

LOW PRESSURE SEWER SPECIFICATIONS

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1. GENERAL

These specifications are intended to technically describe the nature of the materials, equipment and workmanship required to complete the pressure sewers and appurtenances shown on the accompanying plans.

All labor, tools and materials necessary to excavate for, place, join, backfill and finish the pressure sewers and appurtenances, shall be considered as part of the pressure sewer system construction.

Pressure sewers shall be considered to mean pressure pipe as called for on plans, complete with specials, fittings, valves, valve wells, valve boxes, and connections to existing sewer systems.

2. METHOD OF CONSTRUCTION

Construction procedure will generally be left to the discretion of the Contractor, so long as satisfactory progress is made and good workmanship is produced.

3. BASIS OF PAYMENT

Pressure sewers of the diameter specified will be paid for at the contract unit price per lineal foot, measured in place along the center line of pipe, which price shall be payment in full for furnishing the materials, including specials and fittings, all necessary excavation, sheeting or bracing, draining, laying, directional drilling, jointing, normal bedding, special bedding and any undercut of unsuitable bedding soils and replacement of undercut, connections to existing sewer system, tracer wire, testing, water used in testing, backfilling, including excavated material and replacement of unsuitable excavated material with imported material, groundwater control, including well points and deep wells, disposal of surplus excavated materials, replacement of any damage caused by the contractor including, but not limited to, pavement, sprinkler systems, fences, culverts, underground utilities, and animal control wire, landscape features, trees and shrubs and final cleanup and restoration, and all other work incidental to the construction of the pressure sewers. Measurement will be taken from end to end with no reductions for fittings and valves. Special structures or sections for which either lump sum or unit price bids have been taken will be deducted from the total length of pressure sewers and will be paid for at the prices bid therefore.

Flushing connections and/or air vacuum release assemblies will be paid for at the contract unit price per each, furnished and installed. Price shall include, but is not limited to, connection to the pressure sewer, valves, clean-out assemblies and other equipment indicated, manhole enclosure, frame and cover, adjusting rings, valve boxes, excavation, sheeting and bracing, shoring, dewatering, normal or special bedding, backfill, disposal of excavated material, clean-up and restoration.

Service valve and redundant check valve will be paid for at the contract unit price per each. Price shall include all labor, material and equipment required for furnishing and installing redundant check valve and service valve as one unit.

4. MATERIAL TESTING

The Contractor shall provide the Owner with a list of all suppliers of the pipe, fittings, specials and valves. Each of the suppliers shall provide the Owner with a Certificate of Intent of Compliance prior to material delivery. The Certificate shall certify that all materials supplied for the work will be manufactured, tested and inspected in accordance with the contract documents. Each of the above Certificates shall include the following: suppliers name and mailing address, project title, a description of each material supplied, a statement that all materials will be (or have been) manufactured, tested and inspected in accordance with the contract documents for the project, and shall be signed and notarized. All of the above shall be provided at the Contractors' expense.

5. EXCAVATION - (for open cut where approved, boring pits, tie-ins, connections, structures, etc.)

Excavation shall be in accordance with the pipe manufacturer's recommendation. Excavation shall include clearing of the site of the work and the removal and disposal of all materials necessary to be removed in the construction of all work under this Contract.

Excavation shall be to depths indicated on the plans and as necessary to provide cover of five feet over the top of pipe, unless otherwise noted on the plans.

Excavation shall precede the pipe laying by a safe distance, with no more than 50 lineal feet of trench being open at one time, unless authorized by the Engineer. Excavation shall be of sufficient widths and depths to provide adequate room for construction bedding and installation of the work to lines, grades, and dimensions called for on the plans. Trench width, from the invert to a height of twelve (12") inches above the top of the pressure sewer, shall not be greater than thirty (30") inches. If the maximum trench width as specified above is exceeded, the Contractor shall install, at his own expense, such other bedding as is approved by the Engineer to support the added load of the backfill.

Where, through the Contractor's construction procedure, or because of poor existing ground conditions, it is impossible to maintain alignment and grade properly, the Contractor shall install, at his own expense, a compacted one and one-half (1-1/2") inch maximum size aggregate in order to insure that the pipe, when laid, will maintain correct alignment and grade. Any undercut over 18" in depth ordered by the Engineer due to poor existing ground conditions shall be paid for at the contract unit price for undercut.

Excavated materials may be temporarily stored along the trench in a manner that will not cause damage to trees, shrubs, fences, or other property, and that will not interfere with traffic or endanger the bank of the trench by imposing too great a load thereon.

Open cut excavations for shafts or other structures shall be adequately braced and/or sheeted, to prevent caving or squeezing of the soil. All excavations shall be completely dewatered prior to construction of the pressure sewer or other structures, and adequate provisions shall be made to prevent water from flowing through or over newly placed concrete or brickwork. Drainage shall be carried to sumps from which the water may be pumped.

6. PIPE SUPPORT – (for open cut where approved, boring pits, tie-ins, connections, structures, etc.)

In locations where the soil at the bottom of the trench is unstable, when ordered by the Engineer, the Contractor shall construct in the following manner:

A. Stone Refill

Contractor shall excavate below the trench bottom to suitable soils and refill with crushed stone, or crushed gravel equivalent in grading to Michigan Department of Transportation Specifications. Trench undercut and stone refill less than 18" deep shall be incidental to the Contract. Stone placed in the trench by the Contractor in conjunction with, and/or in lieu of, dewatering the trench and not ordered by the Engineer will not be considered stone refill and will be at the Contractor's expense.

7. CONTROL AND DISPOSAL OF WATER

The Contractor shall remove by well points, pumping, bailing or other acceptable method, any water that may accumulate or be found in the trenches or other excavations. He shall make all necessary provisions to keep the trenches and other excavations entirely free of water during construction of pipelines and structures.

Discharge water from dewatering methods shall be sediment free or be discharged through an Engineer-approved sediment entrapment basin.

The Contractor shall at all times have on the site sufficient pumping equipment ready for immediate use to carry out the intent of this section. All cost for dewatering trenches shall be incidental to the Contract. Pumping or draining from trench excavations shall be made on either side of the pipeline and not into the waters of the State. It shall be the Contractor's responsibility to secure the necessary approval of private landowners before discharging water from the trench excavation onto private lands. Water shall be discharged in such a manner as to cause no pollution or erosion problems. The Contractor shall dewater to existing storm sewer systems wherever possible; method of disposal shall be approved by the Owner. All discharge from dewatering wells discharged onto the ground ahead of being piped to a natural watercourse or lake via an existing storm sewer system or by a temporary piping system, shall have built at the point of entry into such storm sewer a silt retention structure.

This silt retention structure may consist of several straw bales adequately anchored and placed as directed by the Engineer. Any eventual silt or solids retained in the area of these structures shall be removed prior to removal of the structure. At no time will silt or similar materials be permitted to filter into a lake or natural watercourse.

8. BEDDING AND BACKFILLING – (for open cut where approved, boring pits, tie-ins, connections, structures, etc.)

If within the road right-of-way, backfill and compaction requirements shall be in conformance with Oakland County Road Commission Supplementary Permit Specifications Underground Construction.

Bedding and backfilling shall be in accordance with the pipe manufacturer's recommendation. The bottom of trench shall be excavated neatly to the required grade prior to filling with four (4") inches of sand, thoroughly compacted by tamping, before the pipe is laid. Wherever compaction is required, it shall be by suitable mechanical compaction equipment approved by the Engineer. Blocking under pipe is prohibited.

After the pipe is laid, sand bedding shall be thoroughly compacted in place, to a level twelve (12") inches above the top of the pipe. Particular care shall be taken to assure filling all spaces under, around, and above the top of the pipe. The bedding shall then be completed to at least twelve (12") inches above the top of the pipe and thoroughly compacted in place.

The backfill from twelve (12") inches above the pipe shall be placed into the trench according to one of the following specified manners, as determined by location of the edge of trench nearest the existing pavements.

Where minimum compaction percentages are specified, test results will be determined by the Modified Proctor Test, ASTM Designation D-1557. Frozen material may not be used for trench backfill.

8. BEDDING AND BACKFILLING – (for open cut where approved, boring pits, tie-ins, connections, structures, etc.)

A. Concrete and Asphalt - (Pavements, Sidewalks, Driveways & Parking Areas)

If within the road right-of-way, backfill and compaction requirements shall be in conformance with Oakland County Road Commission Supplementary Permit Specifications Underground Construction.

Trench Location

Backfill Requirements

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| <p>(1) Crossing.</p> | <p>Backfill shall be in accordance with the detail sheet with mechanically tamped sand or gravel in 6" layers, loose measure, with each layer compacted to not less than 95% of maximum dry density as determined by the ASTM D 1557 Compaction Standard.</p> |
| <p>(2) Parallel and less than 4 feet from edge of concrete or asphalt pavement.</p> | <p>Same A. (1) above.</p> |
| <p>(3) Parallel and less than 10 feet from and more than 4 feet from edge of concrete or asphalt pavement.</p> | <p>Backfill material shall be placed into trench in 6" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Excavated material may be used provided compaction requirement can be met.</p> |

B. Gravel Roads, Driveways, and Parking Areas

Trench Location

Backfill Requirements

- | | |
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| <p>(1) Crossing.</p> | <p>Backfill materials shall be placed into trench in 6" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Excavated material may be used provided compaction requirement can be met. The Contractor shall immediately restore all roads, driveways, and parking areas with (MDOT 21AA natural gravel) or slag aggregate, or approved equal, to match original aggregate, at least 8 inches thick and shall maintain them in good, dust-free condition during the life of the Contract. Additional aggregate shall be added if settlement occurs. Before final acceptance of the road, driveway, or parking area, it shall be top-dressed with approved material to match the original surface treatment. Gravel shall be suitably stabilized with calcium chloride.</p> |
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C. Open Fields & Lawn Areas

Backfill material shall be placed into trench in 12" layers, loose measure, with each layer compacted to not less than 90% of maximum dry density as determined by the ASTM D 1557 Compaction Standard. Excavated material may be used provided compaction requirement can be met. Compaction will be tested at the inspector's discretion.

Contractor shall re-grade as necessary during the life of the Contract. For restoring lawn and landscaped areas see Section GS-8, "Final Cleanup and Restoration". No frozen materials permitted.

8. BEDDING AND BACKFILLING – (for open cut where approved, boring pits, tie-ins, connections, structures, etc.) (Continued)

D. Special Backfill

Where called for on the plans or where required by Road Permits, the Contractor shall backfill trenches in accordance with the requirements of said plans or Road Permits.

Where "Special Backfill Requirements" are called for along highways under the jurisdiction of the State of Michigan, the Road Commission for Oakland County, or the local unit of government, the Owner will employ an independent testing laboratory to make compaction tests and the costs of the tests will be paid for by the Contractor.

Backfilling around all structures shall be placed in compacted one-foot layers, in a manner that will not cause unequal pressure or damage to any exterior coatings or plastering.

9. UNLOADING, HANDLING AND STORING PIPE

All pipes and special castings shall be unloaded and distributed along the line of work in such a manner and with such care as will effectually avoid the cracking of any pipe. Dropping pipe or fittings directly from the truck will not be permitted. No wire rope, chains or hook shall be used for the handling of H.D.P.E. pipe. Slings of rubber or fabric belting shall be used for this purpose. Stringing of pipe along the line shall be done so as to require a minimum of handling of the pipe.

Pipe shall be stored on a flat surface so that the barrel is evenly supported. Pipe shall not be stored in piles higher than 4 feet. When H.D.P.E. pipe is stored outside and exposed to sunlight, it must be covered with a canvas or other opaque material and must be provided with air circulation under the cover. Deflection of any particular amount of H.D.P.E. pipe shall not exceed 5%.

10. DEFECTIVE PIPE AND FITTINGS

No pipe or fitting that is known to be defective shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed by the Contractor and replaced by a sound and perfect piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut shall be square and ground smooth.

11. PLACING OF PIPE

All pipe shall be carefully placed to line and grade called for on the Drawings. Each pipe, as placed, shall be checked by the Contractor for line and grade to ensure that this result is obtained.

Immediately before laying, each section of pipe or fitting shall be thoroughly cleaned of all debris, dirt or other foreign material. It shall be inspected for damage to pipe material and repairs made where required. Care shall be taken to keep the interior of the pipe clean and free from dirt and other foreign materials. Bulkheads or other means shall be used at the open ends of the pipe for this purpose.

After the pipe is laid, (open cut only) the bedding shall be carefully compacted under the haunches of the pipe, and the trench shall be backfilled to twelve-inches above the pipe as specified under "Backfilling Trenches." Sufficient backfill shall be placed after each joint is made along the sides of the pipe to offset conditions that might tend to move the pipe off line or grade. Any pipe found off grade or out of line shall be re-laid properly by the Contractor.

12. HYDROSTATIC TESTS

Following pipe laying and backfilling, the Contractor shall complete all work necessary to perform hydrostatic testing. If, in the opinion of the Engineer, work has not progressed in a reasonable manner, he shall have the right to direct the Contractor to proceed with the work, or any portion thereof, immediately. The Contractor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible leaks and cracks, and retest with his own forces to ready the pressure sewers for final hydrostatic inspection and testing which will be witnessed by the Engineer. Immediately after the pressure sewers have passed such preliminary tests, the Contractor shall submit a written request to the Engineer for final hydrostatic inspection and test.

Prior to and during the hydrostatic test, the new main cannot be connected to pressure sewers or pump stations installed in other Contracts, except as specified herein.

The Contractor shall furnish all necessary personnel, temporary timber bracing, plugs, test pumps, and all other necessary apparatus for conducting the test. All gauges and meters used for testing shall be rated at or above required test pressure. Test gauges will be 3 1/2 "diameter or larger, readable in one or two pound increments. Meters and gauges shall be calibrated every six months. Calibration will be to an accuracy of $\pm 1\%$ or better. Verification of calibration shall be furnished to WRC personnel prior to start of test.

Before applying test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of highest elevation in the pipe, and such opening subsequently closed prior to test.

Test pressure shall be maintained at two hundred (200 lbs.) pounds per square inch at the point of highest elevation in the test section by pumping water from an approved source into the pipe for a period of at least two (2) hours, and in all cases long enough to permit assurance of a satisfactory test. Allowable leakage shall not exceed 50 gallons per inch diameter of pipe per mile of pipe for 24 hours.

Maximum length of main line pipe shall not exceed 2,000 l.f. for any one test.

In the event that the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and repaired where necessary. Any pipes or special castings found to be cracked shall be removed and replaced with new pieces by the Contractor. After this work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.

13. MATERIALS

All pipe to be used shall be of the type called for on the plans and as described in the Proposal, and shall conform to the following specifications:

High Density Polyethylene Pipe

A. Pipe and Fittings

Reference Specifications

- (1) ASTM F714, polyethylene (PE) plastic pipe (SDR-PR) based on outside diameter.
- (2) ASTM D-3350 specification for polyethylene plastics pipe and fittings materials.
- (3) CAS B137.1 polyethylene pipe for cold-water services.

B. Material

- (1) The pipe shall be made from polyethylene resin compound with a cell classification of PE 345464 C in ASTM D 3350.. All pipe shall have an SDR rating of 11.
- (2) The properties of the cell classification PE 345464 C are given below:

HDPE Resin Specifications

PROPERTY	SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation	PPI / ASTM		PE3408
Material Classification	ASTM D 1248		III C 5 P34
Cell Classification	ASTM D 3350-98a		345464C
Density	(3) ASTM D 1505	g / cm ³	0.955
Melt Index	(4) ASTM D 1238	gm / 10 min	0.11
Flexural Modulus	(5) ASTM D 790	psi	135,000
Tensile Strength	(6) ASTM D 638	psi	3,200
Slow Crack Growth			
ESCR	ASTM D 1693	hours in 100%	>5,000
PENT	(6) ASTM D 1473	igepal	>100
HDB @ 73° F	(4) ASTM D 1693	hours	1,600
UV Stabilizer	(C) ASTM D 1603	psi %C	2.5%

- (3) The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from the resin of the same specification from the same raw material supplier.
- (4) Compliance with the requirements of this paragraph shall be certified in writing by the pipe supplier, upon request.

C. Pipe Design

- (1) The Hydrostatic Design Stress shall be 800 psi for PE 3408 materials.
- (2) The pipe dimensions shall be as specified in the manufacturer's literature.

13. MATERIALS (continued)

D. Marking

- (1) The following shall be continuously printed on the pipe, or spaced at intervals not exceeding 5 feet.
 - (a) Name and/or trademark of the pipe manufacturer.
 - (b) Nominal pipe size.
 - (c) Dimension Ratio.
 - (d) The letters PE followed by the polyethylene grade per ASTM D 3350 and PE 3408.
 - (e) Manufacturing Standard Reference e.g., ASTM F714.
 - (f) A production code from which the date and place of manufacture can be determined.
- (2) On top of H.D.P.E. pressure sewer pipe, Contractor is to place an insulated No. 6 copper wire for the entire length of the pressure sewer. At the structure (cleanouts, air release valve, etc.) enough slack shall be left in the wire so that it can run to the top of the structure for connection.

E. Joining Methods

- (1) Wherever possible the polyethylene pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM-D2657, Heat Joining Polyolefin Pipe and Fittings.
- (2) Butt-fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer or in accordance with the PPI TR-33/2001.
- (3) Electro fusion coupling can be used where appropriate. These couplings must handle the same or a higher pressure rating than the pipe or fitting being joined. Installation must be by a trained person.
- (4) The polyethylene pipe may be adapted to fittings or other systems by means of an assembly consisting of a polyethylene stub-end, butt, electro fusion to the pipe, a back-up flange of ductile iron, made to Class 150, ANSI B16.5 dimensional standards with exceptions, bolts of compatible material with a gasket of suitable red rubber cut to fit the joint. In all cases, the bolts shall be drawn up evenly and in line.
- (5) Mechanical joint (MJ) adaptors can be used for connections to valves or other types of pipe with this type of connections. The MJ adapters can be attached to H.D.P.E. pipe by electro fusion or butt fusion.
- (6) Polyethylene pipes of the same outside diameter but different wall thickness shall be joined by means of a flange assembly as designated above.
- (7) The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion or electro fusion of polyethylene pipe and fittings. No pipe or fittings shall be joined by fusion by any contractor unless he is adequately trained and qualified in the techniques involved.

13. MATERIALS (continued)

F. General Requirements

- (1) The pipe manufacturer shall provide, upon request, an outline of quality control procedures performed on polyethylene system components.
- (2) All fittings shall be rated to match pipe rating.
- (3) Fittings shall be fabricated with ends to match line pipe.
- (4) When in line valves or other special fittings are called for on the plans, the Contractor shall install those fittings during pipe installation. Failure to do so may cause expansion/contraction complications that will require rework at the Contractor's expense.

14. PIPE TAPS

New pipe connections to existing pressure sewer or force main shall be made with tapping sleeves and valves compatible with the existing pipe materials in accordance with the detail shown on the drawings.

15. GATE VALVES

Gate valve shall be designed for 250 PSI minimum working pressure and meet the requirements set by ANSI and AWWA. Gate valves shall be ductile iron body, body and bonnet fusion bonded epoxy coating inside and out, fully bronze mounted, bronze stem, O-ring stem seal, non-rising stem, seating mechanism shall be a one-piece wedge design. The single ductile iron wedge shall be bonded-in-place nitrile elastomer covering.

Gate valve shall have a clear waterway equivalent in area, when fully open, equal to that of the connecting pipe. Valve shall be made to open when turned to the left, or counter clockwise. The gate valve shall have a square wrench nut.

Gate valves shall be installed in manholes as detailed on the drawings. Valves to be furnished with flange connections for Ductile Iron pipe. O.D. size to fit IPS (Iron Pipe Size).

Gate valve shall be as manufactured by American Flow Control, or approved equal.

16. TRACER WIRE

Tracer wire shall be 6 gauge stranded copper with plastic insulation and suitable for direct bury.

Tracer wire shall be attached to all sewer pipe at approximately 5 foot intervals or as shown on details. Attachment to pipe shall be made with plastic cable ties or equivalent.

Splices shall be soldered, copper to copper. Splice shall then be attached to pipe with ties and shrink-wrapped in place to re-establish insulation across spliced length.

A minimum length of 6 feet of wire shall be left accessible at clean-outs and other structures.

Contractor is responsible for testing continuity of wire from structure to structure using equipment compatible with Oakland County Water Resources Commissioner locating devices.

17. AIR/VACUUM RELEASE VALVES

Air/vacuum release valves shall have 2-inch NPT inlet, 1-inch NPT outlet, with cast iron body, stainless steel floats and blow off valve. Valve shall be APCO Model 401 SAVV or approved equal.

18. REDUNDANT CHECK VALVE

When connecting discharge pipe to a pressure sewer, each grinder pump station shall be installed with one separate check valve in the discharge line between the grinder pump and the sewer main, upstream from the curb stop box. The valve shall be 1-1/4" and of the gravity operated flapper or ball type. The check valve will provide a full-ported passageway when open and shall be designed to withstand a minimum working pressure of 150 PSI.

The valve body shall be a high gloss, injection molded part made of PVC Type I-II. The check valve flapper shall include a non-fouling, integral hinge made from fabric reinforced synthetic elastomer to assure corrosion resistance, dimensional stability, fatigue strength and trouble free operation. The integral hinge shall be non-metallic and a maximum degree of freedom to assure seating at low backpressure.

19. SERVICE VALVE

When connecting discharge pipe to a pressure sewer, each grinder pump station shall be installed with a service valve in the discharge line between the grinder pump and the sewer main, downstream from the redundant check valve. The valve shall be 1-1/4" brass ball curb valve, with a 1-1/4" service valve 3-piece adjustable box cast iron ring and cover. The cover should be flush with the finished grade.