

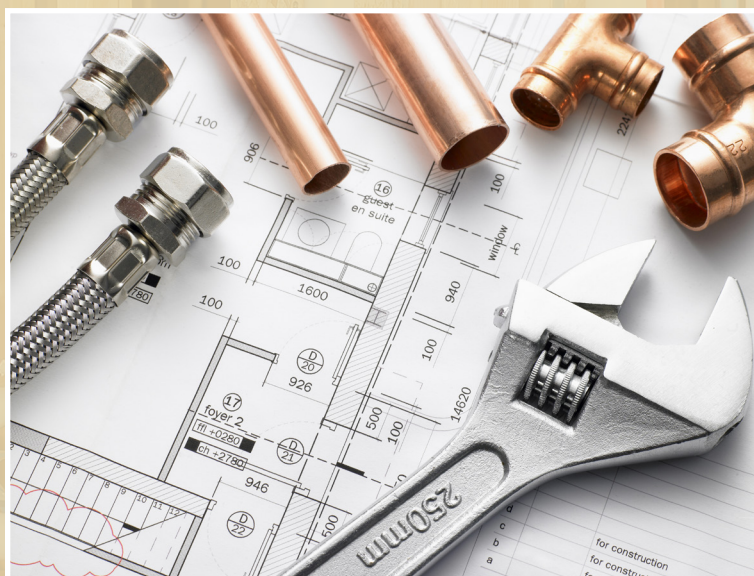
PART



# Layout and Planning

**Chapter 3:** Installation

**Chapter 4:** Design



## CHAPTER

# 3

# Installation



**D**uring the design phases of a building construction project, one must give attention to general plumbing code requirements that will apply to the type of occupancy and use of the structure, as well as the type of preferred or mandated materials that are to be used for installation purposes. Chapter 3, Installation addresses items such as general requirements, protection of plumbing systems, materials and standards, and water/sewer requirements.



## WATER AND SEWER REQUIRED

IPC Chapter 4 establishes the minimum number of required plumbing fixtures for the various group occupancies described in the IBC. This will be discussed in further detail later in the following chapter. The *International Residential Code* requires each dwelling unit in detached one- and two-family dwellings and townhouses to be provided with sanitary and bathing facilities and kitchen facilities. The point here is that where plumbing fixtures are mandated, an approved means of waste discharge is required to which the fixtures shall be connected. Sanitary drainage systems shall be connected to a public sewer. Where a public sewer is not available, sanitary drainage shall be connected to a private sewage disposal system. In most cases, both public sewer utilities and private sewage disposal systems are regulated by state or local authorities. Where such regulations do not exist, the provisions of the *International Private Sewage Disposal Code* will apply where adopted locally. There is an exception that allows waste water from bathing and laundry facilities to discharge to a subsurface landscape irrigation system or to an on-site nonpotable water reuse system. In both cases, you will want to verify that these options, although included in the code, are acceptable to local health regulations. On-site nonpotable water reuse systems will be addressed in Chapter 10.

Wastes that are dangerous or damaging to the building drainage system or to the public or private sewage disposal system shall not be discharged into such systems. While some of those items that can be detrimental or dangerous are identified in the code, it is good to coordinate with the authority having jurisdiction for the public or private sewage disposal system, as well as for the handling and disposal of hazardous materials and fluids, should there be any questions. Certain wastes can be removed or captured by means of interceptors and separators, such as greases, oils and sand, and some chemical wastes can be further diluted prior to entry into the drainage system.

Plumbing fixtures, devices and appliances that require the use of water for proper operation are required to be connected to the water distribution system of the structure, which is then connected to an approved source of water, either a public or private source. Generally, approved water sources will be by means of a public water utility. However, where a potable public water supply is not available, individual sources of potable water shall be used. Quite often an individual source of potable water is a private or community well. It is common for both public and private, or independent, potable water sources to be regulated by agencies or departments outside of the typical building department. For instance, many state and local health departments oversee potable water sources for properties and construction. These regulations will often include mandatory sup-

### You Should Know

The code official should work with the local authority overseeing public sewers and on-site sewage disposal systems, such as a public utility or a health department when it comes to identifying discharges that may be detrimental to the disposal systems. Such agencies may also control hazardous waste disposal operations. ●

### Code Essentials

The *International Private Sewage Disposal Code* contains provisions for on-site sewage disposal systems, and Chapter 14 of the *International Plumbing Code* contains provisions on graywater discharge to subsurface irrigation use. Always verify local regulations that may apply. ●

## You Should Know

Definitions for consideration (see Glossary):

- Third-party certified
- Third-party certification agency •



**FIGURE 3-1** ICC-ES PMG mark

## Code Essentials

Where there are conflicts between the code, manufacturer's installation instructions, referenced standards or other regulations:

- The minimum provisions of the code apply over requirements in referenced standards and manufacturer's instructions. **[IPC 102.8.1, 303.2]**
- The provisions of the code are not deemed to nullify any provisions of local, state or federal law. **[IPC 102.10]** •

ply and storage volumes for private or independent potable water sources. Although the plumbing inspector may have no authority over potable water sources, it is imperative that an approved potable water source is properly identified for the intended use before granting approval for construction. **[Ref. IPC 301.3, 301.4, 302, 602.3, 701.2 and IRC R2601.2, R2602.1]**

## MATERIALS AND STANDARDS

Adherence to the IPC will result in a plumbing installation of good quality. But, quality goes beyond the skill of the installer. Quality construction depends also on materials of good quality. Both the IPC and the IRC include a chapter that lists the various product standards for plumbing materials that are identified in the code, and that chapter includes a reference to the code section(s) where the use and installation of such materials are addressed. Additionally, it is important to note that many code sections also include the applicable product or material standards. This provides a quick and easy means for identifying the appropriate standard for products and materials.

How can you know for sure that the materials used conform to the applicable standard identified in the code? Here is where the third-party certification comes into play. Such identification is what is most commonly referred to as a listing, that the product or material is listed, thus providing confirmation that the product or material has been evaluated by a third-party certification agency. To better explain what a third-party certification agency is, let's consider the ICC Evaluation Services (ICC-ES PMG) program, which is one such agency since it pertains to plumbing, mechanical and gas materials and products (Figure 3-1). The PMG listing mark indicates that the product complies with applicable standards and codes, and that ongoing inspections at the manufacturer's site are conducted to ensure that the quality of the product remains consistent.

It is equally important that the product or material be installed in accordance with the manufacturer's instructions and the code. Keep in mind that there may be rare occasions where a conflict exists between the manufacturer's installation instructions and the code. The code specifically states that where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply. As an example, consider temperature-actuated, flow reduction (TARF) devices that conform to the ASSE 1062 product standard, which is an approved standard recognized by the code. Such devices can be an effective means for reducing the possibility of injury due to exposure to hot water discharge in excess of 120°F. However, the code clearly states that such valves are not to be used alone as a substitute for balanced-pressure, thermostatic or combination shower valves. In this case, the code prevails regardless of what might be indicated in the manufacturer's installa-

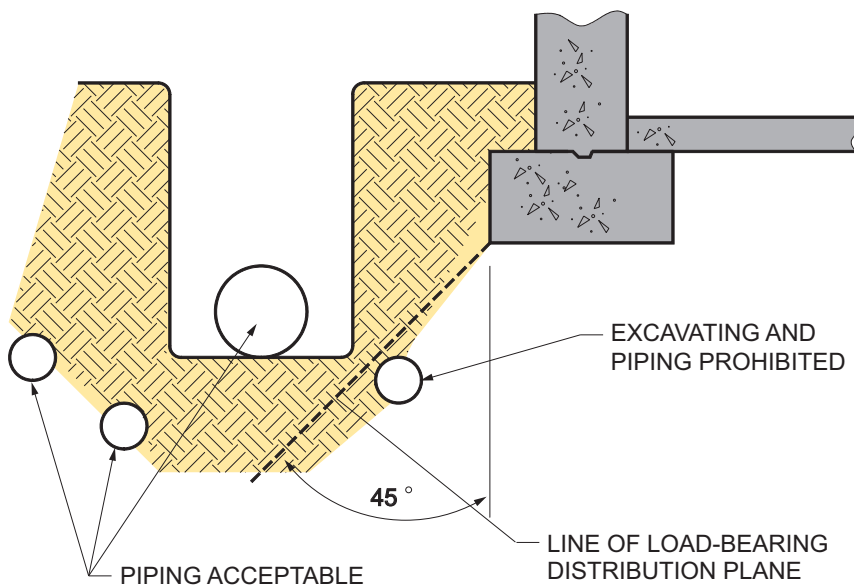
tion instructions. [Ref. IPC 301.7, 303, 412.3, 412.7, Chapter 15 and IRC P2609, P2708.4, P2724.2, Chapter 44]

## PROTECTION OF THE PLUMBING SYSTEM AND STRUCTURE

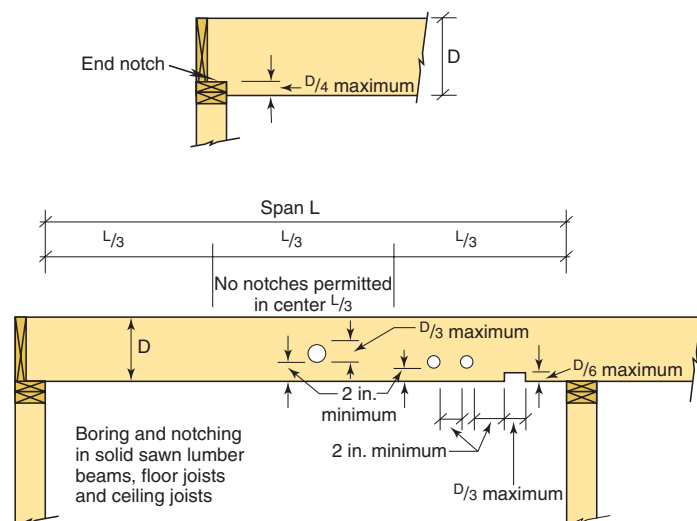
During the installation of the plumbing system, attention must be given to protecting both the plumbing system itself as well as the structure. In this section we will cover some specific code requirements that address this. We will first consider protection of the structural integrity of the building during the plumbing installation, and then we will look at requirements for protection of the plumbing components.

The code states that plumbing is to be installed with due regard to protecting the structural integrity of the structural members. Proper installation of the plumbing fixtures themselves is also necessary for protection of floor and wall surfaces. For now, let's focus on the structural integrity, primarily the foundation and the framing members.

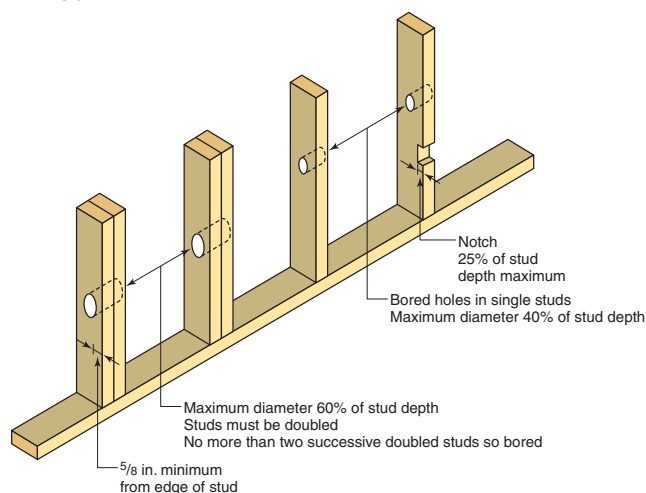
One of the things that can undermine the foundation is the placement of piping underground near the structural foundation, especially when the excavation and piping are installed parallel to the foundation. Trenches that are parallel and next to the foundation cannot extend below the 45-degree bearing plane of the footing wall (Figure 3-2).



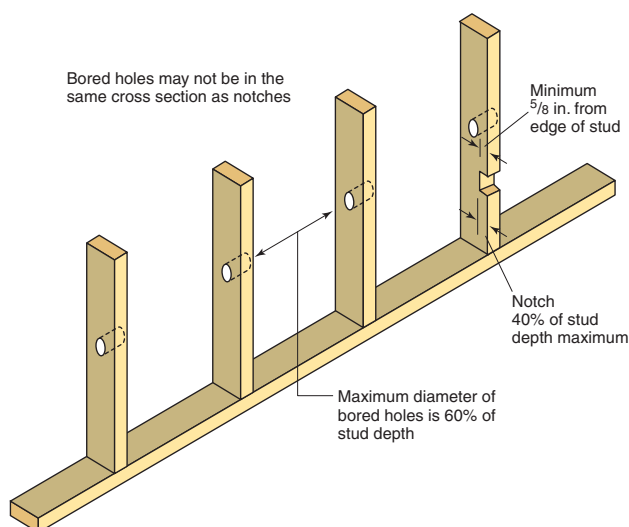
**FIGURE 3-2** Excavation in relation to footing



**FIGURE 3-3** Boring and notching in solid sawn beams, floor joists and ceiling joists



**FIGURE 3-4** Boring and notching of studs in exterior wall or bearing interior wall



**FIGURE 3-5** Boring and notching of studs in nonbearing interior wall

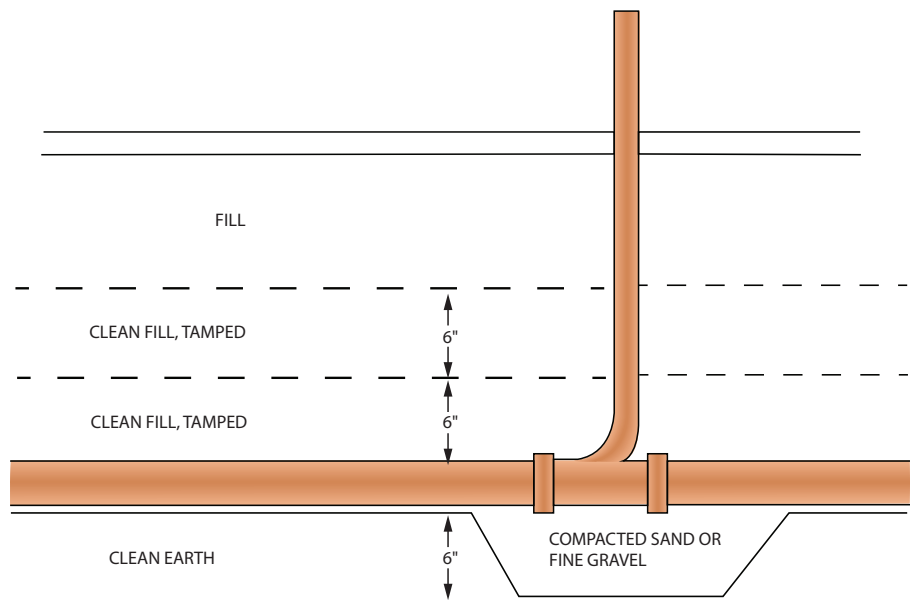
Attention must also be given to the necessary boring and notching of framing members, such as vertical studs and horizontal joists. For the benefit of the plumbing installer, the IPC includes an appendix chapter which details the location and maximum allowances for cutting, notching and boring of wood framing members as required in the IBC and IRC (Figures 3-3, 3-4, 3-5 and Table 3-1). Boring, cutting or notching of trusses and other engineered wood products is prohibited except as specifically permitted by the manufacturer. Otherwise, a registered design professional must consider any alterations in the design of the engineered component. Wherever piping penetrates floors, ceilings or walls that are required to have fire-resistance rating, such penetrations must be protected in accordance with the IBC in order to maintain the fire-resistance rating. Even where fire-resistance rating is not required, approved sealing or caulking of the annular space between the pipe and the sides of the opening are needed in order to prevent the entrance of rodents, which can be damaging to both the structure and the plumbing system, besides being a health hazard.

**TABLE 3-1** Boring and notching limits for wood beams, joists, rafters and studs converted to inches

Sawn lumber beams, floor joists, ceiling joists and rafters		Approximate notch and hole limitations in inches		
Nominal size	Approximate depth 'D'	D/3	D/4	D/6
2 x 4	3 ½ in.	1 ⅜	7/8	½
2 x 6	5 ½ in.	1 ⅓	1 ⅜	15/16
2 x 8	7 ¼ in.	2 ⅜	1 ⅓	1 ⅜
2 x 10	9 ¼ in.	3 ⅓	2 ⅓	1 ½
2 x 12	11 ¼ in.	3 ¾	2 ⅓	1 ⅞
<b>Wood studs</b>		<b>60%</b>	<b>40%</b>	<b>25%</b>
2 x 4	3 ½ in.	2 ⅛	1 ⅜	7/8
2 x 6	5 ½ in.	3 ⅓	2 ⅜	1 ⅜

Consideration must also be given to protection of the piping system itself. This mainly involves providing proper support of the piping and installing safeguards to protect the piping from damage once it is installed. Let's first address support and protection of piping buried below grade.

When installing a piping installation in a trench, the entire length of the piping must be supported, including the fittings. This is not merely to maintain proper slope of the piping, but to protect the joints of the pipe and fittings from sagging, which can result in failure of the joint. The IPC provides some basic guidelines for maintaining solid and continuous support along the bottom of the trench with clean, smooth backfill material. Where material must be added to bring the bottom of the trench to the appropriate level to support the installation, sand or fine gravel shall be placed in adequately compacted layers not to exceed 6 inches in depth. When backfilling to cover the installation, clean fill shall be placed and tamped in maximum 6-inch layers to a depth of 12 inches before completing the fill process (Figure 3-6). Always follow the manufacturer's installation instructions first and foremost, which may be more restrictive than the code provisions.

**FIGURE 3-6** Underground piping placement

## Code Essentials

Appendix C in the IPC contains provisions regarding notching, boring and cutting wood framing members which are consistent with the *International Building Code* (IBC) and the *International Residential Code* (IRC) and are provided to the user of the IPC for a matter of convenience. One must still look to the IBC and IRC for notching, boring and cutting limitations as they apply to other materials, such as cold-formed steel and engineered wood products. ●

Support is also necessary for piping installed above grade, and this applies to both horizontal and vertical piping installations. It's not just the type and weight of the piping material that matters, but also the weight and velocity of the contents within the piping. Piping of 4 inches or larger must be secured at changes of direction greater than 45 degrees to prevent swaying. Table 308.5 provides both horizontal and vertical spacing intervals for support of various piping and tubing material (Table 3-2). The hangers must also be of approved material that is properly attached to the building construction to support the installation. Here too, it is important to follow the manufacturer's installation instructions for the piping or tubing and the hanger.

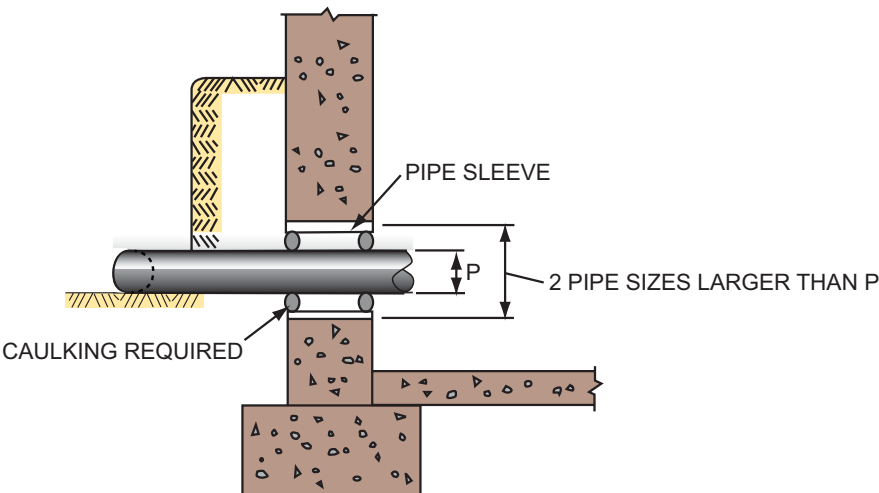
**TABLE 3-2** Hanger spacing

Piping material	Maximum horizontal spacing (feet)	Maximum vertical Spacing (feet)
ABS pipe	4	10 <sup>a</sup>
Cast-iron pipe	5 <sup>b</sup>	15 <sup>b</sup>
Copper tubing (1 <sup>1</sup> / <sub>4</sub> " or smaller)	6 <sup>a</sup>	10
Copper tubing (1 <sup>1</sup> / <sub>2</sub> " or smaller)	10	10
PEX	2.67 (32 inches)	10 <sup>b</sup>
PVC	4	10 <sup>b</sup>

<sup>a</sup> The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

<sup>b</sup> For sizes 2 inches and smaller, a guide shall be installed midway between required vertical supports. Such guides shall prevent pipe movement in a direction perpendicular to the axis of the pipe.

Properly supporting the pipe whether underground or suspended above ground will prevent imposed stresses and strains on the joints. Such strains may also occur where the pipe passes through a foundation.



**FIGURE 3-7** Foundation pipe sleeve

A primary way to protect the pipe is to install a pipe sleeve in the foundation through which the pipe can pass. The pipe sleeve is to be two-pipe sizes larger than the pipe passing through (e.g., a 4-inch pipe will require a minimum 6-inch sleeve) (Figure 3-7). Where the pipe extends through a foundation from within the structure to the exterior, the opening must be sealed to prevent water and moisture intrusion.