

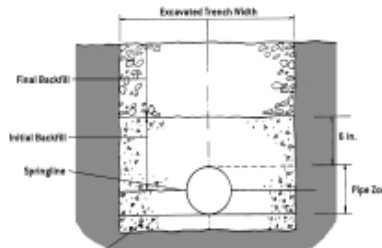
## Installing PVC Pipe in Underground Applications

Switching a commercial plumbing system from cast iron to plastic takes more than just changing materials. Installation requirements change, and failure to address these differences may result in your plumbing system failing.

### Key Points to Remember

#### Bedding and Backfill

Proper bedding and backfill include digging a larger trench and taking extra care when installing the foundation and bedding. Also, the pipe must be compacted to the spring line of the pipe to help PVC and ABS withstand external loads.



Bedding and backfill requirements are outlined in ASTM D2321 (Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications), which is often included in the engineer's specification for installation.

Please note these additional steps are necessary because PVC and ABS do not have adequate stiffness to resist earth and live loads. Failure to meet these requirements may result in the system collapsing and failing.

#### Elevated Temperatures

The Iowa formula uses pipe stiffness in combination with soil type, trench design and other factors to determine maximum burial for flexible systems like ABS and PVC. As shown in the table below, at 140°F only 22% of PVC pipe stiffness remains. If high-temperature discharges from commercial dishwashers, boilers, water heaters, temperature and pressure relief valves or other equipment are not tempered before entering a plastic DWV system, softening of the pipe can occur resulting in collapse or failure.

##### 4" PVC DWV Solid Wall Pipe (ASTM D 2665)

Operating Temperature (°F)	73	80	90	100	110	120	130	140
Correction Factor	1.00	0.88	0.75	0.62	0.50	0.40	0.30	0.22
Pipe Stiffness	310	272.8	232.5	192.2	155	124	93	68.2

#### Using Cellular Core vs Solid Wall Pipe

Cellular, or foam, core PVC and ABS pipe is extruded with a layer of foam sandwiched between inner and outer layers of solid plastic. Due to decreased pipe stiffness and less resistance to mechanical cleaning, some specifiers find cellular core PVC is not suited for commercial applications. If cellular core pipe is used, specifiers should confirm the material installed is consistent with their specification and with the requirements of the application.



Cellular core of PVC stained orange for identification

#### Incorrect Underground Installation



Trench width is too narrow, two pipes buried directly adjacent to one another and improper bedding



Buried pipe collapsed due to exposure to excessive temperatures

## Mechanical Cleaning

Maintenance and drain cleaning to remove blockages are required to keep DWV systems performing optimally. This is especially true in hospitals, prisons, hotels or food service applications. Mechanical cleaning using auger bits or high pressure water may damage ABS or PVC pipe and fittings.

## Unstable Soil

Flexible piping systems like ABS or PVC have less structural strength than rigid metallic piping systems, which is an important consideration when designing systems buried in unstable soil. Burial of pipe beneath a building built on unstable soil is often accomplished by suspending piping systems from structural slabs. The installation of plastic pipe in such situations must be made in accordance with ASTM F2536 (Standard Guide for Installing Plastic DWV Piping Suspended from On-Grade Slabs). Per the standard, cellular core pipe is not permitted to be used in this application due to its reduced pipe stiffness.

*Charlotte Pipe also recommends that specifiers use our Plastics Technical and Installation manual, along with industry references that consider sub-surface conditions unique to each project, and that all installations are made in accordance with ASTM D 2321 and in compliance with applicable code requirements.*

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## Specifications for installation of Cast iron and PVC in typical specification service prepared suggested specs:

Re: SECTION 221316 - SANITARY WASTE AND VENT PIPING  
PART 3 – EXECUTION

3.2 PIPING INSTALLATION

### Cast Iron

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

### PVC

S. Install aboveground PVC Piping according to ASTM D2665  
T. Install underground PVC piping according to ASTM D2321

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### Discussion and suggestions for improvements:

The Cast iron Soil Pipe Handbook as published by CISPI is available at no charge at [www.cispi.org](http://www.cispi.org) and contains complete installation recommendations for cast iron soil pipe and fittings both above and below grade. A contractor can access and download this information easily and without cost, so this simple paragraph as written will result in a proper installation if adhered to.

The specifications for installation of PVC, while technically accurate, are not helpful to the average contractor as they do not maintain copies of the referenced ASTM Standards. The references are very brief and do not include information explaining what the standards cover.

Specifications for PVC installation could be significantly strengthened by referencing the installation instructions of the pipe and fittings manufacturers whose products are being specified. Several manufacturers, including Charlotte Pipe, publish detailed installation instructions in their technical literature. These instructions have specific references to the fundamental elements of both ASTM standards and include pictures, charts, and detail drawings of burial, etc.

The manufacturer's technical documents may be too lengthy for inclusion in a typical specification but a specification that references the ASTM standards, the manufacturer's recommendations and includes a brief list of items covered in those documents would more clearly state what the engineer's expectations are on a project.

### Suggested Short-Form Specification for PVC Drain, Waste and Vent Piping Installation:

Install PVC Pipe and fittings in strict accordance with the installation recommendations of the pipe and fittings manufacturer, Appendix X1 of ASTM D2265 (Storage and Installation Procedures for PVC Plastic Drain, Waste, and Vent Piping) and for buried pipe ASTM D2321 (Standard practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications).

Such instructions shall include but are not limited to cutting, solvent cementing and priming, joints, connections, transitions, alignment and grade, trenching, bedding, backfill and compaction, supports and spacing and allowance for thermal expansion.

*Contact Charlotte Pipe Technical Services for a suggested long-form specification for underground installation of plastic pipe and for a drawing showing a typical trench detail.*

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