Chapter 3: General Regulations

General Comments

The content of Chapter 3 is often referred to as "miscellaneous," rather than general regulations. Chapter 3 received that label because it is the only chapter in the code whose requirements do not interrelate. If a requirement cannot be located in another chapter, it should be located in this chapter.

Some nonplumbing regulations merely reference other codes that have the specific requirements. The requirements provide a cross reference to the appropriate document, recognizing that it affects the plumbing system but the details are not specifically contained in the code (Sections 307, 309, 310 and 313 reference other *International Codes*®).

The jurisdictional requirements specify that the water and sewer must connect to the public system when a public system is provided (Sections 602.1 and 701.2 are more specific on this issue).

Nonplumbing requirements include surface requirements for walls and floors in a toilet room, light and ventilation, floodproofing and rodentproofing.

Purpose

Chapter 3 contains safety requirements for the installation of plumbing and nonplumbing requirements for toilet rooms, including requirements for the identification of pipe, pipe fittings, traps, fixtures, materials and devices used in plumbing systems.

The safety requirements provide protection for the building's structural members, stress and strain of pipe and sleeving. The building's structural stability is protected by the regulations for cutting and notching of structural members. Additional protection for the building occupants includes requirements to maintain the plumbing in a safe and sanitary condition, as well as privacy for those occupants.

SECTION 301 GENERAL

301.1 Scope. The provisions of this chapter shall govern the general regulations regarding the installation of plumbing not specific to other chapters.

❖ The requirements included in Chapter 3 are not interrelated, as is typical with other chapters. Many regulations are not specific plumbing requirements, but relate to the overall plumbing system.

301.2 System installation. Plumbing shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls and other surfaces through fixture usage.

❖ Plumbing components and materials are to be installed in accordance with the requirements of the applicable standard listed in the code.

Where a standard is not provided, the manufacturer's instructions must be followed. For example, because there are very few standards available that regulate the installation of valves, the manufacturer's instructions must be used to install these components.

301.3 Connections to drainage system. Plumbing fixtures, drains, appurtenances and appliances used to receive or discharge liquid waste or sewage shall be directly connected to the sanitary drainage system of the building or premises, in accordance with the requirements of this code. This section shall not be construed to prevent indirect waste systems required by Chapter 8.

Exception: Bathtubs, showers, lavatories, clothes washers and laundry trays shall not be required to discharge to the sanitary drainage system where such fixtures discharge to an *approved* system in accordance with Chapters 13 and 14.

❖ All waste water captured or generated within a building is required to be directed into the sanitary drainage system. In most cases, the connection to the drainage system is a direct connection, meaning that each drain pipe is routed in a continuous manner to its connecting point to a branch of the sanitary drainage system. However, there are some situations where it is not desirable to have a direct connection. For example, a direct connection of the drainage pipe of a commercial kitchen food preparation sink is not desirable because a waste-water backup could contaminate the contents of the sink, perhaps without being noticed by kitchen staff. In these special cases, the drainage pipe is required to discharge through an air break or an air gap into a waste receptor (usually a floor sink), which is indirectly connected to the sanitary drainage system. The outlet of the waste receptor is directly connected to the sanitary drainage system. Chapter 8 covers which fixtures and appliance drains are required to be indirect connected.

The exception to this section recognizes that certain waste-water flows can be a source of water that can be reused for the purposes of water-closet flushing, urinal flushing or subsurface irrigation. These waste-water flows must be collected by a drainage system that is wholly separate from the sanitary drainage system so that extensive treatment of such water is not required before reuse.

301.4 Connections to water supply. Every plumbing fixture, device or appliance requiring or using water for its proper operation shall be directly or indirectly connected to the water supply system in accordance with the provisions of this code.

❖ Fixtures, devices and appliances that require potable water or nonpotable water must be connected, directly or indirectly, to the water supply. In other words, a sink (other than a floor sink) cannot be installed without a faucet installed on the sink.

Indirect connections include faucets or fixture fittings discharging into fixtures such as tubs and lavatories. Direct connections occur at water closets and urinals. Water closets and urinals can be supplied with treated gray water through a direct connection to the fixture if the system meets the requirements of Chapter 13.

301.5 Pipe, tube and fitting sizes. Unless otherwise indicated, the pipe, tube and fitting sizes specified in this code are expressed in nominal or standard sizes as designated in the referenced material standards.

❖ Pipe, tube and fitting sizes referenced in the code refer to the inside diameter (ID) of the pipe, tube or fitting. The ID measurement in the text is expressed in both English and metric units (inches and millimeters). Systeme International d'Unites (SI) metric unit conversions are indicated at the bottom of each table.

301.6 Prohibited locations. Plumbing systems shall not be located in an elevator shaft or in an elevator equipment room.

Exception: Floor drains, sumps and sump pumps shall be permitted at the base of the shaft, provided that they are indirectly connected to the plumbing system and comply with Section 1003.4.

❖ Plumbing systems are prohibited in elevator shafts and elevator equipment rooms because of inaccessibility for repairs and the possible water damage that could be caused to the elevator equipment if a leak developed in the plumbing piping or components. The exception allows floor drains, sumps and sump pumps at the bottom of elevator shafts as long as they are indirectly connected to the plumbing system. An indirect connection is required to prevent waste from a plumbing system from backing up into the elevator shaft. Note that a back-water valve cannot be used as a substitute for the indirect connection.

Because the defined term "plumbing system" includes both sanitary drains and storm sewers, the designer has to make a decision of whether to put the discharge from the floor drain, sump or sump pump into the sanitary system or storm sewer. Two reasons for water to be in the base of an elevator shaft are: 1) the base of many elevator shafts is below grade where ground water (from rain events or a seasonally high water table) might enter through cracks and seams in the walls and floors of the shaft and 2) water from an activated fire sprinkler system could enter through elevator doors. If the water is considered to be storm water, Section 1101.3 would prohibit connection to the sanitary system. If the water is considered no different than what would enter a floor drain, then Section 301.3 would require its discharge to the sanitary system. Other considerations could be whether or not local storm water regulators or waste-water plant operators have authority to specify where such water should be discharged.

The exception references Section 1003.4 to alert the code user that if the elevator is a hydraulic type, an oil separator is required to be installed before the discharge of the floor drain, sump or sump pump enters the plumbing system.

301.7 Conflicts. In instances where conflicts occur between this code and the manufacturer's installation instructions, the more restrictive provisions shall apply.

❖ A conflict refers to instances where the code and manufacturer's instructions differ. The code official must evaluate each circumstance of perceived conflict and identify the requirements that provide the greatest level of protection for life and property.

SECTION 302
EXCLUSION OF MATERIALS DETRIMENTAL TO THE SEWER SYSTEM

302.1 Detrimental or dangerous materials. Ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or any other insoluble material capable of obstructing, damaging or overloading the building drainage or *sewer* system, or capable of interfering with the normal operation of the sewage treatment processes, shall not be deposited, by any means, into such systems.

❖ This section prohibits the disposal of detrimental or dangerous materials into the sewer system. Such materials can cause the pipes to clog or accelerate the clogging of pipes, which prevents the proper disposal of sewage waste. Section 1003 contains design and installation details for the use of interceptors, grease traps and separators to remove oil, grease, sand and other detrimental substances.

Discharge of materials that are flammable or combustible into the public sewer system is prohibited because an accumulation of these types of materials poses a fire and explosion hazard. Insoluble chemicals that are not processed before disposal could react with other discharged chemicals to cause damage to the piping and components of the drainage, sewer and waste treatment systems. Section 803.2 provides details for using approved dilution or neutralizing devices to process harmful chemicals prior to disposal.

302.2 Industrial wastes. Waste products from manufacturing or industrial operations shall not be introduced into the *public sewer* until it has been determined by the code official or other authority having jurisdiction that the introduction

thereof will not damage the public *sewer* system or interfere with the functioning of the sewage treatment plant.

❖ Harmful or hazardous industrial waste must be treated before it is discharged to the sewer. This can require the complete removal or neutralization of certain chemicals or substances.

SECTION 303
MATERIALS

303.1 Identification. Each length of pipe and each pipe fitting, trap, fixture, material and device utilized in a plumbing system shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

❖ The manufacturer is given the option of determining the type of marking for the material. If there is no applicable standard or the applicable standard does not require that a material be identified, identification of the manufacturer is still required by the code. Where the code indicates compliance with an approved standard, the manufacturer must comply with the requirements for marking in accordance with the applicable standard [see Commentary Figures 303.1(1) and 303.1(2)].

303.2 Installation of materials. All materials used shall be installed in strict accordance with the standards under which the materials are accepted and *approved*. In the absence of such installation procedures, the manufacturer's instructions shall be followed. Where the requirements of referenced standards or manufacturer's installation instructions do not conform to minimum provisions of this code, the provisions of this code shall apply.

❖ Plumbing components and materials are to be installed in accordance with the requirements of the applicable standard listed in the code. Where a standard is not provided, the manufacturer's instructions must be followed. For example, because there are very few standards available that regulate the installation of valves, the manufacturer's instructions must be used to install these components.

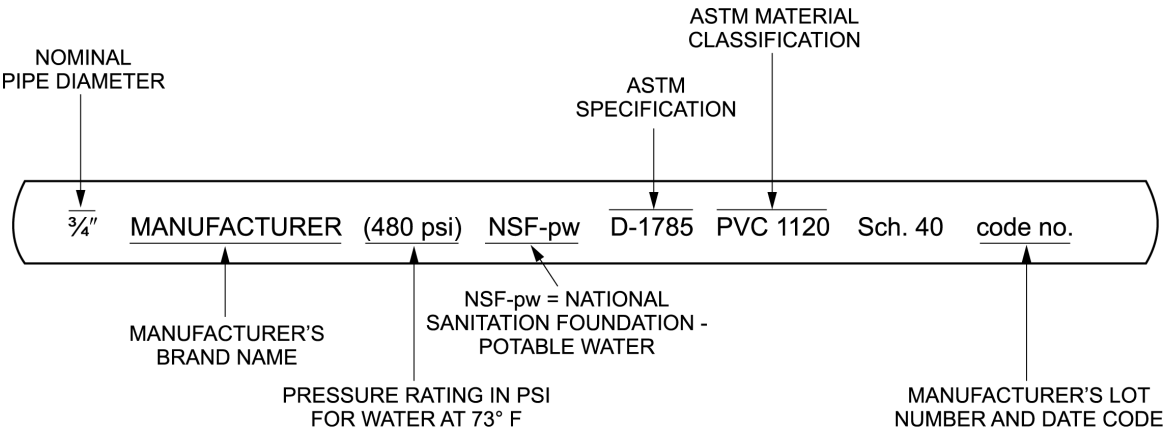
303.3 Plastic pipe, fittings and components. All plastic pipe, fittings and components shall be third-party certified as conforming to NSF 14.

❖ Plastic piping, fittings and plastic pipe-related components, including solvent cements, primers, tapes, lubricants and seals used in plumbing systems, must be tested and certified as conforming to NSF 14. This includes all water service, water distribution, drainage piping and fittings and plastic piping system components, including but not limited to pipes, fittings, valves, joining materials, gaskets and appurtenances. This section does not apply to components that only include plastic parts such as brass valves with a plastic stem, or to fixture fittings such as fixture stop valves. Plastic piping systems, fittings and related components intended for use in the potable water supply system must comply with NSF 61 in addition to NSF 14.

303.4 Third-party certification. All plumbing products and materials shall be listed by a third-party certification agency as complying with the referenced standards. Products and materials shall be identified in accordance with Section 303.1.

❖ The term "third party" refers to an outside organization with no financial or other interest in the outcome.

The code requirements for testing and certification have frequently confused code officials and manufacturers over the years. Securing and submitting the necessary documentation for certain products and materials is often a challenge for contractors and engineers. The code official was also burdened with trying to keep up with the myriad of products he or she sees in the field and the documentation that has (or has not) been submitted. To simplify inspections and approvals, the code requires that all products and materials



For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, °C = [(°F) - 32]/1.8.

Figure 303.1(1)
SAMPLE MARKING OF PVC PRESSURE PIPE

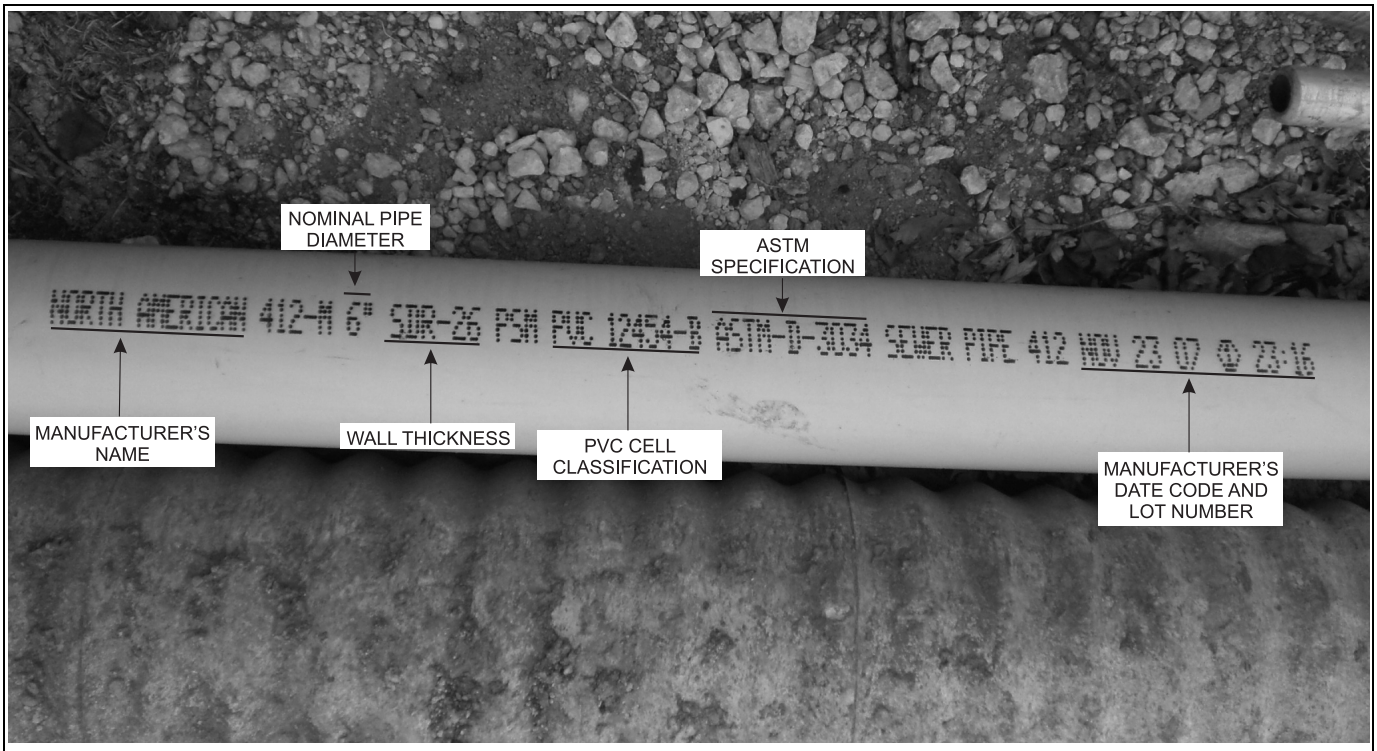


Figure 303.1(2)
MARKING OF PVC GRAVITY SEWER PIPE

be third-party certified. The code official only has to confirm that the product or material has the mark of the third-party certifying agency.

SECTION 304
RODENTPROOFING

304.1 General. Plumbing systems shall be designed and installed in accordance with Sections 304.2 through 304.4 to prevent rodents from entering structures.

❖ Rodents are known to be carriers of diseases and present serious health risks to humans. To prevent the spread of disease, Sections 304.2 through 304.4 require plumbing systems to be installed in a manner that will reduce the potential for rodent entry into structures.

304.2 Strainer plates. All strainer plates on drain inlets shall be designed and installed so that all openings are not greater than $^{1}/_{2}$ inch (12.7 mm) in least dimension.

❖ Rodents often travel and live within sanitary sewer systems. The limitation for opening size in strainer plates for floor and shower drains as well as receptor strainers provides two forms of protection. If rodents are in the sewer system, strainer plates prevent them from entering the building through the floor or shower drain. If rodents are within the structure itself, the strainer plate prevents rodent access to the drainage system.

304.3 Meter boxes. Meter boxes shall be constructed in such a manner that rodents are prevented from entering a structure by way of the water service pipes connecting the meter box and the structure.

❖ The water service pipe may be tunneled into the building from the meter box. When such an installation occurs, the annular space around the pipe must be protected to prevent rodents from getting into the building. This can be accomplished by a barrier to block their entry, such as a corrosion-resistant heavy wire screen or metal plate that is securely fastened in place.

304.4 Openings for pipes. In or on structures where openings have been made in walls, floors or ceilings for the passage of pipes, the annular space between the pipe and the sides of the opening shall be sealed with caulking materials or closed with gasketing systems compatible with the piping materials and locations.

❖ Rodents can enter a building through the annular spaces around piping that penetrates a wall, ceiling or floor. These spaces must be blocked using caulking or gasketing (see also commentary, Section 315).

SECTION 305
PROTECTION OF PIPES AND PLUMBING SYSTEM COMPONENTS

305.1 Corrosion. Pipes passing through concrete or cinder walls and floors or other corrosive material shall be protected against external corrosion by a protective sheathing or wrapping or other means that will withstand any reaction from the lime and acid of concrete, cinder or other corrosive material.

Sheathing or wrapping shall allow for movement including expansion and contraction of piping. The wall thickness of the material shall be not less than 0.025 inch (0.64 mm).

❖ Metallic piping must be protected from external corrosion in locations where the piping is in direct contact with materials known to be corrosive.

This section specifically identifies walls and floors built of cinder(s) or concrete as being corrosive. Cinders are a byproduct created from the burning of coal. Cinders contain sulfur compounds and, where exposed to moisture, these compounds can form acids that can be corrosive to metals. Cinders are sometimes used as an aggregate in lightweight (nonstructural) concrete for slab-on-grade floors and lightweight (nonstructural) "cinder blocks."

Concrete, in a wet slurry state, is caustic (pH level of 12 to 13) due to the limestone-based portland cement in the concrete reacting with water. Because concrete (and masonry units made from concrete) could contain acid-producing cinders and cured concrete is still somewhat caustic, metallic piping must be protected from direct contact with concrete or concrete masonry units.

Naturally corrosive soils, such as found in swamps, peat bogs or tidal marshes, can corrode metallic piping. Fill materials containing furnace slag, cinders, ash or spent industrial byproducts can also be corrosive to metallic piping. The designer or installer should consult with soils engineers, piping manufacturers as well as local code officials concerning the need for corrosion protection of metallic piping in contact with soil or fill materials of potentially corrosive nature.

Direct exposure of metallic piping to corrosive materials can be prevented by sheathing or wrapping of the piping. Sheathing involves inserting the piping into a flexible plastic sleeve of material. Wrapping of piping is where a flexible product is "wrapped" around the pipe circumference. Sheets of flexible plastic material can be wrapped around the circumference of the piping with sufficient overlap at the ends to ensure complete protection of the pipe.

Where sheathing or wrapping protects piping, it must allow for pipe movement. In other words, the sheathing or wrapping should not be adhered to the pipe so that the pipe cannot expand and contract within the protective material. This section requires the thickness of the sheathing or wrapping to be at least 0.025 inch (0.64 mm). Note that this thickness value is much greater that the commonly available flexible plastic sleeve materials (usually colored red or blue for pipe identification) of either 0.006 or 0.010 inch (0.15 mm or 0.25 mm) that are found to be stocked in the majority of plumbing supply houses. Although use of these thinner sheathing materials appears to be a widely accepted practice, these materials do not meet the minimum thickness requirement stated in this section. Therefore, the code official must approve the use of sheathing materials having a material thickness of less than 0.025 inch (0.64 mm) thick.

305.2 Stress and strain. Piping in a plumbing system shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement.

❖ A plumbing system must not be damaged by stresses, strains or movement of the building components. In piping systems, provisions must be made for the expansion and contraction of the pipes themselves. Each piping material has a different rate of expansion and contraction that must be considered when designing the restraint system for the piping and the structure that surrounds the piping system.

Changes in temperature can cause distortion of the pipe material; for example, heat causes the material to expand. The greatest amounts of expansion and contraction in piping will occur along the length of the pipe. Hot water piping can experience significant movements in short runs of piping. Though the amount of expansion per unit length is low, large movements can occur in long lengths of pipe. Commentary Figure 305.2 contains the expansion rate for various pipe materials.

The most common method to absorb thermal expansion in plumbing piping systems is through the installation of one or more offsets in the piping. The typical offset piping arrangements used are the "L" bend (1-elbow change in direction), the "Z" bend (2-elbow offset) and the "U" bend (4-elbow offset) [see Commentary Figures 305.2(1) through 305.2(3)]. The

PIPING MATERIAL	RATE OF THERMAL EXPANSION in/in/°F
Brass-red	0.000009
Copper	0.00001
Cast iron	0.0000056
Carbon steel	0.000005
Ductile iron	0.0000067
Stainless steel	0.0000115
Borosilicate (glass)	0.0000018
ABS	0.00005
CPVC	0.000035
HDPE	0.00011
PE	0.00008
PEX	0.00093
PP	0.000065
PVC	0.00004
PVDF	0.000096

Source: *Facility Piping Systems Handbook*, 2nd Edition, Frankel, McGraw Hill, 2002.

For SI: 1 inch = 25.4 mm, °F = 68°C + 32.

Figure 305.2
THERMAL EXPANSION RATES FOR PIPING MATERIALS

length, *L*, in each of these figures is determined from the following equation:

$$L = [1.5 \times (E/S) \times D_o \times (G)]^{1/2}$$

where:

E = Modulus of elasticity at pipe temperature (psi)

S = Maximum allowable stress for the pipe material at the highest in-service pipe temperature (psi)

D_o = Outside diameter of pipe (inches)

G = Change in length of piping due to temperature change (inches). Thermal expansion rate of the pipe material from Commentary Table 305.2 × Change in temperature of the pipe (installation day to highest in-service temperature expected) × Length of pipe in feet between points where the pipe is restricted from expanding in length × 12 inches per foot.

The values for *E* and *S* are obtained from piping manufacturers, engineering publications or the material standards for the pipe products.

Sample Problem: A 160-foot-long straight run of 1-inch copper tube size CPVC pipe is to be installed to convey hot water at 140°F. The ends of the piping will be attached to equipment. The temperature at the time of installation will be 50°F. Determine the required offset length, *L*, to accommodate the thermal expansion that will occur when the system is operating.

Problem Approach

Obtain the thermal expansion rate from Commentary Table 305.2, calculate the amount of thermal expansion of the piping run, obtain the modulus of elasticity and allowable stress values from the piping manufacturer, and calculate the required offset length, *L*.

Solution

For CPVC piping material, the thermal expansion rate listed in Commentary Table 305.2 is 0.000035 inches/inch/°F. The change in temperature of the pipe from installation to service condition is 140°F minus 50°F, which equals 90°F. The change in length of the pipe, *G*, is calculated as follows:

G = 0.000035 inches/inch/°F × 90°F × 160 feet × 12 inches per foot

G = 6.1 inches

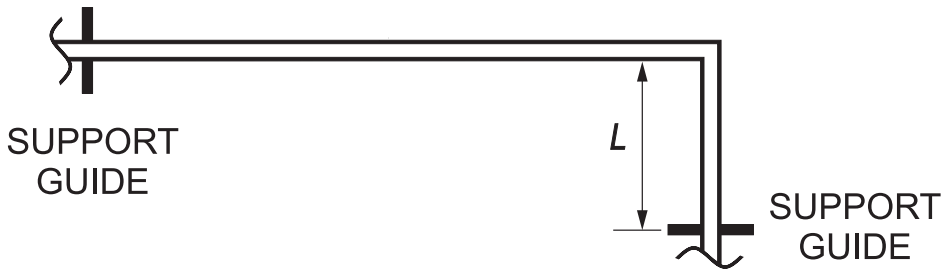
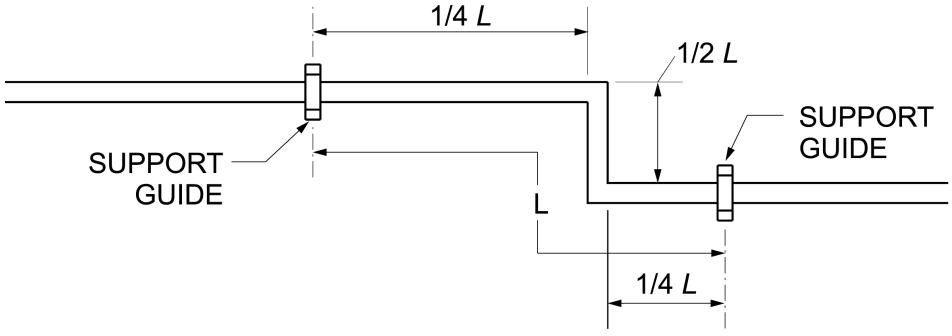


Figure 305.2(1)
"L" BEND



OFFSET PIPING MUST BE SUPPORTED WITH HANGERS, SLIDE PLATES OR SPRING HANGERS.

Figure 305.2(2)
"Z" BEND