

# VERMONT CONSTRUCTION SPECIFICATION

## 41 – PIPE CONDUITS AND DRAINS

### 1. Scope

The work shall consist of furnishing and placing plastic, corrugated metal, steel pipe and drain tile and the necessary fittings as shown on the drawings.

### 2. Material

**A. Corrugated Metal Pipe (CMP)** shall be metallic zinc-coated, aluminum-coated, or aluminum-zinc alloy-coated corrugated steel pipe and fittings or aluminum corrugated pipe and fittings conforming to the requirements of ASTM A742, A760, A761, A762, A849, A875, A885, A929, B745, B746, or B790 for the specified type, class, fabrication of pipe and coating.

**Coupling bands** are to be provided for each section of pipe. The hardware for fastening the coupling band tightly to the connecting pipe shall be fabricated to permit tightening sufficiently to provide the required joint tensile strength and, if required, watertightness without failure of its fastening.

Gaskets, if specified, are to be provided for each coupling band. The fabrication of coupling bands and fastening hardware, in addition to the above, shall be sufficient to provide the required gasket seating without warping, twisting, or bending.

**Fittings** shall be fabricated from steel conforming to ASTM A444, A742, A806, A819, A849, A875, A885, and A929 or sheet aluminum meeting the requirements contained in ASTM B744. The coating of fittings shall be the same as that specified for the contiguous corrugated pipe.

**B. Steel pipe** shall conform to the requirements of the applicable specification listed below for the kind of pipe and the type, weight, grade, and finish specified:

<b>Steel Pipe</b>	<b>Specification</b>
Steel, black and hot-dipped, zinc-coated welded and seamless	ASTM A53
Steel, electric-fusion (ARC) - welded (sizes NPS 16 and over)	ASTM A134
Electric-resistance-welded steel	ASTM A135
Electric-fusion (ARC)-welded steel (NPS 4 and over)	ASTM A139
Steel water pipe, 6 inches and larger	AWWA C200

**Fittings** shall conform to the requirements for the types and kinds specified.

<b>Fittings</b>	<b>Specification</b>
Heat-treated carbon steel fittings for low-temperature and corrosive service	ASTM A858
Threaded couplings, steel, black or zinc-coated (galvanized) welded or seamless, for use in steel pipe joints	ASTM A865

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- C. Corrugated polyethylene tubing** shall conform to the requirements of ASTM F 405, ASTM F 667, ASTM F 894, AASHTO M 252, or AASHTO M 294 for the appropriate tubing sizes and fittings. Fitting shall conform to the following requirements:

<b>Fittings</b>	<b>Specification</b>
3-6 inch diameter pipe and fittings	ASTM F405
8-, 10-, 12-, 15-, 18-, and 24-inch diameter pipe and fittings	ASTM F667
18- to 120-inch diameter pipe and fittings	ASTM F894
3- to 10-inch diameter N12 pipe and fittings	AASHTO M252
12- to 36-inch diameter N12 pipe and fittings	AASHTO M294

- D. Plastic Pipe** shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122.

Plastic pipe shall conform to the specifications listed below:

<b>Poly Vinyl Chloride (PVC) Pipe</b>	<b>Specification</b>
Plastic pipe - Schedules 40, 80, 120	ASTM D1785 ASTM D2466
Pressure rated pipe - SDR Series	AWWA C900 ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Joints for IPS PVC pipe using solvent weld cement	ASTM D2672
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings	ASTM F3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Type PS-46 gravity flow sewer pipe and fittings	ASTM F789
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F949
<b>Polyethylene (PE) Plastic Pipe</b>	<b>Specification</b>
Schedule 40	ASTM D2104
SIDR-PR based on controlled inside diameter	ASTM D2239
Schedules 40 and 80 Based on outside diameter	ASTM D2447
SDR-PR based on controlled outside diameter	ASTM D3035
<b>High Density Polyethylene (HDPE) Plastic Pipe</b>	<b>Specification</b>
Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Plastic moldings and extrusion compounds	ASTM D1248
Heat joining polyolefin pipe and fittings	ASTM D2657

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<b>Acrylonitrile-Butadiene-Styrene (ABS) Pipe</b>	<b>Specification</b>
Plastic pipe, schedules 40 and 80	ASTM D1527
Plastic pipe, SDR-PR	ASTM D2282
Schedule 40 plastic drain, waste, and vent pipe	ASTM D2661
Composite sewer pipe	ASTM D2680
Sewer pipe and fittings	ASTM D2751

**Fittings and joints** shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects.

Fittings and joints shall conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, and the requirements shown on the drawings.

**Solvents** for solvent welded pipe joints shall be compatible with the plastic pipe used and shall conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

**Rubber gaskets** for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

**Perforations** shall conform to the following requirements unless otherwise specified on the drawings:

- a. Perforations shall be either circular or slots.
- b. Circular perforations shall be  $1/4 \pm 1/16$ -inch diameter holes arranged in rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight times the perforation diameter. Perforations may appear at the ends of short and random lengths. The minimum perforation opening per foot of pipe shall be as shown in table below. Rows shall be arranged in two equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations shall be separated by an arc of not less than 60 degrees or more than 125 degrees. The uppermost rows of perforations shall be separated by an arc not to exceed 166 degrees. The spacing of rows between these limits shall be uniform. The minimum number of rows shall be as shown in Table 1.

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- c. Slot perforations shall be symmetrically located in two rows, one on each side of the pipe centerline. Slot perforations shall be located within the lower quadrants of the pipe with slots no wider than 1/8 inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe shall be as shown in Table 1.
- d. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges and of any material that would reduce the effective opening.

**Table 1 – Pipe Perforations**

Normal Pipe Size (Inches)	Minimum Number of Rows		Minimum Opening/Foot (Square Inches)
	Circular	Slot	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

### 3. Handling and Storage

All pipe and conduits shall be delivered to the job site and handled by means that provide adequate support and do not subject it to undue stresses or damage. When handling and placing pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting, especially in cold weather. The contractor shall follow the manufacturer's specifications for handling pipe and shall furnish equipment necessary to handle and install the pipe without damaging the pipe or coating.

Pipe shall be stored on a relatively flat surface so that the full length of the pipe is evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

### 4. Excavation

The pipe shall be installed to the dimension, alignment and grades shown on the drawings. Unless otherwise specified on the drawings, excavation for and subsequent installation of pipe line shall begin at the outlet end and progress upgrade. The trench or excavation for the pipe shall be constructed to the lines, depths, cross sections, and grade shown on the drawings. Whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade, the pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field

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All trench excavation shall be sloped, braced, and supported to safeguard the work and workers according to Federal and State safety regulations. It is the contractor's responsibility to be knowledgeable of all current VOSHA rules and regulations relating to working in trenches and overall safety of the construction site.

Trenches over 5 feet in depth in which workers will enter shall be shored, sloped or otherwise stabilized to prevent sliding or cave-ins. When such bracing and supporting is required, the width of the excavation shall be adjusted to accommodate space for sheeting, bracing or other supporting installations. The Contractor shall furnish, place, and subsequently remove such supporting installations.

### **5. Laying and Bedding of Pipe**

Pipe material shall be handled properly at all times in accordance with manufacturer's recommendations. Pipe and fittings shall not be thrown, dropped or dragged. If the coating of the pipe or its fittings are damaged, coatings shall be repaired in accordance with manufacture's recommendations or removed from the site.

The pipe shall be laid to the line and grade shown on the drawings. Pipe with integral bell joints shall be laid with the bell end upgrade. Upgrade ends of all drain pipes shall be closed with suitable plugs. Each pipe section shall be laid in a manner that provides a continuous uniform support.

Bedding, if required, shall be installed according to pipe manufacturer's specifications or as shown on drawings. The depth of bedding shall not exceed 6 inches.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about a vertical centerline. Perforations shall be clear of any obstructions at the time the pipe is laid.

### **6. Joints and Fittings**

Pipe joints and fittings shall be assembled in accordance with pipe manufacturer's recommendations.

Field cuts of pipe shall be square and perpendicular to the pipe axis. Spigot ends shall be smoothly reamed and beveled to be similar to factory prepared spigots. Where insertion stop marks were provided on standard pipe lengths, they shall be reproduced on the cut lengths for the same distance.

### **7. Backfilling**

Conduit backfill shall be selected, marked, placed and compacted to the density of the surrounding material taking care not to displace or damage the conduit or its protective coating. The final backfill material shall be a clean gravel, sand or material excavated from the trench. Backfill shall be free of clods, foreign debris and rock fragments greater than 6 inches. Care shall be taken to avoid dropping stones into the trench which could damage the pipe. Rock fragments greater than 3 inches shall not be placed within two feet of the conduit. Organic soils shall not be used for backfill regardless of their origin.

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Unless otherwise specified on the drawings, earth backfill shall be placed in the manner specified in Vermont Construction Specification 11, Earthwork. Special care shall be taken to prevent lifting the pipe from the bedding by pressures exerted by tamping or compacting of backfill under the haunches of the pipe. Backfill shall be placed in horizontal layers with a maximum thickness of 6 inches before compaction. Rolling equipment shall not be used until a minimum of 30 inches of backfill material has been placed over the top of the pipe.

Excess material shall be spoiled in locations shown on the drawings or as designated by the NRCS Representative.