and on center. Box shall not rest on valve or on main.

Valves installed on the inlet side of regulator stations will be located at sufficient distance to permit the operation of the valve during an emergency.

Valve types, when not indicated on the Plans, shall be determined from the following current Department practice:

	Plastic Type 2" & 3"	Plastic Plug Type 1"	Steel Gate (Kerotest) 2" & over	Steel Plug 1-1/2" & over	Steel Ball 2" & over
Line Valves in PE Mains	X	X			
P.E. to P.E. Branch	X	X			
P.E. Service	X	X			
P.E. Branch Off Steel with No-blo Tee Connex.	X				
Tap Off Steel Main			X		X
Reliefs (Above Ground)			X		X
Line Valves for Steel Mains			X		X
Steel Risers (2" & larger)			X		X
Reg. Station (Above Ground)			X	X	X

Table of Contents

19.01 General 1

19.02 Transmission Line Testing 1

19.03 Gas Main Testing 2

19.04 Gas Services Testing 2

19.05 Test Records 3

19.01 General

All testing apparatus shall be furnished and installed by the Contractor. Cost of testing shall be incidental to the main or service. Test gauge furnished shall be graduated in not more than 2 psi increments.

19.02 Transmission Line Testing. (Operating at Hoop Stress of 30% or more of SMYS [192.505(a)])

A. Test Pressure: The minimum test pressure will be 150% of the maximum operating pressure in Class 3 and 4 locations, and will be 125% of the maximum operating pressure in Class 1 and 2 locations. The maximum test pressure depends on the strength of the pipeline and the components in it. If water is the test medium, elevation must be considered.

B. Test Medium: In Class 1 or Class 2 locations, if there is a building intended for human occupancy within 300 feet of a pipeline, a hydrostatic test is required (except as noted below) on the segment within 300 feet of such a building, but in no event may the test section be less than 600 feet unless the new or relocated pipe is less than 600 feet.

   NOTE: *Air or inert gas may be used if the building is evacuated while the hoop stress exceeds 50% of SMYS.*

   In Class 1 and Class 2 locations, the regulator station must be tested to at least Class 3 location requirements. [192.505(b)]

C. Test Duration: The test pressure must be maintained for a minimum of eight hours in addition to the stabilization period. [192.505(c)]

D. Fabricated Units and Short Sections: For fabricated units and short sections of pipe, where post installation test is impractical, pre-tested pipe shall be used. Pretested pipe must be pressure tested for at least four hours. [192.505(e)]

E. Components Other Than Pipe: No test is required for components that are the only item being replaced if:

   The component was tested to at least the pressure required for the pipeline to which it is being added, or the component was manufactured under a quality control system that ensures that each item manufactured is at least equal in strength to the pressure required for the pipeline to which it is being added (fittings, valves, regulators, relief valves, etc.).

19.03 Gas Main Testing

All new or reinstated mains shall be pressure tested after backfilling but before being placed into service. Main shall be isolated from the existing system. Valves shall not be used to isolate or to hold test pressure. On tie-ins and appurtenances, where the air test is impractical, the test shall consist of soap testing all joints and fittings under operating pressure, provided pre-tested pipe is used (Section 16).

Mains to have an MAOP of 66 psig or less shall be pressure tested with air at 100 psig. Mains to have an MAOP greater than 66 psig, but operating at a hoop stress less than 30 percent of SMYS, shall be pressure tested to MAOP x 1.5 with air, inert gas, natural gas or water as approved by the Engineer. Test duration shall be in accordance with the following table, but in no case more than 24 hours for steel pipe or 8 hours for polyethylene pipe.

For polyethylene pipe, the maximum test duration shall be 8 hours including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize the test section. If the test is not completed due to leakage, equipment failure, or for any other reason, depressurize the test section completely, and allow it to relax at least 8 hours before pressurizing the test section again.

Size	Test Time Hours per 1000'	Minimum Time
1"	1.0	-
2"	1.0	2.0
3"	2.0	3.0
4"	3.0	4.0
6"	4.0	4.0
8"	4.5	6.0
10"	9.0	8.0
12"	12.0	8.0
16"	24.0	8.0

Mains requiring a test duration greater than 12 hours shall have a recording gauge monitoring the test.

Qualified department employee shall monitor and certify the test, showing initial and final time and pressures, date, and signature. Records of all pipelines operating at more than 100 psi will be retained for the life of the pipe.

19.04 Gas Services Testing

All new or reinstated gas services installed on live mains shall be pressure tested individually and separate from the main or meter connection plumbing unless approved

by Utility Operations or Engineering. Before it is tapped, test shall include the riser, meter stop valve, and the attached service tee.

A repaired service must be pressure tested from the repair to the meter stop valve. Final joint at repair coupling may be soap tested.

Test gauge shall be installed on the outlet side of the opened meter stop valve.

All service lines shall be tested with air and accepted if it maintains 100 psig for one-half (1/2) hour. Accepted service can then be tapped to the main, the tap or punch tee cap soap tested, the service purged, and a threaded plug installed on the meter stop valve.

Service lines may be installed and tapped on PE mains not in service. Both main and service shall be tested to pressure and duration required for the main.

Mains not in service and to which services are to be connected and tested shall contain air pressure between 30 psi and 50 psi to enable a soap test of the tap or punch tee cap. Purging shall immediately follow or be done simultaneously with the main purging.

Each completed and purged service will have a pin type lock installed immediately by Department personnel. Lock will be removed only by Department personnel or authorized personnel.

Qualified department employee or Utility Operations Leadworker shall monitor and certify the test, showing initial and final time and pressures, date, and signature.

19.05 Test Records

All pressure test records shall be kept for the life of the facility +5 years. Document any leaks, failures, and their disposition, and any significant elevation variations on the applicable forms.

Table of Contents

20.01 General 1

20.02 Purging High Pressure Gas Mains and Services 1

20.03 Transmission Line 1

20.04 Distribution System 1

20.04.01 Purging 2" or larger Pipes. 1
20.04.02 Purging 1" or 1/2" Gas Services 2

Table 20-1: Purge Venting 2

20.01 General

This section of the Standard Specifications establishes requirements and policies for purging HP gas pipelines, transmission mains and services.

20.02 Purging High Pressure Gas Mains and Services, gas to air and air to gas.

Safety and Preventing Accidental Ignition

A. Whether purging the line from air to gas or from gas to air, the purging material shall be introduced at a rate indicated in the purging table. If this rate cannot be achieved, then a slug of inert gas such as nitrogen must be introduced into the line before purging begins, to separate the gas and air.

B. Before purging begins, all sources of potential ignition must be removed from the area, and a fire extinguisher must be on site and visible.

C. Warning signs shall be posted where appropriate to caution or instruct others who are in or near the affected area.

20.03 Transmission Line

Refer to Section 13.03, Shutdown and Purging 10" Great Lakes Interconnect Transmission Line.

20.04 Distribution System

20.04.01 Purging 2" or larger Pipes.

A. Purging 2" and larger mains or services shall be by Department personnel or directed by a Department inspector. Purge stacks at exit end of pipe are required.

B. Entry and exit fittings and apparatus should not restrict flow velocity to less than 200 feet per minute through the purged pipe. The main shall not be purged through services with an EFV.

Table 20-1
Purge Venting

Pipe Size to be Purged	Volume (CFH) to obtain Vel of 200 FPM	*Max Length of ½" pipe if used to exit purge gas
2"	280	440'
3"	615	110'
4"	1060	35'
6"	2410	Engineer to Determine
8"	4325	Engineer to Determine
10"	6880	Engineer to Determine
12"	9825	Engineer to Determine
16"	15720	Engineer to Determine

*Based on 15 PSI min - inlet pressure

C. Stack shall be a grounded metal stack, a minimum of one size smaller than the line being purged. Stack shall extend at least 6' above grade and be directed upward but angled away from wall if at a building.

D. Person at purge location shall have visual or audio communication contact with person at control valve.

E. Purging air to gas should be continuous at each purge point until a gascope indicates at least 85% pure gas. Where possible, valved branches should be turned off until that branch is purged. Any connected services also purged consecutively and without delay. On a system with several purge locations not isolated by valves, the highest ends shall be purged first.

   Purging gas to air should be continuous until a mixture less then 10% LEL is measured at venting end.

20.04.02 Purging 1" or 1/2" Gas Services

Purging 1" or 1/2" gas services may be done by the Contractor without direct department supervision, gascope testing, or vent stack, except a vent stack to unconfined space is required if pipe end is below grade or inside of enclosed structure.

Table of Contents

21.01 General 1

21.02 Abandoning Transmission Lines and Gas Mains 1

21.03 Abandoning Services (Cut off at main) 1

21.04 Partially Abandoning Services (Cut off at service valve) 2

21.01 General

This section of the Standard Specifications establishes requirements and policies for abandoning existing gas pipelines and services.

21.02 Abandoning Transmission Lines and Gas Mains

Each pipeline abandoned in place must be physically disconnected from all sources of gas supply. Any main being abandoned which is 2" or larger and a length of 50 feet or longer shall be purged of gas following the procedures outlined in Section 20.02, Purging High Pressure Gas Mains & Services.

Purge shall continue until a mixture less than **10% LEL** is measured at vented end. Mains specified on the Plan to be abandoned shall be abandoned in place. The Contractor shall effect the cutoffs where the main is steel or plastic and has been depressurized and purged, if necessary.

The Department will provide labor and materials to seal any end still connected to a gas source using standard fuse or welded end caps or blind flanges.

Openings at ends which have been disconnected from any gas source shall be sealed either by Department or Contractor as follows:

2"+ Steel Mains	by weld-on plate, coupling and end cap, blind flange, injected sealant foam or concrete.
2"+ Plastic Mains	by fused end cap
Cast Iron Mains pipe plug, (previously abandoned)	by M.J. cap, M.J. coupling & plug, tamp on plastic injected sealant foam or concrete.

When removing sections of the previously abandoned low-pressure cast iron gas system it is necessary to provide at least a 1" Type K copper or PE jumper drain to allow the abandoned system to continue draining freely. Exemptions to this requirement will only be made by the Engineer in areas where the old abandoned low-pressure gas system is on level terrain.

21.03 Abandoning Services (Cut off at main)

Any abandoned service must be disconnected from gas source and depressurized. Purging of gas is required if service is 1" or larger and longer than 50 feet. When purging a service, the same procedure as purging abandoned main (Section 21.02) shall be followed.

A. P.E. Services (1/2" & 1" with P.E. Service Tees). Turn down self-tap cutter, soap and reinstall cap, cut service and attach short capped 1/2" stub with mechanical fitting or fuse-on P.E. cap as close to service tee as practical.

B. 1/2" P.E. or 5/8" Service with steel tap tee. Turn down self-tap cutter in mini-tee, reinstall cap, remove extrube steel service, insert short capped ±" P.E. stub in compression fitting and retighten nut to seal. P.E. stub must have stiffener installed.

C. P.E. Services (2" & 3" with Tee or branch saddle off P.E. main). Squeeze off service and fuse on end cap as close to main tee as practical. If a P.E. Service valve is too close to main, then shut valve, install end cap just downstream, and do not replace box.

D. Steel Service (1-1/4", 1-1/2" & 2"). Connected to main with weld on No-Blo tee. Remove cap, insert rubber stopper using machine, cut off service, weld a sized steel slug in end, reinstall completion plug and cap.

E. Steel Service (2" & larger which have no tap valve or No-Blo tee). Stopple service as close to main as possible; weld on end cap.

21.04 Partially Abandoning Services (Cut off at service valve)

Steel Service (2" & larger which have tapping valve at main). Shut off service valve, install blind flange on valve, **do not** replace box. If valve is a plug type, it must be lubricated before burying. Record to remain in active service file and noted as "cut off at valve."

Table of Contents

22.01 General 1

22.02 General Requirements. 1

22.03 Valve Requirements for Gas Meter Connections 2

22.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of service meter connections.

22.02 General Requirements

This work consists of plumbing in gas piping less than 2 inches in diameter above the outside meter stop valve, installing the regulator, meter, and inside stop valve. Plumbing shall conform to Section 2200, Uniform Mechanical Code, with Chapter 1346 MN Amendments, the National Fuel Line Code, as applicable, the Detail Drawings, and the following requirements.

General provisions for installing meters and regulators are contained in Section 30 and in the following provisions.

A. When relocating meters from inside to outside, buildings having 1 or 2 inside meters shall have the new meters installed outside. Buildings with 3 or more inside meters will have the new meters installed inside, unless otherwise specified.

B. Piping shall be extended from inside stop valve to existing gas piping, and piping shall be restored or removed, as necessary, where meters were removed.

C. Abandon any unused underground service piping in accordance with Section 21.

A schedule of connections will be provided.

The Department shall furnish the following materials to Contractor, who shall pick them up from 520 Garfield Avenue:

Service regulator, meter and meter bar or meter mounting bracket, test plugs, or relief devices, as may be required.

All other materials shall be furnished by the Contractor, including:

Gas pipe for plumbing shall be black iron or steel, conforming to Section 14.02.02. Fittings shall be threaded black iron or steel.

Pipe shall not be less than 1" between regulator and small meters whether single or duplex.

Inside Stop and other materials incidental for the installation.

Outside threads of all pipe and fittings shall be doped with "Rector Seal" or Teflon tape.

Prior to installing meters, the meter swivel threads shall be lubricated with "Permatex Anti-Seize" or a similar approved compound.

Pipe supports shall be installed as required to adequately support all piping.

All piping, fittings, valves, and brackets outside of the building shall be cleaned of oil, dirt, scale, and primed with Rust-Oleum Primer #678 or #769, Rustex or DeRusto. Color shall be gray. Spray painting is not permitted. Paint shall be brushed on after the pipes are wiped with a cloth wet with oil cutting solvent.

Removed piping shall be disposed of according to the wishes of the building owner.

All meter connections using 1-1/4" regulators or larger, regardless of service size, shall have test points installed on both sides of regulator. Test points shall be weld on 1/4" couplings complete with "Pete's Plugs".

Threaded nipples with 1/4" welded on test points and Pete's Plugs will be furnished by the Department at no charge.

22.03 Valve Requirements for Gas Meter Connections

A. Inside shutoffs. Each service entering a building must have a lever-operated valve at a convenient location and as close to the entry location as possible. Valves shall be ball type as specified in Department Standard Specifications Section 14.04.06 for 2" size and smaller. Approved lever handle plug type may be used for larger sizes.

B. Meter Stop Valves. Each meter shall have an independent shutoff valve capable of being locked in a closed position with a 1/2" pin type lock. Single or master meter stop (3/4" and 1") are specified in Section 14.04.04. Valves for multiple meter stops shall be as specified in Section 14.04.07, and be tamper-proof, lock-wing type, suitable for locking in a closed position.

Department personnel will immediately install a pin lock on each closed meter stop following installation, testing and purging of a new gas service. The pin lock shall be removed by Department personnel or Department-authorized person only when testing meter connection work and for light-up purposes.

Table of Contents

23.01 General 1

23.02 Installation of Distribution Regulator Stations 1

23.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of steel gas distribution systems and a transmission line.

23.02 Installation of Distribution Regulator Stations

Distribution Regulator Stations shall be furnished and installed as a joint effort by the Contractor and the Department. This following schedule lists approved materials for regulator stations. Station will be furnished and installed by the Department with the Contractor providing excavation and restoration.

Station Component(If applicable)	**Material/Reference**
Underground Steel Piping and Fittings	14.03.01
Plastic Piping (if any)	14.03.02 & 14.03.03
Control Piping	Stainless Steel w/ Swagelok fittings
Connections to Mains	23.02 16.08
Underground Valves (except on CI)	14.04.01 or 14.04.02
Aboveground Valves	14.04.01 or 14.04.02
Control Valves	Brass Ball Valves
Gauge Point Connection	Pete's Plug
Relief Device (if required)	See Reg. Detail
Regulator Device	See Reg. Detail
Monitor Control (pilot)	See Reg. Detail
Strainer	14.05.07
Insulator (above grade) (below grade)	 14.06.03
Pipe Coating (below grade)	14.06.04
Prime and Paint (above grade)	14.06.05
Pressure Testing (above reg. valves)	Soap Test
Pressure Testing (below reg. valves)	Same as Mains

Stations to be furnished and installed by the Department shall require only excavation, backfill, surface restoration, and labor and equipment for lifting on site by the Contractor. The Contractor will be compensated for this in a unit item under Excavations Miscellaneous or Excavations for Regulator Station.

Stations shall be constructed at locations indicated on the Plan, according to these Specifications and the Detail Drawing.

Leakage testing on new mains, which also have regulator stations attached, shall be tested only up to the below-grade regulator shutoff valves or to temporary regulator

branch caps. Flanges or threads on regulator side of valves shall be soap tested by the Department when station is in operation.

Regulator Stations constructed on inplace mains shall have gas introduced into the station and all joints soap tested at operating pressure.

Table of Contents

23.01 General 1

23.02 Installation of Distribution Regulator Stations 1

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Control Piping	Stainless Steel w/ Swagelok fittings
Connections to Mains	23.02 16.08
Underground Valves (except on CI)	14.04.01 or 14.04.02
Aboveground Valves	14.04.01 or 14.04.02
Control Valves	Brass Ball Valves
Gauge Point Connection	Pete's Plug
Relief Device (if required)	See Reg. Detail
Regulator Device	See Reg. Detail
Monitor Control (pilot)	See Reg. Detail
Strainer	14.05.07
Insulator (above grade) (below grade)	 14.06.03
Pipe Coating (below grade)	14.06.04
Prime and Paint (above grade)	14.06.05
Pressure Testing (above reg. valves)	Soap Test
Pressure Testing (below reg. valves)	Same as Mains

Stations to be furnished and installed by the Department shall require only excavation, backfill, surface restoration, and labor and equipment for lifting on site by the Contractor. The Contractor will be compensated for this in a unit item under Excavations Miscellaneous or Excavations for Regulator Station.

Stations shall be constructed at locations indicated on the Plan, according to these Specifications and the Detail Drawing.

Leakage testing on new mains, which also have regulator stations attached, shall be tested only up to the below-grade regulator shutoff valves or to temporary regulator

branch caps. Flanges or threads on regulator side of valves shall be soap tested by the Department when station is in operation.

Regulator Stations constructed on inplace mains shall have gas introduced into the station and all joints soap tested at operating pressure.

Table of Contents

24.01 General 1

24.02 Installation of System Reliefs 1

SECTION 24: INSTALLATION OF SYSTEM RELIEFS

24.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of system reliefs.

24.02 Installation of System Reliefs

System reliefs are installed either as an integral part of a distribution regulator station or as an isolated appurtenance, detached and installed at a location remote from the regulator station. The former will be installed as part of regulator station according to this section.

Relief vents shall be designed and installed to reduce the accumulation of water, snow, or ice, and located where gas can be discharged into the atmosphere without undue hazard. New station construction shall follow plan detail. Refitted stations may follow vent detail in standard Detail Drawing G-31 or G-32 and pointed where the hazard of gas release is minimal, and away from the station inlet underground valve.

Department shall furnish materials identified in the Detail Drawing for the relief to the same extent as for regulator stations in this section.

Department will furnish and install all required materials except excavation, backfill and restoration, which shall be done by the Contractor and compensated for under a Proposal Item, Excavation Miscellaneous or Excavation for System Relief.

Leakage pressure testing of new mains shall be done up to shutoff valve below relief device. Joints above the relief shutoff valve shall be soap-tested under operating pressure.

Reliefs and new associated piping installed on in-place mains shall be soap tested under operating pressure.

Table of Contents

25.01 General 1

25.02 Anode Installation 1

25.03 Insulator Installation 1

25.04 Test Stations 1

25.05 Continuity Wires 2

25.06 Field Coating Application (Below Grade) 2

25.07 Field Coating Applications (Above Grade) 4

25.08 Surface Preparation 4

25.01 General

This section of the Standard Specifications establishes requirements and policies for the installation of cathodic protection materials.

25.02 Anode Installation

For the protection of steel mains, anodes shall be placed as shown in the Detail Drawing. The backfill immediately surrounding the anode must be saturated with a pail of water before finishing the backfill. Wires shall have slack and be hand backfilled.

25.03 Insulator Installation

A. Casing Insulator Installation. Casing insulators shall be installed between steel carrier pipes and steel casings. Insulators shall conform to Section 14.06.03. Insulators shall be spaced at intervals between 10 and 15 feet and not farther than 2 feet from the ends.

B. Pipe Support Insulator Installation.

Installation of Glas Mesh Type 180 or Type 240 Pipe Saddles
All Defective coating, loose paint, rust, and corrosion products to be removed under the proposed pipe saddle or casing insulator. Surface to be free of moisture, grease and oil. The surface may be painted or taped to match the color of the pipe prior to the installation of pipe saddle. For the pipe saddles type 180 or 240 must be attached to the pipe with seam sealer and all exposed edges to be beveled. This is to prevent moisture entrance into the saddle.

Installation of the Glas Mesh Type 220/240 Casing Insulator
The type 240 (larger of the two) shall be installed on the bottom of the pipe and the type 220 on top and overlapping the type 240. Both of these insulators must be installed with seam seal, all voids must be filled so that moisture can not enter either insulator.

25.04 Test Stations

Test Stations shall be installed at locations indicated on the Plans, according to the Standard Detail Drawing. Box shall be plastic, as specified in Section 14.06.02.

For installations in areas subject to vehicular traffic, where it is impractical to locate the box outside the pavement, the plastic box shall be set in the top section of a CI valve box. When installation is intended to be on poles or other structures, such will be noted on the Plans.

Test Stations located at valves shall have the test box placed adjacent to the valve box.

Each test lead wire must be connected to the pipeline so as to remain mechanically secure and electrically conductive. Each test lead wire must be attached to the pipeline so as to minimize stress concentration on the pipe. Each bared test lead wire and bared metallic area at point of connection to the pipeline must be coated with an electrical insulating material compatible with the pipe coating and the insulation on the wire. (See Detail Drawing G-18).

Before any new test lead is connected to the transmission line, the pressure in the line must be reduced such that it is below 20% SMYS on the line.

25.05 Continuity Wires

Whenever continuity cannot be assured when connecting steel gas mains or services with compression type couplings, continuity shall be maintained with #4 stranded copper bond wires coated for direct burial. Ends shall be cadwelded or thermit welded from pipe-to-pipe and pipe-to-coupling and the welds coated.

25.06 Field Coating Application (Below Grade)

Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must:

A. Be applied on a properly prepared surface;

B. Have sufficient adhesion to the metal surface to effectively resist underfilm migration of moisture;

C. Be sufficiently ductile to resist cracking;

D. Have sufficient strength to resist damage due to handling and soil stress; and,

E. Have properties compatible with any supplemental cathodic protection.

Each external protective coating which is an electrically insulating type must also have low moisture absorption and high electrical resistance.

If coating pipe is installed by boring, driving, or other similar method, precautions must be taken to minimize damage to the coating during installation.

Coating materials specified in Section 14.06 shall be applied to all uncoated portions of pipe, fittings, valves, including bolts, couplings, damaged coatings, and other related steel components of the gas system. Casing pipes do not require coatings.

Field coating for underground pipeline shall be applied as follows:

TC Mastic or wax tape by Trenton or approved equal shall be applied to mechanical bolt-type couplings, flanges and flanged fittings, no-blo tees, tapping saddles, and other irregular shaped fittings.

All valves shall be field coated regardless of existing factory applied coatings.

Cold tapes -- Weld joints, weld fittings, and coating repair.

Optional hot-type applications shall be as follows:

Shrink Sleeves - weld joints and boltless compression couplings

Tapecoat 20 - weld joints, weld fittings, and coating repair

Directional bore pipe shrink sleeves, Dirax by Raychem

Coating shall be applied to dry, clean and primed surfaces.

Primer must be the companion to the manufacturer's coating.

Tape shall overlap 1/2 inch for spiral method of wrapping and 1 inch for the cigarette method.

Holidays over two square inches shall be repaired by wrapping tape completely around the pipe.

Holidays less than two square inches in the epoxy pipe coating may be repaired using P hot melt patch sticks, Scotchkote 206-P or equivalent.

25.07 Field Coating Applications (Above Grade)

General Applications	System			
	Top Coat	Primer	Prep.	Applic.
A. New Meter Connections, New outdoor fuel pipe	None Required	Rust-oleum #678 or 769 14.06.05A	SSPC-SP1 & SSPC-SP2	Brush
B. Regulator Stations	Pittsburg 2 part Urethane Gray	Dupont Vari Prime-Green (acid base)	SSPC-SP1 & SSPC-SP2	Brush or Spray
C. Meter Set Piping Recoating Program	Polymide Epoxy 14.06.05B 5-8 Mills	None Required	SSPC-SP2	Brush
D. New Uncoated gas mains, fittings, on creek crossings, bridges, etc.	Acrylic-Urethane Enamel 14.06.05C	Inorganic zinc-rich primer 3 Mills	SSPC-SP10 Or NACE #2	Spray or Brush
E. Previously painted mains, fittings on creek crossings, bridges, etc.	Acrylic-Urethane Enamel 14.06.05C	Organic zinc-rich primer 3 Mills	SSPC-SP6 Or NACE #3	Spray or Brush
F. Previous coal tar, 3M or X-TRU, coated mains on creek crossings, bridges, etc.	Tape coating & Aluminizd Mastic 14.06.05D	TC Omni Prime None Required for Mastic or Wax Tape	SSPC-PC7 Or NACE #4	Machine or hand, mastic is brushed

25.08 Surface Preparation

Painting or coating systems will require one of the following surface preparations. Specs referred to are Steel Structures Painting Manual.

SSPC-SP1-Solvent cleaning. Oil to be removed with solvent and brush or wipe cloth.

SSPC-SP2-Hand tool cleaning with wire brush as necessary to remove loose paint, loose rust, dirt, and pipe tape.

SSPC-SP5 or NACE-1- White Metal Blast Cleaning

Completely remove all mill scale, rust, rust scale, previous coating, etc., leaving the surface a uniform gray-white color.

SSPC-SP10 or NACE-2- Near White Blast Cleaning
Remove all blast scale, mill scale, previous coating, etc., leaving only light stains from rust, mill scale, and small specks of previous coating. At least 95% of each square inch of surface area is to be free of all visible residues, and the remainder shall be limited to slight coloration.

SSPC-SP6 or NACE-3- Commercial Grade Blast Cleaning
Completely remove all dirt, rust scale, foreign matter, and previous coating, etc., leaving only shadows and/or streaks caused by rust stain and mill scale oxides. At least 66% of each square inch of surface area is to be free of all visible residues, except slight discoloration.

SSPC-SP7 or NACE-4- Brush-Off Blast Cleaning
Remove rust scale, loose mill scale, loose rust, and loose coatings, leaving tightly bonded mill scale, rust, and previous coatings. This is an ideal method for removing oxides and/or loose and peeling coatings from galvanized metal. Results are comparable to those achieved through chipping, scraping, and wire brushing. In all cases of surface preparation, the surface must be primed within 6-8 hours of abrasive blasting.

Table of Contents

26.01 Method of Measurement 1

26.01.01 Gas Pipe. 1
26.01.02 Service Meter Connections. 1
26.01.03 Excavation for Cutoffs, Regulator Station, Relief & Miscellaneous. 2

26.02 Basis of Payment 2

SECTION 26: MEASUREMENT AND PAYMENT FOR HIGH PRESSURE GAS PIPELINES

26.01 Method of Measurement

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Plans or Special Provisions. Pipe will generally be designated by size and kind or type. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Item.

26.01.01 Gas Pipe.

Gas main pipe of each kind and size will be measured separately by the overall length along the center of the pipeline from the beginning of each installation and without regard to intervening valves, casings, couplings, transitions of other material or sizes, or minor line deviations caused by slack in laying coiled pipe. Terminal points of measure will be to the physical ends of the pipeline, to the centerline of in-place connecting pipelines. Bend and ties shall be included and measured from intersecting centerlines. Reducers, where transition is not abrupt, shall be measured as the larger size pipe.

Gas service pipe will be measured as the ground distance from the center of tapping tee, (or gas main for large services) to the point where the riser comes out of the ground.

All costs of installing gas main placed by horizontal directional drilling between the locations shown on the plans or as directed by the Engineer; including gas main pipe, appurtenances, locating wire, and testing; shall be paid for at the contract unit price per linear foot for Install (diameter, PE or steel) Gas Main by Horizontal Directional Drill. If the Contractor chooses at his option to horizontally directional drill gas main not shown on the plans or designated by the Engineer for horizontally directional drilling, payment shall be made at the contract unit price per linear foot for Install (diameter, PE or steel) Gas Main.

26.01.02 Service Meter Connections.

Measurement shall be made on the basis of one (1) connection per meter, except when connection is to multiple meters which are not replaced or relocated, in which case measurement will be one connection regardless of the number of meters. Multiple meters, which are replaced or relocated, will be measured as one (1) connection per meter.

Multiple meters all less than 400, if replaced or relocated, and requiring a B-31 regulator or larger, shall be paid for as one connection, greater than or equal to 400 for the first meter and less than 400 for the rest.

Removed meters which are piped through or capped off shall be paid for at one-half (1/2) the respective meter connection bid price.

Meter Connections will be paid for by size accordance to the meter rated capacity as follows:

Meter Connections (less than 400 CFH)
Meter Connections (400 CFH and larger)

26.01.03 Excavation for Cutoffs, Regulator Station, Relief & Miscellaneous.

Excavations designated on the Plans and as a unit item in the proposal on a per each basis will be measured separately for each such excavation completed, including backfill and required surface restoration. This item shall be measured for payment only to the extent that the excavation does not lie in a location already requiring excavation for construction of other items for which excavation is included.

26.02 Basis of Payment

Payments for gas mains and related facilities will only be made under the items in the proposal. Cost of other work necessary to complete in place the improvements required on the Plans and in the Contract Documents will be considered incidental and the costs included in the unit items unless it qualifies as extra work and is properly authorized.

Payment for gas main and gas services shall be compensated in full for all costs of furnishing and installing the pipe complete in place as specified, with the exception of rock excavation, granular borrow material not specified as a Laying Condition, and casing pipes where separate payment is established, but including all costs of pipeline installation not exempt by a pay item or authorized extra. Incidental pipeline cost shall include, but not be limited to, furnishing and installing all required materials for the pipeline (unless specified to be furnished or installed by the Department) including valves, couplings, insulators, locating wires, continuity wires, test stations, anodes, field coatings, joining, fittings, testing, excavation, backfill, surface restoration as may be required. Cost of services shall include the connection to main, riser, meter stop, plug, beside the same applicable incidentals required for gas main.

Payment for service meter connections shall be on a unit price basis and shall include full compensation for all materials, labor, equipment necessary to install the regulator, meter, inside stop valve and interconnecting plumbing from the meter stop valve to the inside stop valve or existing plumbing where such plumbing exists. Meters requiring removal only will be paid for at one-half the bid price for meter connections.

Payment for excavations for cutoffs, regulator stations, system reliefs or miscellaneous shall include all labor and materials not specifically furnished or installed by the Department.

Payment for items which are eligible for compensation will generally be made on the basis of the following schedule. Consult the proposal for actual payment items for this project.

Item Name	Unit
Gas Main (Size and Type)	Linear Foot
Gas Service (Size and Type)	Linear Foot
Service Meter Connection (Size)	Each
Excavation for (Cutoffs, Regulator Station, Reliefs, Miscellaneous)	Each
Valve Boxes	Each
Reconnect Services	Each

Table of Contents

27.01 General 1

27.02 Qualification Procedure 1

27.03 Welding Qualifications 1

27.03.01 Butt Welding Procedure Specifications 1
27.03.02 Procedure Qualification Record 5
27.03.03 Fillet Welding Procedure Specifications 6
27.03.04 Procedure Qualification Record 10
27.03.05 Coupon Test Report 11

27.04 Maintaining Welding Qualification 12

27.05 Records 12

Figure 27-1: Butt Welding Procedure Qualification Record 5

Figure 27-2: Fillet Welding Procedure Qualification Record 10

Figure 27-3: Coupon Test Report 11

27.01 General

Welding of joints and connections for gas pipelines shall only be done by welders qualified in accordance with the requirements of this section.

Upon request by the inspector or at any time before beginning production welding, a contractor must submit documentation of welders' qualifications on a form similar to the API Welder Qualification, Coupon Test Report as shown in Figure 27-3. Documentation may be submitted to Duluth Public Works and Utilities Department, Engineering Division, 411 West 1st Street, Duluth.

Department welders must be qualified in the same manner as contract welders.

27.02 Qualification Procedure

A. The Department has established specifications for Welding Procedures #DPWU-1 (formerly #DWG-3)for single V butt welds and #DPWU-2 for fillet welds shown in Section 27.03(C) along with the recorded qualifying procedures shown in Figures 27-1 and 27-2. Welders Qualification Tests must be set up and performed within the parameters of this specification which is established in Section 27.03 (A & C) for butt welds and for fillet welds.

B. A welder must be qualified by an independent testing company, the name of which is to be indicated on the qualifying document.

C. Qualifying document must be the same or similar to the form shown in Figure 27-3, the API Welder Qualification Coupon Test Report.

D. Testing company shall evaluate test welds in accordance with API 1104, 19th Edition, Section 6 or Section 9 for butt welds and fillet welds if fillet welding is required on the specific project they are working on. Department welders will perform the Multiple Qualification test as outlined in API 1104, 19th Edition, Section 6.3. If contract welders need to qualify on fillet welds, they must be qualified in the same manner.

27.03 Welding Qualifications

27.03.01 Butt Welding Procedure Specifications

SMAW, E-6010 & E8010G ELECTRODES
ASTM A53, API GRADE B THROUGH X-60
ALL PIPE DIAMETERS, WALL THICKNESSES $\leq$ 3/4"

A. Reference

API Standard 1104, 19th Edition
City of Duluth Procedure #DPWU-1 (formerly DWG-3)

B. Process

Welding shall utilize the Shielded Metal Arc Welding (S.M.A.W.) process.

C. Parent Metals

Metals welded according to this standard shall cover ASTM A53, API Grade B through X-60

D. Diameter and Wall Thickness:
This procedure shall apply to material having any diameter or wall thickness $\leq$3/4"

E. Joint Design

The joint ends shall be beveled to an angle of 30°, + 5°,-0 °, with a root face of 1\16", $\pm$ 1\32". Bevels shall form a "V" groove with an included angle of 60°. The root opening shall be 1\16", $\pm$1\32".

F. Filler Metal

The filler material shall conform to AWS A5.1, E-6010, Group F-3 (ASME) Weld Analysis A-1 for the first pass (root) and AWS A5.5, E8010-G, Group F-3 (ASME) Weld Analysis A-1 for subsequent passes (hot pass, filler and cap)

G. Size of Electrodes and Number of Beads

Wall Thickness (inches)	Stringer bead E-6010	Hot Pass E-8010G	Fill and cap E-8010G
< 0.188	3/32"	3/32"	1/8"
.188 - 0.250	1/8"	1/8" - 5/32"	1/8" - 5/32"
> 0.250	5/32"	5/32" - 3/16"	3/16"

The minimum number of passes is dependent on wall thickness but shall not be less than 3 passes with no pass deposited thicker than 1/8".

H. Electrical Characteristics

The welding current shall be D.C. current, Reverse Polarity (electrode positive)

Electrode	Rod diam.	Amperage	Voltage
E-6010	3/32"	60 - 100	20 - 26
E-6010	1/8"	75 - 130	20 - 27
E-6010	5/32"	90 - 170	20 - 27
E-8010G	1/8"	75 - 130	20 - 27
E-8010G	5/32"	90 - 170	24 - 27
E-8010G	3/16"	140 - 190	24 - 27

I. Direction of Welding

Welding shall progress down ward from top or any point on the side of the pipe to bottom center.

J. Speed of Travel

The speed of travel should be within the range of 3 - 14 inches per minute.

K. Number of Welders

When the nominal pipe diameter is less than 16", one welder may be used to run the stringer Bead (root bead). When the nominal pipe diameter is 16" or greater, two welders will be required to run the stringer bead and hot pass.

L. Time Lapse Between Passes

The second pass (hot pass) shall follow the stringer bead (root bead) within five minutes, except when unavoidable circumstances prevail which make this requirement impractical. A minimum of 3 passes shall be completed before the end of the day. Any weld that is not finished the day it is started shall be finished the next workday.

M. Type of Line-up Clamp

Fabrication, Maintenance, and Tie-In welding: External line-up clamps may be used on all sizes of welds.

N. Removal of Line-up Clamp

On 16" or larger diameter pipe, the line-up clamp shall remain in place until 100% of stringer bead (root bead) is completed. The department may reduce said percentage if, in its sole judgment, acceptable welds can be produced at that reduced percentage. However, the department retains the right to require the contractor to return to 100% if the welding quality is not acceptable. When the pipe diameter is less than 16", the line-up clamp may be removed upon completion of tack welds (minimum of 50% of total joint) adequate to prevent the loss of joint spacing, the development of high low, or the formation of cracks in the tack welds or stringer bead. Under no circumstances shall the line-up clamp be removed while welding is in progress or when metal temperature is above 400 °.

O. Cleaning

All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started. The bevel surface includes all areas in immediate proximity to the pipe end on both the I.D. and O.D. Slag shall be removed from the surface before the next bead is applied. Power tools may be used. The finished weld and immediately adjacent pipe must be cleaned of all flux, smoke debris and weld splatter. All welds will be visually inspected to ensure compliance with the qualifying welding procedure.

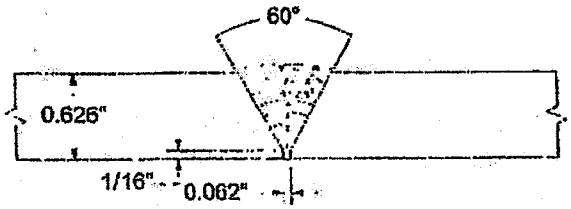
P. Preheat

Preheat shall be required when the ambient or metal surface temperature is below 40 ° for all pipe grades. The minimum preheat temperature is 200 ° to be applied to an area no less than 3" either side of the joint. If moisture is present on the parent metal, it shall be driven off by preheating to temperature at which it will not reform during the welding operation.

27.03.02 Procedure Qualification Record: Figure 27-1

API STANDARD 1104

Reference API Standard 1104, 18th edition
PROCEDURE SPECIFICATION NO. DPWU-1 Formerly DWG-3
For Shielded Metal Arc Welding of API 5L Pipe and Fittings
Process: SMAW
Material: X-60
Diameter and wall thickness: 20" X .626"
Joint design: Single V Groove (Butt)
Filler metal and no. of beads: 6010 + (Root)(1)(Group 1) 8010G (Hot pass and fill)(10)(Group 2)
Electrical or flame characteristics: DC/RP
Position: 6G
Direction of welding: Downhill
No. of welders: 2
Time lapse between passes: 5 minute maximum between root and hot pass
Type and removal of lineup clamp: External (removed after 50% of bead was completed)
Cleaning and/or grinding: Grind as needed, use of power grinder and wire brush
Preheat/stress relief: None
Shielding gas and flow rate: NA
Shielding flux: N/A
Speed of travel: 4-12" per min
Plasma gas composition: N/A | Plasma gas flow rate: N/A
Plasma gas office size: N/A
Stringers and tabulations attacked: N/A
Tested: 8/13/01 | Welder: John Anderson/Roger Wheeler
Approved: 9/04/01 | Welding Supervisor:
Adopted: | Chief Engineer: 9/04/01



ELECTRODE SIZE AND NUMBER OF BEADS

Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	6010+1/8" Lincoln	20-27	80-140	4-12" per minute
2	8010G 5/22" Lincoln	24-27	90-170	4-12" per minute
3	8010G 3/16" Lincoln	24-27	90-170	4-12" per minute
4-10	8010G 3/16" Lincoln	24-27	90-170	4-12" per minute

27.03.03 Fillet Welding Procedure Specifications

SMAW, E-6010 & E8010G ELECTRODES
ASTM A53, API GRADE B THROUGH X-60
ALL

PIPE DIAMETERS, WALL THICKNESSES ≤ 3/4"

A. Reference

API Standard 1104, 19th Edition
City of Duluth Procedure #DPWU-2

B. Process

Welding shall utilize the Shielded Metal Arc Welding (S.M.A.W.) process.

C. Parent Metals

Metals welded according to this standard shall cover ASTM A53, API Grade B through X-60

D. Diameter and Wall Thickness

This procedure shall apply to material having any diameter or wall thickness ≤3/4"

E. Joint Design

Branch Connections
Branch ends shall be beveled to an angle of 45°, +5°/-0°, with a root face of 1\16", ±1\32". The root opening shall be 1/16"±1\32".

Sleeves
Side seams shall be beveled to an angle of 30° +5°,-0° with a root face of 1\16", ±1\32". The end preparation shall be with as little space between the sleeve and the pipe as possible.

F. Filler Metal

The filler material shall conform to AWS A5.1, E-6010, Group F-3 (ASME) Weld Analysis A-1 for the first pass (root) and AWS A5.5, E8010-G, Group F-3 (ASME) Weld Analysis A-1 for subsequent passes (hot pass, filler and cap).

G. Size of Electrodes and Number of Beads

Wall Thickness (Inches)	Stringer bead E-6010	Hot Pass E-8010G	Fill and cap E-8010G
< 0.188	3/32"	3/32"	1/8"
0.188-0.250	1/8"	1/8" - 5/32"	1/8" - 5/32"
> 0.250	5/32"	5/32" - 3/16"	3/16"

The minimum number of passes is dependent on wall thickness but shall not be less than 3 passes with no pass deposited thicker than 1/8". If welding on pressurized pipelines, the maximum electrode size shall be 1/8".

H. Electrical Characteristics

The welding current shall be D.C. current, Reverse Polarity (electrode positive).

Electrode	Rod Diameter	Amperage	Voltage
E-6010	3/32"	75 - 110	20 - 25
E-6010	1/8"	90 - 135	23 - 27
E-6010	5/32"	120 - 160	24 - 28
E-8010G	1/8"	90 - 135	23 - 27
E-8010G	5/32"	120 - 160	24 - 28
E-8010G	3/16"	130 - 175	25 - 29

I. Direction of Welding

Welding shall progress down ward from top or any point on the side of the pipe to bottom center.

J. Speed of Travel

The speed of travel should be within the range of 3 - 14 inches per minute.

K. Number of Welders

When the nominal pipe diameter is less than 16", one welder may be used to run the stringer Bead (root bead). When the nominal pipe diameter is 16" or greater, two welders will be required to run the stringer bead and hot pass.

L. Time Lapse Between Passes

The second pass (hot pass) shall follow the stringer bead (root bead) within five minutes, except when unavoidable circumstances prevail which make this requirement impractical. A minimum of 3 passes shall be completed before the end of the day. Any weld that is not finished the day it is started shall be finished the next work day.

M. Type of Line-up Clamp

Branch Connections

Spacing tools and manual holding during tacking off is acceptable if correct stringer bead space and proper alignment is maintained. If this is not possible, then mechanical holding devices shall be required.

Sleeve or Patch

Chains, clamps, hydraulic jacks or other similar mechanical holding devices shall be used to hold the sleeve or patch in intimate contact with the pipe before welding starts.

N. Removal of Line-up Clamp

On 16" or larger diameter pipe, the line-up clamp shall remain in place until 100% of stringer bead (root bead) is completed. The department may reduce said percentage if, in its sole judgment, acceptable welds can be produced at that reduced percentage. However, the department retains the right to require the contractor to return to 100% if the welding quality is not acceptable. When the pipe diameter is less than 16", the line-up clamp may be removed upon completion of tack welds adequate to prevent the loss of joint spacing, the development of high low, or the formation of cracks in the tack welds or stringer bead. Under no circumstances shall the line-up clamp be removed while welding is in progress or when metal temperature is above 400°.

O. Cleaning

All rust, dirt, and foreign matter shall be removed from the bevel surface before welding is started. The bevel surface includes all areas in immediate proximity to the pipe end on both the I.D. and O.D. Slag shall be removed from the surface before the next bead is applied. Power tools may be used. The finished weld and immediately adjacent pipe must be cleaned of all flux, smoke debris and weld splatter.

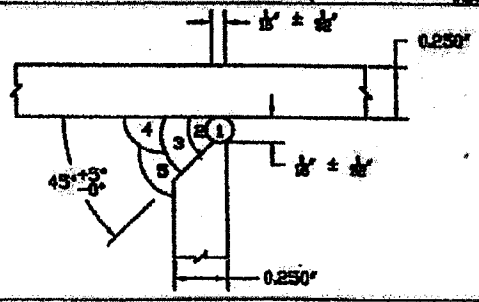
Q. Preheat

Preheat shall be required when the ambient or metal surface temperature is below 40° for all pipe grades. The minimum preheat temperature is 200° to be applied to an area no less than 3" either side of the joint. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not reform during the welding operation.

27.03.04 Procedure Qualification Record: Figure 27-2

API STANDARD 1104

Reference: API Standard 1104, 5.2
PROCEDURE SPECIFICATION NO. DPWU-2
For shielded metal arc welding Welding of API 5L Pipe and fittings
Process: SMAW
Material: X-52
Diameter and wall thickness: 12.75" O.D. X .250"
Joint design: Branch connection
Filler metal and no. of beads: 6010 + (root)(1)(Group1) 8010G (Hot pass and fill)(5)(Group 2)
Electrical or flame characteristics: DC/RP
Position: Run (horizontal) Branch (down)
Direction of welding: Downhill
No. of welders: 1
Time lapse between passes: 5 minute maximum between root and hot pass.
Type and removal of lineup clamp: Manual or mechanical
Cleaning and/or grinding: Clean and grind as needed
Preheat/stress relief: N/A
Shielding gas and flow rate: N/A
Shielding flux: N/A
Speed of travel: 4" to 12" per minute
Plasma gas composition: N/A — Plasma gas flow rate: N/A
Plasma gas orifice size: N/A
Stretches and tabulations attached: N/A
Tested: 3-27-03 Twin Pipe Testing — Welder: Pat Walsh
Approved: — Welding supervisor:
Adopted: — Chief engineer: David J. Frank



ELECTRODE SIZE AND NUMBER OF BEADS

Bead Number	Electrode Size and Type	Voltage	Amperage and Polarity	Speed
1	6010+/18" Lincoln	20-27	80-140	4-12" per minute
2	8010G-5/32" Lincoln	24-27	90-170	4-12" per minute
3	8010G-3/16" Lincoln	24-27	90-170	4-12" per minute
4 to 5	8010G-3/16" Lincoln	24-27	90-170	4-12" per minute

27.03.05 Coupon Test Report: Figure 27-3

API WELDER QUALIFICATION

COUPON TEST REPORT

Date: 8-13-01	Test No: DPWU-1 formerly DWG-3
Location: City of Duluth Weld Shop – Garfield Ave. – Duluth, MN	
State: MN	Weld Position: Fixed – 6G
Welder: Pat Walsh/Brian Packingham	Mark:
Welding time: 1 hour	Time of day: 11:00 am
Mean temperature: 72°F	Wind break used: Indoors
Weather conditions: Sunny	
Voltage: 20-27	Amperage: 80-140
Welding machine type: Lincoln	Welding machine size: 200 amp
Filler Metal: 6010 (root) (Group 1) 8010 (hot pass and fill) (Group 2)	
Reinforcement size: 1/16"	
Pipe type and grade: X52	
Wall thickness: 0.312"	Outside diameter: 16"
Direction of Weld: Vertical – downhill	

DESTRUCTIVE TESTS

	Dimensions			Tensile Strength				
Spec #	Thick	Width	Area	Max Load	Ultimate (PSI)	Break	Bend	Nick Break
PW 1T	0.312	0.885	0.276		66589	Pipe		
PW 2T	0.312	0.881	0.275		68773	Pipe		
PW 1B	0.311	1.000	0.311		72433	Pipe		
PW 2B	0.309	0.868	0.268		70914	Pipe		
BP 1T	0.310	0.868	0.269		70586	Pipe		
BP 2T	0.312	0.874	0.273		72458	Pipe		
BP 1B	0.310	0.927	0.287		68774	Pipe		
BP 2B	0.311	0.880	0.274		69719	Pipe		
PW 1T	0.312	1.000	0.312				F-Pass	
PW 2T	0.312	1.000	0.312				R-Pass	
PW 1B	0.312	1.000	0.312				F-Pass	
PW 2B	0.312	1.000	0.312				R-Pass	
BP 1T	0.312	1.000	0.312				F-Pass	
BP 2T	0.312	1.000	0.312				R-Pass	
BP 1B	0.312	1.000	0.312				F-Pass	
BP 2B	0.312	1.000	0.312				R-Pass	
PW 1T	0.312	1.000	0.312					Pass
PW 2T	0.312	1.000	0.312					Pass
PW 1B	0.312	1.000	0.312					Pass
PW 2B	0.312	1.000	0.312					Pass
BP 1T	0.312	1.000	0.312					Pass
BP 2T	0.312	1.000	0.312					Pass
BP 1B	0.312	1.000	0.312					Pass
BP 2B	0.312	1.000	0.312					Pass

TESTED BY: Twin Ports Testing, Inc.	DATE: 8-13-01
APPROVED BY: Larry L. Winner	DATE: 9-04-01
WELDING SUPERVISOR:	DATE:
WELDER: B. Packingham Pat Walsh	DATE: 8-15-01 8-15-01

27.04 Maintaining Welding Qualification

A welder can maintain qualification for butt welds if during the previous 6 months at least one weld has been tested and found acceptable under API Standard 1104, 19th Edition.

A welder can maintain qualification for fillet welds if during the previous 6 months at least one weld has been tested and found acceptable under API Standard 1104, 19th Edition.

27.05 Records

The Safety and Training Officer or his/her designee will keep qualifying documents for Department Welders and a copy of requalifying record.

Qualifying documents submitted for contract welders will be filed in job file for that particular contract and kept for the life of the pipeline.

Table of Contents

28.01 Qualification Tests 1

28.02 Identification Cards 1

28.03 Qualification Records 1

28.04 Qualification of Inspectors (192.287) 2

28.05 Fusion Qualification Procedure 2

28.05.01 General 2
28.05.02 Part 1 – Written Test 2
28.05.03 Part II – Joint Fabrication Test 2

28.06 Heat Fusion Test Requirements 3

28.07 Electrofusion Qualification Requirements (192.285) 4

28.08 Mechanical Qualification Requirements 4

28.09 Requalification Requirements 4

Figure 28-1: Fabricated Assembly for PE Fusion Qualification Test Part III 4

28.01 Qualification Tests

A. Qualification tests are used to determine the ability of those tested to produce sound joints with the equipment, materials, and procedures that are used in the field. It should be realized that the test is conducted under controlled conditions.

   Successful passage of the test does not guarantee that a person will make sound joints under all field conditions.

B. The qualification test shall be successfully completed by each joiner employed by the Department or by an employee of a contractor before being permitted to make joints on the Department's gas plastic P.E. system.

C. Joiners may be qualified in one or more of the following categories:

Fusion	Socket
	Saddle
	Butt
	Electrofusion
Mechanical (Dept. only)	Lyco-Fit
	Chicago Fitting
	Continental Con-stab

28.02 Identification Cards

Qualified contractor fusors must carry on their person a Department-issued certification card which will be issued by the Department upon passage of the qualification test. This card must be presented on request. The card will indicate if fusor is qualified for socket, saddle, butt fusion or electrofusion. The inspector shall verify by office records that the fusor's qualifications are current. In addition each fusor will have available the standard specification for fusion.

28.03 Qualification Records

The Safety & Training Officer or his/her designee shall maintain a record of each test and shall maintain a list of currently qualified persons in each category. Persons who do not requalify during the required interval shall be deleted from the current list. The list shall contain both Department and Contractor joiners.

Old lists and test records shall be kept for seven years.

28.04 Qualification of Inspectors (192.287)

Each person responsible for inspecting fusion joining must be qualified by training or experience in evaluating whether joints made according to the procedure in this manual are acceptable.

Each inspector will be qualified, in addition to experience or other training, by passage of Part I of the qualification test which is the written portion. Part II is the Joint Fabrication portion of the test. Persons who qualify on both Part I and Part II are also considered qualified to inspect provided that their certificate has not expired.

28.05 Fusion Qualification Procedure

28.05.01 General

Qualification testing is conducted in two parts. Part I must be passed before proceeding to Part II.

28.05.02 Part 1 – Written Test

This test may or may not be preceded by classroom training. The test shall consist of questions pertinent and critical to making satisfactory joints. Questions may be derived from information provided in Section 16.07 of the Standard Specifications titled "Joining Pipe and Fittings". Reference material will not be permitted to be used during test and measures will be taken by the test monitor to assure same.

An overall score of 75% is required to pass the written test.

28.05.03 Part II – Joint Fabrication Test

Fabrication of various fusion joints will be done by the applicant, in the presence of a Department-qualified fusor at the Department Utility Operations Division, 520 Garfield Avenue.

Plastic pipe and fittings for socket, saddle and butt will be furnished by Department.

Tools and irons for socket, saddle and butt fusion joining must be provided by the applicant.

Tools, equipment, piping, and fittings for electrofusion must be provided by the applicant.

A fee shall be charged to recover costs of the testing.

Applicant may not refer to manual or written notes during Joint Fabrication Test.

Completed Assembly must be as it appears in the detail shown in Figure 28-1.

28.06 Heat Fusion Qualification Requirements

A. The fabricated assembly completed by the applicant shall be subjected to visual inspection for comparison with standard pipe manufacturer photos for acceptable and not acceptable joints.

B. The following defects will result in a failed test:

1. Failure to follow procedures
2. Visual defect
3. Failure during destructive test

C. Tests

1. Socket (2" and 1/2") Visual and Destructive

   The applicant must complete a socket type joint for testing by the Department. The test will include cutting three strips, 1" wide and 6" along the pipe through the joint. The test will include bending the strips 180° over and checking for disbondment.

2. Service Punch Tee (2" x 1/2") Visual and Destructive

   The applicant must complete a service punch tee type joint, including tapping the service tee prior to testing by the Department. The test will include slipping an 1-1/2" steel pipe over the top of the service punch tee (cap must be removed) and bending the tee to 45° in all directions to attempt to disbond service tee from main.

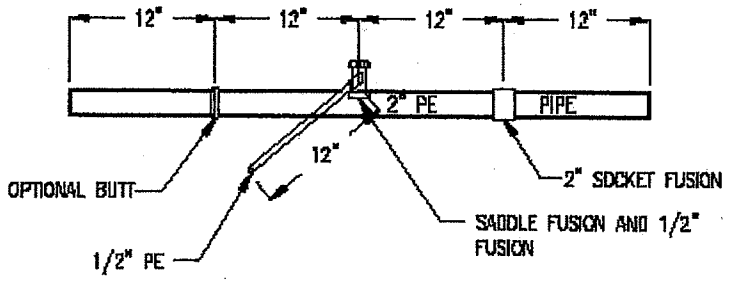
   The punch tee will also be sawed in half at 90° to the main line to check for overmelt at the 1/2" pipe connection to the service punch tee which may cause orificing at the connection.

3. Butt (2") Visual and Destructive

   The applicant must complete a butt type joint for testing by the Department. The test will include cutting three strips, 1" wide and 6" along the pipe through the joint. The test will include bending the strips 180° over and checking for disbondment.

   The butt joint test, if done alone, may be done on 2", 3", 6"or 8" pipe.

Figure 28-1
Fabricated Assembly for P.E. Fusion Qualification Test Part III



28.07 Electrofusion Qualification Requirements (192.285)

Applicants qualifying for electrofusion shall be certified according to Section 28.05. In addition, the applicant shall make an electrofuse coupling joint and/or a sidewall/saddle including tapping a fusion service tee. The applicant must be tested for each type of work that they will be performing for the utility.

The test will include a visual inspection and cutting three test strips, 1" wide and 6" along the pipe through the joint. The test will include bending the strips 180° over and checking for disbondment.

Prior to any testing by the Department, the applicant must tap the fusion service tee in the proper manner in order to be qualified to fuse and tap service tees.

28.08 Mechanical Qualification Requirements (Department Only)

Applicants qualifying to connect plastic pipe using mechanical type fittings shall assemble one connection of each type being qualified for in the presence of a testor. Assembly must follow the procedure for the fitting as shown in Section 16.07 "Joining Pipe & Fittings."

Testor shall monitor the assembly for procedural correctness and examine the finished assembly for comparison to a proper assembled fitting. Destructive or pressure testing is not required.

28.09 Requalification Requirements

Requalification shall be accomplished by making at least one joint on the job site each year for each joint type. If no jobs are in progress, then at least one joint shall be made in the shop and tested before the due date of the fusor's annual requalification.

A person must be requalified if, during any 12-month period, that person:

A. Does not make any joints under that procedure, i.e., socket, saddle, butt type - or:

B. Has 3 joints or 3% of joints made, whichever is greater, under that procedure, that are found unacceptable by pressure testing or visual inspection.

City of Duluth, Minnesota

Public Works & Utilities Department - Engineering Division

2011 Edition

Standard Construction Specifications

APPENDIX B

SCHEDULE FOR MATERIALS TESTING

SCHEDULE FOR MATERIALS TESTING
CITY OF DULUTH STREET AND UTILITY PROJECTS

CONCRETE CURB & GUTTER, SIDEWALK AND APRONS

Field Testing	Cylinders	Plant Inspection	Concrete Aggregate Graduations
• Test two trucks early in the day (first 2 trucks if possible) for air and slump. • Test air & slump 2 times per Block, one on each side. • Note: If less than 200 ft., no test required.	• Two sets per Block, one on each side.	• One inspection per project on either curb & gutter or sidewalk.	• One test/aggregate pile for the mix placed during the plant inspection.
• Test two trucks early in the day (first two trucks if possible) for air and slump. • Two tests per Block, one on each side.	• Two tests per Block, one on each side.	• One inspection per project on either curb & gutter or sidewalk.	• One test/aggregate pile for the mix placed during the plant inspection.

BITUMINOUS

Quality Assurance Testing (Owner's Testing Agency)	Quality Control Testing (Suppliers Testing)
• For S.I.P. projects, one companion sample (split with contractor) per mix placed per project. Test for asphalt content, gradation, and air voids. • No plant inspection required by owners testing agency on S.I.P projects. • One companion core for density from contractor per lot per lift. One lot for 300–600 tons, two lots for 601-1000 tons, three lots for 1001–1600 tons, four lots for 1601 – 3600 tons.	• Percent crushing - two per/mix/day at start-up, then sample daily, test minimum of one weekly. • Plant aggregate gradation – one/1000 tons at start-up, then one/2000 tons. • Asphalt content and air voids– one/500 tons/mix for first 2000 tons, then one/1000 tons. • Core density – three cores per lot per lift (see QA for lot determination). Two tested by supplier and one forwarded to owner's testing agency.

SCHEDULE FOR MATERIALS TESTING
CITY OF DULUTH STREET AND UTILITY PROJECTS

Specified Method	Sampling & Testing	Sampling Notes	Compaction Testing	Compaction Notes
UTILITY COMPACTION				
Specified Density	• One sieve and proctor for each backfill borrow material at source and one for on site native material.	<u>Materials to be tested:</u> • Course filter aggregate • Granular backfill • Native material from site Note: If material looks like it changed, test again.	• Take moisture of native material on first day of utility work. • Take densities at 1/1000' of pipe and 1/10 M.H. at every 3 feet in depth. • Compact in 8" lifts. • Required compaction is 100% around manholes; 100% in the top 3 feet from surface above pipes; 95% below the top 3 feet in utility trenches.	• Additional tests where inspector notes rutting or pumping; additional moistures after wet weather. • Most common problem is too much moisture in native backfill; may require granular borrow backfill to be used.
SELECT GRANULAR BORROW				
Specified Density	• One sieve and proctor from source.	• Take additional samples if material changes or source changes, at contractor's cost	• Two nuclears/Block prior to Class 5. • Compact in 8" layers or less. • Required density is 100%.	• Take additional densities where rutting is noted. • The most common problem with select granular is not enough moisture or more than 7%. • Retest at contractor's cost.
CLASS 5				
Specified Density	• One sieve and proctor at source.	• Take additional samples if material changes or source changes, at contractor's cost.	• Two nuclears/Block prior to curb and gutter. • Required density is 100%.	• Excavate and recompact areas where visible rutting. • Most common problem is segregation of aggregates; replacement/blending as directed by the Engineer. Retests are contractor's cost.

City of Duluth, Minnesota

Public Works & Utilities Department - Engineering Division

2011 Edition

Standard Construction Specifications

APPENDIX C

PROJECT LABOR AGREEMENT

PROJECT LABOR AGREEMENT

NO STRIKE, NO LOCKOUT

PUBLIC SECTOR

CITY OF DULUTH

&

(Name of Contractor)

INDEX	
AGREEMENT	1
ARTICLE I - PURPOSE	2
ARTICLE II - SCOPE OF THE AGREEMENT	2
ARTICLE III - UNION RECOGNITION AND REPRESENTATION	4
ARTICLE IV - LABOR HARMONY CLAUSE	5
ARTICLE V - WORK STOPPAGES AND LOCKOUTS	6
ARTICLE VI - DISPUTES AND GRIEVANCES	6
ARTICLE VII - JURISDICTIONAL DISPUTES	6
ARTICLE VIII - NO DISCRIMINATION	7
ARTICLE IX - SAVINGS AND SEPARABILITY	7
ARTICLE X - DURATION OF THE AGREEMENT	7
SCHEDULE "A"	10

AGREEMENT

This Project Labor Agreement (hereinafter, the "Agreement"), is entered into effective the _____day of _____, 2009, by and between the various contractors engaged in the construction of facilities to be known as the (Project). The parties to this Agreement are the Building and Construction Trades Council, on behalf of its affiliated Local Unions (hereinafter "Union" or "Unions"), the City of Duluth (hereinafter "Owner") and Contractor (hereinafter "Construction Manager/General Manager," "Contractor," and "Contractors").

It is understood by the parties to this Agreement that it is the policy of the Owner that the construction work covered by this Agreement shall be contracted to Contractors who agree to be bound by the terms of this Agreement. Therefore, the Union agrees that other Contractors may execute the Agreement for the purpose of covering that work. The Construction Manager/General Contractor shall monitor compliance with this Agreement by all Contractors who through their execution of this Agreement, together with their subcontractors, have become bound hereto.

The term "Contractor" shall include all Contractors and subcontractors of whatever tier engaged in on-site construction work within the scope of this Agreement.

The Union and all signatory Contractors agree to abide by the terms and conditions contained in this Agreement with respect to the administration of the Agreement by the Owner and the performance of the construction by the Contractor of the Project. This Agreement represents the complete understanding of the parties, and it is further understood that no Contractor party is required to sign any other agreement as a condition of performing work within the scope of this Agreement. No practice, understanding or agreement between a Contractor and a Union party which is not explicitly set forth in this Agreement shall be binding on any other party unless endorsed in writing by the Project Contractor.

ARTICLE I - PURPOSE

The (Project), an undertaking of the Owner, is a public project which will employ numbers of skilled and unskilled workers. Construction of the Project will entail utilization of the construction industry in an area having multiple labor contracts and employer associations. Consequently, conflicts within labor-management relations could cause delay or disruption of the efficient completion of the .project unless maximum cooperation of all segments of the construction industry is obtained. This Agreement is to establish as the minimum standards on the Project the hours and working conditions as those prevailing for the largest number of workers engaged in the same classes of work within the area.

It is in the public interest that the Project progress and be completed in an expeditious and efficient manner, free of disruption or delay of any kind. Therefore, it is essential to secure optimum productivity and to eliminate any delays in the work. In recognition of the special needs of this Project and to maintain a spirit of harmony, labor-management peace and stability during the term of this Project Labor Agreement, the parties agree to establish effective and binding methods for the settlement of all misunderstandings, disputes or grievances which may arise. Therefore, the Unions agree not to engage in any strike, slowdown or interruption of work and the Contractor agrees not to engage in any lockout.

ARTICLE II - SCOPE OF THE AGREEMENT

Section 1. This Agreement, hereinafter designated as the "Project Labor Agreement" or "Agreement," shall apply and is limited to all construction work included in all Bid Categories for the (Project), under the direction of the signatory Contractors and performed by those Contractor(s) of whatever tier which have contracts awarded for such work on and after the effective date of this Agreement with regard to the Project.

Such Project is generally described as the construction of:
(Project)

Section 2. It is agreed that all direct subcontractors of a Contractor, of whatever tier, who have been awarded contracts for work covered by this Agreement on or after the effective date of this Agreement shall be required to accept and be bound by the terms and conditions of the Project Labor Agreement.

Section 3. The provisions of this Project Labor Agreement shall apply to all craft employees represented by any Union listed in Schedule A hereto attached and shall not apply to other field personnel or managerial or supervisory employees as defined by the National Labor Relations Act.

Section 4. All employees covered by this Agreement shall be classified in accordance with work performed and paid the base hourly wage rates for those classifications as specified in the attached Schedule A.

Section 5. The Contractors agree to pay contributions to the established employee benefit funds in the amounts designated in the appropriate Schedule A.

Contractors that are not signatory to a collective bargaining agreement beyond the scope of this Agreement ("PLA contractor") may select to participate in the legally established industry health reimbursement arrangement ("HRA") plan, in lieu of contributing to the respective bona fide benefit funds as designated in Schedule A. The amount of the contribution is based on the difference between the contribution amount of the bona fide Schedule A benefit funds and the cost of the PLA contractor's bona fide non-discretionary plans. Contributions must be made on behalf of named employees. Participating contractors will submit to the Trustees of the HRA trust and plan a copy of their plan, summary plan description, and the premium structure for workers covered under the PLA contractor's bona fide, non-discretionary plans. The value of the PLA contractor's benefit plans are subject to confirmation by the Trustees of the HRA trust and plan. This may include an independent audit according to a policy as established by the Trustees. Contractors are required to submit certified payroll reports to the Trustees or authorized administrator in order to confirm compliance with the terms of the HRA. trust and plan.

The Contractors adopt and agree to be bound by the written terms of the legally-established Trust Agreements (or in lieu thereof, the aforementioned HRA plan and trust including any policies) specifying the detailed basis on which payments are to be made into, and benefits paid out of, such Trust Funds. The Contractors authorize the parties to such Trust Agreements to appoint trustees and successor trustees to administer the Trust funds and hereby ratify and accept theTrustees so appointed as if made by the Contractors.

Section 6. In the event of any conflict between any provisions of this Agreement and in the Local Area Agreements, the terms of this Agreement will be applied. In other words, where a subject covered by the provisions of this Project Labor Agreement is also covered by the Local Area Agreement the provisions of this Project Labor Agreement shall prevail. Where a subject is covered by the Local Area Agreement and not covered by this Project Labor Agreement, the Local Area Agreement provisions shall prevail.

Section 7. This Agreement shall only be binding on the signatory parties hereto and shall not apply to the parents, affiliates, subsidiaries, or other ventures of any such party.

Section 8. This Agreement shall be limited to work historically recognized as construction work. Nothing contained herein shall be construed to prohibit, restrict, or interfere with the performance of any other operation, work or function which may occur in or around the Project site or be associated with the development of the Project, or with the ongoing operations of the Owner.

Section 9. It is understood that the liability of any Contractor and the liability of the separate Unions under this Agreement shall be several and not joint. The Union agrees that this Agreement does not have the effect of creating any joint employment status between or among Owner and any Contractor.

Section 10. All workers delivering fill, sand, gravel, crushed rock, transit/concrete mix, asphalt or other similar materials and all workers removing any materials from the construction site as required by the specifications are subject to the provisions of the Minnesota state

prevailing wage law and are entitled to the appropriate area standard wage. For purposes of this contract, such materials are for specified future use and per Minnesota state prevailing wage law delivery and pickup of the above-listed materials constitutes incorporation.

ARTICLE III - UNION RECOGNITION AND REPRESENTATION

Section 1. The Contractor recognizes the Union as the sole and exclusive bargaining representative of all craft employees working on facilities within the scope of this Agreement.

Section 2. Authorized representatives of the Union shall have access to the Project, provided they do not interfere with the work of employees and further provided that such representatives fully comply with the posted visitor and security and safety rules of the Project.

ARTICLE IV - LABOR HARMONY CLAUSE

The contractor shall furnish labor that can work in harmony with all other elements of labor employed on that (Project) and shall submit a labor harmony plan to demonstrate how this will be done. "Harmony" shall include the provision of labor that will not, either directly or indirectly, cause or give rise to any work disruptions, slow downs, picketing, stoppages, or any violence or harm to any person or property while performing any work, or activities incidental thereto at the (project). The labor harmony plan should include the company's labor management policies, collective bargaining agreements if any and their expiration dates, past labor relations history, a listing of activities anticipated under this contract that may potentially cause friction with on-site workers, and procedures the company will undertake to eliminate this friction.

The contractor agrees that it shall require every lower-tier subcontractor to provide labor that will work in harmony with all other elements of labor employed in the work, and will include the provisions contained in the paragraph above, in every lower-tier subcontract let for work under this contract.

The requirement to provide labor that can work in harmony with all other elements of labor employed in the work throughout the contract performance is a material element of this contract. Failure by the contractor or any of its lower tier subcontractors to comply with this requirement shall be deemed a material breach of the contract which will subject the contractor to all rights and remedies the city of Duluth may have, including without limitation the right to terminate the contract.

ARTICLE V - WORK STOPPAGES AND LOCKOUTS

Section 1. There shall be no strike, picketing, work stoppages, slowdowns or other disruptive, activity for any reason by the Union or employees against any Contractor covered under this Agreement, and there shall be no lockout by the Contractor. Failure of any Union or employee to cross any picket line established by any union, signatory or non-signatory, or any other organization, at or in proximity to the Project site is a violation of this Article.

Section 2. Any party alleging a breach of Section 1, of Article IV shall have the right to petition a court for temporary and permanent injunctive relief. The moving party need not show the existence of irreparable harm, and shall be required to post bond only to secure payment of court costs and attorney fees as may be awarded by the court.

ARTICLE VI - DISPUTES AND GRIEVANCES

Section 1. This Agreement is intended to provide close cooperation between management and labor. The Construction Manager/General Contractor and the Building and Construction Trades Council shall each assign a representative to this Project for the purpose of assisting the Local Unions, together with the Contractor, to complete the construction of the Project economically, efficiently, continuously and without interruption, delays or work stoppages.
Each Contractor shall hold a pre-job conference with the Union and Construction Manager/General Contractor to clear up any project question and work assignments in which there is thought to be a difference in opinion. Every effort will be made to hold such conference well in advance of actual work performance.

Section 2. The Contractor, Union, and employees collectively and individually, realize the importance to all parties to maintain continuous and uninterrupted performance of the work of the Project, and agree to resolve disputes over grievances in accordance with the arbitration provisions set forth in the Local Area Agreements in effect with the Unions listed in Schedule A attached hereto.

ARTICLE VII - JURISDICTIONAL DISPUTES

Section 1. There will be no strikes, work stoppages, slowdowns, or other disruptive activity arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted as assigned by the Contractor.

Section 2. Building construction work shall be assigned by the Contractor in accordance with the procedural rules of the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (hereinafter the "Plan"). Any jurisdictional dispute over the Contractor's assignment of work shall be settled in accordance with the provisions of the Plan.

Section 3. Where a jurisdictional dispute involves the International Brotherhood of Teamsters, it shall be referred for resolution to that International Union and the disputing International Union. The resolution of the dispute shall be reduced to writing, signed by the authorized representative of the International Unions and the Contractor. The assignments made by the Contractor shall be followed until such time as the dispute is resolved in accordance with this Section.

ARTICLE VIII - NO DISCRIMINATION

Section 1. The Contractor and Union agree that they will not discriminate against any employee or applicant for employment because of his or her membership or nonmembership in a Union or based upon race, color, religion, sex, national origin or age in any manner prohibited by law or regulation.

Section 2. Any complaints regarding application of the provisions of Section 1, should be brought to the immediate attention of the involved Contractor for consideration and resolution.

Section 3. The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

ARTICLE IX - SAVINGS AND SEPARABILITY

It is not the intention of the parties to violate any laws governing the subject matter of this Agreement. The parties hereto agree that in the event any provisions of the Agreement are finally held determined to be illegal or void as being in contravention of any applicable law, the remainder of the Agreement shall remain in full force and effect unless the part or parts so found to be void are wholly inseparable from the remaining portions of this Agreement. Further, the contractor and Union agree that if and when any and all provisions of this Agreement are finally held or determined to be illegal or void by Court of competent jurisdiction, the parties will promptly enter into negotiations concerning the substance affected by such decision for the purpose of achieving conformity with the requirements of an applicable law and the intent of the parties hereto.

ARTICLE X DURATION OF THE AGREEMENT

The Project Labor Agreement shall be effective the _____ day of _____, 2008, and shall continue in effect for the duration of the Project construction work described in Article II hereof Construction of any phase, portion, section or segment of the project shall be deemed complete when such phase, portion, section or segment has been turned over to the Owner and has received the final acceptance from the Owner's representative.

Since there are provisions herein for no strikes or lockouts in the event any changes are negotiated and implemented under a Local Area Agreement during the term of this Agreement, the Contractor agrees that, except as specified herein, such changes shall be recognized and shall apply retroactively to the termination date in the particular Local Agreement involved. Each Contractor which has a Local Agreement with a Union at the time that its contract at the project

commences shall continue it in effect with each said Union so long as the Contractor remains on the project. In the event any such Local Area Agreement expires, the Contractor shall abide by all of the terms of the expired Local Agreement until agreement is reached on a new Local Agreement, with any changes being subject to the provisions of this Agreement.

The Union agrees that there will be no strikes, work stoppages, sympathy actions, picketing, slowdowns or other disruptive activity affecting the Project by any Union involved in the negotiation of a Local Area Agreement nor shall there be any lockout on this Project affecting the Union during the course of such negotiations.

IN WITNESS WHEREOF the parties have entered into this Agreement to be effective as of the day and year above written.

DULUTH BUILDING AND CONSTRUCTION TRADES COUNCIL

By: _____

Its _____
(Printed Name/Title)

Date: _____

CONTRACTOR

By: _____

Its _____
(Printed Name/Title)

Date: _____

CITY OF DULUTH

By:_____
Mayor

Attest:

_____
City Clerk

Date: _____

_____
City Auditor

Date: _____

_____
Assistant City Attorney

Date: _____

SCHEDULE "A"

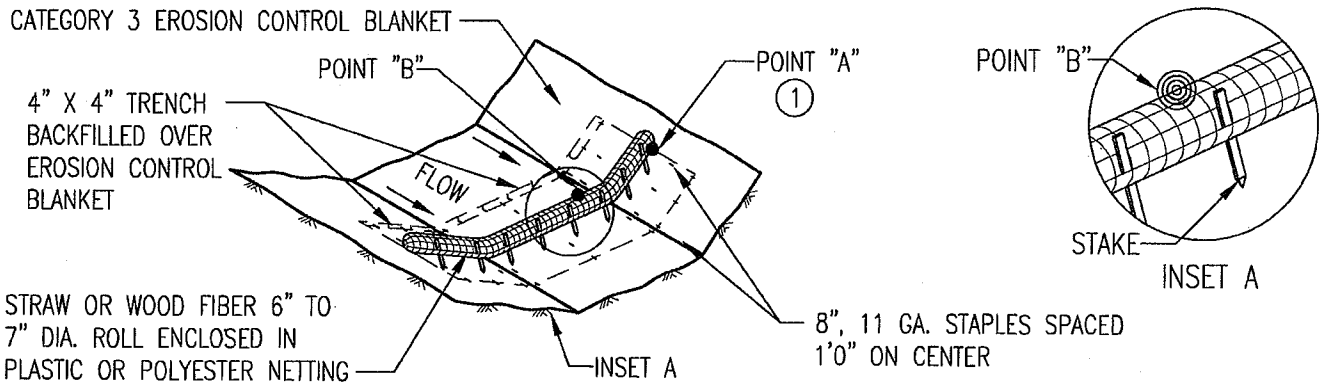
A1 Asbestos Workers Local 49
A-2 Boilermakers Local 647
A-3 BAC Local 1 Chapter 3 Duluth & Iron Range
A-4 Carpenters Local 361
A-5 Cements Masons/Plasterers Local 633
A-6 Elevator Constructors Local 9
A-7 IBEW Local 242
A-8 Iron Workers Local 512
A-9 Laborers Local 1091
A-10 Millrights & Machinery Erectors Local 1348
A-11 Operating Engineers Local 49
A-12 Painters & Allied Trades Local 106
A-13 Plumbers & Fitters Local 11
A-14 Roofers Local 96
A-15 Sheet Metal Workers Local 10
A-16 Sprinkler Fitters Local 669
A-17 Teamsters Local 346

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

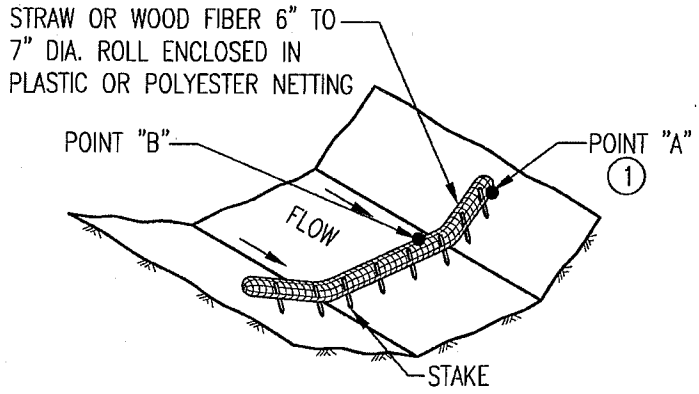
STANDARD DETAIL DRAWINGS

EROSION CONTROL DETAILS

ER-1	DITCH CHECK #1
ER-2	DITCH CHECK #2
ER-3	INLET PROTECTION
ER-4	SILT FENCE
ER-5	ROCK CONSTRUCTION ENTRANCE

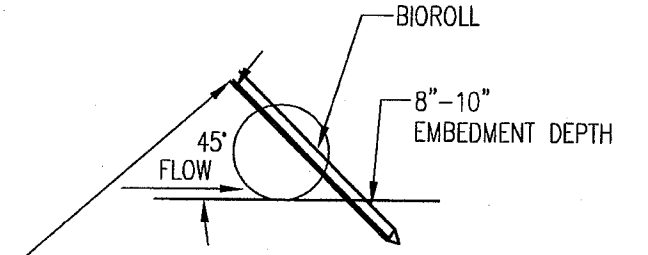


TYPE 3: BIOROLL BLANKET SYSTEM DITCH CHECK



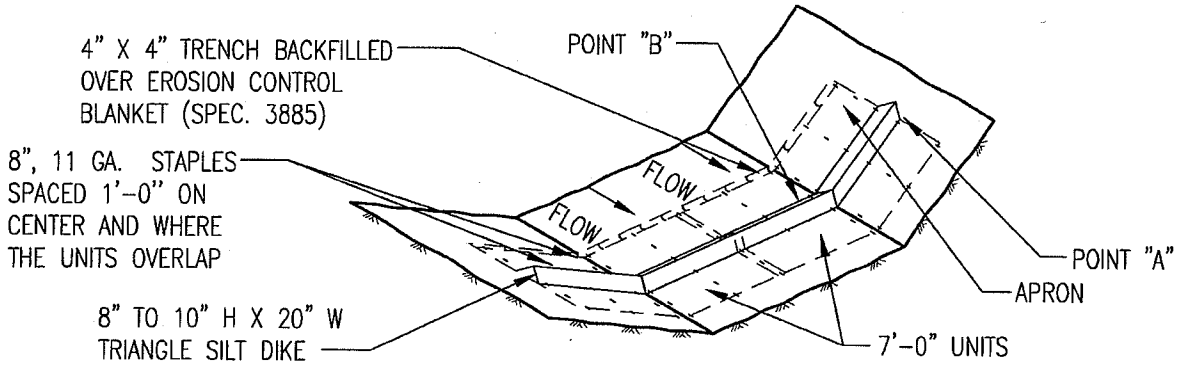
TYPE 2: BIOROLL DITCH CHECK

USE ON ROUGH GRADED AREAS



1" X 2" X 18" LONG WOODEN STAKES AT 1'-0" SPACING MAXIMUM. STAKES SHALL BE DRIVEN THROUGH THE BACK HALF OF THE BIOROLL AT AN ANGLE OF 45 DEGREES WITH THE TOP OF THE STAKE POINTING UPSTREAM. PROVIDE 8" TO 10" OF EMBEDMENT DEPTH.

BIOROLL STAKING DETAIL

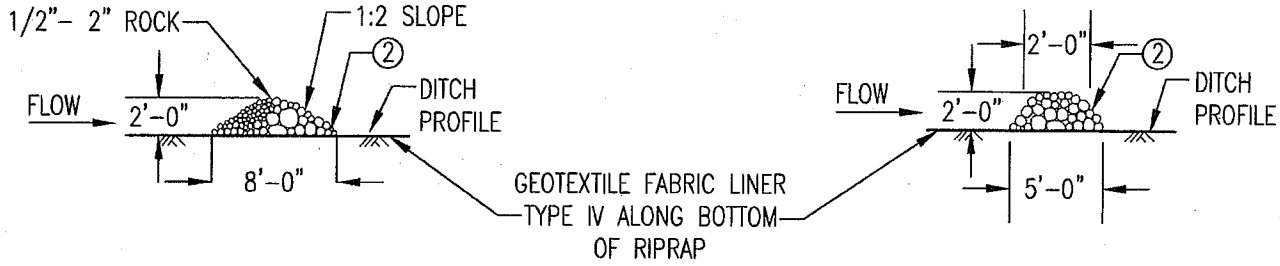


TYPE 6: GEOTEXTILE TRIANGULAR DIKE DITCH CHECK

NO SCALE

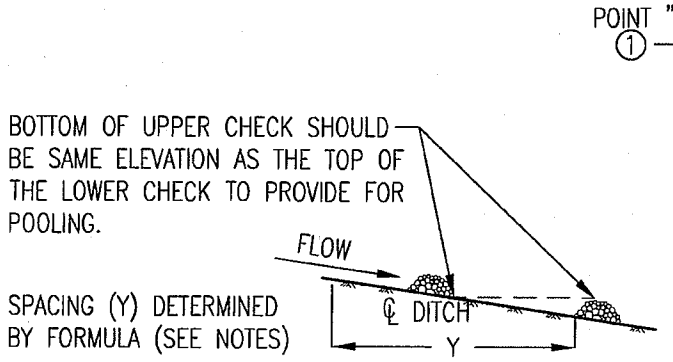
GENERAL DESIGN GUIDELINES						
DITCH CHECK TYPE	SILT FENCE	BIOROLL	BIOROLL BLANKET	TRIANGULAR DIKE	ROCK WEEPER	ROCK CHECK
STORM FREQUENCY	2 YR-24 HR	2 YR-24 HR	2 YR-24 HR	2 YR-24 HR	5 YR-24 HR	5 YR-24 HR
MAX FLOW VELOCITY	<1 FT/SECOND	1.5 FT/SECOND	4.5 FT/SECOND	1.5 FT/SECOND	12 FT/SECOND	12 FT/SECOND
MAX DITCH GRADE	0%-0.5%	1.5%-3%	1.5%-3%	1.5%-2.0%	3%-5%	3%-5%
MAX DRAINAGE AREA	1 ACRE	2 ACRE	2 ACRE	4 ACRE	4+ ACRE	4+ ACRE

DITCH CHECK - #1	ER-1
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES NO SCALE

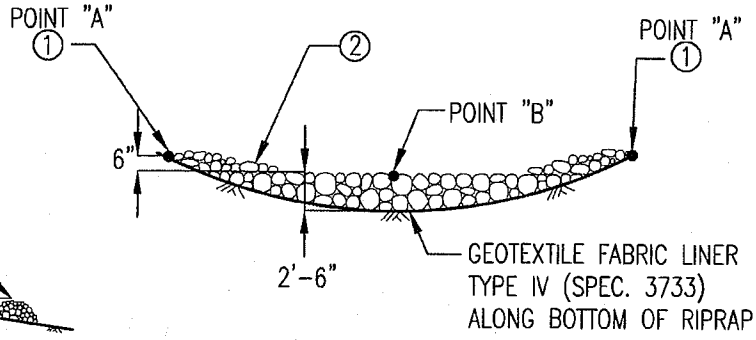


TYPE 5: ROCK WEEPER ③
PROFILE VIEW
USE ON ROUGH GRADED AREAS

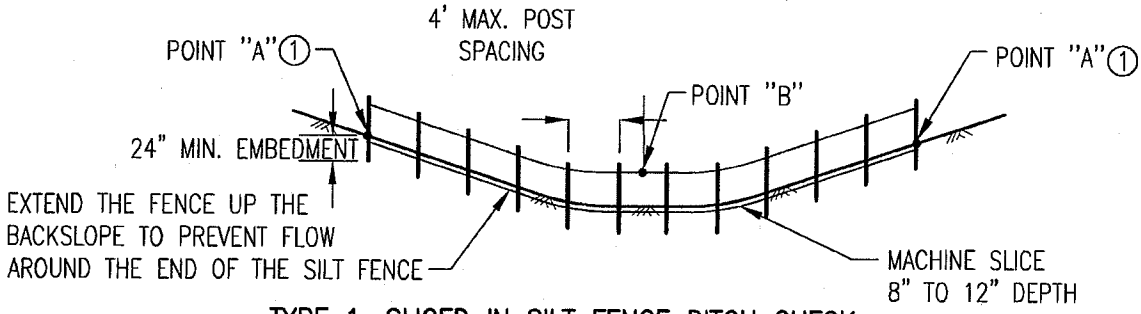
TYPE 7: ROCK CHECK ④
PROFILE VIEW
USE ON ROUGH GRADED AREAS



DITCH CHECK SPACING ④



CROSS SECTION
(ROCK WEEPER AND ROCK CHECK)



TYPE 1: SLICED IN SILT FENCE DITCH CHECK

NO SCALE

NOTE:
THE AMOUNT OF SILT FENCE ABOVE GROUND SHOULD BE 24"TO 28". WHEN SEDIMENT BUILD UP REACHES 8"TO 9", THE SEDIMENT MUST BE REMOVED.

NOTES:

SEE SPECS. 2573, 3601, 3733, 3885, 3886 & 3889

APPROXIMATE SPACING BETWEEN EACH DITCH CHECK SHOULD BE DETERMINED FROM THE FOLLOWING SPACING FORMULA:

APPROXIMATE SPACING OF DITCH CHECKS (FT.) = Y = [DITCH CHECK HEIGHT (FT)/% CHANNEL SLOPE] X 100

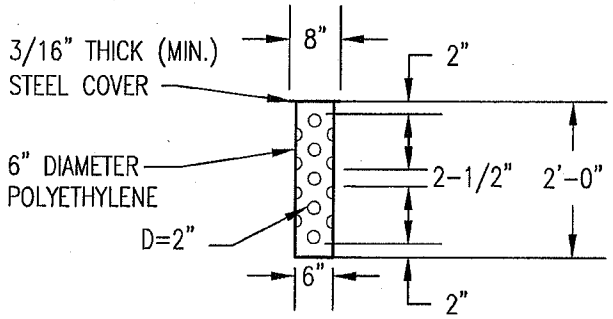
① POINT "A" MUST BE A MINIMUM OF 6 INCHES HIGHER THAN POINT "B" TO ENSURE THAT WATER FLOWS OVER THE DIKE AND NOT AROUND THE ENDS.

② CLASS I – IV RIPRAP (SPEC. 3601) WITH GEOTEXTILE FABRIC LINER, TYPE IV (SPEC. 3733).

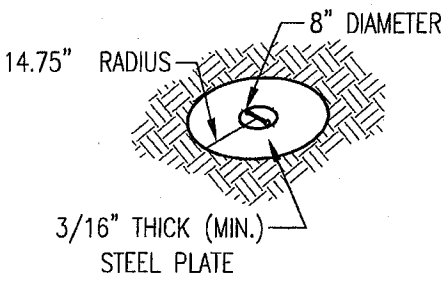
③ THE ROCK WEEPER FILTERS SEDIMENT OUT OF THE WATER BETTER THAN THE OTHER DITCH CHECKS. THE ROCK WEEPER COULD BE USED AS A PERMANENT WATER FILTERING FEATURE.

④ PERMANENT ROCK DITCH CHECKS PLACED WITHIN THE CLEAR ZONE WILL NEED TO BE 18" OR LESS IN HEIGHT. A 1:6 APPROACH AND DEPARTURE SLOPE SHALL BE PROVIDED.

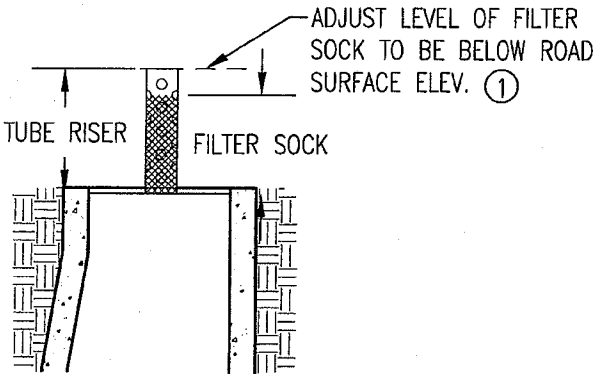
DITCH CHECK – #2		ER-2
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



TUBE RISER

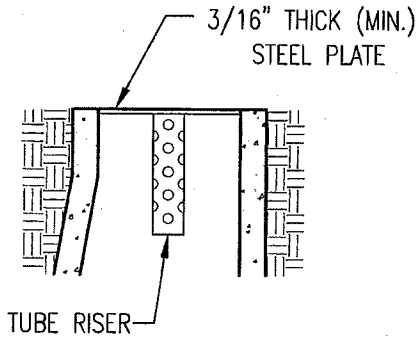


PERSPECTIVE VIEW

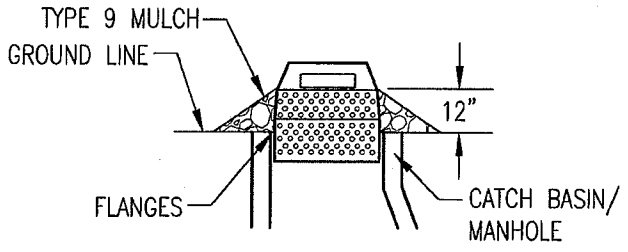


SECTION
(UP POSITION)

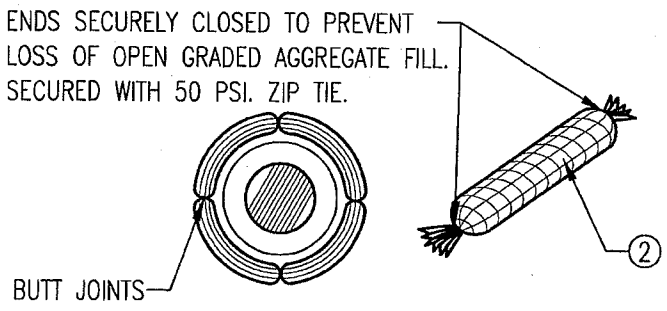
POP-UP HEAD



SECTION
(DOWN POSITION)



SEDIMENT CONTROL INLET HAT

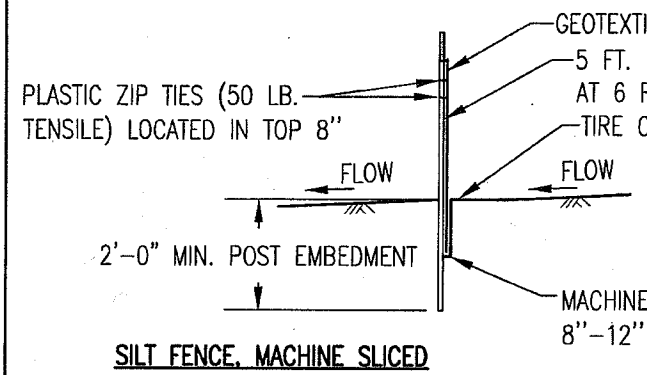


ROCK LOG/COMPOST LOG

NOTE:
THE SEDIMENT CONTROL BARRIER SHALL BE A METAL OR PLASTIC/POLYETHYLENE RISER SIZED TO FIT INSIDE THE CATCH BASIN/MANHOLE; HAVE PERFORATIONS TO ALLOW FOR WATER INFILTRATION; HAVE AN OVERFLOW OPENING, FLANGES AND A LID/COVER.

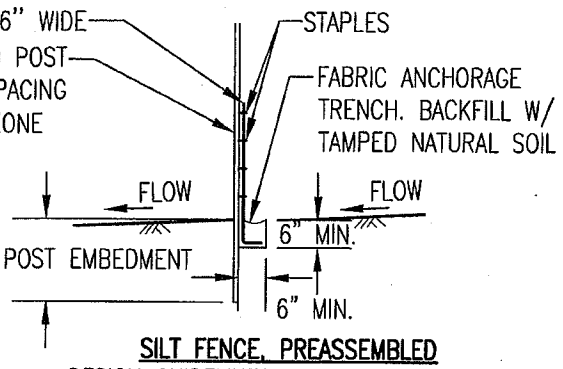
NOTES:
SEE SPECS. 2573, 3137, 3886 & 3891.
MANUFACTURED ALTERNATIVES LISTED ON MNDOT'S APPROVED PRODUCTS LIST MAY BE SUBSTITUTED.
(1) SOCK HEIGHT MUST NOT BE SO HIGH AS TO SLOW DOWN WATER FILTRATION TO CAUSE FLOODING OF THE ROADWAY.
(2) GEOTEXTILE SOCK BETWEEN 4-10 FEET LONG AND 4-6 INCH DIAMETER. SEAM TO BE JOINED BY TWO ROWS OF STITCHING WITH A PLASTIC MESH BACKING OR PROVIDE A HEAT BONDED SEAM (OR APPROVED EQUIVALENT). FILL ROCK LOG WITH OPEN GRADED AGGREGATE CONSISTING OF SOUND DURABLE PARTICLES OF COARSE AGGREGATE CONFORMING TO SPEC. 3137 TABLE 3137-1; CA-3 GRADATION.

INLET PROTECTION		ER-3
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



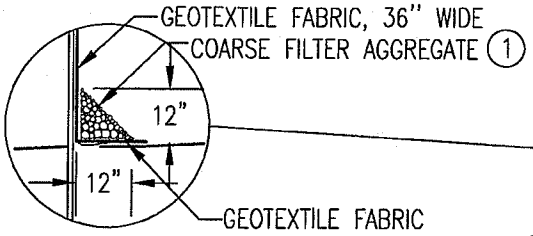
SILT FENCE, MACHINE SLICED

DESIGN GUIDELINES:
TO PROTECT AREAS FROM SHEET FLOW.
MAXIMUM CONTRIBUTING AREA: 1 ACRE

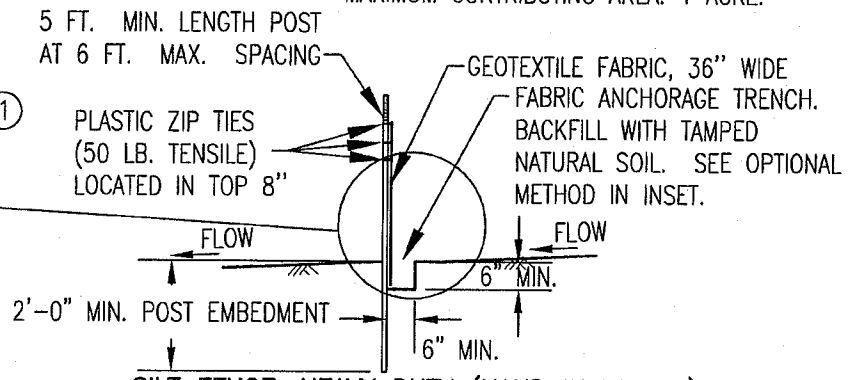


SILT FENCE, PREASSEMBLED

DESIGN GUIDELINES:
TO PROTECT AREAS FROM SHEET FLOW.
MAXIMUM CONTRIBUTING AREA: 1 ACRE.



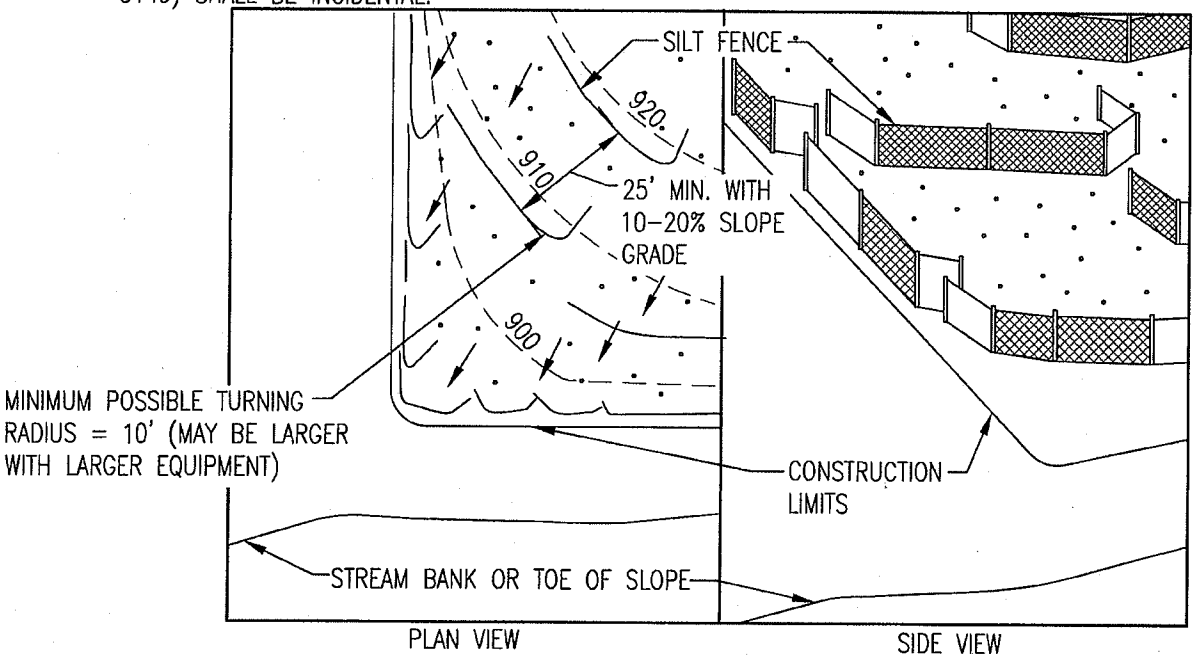
OPTIONAL METHOD FOR SILT FENCE, HEAVY DUTY



SILT FENCE, HEAVY DUTY (HAND INSTALLED)

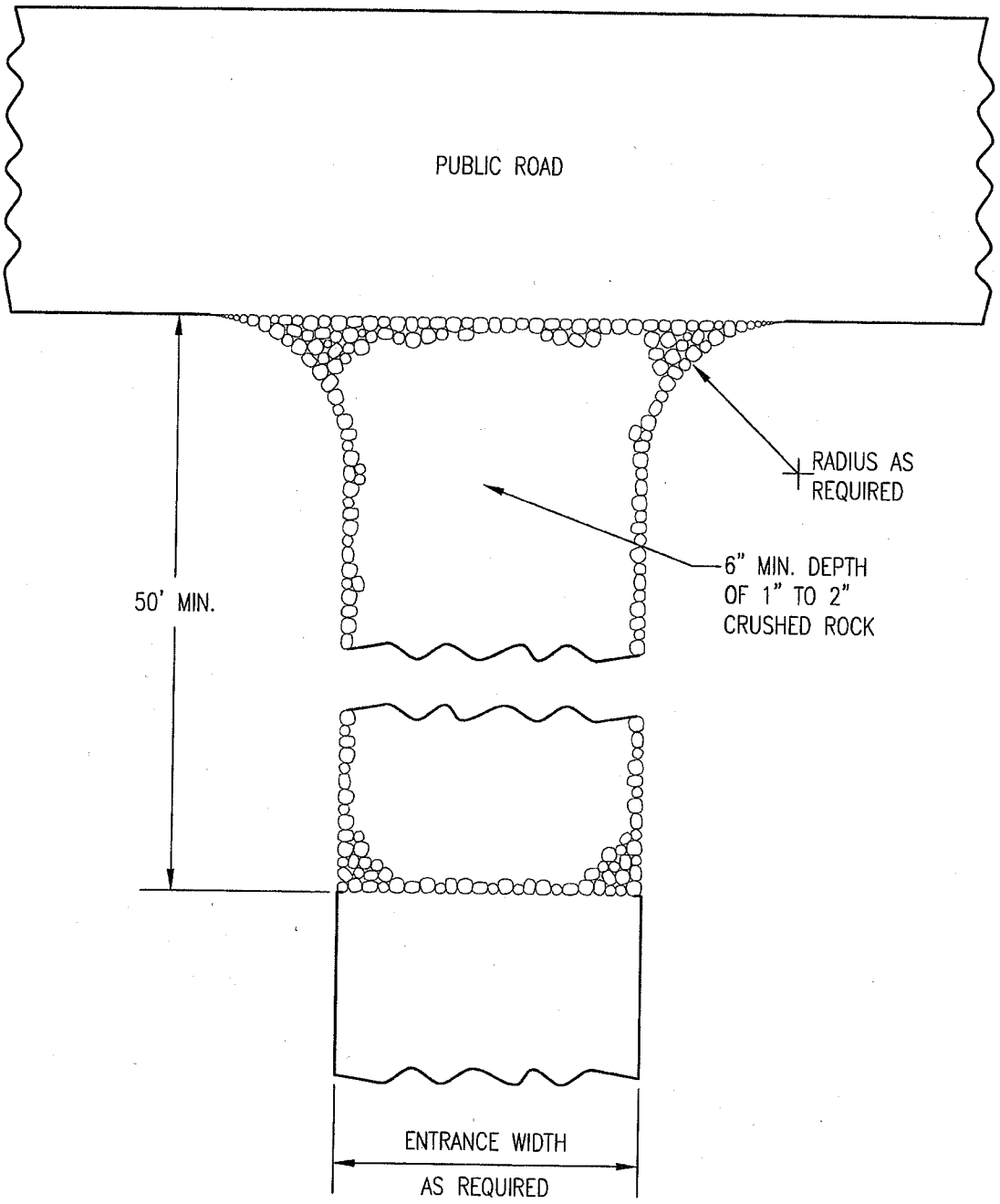
DESIGN GUIDELINES:
TO PROTECT AREAS FROM SHEET FLOW.
MAXIMUM CONTRIBUTING AREA: 1 ACRE.

NOTES: SEE SPECS. 2573, 3149 & 3886.
(1) COARSE FILTER AGGREGATE (SPEC. 3149) SHALL BE INCIDENTAL.



DISTRURBED SOIL, WORK AREA DRAINS TO STREAM

SILT FENCE, J-HOOK INSTALLATION		ER-4
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. SEE SPECS. 2573, 3892, & 3894.
2. ROCKS AT ENTRANCE CLEAN WORKSITE MUD OFF OF TRUCK TIRES BEFORE TRUCKS ENTER MAIN ROAD. KEEPING MUD OFF THE ROAD WILL PREVENT AUTO DAMAGE AND KEEP CONSTRUCTION SEDIMENT OUT OF DRAINAGE SYSTEMS AND WETLANDS. GEOTEXTILE MAY BE PLACED UNDER THE ROCK TO KEEP ROCKS SEPARATE FROM SOIL.
3. MAINTAIN ENTRANCE WITH CLEAN ROCK.

ROCK CONSTRUCTION ENTRANCE		ER-5
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

THE CITY OF

DULUTH

MINNESOTA

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

STANDARD DETAIL DRAWINGS

EXCAVATION DETAILS

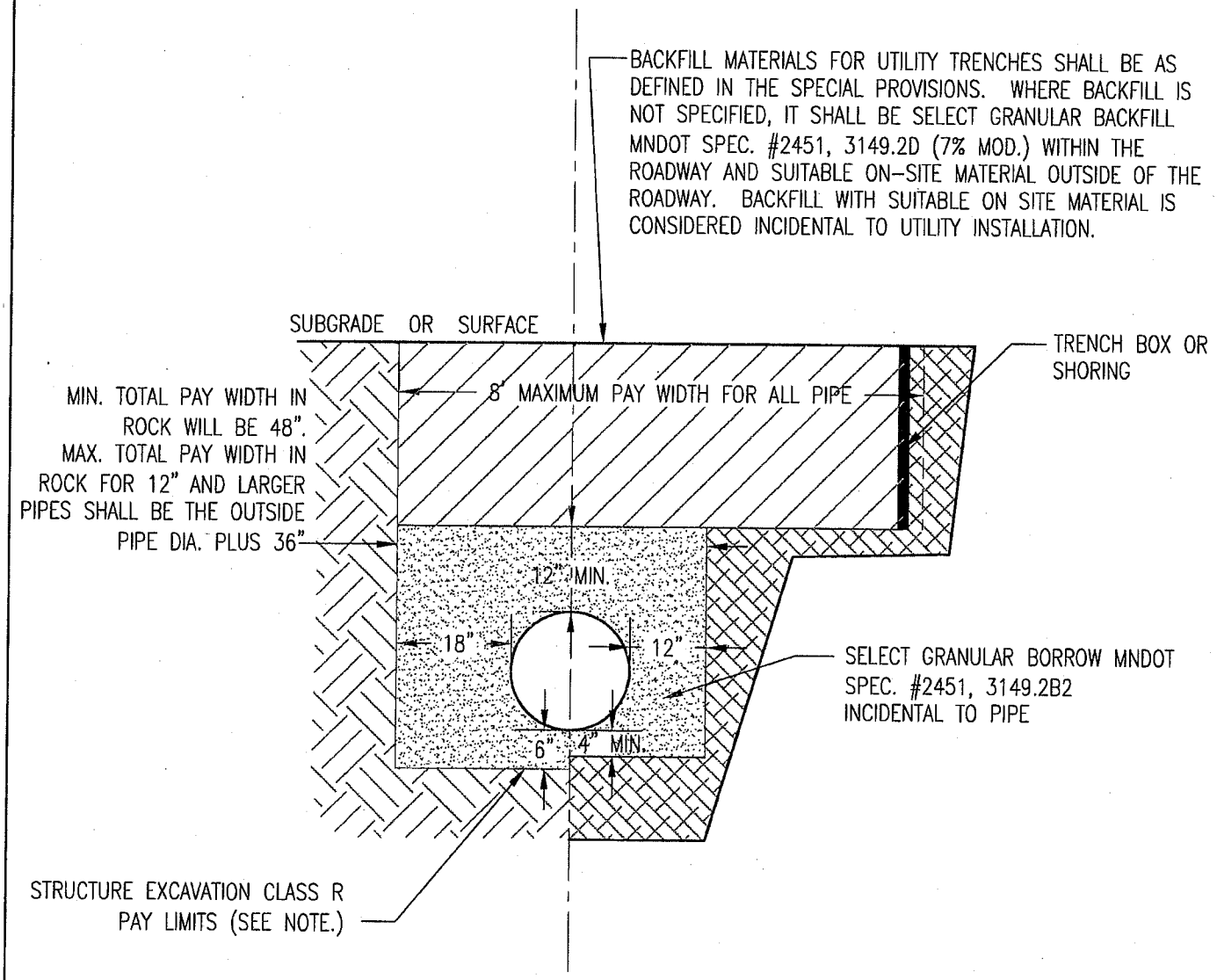
EX-1 DUCTILE IRON, PE WATERMAIN, PRESSURE SEWER, & FORCEMAIN BEDDING DETAIL

EX-2 ALL STEEL & 6" & LARGER PE GAS MAIN BEDDING DETAIL

EX-3 PVC & CORRUGATED PE SEWER PIPE BEDDING DETAIL

ROCK SECTION

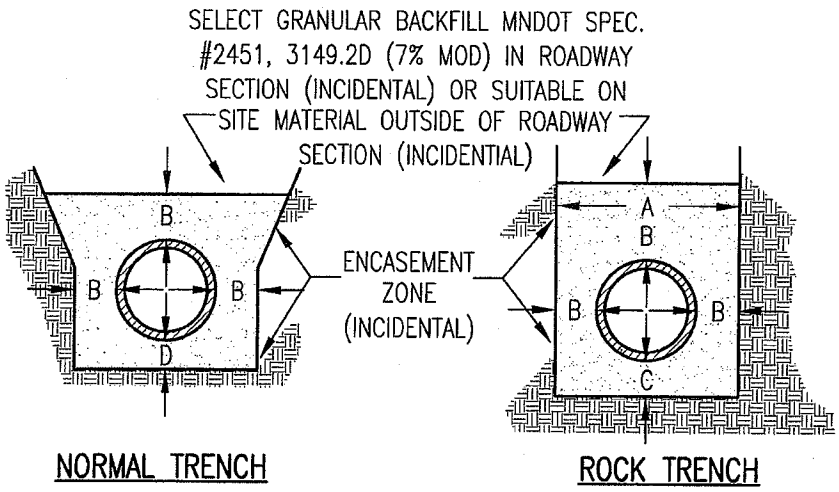
UNDISTURBED GROUND SECTION

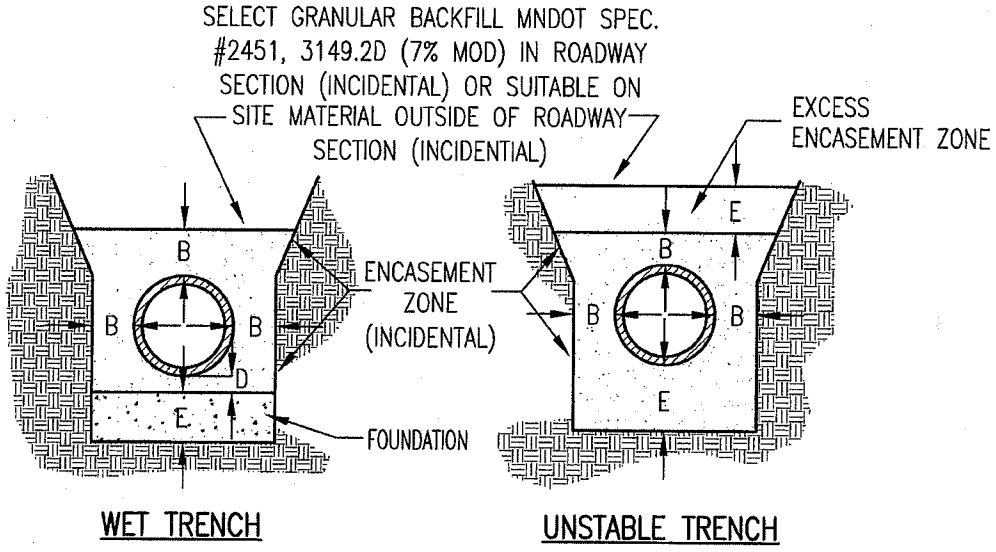


NOTES:

1. TRENCH STABILIZATION MATERIAL MAY BE USED IN AREAS AS DETERMINED BY THE ENGINEER.
2. A MIN. OF 1 CU. YD. OF STRUCTURE EXCAVATION, CLASS R, WILL BE PAID FOR EVERY 10' OF PIPE WHERE ROCK REMOVAL IS REQUIRED.
3. EXCESS EXCAVATION MATERIAL SHALL BE DISPOSED OF OFF PROJECT R.O.W. (INCIDENTAL)
4. WHERE UTILITIES ARE INSTALLED IN ROCK TRENCHES OUTSIDE OF THE ROADWAY, THE CONTRACTOR SHALL PROVIDE COMMON BORROW MATERIAL TO SUPPLEMENT SUITABLE ON SITE BACKFILL MATERIALS AS NECESSARY. COMMON BORROW MATERIAL IS INCIDENTAL TO STRUCTURE EXCAVATION, CLASS R. REFER TO SPECIFICATIONS FOR RESTRICTIONS ON COMMON BORROW MATERIALS.

DUCTILE IRON, PE WATERMAIN, PRESSURE SEWER, & FORCEMAIN BEDDING		EX-1
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE





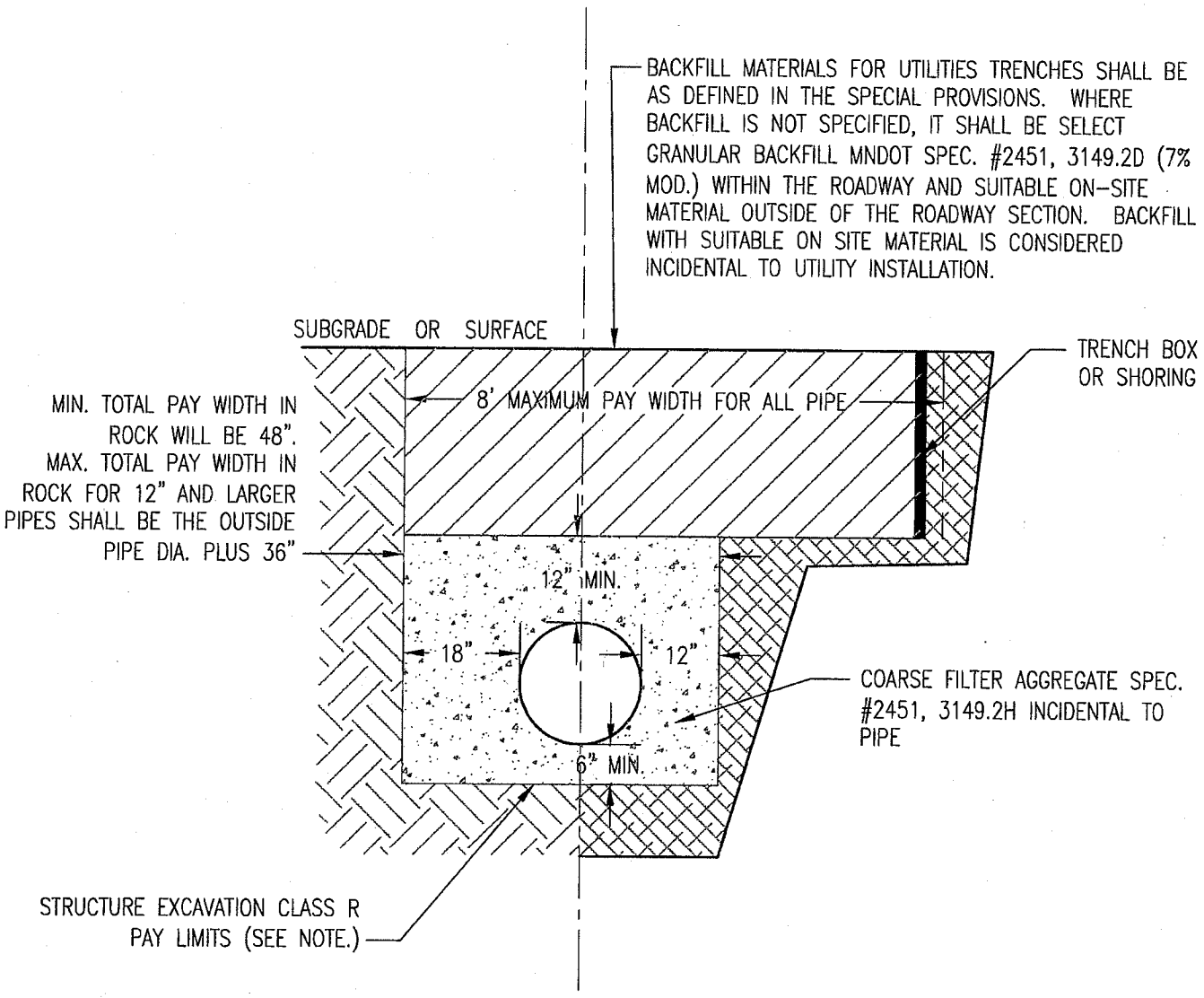
1. DIMENSIONS:
   - A. MAXIMUM PAY WIDTH – O.D. PIPE +24"
   - B. MINIMUM – 6"
   - C. 6" BELOW PIPE
   - D. 4" BELOW PIPE
   - E. DETERMINED BY THE ENGINEER
2. ENCASEMENT MATERIAL TO BE MNDOT SPEC. #2451, 3149.2K SAND COVER
3. FOUNDATION MATERIAL SHALL BE GRADED AS FOLLOWS:

SIEVE SIZE	FOUNDATION
2"	100
1"	85–100
3/4"	30–60
3/8"	0–10

ALL STEEL & 6" AND LARGER PE GAS MAIN BEDDING DETAIL		EX–2
REVISED/APPROVED 3/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

ROCK SECTION

UNDISTURBED GROUND SECTION



NOTES:

1. TRENCH STABILIZATION MATERIAL MAY BE USED IN AREAS AS DETERMINED BY THE ENGINEER.
2. A MIN. OF 1 CU. YD. OF STRUCTURE EXCAVATION, CLASS R, WILL BE PAID FOR EVERY 10' OF PIPE WHERE ROCK REMOVAL IS REQUIRED.
3. EXCESS EXCAVATION MATERIAL SHALL BE DISPOSED OF OFF PROJECT R.O.W. (INCIDENTAL)
4. WHERE UTILITIES ARE INSTALLED IN ROCK TRENCHES OUTSIDE OF THE ROADWAY, THE CONTRACTOR SHALL PROVIDE COMMON BORROW MATERIAL TO SUPPLEMENT SUITABLE ON SITE BACKFILL MATERIALS AS NECESSARY. COMMON BORROW MATERIAL IS INCIDENTAL TO STRUCTURE EXCAVATION, CLASS R. REFER TO SPECIFICATIONS FOR RESTRICTIONS ON COMMON BORROW MATERIALS.

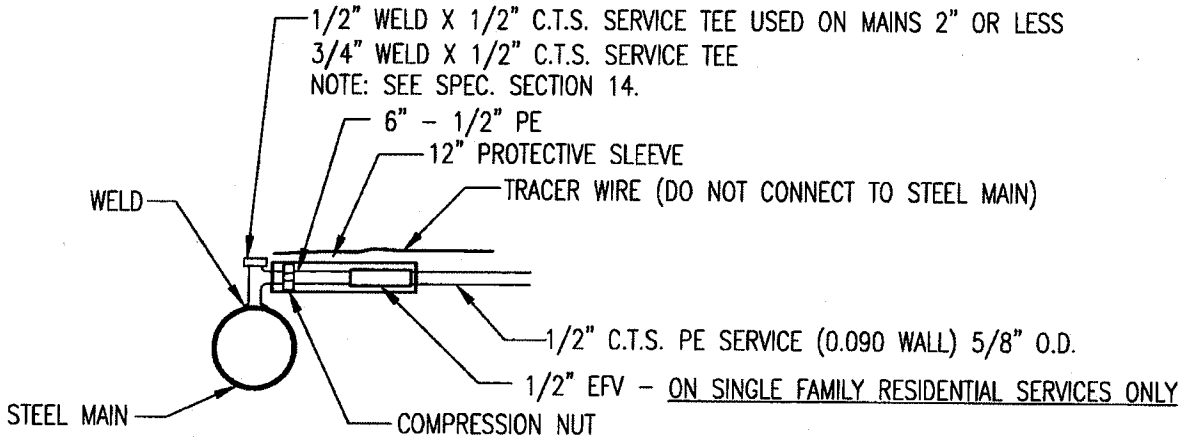
PVC AND CORRUGATED POLYETHYLENE SEWER PIPE BEDDING DETAIL		EX-3
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

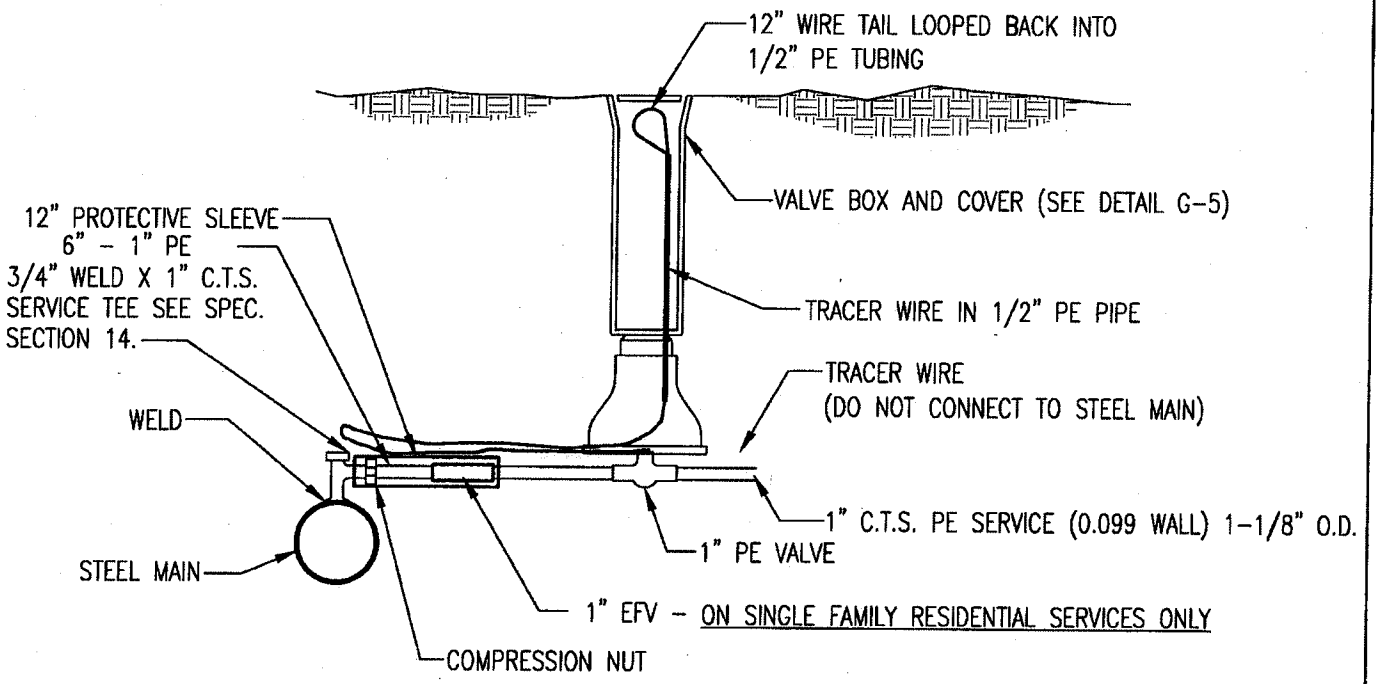
STANDARD DETAIL DRAWINGS

GAS SYSTEM DETAILS

G-2	STEEL TO PE SERVICE CONNECTION (EDITED 3-1-12)
G-3	GAS MAIN BRANCH CONNECTIONS TO STEEL MAIN
G-4	TYPICAL WELD JOINTS
G-5	PE VALVE BOX SETTING
G-8	HP GAS CROSSING AT RAILROAD
G-9	TYPICAL STEEL GAS SERVICE RISER
G-10	HIGH PRESSURE GAS SERVICE INSTALLATIONS - RESIDENTIAL (EDITED 3-1-12)
G-11	HIGH PRESSURE GAS SERVICE INSTALLATION - 1" CTS & 2" ITS (EDITED 3-1-12)
G-11A	METER INSTALLATION DETAIL, SIZES 400, 675, & 1000
G-12	ROOTS METER INSTALLATION
G-12A	15C ROOTS COMPACT METER INSTALLATION
G-12B	5 M ROOTS COMPACT METER INSTALLATION
G-13	UNDERGROUND GAS FUEL LINE PIPING - PAST METER
G-14	DUPLEX METER CONNECTION
G-14A	TYPICAL MULTI-METER INSTALLATION
G-14B	TYPICAL MULTI-METER INSTALLATION - 6 RESIDENTIAL METERS
G-15	MOBILE HOME GAS METER CONNECTION
G-16	SEALING UNUSED LP GAS SERVICES
G-17	CATHODIC PROTECTION
G-18	TYPICAL METHOD OF BRAZED CONNECTION TO PIPE
G-22	GAS PIPING BUILDING ENTRY, BELOW GRADE
G-23	TYPICAL WELL FOR BELOW GRADE GAS PIPE ENTRY
G-24	TYPICAL GAS PIPING REVISION
G-26	TELEMETRIC GAS PRESSURE STATION
G-30	TYPICAL CAGE & LANDSCAPING FOR GAS DISTRIBUTION REGULATOR
G-31	HIGH PRESSURE GAS REGULATOR INSTALLATION
G-32	HIGH PRESSURE GAS REGULATOR INSTALLATION

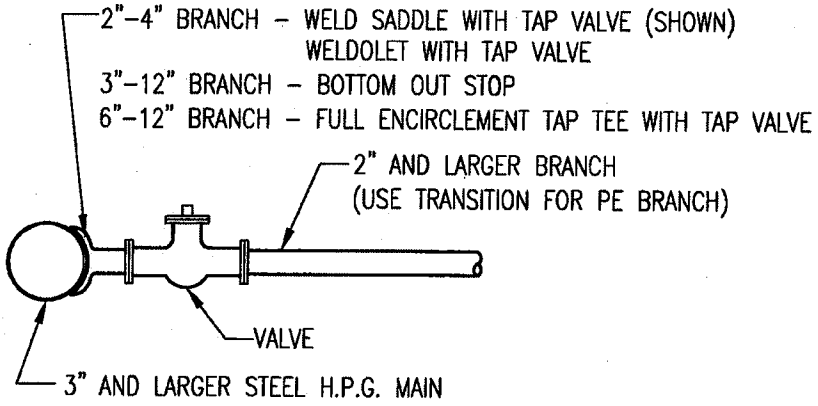


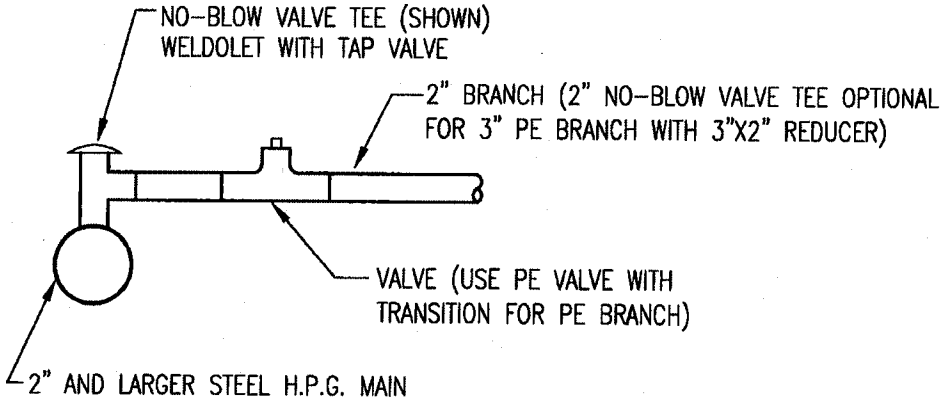
1/2" C.T.S. PE SERVICE ON STEEL MAIN



1" C.T.S. PE SERVICE ON STEEL MAIN

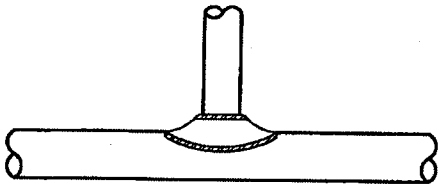
STEEL TO PE SERVICE CONNECTION		G-2
REVIEWED/APPROVED 3/1/12	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE





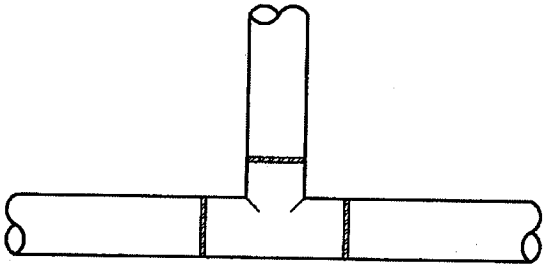
GAS MAIN BRANCH CONNECTIONS TO STEEL MAIN		G–3
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

REDUCED LATERAL

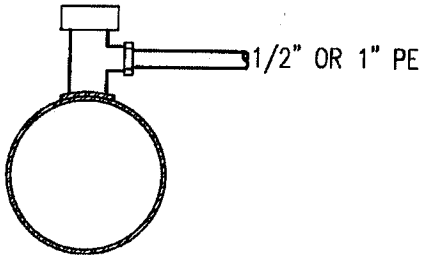


SADDLE

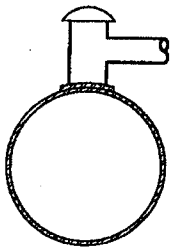
FULL SIZE OR REDUCED ONE SIZE ONLY



WELDING TEE IN LINE

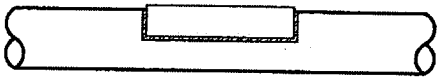


1/2" AND 1" TAP TEES

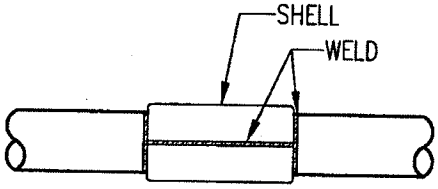


1", 1-1/2", 2" NO-BLOW TEE

MUELLER STOP - 2" & 3"
RUBBER PLUG

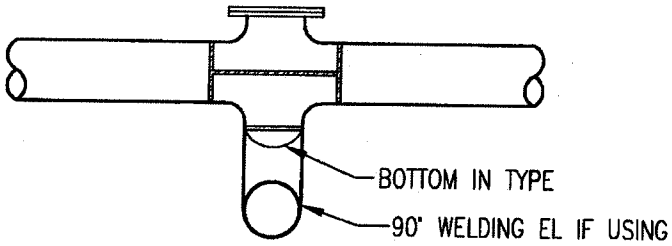


HALF SOLE REPAIR



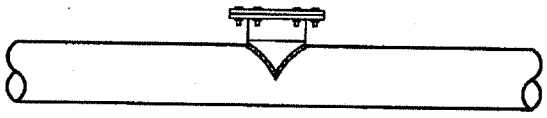
PUMPKIN ENCIRCLEMENT

MUELLER LINE STOP



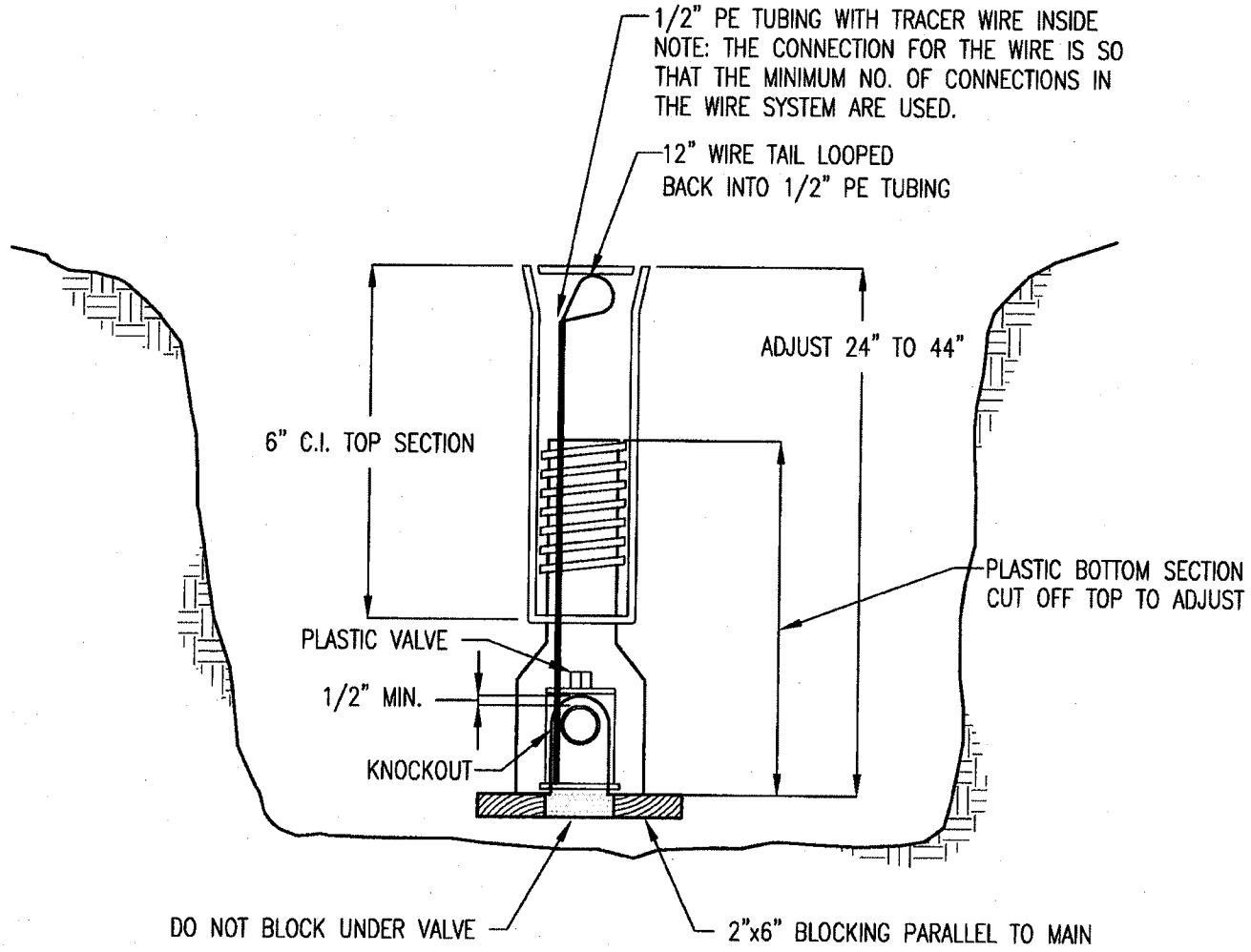
MUELLER STOP
4"-6"-8"-10"-12"
(STEEL PLUG)

T.D. WILLIAMSON LINE STOP

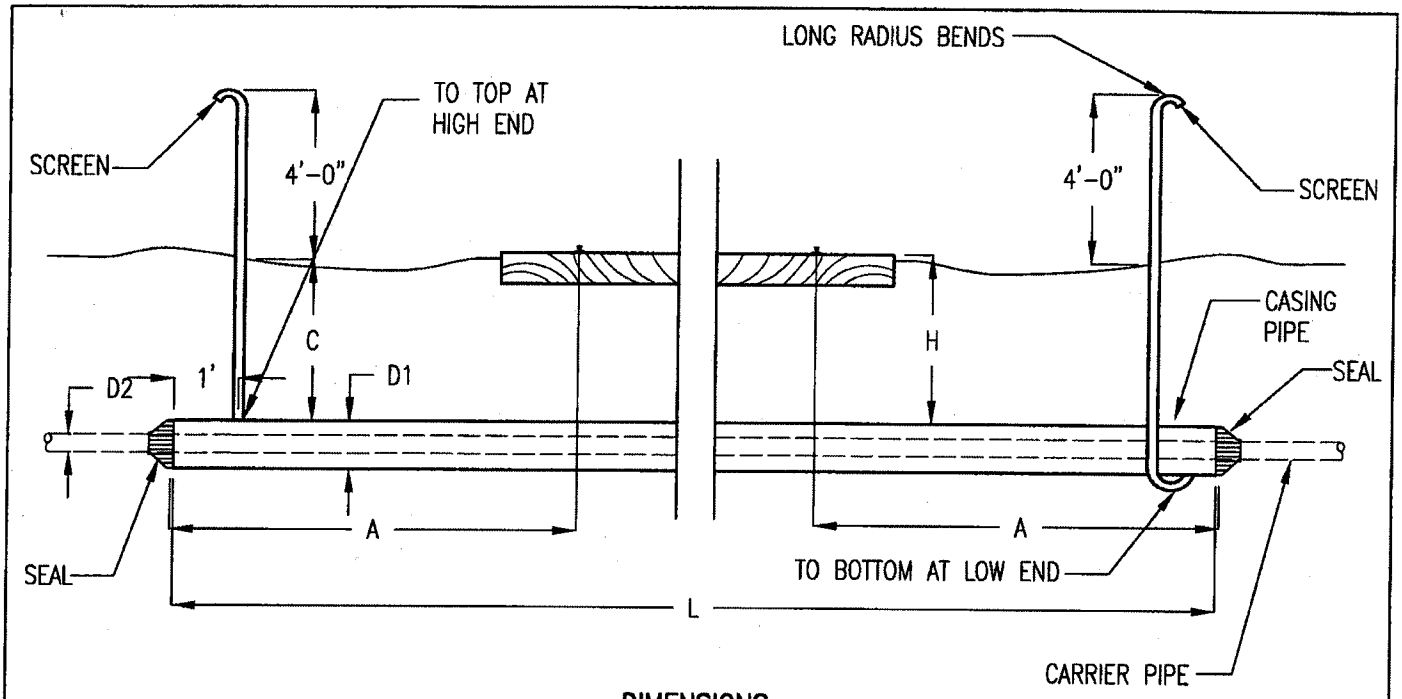


T.D. WILLIAMSON STOP
10" - 12" - 14" - 16"

TYPICAL WELD JOINTS		G-4
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



PE VALVE BOX SETTING		G-5
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



DIMENSIONS

A = _____

L = _____

H = _____

C = _____

D1 (CASING DIA.) = _____

D2 (CARRIER DIA.) = _____

CASING THICKNESS = _____

1/4" – 6" THRU 16"
5/16" – 18" THRU 20"
3/8" – 22" THRU 24"

MATERIALS

CASING = _____

CASING SEALS – P.S.I. MODEL "S" FOR PE, LINK SEAL FOR STEEL PIPE _____

CASING INSULATORS = _____

CARRIER PIPE = _____

VENT PIPE – 2" WELDED STEEL AS DETAILED _____

OPERATING PRESSURE = _____

GENERAL INFORMATION

RAILROAD COMPANY = _____

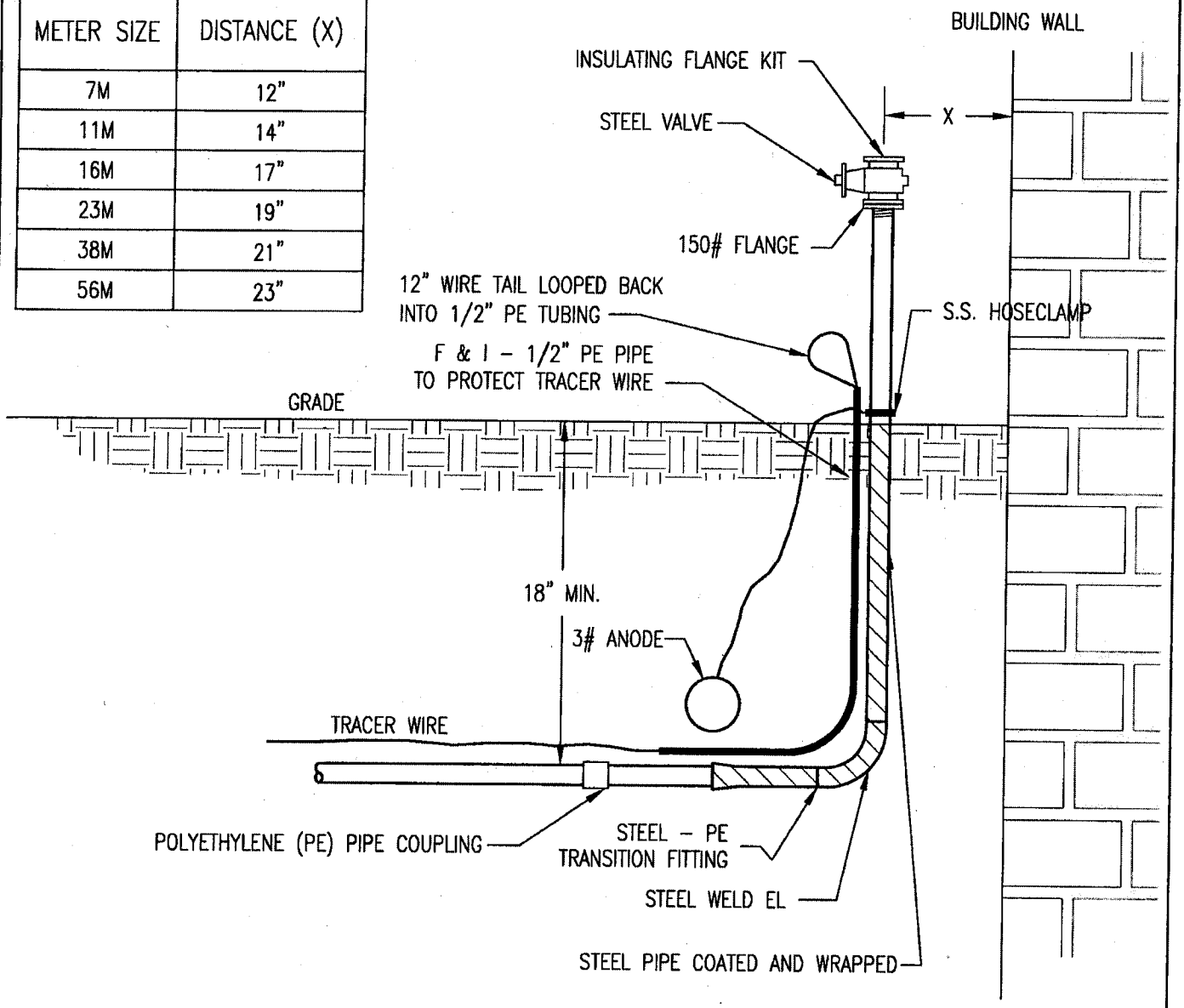
NO. OF TRACKS = _____

CROSSING LOCATION = _____

METHOD OF INSTALLATION = _____

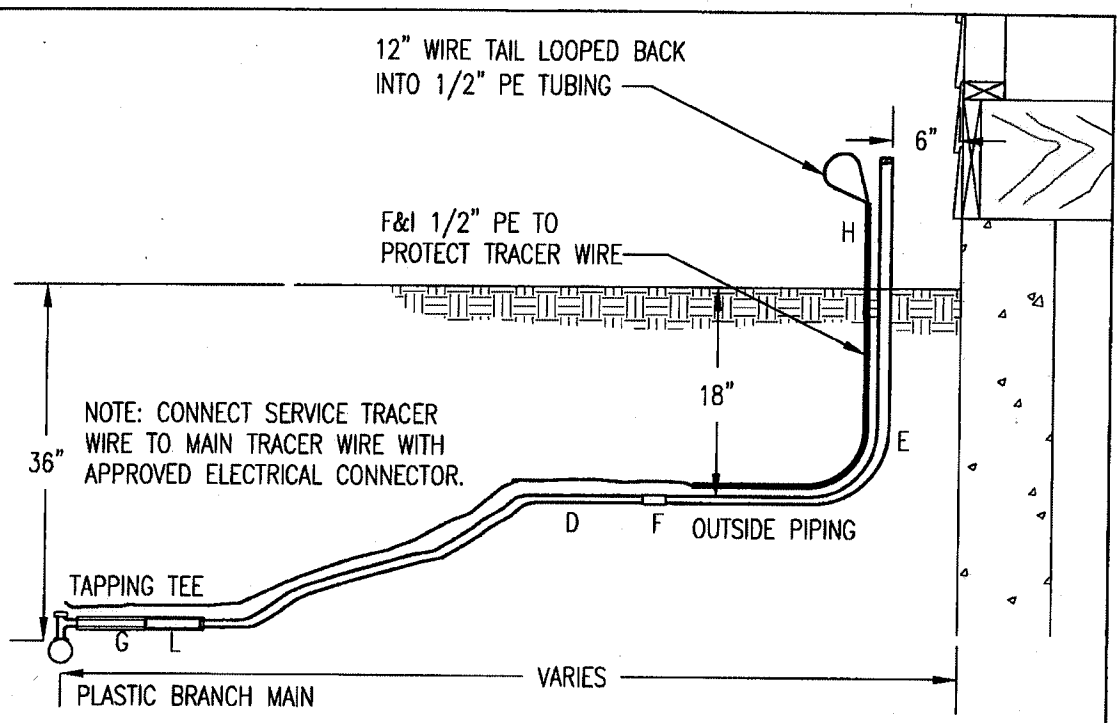
HP GAS CROSSING AT RAILROAD		G–8
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

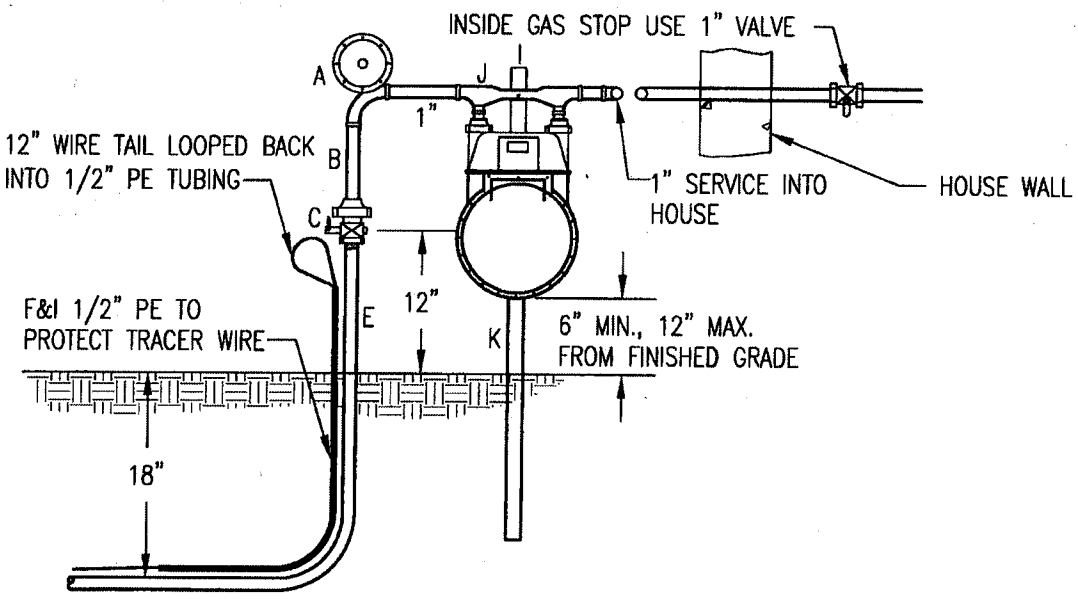
METER SIZE	DISTANCE (X)
7M	12"
11M	14"
16M	17"
23M	19"
38M	21"
56M	23"



THIS SERVICE IS STANDARD FOR:
3" & LARGER SERVICES ON 22# OR 66# SYSTEMS.

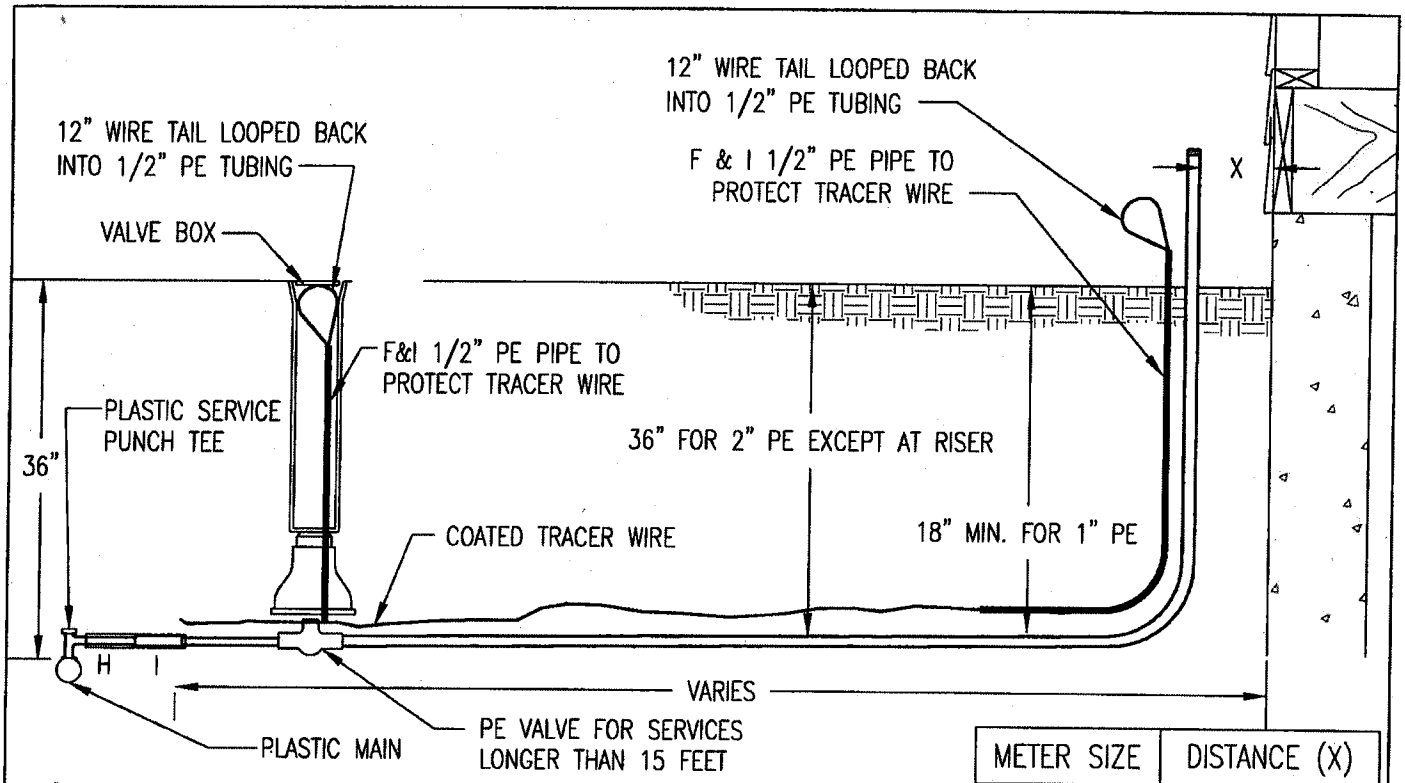
TYPICAL STEEL GAS SERVICE RISER		G-9
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE





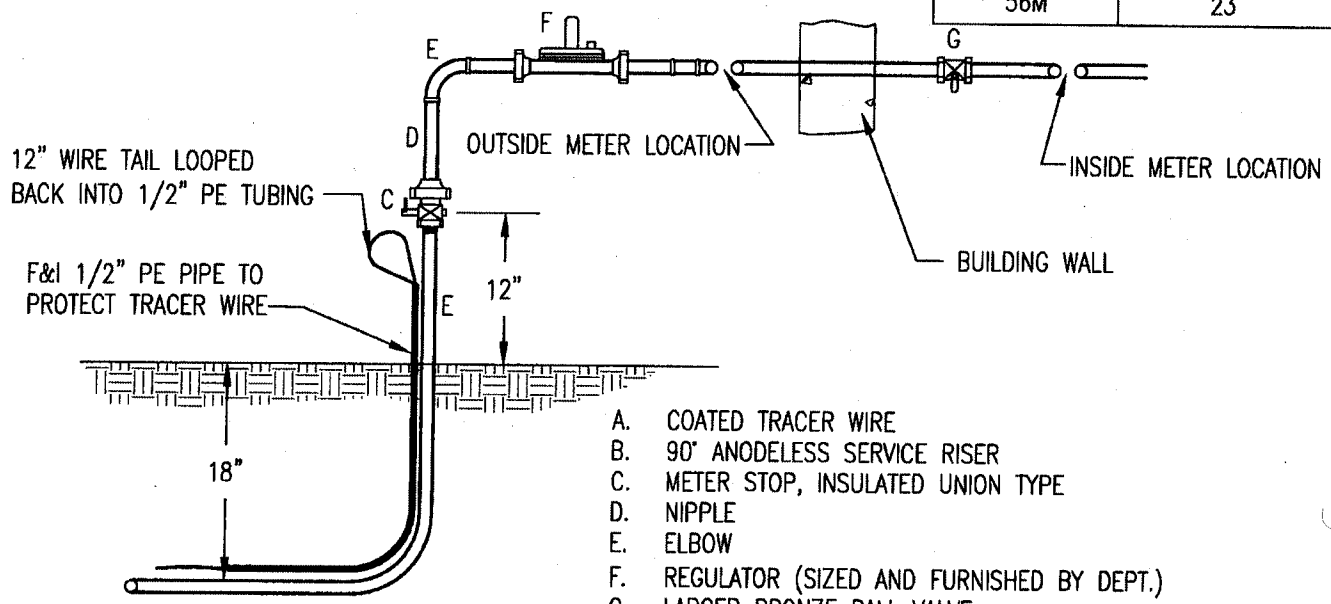
A. REGULATOR, FISHER S-252 OR SCHUMBERGER B-42, BOTH WITH 1/8" ORIFICE
B. 3/4" NIPPLE
C. 3/4" METER STOP
D. 1/2" C.T.S. P.E. TUBING (5/8" O.D.)
E. 1/2" X 3/4" ANODELESS SERVICE RISER
F. 1/2" C.T.S. P.E. SOCKET COUPLING
G. PLASTIC PROTECTIVE SLEEVE
H. COATED TRACER WIRE
I. 1" BRONZE BALL VALVE
J. ROCKFORD ECLIPSE 701173 26-M WEDGESEAL METER BAR (OR EQUAL)
K. ADVANCE ENG. CORP. D.P. 1004 METER MOUNTING BRACKET (OR EQUAL)
L. 1/2" EFV – ON SINGLE FAMILY RESIDENTIAL SERVICES ONLY

HIGH PRESSURE GAS SERVICE INSTALLATION – RESIDENTIAL		G-10
REVISED/APPROVED 3/1/12	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



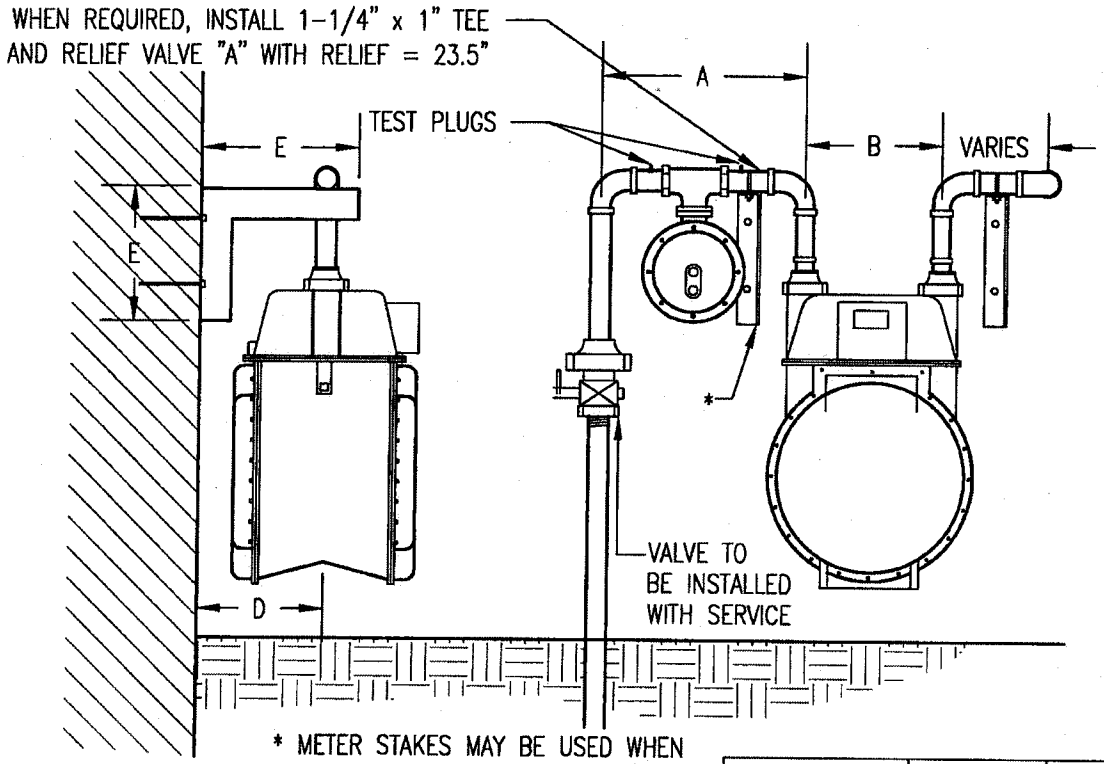
METER SIZE	DISTANCE (X)
7M	12"
11M	14"
16M	17"
23M	19"
38M	21"
56M	23"

1. CONNECT SERVICE TRACER WIRE TO MAIN TRACER WIRE WITH ELECTRIC CONNECTOR.
2. IN MULTIPLE METER SITUATIONS, EACH METER SHALL HAVE A LOCKING VALVE WHICH ALLOWS ANY METER TO BE LOCKED OUT OF SERVICE WHILE THE OTHER REMAIN IN SERVICE.
3. TEST POINTS SHALL BE INSTALLED WITH 1-1/4" OR LARGER REGULATOR ON HIGH AND LOW SIDES USING WELD ON 1/4" COUPLING COMPLETE WITH PETE'S PLUGS.



A. COATED TRACER WIRE
B. 90° ANODELESS SERVICE RISER
C. METER STOP, INSULATED UNION TYPE
D. NIPPLE
E. ELBOW
F. REGULATOR (SIZED AND FURNISHED BY DEPT.)
G. LARGER BRONZE BALL VALVE
H. PLASTIC PROTECTIVE SLEEVE (RIGID P.E. - 12" LONG)
I. 1" EFV - ON 1" SINGLE FAMILY RESIDENTIAL SERVICES ONLY

HIGH PRESSURE GAS SERVICE INSTALLATION - 1" CTS & 2" IPS SERVICES		G-11
REVIEWED/APPROVED 3/1/12	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



* METER STAKES MAY BE USED WHEN ATTACHMENT TO BUILDING IS NOT POSSIBLE

DIMENSION	400	675	1000
A	17-9/16"	17-11/16"	17-15/16"
B	7"	10"	11"
C	27"	32"	36"
D	9"	9"	9"
E	11"	11"	11"

NOTE:

① EXTEND VENT ONLY WHEN NECESSARY, SEE O & M SECTION 30. DEPT. TO FURNISH: REGULATOR, TEST "PETE'S PLUG" – 2 EACH WITH 1-1/4" NIPPLES, METER WITH SWIVELS AND NUTS, AND ANGLE BRACKETS.

② RELIEF DEVICE REQUIRED – 1" FISHER 289L

CUSTOMER LOAD (CFH)	397 TO 600		600 TO 900		900 TO 1428	
METER SIZE	400		675		1000	
METER CONNECTION	1-1/2"		1-1/2"		2"	
PRESSURE LOSS (WC)	1/2" @ 397 CFH		1/2" @ 397 CFH		1/2" @ 397 CFH	
	1" @ 595 CFH		1" @ 918 CFH		1" @ 1428 CFH	
REGULATOR TYPE	B-31-R, 1-1/4" CONN.		B-31-R, 1-1/4" CONN.		B-31-R, 1-1/4" CONN.	
SYSTEM PRESSURE	22#-10#	66#-30#	22#-10#	66#-30#	22#-10#	66#-30#
ORIFICE	1/8"	1/8"	3/16"	1/8"	1/4"	3/16" ②
CAP @ PIN MAX.	600	1560	1560	1560	2240	2500
CAP @ PIN MIN.	400	765	870	765	1470	2025
VENT MAX. LENGTH ①	130'	20'	18'	20'	0'-3/4", 30'-1"	0'-3/4", 8'-1"
CAPACITY DATA IS FOR SANDARD 7" (WC) DELIVERY PRESSURE						

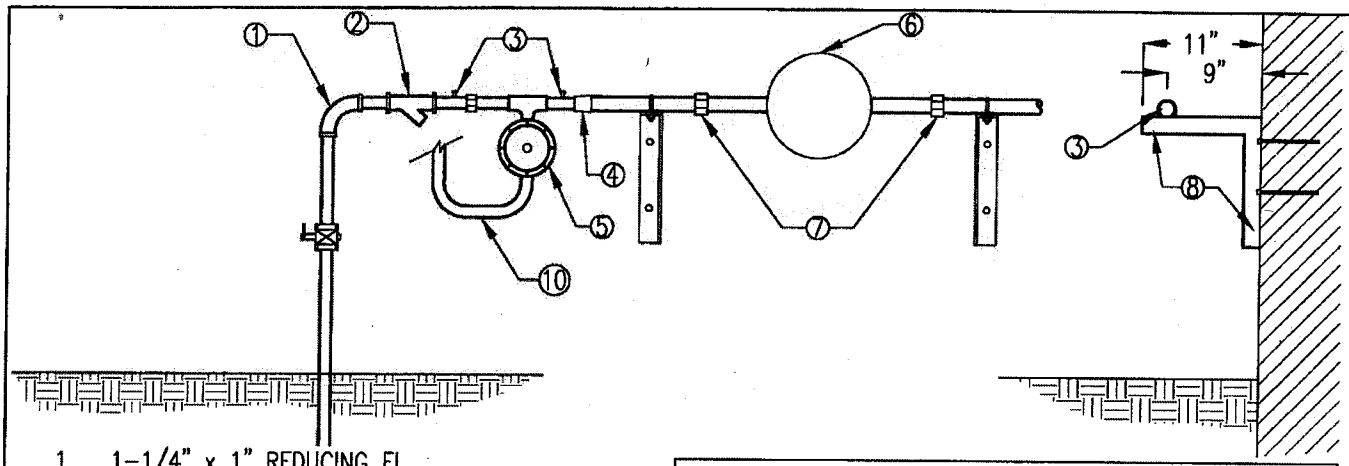
METER INSTALLATION DETAIL – SIZES 400, 675, & 1000

G-11A

REVIEWED/APPROVED 3/1/11

CITY OF DULUTH STANDARD DETAIL
DEPT. OF PUBLIC WORKS AND UTILITIES

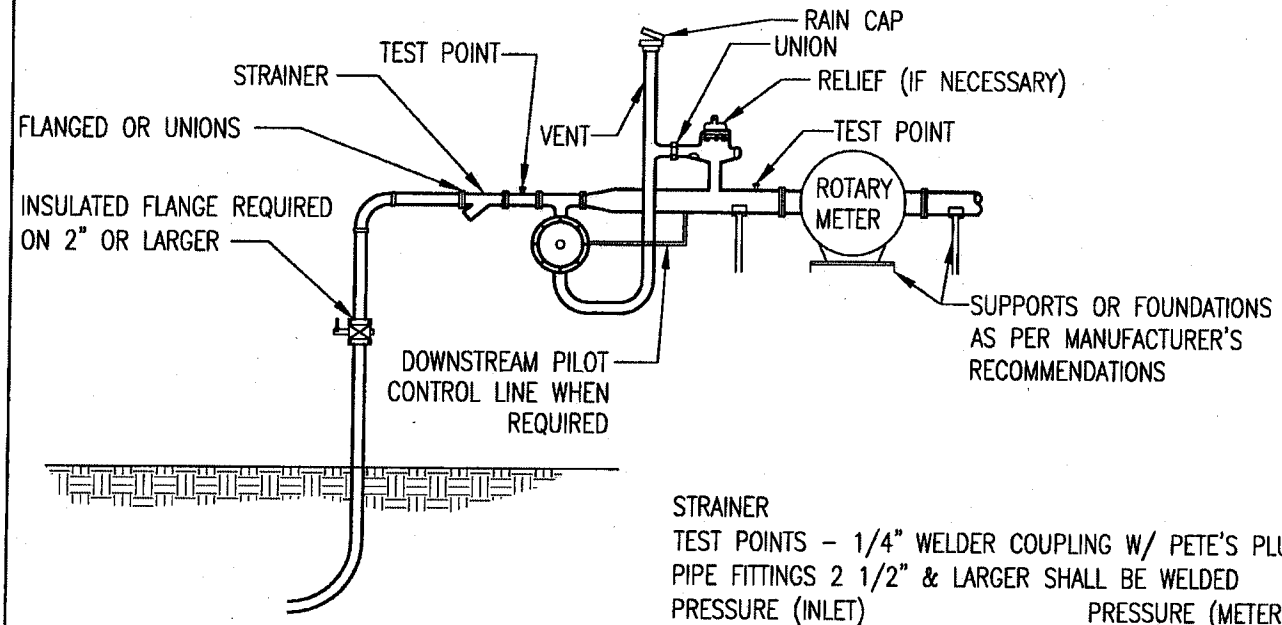
NO SCALE



1. 1-1/4" x 1" REDUCING EL
2. 1-1/4" STRAINER W/BLOWDOWN
3. 1/4" WELD ON COUPLING & PETE'S PLUGS
4. 1-1/2" x 1-1/4" REDUCER
5. SPRAGUE B-31R REGULATOR
6. 1.5M125 ROOTS METER
7. 1-1/2" UNIONS
8. 1-1/2" WELDED ANGLE
9. 1-1/2" x 1/4" U-CLAMPS
10. VENT W/RAIN CAP WHERE REQUIRED

1.5M125 ROOTS METER & REGULATOR DETAIL

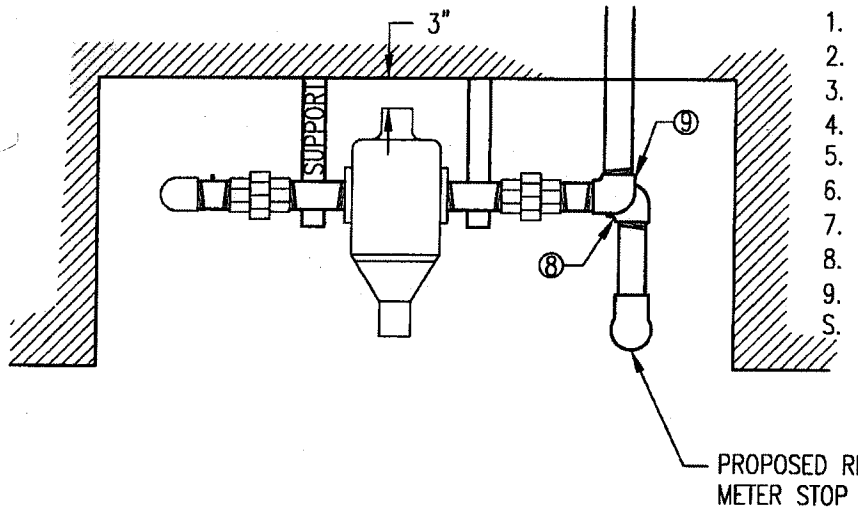
REGULATOR CAPACITY (CFH)						
P OUT	7" WC			2 PSI*		
ORIFICE	1/8"	3/16"	1/4"	3/16"	1/4"	5/16"
P IN						
55	1300	–	–	850	1450	1650
35	860	2280	–	1560	1100	1250
15	–	1080	1640	–	–	–
10	–	–	1470	–	–	–
*METER PRESSURE 1.83 PSI @ MAX. FLOW						



TYPICAL DETAIL – 3M125 ROOTS METER & LARGER

STRAINER
TEST POINTS – 1/4" WELDER COUPLING W/ PETE'S PLUGS
PIPE FITTINGS 2 1/2" & LARGER SHALL BE WELDED
PRESSURE (INLET) PRESSURE (METERING)
REGULATOR–TYPE ORIFACE
(BY GAS DIVISION)
RELIEF–TYPE (BY GAS DIVISION)
BUILDING TO BACK OF METER – MIN. 3"
FLANGES SHALL BE 150# FLAT FACE

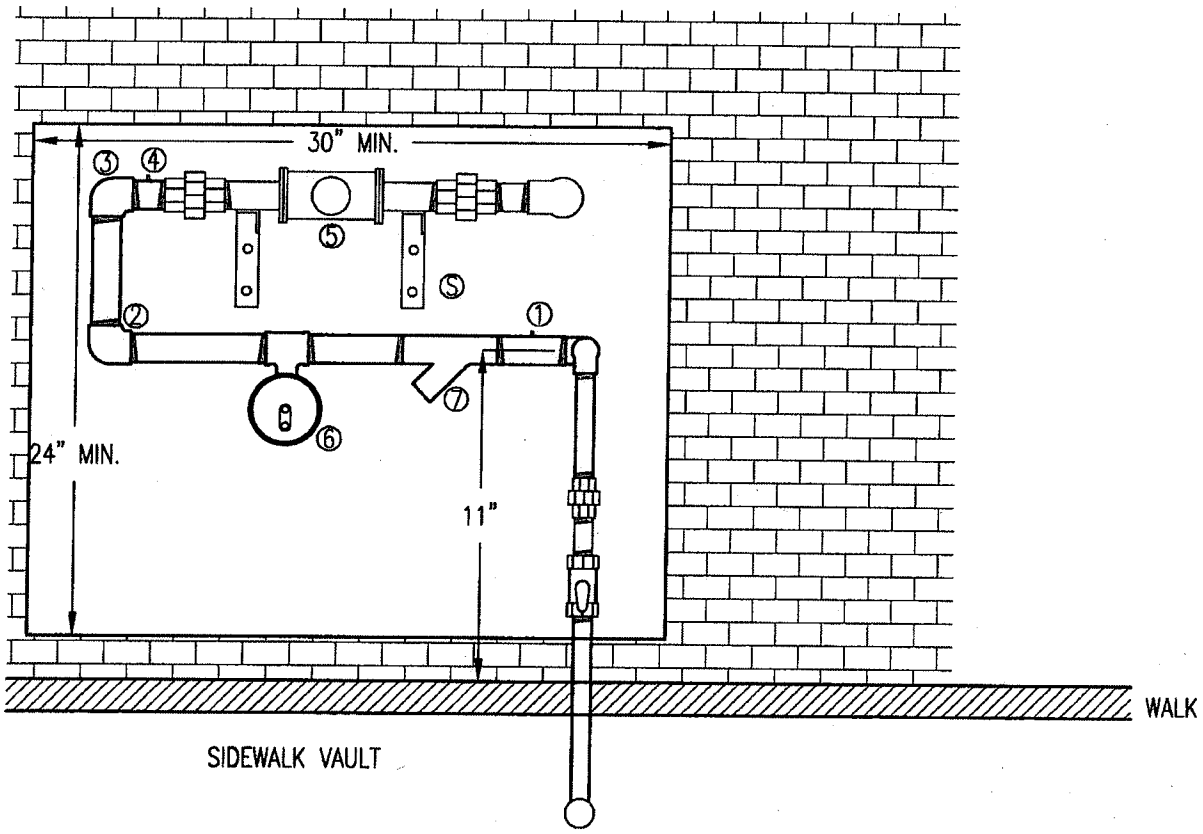
ROOTS METER INSTALLATION		G–12
REVIEWED/APPROVED 3/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



MATERIALS LIST

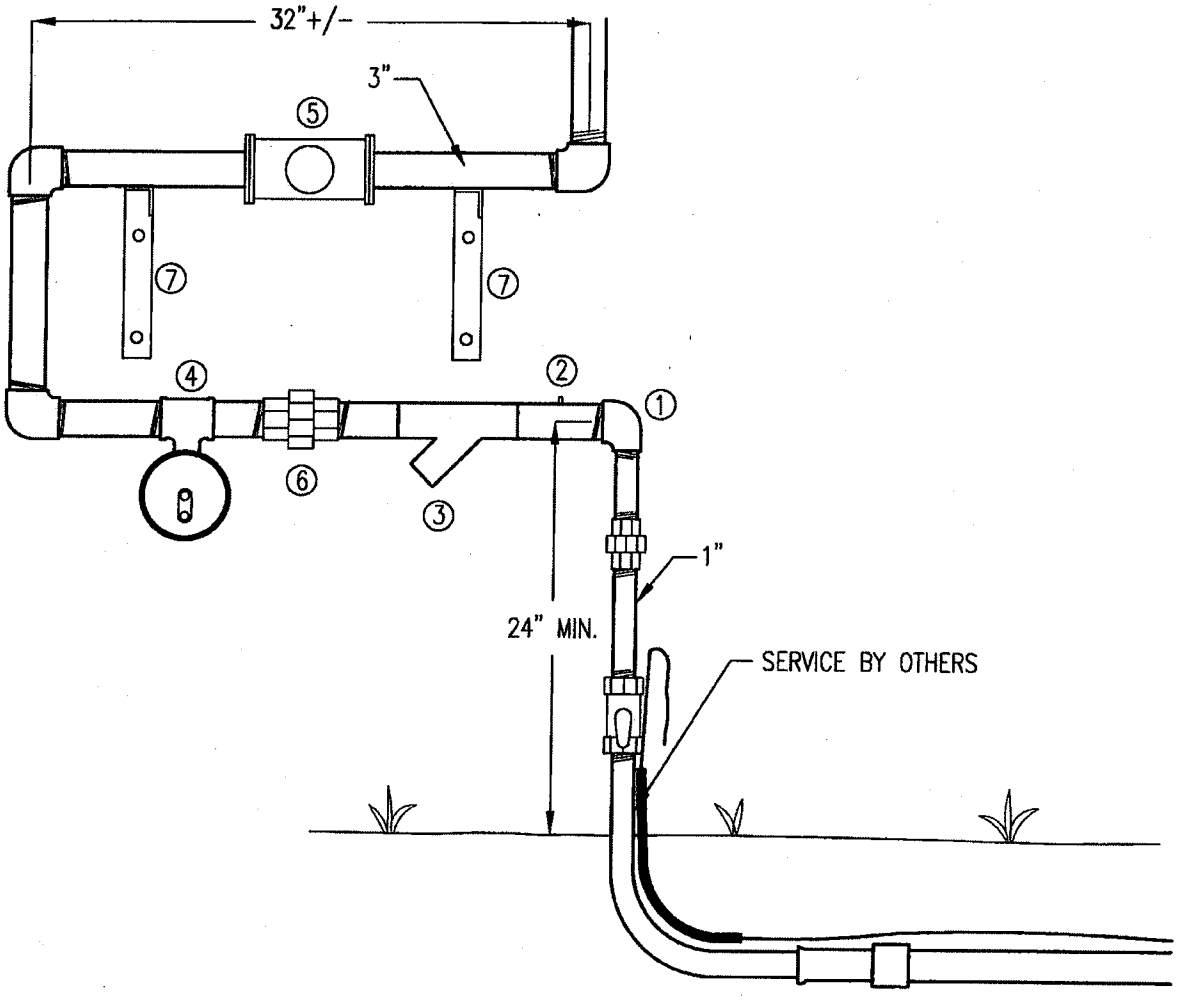
1. 1-1/4" x 3" NIPPLE W/ TEST PLUG
2. 1-1/4" x 1/1/2" RED. EL.
3. 1-1/2" EL.
4. 1-1/2" x 3" NIPPLE W/ TEST PLUG
5. 15C ROOTS METER
6. B-31-R WITH 3/16" ORF. REG.
7. 1-1/4" STRAINER
8. 3/4" x 1-1/4" RED. EL.
9. 1-1/2" EL.
S. ANGLE IRON SUPPORTS

TOP VIEW



FRONT VIEW

15C ROOTS COMPACT METER INSTALLATION		G-12A
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

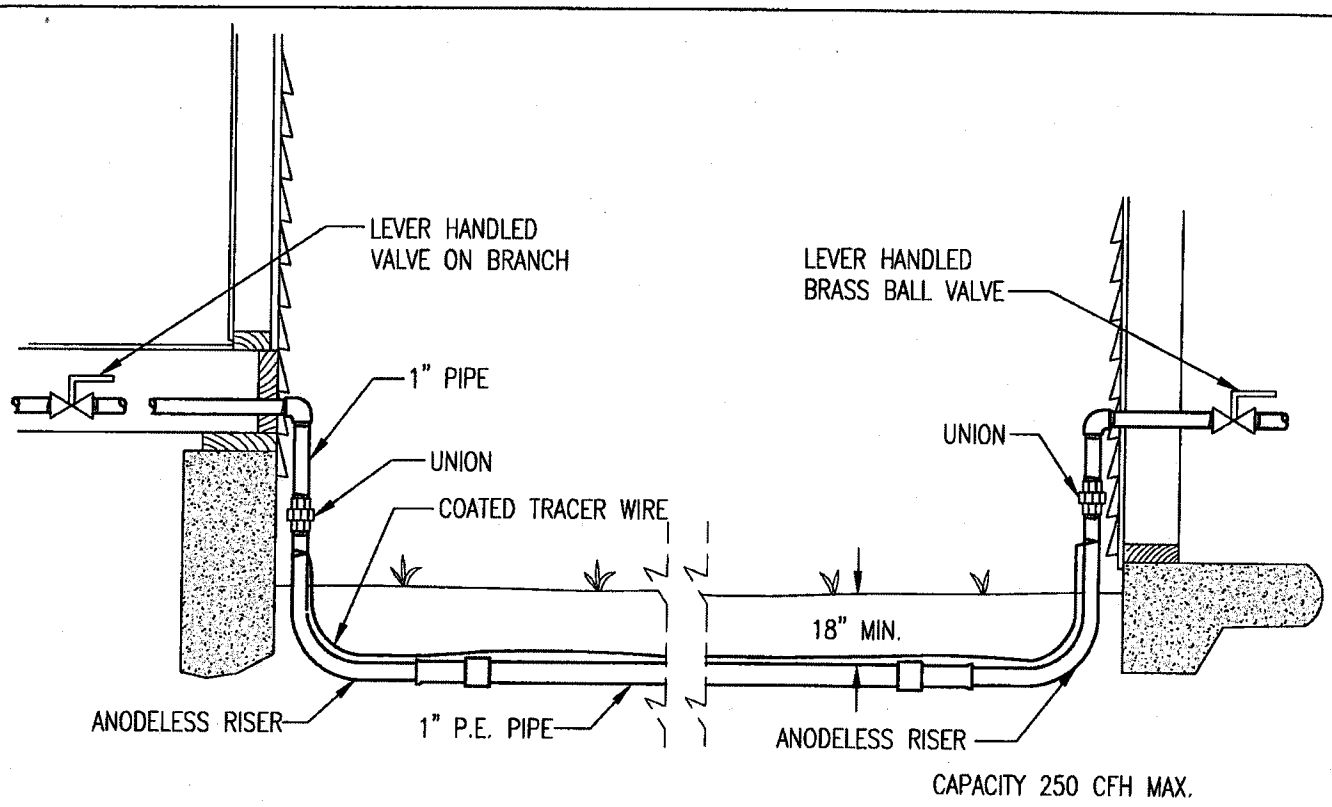


MATERIALS LIST

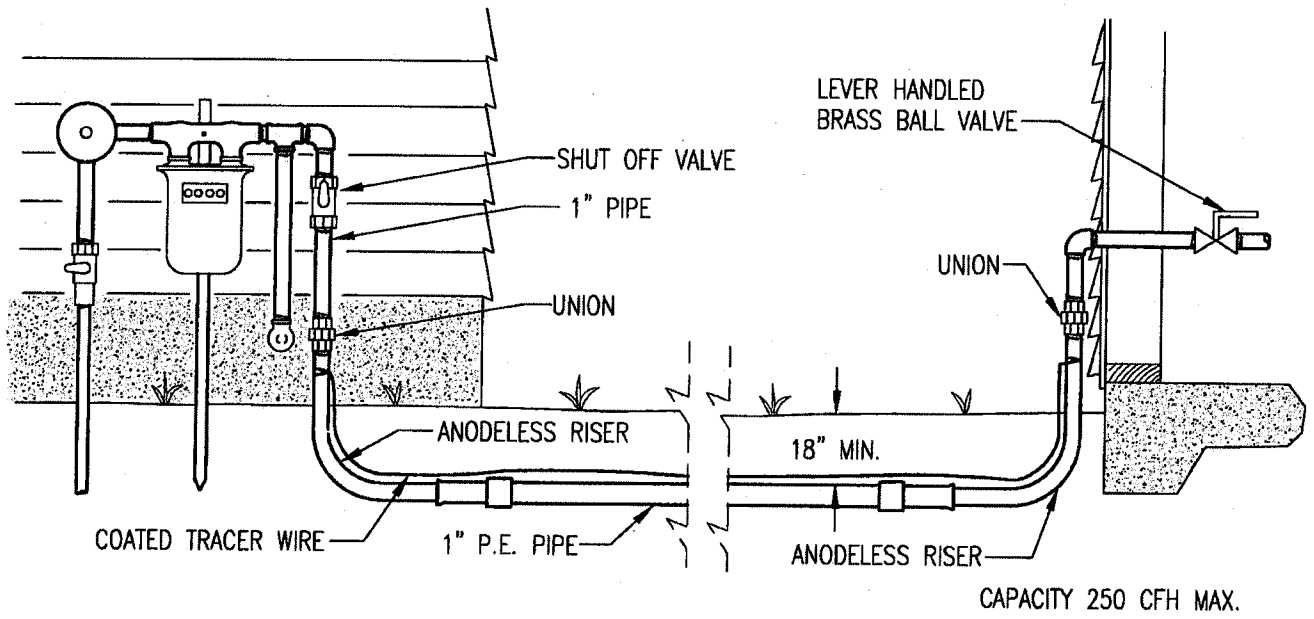
1. 1" x 2" STREET EL
2. TEST POINTS (D)
3. 2" STRAINER (D)
4. FISHER S202 – 2" – W/ 3/8" ORIFICE REGULATOR (D)
5. 5 M ROOTS METER – 3" FLANGE CONN. (D)
6. 2" UNION
7. ANGLE IRON BRACKETS (D)

(D) INDICATES TO BE FURNISHED BY DEPARTMENT

5 M ROOTS COMPACT METER INSTALLATION		G-12B
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



STANDARD TYPICAL GAS FUEL LINE TO OUT BUILDING



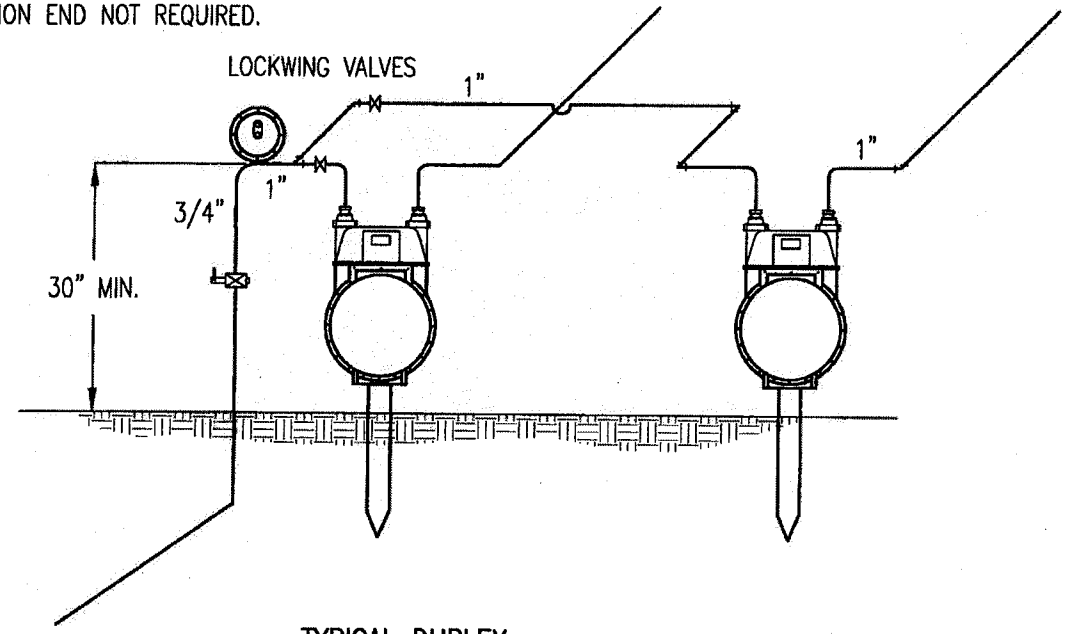
NON-STANDARD GAS FUEL LINE TO OUT BUILDING

- ONLY WITH PERMISSION OF ENGINEER
- REGISTERED LETTER MUST BE SENT TO CUSTOMER

UNDERGROUND GAS FUEL LINE PIPING – PAST METER		G-13
REVIEWED/APPROVED 3/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

SEE SPEC. SECTION 14
FOR INSIDE SHUTOFF REQUIRED

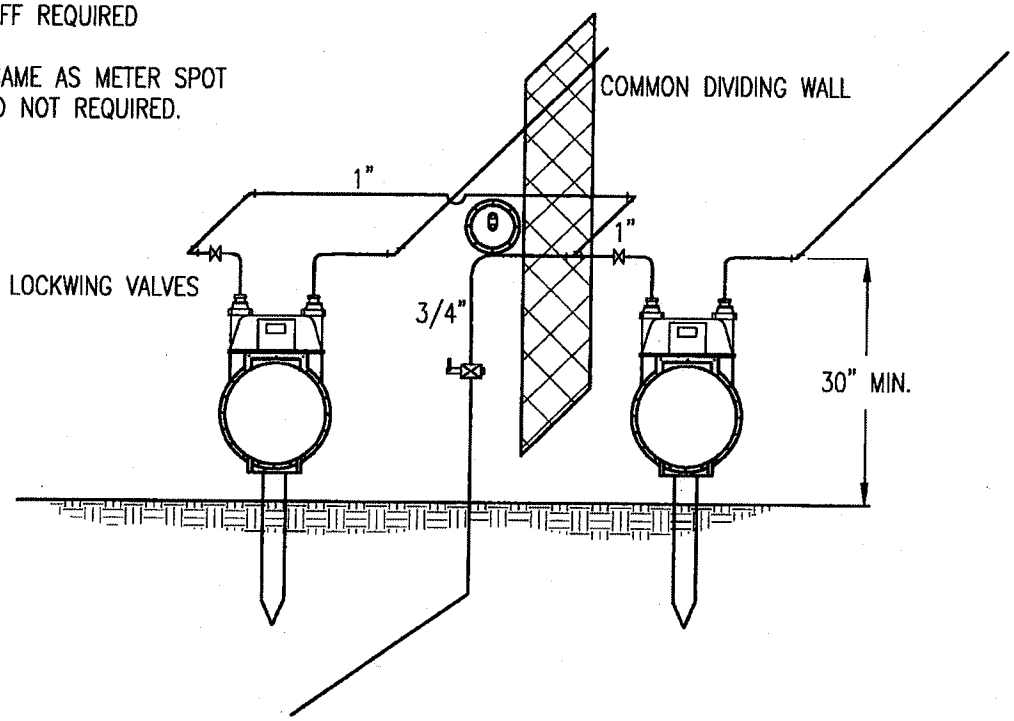
LOCKWING VALVE SAME AS METER SPOT
EXCEPT UNION END NOT REQUIRED.



TYPICAL DUPLEX

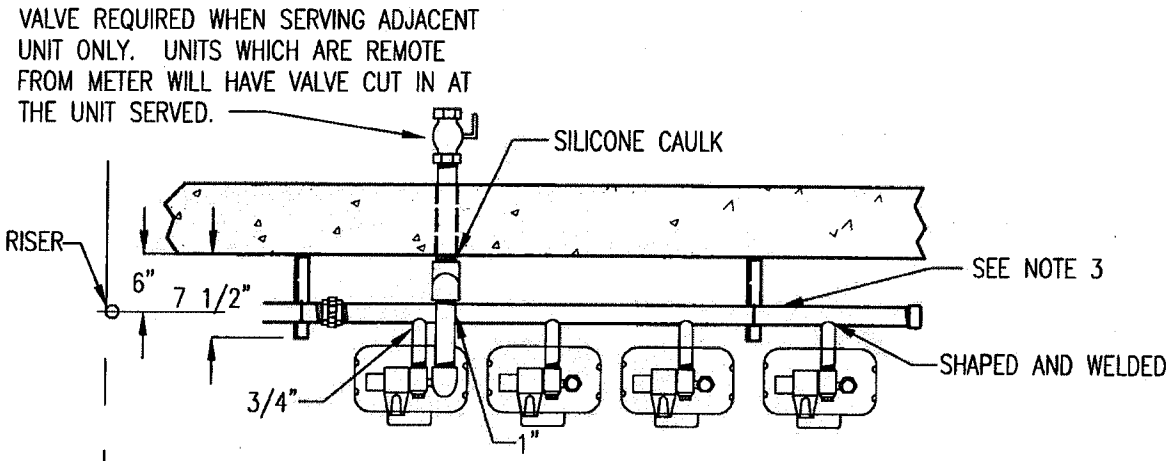
SEE SPEC. SECTION 14
FOR INSIDE SHUTOFF REQUIRED

LOCKWING VALVE SAME AS METER SPOT
EXCEPT UNION END NOT REQUIRED.



SIDE-BY-SIDE DUPLEX
(IF METERS CAN BE AT DIVIDING WALL)

DUPLEX METER CONNECTION		G-14
REVIEWED/APPROVED 3/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

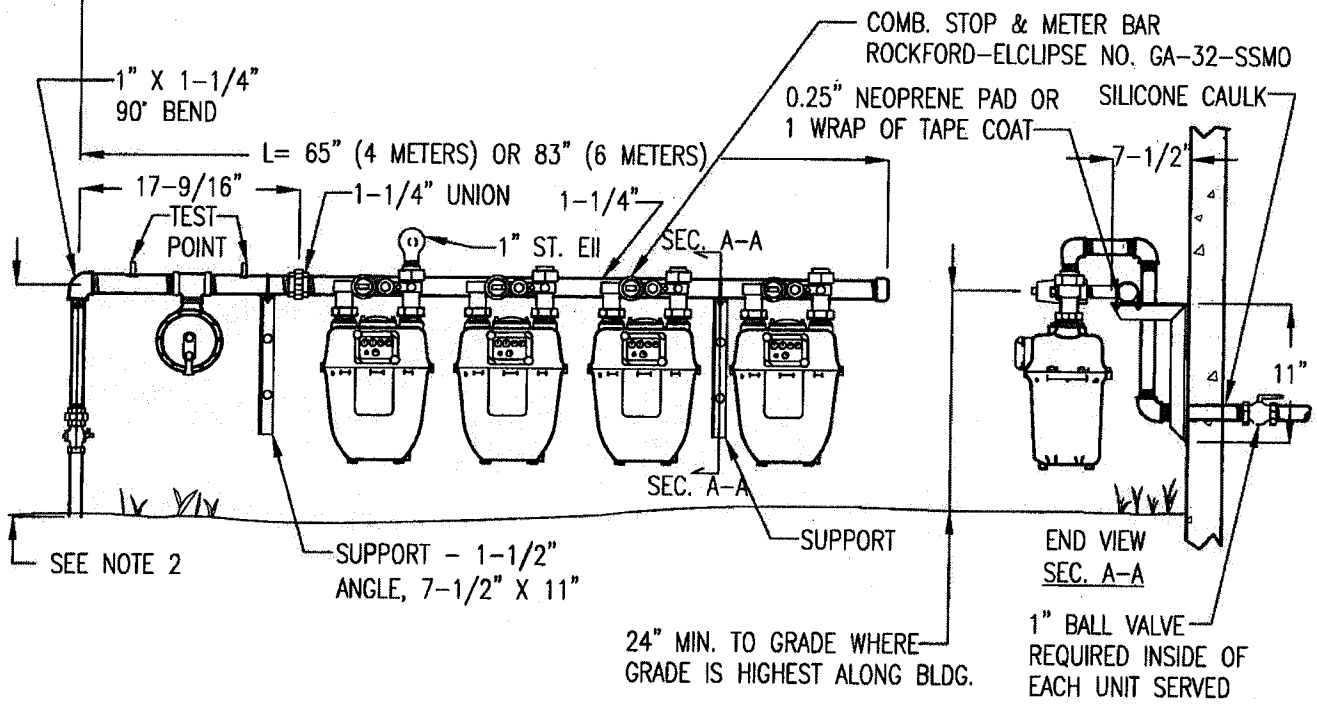


NOTES:

1. 6 METER SET REQUIRES 4 ANGLE SUPPORTS.
2. HEIGHT IS DETERMINED BY ANY METER NOT BEING CLOSER THAN 6" OFF GRADE. MANIFOLD SHALL BE HORIZONTAL.
3. 1-1/4" MANIFOLD BY DEPT. OR MANUFACTURER.
4. DEPT. TO ATTACH BRASS TAG W/NUMBER OF UNIT SERVICED TO EACH METER BAR.

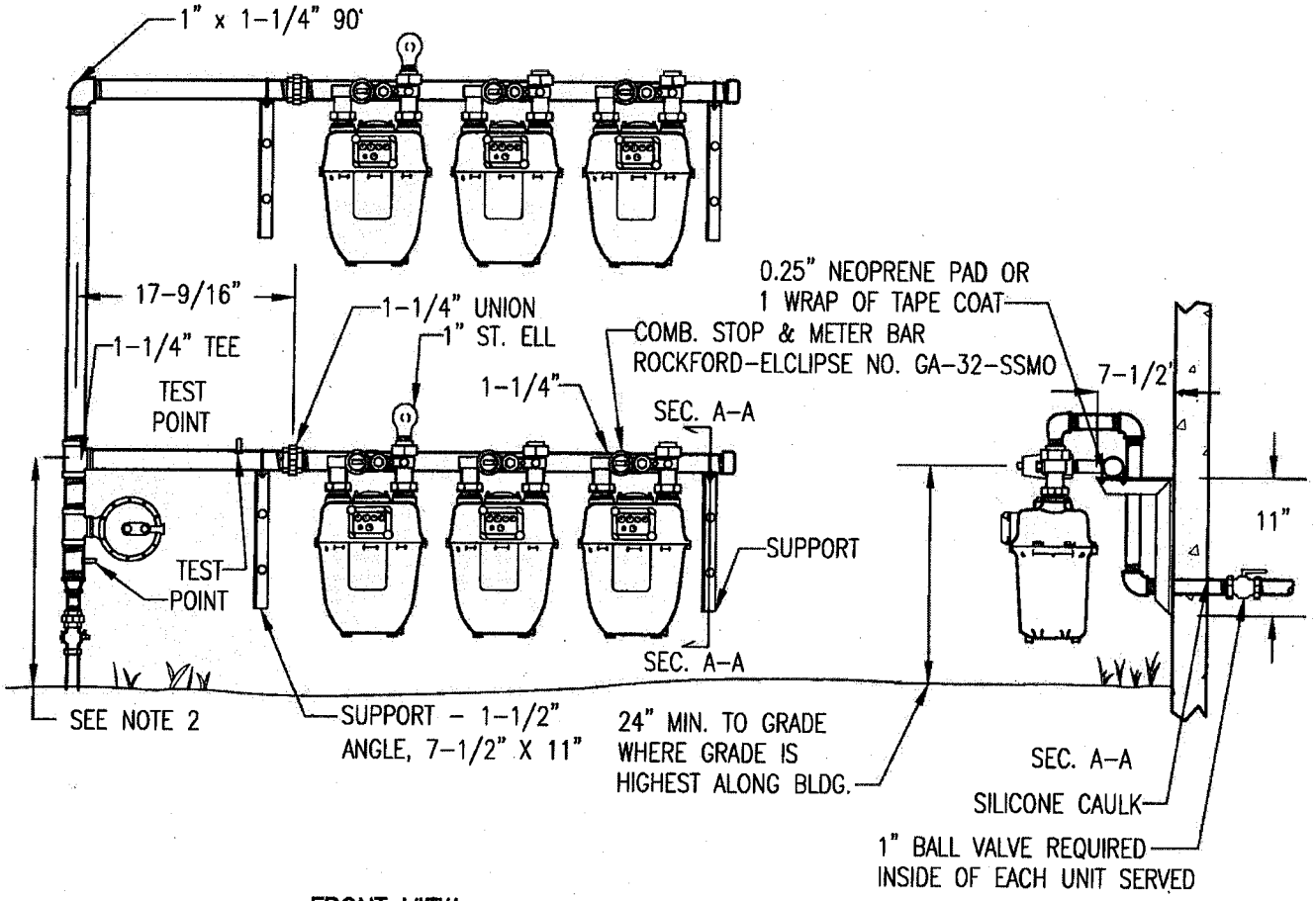
TOP VIEW

3 OR MORE RESIDENTIAL METERS



FRONT VIEW

TYPICAL MULTI-METER INSTALLATION		G-14A
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



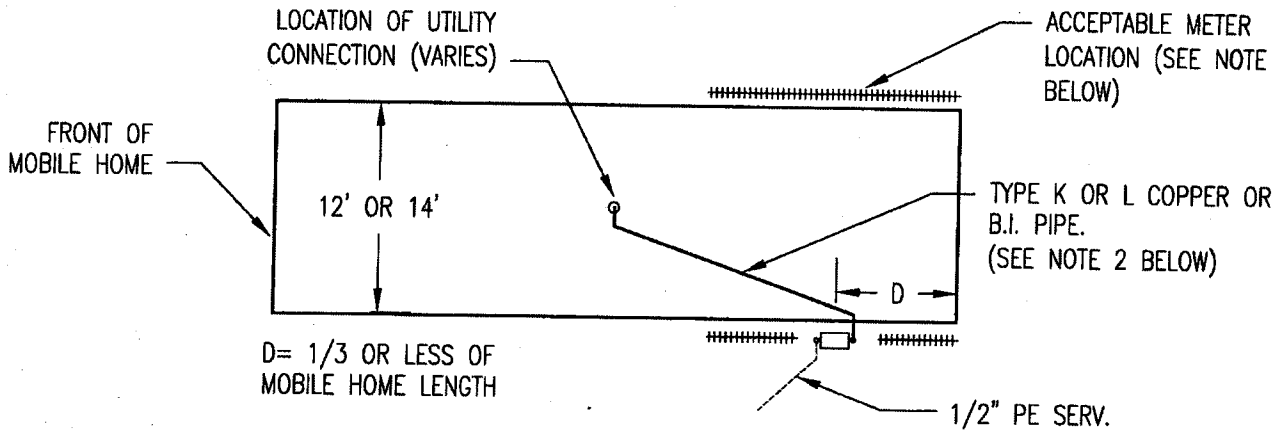
FRONT VIEW

END VIEW

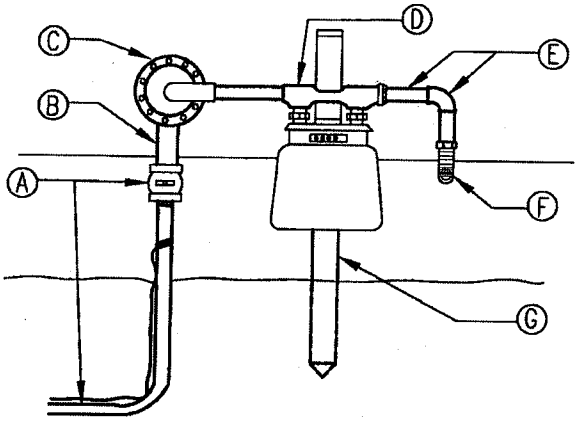
NOTES

1. 6 METER SET REQUIRES 4 ANGLE SUPPORTS.
2. HEIGHT IS DETERMINED BY ANY METER NOT BEING CLOSER THAN 6" OFF GRADE. MANIFOLD SHALL BE HORIZONTAL.
3. 1-1/4" MANIFOLD BY DEPT. OR MANUFACTURER.
4. DEPT. TO ATTACH BRASS TAG W/NUMBER OF UNIT SERVICED TO EACH METER BAR.

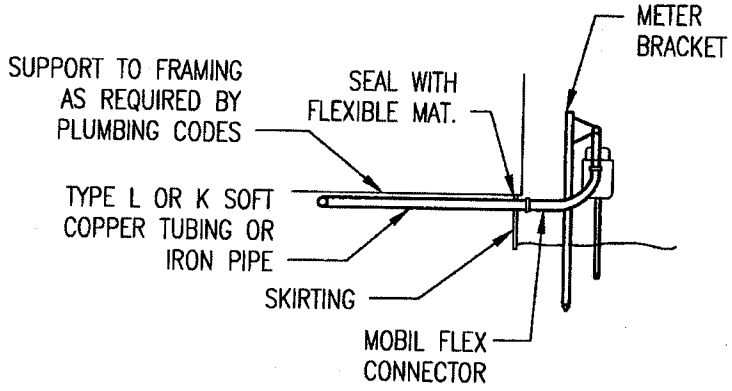
TYPICAL MULTI-METER INSTALLATION - 6 RESIDENTIAL METERS		G-14B
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



MOBILE HOME UTILITY CONNECTION



METER SET – FRONT VIEW N.T.S.



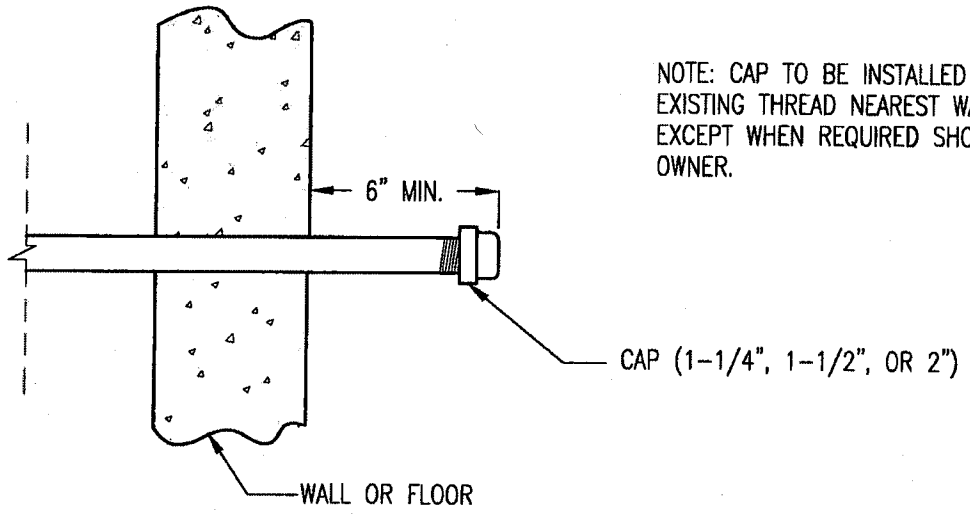
MOBILE HOME ENTRANCE – SIDE VIEW N.T.S.

A. RISER & METER STOP (TO BE INSTALLED BY OTHERS)
B. 3/4" NIPPLE
C. REGULATOR – 252 (TO BE FURNISHED BY DEPT.)
D. METER BAR (TO BE FURNISHED BY DEPT.)
E. 1" NIPPLE W/ 1" X 3/4" REDUCING ELL
F. MOBILE FLEX CONNECTOR
G. METER BRACKET (TO BE FURNISHED BY DEPT.)

SPECIFICATIONS:

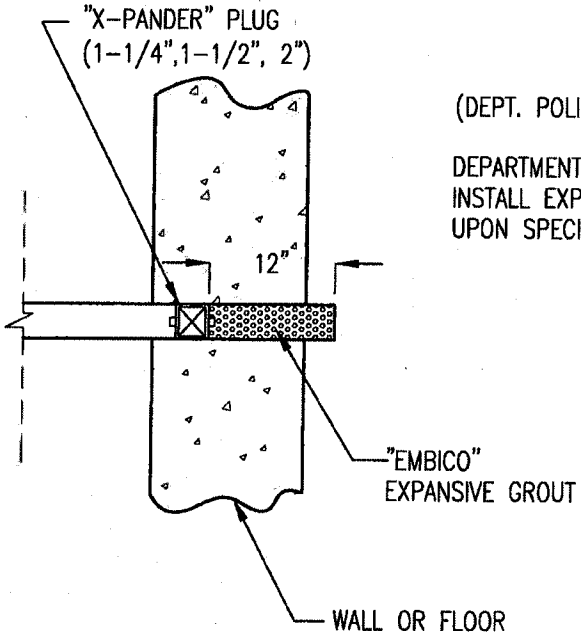
1. METER LOCATION SHALL BE ALONG THE SIDE AND WITHIN THE REAR 1/3 OF LENGTH.
2. ALL HEATING ACCOUNTS TO HAVE NOT LESS THAN 3/4" COPPER LINE WITH FLARED FITTINGS OR 3/4" B.I. PIPE THREADED FROM METER TO POINT WHERE PRESENT LINE ENTERS FLOOR FROM UNDERNEATH. NON-HEATING ACCOUNTS TO HAVE NOT LESS THAN 5/8" COPPER OR 1/2" B.I. PIPE BETWEEN ABOVE MENTIONED POINTS.
3. ANY EXISTING PIPING WHICH MEETS THE ABOVE REQUIREMENTS MAY BE UTILIZED IN MAKING THE CONNECTION.
4. EXISTING AND NEW PIPING DOWNSTREAM FROM FLEXIBLE CONNECTOR SHALL BE PRESSURE TESTED AT 10 PSI BEFORE SETTING METER.

MOBILE HOME GAS METER CONNECTION		G-15
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTE: CAP TO BE INSTALLED AT LAST EXISTING THREAD NEAREST WALL OR FLOOR EXCEPT WHEN REQUIRED SHORTER BY OWNER.

STANDARD METHOD



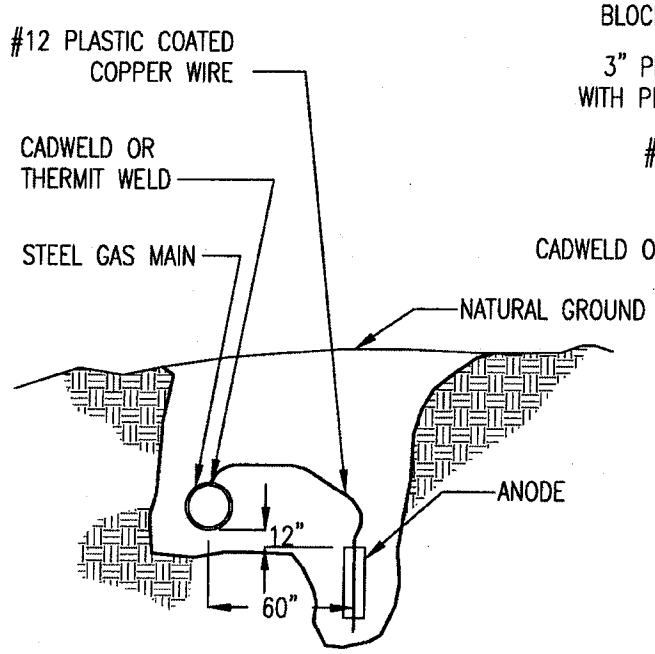
(DEPT. POLICY I-54)

DEPARTMENT WILL CUT PIPE OFF CLOSE AS POSSIBLE AND INSTALL EXPANDING RUBBER PLUG AND EXPANSIVE GROUT ONLY UPON SPECIFIC REQUEST BY OWNER.

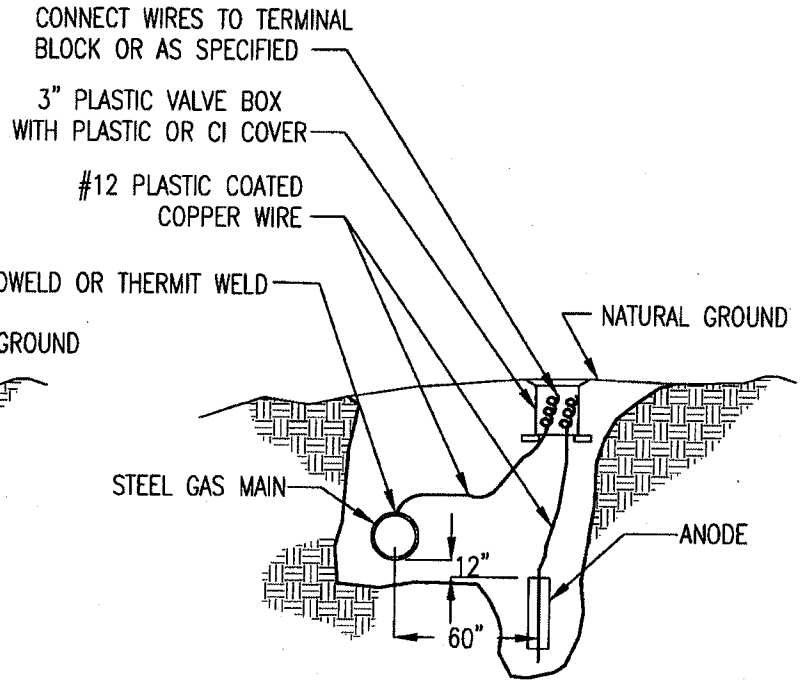
(STREET MAIN MUST BE INACTIVE)

SPECIAL METHOD

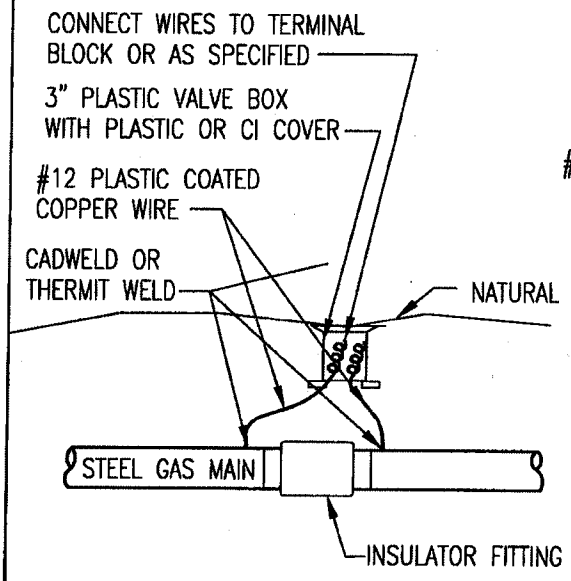
SEALING UNUSED LP GAS SERVICES		G-16
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



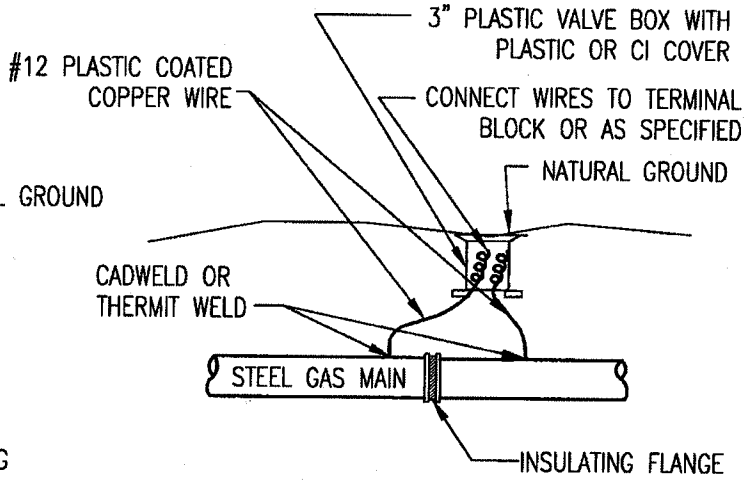
ANODE WITHOUT TEST LEADS



ANODE WITH TEST LEADS



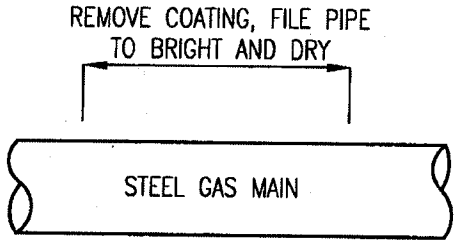
TYPICAL INSULATOR WITH TEST LEADS



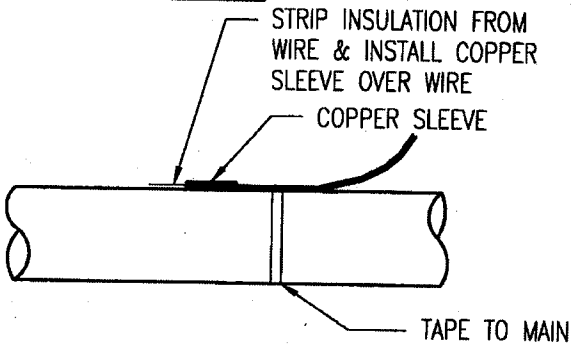
TYPICAL INSULATING FLANGE WITH TEST LEADS

CATHODIC PROTECTION		G-17
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

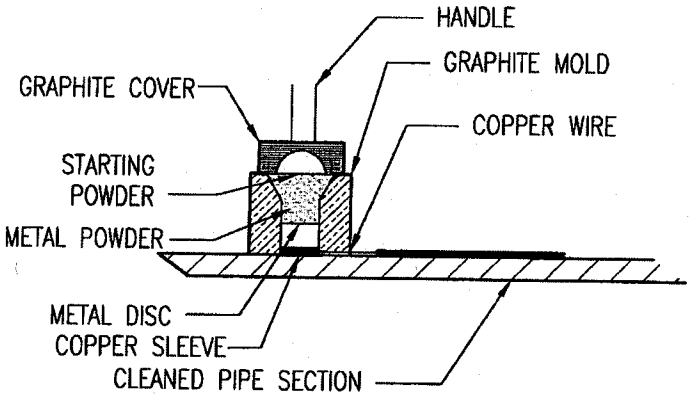
STEP 1



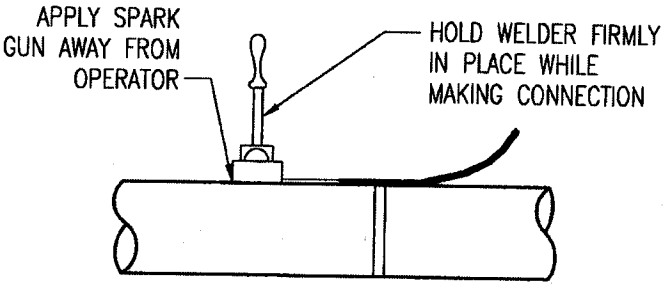
STEP 2



STEP 3



STEP 4

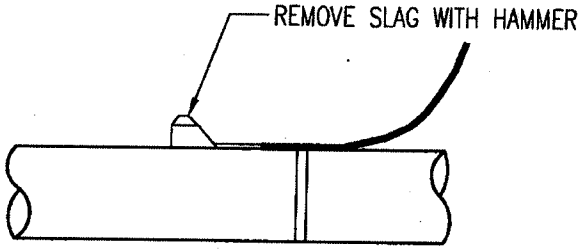


PROCEDURES

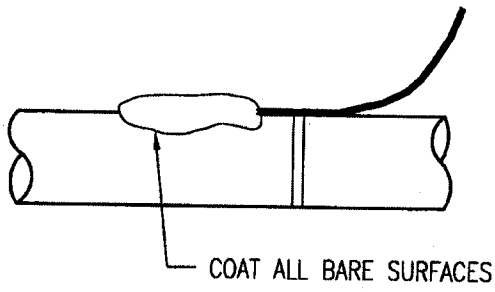
1. PREPARE GRAPHITE MOLD AS SHOWN IN DETAIL.
   - A. PLACE METAL DISC
   - B. PLACE METAL POWER
   - C. FILL WITH STARTING POWDER
   - D. PLACE GRAPHITE COVER
2. PLACE GRAPHITE MOLD ON PIPE

MAXIMUM SIZE CHARGE TO BE USED SHALL BE "CADWELD" CA-15.

STEP 5

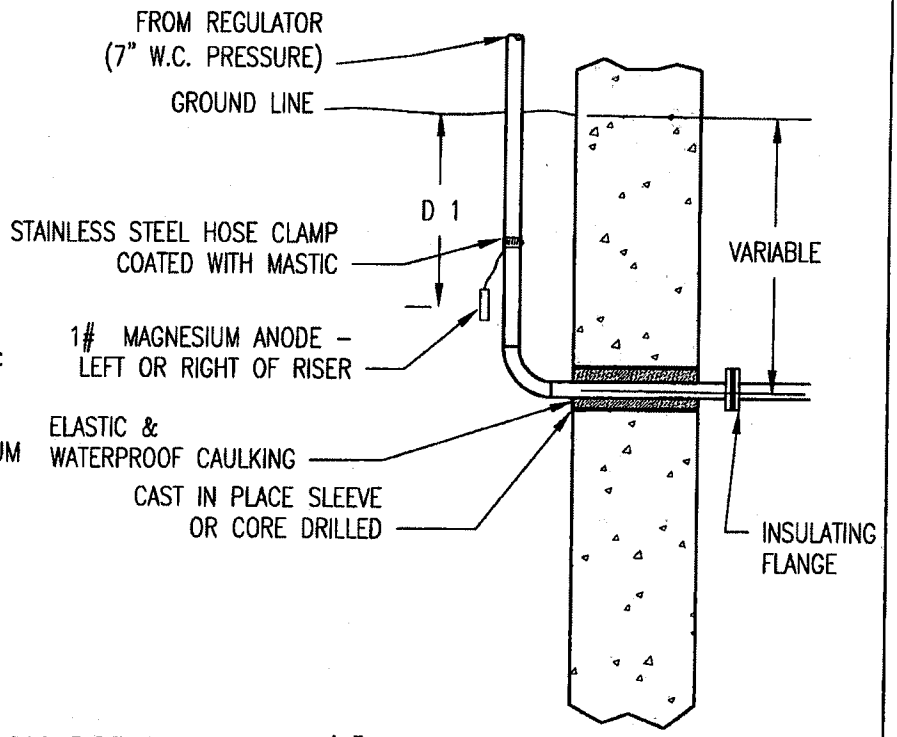


STEP 6



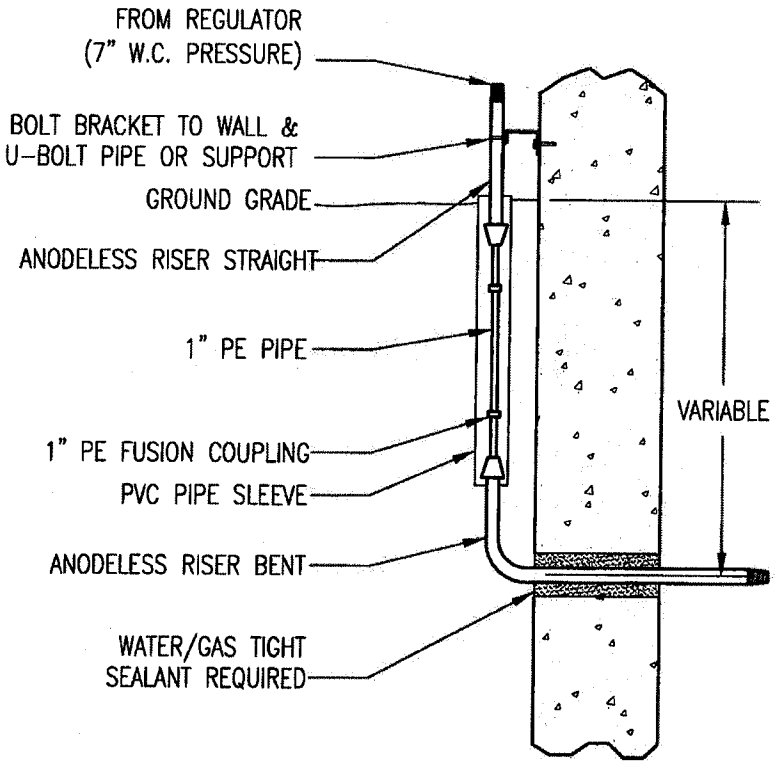
TYPICAL METHOD OF BRAZED CONNECTION TO PIPE		G-18
REVIEWED/APPROVED 10/13/10	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

NOTES:
1. ABOVE GRADE ENTRY IS REQUIRED GENERALLY, BELOW GRADE WILL BE PERMITTED ONLY BY SPECIAL EXCEPTION.
2. PIPE SHALL BE AT LEAST STANDARD WEIGHT STEEL, CONFORMING TO A53 OR API 5L, WELDED, COATED, & WRAPPED ACCORDING TO SPEC. SECTION 25.
3. GAS PIPE THROUGH WALL SHALL BE IN SLEEVE OR CORE DRILLED HOLE AND ANNULAR SPACE SEALED WITH ELASTIC & WATERPROOF CAULKING. CEMENT CAULK NOT PERMITTED.
4. ANODE DEPTH (D 1) SHALL BE A MINIMUM OF 2' OR BELOW MID DEPTH OF RISER, WHICHEVER IS DEEPER.



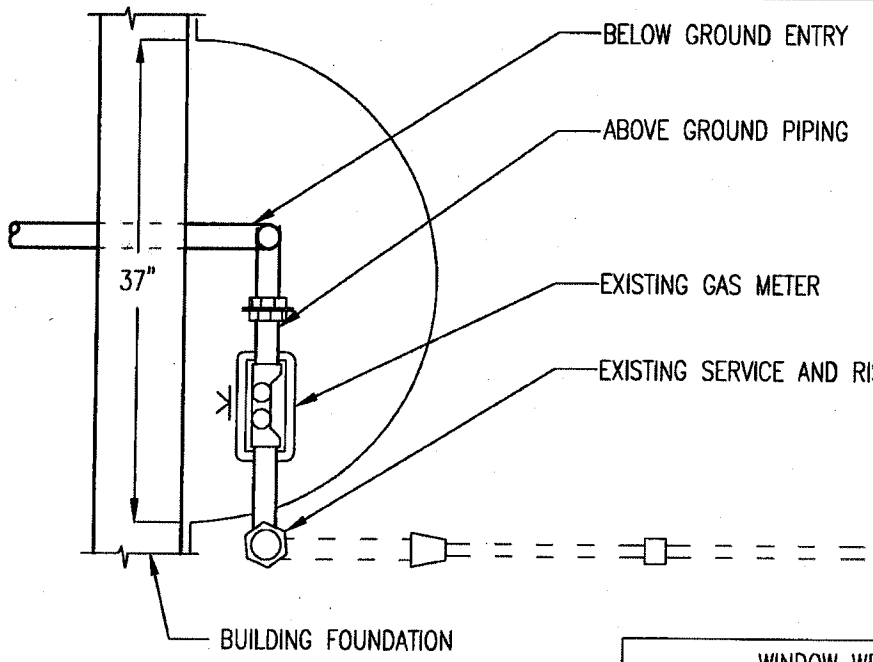
BELOW GRADE GAS PIPE ENTRY - 2 1/2" & LARGER

NOTES
1. ABOVE GRADE ENTRY IS REQUIRED GENERALLY, BELOW GRADE WILL BE PERMITTED ONLY BY SPECIAL EXCEPTION.
2. PE COUPLING SHALL BE FUSED ONLY BY CERTIFIED FUSORS - DEPT. STANDARD SPECIFICATION SEC. 25.



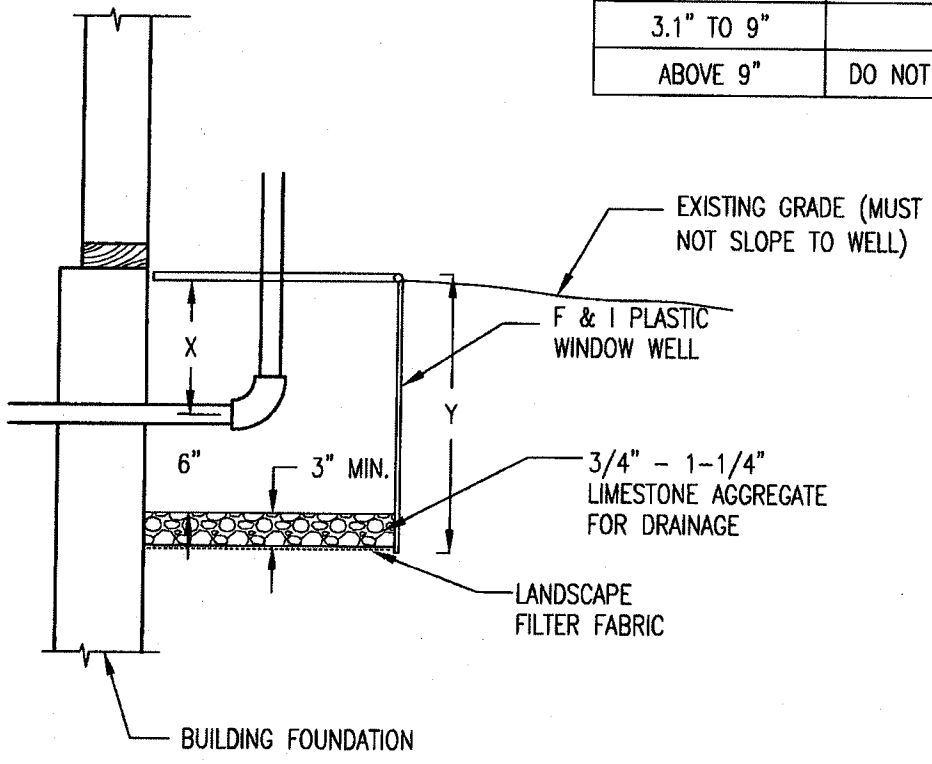
BELOW GRADE GAS PIPE ENTRY - 1" & 2"

GAS PIPING BUILDING ENTRY, BELOW GRADE		G-22
REVIEWED/APPROVED 3/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



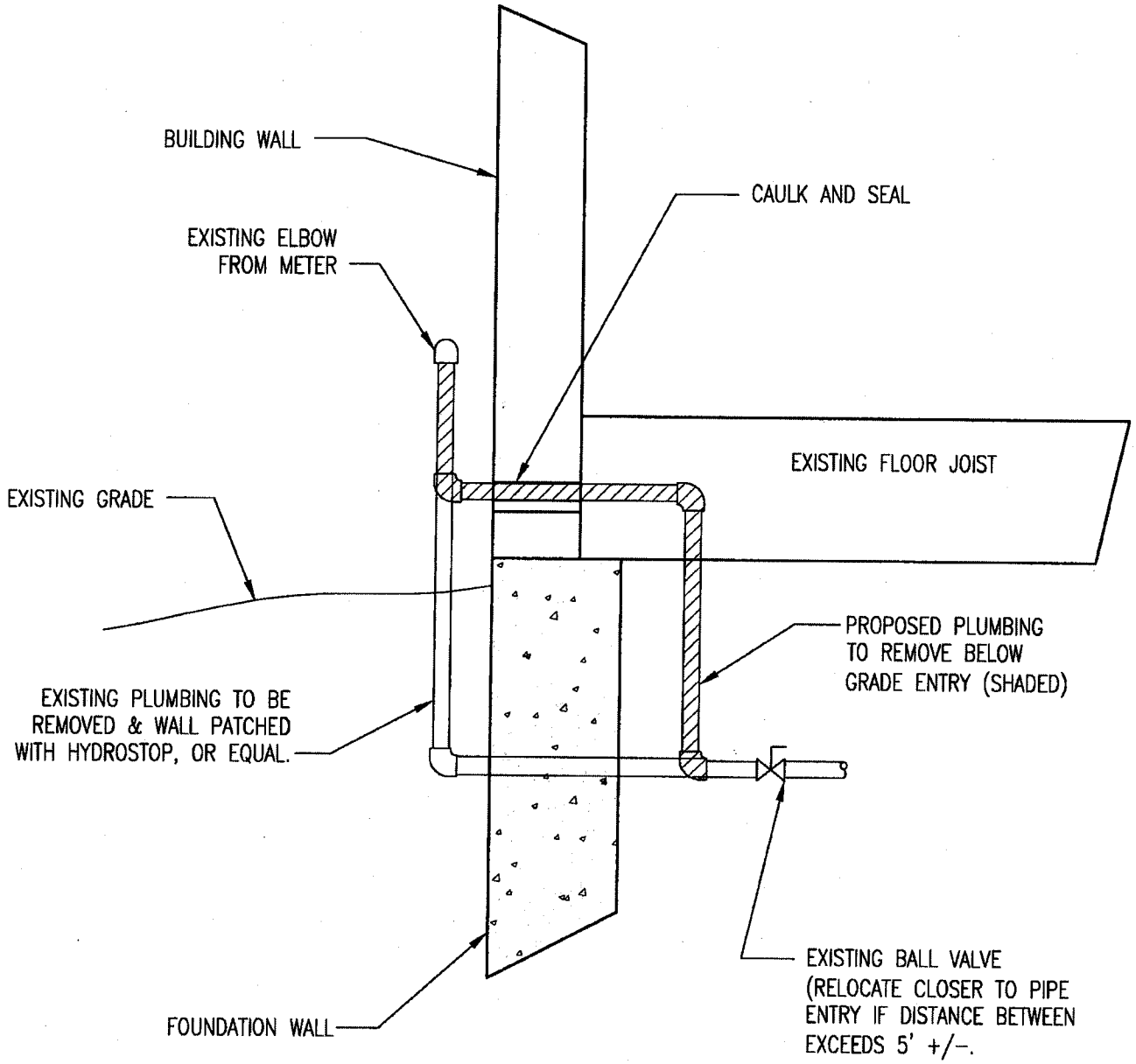
PLAN VIEW

WINDOW WELL SIZING CHART	
IF X IS...	Y=
3" OR LESS	12"
3.1" TO 9"	18"
ABOVE 9"	DO NOT USE WINDOW WELL

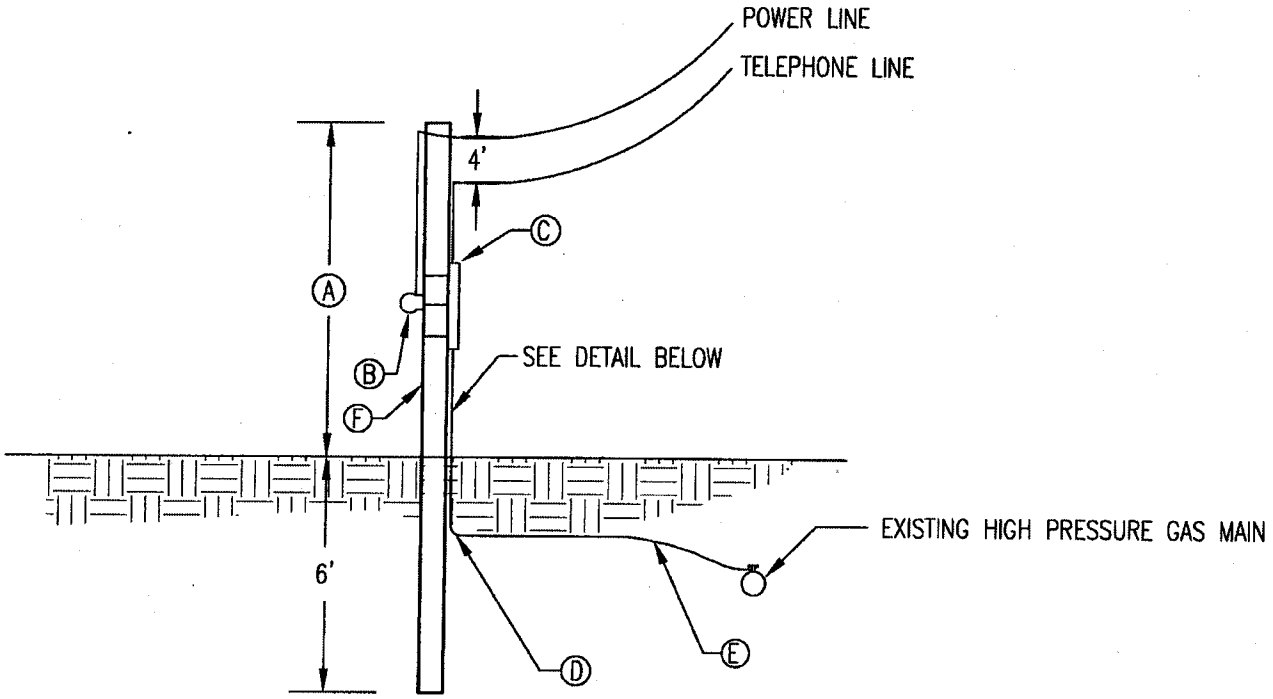


SIDE VIEW

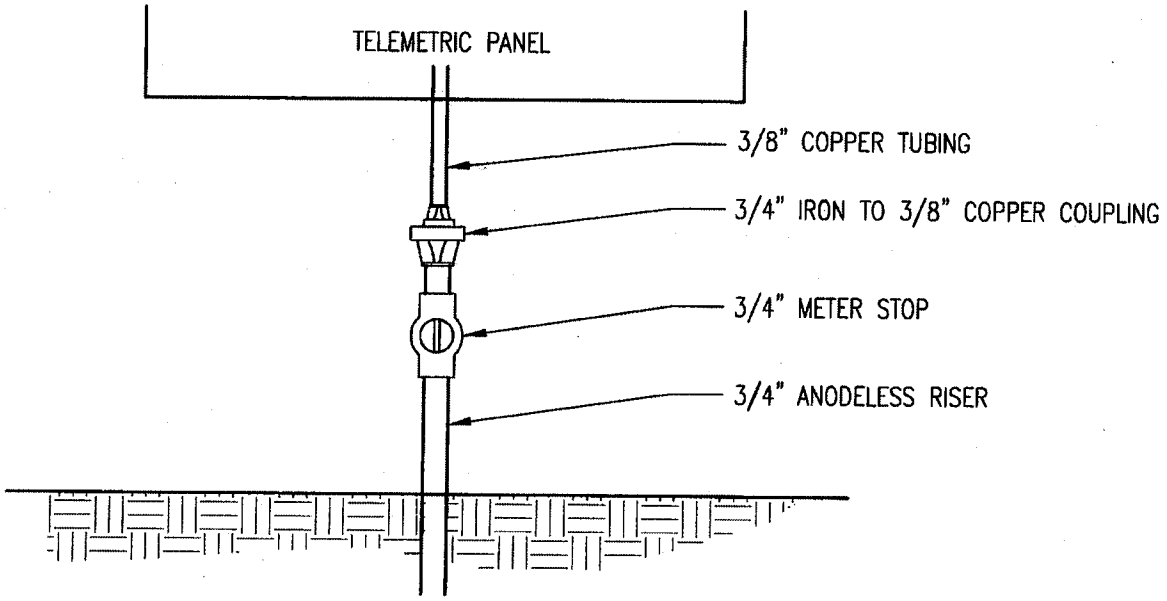
TYPICAL WELL FOR BELOW GRADE GAS PIPE ENTRY		G-23
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



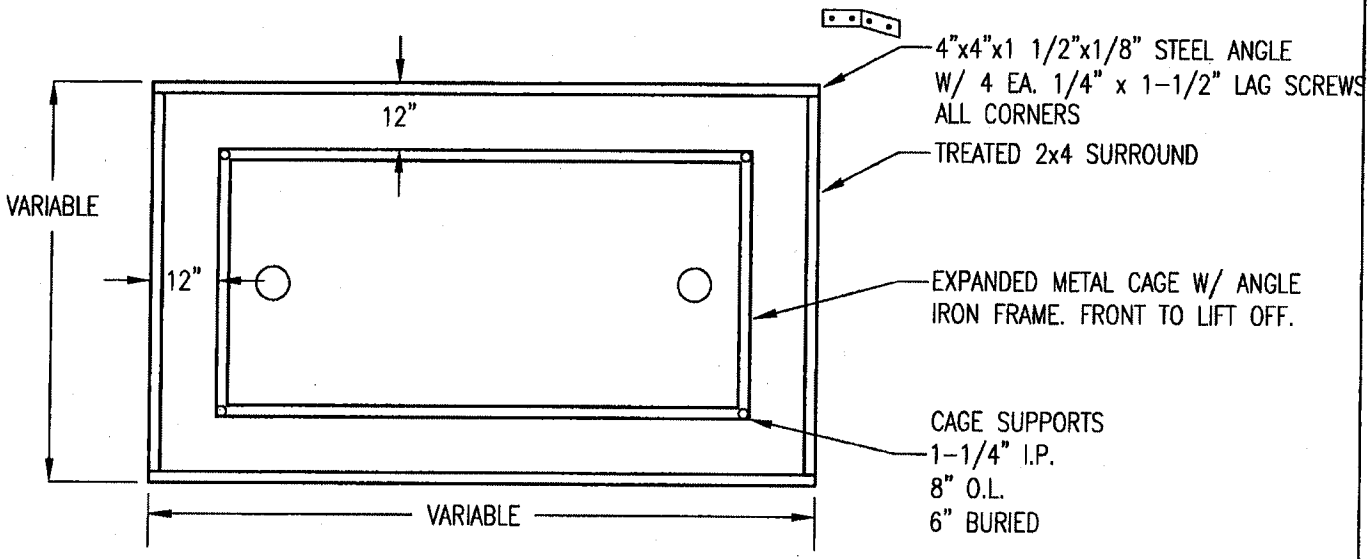
TYPICAL GAS PIPING REVISION		G-24
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



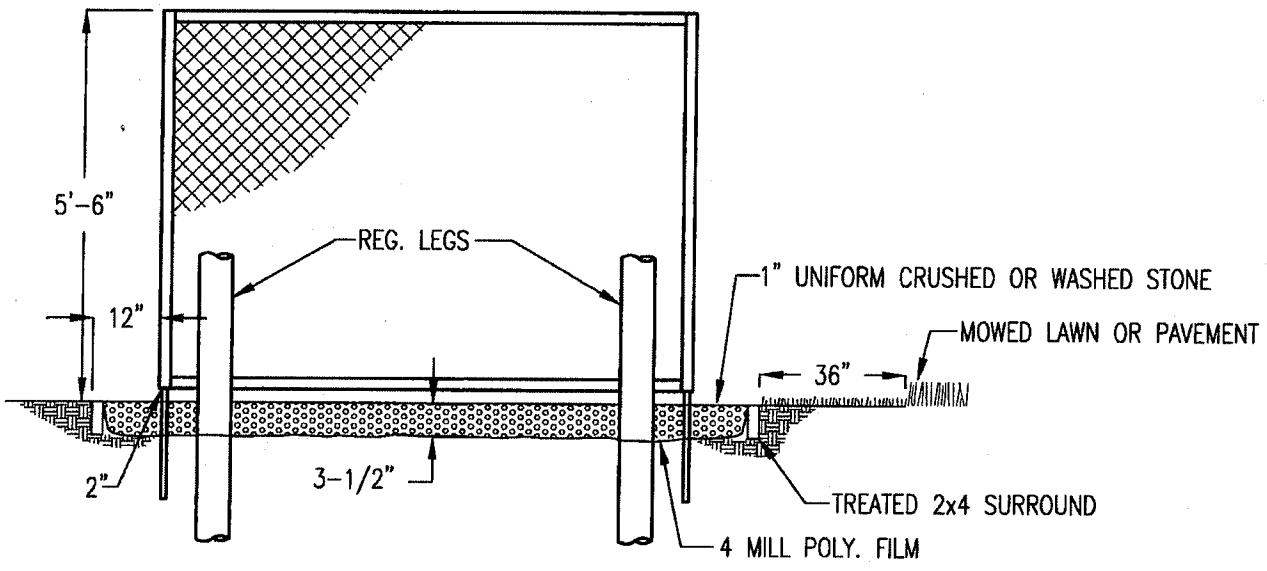
A. 22' MIN. FOR STREET X-ING OR 18' MIN. OTHERWISE
B. ELECTRIC METER
C. TELEMETRIC PANEL (6' MAX. TO TOP)
D. 3/4" ANODELESS RISER
E. 1/2" C.T.S. PE H.P. GAS SERVICE
F. 6" STL. POLE FOR STREET X-ING
4" STL. POLE FOR OTHER



TELEMETRIC GAS PRESSURE STATION		G-26
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

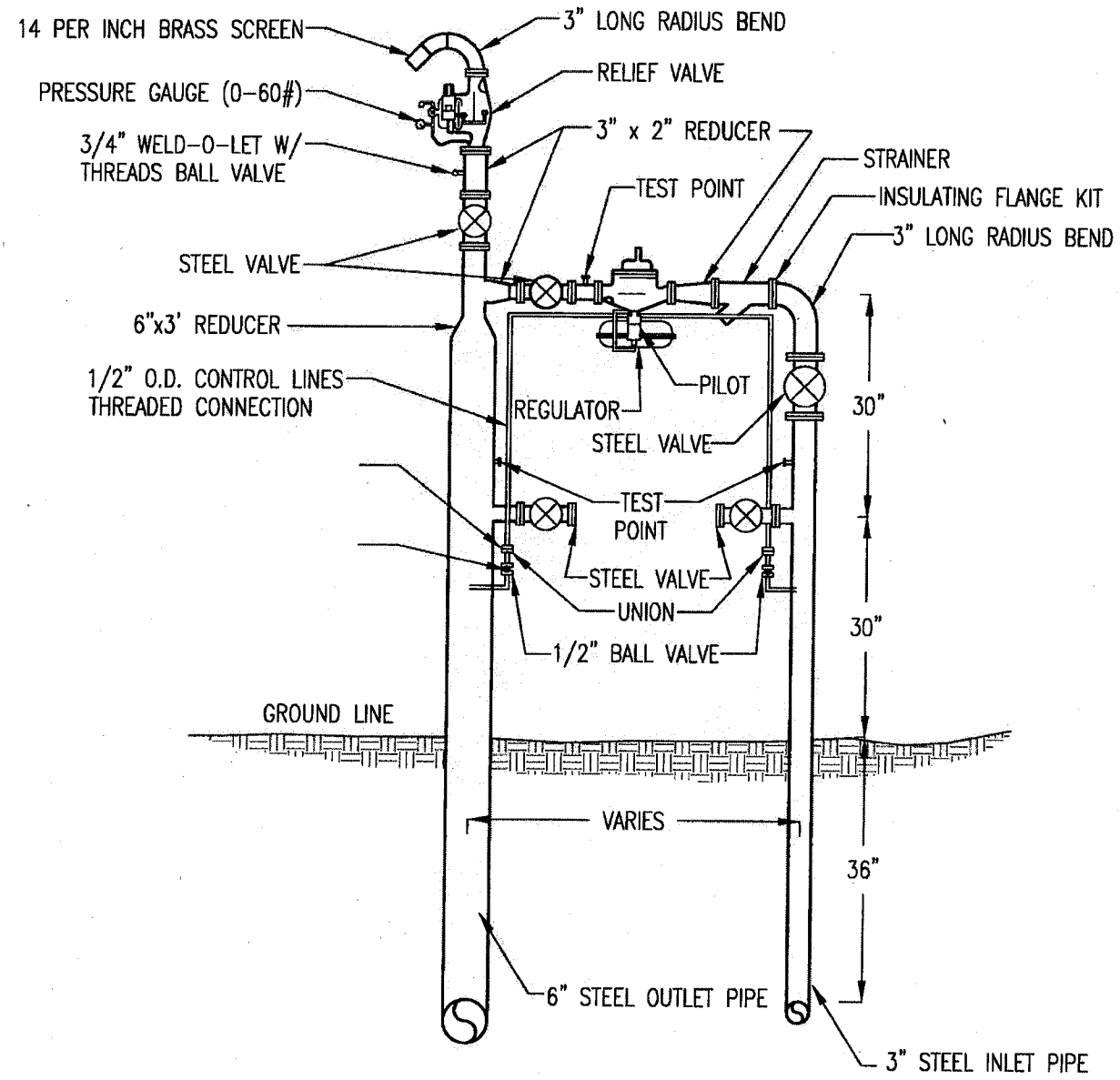


PLAN



PROFILE

TYPICAL CAGE & LANDSCAPING FOR GAS DISTRIBUTION REGULATOR		G-30
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



LOCATION:_____

INLET PIPE SIZE: 3" PRESSURE: 66 PSIG MAX.

OUTLET PIPE SIZE: 6" PRESSURE: 22 PSIG MAX.

REGULATOR: TYPE: FISHER 1098 EGR

ORIFICE: WHISPER TRIM

BYPASS: 2" WITH LOCKED GATE VALVES (OR APPROVED EQUAL VALVE)

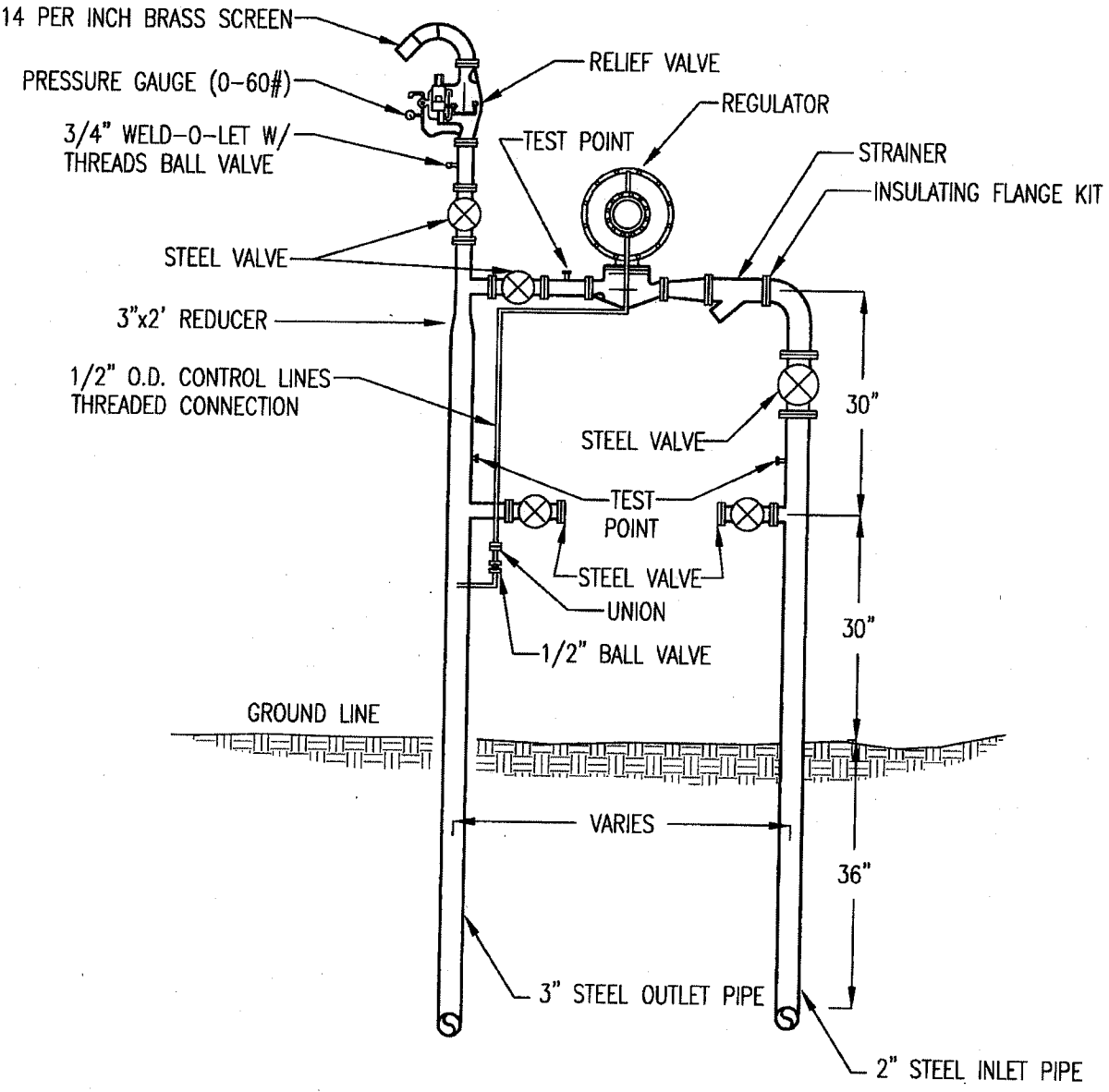
RELIEF: 3" FISHER 63 EG, SET 25 PSI

GATE VALVES: KEROTEST, FLANGED, SCOTCHCOAT, W/ LOCKING DEVICE (OR APPROVED EQUAL)

TEST POINTS: 1/2" x 1/4" WELD ON REDUCERS W/ PETES PLUGS

CONTROL LINES: 1/2" O.D. RIGID S.S. W/ SWEDGELOK FITTING

HIGH PRESSURE GAS REGULATOR INSTALLATION		G-31
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



LOCATION:_____

INLET PIPE SIZE: 2" PRESSURE: 66 PSIG MAX.

OUTLET PIPE SIZE: 3" PRESSURE: 22 PSIG MAX.

REGULATOR: TYPE: FISHER 99

ORIFICE: 7/8"

BYPASS: 2" WITH GATE VALVES (OR APPROVED EQUAL VALVE)

RELIEF: 2" FISHER 63 EG, SET 25 PSI

GATE VALVES: KEROTEST, FLANGED, SCOTCHCOAT, W/ LOCKING DEVICE (OR APPROVED EQUAL)

TEST POINTS: 1/2" x 1/4" WELD ON REDUCERS W/ PETES PLUGS

CONTROL LINES: 1/2" O.D. RIGID S.S. W/ SWEDGELOK FITTING

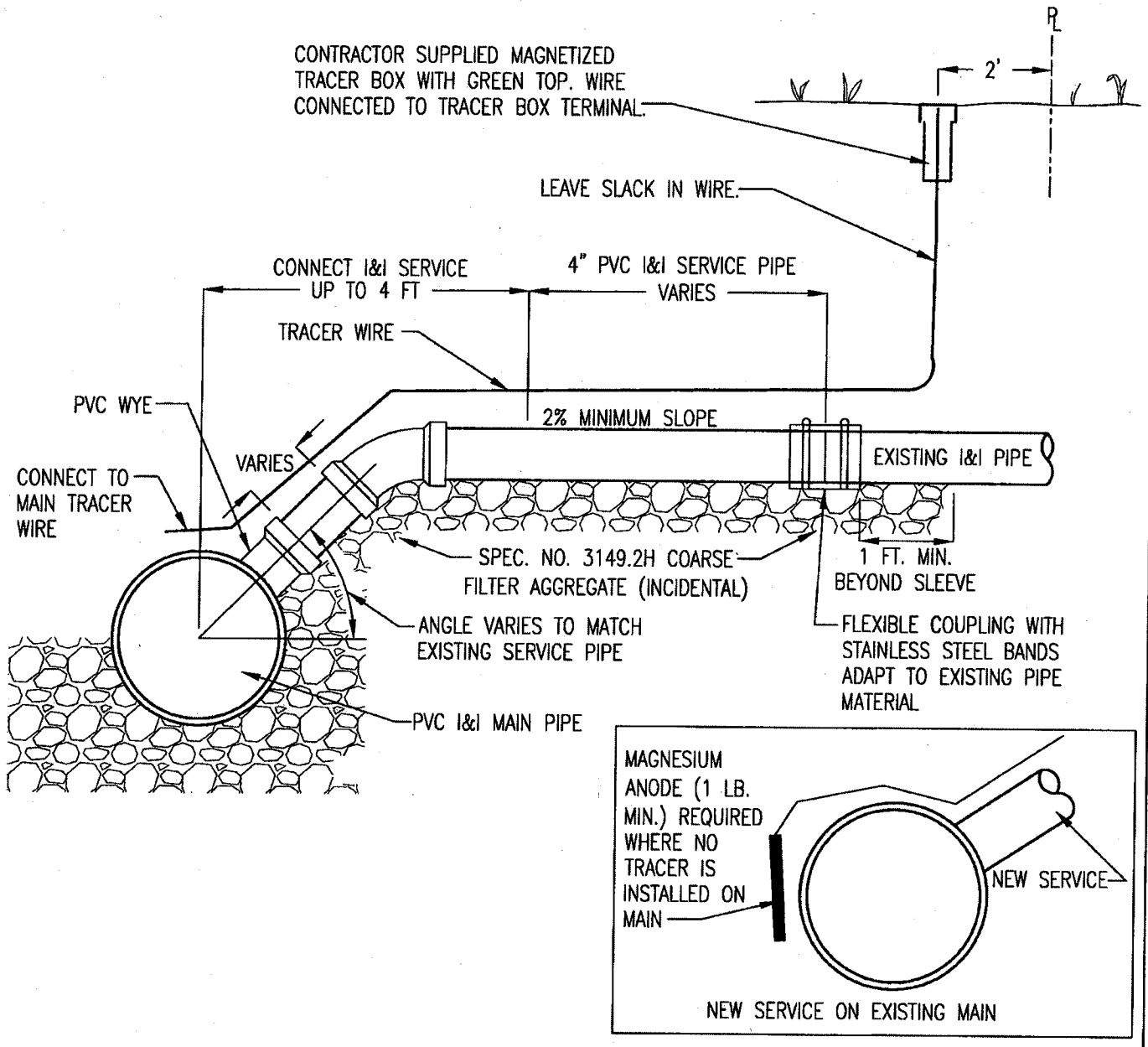
HIGH PRESSURE GAS REGULATOR INSTALLATION		G-32
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

STANDARD DETAIL DRAWINGS

I &.I DETAILS

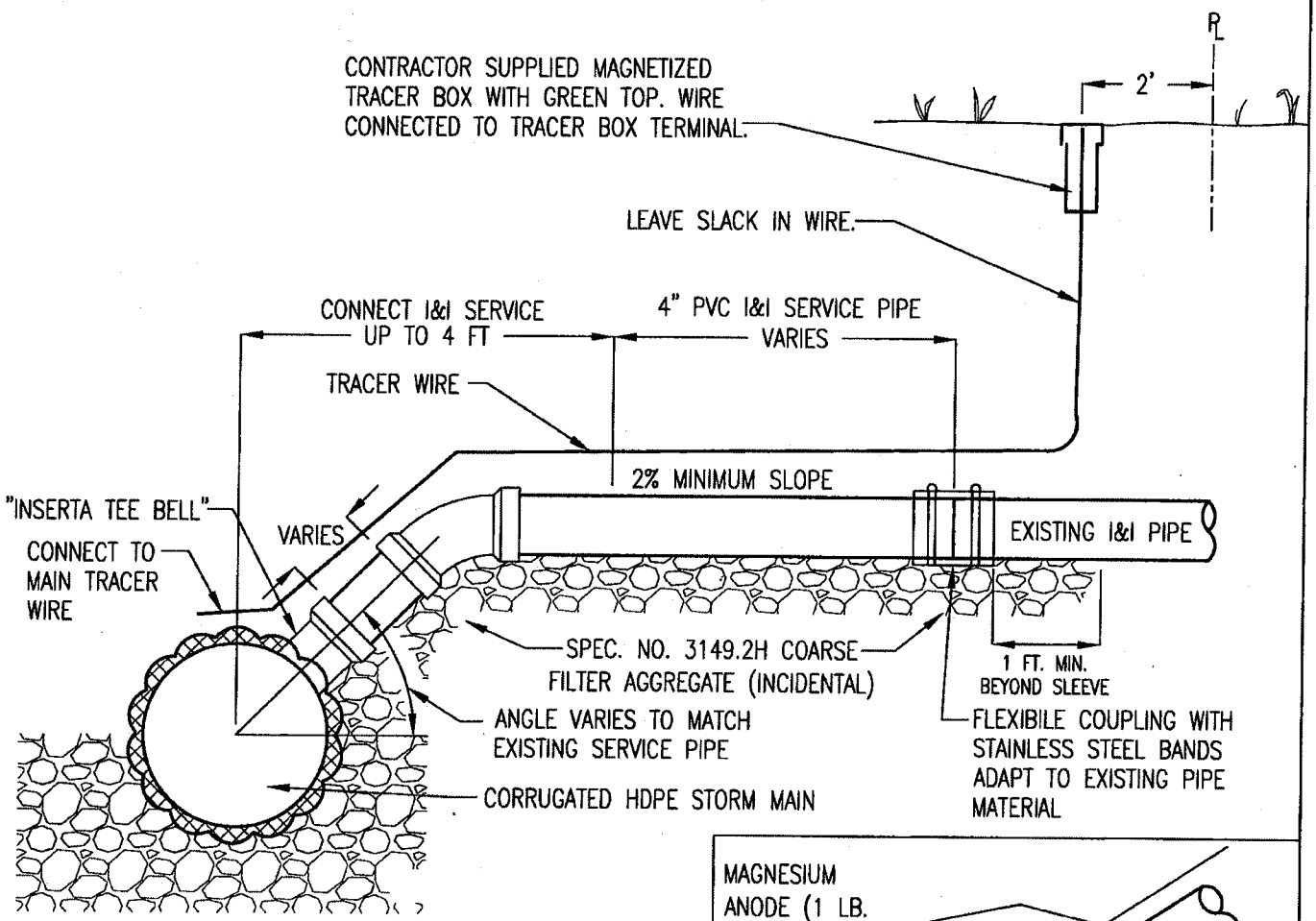
I&I-1	CONNECT I&I SERVICE - TYPE A (EDITED 01/01/2012)
I&I-2	CONNECT I&I SERVICE - TYPE B (EDITED 01/01/2012)
I&I-3	CONNECT I&I SERVICE - TYPE C (EDITED 01/01/2012)
I&I-4	CONNECT I&I SERVICE - TYPE D



NOTE:

1. CONNECT I&I SERVICE (TYPE A) INCLUDES: FURNISH AND INSTALL WYE IN I&I MAIN, UP TO 4 FT. OF PVC SERVICE PIPE AND ALL FITTINGS.
2. 4" PVC I&I SERVICE PIPE IS INTENDED FOR THE CONNECTION OF EXISTING 4" SERVICES (WHEN FOUND TO BE IN NEED BY THE ENGINEER) COMPLETE IN PLACE FROM 4 FT. BEYOND THE C/L OF THE I&I MAIN TO A POINT DESIGNATED BY THE ENGINEER.

CONNECT I&I SERVICE – TYPE A		I&I–1
REVIEWED/APPROVED 1/1/12	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTE:

1. CONNECT I&I SERVICE (TYPE B) INCLUDES: FURNISH AND INSTALL "INSERTA TEE" CORRUGATED POLYETHYLENE BELL (OR APPROVED EQUIAVLENT) INTO CORED HOLE IN CORRUGATED HDPE STORM MAIN, UP TO 4 FT. OF PVC SERVICE PIPE AND ALL FITTINGS.
2. 4" PVC I&I SERVICE PIPE IS INTENDED FOR THE CONNECTION OF EXISTING 4" SERVICES (WHEN FOUND TO BE IN NEED BY THE ENGINEER) COMPLETE IN PLACE FROM 4 FT. BEYOND THE C/L OF THE I&I MAIN TO A POINT DESIGNATED BY THE ENGINEER.

CONNECT I&I SERVICE – TYPE B		I&I–2
REVIEWED/APPROVED 1/1/12	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

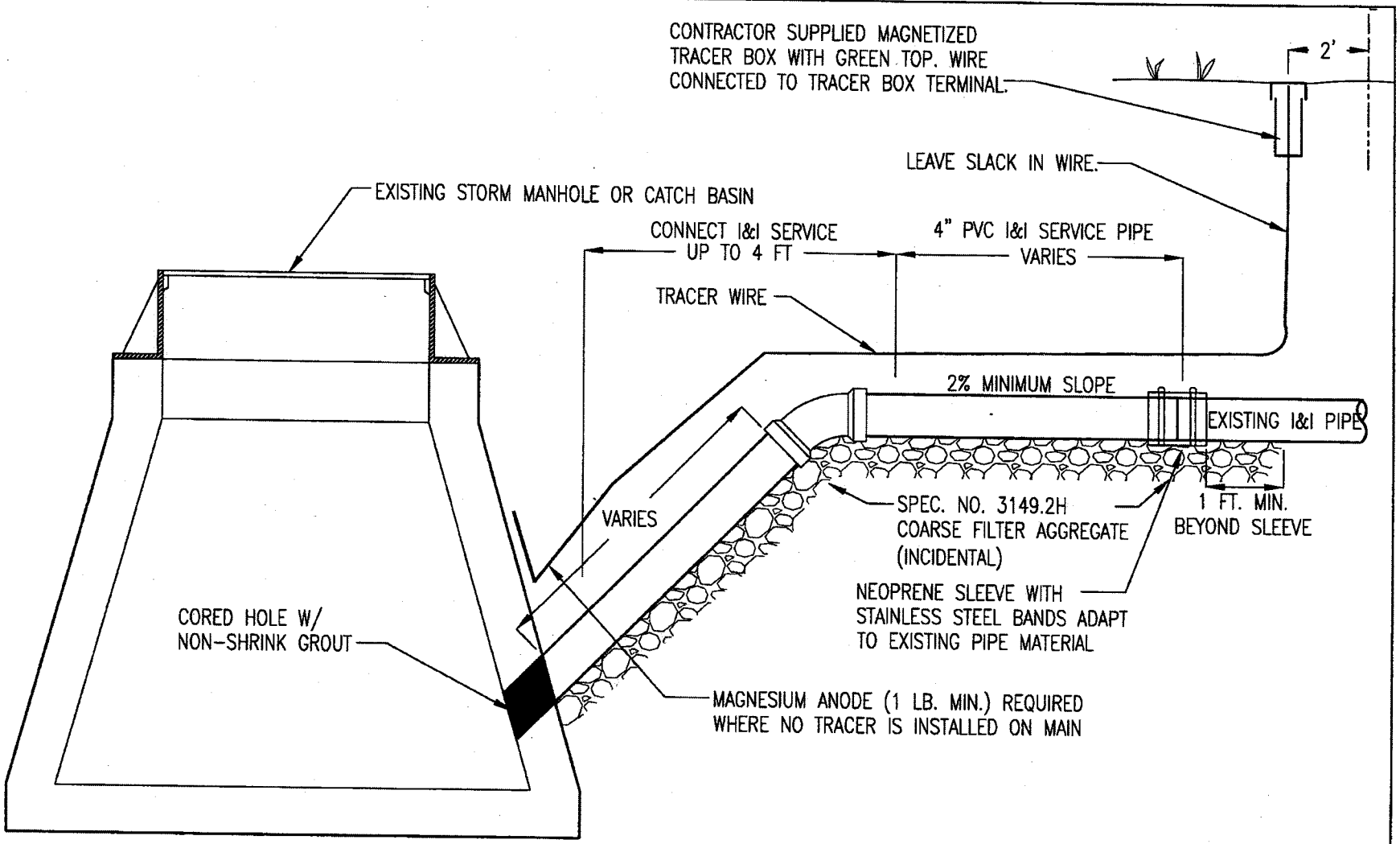
REVIEWED/APPROVED 1/1/12

CONNECT I&I SERVICE – TYPE C

CITY OF DULUTH STANDARD DETAIL
DEPT. OF PUBLIC WORKS AND UTILITIES

I&I–3

NO SCALE



NOTE:

1. CONNECT I&I SERVICE (TYPE C) CORE HOLE, GROUT PVC PIPE WITH NON–SHRINK GROUT, UP TO 4 FT. OF PVC SERVICE PIPE AND ALL FITTINGS.
2. 4" PVC I&I SERVICE PIPE IS INTENDED FOR THE CONNECTION OF EXISTING 4" SERVICES (WHEN FOUND TO BE IN NEED BY THE ENGINEER) COMPLETE IN PLACE FROM 4 FT. BEYOND THE C/L OF THE I&I MAIN TO A POINT DESIGNATED BY THE ENGINEER.

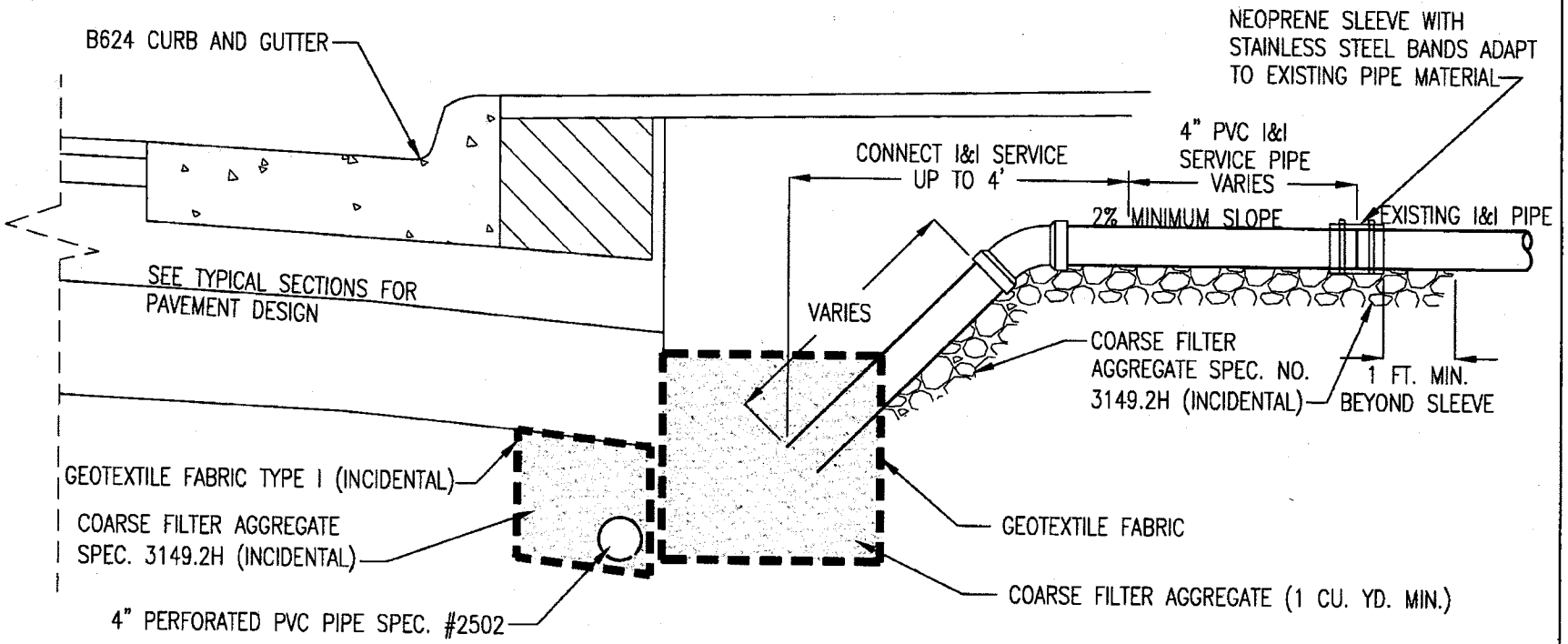
REVIEWED/APPROVED 3/11/09

CONNECT I&I SERVICE – TYPE D

CITY OF DULUTH STANDARD DETAIL
DEPT. OF PUBLIC WORKS AND UTILITIES

I&I–4

NO SCALE



NOTE:

1. CONNECT I&I SERVICE (TYPE D) INCLUDES: PLACING A MINIMUM OF 1 CU. YD. OF COARSE FILTER AGGREGATE ENCLOSED IN GEOTEXTILE FABRIC (TYPE I), INSERTING PVC I&I SERVICE PIPE IN CENTER OF AGGREAGATE AND UP TO 4 FT. OF PVC SERVICE PIPE AND ALL FITTINGS.
2. 4" PVC I&I SERVICE PIPE IS INTENDED FOR THE CONNECTION OF EXISTING 4" SERVICES (WHEN FOUND TO BE IN NEED BY THE ENGINEER) COMPLETE IN PLACE FROM 4 FT. BEYOND THE CENTER OF THE FILTER AGGREGATE TO A POINT DESIGNATED BY THE ENGINEER.

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

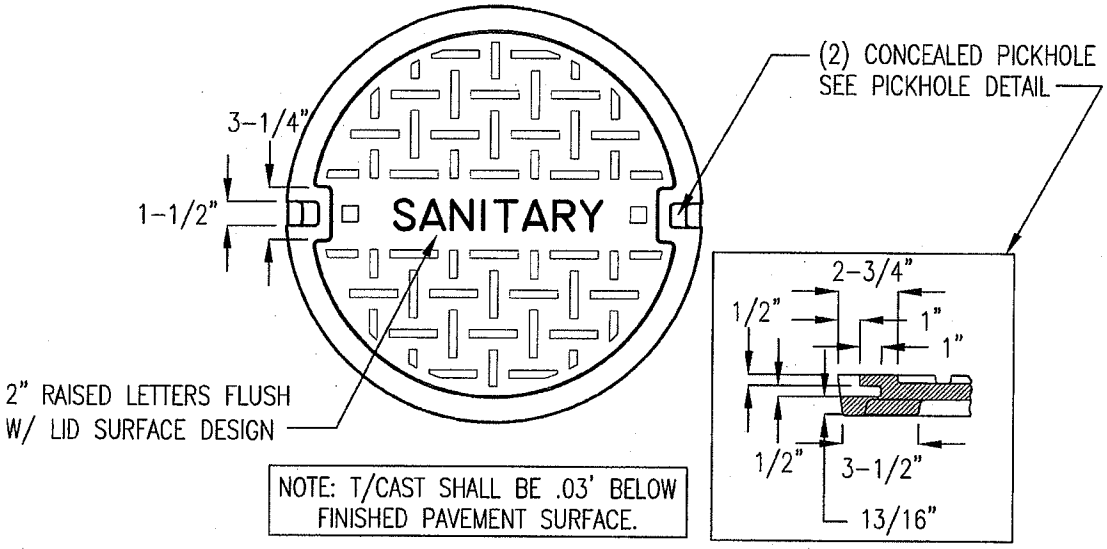
STANDARD DETAIL DRAWINGS

SANITARY SEWER DETAILS

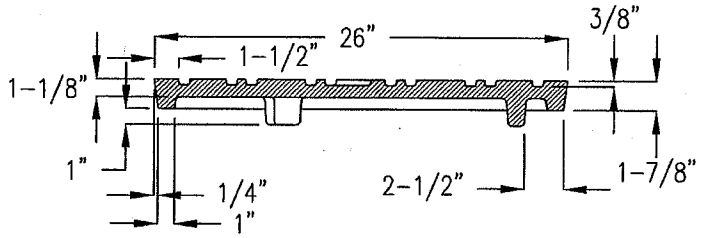
SAN-1	SANITARY CASTING DETAIL
SAN-2	TYPICAL SEWER SERVICE CONNECTION
SAN-3	SANITARY MANHOLE SEAL
SAN-4	CONSTRUCT INSIDE DROP STRUCTURE
SAN-5	HDPE SANITARY SEWER PRESSURE LATERAL CONNECTION
SAN-6	HDPE FORCEMAIN TO GRAVITY MAIN MANHOLE
SAN-7	AIR-RELEASE MANHOLE
SAN-8	CLEANOUT MANHOLE
SAN-9	POLYETHYLENE MH ADJUSTING RING - FLAT
SAN-10	POLYETHYLENE MH ADJUSTING RING - WEDGE
SAN-11	PRECAST MJ SEWER MANHOLE

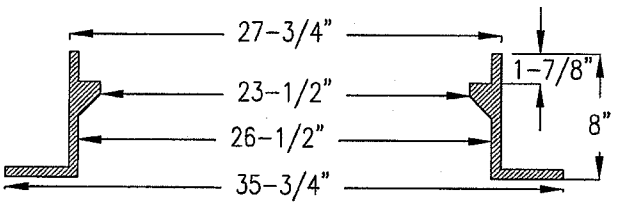
WGT. 298 LBS		MATERIAL: GRAY IRON CLASS 35B
WGT. 122 LBS	TOTAL WEIGHT 420 LBS.	SPEC.: ASTM A-48-74

NOTE: SUITABLE FOR HS25 WHEEL LOADS

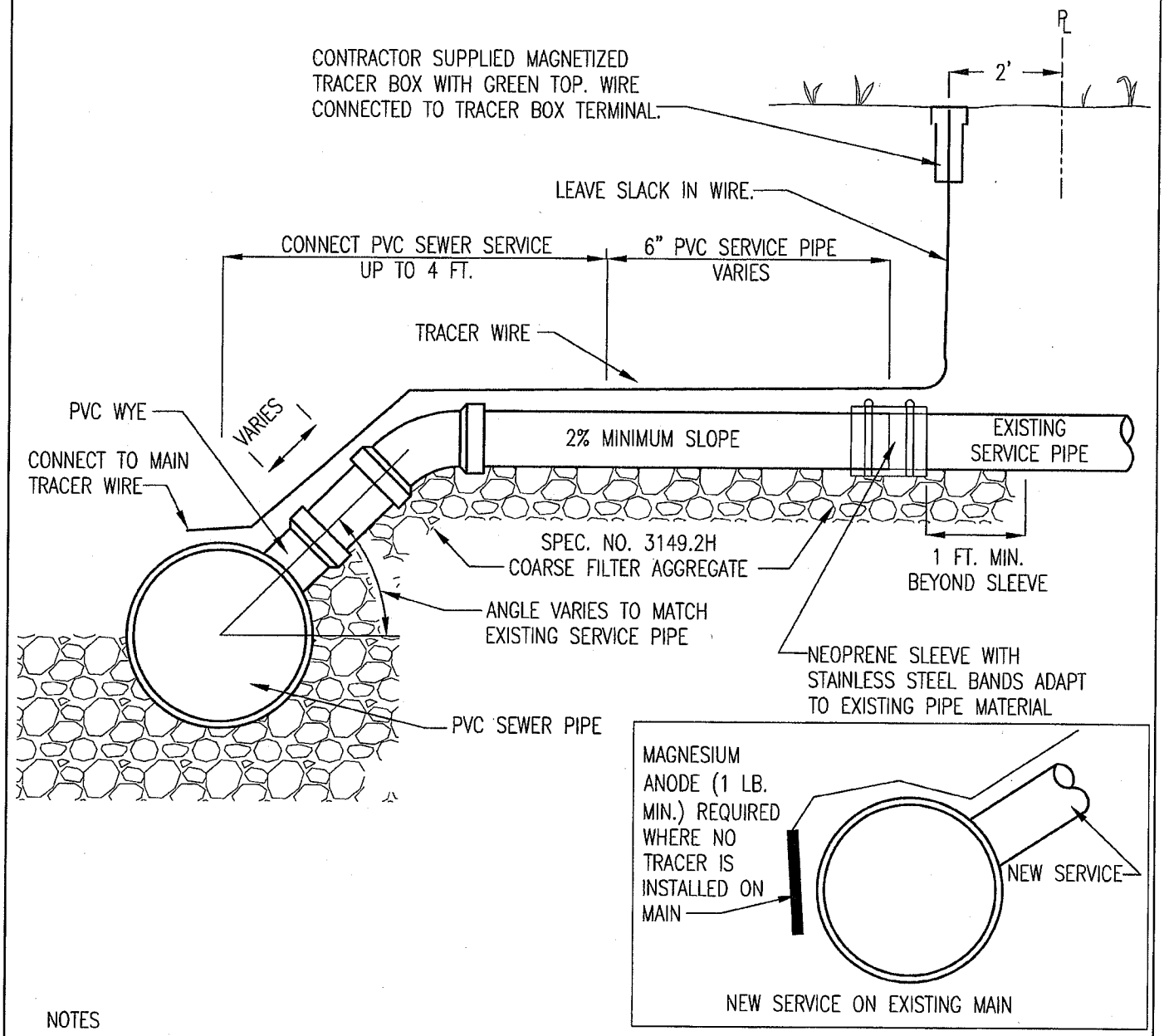


NOTE: T/CAST SHALL BE .03' BELOW FINISHED PAVEMENT SURFACE.





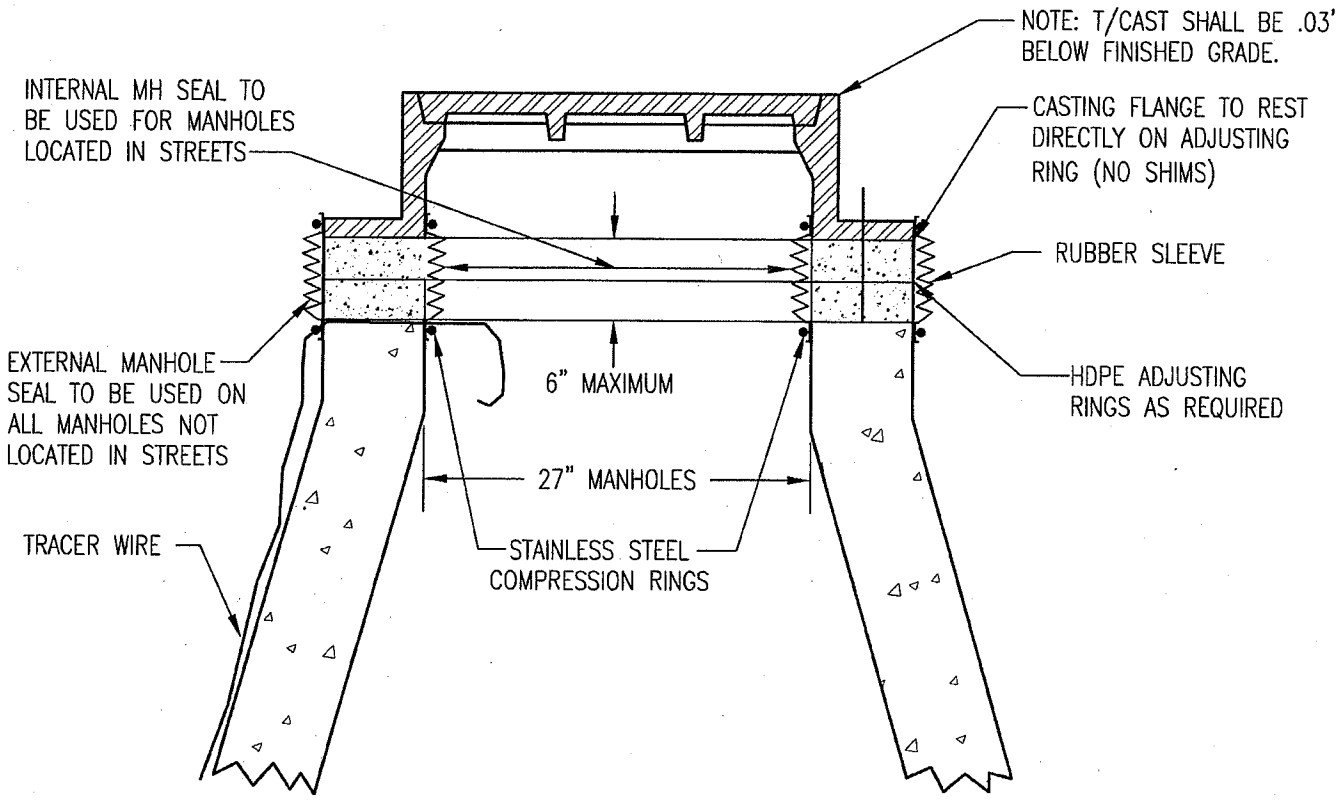
SANITARY CASTING DETAIL		SAN-1
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES

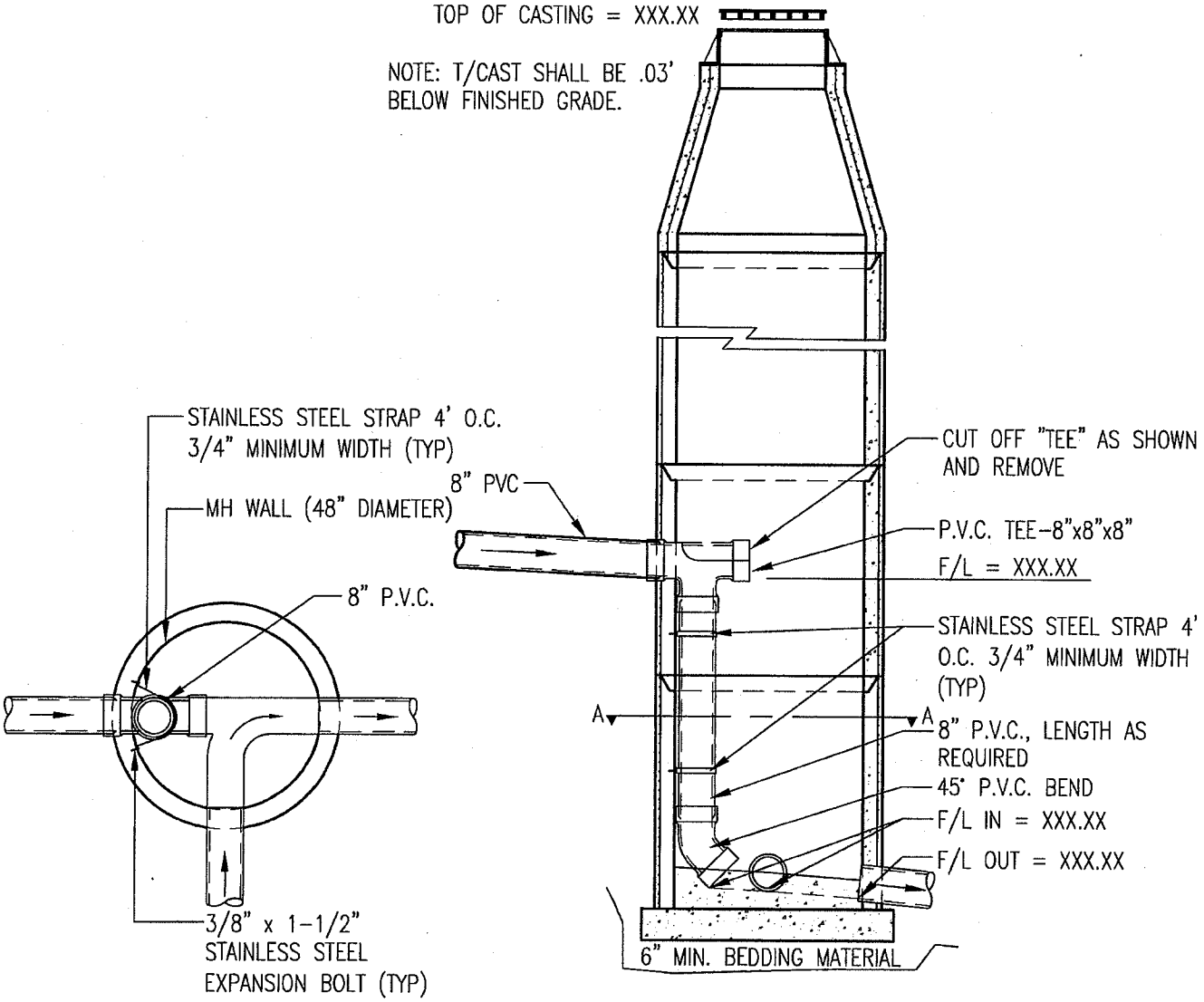
1. BID ITEM FOR PVC WYE INCLUDES FURNISHING AND INSTALLING WYE IN SEWER MAIN.
2. CONNECT SANITARY SERVICE INCLUDES UP TO 4.0' OF PVC HOUSE SERVICE PIPE AND ALL FITTINGS
3. 6" PVC SEWER SERVICE PIPE IS INTENDED FOR THE RECONSTRUCTION OF SEWER SERVICES (WHEN FOUND TO BE IN NEED BY THE ENGINEER) COMPLETE IN PLACE FROM 4.0' BEYOND THE C/L OF THE SEWER MAIN TO A POINT DESIGNATED BY THE ENGINEER
4. FOR NEW SERVICES, PIPE TO STOP AT RIGHT OF WAY
5. #12 GAUGE GREEN INSULATED COPPER TRACER WIRE SHALL BE INSTALLED WITH SANITARY SEWER MAINS AND SERVICES. TRACER WIRE TERMINAL BOXES SHALL BE INSTALLED DIRECTLY ABOVE THE SEWER SERVICE OR AS DETERMINED BY THE ENGINEER
6. FOR SERVICES, TRACER WIRE SHALL RUN FROM THE WYE AND TERMINATE IN A FLUSH MOUNTED TRACER BOX WITH A GREEN CAST IRON LOCKABLE TOP.
7. THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT OR COMPRESSION TYPE CONNECTORS. WIRE NUTS SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.

TYPICAL SEWER SERVICE CONNECTION		SAN-2
REVISED/APPROVED 2/1/10	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTE:
1. ALL SEALS SHALL EXTEND FROM THE CASTING TO THE CONE
2. TRACER WIRE REQUIRED ON ALL SANITARY SEWER MAINS

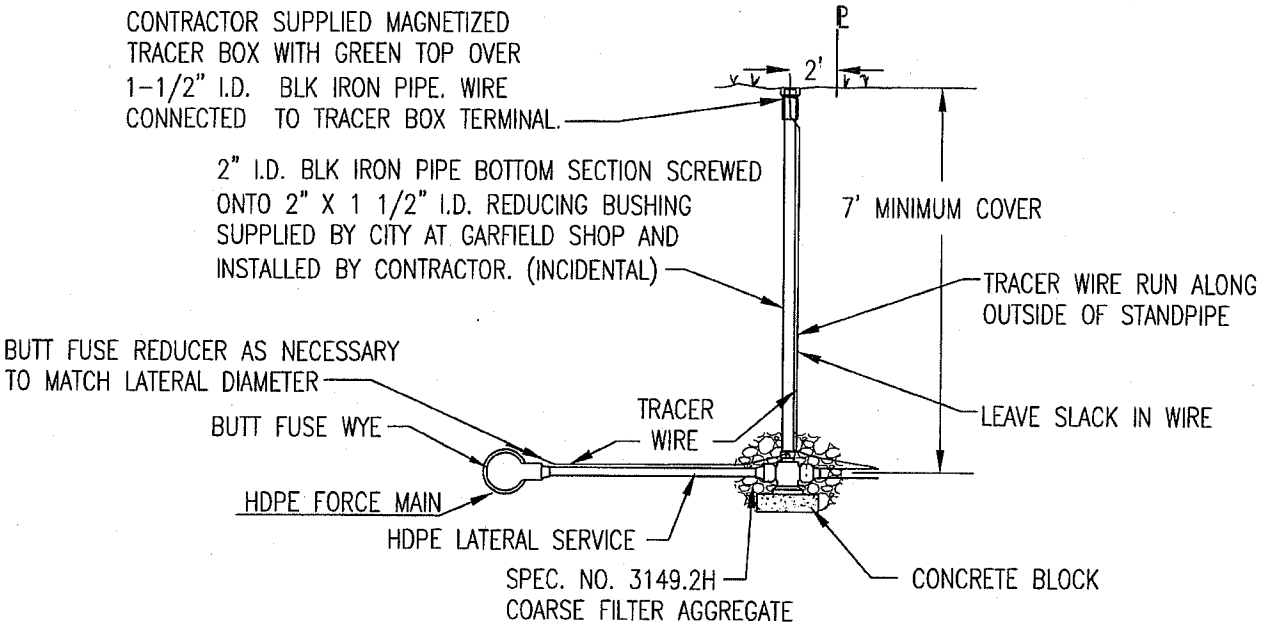
SANITARY MANHOLE SEAL		SAN-3
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

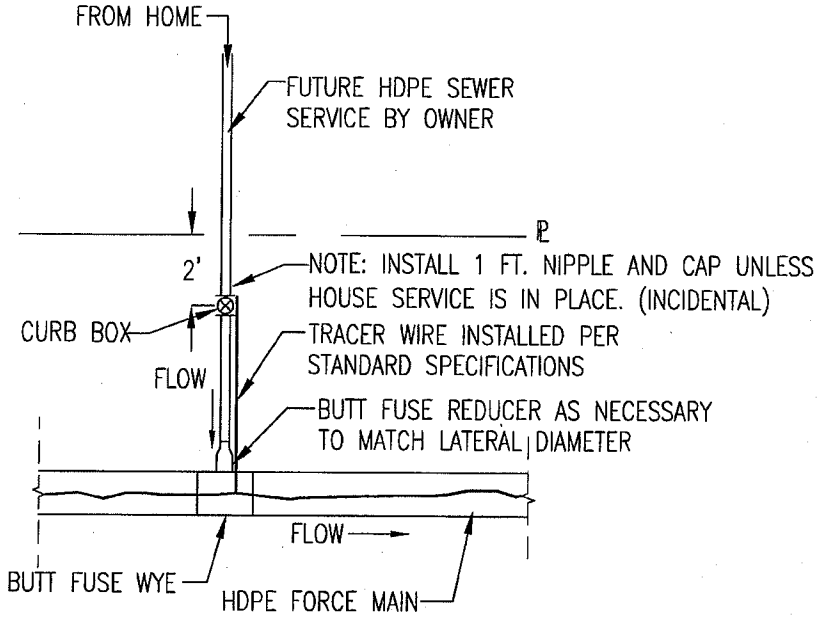


SECTION AA

NOTES: REFER TO PLAN/PROFILES FOR ELEVATIONS

CONSTRUCT INSIDE DROP STRUCTURE		SAN-4
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

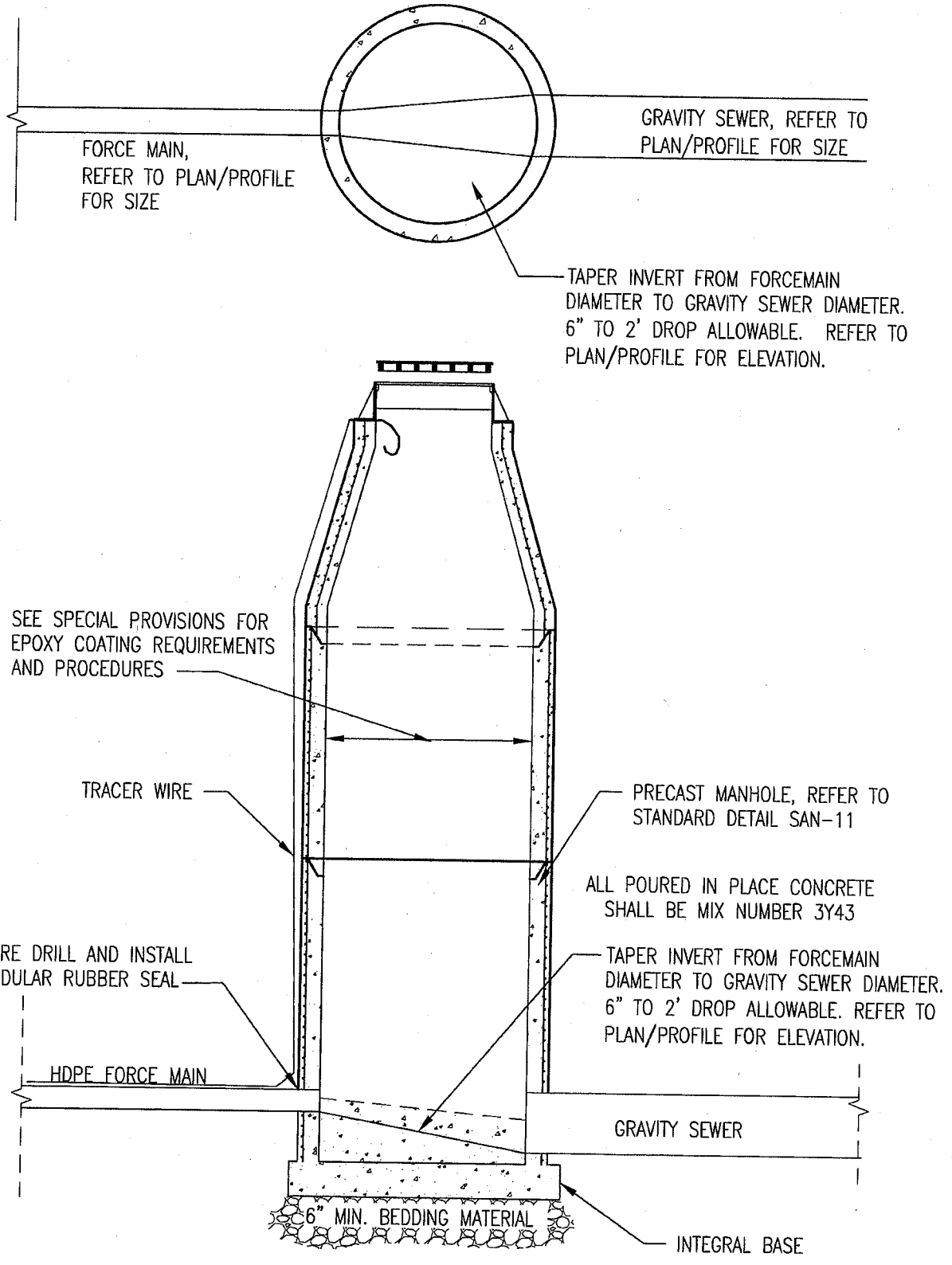




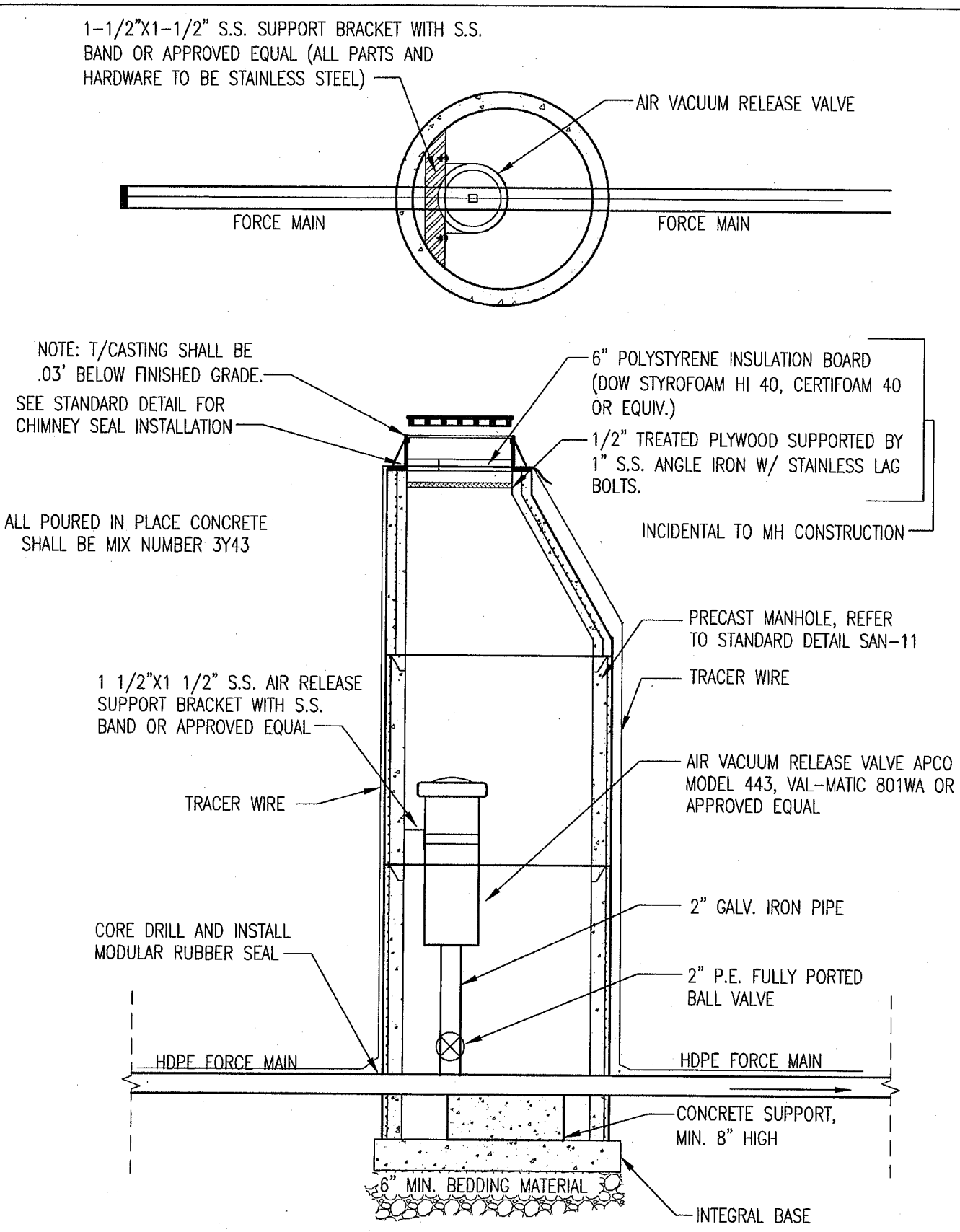
NOTES:

1. #12 GAUGE GREEN INSULATED COPPER TRACER WIRE SHALL BE INSTALLED WITH THE NON-CONDUCTIVE SERVICE PIPE. TRACER WIRE INSTALLATION REQUIRES ACCESS POINTS AT LEAST EVERY 300 FEET.
2. THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT OR COMPRESSION TYPE CONNECTORS. WIRE NUTS SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.
3. TRACER WIRE SHALL RUN FROM THE WYE AND TERMINATE IN A FLUSH MOUNTED TRACER BOX WITH A GREEN CAST IRON TOP.

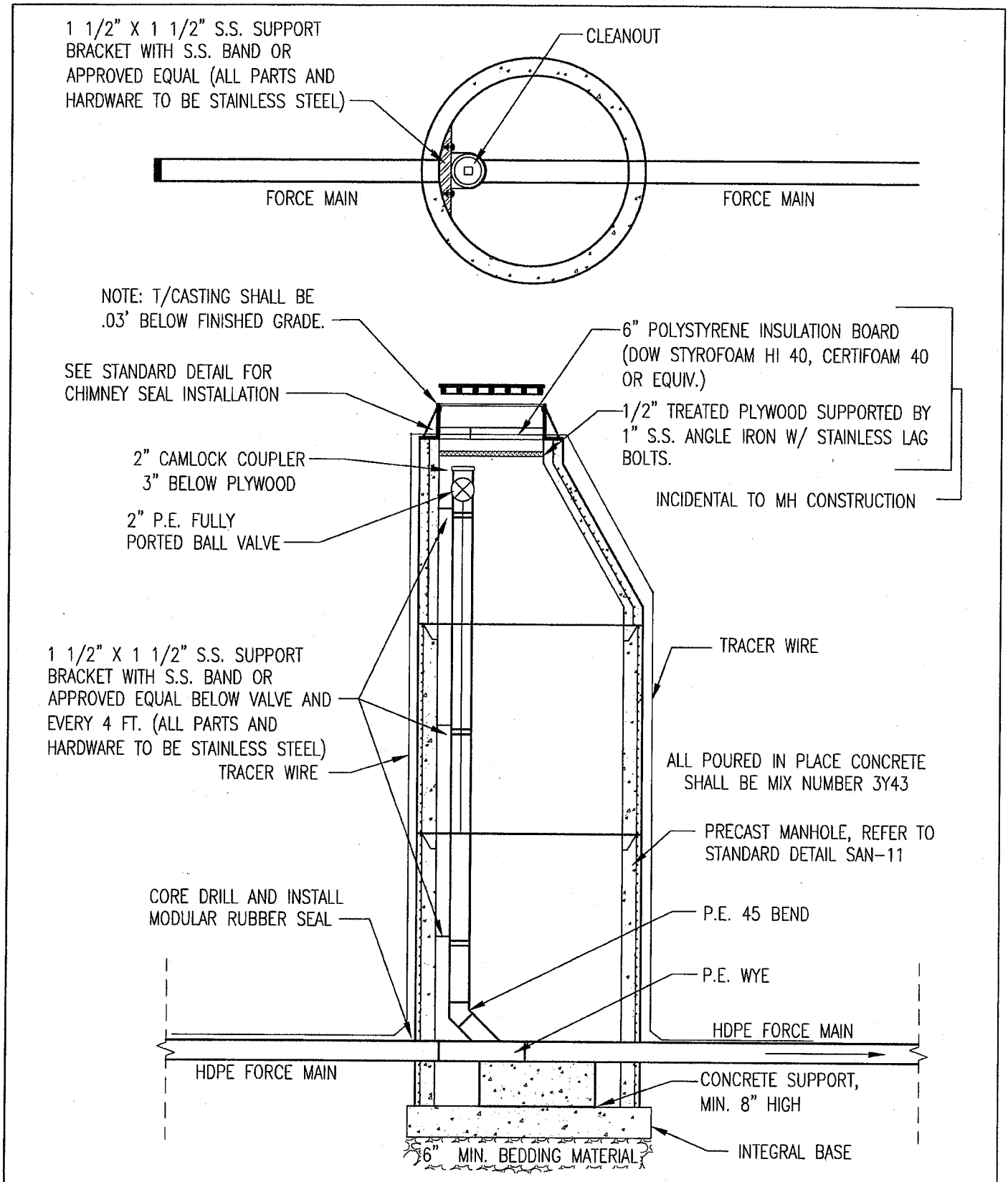
HDPE SANITARY SEWER PRESSURE LATERAL CONNECTION		SAN-5
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



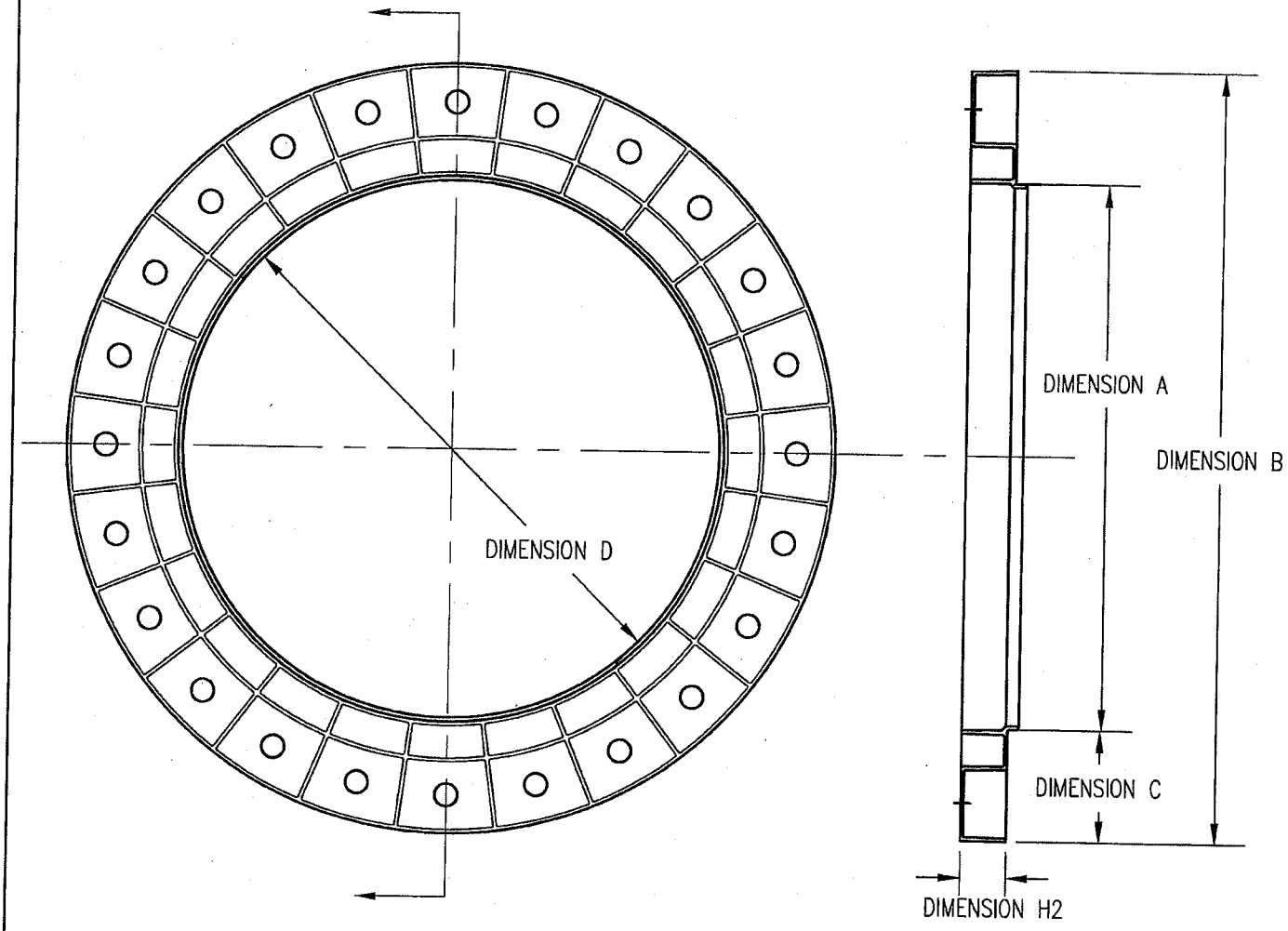
HDPE FORCEMAIN TO GRAVITY MAIN MANHOLE		SAN-6
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



AIR-RELEASE MANHOLE		SAN-7
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



CLEANOUT MANHOLE		SAN-8
REVISED/APPROVED 2/01/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

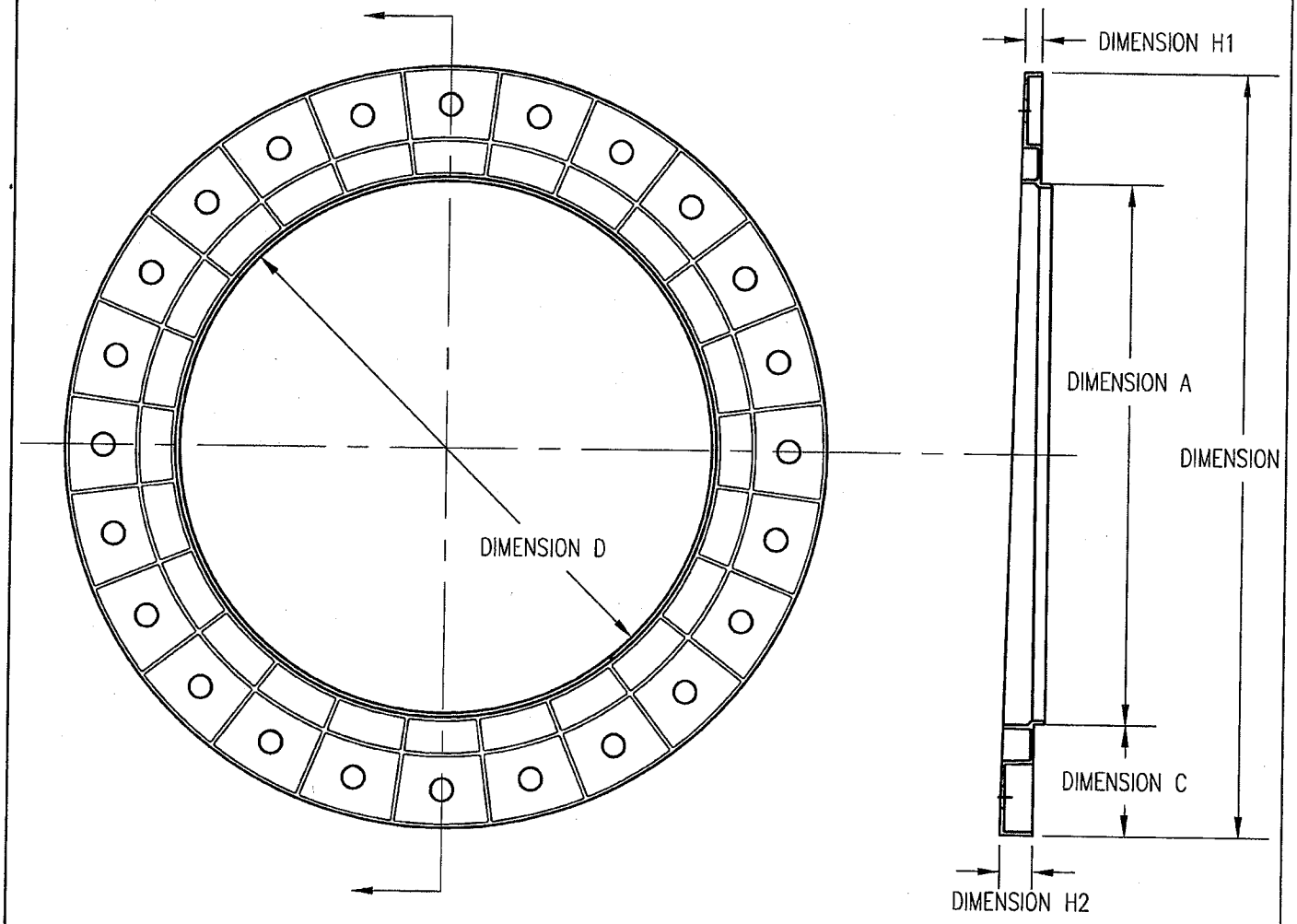


DIMENSION SCHEDULE					
CONE SIZE	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION H1
27.00	26.75	36.50	5.00	26.25	1.20, 1.50, 2.00, 4.00

DESCRIPTION

1. PLASTIC INJECTION MOLDED ADJUSTMENT RING
2. MOLDED FROM HIGH DENSITY POLYETHYLENE AS DEFINED IN ASTM SPECIFICATION D1248
3. ACTUAL RESIN PROPERTIES WILL VARY ALLOWING FOR THE UTILIZATION OF A MAXIMUM PERCENT OF RECYCLED MATERIAL
4. THE PERCENT OF POST CONSUMER WASTE TO INDUSTRIAL WASTE WILL VARY WITH AVAILABILITY AND PROPERTY RETENTION NEEDS
5. COLOR, SHADE AND UNIFORMITY WILL VARY WITH THE MIX OF THE POST CONSUMER AND INDUSTRIAL WASTE MATERIALS
6. DIMENSIONS SHOWN ARE NOMINAL – ACTUAL SIZE WILL VARY WITHIN ALLOWABLE TOLERANCE AND REQUIRED FIT

POLYETHYLENE MH ADJUSTING RING – FLAT		SAN–9
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

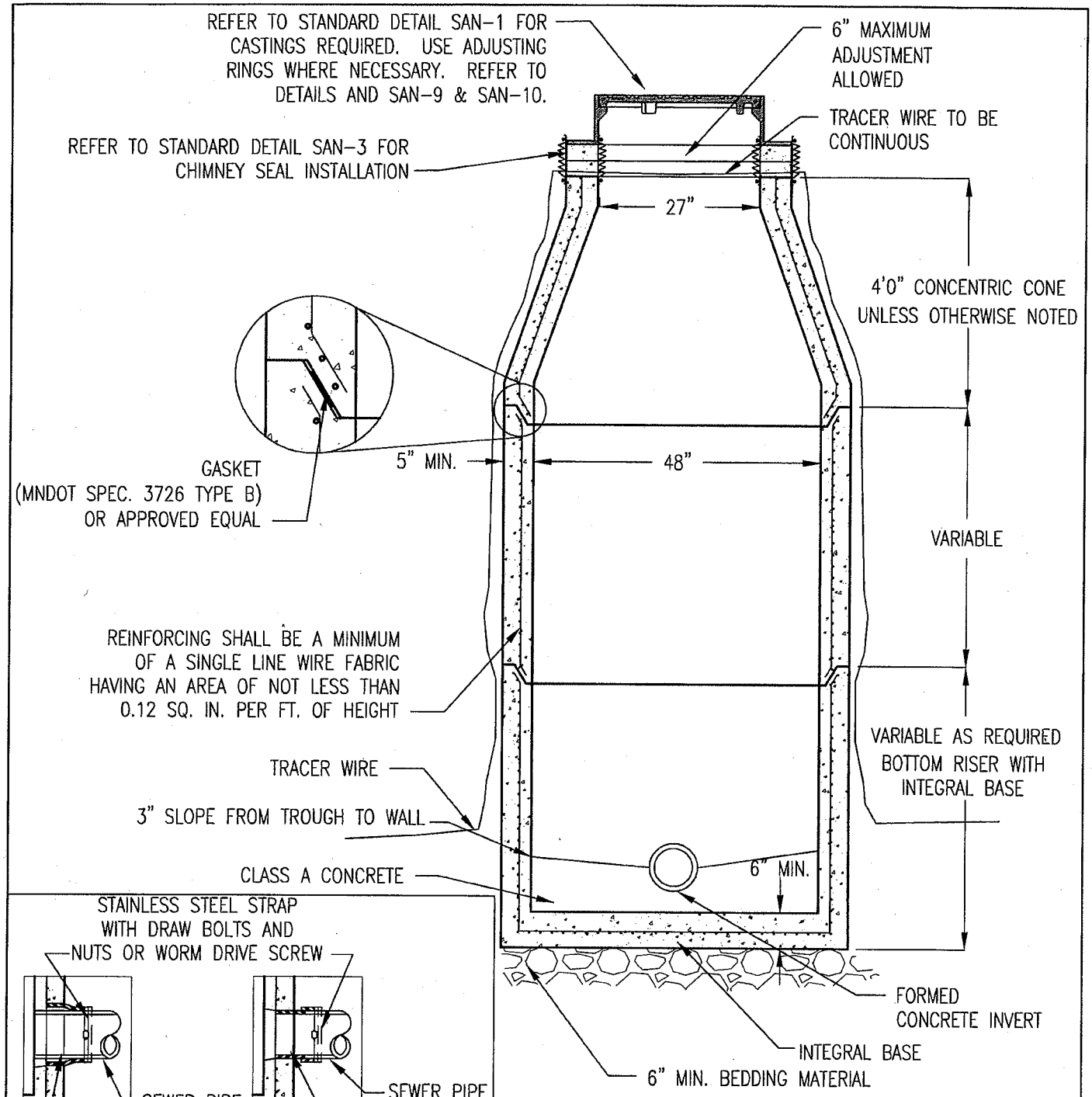


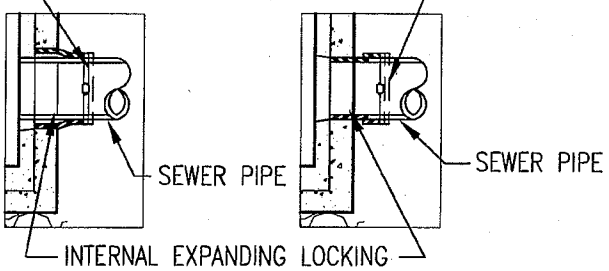
DIMENSION SCHEDULE					
CONE SIZE	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION H1–H2
27.00	26.75	36.50	5.00	26.25	0.75 – 1.50

DESCRIPTION

1. PLASTIC INJECTION MOLDED ADJUSTMENT RING
2. MOLDED FROM HIGH DENSITY POLYETHYLENE AS DEFINED IN ASTM SPECIFICATION D1248
3. ACTUAL RESIN PROPERTIES WILL VARY ALLOWING FOR THE UTILIZATION OF A MAXIMUM PERCENT OF RECYCLED MATERIAL
4. THE PERCENT OF POST CONSUMER WASTE TO INDUSTRIAL WASTE WILL VARY WITH AVAILABILITY AND PROPERTY RETENTION NEEDS
5. COLOR, SHADE AND UNIFORMITY WILL VARY WITH THE MIX OF THE POST CONSUMER AND INDUSTRIAL WASTE MATERIALS
6. DIMENSIONS SHOWN ARE NOMINAL – ACTUAL SIZE WILL VARY WITHIN ALLOWABLE TOLERANCE AND REQUIRED FIT

POLYETHYLENE MH ADJUSTING RING – WEDGE		SAN–10
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE





PIPE SLEEVE DETAIL

1. MANHOLE FLEXIBILE SLEEVES SHALL BE NPC KOR-N-SEAL 1 OR PRESS SEAL PSX DIRECT DRIVE
2. ALL PIPE SLEEVES MUST BE WATER TIGHT

NOTES

1. SANITARY MANHOLES SHALL NOT HAVE STEPS.
2. ALL SANITARY MANHOLES SHALL BE VACUUM TESTED.
3. ALL SANITARY MANHOLES SHALL BE WATERTIGHT. ANY OBSERVABLE WATER SEEPAGE THROUGH THE END OF THE WARRANTY PERIOD SHALL BE CAUSE TO REJECT MANHOLES.
4. AN INSIDE DROP IS REQUIRED PER DETAIL SAN-4 ANYTIME THE DROP IS GREATER THAN 2.0'.

PRECAST MECHANICAL JOINT SEWER MANHOLE		SAN-11
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

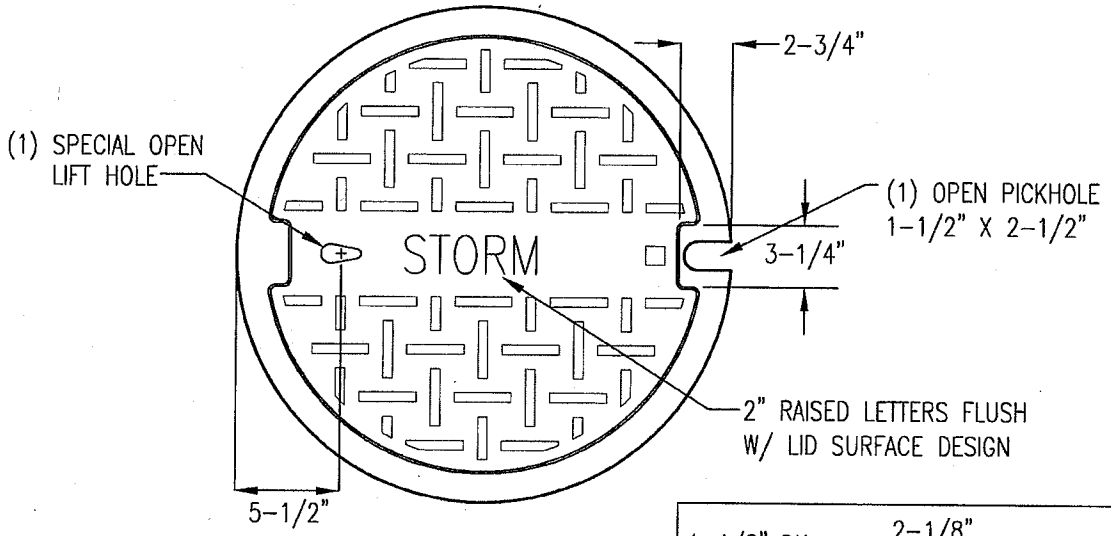
STANDARD DETAIL DRAWINGS

STORM SEWER DETAILS

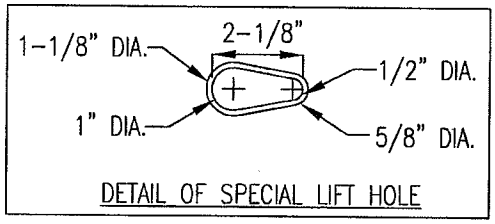
STRM-1	STORM MANHOLE CASTING
STRM-2	CATCH BASIN/CURB BOX CASTINGS
STRM-3	CATCH BASIN/CURB BOX CASTINGS
STRM-4	FABRIC WRAPPED CATCHBASIN CASTING
STRM-5	FABRIC WRAPPED MANHOLE
STRM-6	GUTTER SWALE
STRM-7	GUTTER STAMP

WGT. 298 LBS		MATL. GRAY IRON CLASS 35B
WGT. 122 LBS	TOT.WGT. 420 LBS.	SPEC. ASTM A-48-74

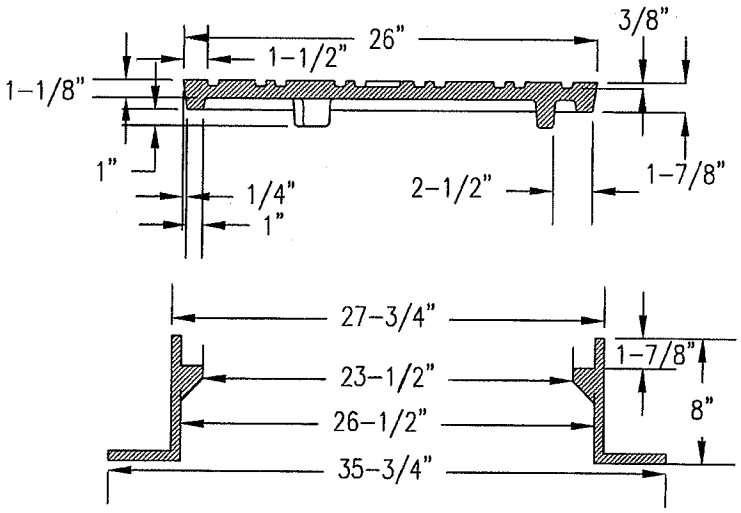
NOTE: SUITABLE FOR HS25 WHEEL LOADS



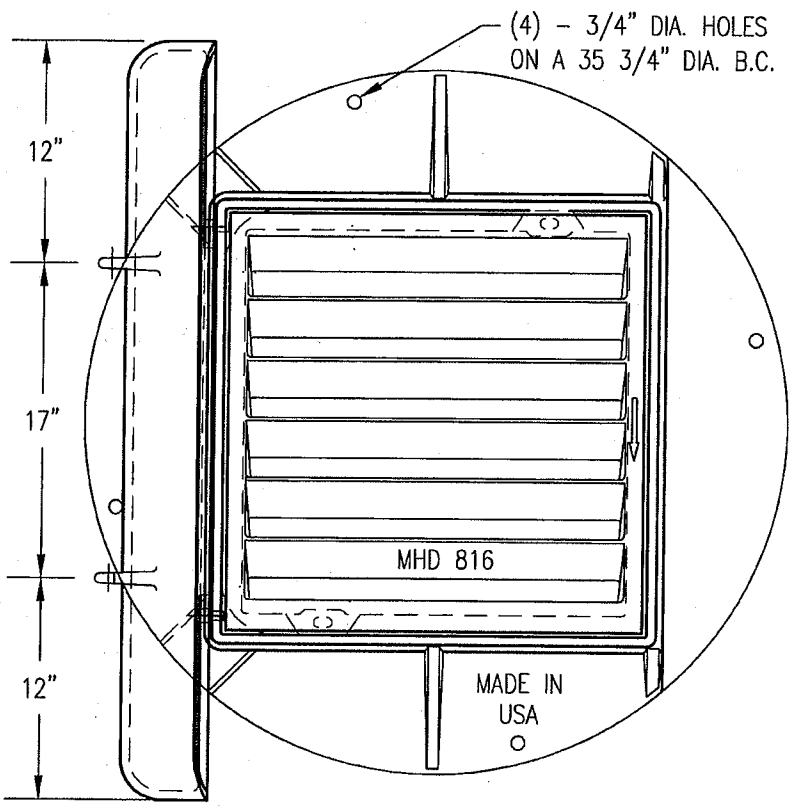
NOTE: T/CAST SHALL BE .03' BELOW FINISHED PAVEMENT SURFACE.

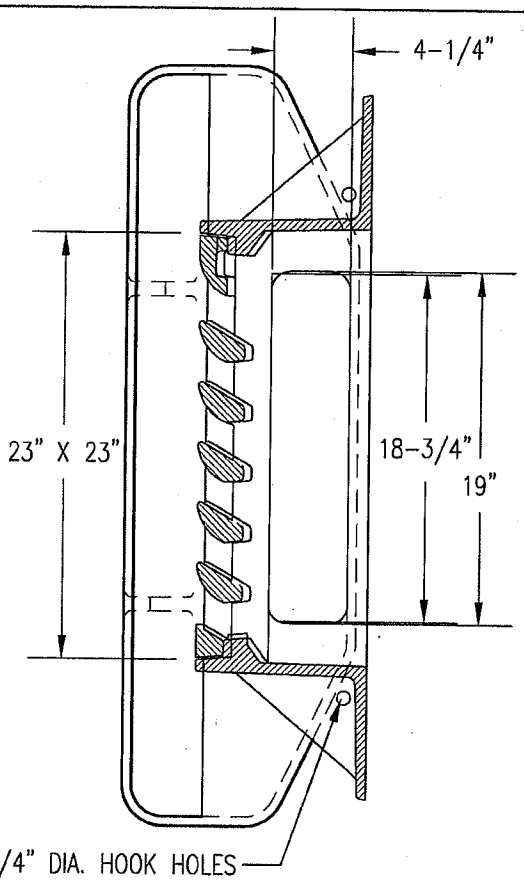


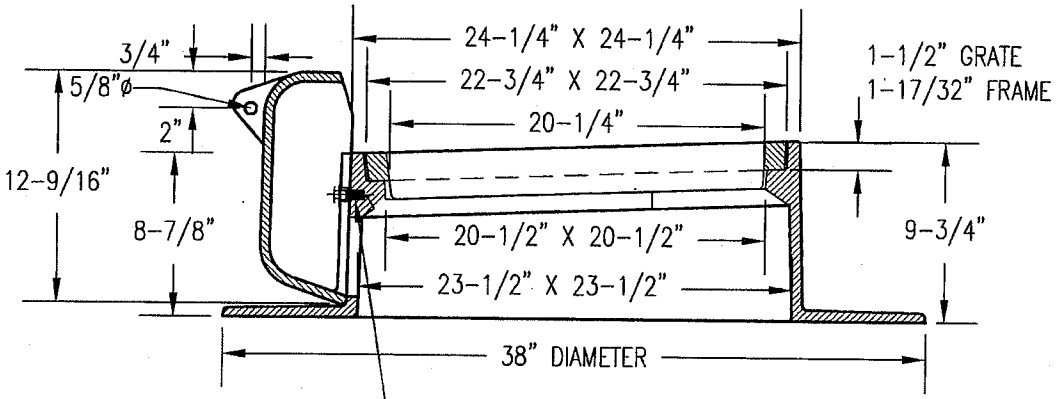
DETAIL OF SPECIAL LIFT HOLE



STORM MANHOLE CASTING		STRM-1
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



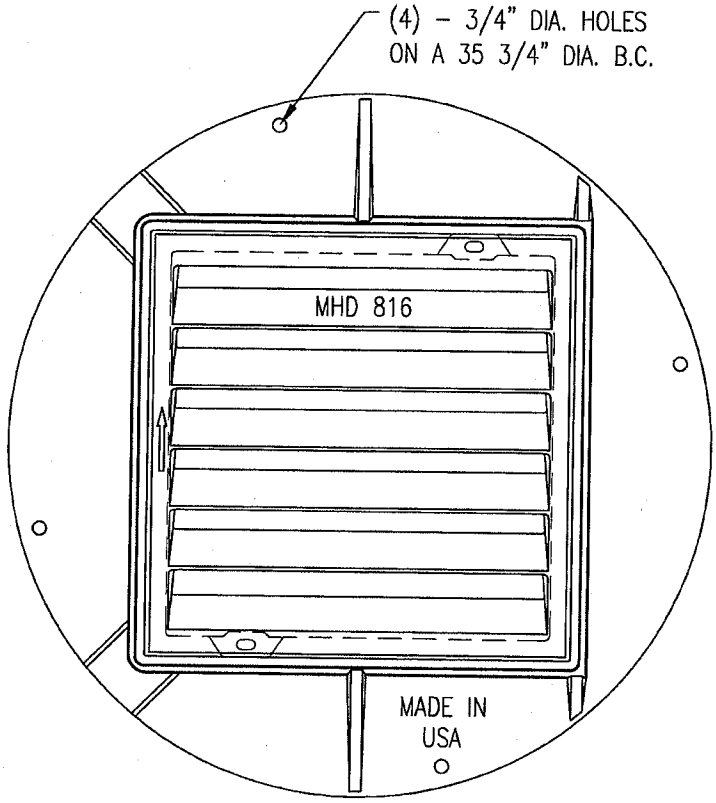


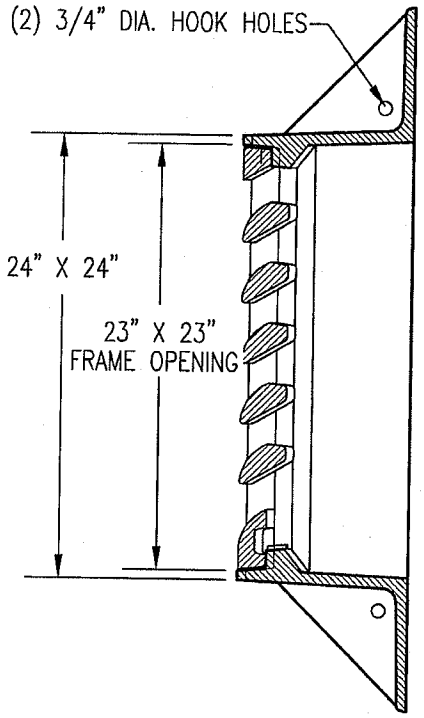


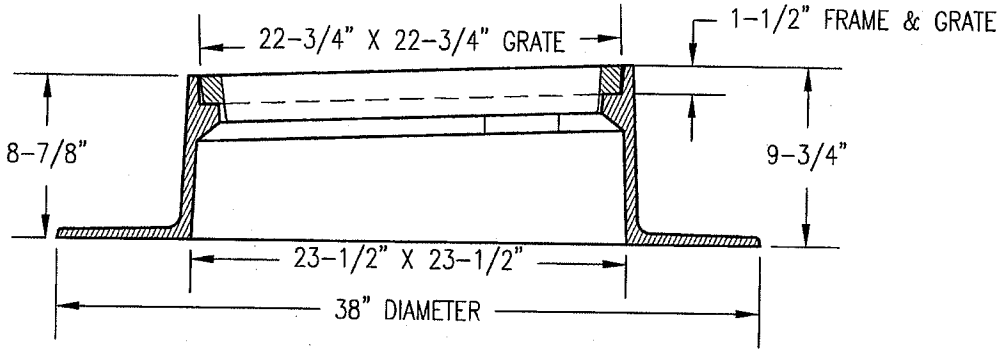
NOTES:

1. COMPONENT NO'S: FRAME 5002, GRATE MHD 816 (STD PLATE 4154B), CURB BOX 823A (STD PLATE 4160D).
2. MATERIAL: CAST GRAY IRON ASTM A-48, CLASS 35B
3. WEIGHT: FRAME APPROX. 257#, GRATE 131#, CURB BOX 105#.
4. ALL GUTTERS UPSTREAM OF CATCH BASINS SHALL BE STAMPED, "NO DUMPING, LEADS TO LAKE" WITH A CITY SUPPLIED STAMP.

CATCH BASIN/CURB BOX CASTINGS		STRM-2
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



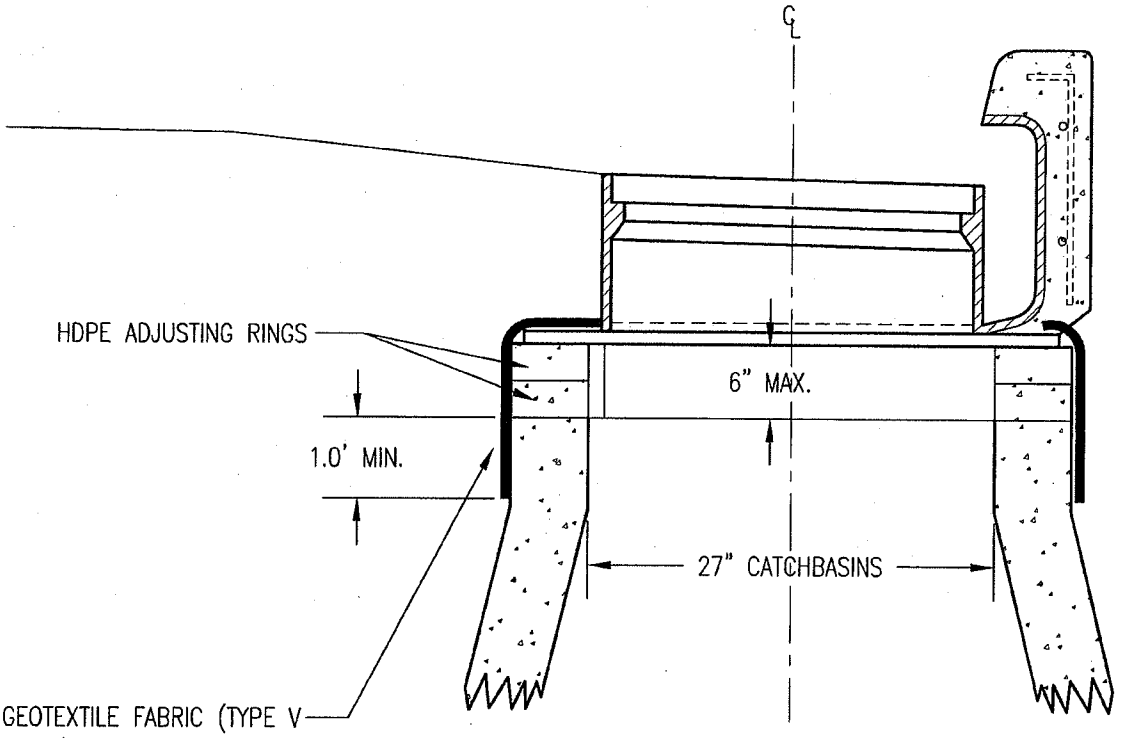




NOTES:

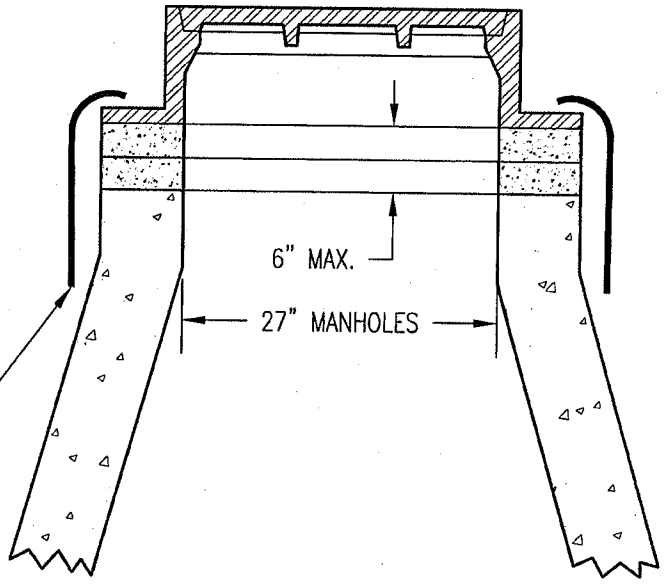
1. COMPONENT NO'S: TOP FRAME 5005, GRATE 816 (STD PLATE 4154B).
2. MATERIAL: CAST GRAY IRON ASTM A–48, CLASS 35B
3. WEIGHT: FRAME 262#; GRATE 131#
4. ALL GUTTERS UPSTREAM OF CATCH BASINS SHALL BE STAMPED, "NO DUMPING, LEADS TO LAKE" WITH A CITY SUPPLIED STAMP.

CATCH BASIN/CURB BOX CASTINGS		STRM–3
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

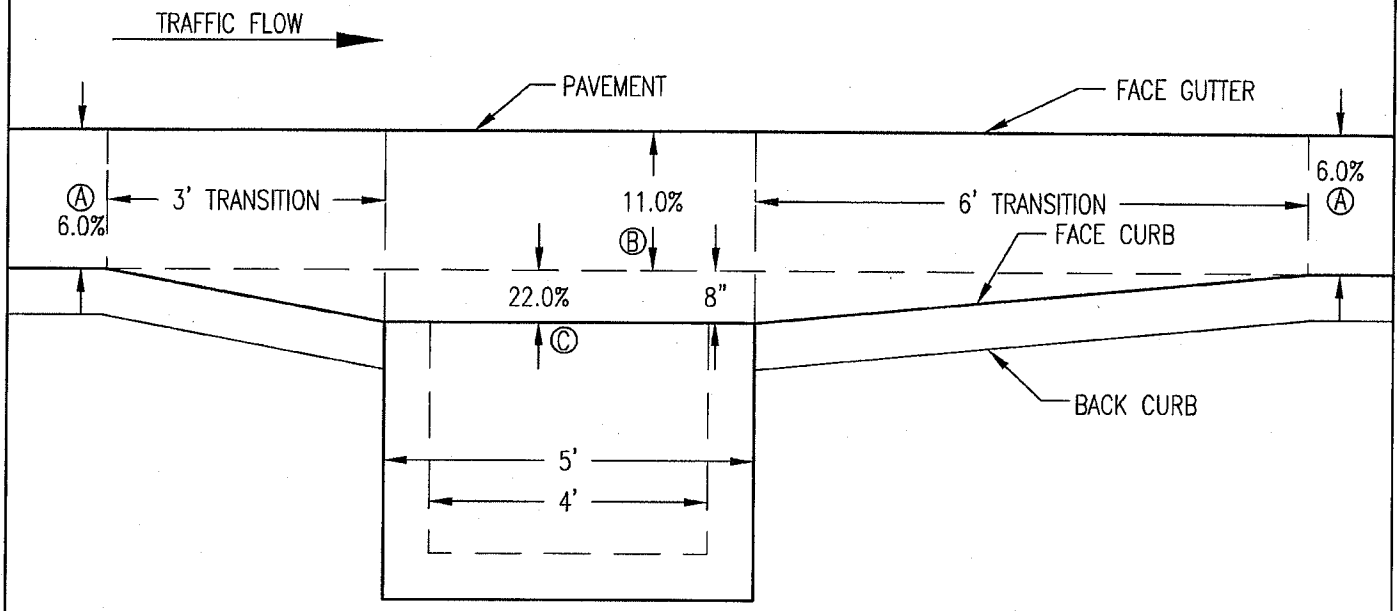


FABRIC WRAPPED CATCH BASIN CASTING		STRM-4
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

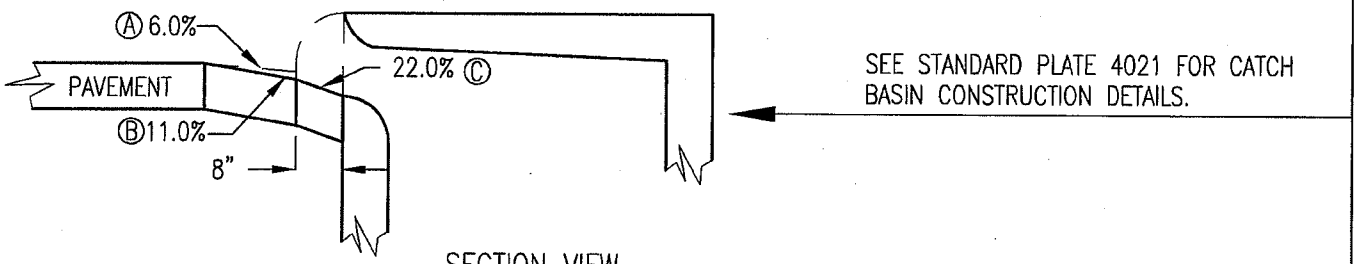
TYPE V NON-WOVEN GEOTEXTILE FABRIC WRAP ENTIRELY AROUND, WITH 1 FT OVERLAP FROM TOP OF STRUCTURE. (TAPE TOP OF FABRIC TO CASTING THEN BACKFILL.) REQUIRED ON ALL STORM MANHOLES (INCIDENTAL)



FABRIC WRAPPED MANHOLE		STRM-5
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

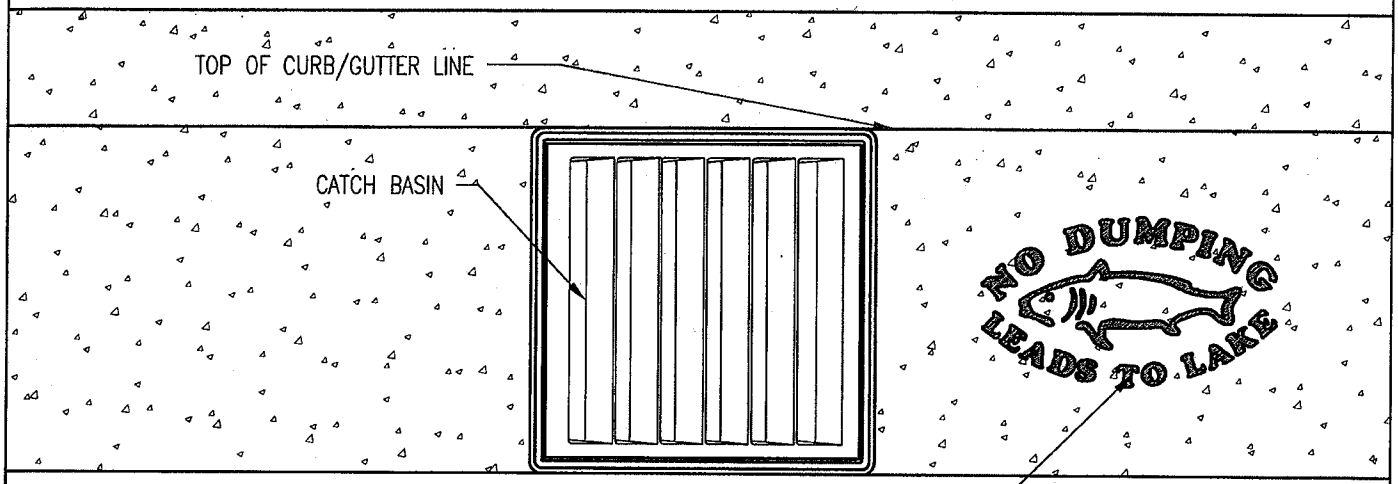


PLAN VIEW



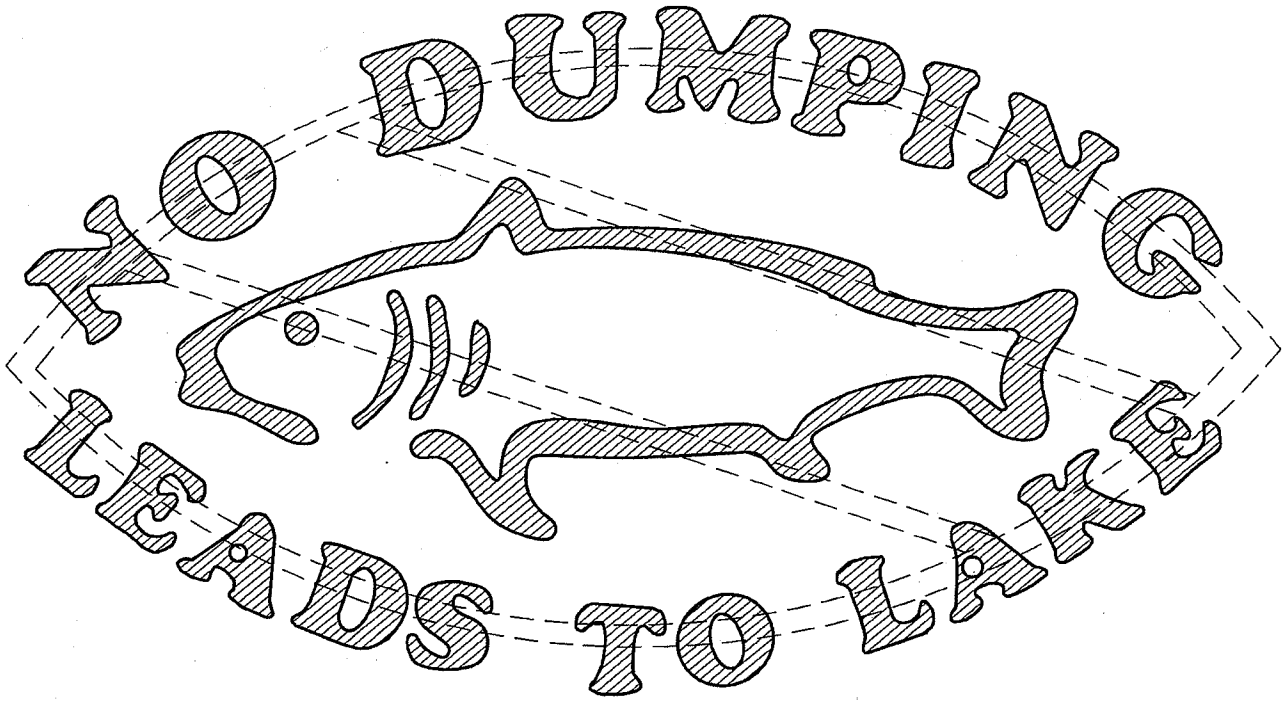
SECTION VIEW

GUTTER SWALE		STRM-6
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



GUTTER STAMP TO BE PLACED A MAXIMUM OF 18" FROM CATCH BASIN GRATE ON UPHILL SIDE AND CENTERED IN GUTTER.

GUTTER STAMP TO BE OBTAINED FROM CITY OF DULUTH BY CONTRACTOR.



GUTTER STAMP		STRM-7
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

THE CITY OF

DULUTH

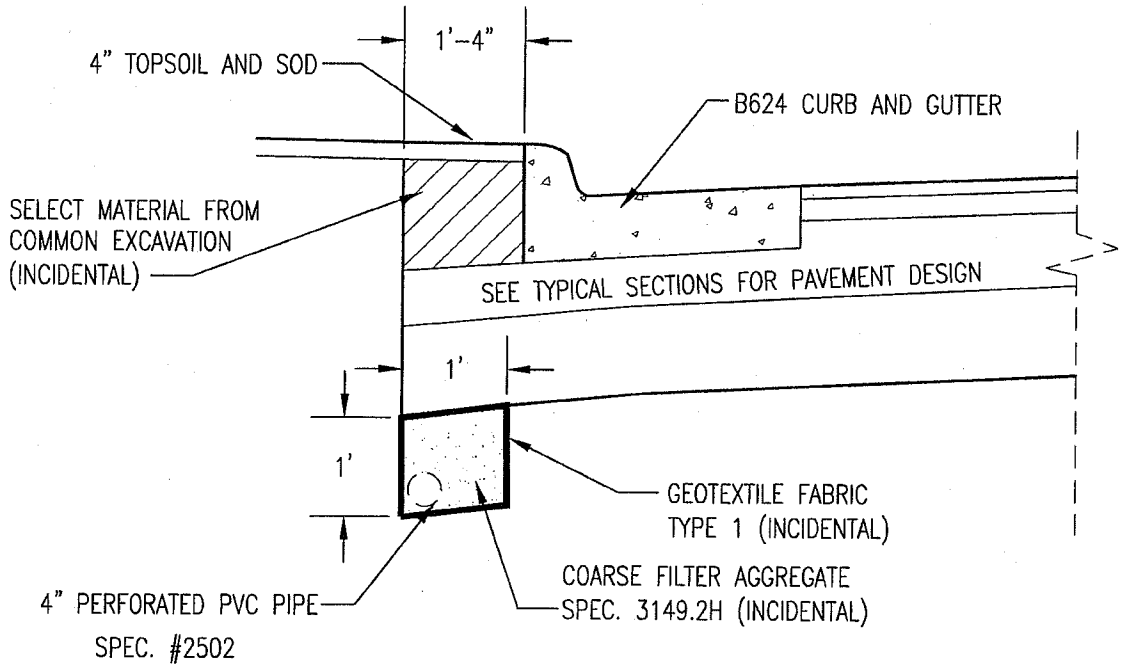
MINNESOTA

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

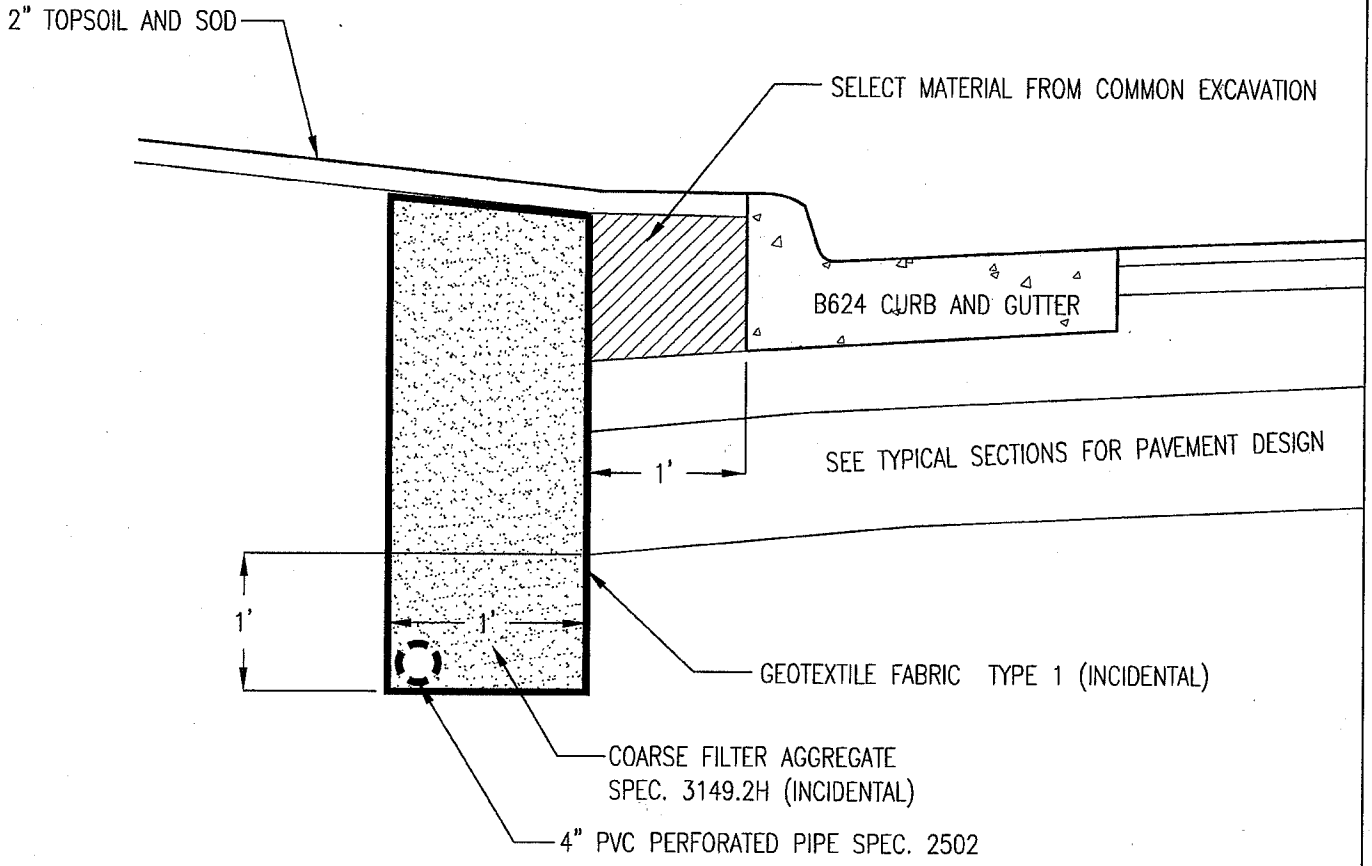
STANDARD DETAIL DRAWINGS

STREET

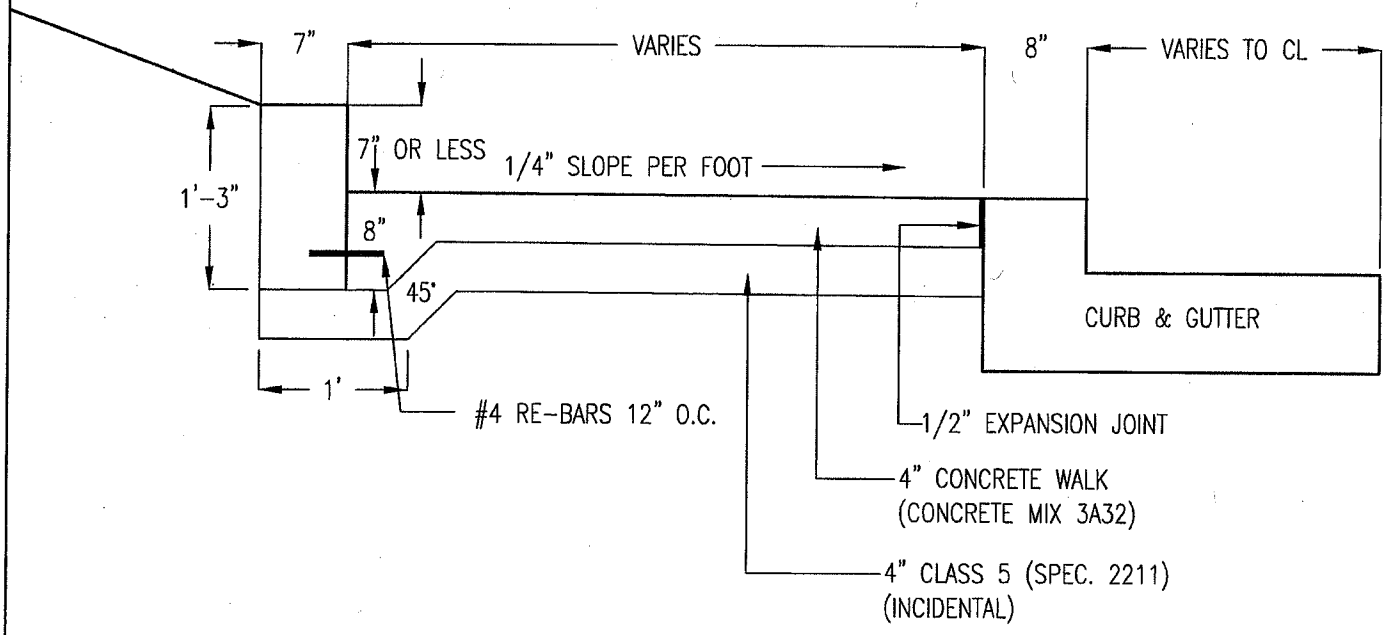
STR-1	PERFORATED PIPE DETAIL
STR-2	PERFORATED PIPE - SPECIAL
STR-3	4" CONCRETE WALK SPECIAL
STR-4	BITUMINOUS CURB
STR-5	DRIVEWAY & ALLEY ENTRANCE
STR-6	CONCRETE RETAINING WALL
STR-7	CONCRETE STEPS
STR-8	STREET RESTORATION OVER TRENCH



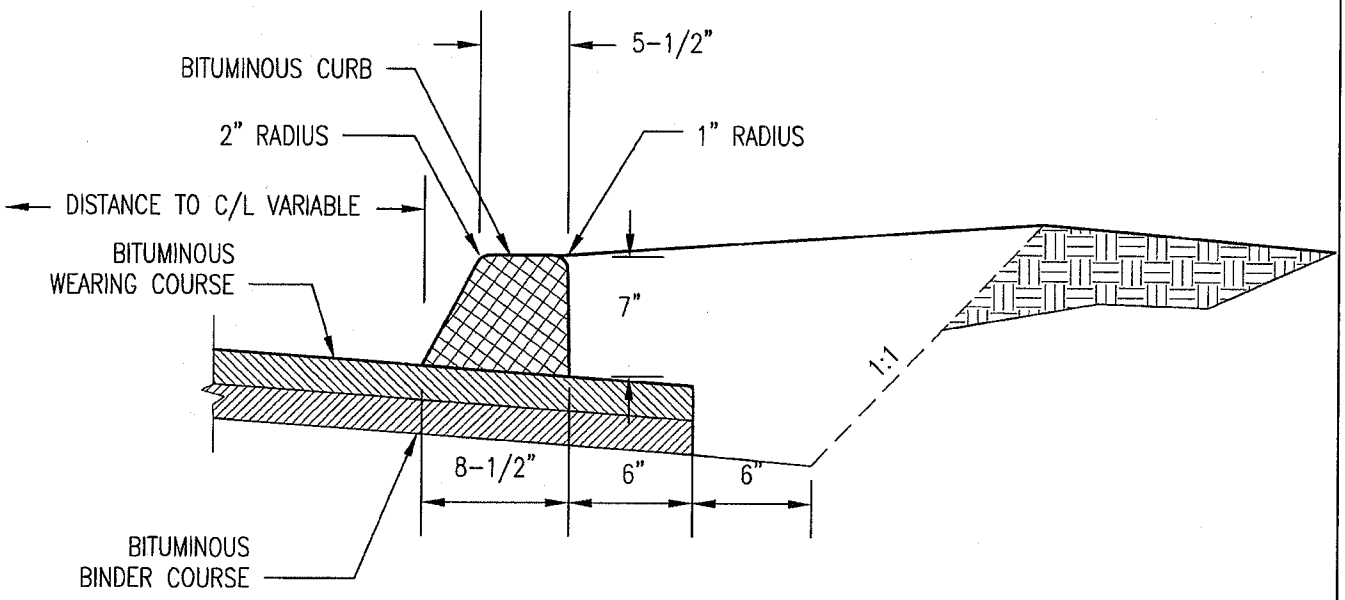
PERFORATED PIPE DETAIL		STR-1
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



PERFORATED PIPE – SPECIAL		STR–2
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

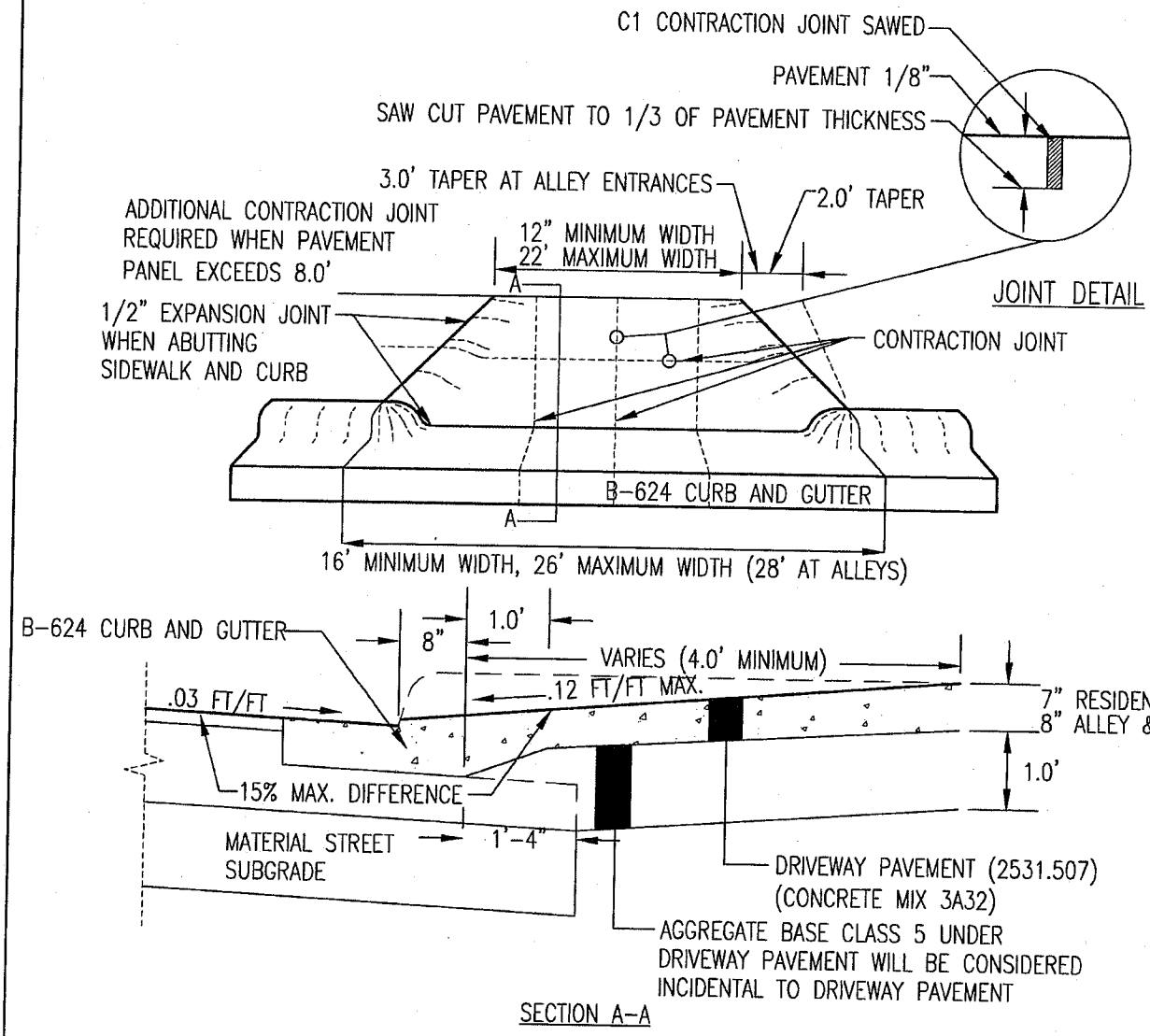


4" CONCRETE WALK SPECIAL		STR-3
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



VOLUME OF CURB
0.338 CU. FT. PER LIN. FT.

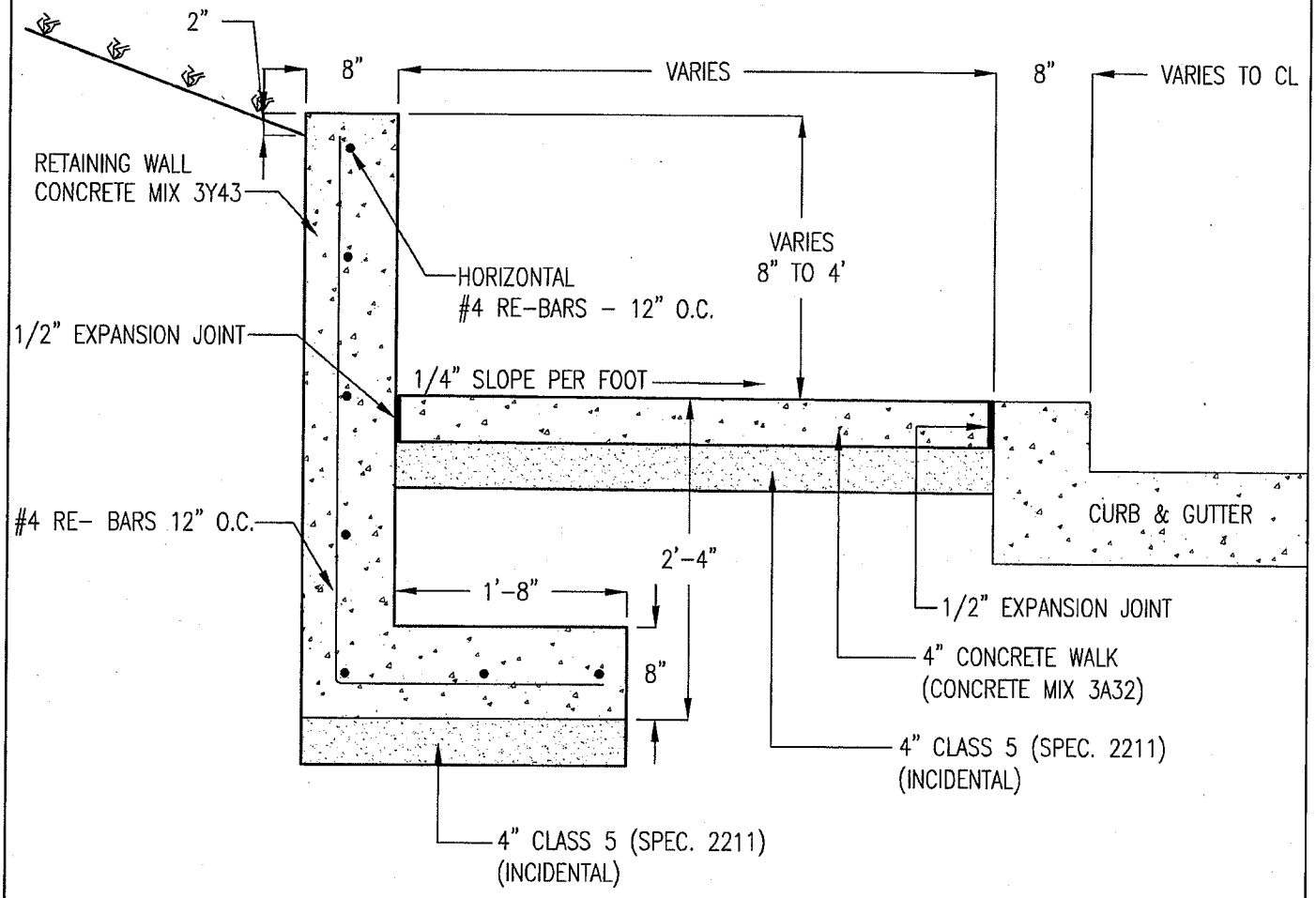
BITUMINOUS CURB		STR-4
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



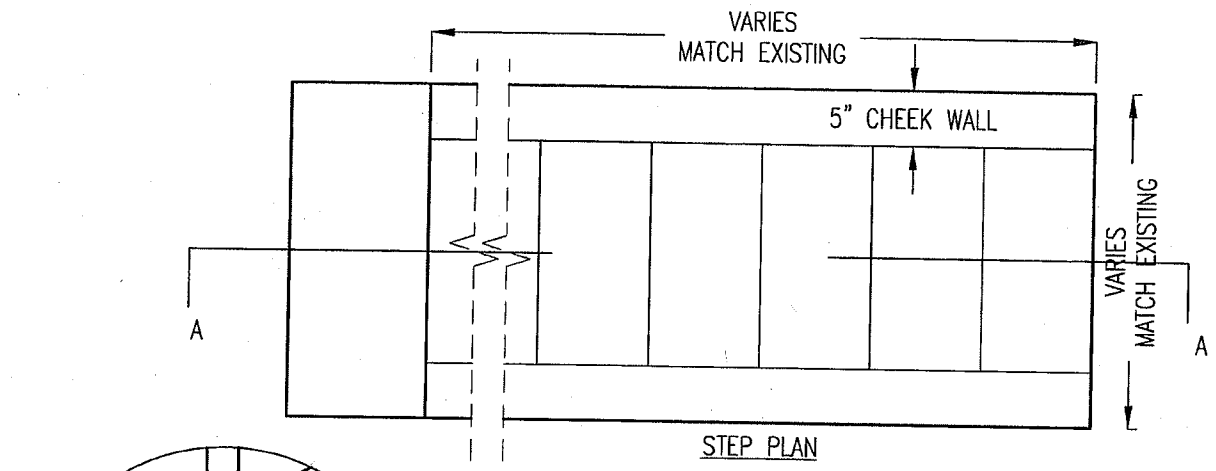
NOTE: THE CREST OF THE DRIVEWAY MUST BE AT LEAST 6" ABOVE GUTTER TO CONTAIN RUNOFF. NOTE: STATE OF MIN. STANDARD PLATE 7035L NOTE 5 SHALL NOT APPLY.

DRIVEWAY & ALLEY ENTRANCES		STR-5
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

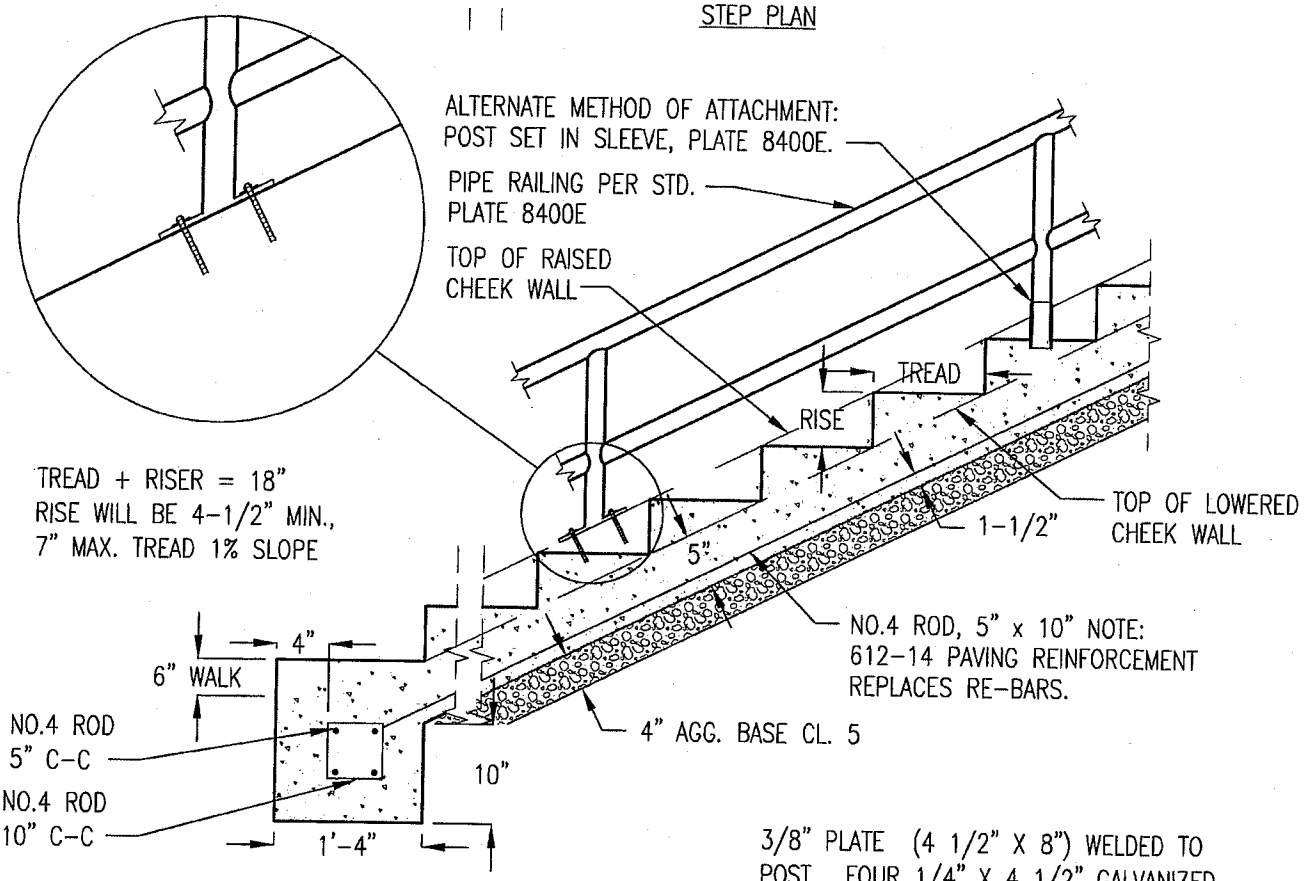
EXACT LOCATION AND ELEVATION OF
RETAINING WALL WILL BE DETERMINED
IN THE FIELD BY THE ENGINEER



CONCRETE RETAINING WALL		STR-6
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



STEP PLAN



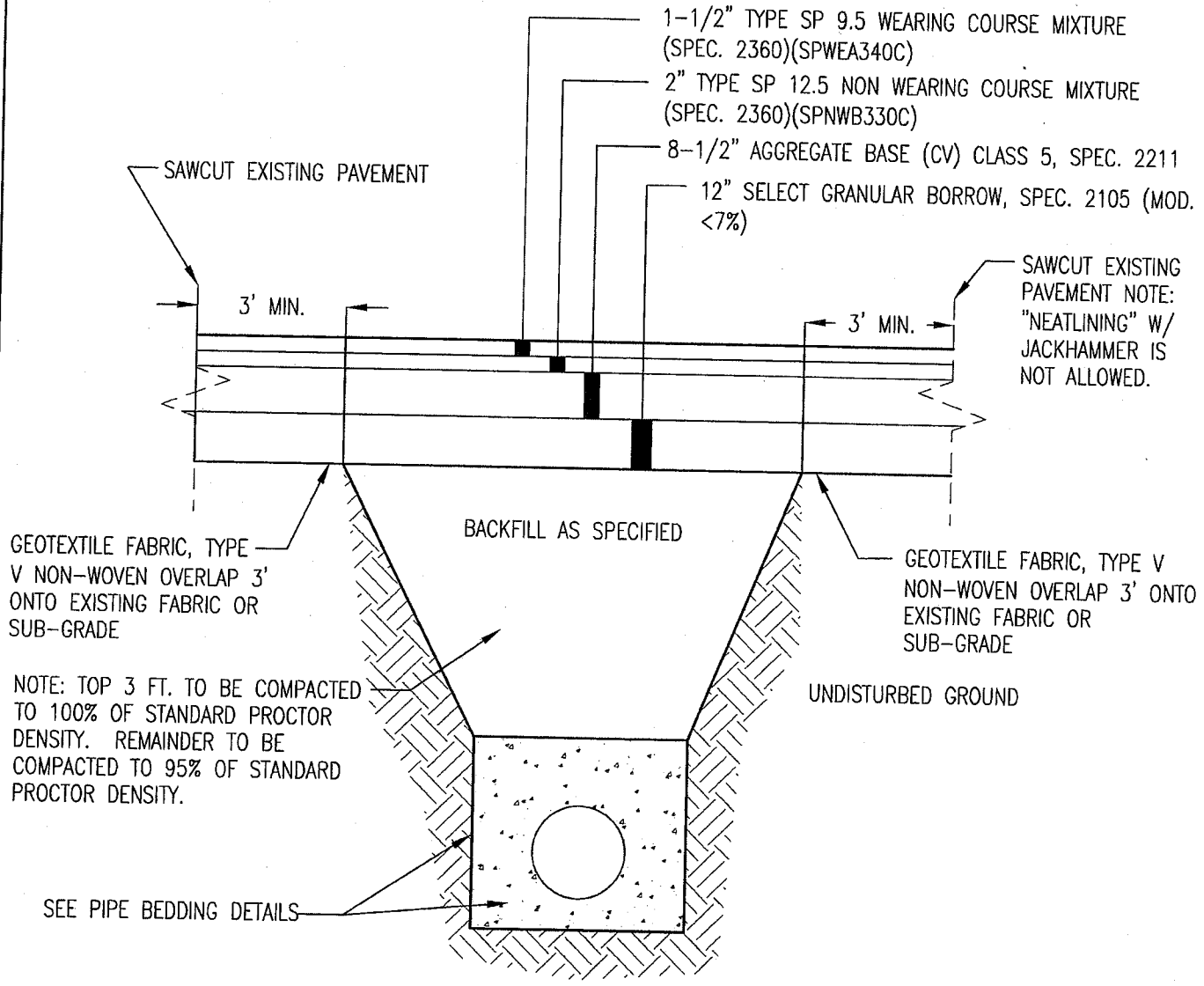
SECTION A-A

3/8" PLATE (4 1/2" X 8") WELDED TO POST. FOUR 1/4" X 4 1/2" GALVANIZED BOLTS, DRILLED AND GROUTED INTO CHEEK WALL CONCRETE OR OTHER METHOD OF ATTACHMENT AS APPROVED BY ENGINEER.

NOTES:

1. 5" WIDE RAISED OR LOWERED CHEEK WALLS TO BE DETERMINED IN FIELD BY ENGINEER.
2. RAILINGS WILL BE REQUIRED WHERE MORE THAN THREE STEPS ARE NEEDED.
3. INCLUDES: ALL EXCAVATION (EXCEPT ROCK EXC.), REMOVAL OF EXISTING STEPS, FORMING, CLASS 5, REINFORCING AND BACKFILL, CONCRETE SHALL BE MIX 3Y43, RAILINGS WHERE NECESSARY. RAILINGS TO BE PAINTED WITH BLACK RUST PROOF PAINT, PER SPEC. NO'S 3501, 3507 & 3526.

CONCRETE STEPS		STR-7
REVIEWED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



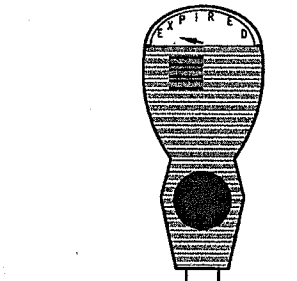
STREET RESTORATION OVER TRENCH		STR-8
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

STANDARD DETAIL DRAWINGS

TRANSPORTATION

T-1	TYPICAL PARKING METER INSTALLATION
T-2	SIGN INSTALLATION
T-3	STREET NAME SIGN FOOTING
T-4	E-250 INSTALLATION
T-5	E-350 INSTALLATION
T-6	E-650 INSTALLATION
T-7	RURAL STREET - TYPICAL SECTION
T-8	URBAN STREET WITH SIDEWALKS - TYPICAL SECTION



TYPICAL INSTALLATION
BASE COLLAR IN
CONCRETE WALK

REMOVE CONCRETE WALK,
CORE, OR SAW OPENING
FOR METER BASE COLLAR,
AS DIRECTED BY
ENGINEER

BASE COLLAR
STEEL PIPE

2" MINIMUM

REBAR SUPPORT FOR PIPE

STEEL PIPE 2.5" I.D. X 2.9" O.D.

2" MINIMUM

12"

CONCRETE SIDEWALK

1"

5"

5"

TYPICAL TOP VIEW

5/16" REBAR OR
EQUIVALENT FOR
BOTTOM TEE

2" MINIMUM

38"

SOIL

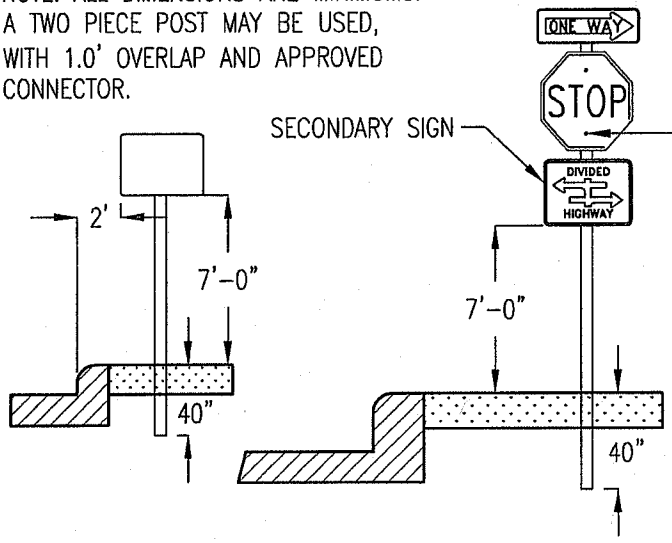
REBAR SUPPORT
FOR PIPE

TYPICAL PARKING METER BASE COLLAR
IN CONCRETE SIDEWALK

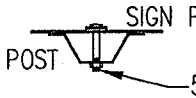
TYPICAL PARKING METER BASE COLLAR
INSTALLATION IN SOIL

TYPICAL PARKING METER INSTALLATION		T-1
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

NOTE: ALL DIMENSIONS ARE MINIMUMS.
A TWO PIECE POST MAY BE USED,
WITH 1.0' OVERLAP AND APPROVED
CONNECTOR.



STAINLESS STEEL WASHER & NYLON WASHER (T=1/16" MIN., I.D.=3/8" MAX., O.D.=7/8" MAX.)



NOTE: SEE SPECIAL PROVISIONS FOR SIGN AND AND POST SPECIFICATIONS.

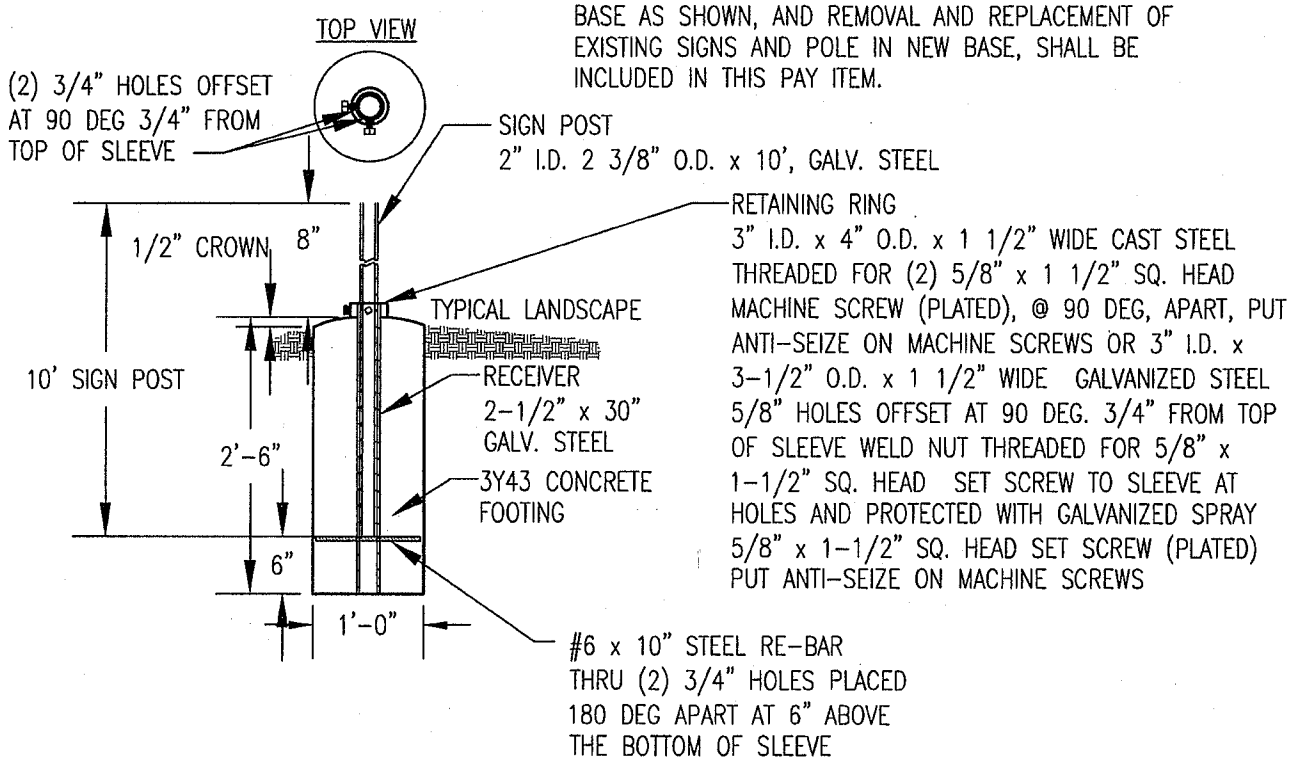
SIGN PANEL TO POST CONNECTION

ALL MATERIALS AND LABOR USED TO RELOCATE EXISTING SIGN AS SHOWN, SHALL BE INCLUDED IN THIS PAY ITEM:

SPEC. 2564.602, REMOVE AND REINSTALL SIGN, EACH

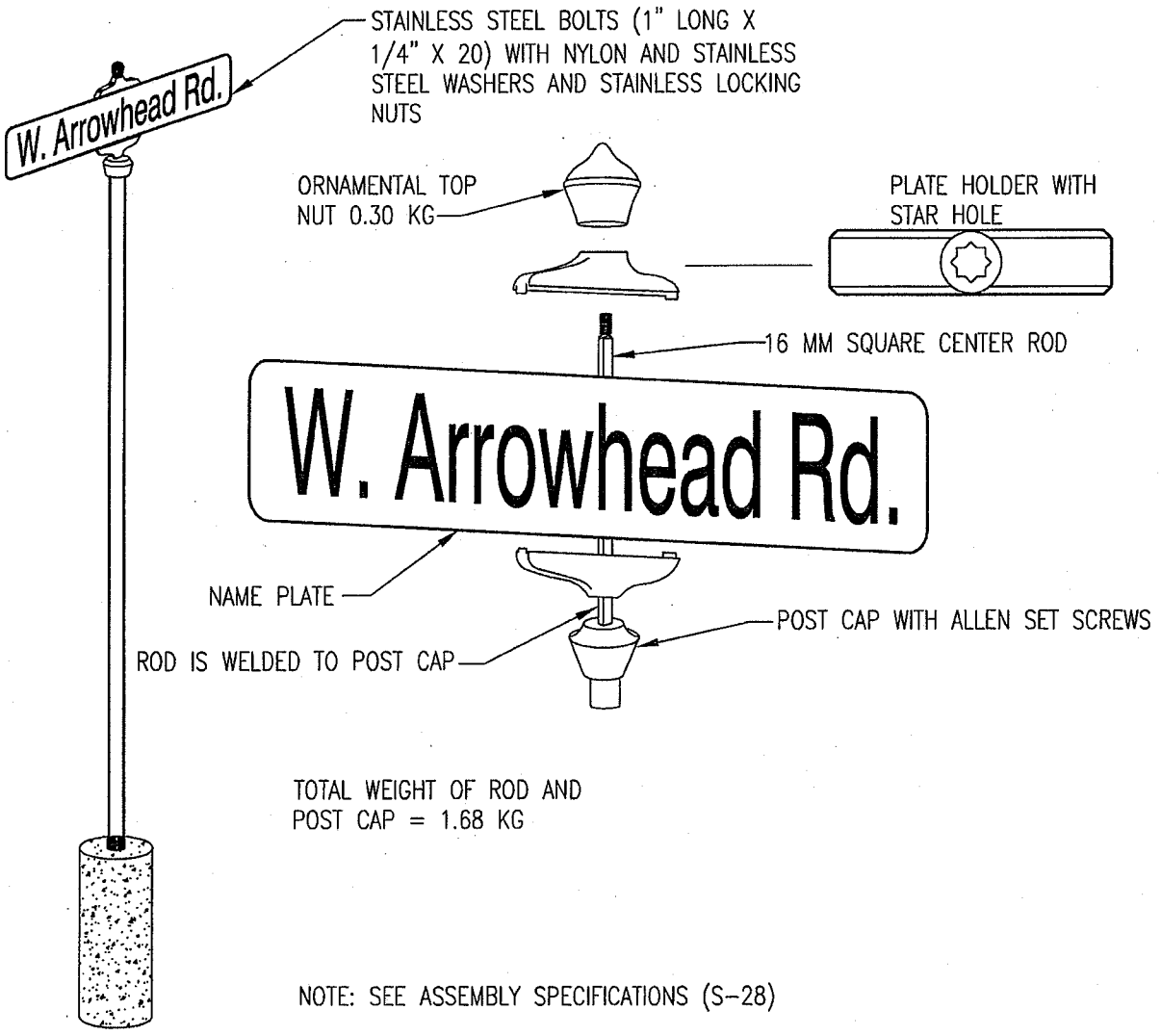
SIGN INSTALLATION DETAIL		T-2
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

ALL MATERIALS AND LABOR USED TO CONSTRUCT SIGN BASE AS SHOWN, AND REMOVAL AND REPLACEMENT OF EXISTING SIGNS AND POLE IN NEW BASE, SHALL BE INCLUDED IN THIS PAY ITEM.

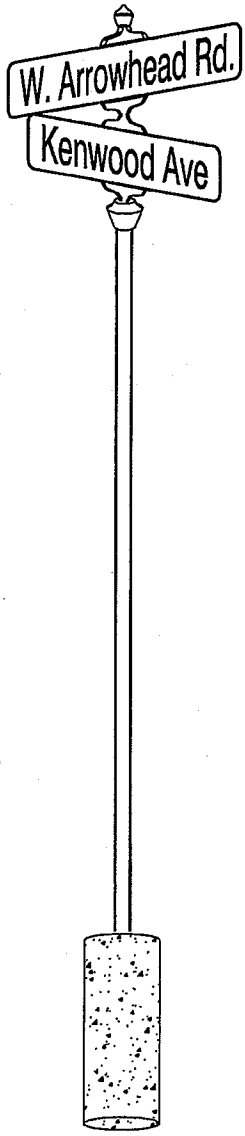


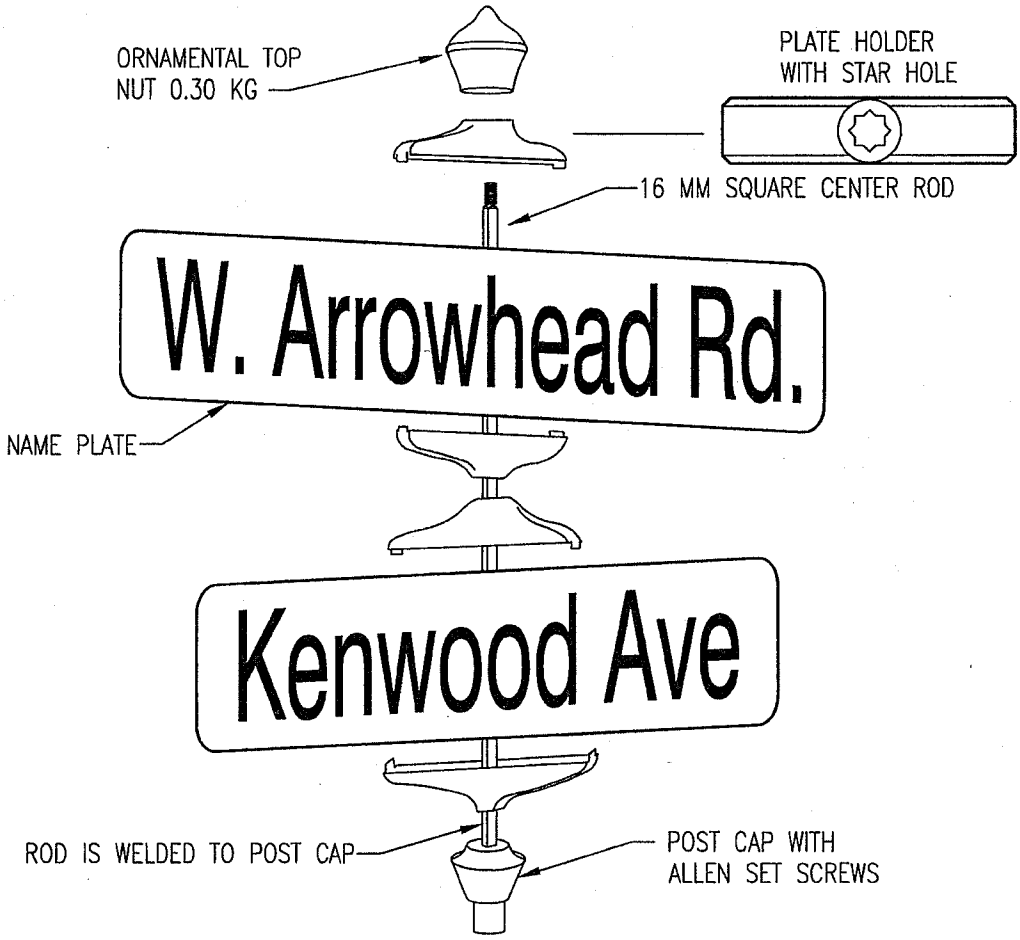
SPEC. 2564.602, REMOVE AND REINSTALL SIGN, EACH

STREET NAME SIGN FOOTING DETAIL		T-3
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



E-250 INSTALLATION		T-4
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

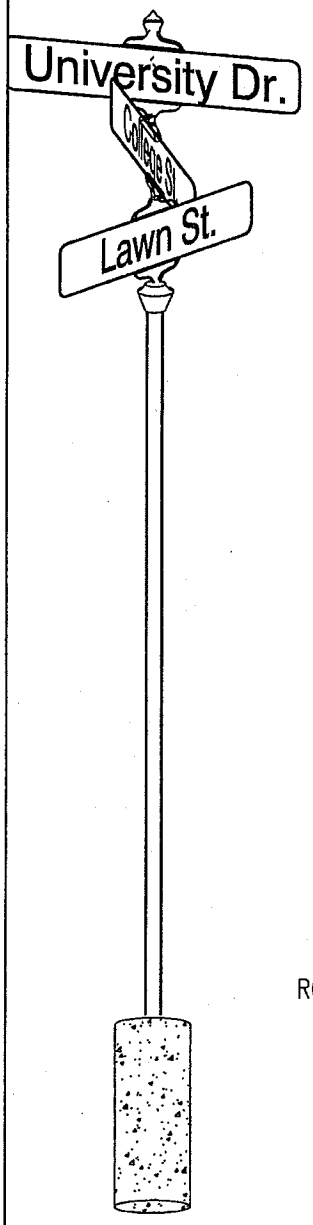




TOTAL WEIGHT OF ROD AND
POST CAP = 2.15 kg

NOTE: SEE ASSEMBLY SPECIFICATIONS (S-28)

E-450 INSTALLATION		T-5
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



ORNAMENTAL TOP
NUT 0.30 KG

16 MM SQUARE CENTER ROD

PLATE HOLDER WITH
STAR HOLE

NAME PLATE

University Dr.

Lawn St.

College St.

ROD IS WELDED TO POST CAP

POST CAP WITH
ALLEN SET SCREWS

TOTAL WEIGHT OF ROD AND POST CAP = 2.74 KG

NOTE: SEE ASSEMBLY SPECIFICATIONS (S-28)

E-650 INSTALLATION		T-6
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

TYPICAL SECTION FOR RECONSTRUCTION ONLY
RURAL STREET

NOTES

1. ALL DITCH BOTTOMS, TOE OF FILL SLOPES, AND TOP OF BACK SLOPES SHALL BE ROUNDED.
2. CONSTRUCT TYPICAL SECTION TO END OF RADII ON ROAD APPROACHES.
3. CONSTRUCT BROKEN BACK SLOPE WHEN ELEVATION AT PIVOT POINT TO NATURAL GROUND LEVEL AT TOE OF SLOPE EXCEEDS 3'.
4. ALL UTILITY POLES AND UNYIELDING OBJECTS SHALL BE REMOVED AND RELOCATED OUTSIDE THE CLEAR ZONE.
5. STANDARD DITCH BOTTOM IS 3' AND IS 34.42' FROM CENTERLINE. SEE SWPPP SHEET AND THE CROSS SECTIONS FOR EXCEPTIONS.
6. TACK, SPEC 2357, SHALL BE APPLIED BETWEEN ALL LAYERS OF BITUMINOUS PAVEMENT.
7. SLOPE DRESSING MATERIAL IS TO BE PLACED ON ALL SLOPES. MATERIAL IS TO BE SALVAGED FROM PAY ITEM 2106.607 EXCAVATION - COMMON. SLOPE DRESSING MATERIAL PLACEMENT IS INCLUDED IN PAY ITEM 2106.607 COMMON EMBANKMENT (CV).
8. PAY ITEM 2106.607 COMMON EMBANKMENT (CV). MATERIAL USED SHALL BE SELECT GRADING MATERIAL FROM PAY ITEM 2106.607 EXCAVATION - COMMON , OR HAULED IN FROM OFF PROJECT CONTRACTOR SOURCES IF AVAILABILITY IS DETERMINED TO BE INSUFFICIENT BY THE CONTRACTOR OR THE PROJECT ENGINEER.
9. PAY ITEM 2106.607 COMMON EMBANKMENT (CV).. MATERIAL USED SHALL BE REGULAR GRADING MATERIAL OR EXCESS SELECT GRADING MATERIAL FROM PAY ITEM 2106.607 EXCAVATION - COMMON.
10. ALL EXCAVATION TO BE PAID AS 2106.607 EXCAVATION - COMMON. BITUMINOUS REMOVAL QUANTITY IS NOT INCLUDED IN EXCAVATION - COMMON PAY ITEM.
11. ANY ADDITIONAL EXCAVATION (OTHER THAN SLOPE DRESSING MATERIAL), AS DEEMED NECESSARY BY THE ENGINEER WILL BE ADDED TO THE EXCAVATION - COMMON QUANTITY AND PAID FOR AT THE BID PRICE. ANY ADDITIONAL BACKFILL SHALL BE BY THE APPROPRIATE EMBANKMENT ITEM AND WILL BE PAID FOR AT THE ITEMS UNIT BID PRICE.

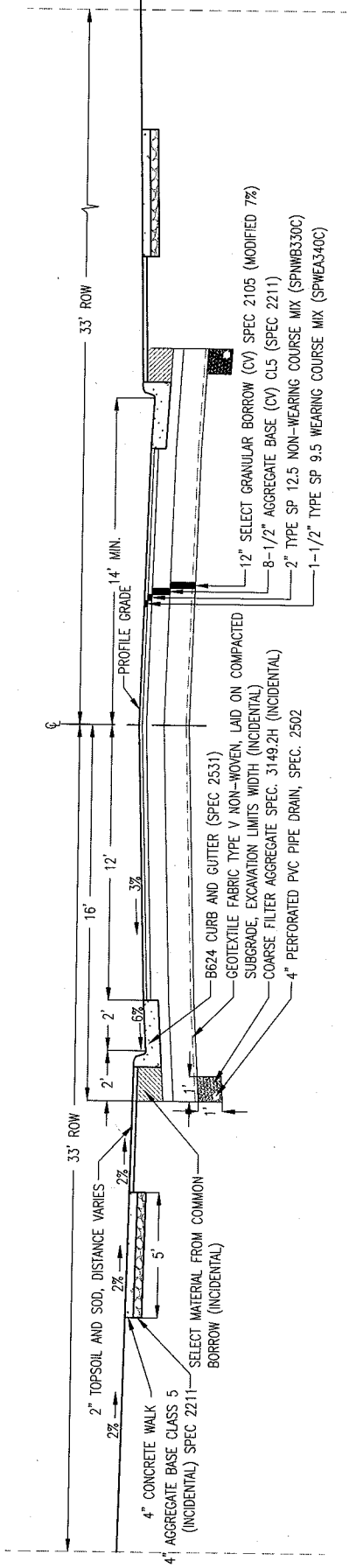
RURAL STREET – TYPICAL SECTION

T-7

6/25/2012

CITY OF DULUTH STANDARD DETAIL
DEPT. OF PUBLIC WORKS AND UTILITIES

NO SCALE



TYPICAL SECTION
URBAN STREET WITH SIDEWALKS

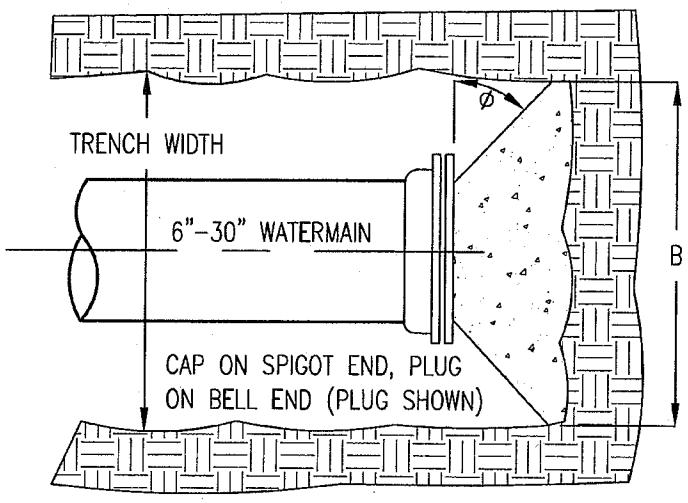
URBAN STREET WITH SIDEWALKS – TYPICAL SECTION		T-8
6/25/2012	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

DEPARTMENT OF PUBLIC WORKS & UTILITIES
ENGINEERING DIVISION

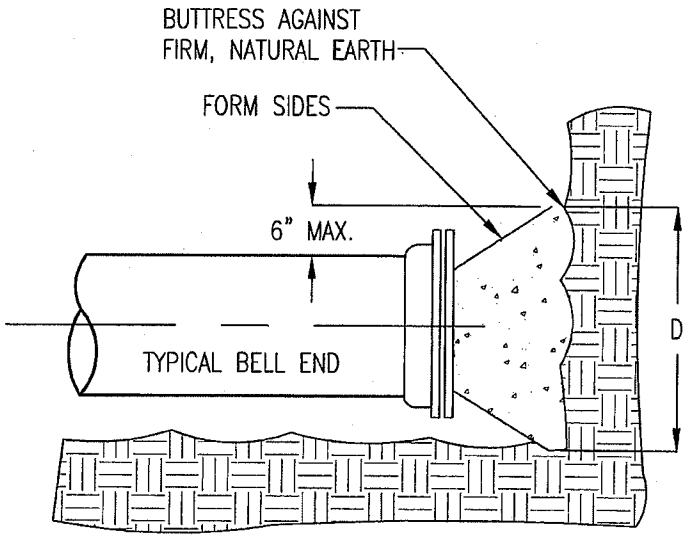
STANDARD DETAIL DRAWINGS

WATER SYSTEM DETAILS

W-2	PLUG BLOCKING FOR WATERMAIN
W-3	THRUST BLOCKING FOR WATERMAIN
W-4	FIRE HYDRANT SETTING DETAIL - DUCTILE IRON
W-4A	FIRE HYDRANT SETTING DETAIL - HDPE
W-5	TYPICAL COPPER WATER SERVICE
W-5A	TYPICAL HDPE WATER SERVICE
W-6	STRAPPING WATERMAIN VERTICAL OFFSETS
W-8	1-1/4" BLOWOFF FOR 6" AND 8" WATERMAINS
W-8A	1-1/4" BLOWOFF (VALVE BOX TYPE) ON EXISTING WATERMAINS
W-9	MANUAL AIR RELEASE VALVE BOX TYPE
W-10	AUTO AIR-RELEASE VALVE AND MANHOLE
W-11	EXCAVATION FOR TAPPING SLEEVE AND VALVE
W-13	WATER SERVICE INSULATION
W-15	CAST IRON WATER MANHOLE FRAME AND COVER
W-16	DULUTH THREAD
W-17	WATER VALVE BOX - DUCTILE IRON
W-17A	WATER VALVE BOX - HDPE
W-30	TYPICAL WATER METER INSTALLATION - SINGLE
W-31	TYPICAL WATER METER INSTALLATION - BYPASS
W-32	MULTIPLE WATER METER INSTALLATION
W-34	TYPICAL 6" FIRE SERVICE WITH DOMESTIC WATER



PLAN



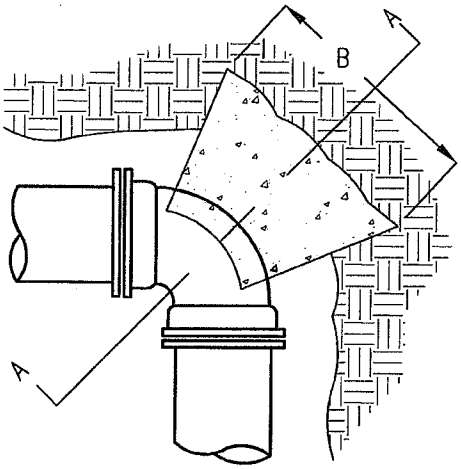
ELEVATION

BLOCKING DIMENSIONS		
PLUG SIZE	B	D
6"	12"	15"
8"	24"	15"
10"	24"	20"
12"	30"	22"
16"	40"	28"
20"	50"	34"
24"	62"	40"
30"	80"	48"

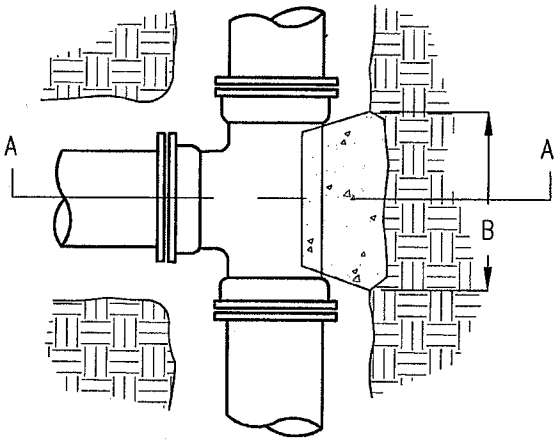
NOTES:

1. BLOCKING DIMENSIONS BASED ON EARTH RESISTANCE OF 2 TONS PER SQ. FT. WHERE, IN THE OPINION OF THE ENGINEER, EARTH IS POOR, BLOCKING SHALL BE INCREASED IN SIZE AS DIRECTED OR STRAPPING MAY BE NECESSARY.
2. ANGLEØ SHALL BE EQUAL TO OR LARGER THAN 45°.
3. BLOCKING SHALL BE CENTERED ON MAIN.
4. CONCRETE SHALL BE TYPE 3, GRADE B – MNDOT 2461.
5. POLYETHYLENE SHALL BE USED TO SEPARATE CONCRETE FROM FITTING.
6. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

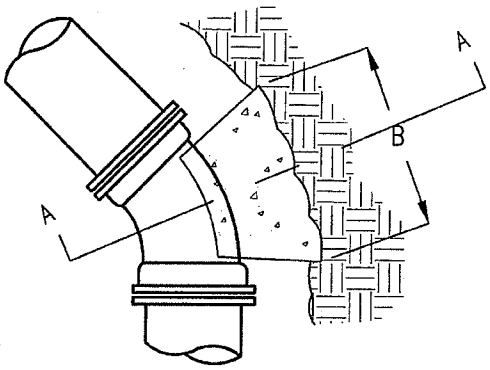
PLUG BLOCKING FOR WATERMAIN		W–2
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



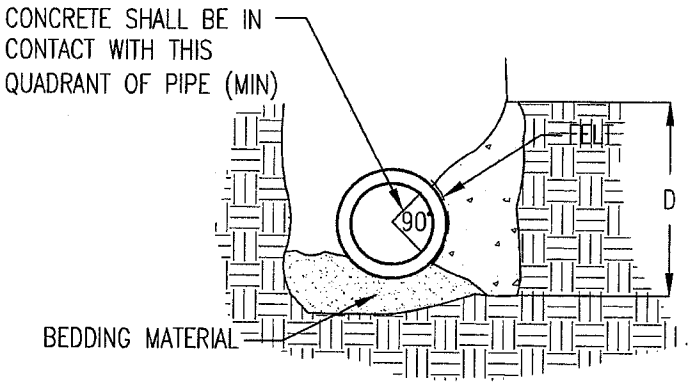
PLAN – 90° BEND



PLAN – TEE



PLAN – 45° BEND



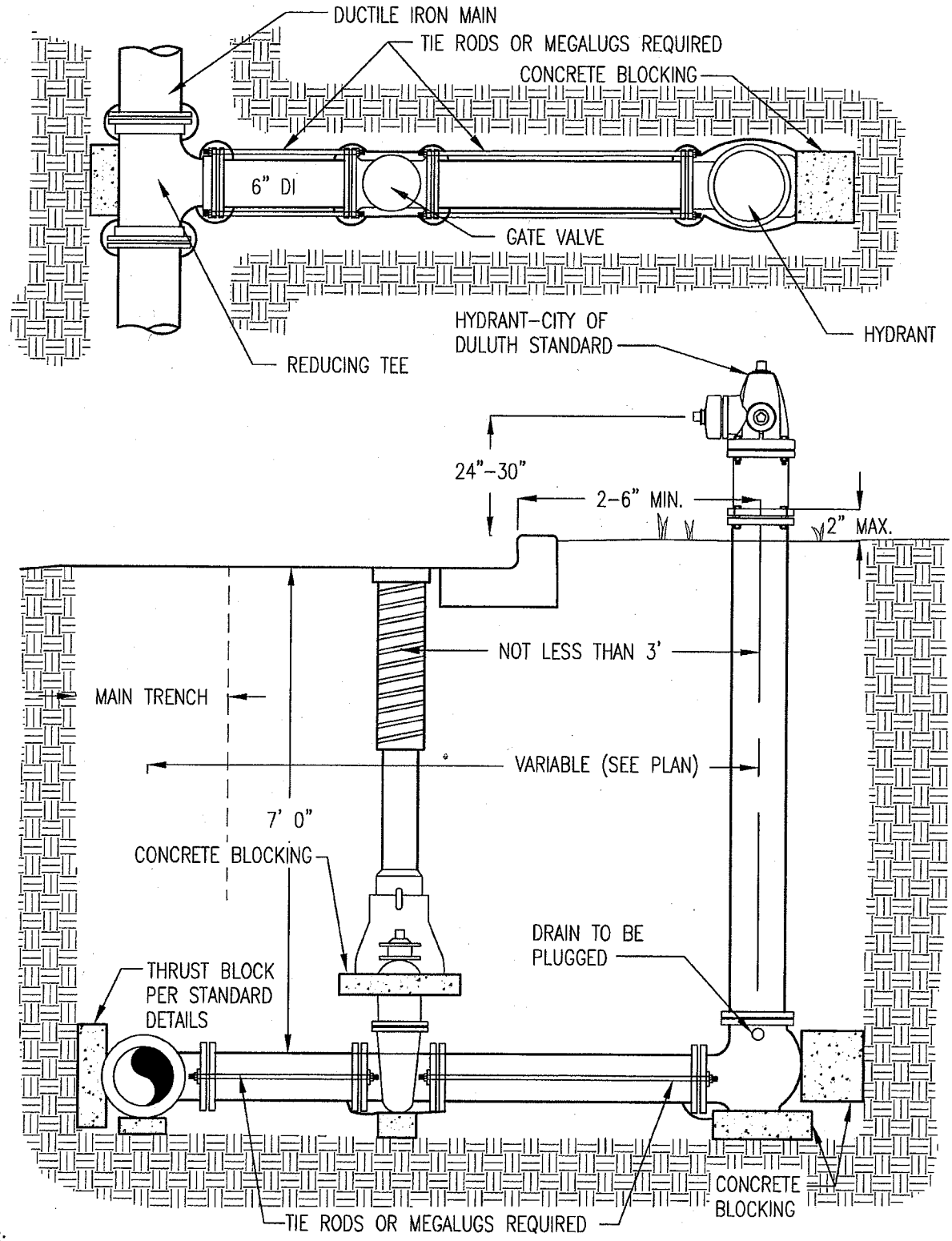
SECTION A–A

NOTES

1. DIMENSIONS IN TABLE ARE BASED ON A WATER PRESSURE OF 150 P.S.I. & AN EARTH RESISTANCE OF 2 TONS/S.F.
2. BLOCKING TO BE SET AGAINST UNDISTURBED SOIL
3. CONCRETE SHALL BE TYPE 3 GRADE B. (MNDOT SPEC. 2461) CONCRETE SHALL NOT INTERFERE WITH MECHANICAL JOINTS
4. POLYETHLYENE SHALL BE USED TO SEPARATE CONCRETE FROM FITTING.
5. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

BLOCKING DIMENSIONS								
BEND OR BRANCH SIZE	22-1/2" BENDS		45° BENDS		90° BENDS		TEES	
	B	D	B	D	B	D	B	D
0'-6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-2"	1'-3"	1'-0"
0'-8"	1'-0"	1'-0"	1'-4"	1'-2"	1'-10"	1'-6"	1'-6"	1'-4"
1'-0"	1'-4"	1'-4"	1'-10"	1'-10"	2'-8"	2'-3"	2'-3"	2'-0"
1'-4"	1'-10"	1'-8"	2'-6"	2'-4"	3'-10"	2'-10"	3'-2"	2'-4"
1'-8"	2'-4"	2'-0"	3'-3"	2'-10"	5'-0"	3'-4"	4'-0"	3'-0"
2'-0"	2'-10"	2'-4"	4'-0"	3'-3"	6'-4"	3'-10"	5'-3"	3'-4"
2'-6"	3'-6"	3'-0"	5'-4"	3'-10"	8'-0"	4'-8"	6'-3"	4'-3"

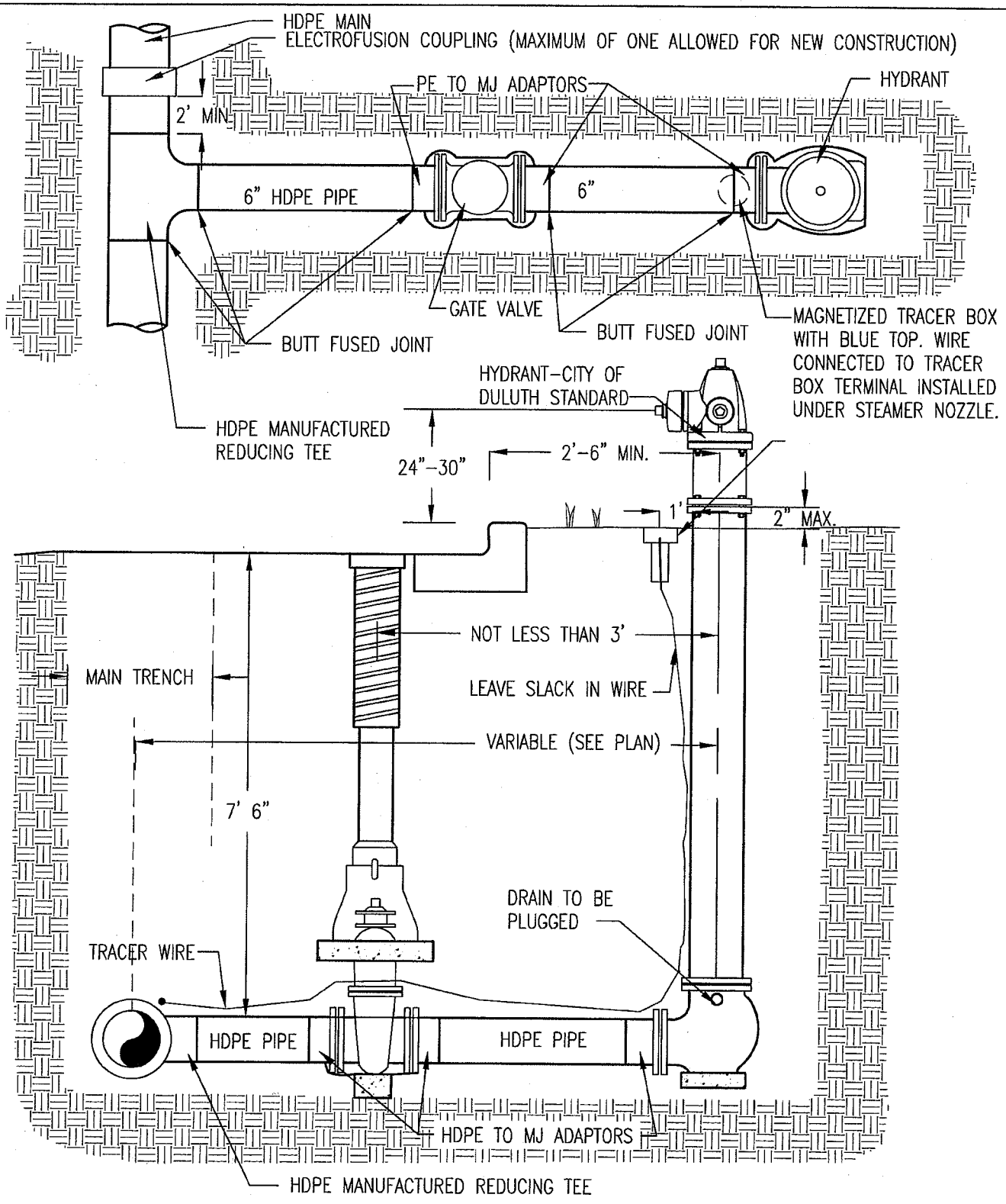
THRUST BLOCKING FOR WATERMAIN		W-3
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. VALVES SHALL BE CONNECTED DIRECTLY TO AN ANCHORING TEE. WHENEVER DIRECT CONNECTION IS NOT POSSIBLE, TIE RODS OR MEGALUGS SHALL BE USED. TIE RODS SHALL BE GALVANIZED.
2. USE EPOXY COATING ON VALVE AND HYDRANT BASE.
3. ALL BOLTS SHALL BE COR–TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B–418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE – REGULAR.

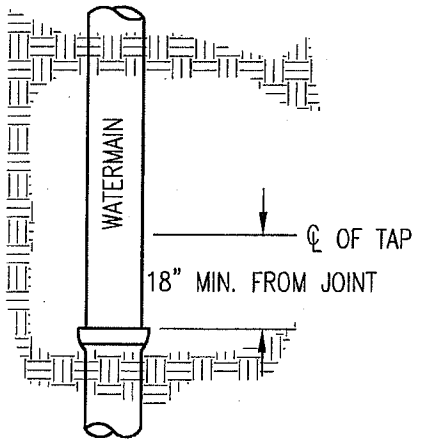
FIRE HYDRANT SETTING DETAIL – DUCTILE IRON		W–4
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES

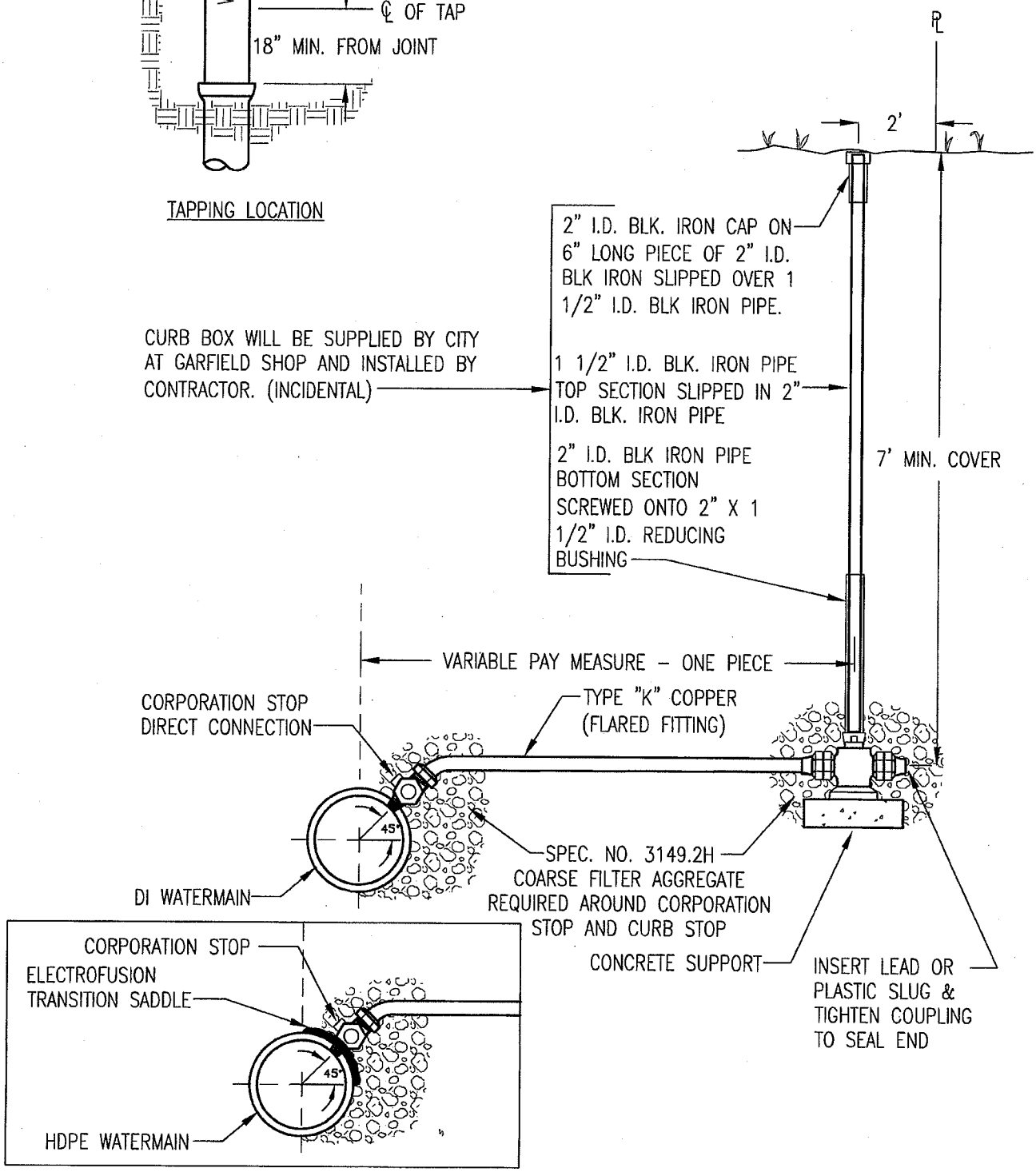
1. VALVES SHALL BE CONNECTED DIRECTLY TO MECHANICAL JOINT ADAPTORS.
2. USE EPOXY COATING ON VALVE AND HYDRANT BASE
3. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B-418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE - REGULAR.

FIRE HYDRANT SETTING DETAIL - HDPE		W-4A
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



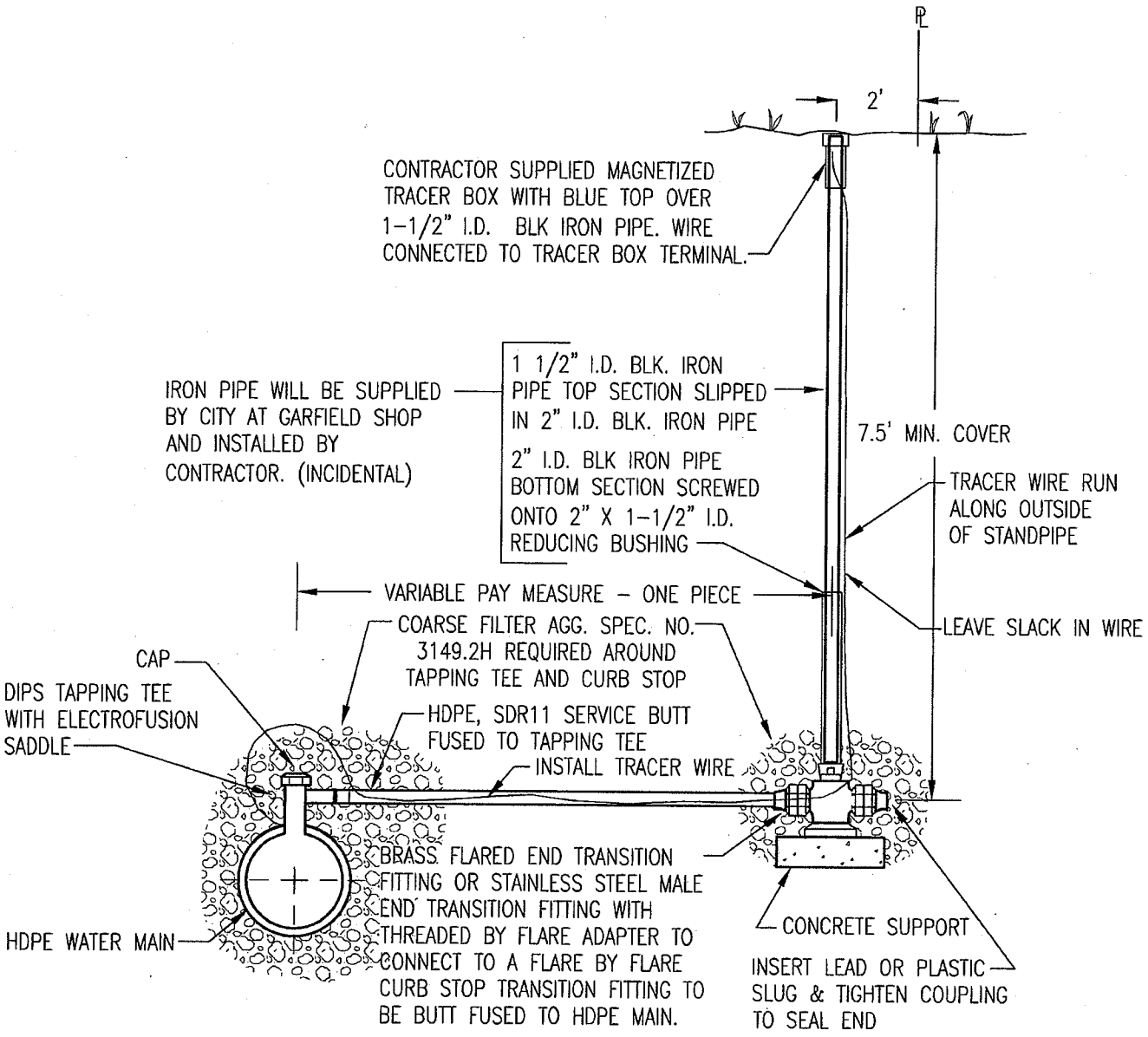
TAPPING LOCATION

NOTE: EXCAVATE 6" UNDER IN-PLACE MAIN AND BACKFILL WITH COARSE FILTER AGGREGATE MNDOT SPEC. # 3149.2H. CONTRACTOR SHALL PROVIDE & PLACE A TRENCH BOX WHEN REQUIRED.



TYPICAL COPPER WATER SERVICE - 3/4", 1", 1-1/4", AND 2"		W-5
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

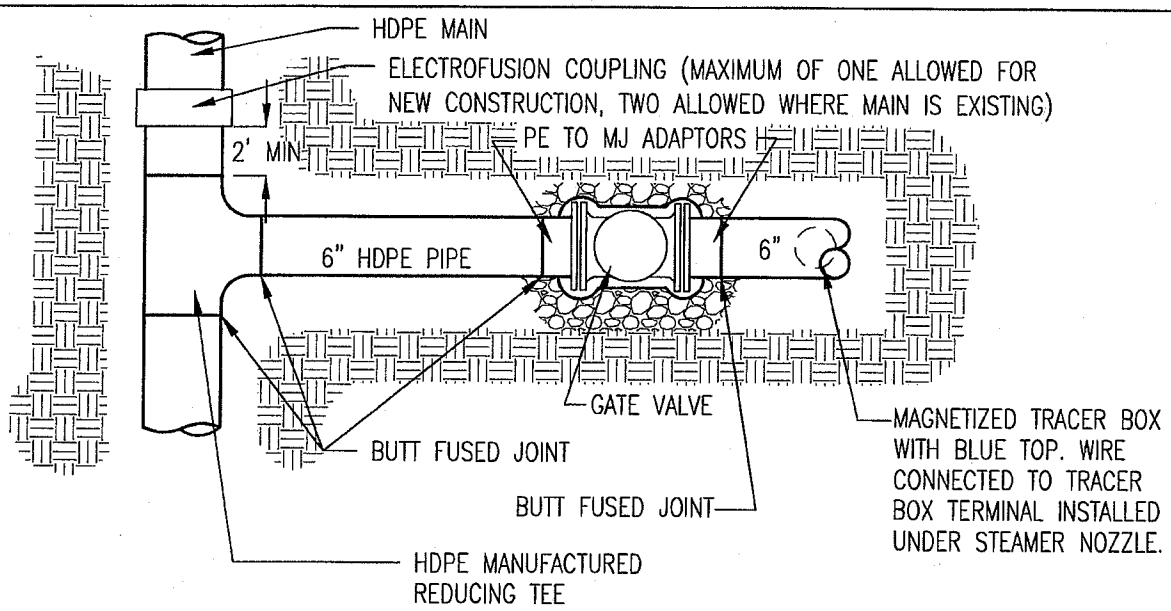
NOTE: EXCAVATE 6" UNDER IN-PLACE MAIN AND BACKFILL WITH COURSE FILTER AGGREGATE MNDOT SPEC. # 3149.2H. CONTRACTOR SHALL PROVIDE & PLACE A TRENCH BOX WHEN REQUIRED.

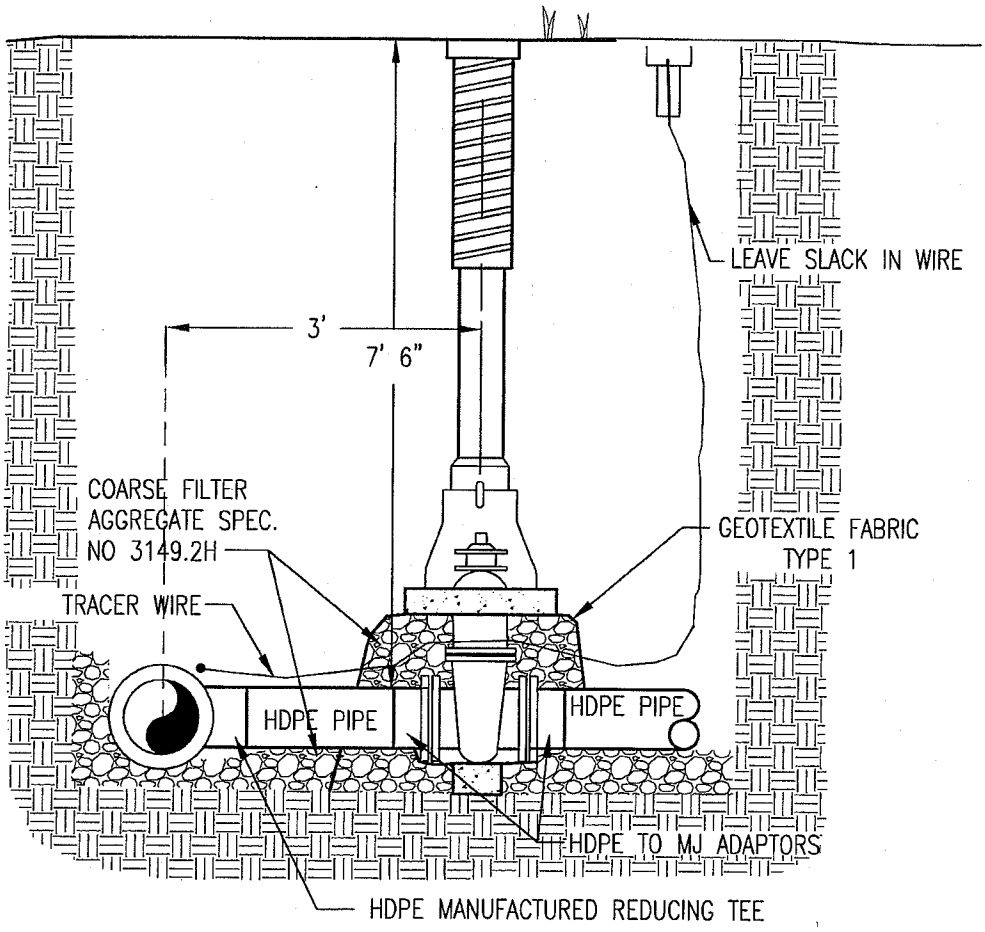


NOTE: SERVICE TO BE AIR TESTED PRIOR TO TAPPING MAIN

THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT OR COMPRESSION TYPE CONNECTORS. WIRE NUTS OR CLIP TYPE CONNECTOR SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.

TYPICAL HDPE WATER SERVICE - 3/4", 1", 1-1/4", AND 2"		W-5A
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



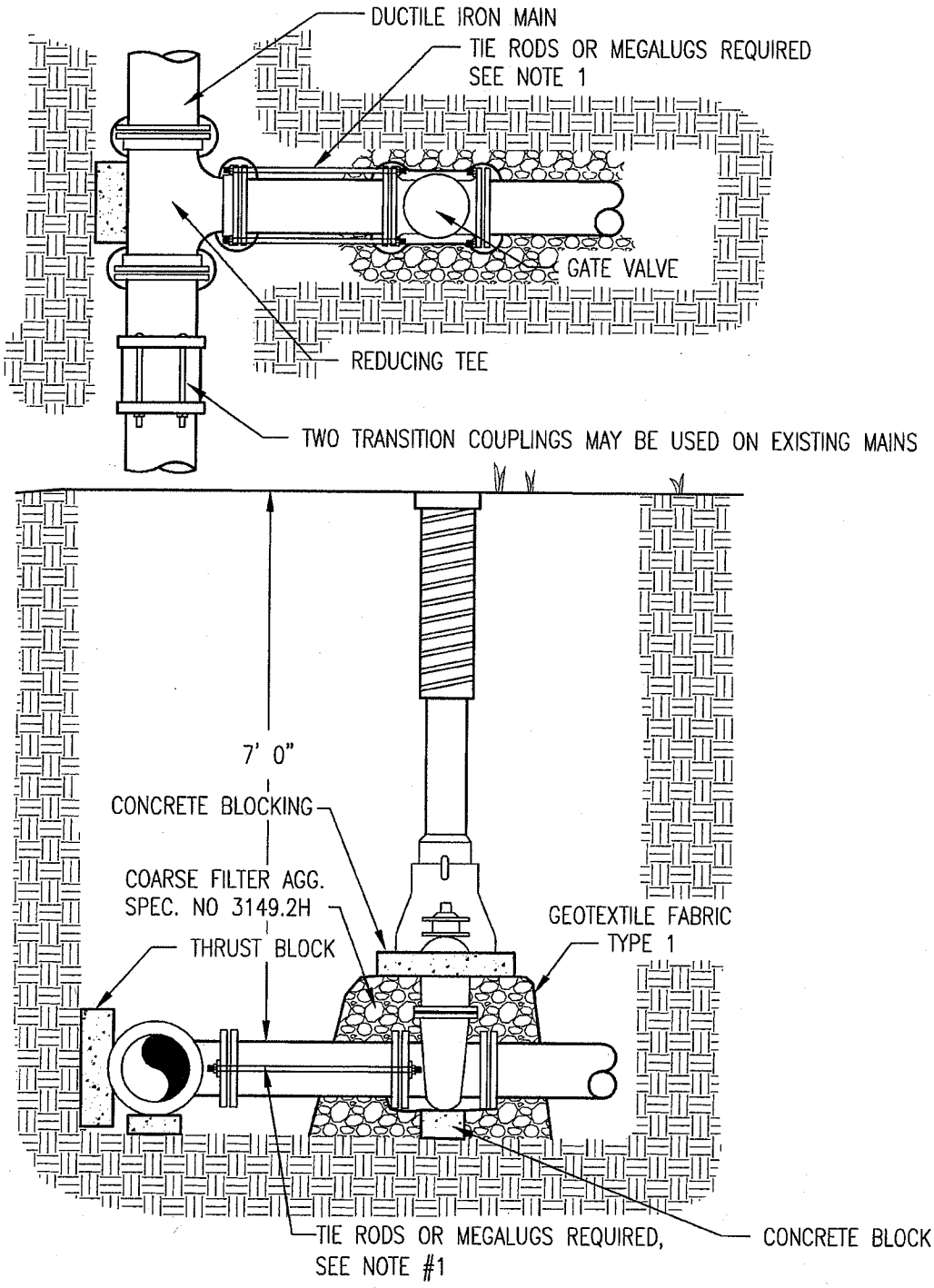


NOTES

1. VALVES SHALL BE CONNECTED DIRECTLY TO MECHANICAL JOINT ADAPTORS.
2. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B-418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE - REGULAR.

4" & LARGER WATER SERVICE - HDPE		W-5B
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

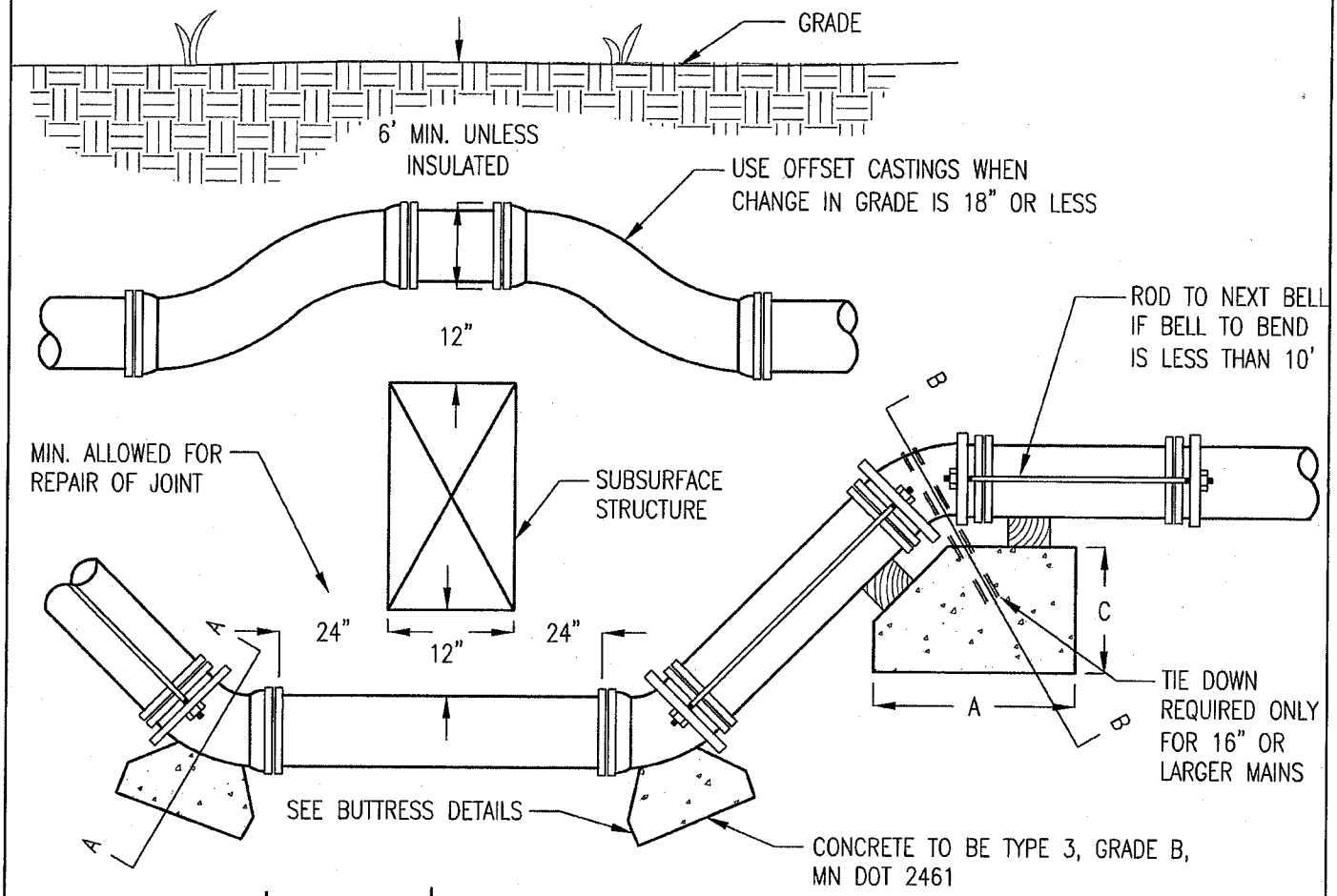
NOTE: ON EXISTING WATERMAINS, HOT TAPS SHALL BE PERFORMED FOR NEW SERVICES WHEN POSSIBLE.

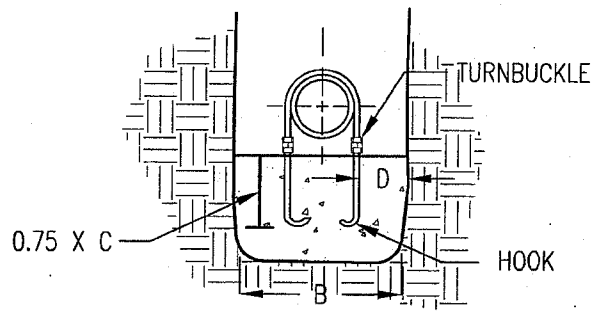


NOTES:

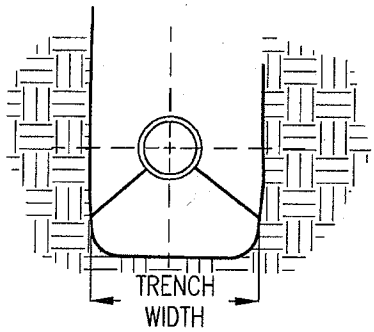
1. VALVES SHALL BE CONNECTED DIRECTLY TO AN ANCHORING TEE. WHENEVER DIRECT CONNECTION IS NOT POSSIBLE, TIE RODS OR MEGALUGS SHALL BE USED. TIE RODS SHALL BE GALVANIZED.
2. USE EPOXY COATING ON VALVE.
3. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B-418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE - REGULAR.

4" & LARGER WATER SERVICE - DUCTILE IRON		W-5C
REVISED/APPROVED 2/1/11	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE





SECTION B–B



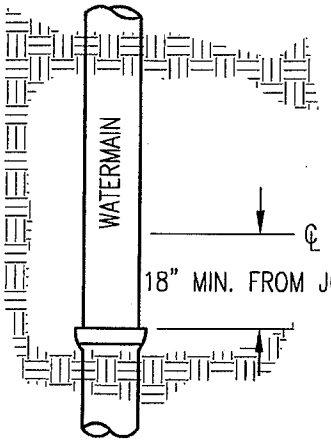
SECTION A–A

NOTES:

1. TIE RODS, BOLTS, NUTS, BANDS, AND WASHERS TO BE FURNISHED BY THE CONTRACTOR AND INSTALLED BY CONTRACTOR. ALL RODS AND CONNECTING HARDWARE SHALL BE GALVANIZED. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS
2. STRAPPING MATERIAL:
   - 2.1. NO. RODS 2 PER TIE
   - 2.2. DIA. RODS 1 INCH
   - 2.3. STRAP SIZE 1/2" X 2"
   - 2.4. BOLT DIA. 3/4"
   - 2.5. WASHER SIZE 1/2" X 3" X 5"
3. OFFSETS FOR 16" WATER MAIN AND LARGER, TIE DOWNS SHALL BE INSTALLED AS SHOWN. TURNBUCKLE AND BLOCK SIZES:

PIPE SIZE	A	B	C	D
16"	6'–0"	2'–6"	3'–0"	0'–1"
20"	8'–0"	3'–0"	3'–0"	0'–1 1/4"
24"	8'–0"	3'–0"	5'–0"	0'–1 1/2"
30"	8'–0"	5'–0"	5'–0"	0'–2"

STRAPPING WATERMAIN VERTICAL OFFSETS		W–6
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



TAPPING LOCATION

NOTE: EXCAVATE 6" UNDER IN-PLACE MAIN AND BACKFILL WITH COARSE FILTER AGGREGATE MNDOT SPEC. # 3149.2H. CONTRACTOR SHALL PROVIDE & PLACE A TRENCH BOX WHEN REQUIRED.

CONTRACTOR SUPPLIED MAGNETIZED TRACER BOX WITH BLUE TOP OVER 1-1/2" I.D. BLK IRON PIPE. WIRE CONNECTED TO TRACER BOX TERMINAL.

IRON PIPE WILL BE SUPPLIED BY CITY AT GARFIELD SHOP AND INSTALLED BY CONTRACTOR. (INCIDENTAL)

1 1/2" I.D. BLK. IRON PIPE TOP SECTION SLIPPED IN 2" I.D. BLK. IRON PIPE

2" I.D. BLK IRON PIPE BOTTOM SECTION SCREWED ONTO 2" X 1 1/2" I.D. REDUCING BUSHING

TRACE WIRE RUN ALONG OUTSIDE OF STANDPIPE

7.5' MIN. COVER

LEAVE SLACK IN WIRE

SPEC. NO. 3149H COARSE FILTER AGGREGATE REQUIRED AROUND CORPORATION STOP AND CURB STOP

2" X 2" I.P.S. STAINLESS STEEL MALE END TRANSITION FITTING WITH IRON PIPE THREADS TO HDPE

2" CU TUBE NUT. 2" FEMALE CU THREAD TO 2" FEMALE IRON PIPE THREAD.

2" 45° BEND

2" CORPORATION STOP

ELECTROFUSION COUPLING

INSTALL TRACER WIRE

2" HDPE, SDR11

2" HDPE, SDR11 WATERMAIN

DI OR CI WATERMAIN

SADDLE

CONCRETE SUPPORT

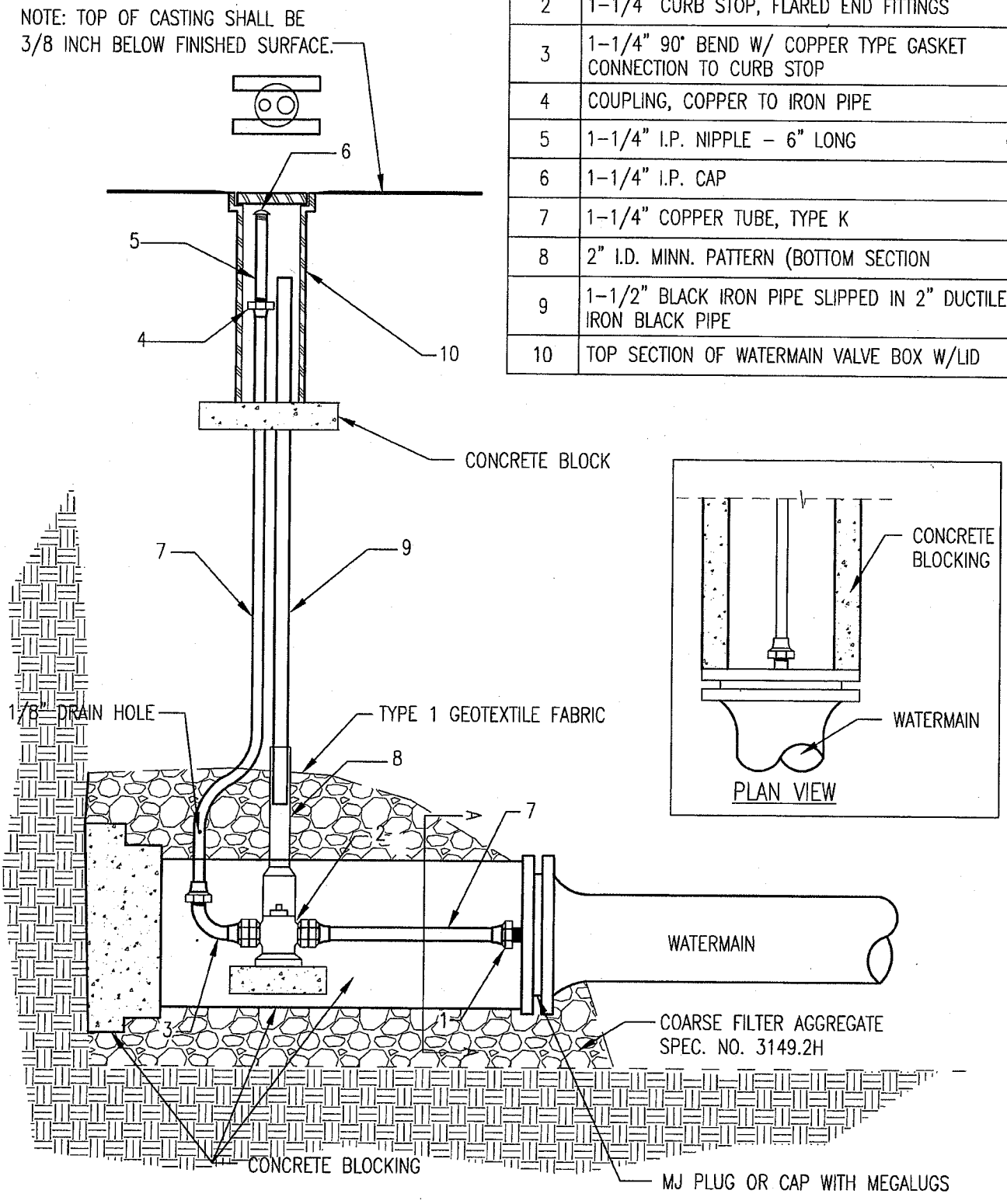
CONNECT TRACER WIRE TO WATERMAIN TO ENSURE ELECTRICAL CONDUCTIVITY.

BRASS FLARED END TRANSITION FITTING OR STAINLESS STEEL MALE END TRANSITION FITTING WITH THREADED BY FLARE ADAPTER TO CONNECT TO A FLARE BY FLARE CURB STOP, TRANSITION FITTING TO BE BUTT FUSED TO HDPE MAIN.

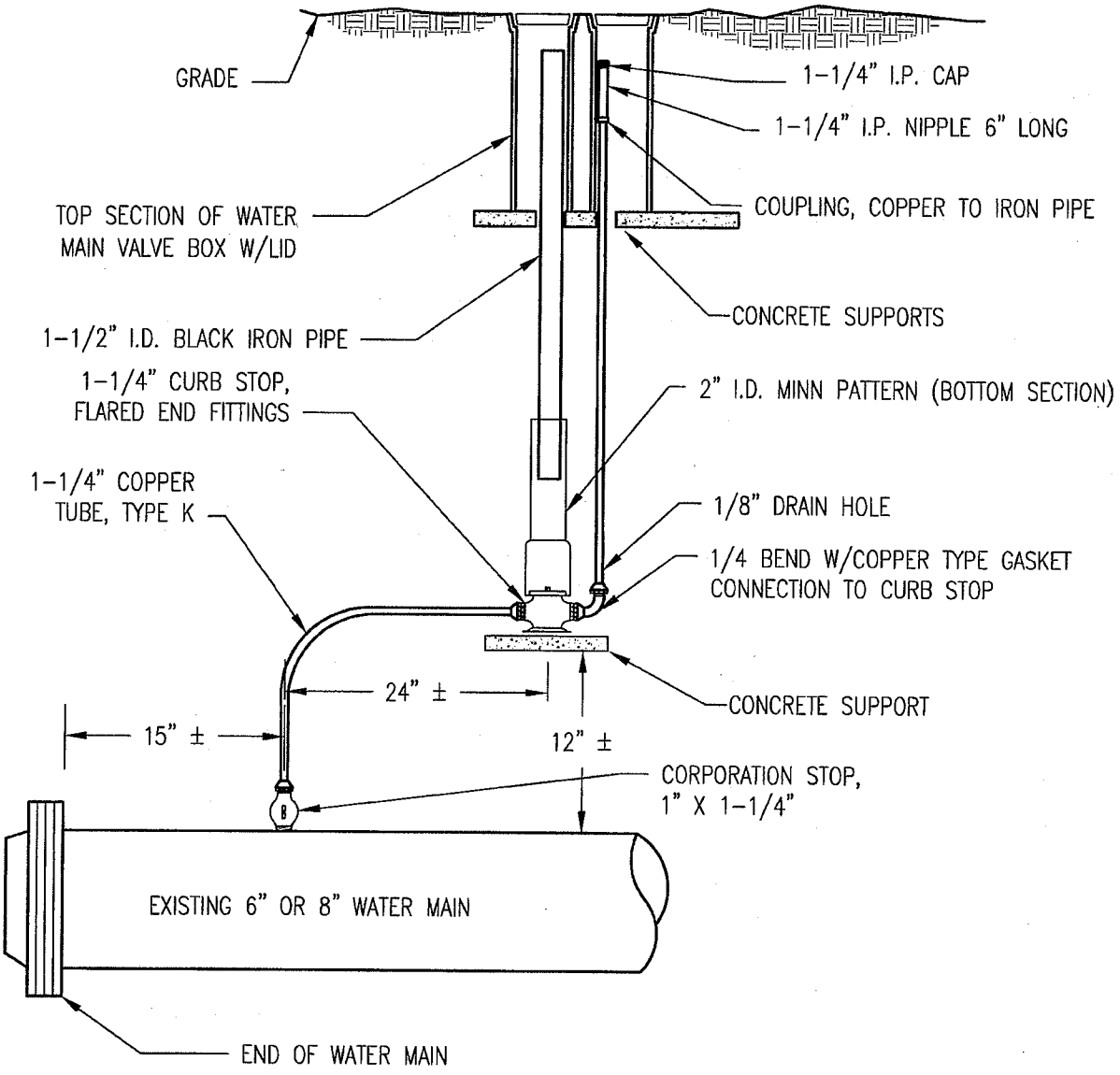
THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. THE NUMBER OF CONNECTIONS MUST BE KEPT TO A MINIMUM. ANY SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT OR COMPRESSION TYPE CONNECTORS. WIRE NUTS OR CLIP TYPE CONNECTORS SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.

2" HDPE WATER MAIN CONNECTION TO DI OR CI		W-7
REVISED/APPROVED 12/17/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

ITEM	DESCRIPTION
1	1-1/4" I.P. THREAD TO FLARE COPPER COUPLING
2	1-1/4" CURB STOP, FLARED END FITTINGS
3	1-1/4" 90° BEND W/ COPPER TYPE GASKET CONNECTION TO CURB STOP
4	COUPLING, COPPER TO IRON PIPE
5	1-1/4" I.P. NIPPLE - 6" LONG
6	1-1/4" I.P. CAP
7	1-1/4" COPPER TUBE, TYPE K
8	2" I.D. MINN. PATTERN (BOTTOM SECTION
9	1-1/2" BLACK IRON PIPE SLIPPED IN 2" DUCTILE IRON BLACK PIPE
10	TOP SECTION OF WATERMAIN VALVE BOX W/LID

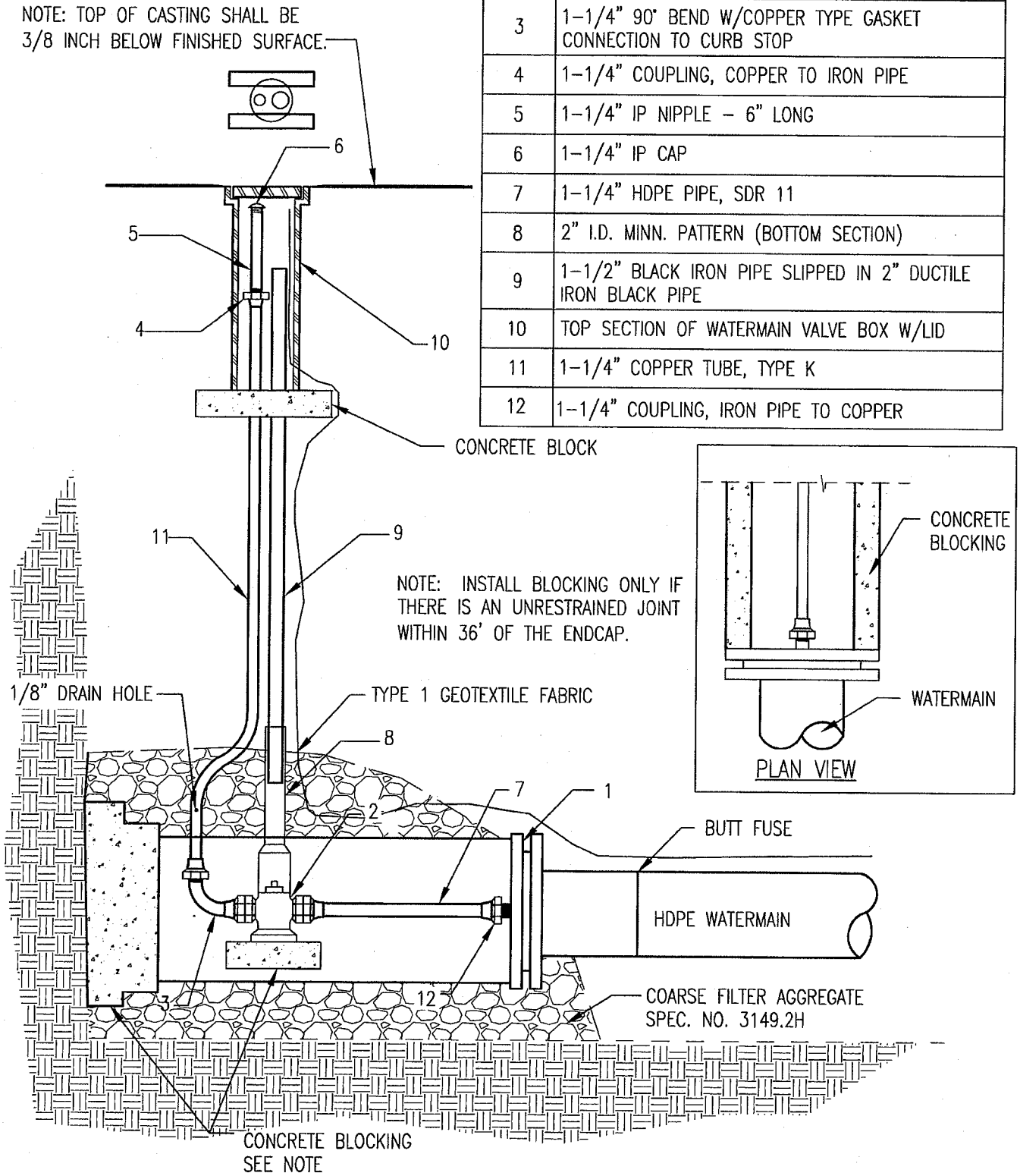


1-1/4" BLOWOFF FOR 6" & 8" DUCTILE IRON WATERMAINS		W-8
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



1-1/4" BLOW OFF (VALVE BOX TYPE) ON EXISTING WATERMAIN		W-8A
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

ITEM	DESCRIPTION
1	MJ ADAPTOR AND TAPPED DI ENDCAP
2	1-1/4" CURB STOP, FLARED END FITTINGS
3	1-1/4" 90° BEND W/COPPER TYPE GASKET CONNECTION TO CURB STOP
4	1-1/4" COUPLING, COPPER TO IRON PIPE
5	1-1/4" IP NIPPLE - 6" LONG
6	1-1/4" IP CAP
7	1-1/4" HDPE PIPE, SDR 11
8	2" I.D. MINN. PATTERN (BOTTOM SECTION)
9	1-1/2" BLACK IRON PIPE SLIPPED IN 2" DUCTILE IRON BLACK PIPE
10	TOP SECTION OF WATERMAIN VALVE BOX W/LID
11	1-1/4" COPPER TUBE, TYPE K
12	1-1/4" COUPLING, IRON PIPE TO COPPER



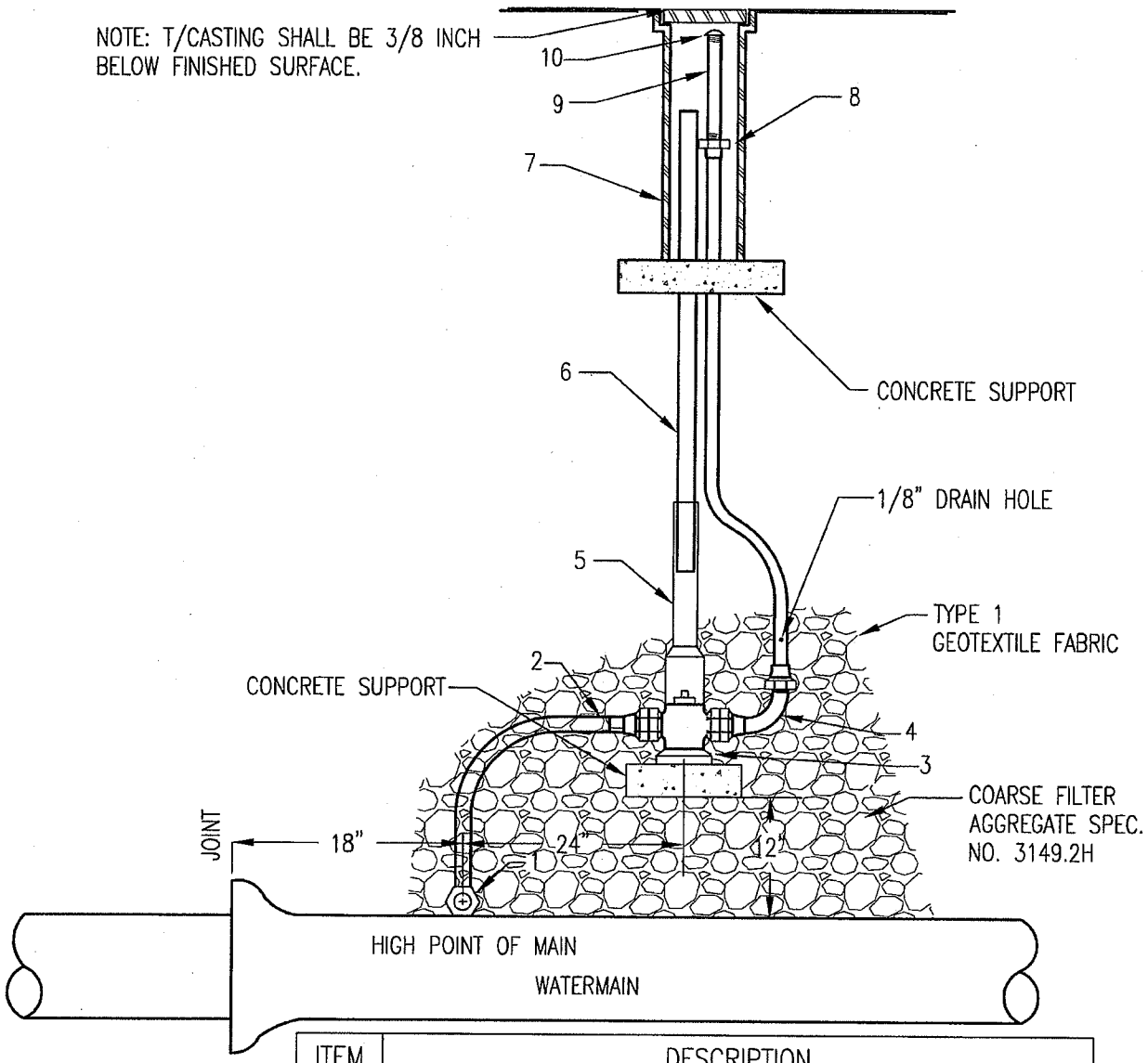
1-1/4" BLOWOFF FOR HDPE WATERMAINS

W-8B

REVISED/APPROVED 12/18/09

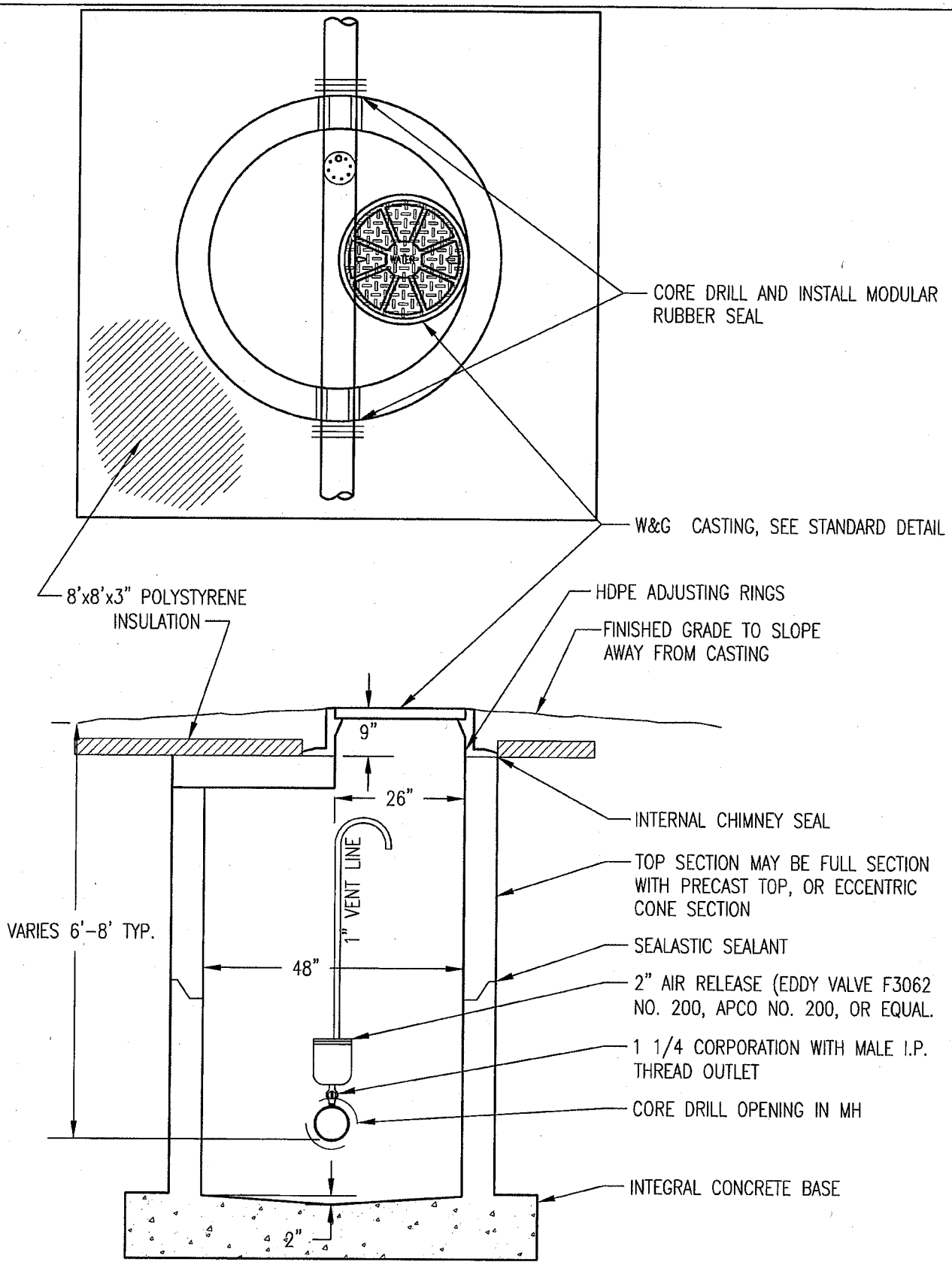
CITY OF DULUTH STANDARD DETAIL
DEPT. OF PUBLIC WORKS AND UTILITIES

NO SCALE

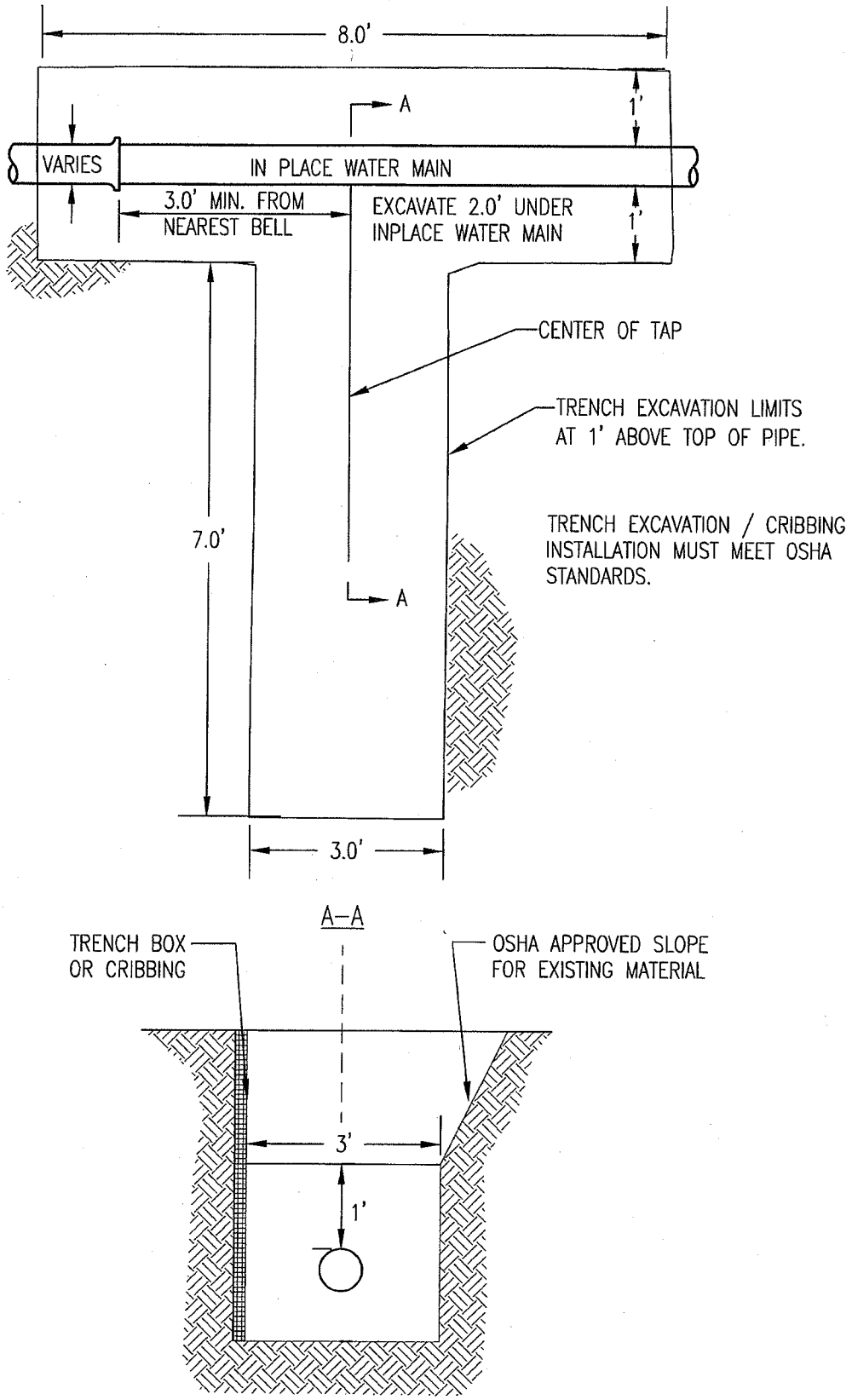


ITEM	DESCRIPTION
1	1" CORPORATION STOP
2	1" COPPER TUBE, TYPE K
3	1" CURB STOP, FLARED END FITTINGS
4	1 90° BEND W/ COPPER TYPE GASKET CONNECTION TO CURB STOP
5	2" I.D. MINN. PATTERN (BOTTOM SECTION)
6	1-1/2" I.D. BLACK IRON PIPE
7	TOP SECTION OF WATERMAIN VALVE BOX W/ LID
8	COUPLING, COPPER TO IRON PIPE
9	1" I.P. NIPPLE - 6" LONG
10	1" I.P. CAP

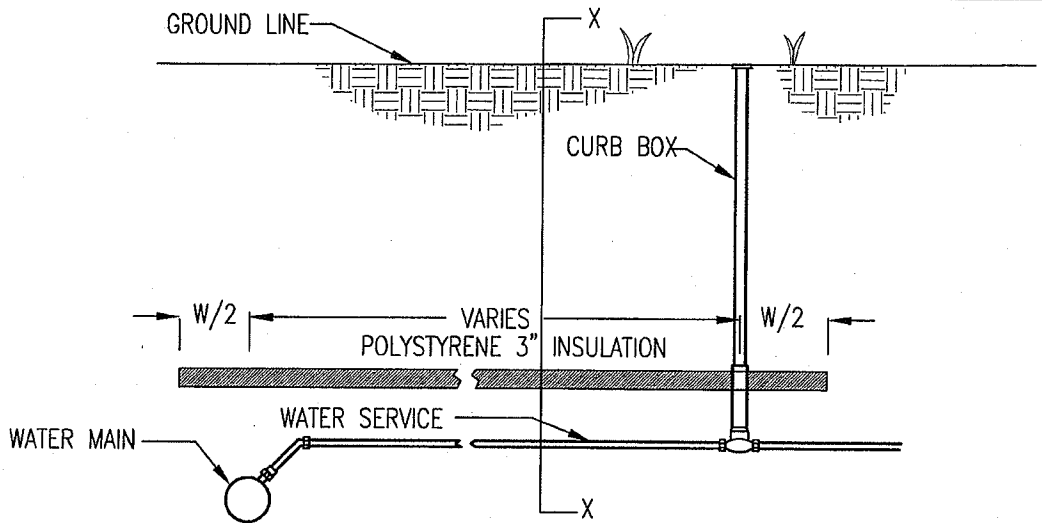
MANUAL AIR RELEASE VALVE BOX TYPE		W-9
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



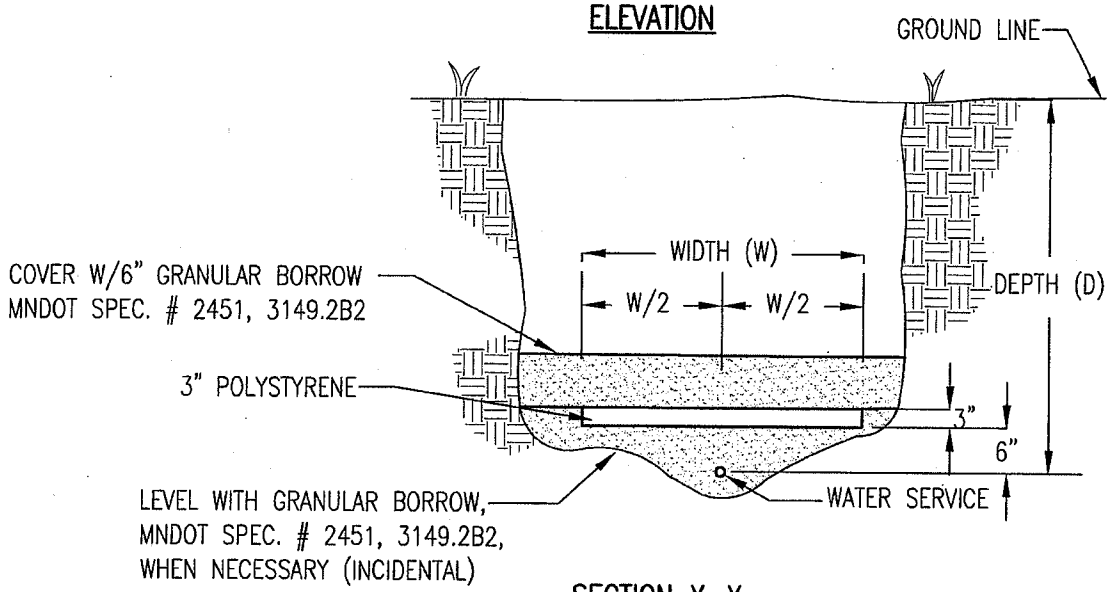
AUTO AIR RELEASE VALVE AND MANHOLE		W-10
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



EXCAVATION FOR TAPPING SLEEVE AND VALVE		W–11
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



ELEVATION



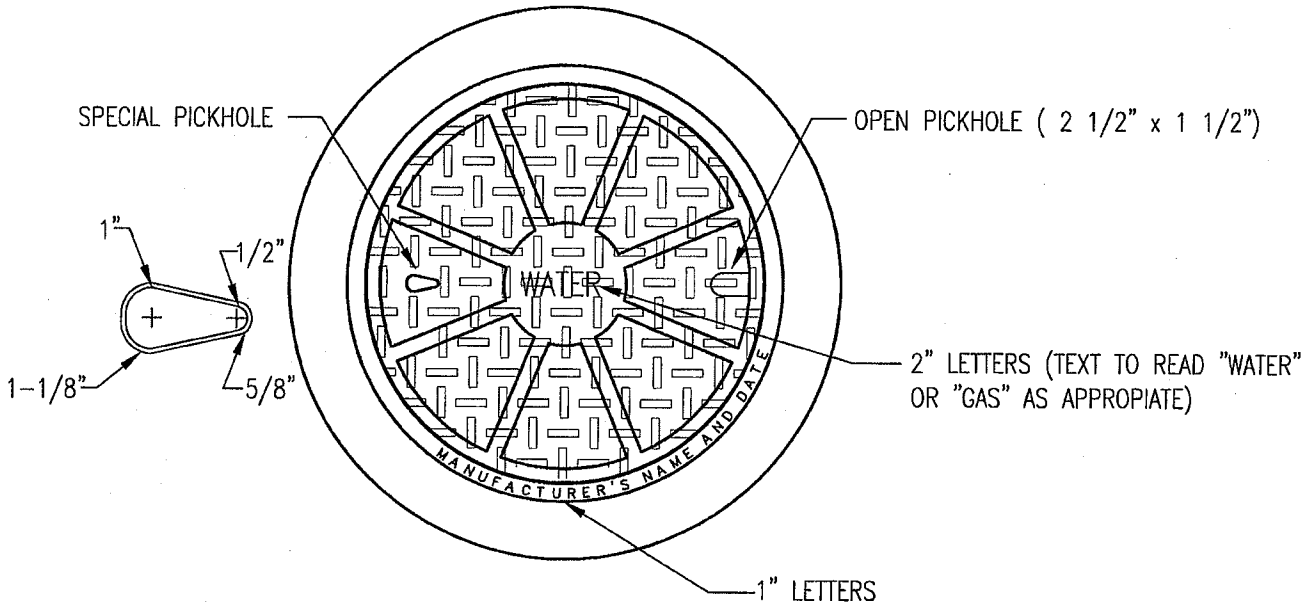
SECTION X–X

NOTES:

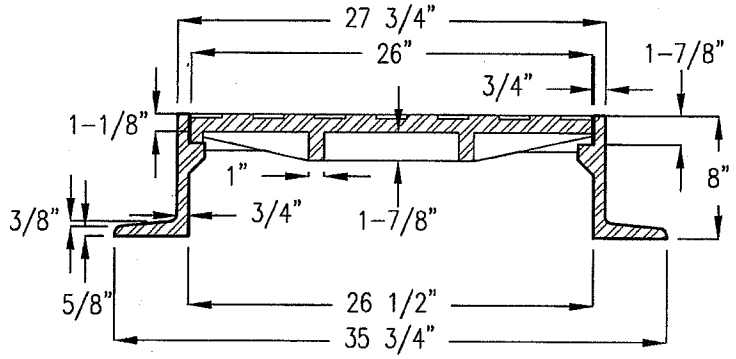
1. LAYERING OF 2 OR 3 SHEETS TO ARRIVE AT 3" IS PERMITTED WITH JOINTS OFFSET A MINIMUM OF 6".
2. POLYSTYRENE SHALL BE AS SPECIFIED IN THE CITY OF DULUTH PUBLIC WORKS AND UTILITIES STANDARD CONSTRUCTION SPECIFICATIONS.

DEPTH (D)	WIDTH (W)
7' OR MORE	NONE
5.2' TO 6.9'	4'–0"
4.3' TO 5.1'	6'–0"
3.0' TO 4.2'	8'–0"

WATER SERVICE INSULATION		W–13
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



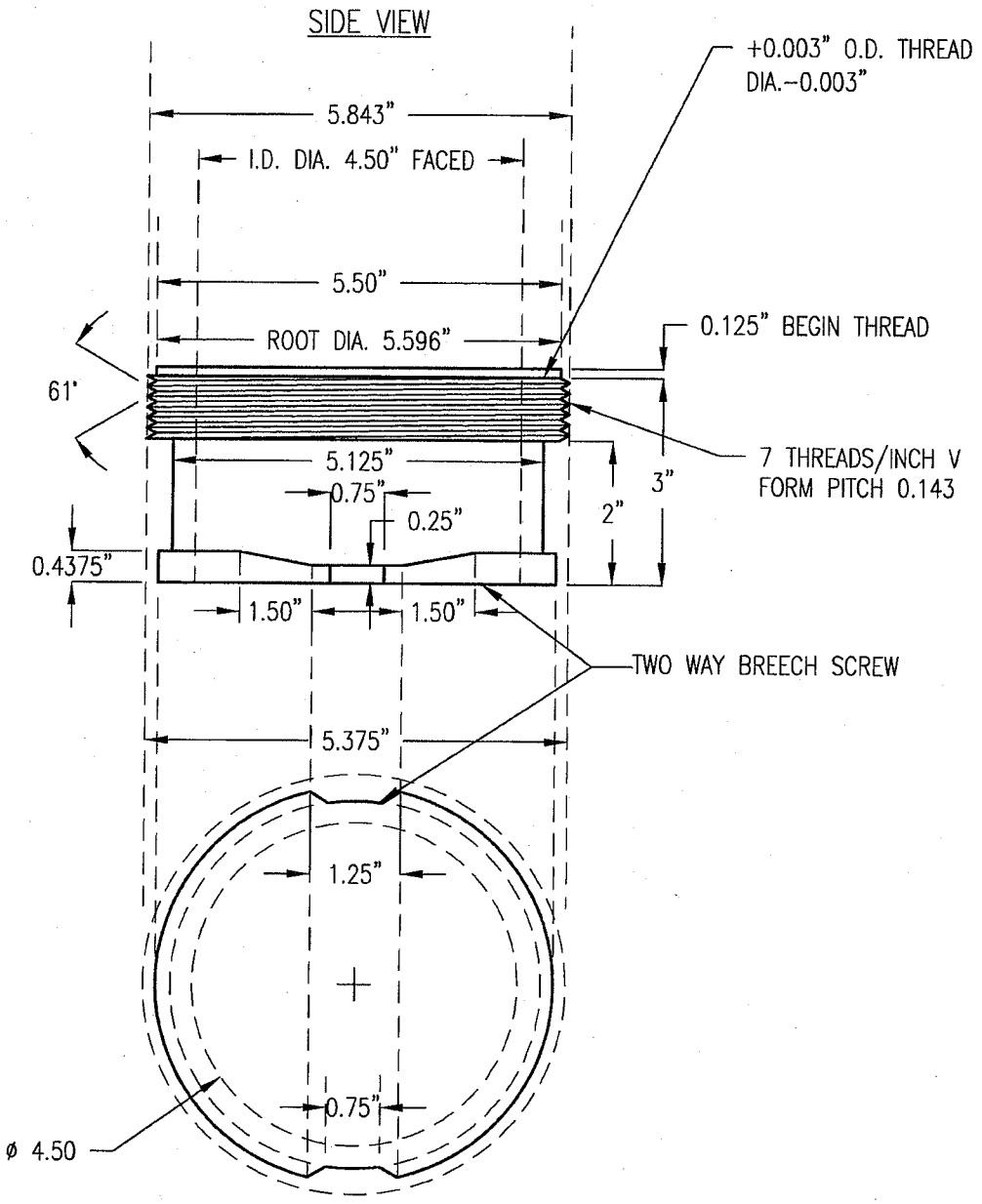
PLAN OF COVER



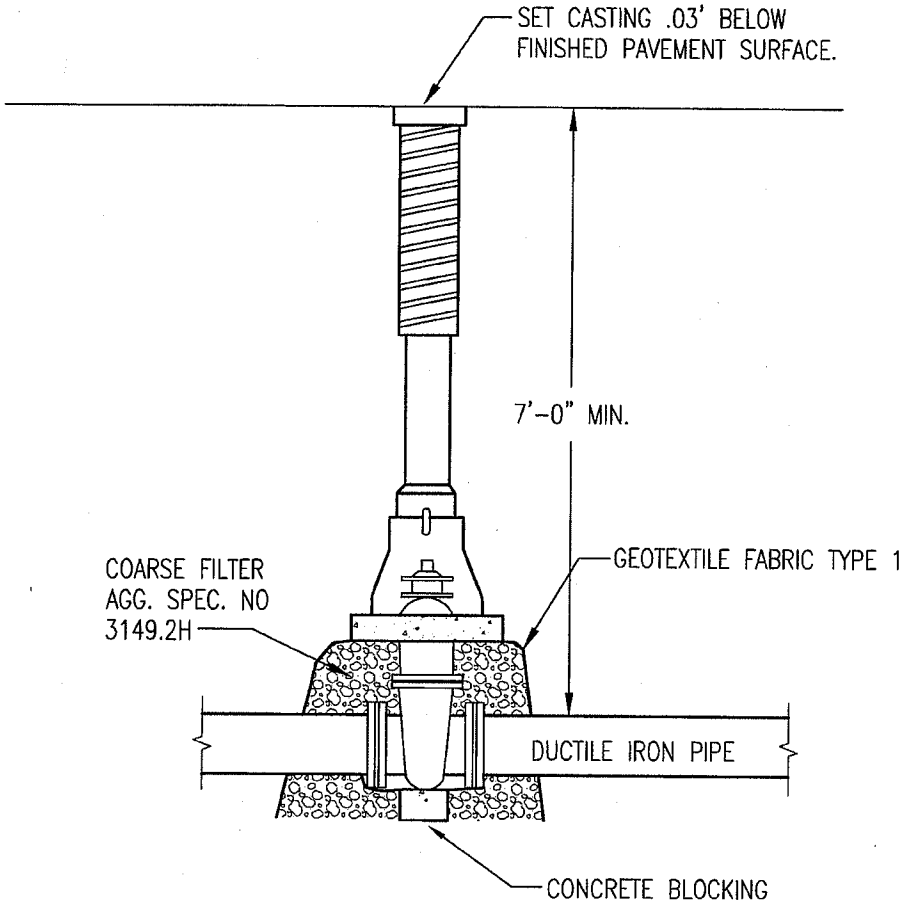
SECTION OF FRAME AND COVER

NOTE: ROUND OFF ALL EXPOSED EDGES FURNISHED WITH MACHINED HORIZONTAL BEARING SURFACES.
WEIGHT: RING-295 LBS. COVER - 162 LBS. SIMILAR OR EQUAL TO NEENAH FOUNDRY NQR-1723 (EXCEPT WITH LETTERING AS NOTED)

CAST IRON WATER MANHOLE FRAME AND COVER		W-15
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



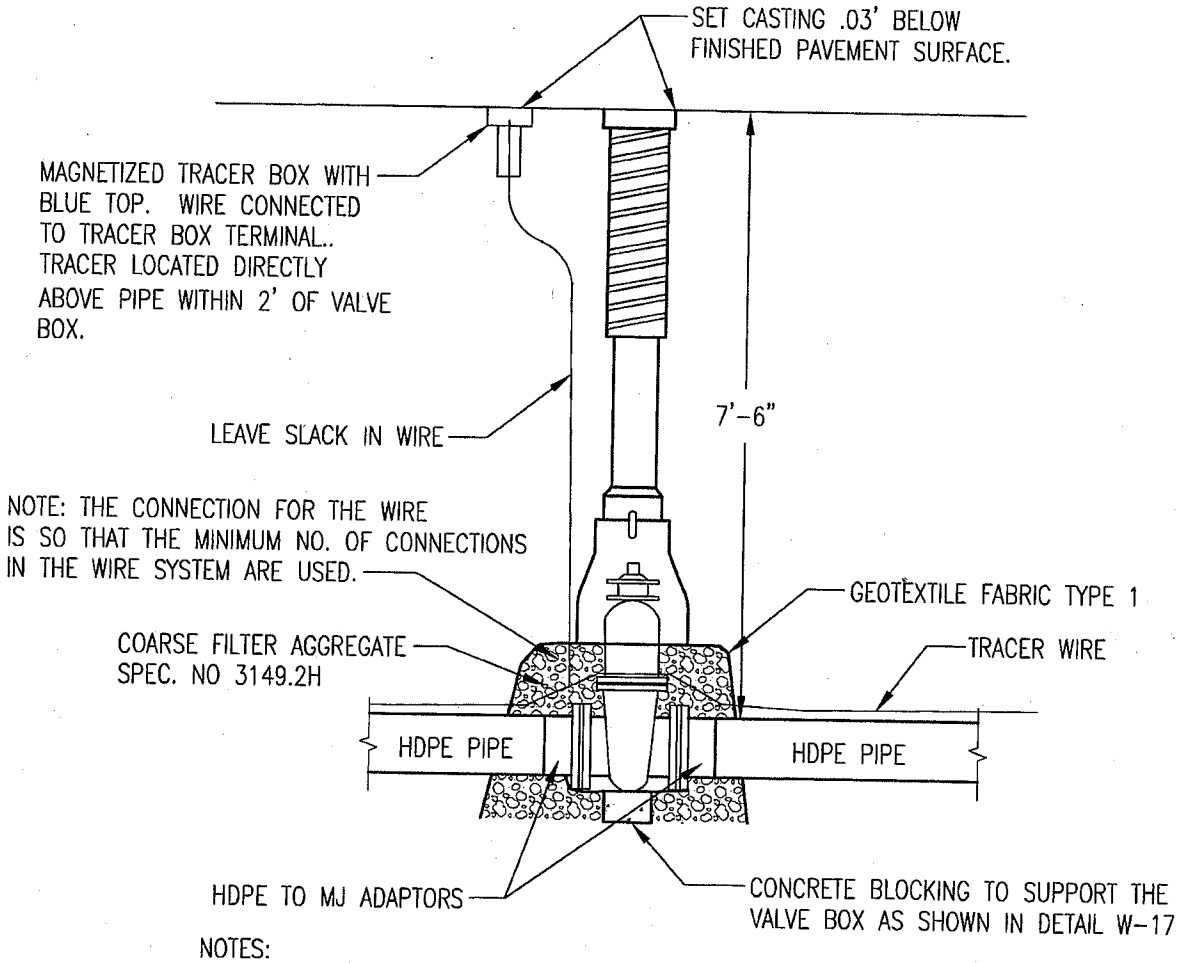
DULUTH THREAD FOR STEAMER NOZZLE		W-16
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. USE EPOXY COATING ON EXTERIOR OF VALVES
2. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B-418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE - REGULAR.

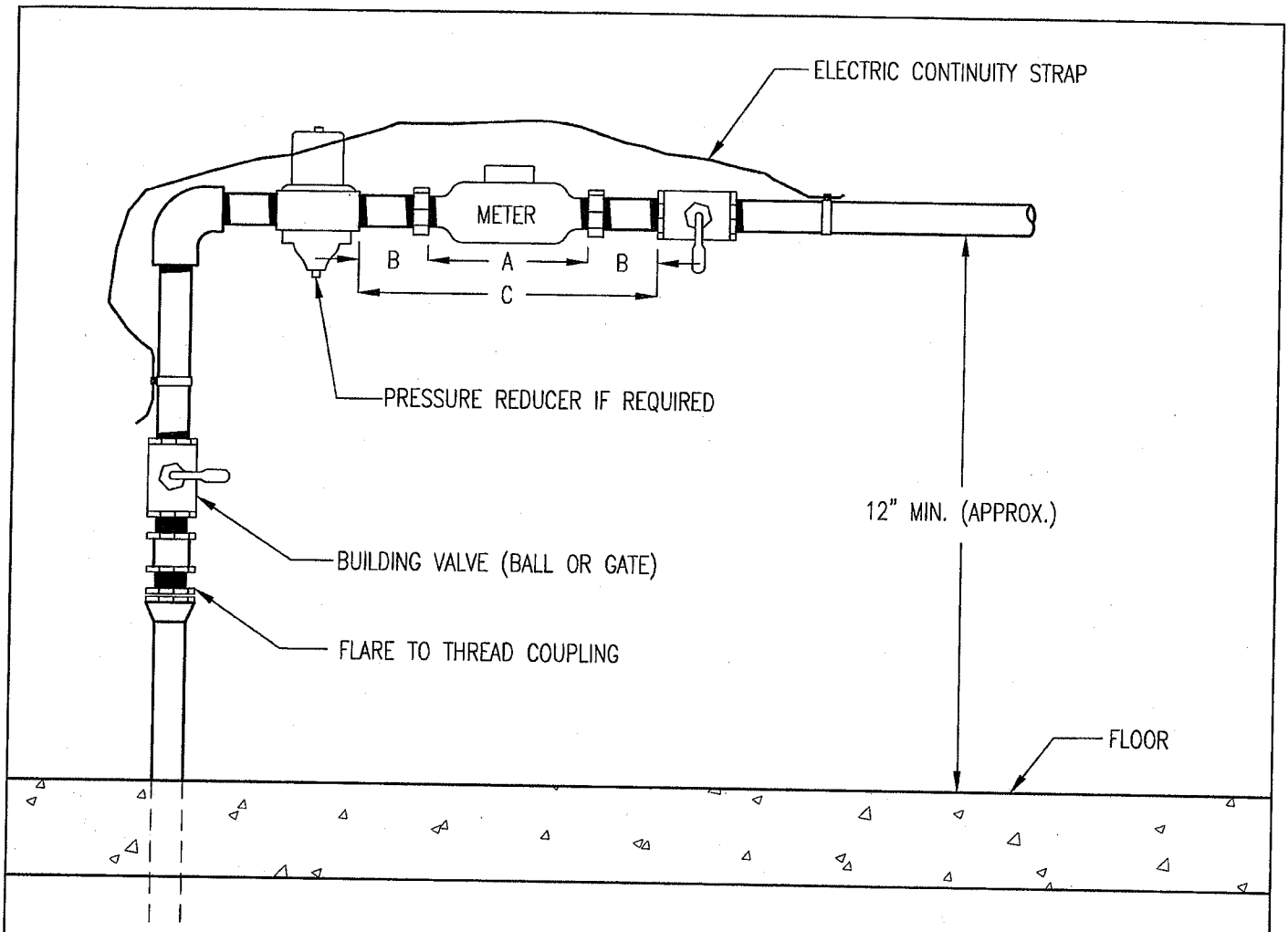
WATER VALVE BOX - DUCTILE IRON MAIN		W-17
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. VALVES SHALL BE CONNECTED DIRECTLY TO HDPE WITH HDPE TO MECHANICAL JOINT ADAPTERS.
2. USE EPOXY COATING ON EXTERIOR OF VALVES.
3. ALL BOLTS SHALL BE COR-TEN WITH ZINC ANODE CAPS CONFORMING TO ASTM B-418 FOR ALL MECHANICAL JOINT FITTINGS. ANODE SIZE - REGULAR.
4. FOR OPEN CUT PIPE INSTALLATIONS, ELECTROFUSION COUPLINGS ARE NOT ALLOWED FOR CONNECTION OF HDPE TO MJ ADAPTERS. FOR DIRECTIONAL DRILLED INSTALLATIONS, ONE ELECTROFUSION COUPLING MAY BE USED PER VALVE.

WATER VALVE BOX - HDPE MAIN		W-17A
REVISED/APPROVED 2/1/10	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE

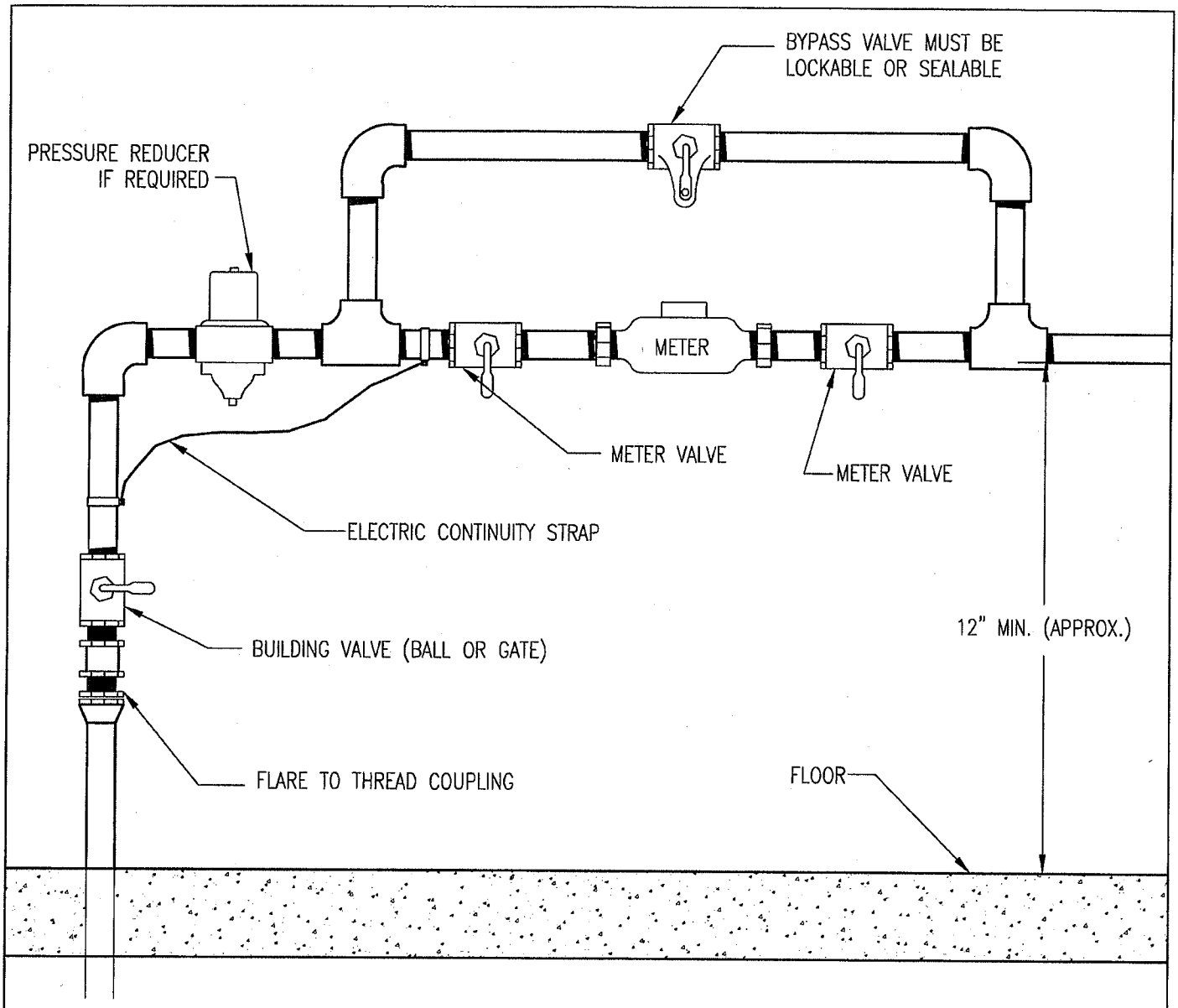


WATER METER SIZE					
	5/8"	3/4"	1"	1 1/2"	2"
A – METER LENGTH	7-1/2"	9"	10 3/4"	12-5/8"	15-1/4"
B – METER TAIL PIECE	2-3/8"	2-1/2"	2 5/8"	2-1/2"	2-5/8"
C – METER W/ TAIL PIECE	12-1/2"	14"	16"	17-5/8"	20-1/2"
TAIL PIECE THREAD SIZE	1/2"	3/4"	1"	2-1/4" X 1-3/4"	2-1/4" X 1-3/4"
MAX. METER OUTPUT (GPM)	25	35	70	120	170

NOTES:

1. SUPPLY PIPE AND FITTINGS BETWEEN BUILDING VALVE AND METER SHALL BE THREADED BRASS AND/OR COPPER AND NOT BE LESS THAN 3/4" SIZE.
2. METERS SHALL ALWAYS BE INSTALLED IN A HORIZONTAL POSITION.
3. VALVES SHALL BE GATE OR FULL-WAY BALL VALVES.
4. PRESSURE REDUCING VALVE IS REQUIRED WHERE PRESSURE EXCEEDS 80 PSI.
5. ELECTRICAL CONTINUITY STRAP IS REQUIRED EXCEPT WHERE BYPASS IS INSTALLED. SIZE OF STRAP BY ELECTRICAL CODE.

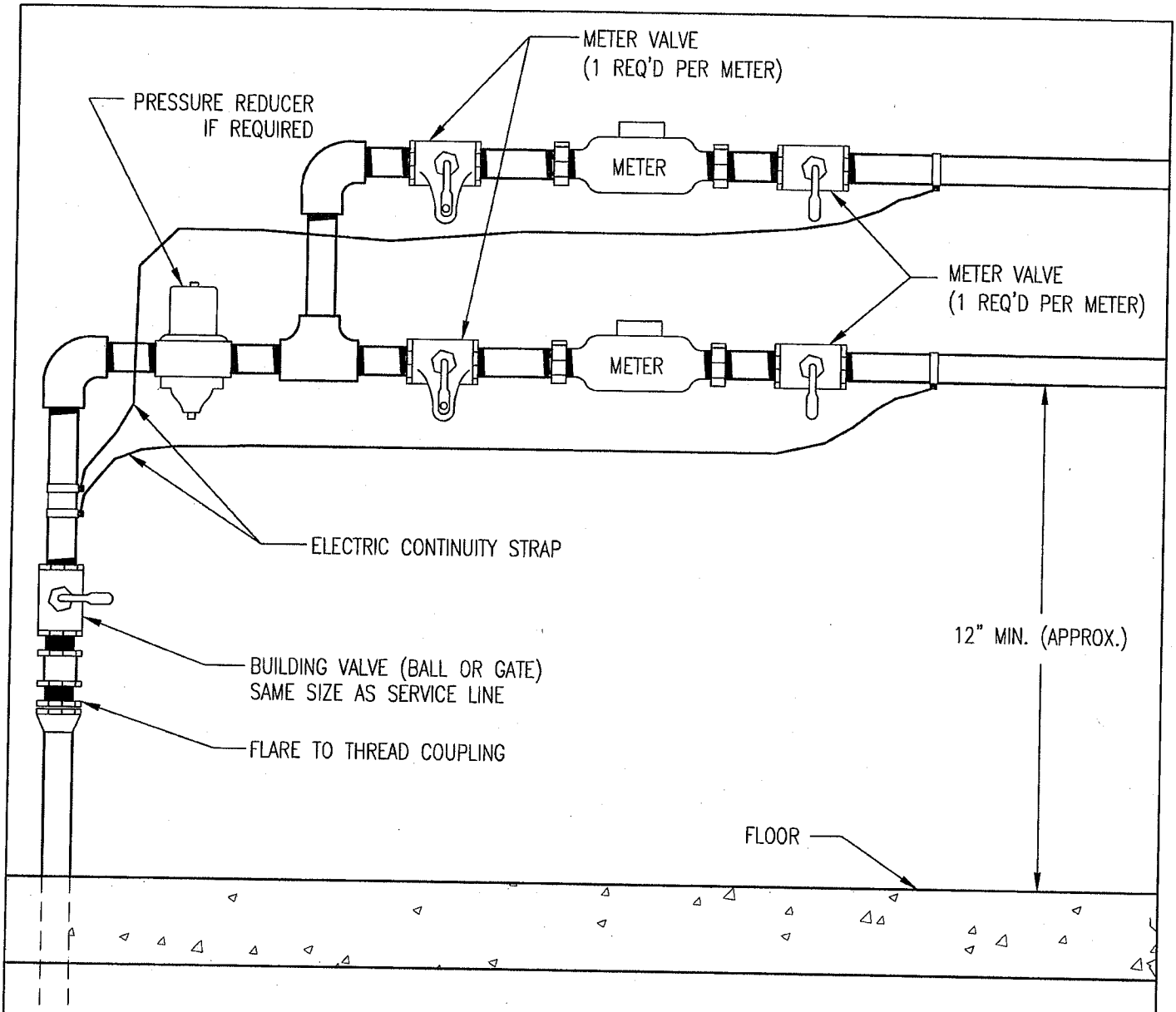
TYPICAL WATER METER INSTALLATION – SINGLE		W-30
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. SUPPLY PIPE AND FITTINGS BETWEEN BUILDING VALVE AND METER SHALL BE THREADED BRASS AND/OR COPPER AND NOT BE LESS THAN 3/4" SIZE
2. METERS SHALL ALWAYS BE INSTALLED IN A HORIZONTAL POSITION
3. VALVES SHALL BE GATE OR FULL-WAY BALL VALVES
4. PRESSURE REDUCING VALVE IS REQUIRED WHERE PRESSURE EXCEEDS 80 PSI
5. ELECTRICAL CONTINUITY STRAP IS REQUIRED EXCEPT WHERE BYPASS IS INSTALLED. SIZE OF STRAP BY ELECTRICAL CODE
6. BYPASS VALVE MUST BE LOCKABLE OR SEALABLE
7. METER INSTALLATIONS 2" OR LARGER MAY REQUIRE A BYPASS IF POTENTIAL HEALTH OR SAFETY RISKS INCREASE IF WATER SUPPLY IS INTERRUPTED

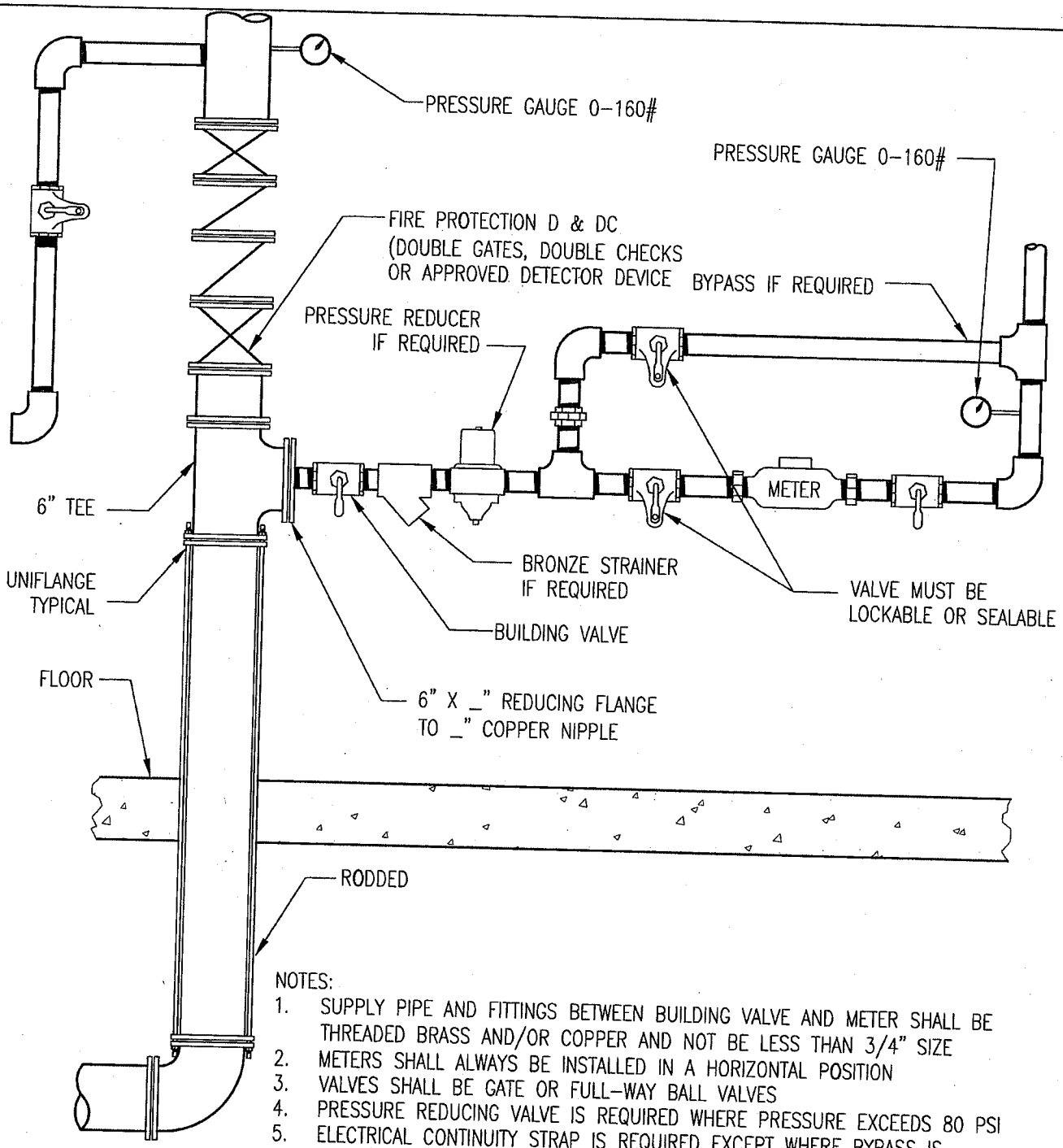
TYPICAL WATER METER INSTALLATION WITH BYPASS		W-31
REVISED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. SUPPLY PIPE AND FITTINGS BETWEEN BUILDING VALVE AND METER SHALL BE THREADED BRASS AND/OR COPPER AND NOT BE LESS THAN 3/4" SIZE
2. METERS SHALL ALWAYS BE INSTALLED IN A HORIZONTAL POSITION
3. VALVES SHALL BE GATE OR FULL-WAY BALL VALVES
4. PRESSURE REDUCING VALVE IS REQUIRED WHERE PRESSURE EXCEEDS 80 PSI
5. ELECTRICAL CONTINUITY STRAP IS REQUIRED EXCEPT WHERE BYPASS IS INSTALLED. SIZE OF STRAP BY ELECTRICAL CODE
6. FOR METERS 3" AND LARGER, A STRAINER IS REQUIRED AHEAD OF METER
7. UPSTREAM METER VALVE ON MULTIMETER INSTALLATIONS MUST BE LOCKABLE

MULTIPLE WATER METER INSTALLATION		W-32
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE



NOTES:

1. SUPPLY PIPE AND FITTINGS BETWEEN BUILDING VALVE AND METER SHALL BE THREADED BRASS AND/OR COPPER AND NOT BE LESS THAN 3/4" SIZE
2. METERS SHALL ALWAYS BE INSTALLED IN A HORIZONTAL POSITION
3. VALVES SHALL BE GATE OR FULL-WAY BALL VALVES
4. PRESSURE REDUCING VALVE IS REQUIRED WHERE PRESSURE EXCEEDS 80 PSI
5. ELECTRICAL CONTINUITY STRAP IS REQUIRED EXCEPT WHERE BYPASS IS INSTALLED. SIZE OF STRAP BY ELECTRICAL CODE
6. FOR METERS 3" AND LARGER, A STRAINER IS REQUIRED AHEAD OF METER
7. UPSTREAM METER VALVE ON MULTIMETER INSTALLATIONS MUST BE LOCKABLE
8. BYPASS VALVE MUST BE LOCKABLE OR SEALABLE
9. UPSTREAM METER VALVE ON DOMESTIC BRANCH OFF OF A FIRE SERVICE MUST BE LOCKABLE

TYPICAL 6" FIRE SERVICE WITH DOMESTIC WATER		W-34
REVIEWED/APPROVED 3/11/09	CITY OF DULUTH STANDARD DETAIL DEPT. OF PUBLIC WORKS AND UTILITIES	NO SCALE