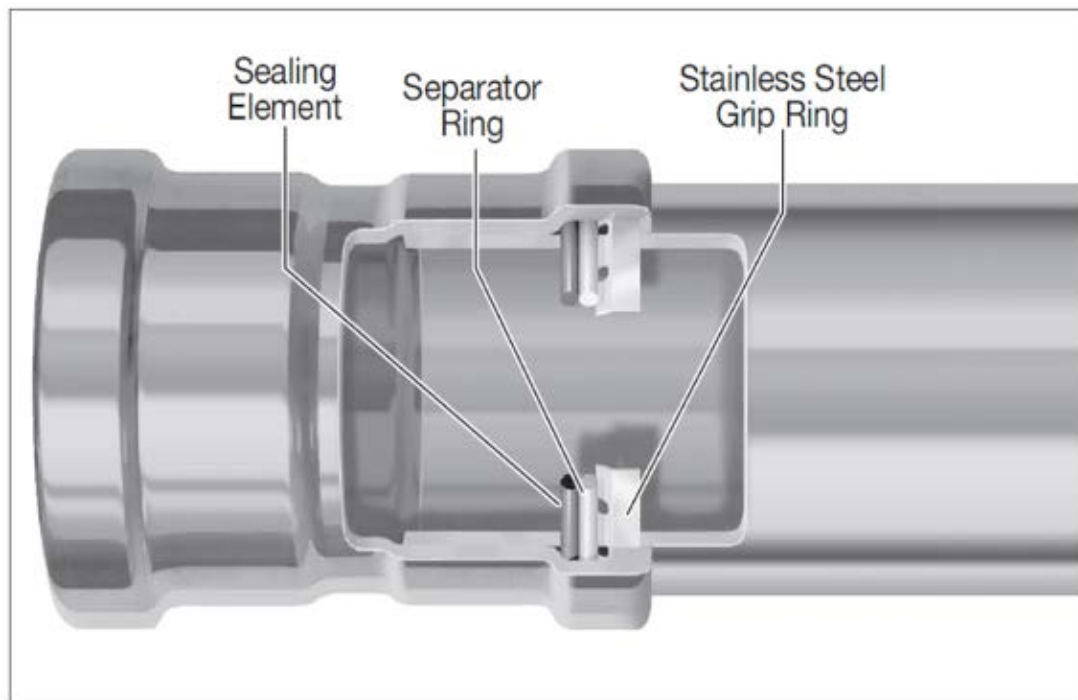


# CodeNotes™



## Joining of Metallic Tubing and Piping Using Press-Connect Fittings

Based on the 2021 International Mechanical Code (IMC®), 2021 International Plumbing Code (IPC®), the 2021 International Fuel Gas Code (IFGC®) and 2021 International Residential Code (IRC®)



### General

Press-connect fittings are designed to create tubing and piping joints and are an alternative joining method that does not reduce the wall thickness of the tubing or pipe like traditional threaded joints do. Additionally, the installation of press-connect fittings does not require a heat source that traditional joining methods such as soldering, welding, or brazing do. With a press-connect joint, a pressing tool is used, in conjunction with a specifically sized jaw or ring to press specially designed press-connect fittings, to join pipe and tubing. These specialized fittings house a sealing element that, when pressed, creates a permanent, reliable liquid and gas tight connection. Using this method of joining pipes for repairs, eliminates the need for the full evacuation of the piping system, as well as the requirement of a hot work permit. Press-connect fittings have been used in plumbing, mechanical, and fire protection applications that include residential, commercial, industrial, and marine piping systems for over 25 years.

Per the 2021 International Mechanical Code (IMC), 2021 International Plumbing Code (IPC), and the 2021 International Residential Code (IRC), a press-connect fitting used to create a joint between 2 sections of metallic tube or pipe or fittings is defined as the following:

**PRESS-CONNECT JOINT.** A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion-resistant grip or bite ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.

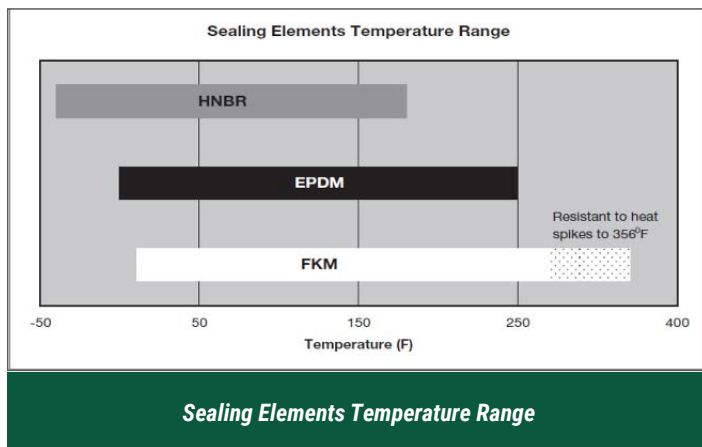
The 2021 IFGC does not use the term press-connect joint but instead, considers a press-connect joint as another type of Mechanical Joint as follows:

**JOINT, MECHANICAL.** A general form of gas-tight joints obtained by the joining of metal parts through a positive-holding mechanical construction, such as a press-connect joint, flanged joint, threaded joint, flared joint or compression joint.

## Materials

Press-connect fittings are typically made from copper, copper alloys, stainless steel, or carbon steel and are installed to match the application for which they are being used.

Press-connect fittings are available in the standard forms of pipe fittings such as elbows, tees, adapters, couplings, caps, branch adapters, valves, etc. and are offered in sizes from ½" to 4" tube or pipe diameter and are manufactured in a variety of alloys which include copper/copper alloy, carbon steel, stainless steel (304 & 316) and 90/10 copper nickel. The most common types of elastomeric seals utilized in press-connect fittings include EPDM (Ethylene Propylene Diene Monomer), FKM (Fluoroelastomer), and HNBR (Hydrogenated Nitrile Butadiene Rubber). Each of these sealing element materials have specific optimal sealing properties and attention should be paid that the correct elastomeric material is being used for the type of liquid or gas that is being transported in the given piping system application.



The operating temperature range of EPDM elastomeric seals in press-connect fittings is typically 0°F to 250°F. This elastomer seal is used in applications such as potable water, process water, hydronic heating, fire sprinkler and compressed air. EPDM sealing elements are often shiny black in color, and possess excellent resistance to aging, ozone, sunlight, weathering, environmental influences, alkalis and most alkaline solutions along with chemicals used in a broad range of applications, including ketones. EPDM has particularly good resistance to hot water, making it ideal for seals and gaskets.

The temperature range of FKM elastomeric seals is typically 14°F to 284°F, with allowable spikes to 356°F for a maximum of 24 hours. These sealing elements are often dull black in color, and possess excellent resistance to chemicals, higher temperatures, aging, ozone, sunlight, weathering, environmental influences, oils, and petroleum-based additives. Their resistance to aggressive chemicals and higher operating temperatures makes it ideal for seals and gaskets in solar and industrial process applications.

HNBR elastomeric seals temperature range is typically -40°F to 180°F are often non-black in color (elastomer seal color varies by press-connect manufacturer) which differentiates them from EPDM and FKM. They are used where resistance to petroleum-based additives are required and possess excellent physical strength and retention properties after long-term exposure to heat, oil, and chemicals. HNBR sealing elements are used in applications of natural, propane, mixed, and manufactured gases as well as oils and lubricants. These unique properties have resulted in wide adoption in automotive, industrial, and assorted high performance applications.

## Water Supply and Distribution Systems

IPC Chapter 6, "Water Supply and Distribution", covers water distribution piping systems that transport potable water in commercial building applications. In this chapter, press-connect fittings are recognized as an acceptable joining method for copper tubing in IPC Section 605.13.5 where it states these connections "shall conform to one of the standards indicated in IPC Table 605.5, and shall be installed in accordance with the manufacturer's instructions. Cut tube ends shall be reamed to the full inside diameter of the tube end. Joint surfaces shall be cleaned. The tube shall be fully inserted into the press-connect fitting. Press-connect joints shall be pressed with a tool certified by the manufacturer."

It is also important to note that in IPC 605.2, that pipe and pipe fittings in the water supply system have <8% lead content and in IPC 605.2.1, that pipe and pipe fittings that supply potable water must also be listed to NSF 372 which indicates that they contain <0.25% weighted average lead content. A press-connect fitting with a listing to NSF 372 satisfies both of these requirements.

IPC Table 605.5 PIPE FITTINGS (FOR PRESS-CONNECT ONLY)	
MATERIALS	STANDARDS
Copper or copper alloy	ASME B16.51; ASTM F3226
Fittings for cross-linked polyethylene (PEX) plastic tubing	ASTM F877; CSA B137.5
Stainless steel (Type 304/304L)	ASTM A312; ASTM F3226
Stainless steel (Type 316/316L)	ASTM A312; ASTM F3226

**IPC Table 605.5**  
**Pipe Fittings (For Press-Connect Only)**

## Refrigeration Piping Systems

IMC Chapter 11 Refrigeration covers refrigeration piping systems that utilize refrigerants other than ammonia. It is important to note that refrigeration systems that utilize ammonia as the refrigerant are not covered by this chapter. In accordance with IMC 1107.5, "Refrigerant pipe fittings shall be approved for installation with the piping materials to be installed, and shall conform to one or more of the standards listed in Table 1107.5 or shall be listed and labelled as complying with UL 207". IMC Section 1108.3.2 describes a press-connect joint as a form of mechanical joint and requires that press-connect joints be installed in accordance with the manufacturer's instructions. Materials that can be joined between tubing, piping, or fittings with press-connect joints include aluminum tube (Section 1108.4), brass (copper alloy) pipe (Section 1108.5), copper pipe (Section 1108.6), copper tube (Section 1108.7), steel pipe (Section 1108.8), and steel tube (Section 1108.9). Additionally, IMC Table 1101.2 allows Factory-Built Equipment and Appliances to have refrigeration press-connect fittings as long as they meet the requirements of UL 109 and UL 207.

## Hydronic Piping Systems

IMC Chapter 12, "Hydronic Piping", addresses the piping systems used in heating and cooling systems. Such piping typically conveys water, water and antifreeze solutions, steam and condensate. The fluids conveyed are heated or cooled by boilers, chillers and heat pumps, which are all components of HVAC systems."

Piping materials that can be used in hydronic applications include those in IMC Table 1202.4 and approved hydronic pipe fitting materials can be found in IMC Table 1202.5, which includes the standards to which these materials must be listed and labeled. Specifically, copper or copper-alloy tubing (Section 1203.6), steel pipe (Section 1203.12), and steel tubing (Section 1203.13) can be used to make joints in hydronic applications. Additionally, IMC 1203.6 requires that press-connect joints shall be installed in accordance with the manufacturer's instructions.

TABLE 1202.4 HYDRONIC PIPE	
MATERIAL	STANDARD (see Chapter 15)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D1527; ASTM F2806
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D2846; ASTM F441; ASTM F442
Chlorinated polyvinyl chloride/aluminum/chlorinated polyvinyl chloride (CPVC/AL/CPVC)	ASTM F2855
Copper or copper-alloy pipe	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tube (Type K, L or M)	ASTM B75; ASTM B88; ASTM B135; ASTM B251
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pressure pipe	ASTM F1281; CSA CAN/CSA-B-137.10
Cross-linked polyethylene (PEX) tubing	ASTM F876; ASTM F3253; CSA B137.5
Ductile iron pipe	AWWA C115/A21.15; AWWA C151/A21.51
Lead pipe	FS WW-P-325B
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F1282; CSA B137.9
Polypropylene (PP) plastic pipe	ASTM F2389
Polyvinyl chloride (PVC) plastic pipe	ASTM D1785; ASTM D2241
Raised temperature polyethylene (PE-RT)	ASTM F2623; ASTM F2769; CSA B137.18
Steel pipe	ASTM A53; ASTM A106
Steel tubing	ASTM A254

**Table 1202.4**  
**Hydronic Pipe**

TABLE 1202.5 HYDRONIC PIPE FITTINGS	
MATERIAL	STANDARD (see Chapter 15)
Copper and copper alloys	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.24; ASME B16.26; ASME B16.51; ASSE 1061; ASTM F1974
CPVC	ASSE 1061; ASTM D2846; ASTM F438; ASTM F439
Ductile iron and gray iron	ANSI/AWWA C110/A21.10; ASTM A395; ASTM A536; ASTM F1476; ASTM F1548; AWWA C153/A21.53
Ductile iron	ANSI/AWWA C153/A21.53
Gray iron	ASTM A126
Malleable iron	ASME B16.3
PE-RT fittings	ASSE 1061; ASTM D3261; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; CSA B137.1; CSA B137.18
PEX fittings	ASSE 1061; ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2159; ASTM F3253
Plastic	ASTM D2466; ASTM D2467; ASTM D2846; ASTM F438; ASTM F439; ASTM F877; ASTM F2389; ASTM F2735
Steel	ASME B16.5; ASME B16.9; ASME B16.11; ASME B16.28; ASTM A53; ASTM A106; ASTM A234; ASTM A395; ASTM A420; ASTM A536; ASTM F1476; ASTM F1548

**Table 1202.5**  
**Hydronic Pipe Fittings**

## Fuel Oil Piping and Storage Systems

IMC Chapter 13 Fuel Oil Piping and Storage, per the note, this chapter covers "fuel oil piping and fuel oil storage related to heating appliances, power generators and similar equipment/appliances. The requirements focus on preventing fuel leaks and equipment failures that could result in severe fire hazards." Piping materials that can be joined with press-connect fittings in fuel oil applications include copper or copper-alloy pipe (Section 1303.4), copper or copper-alloy tubing (Section 1303.5), steel or stainless steel pipe (Section 1303.7), or steel or stainless steel tubing (Section 1303.8). Press-connect joints shall be installed in accordance with the manufacturer's instructions and shall conform to one of the standards listed in Table 1302.3 (Section 1303.3.5).

**TABLE 1302.3  
FUEL OIL PIPING AND FITTINGS**

MATERIAL	STANDARD (see Chapter 15)
Copper or copper-alloy pipe and fittings	ASTM B42; ASTM B43; ASTM B302; ASTM F3226
Copper or copper-alloy tubing and fittings (Type K, L or M)	ASME B16.51; ASTM B75; ASTM B88; ASTM B280; ASTM F3226
Labeled pipe	(See Section 1302.4)
Nonmetallic pipe	ASTM D2996
Steel and stainless steel pipe and fittings	ASTM A53; ASTM A106; ASTM A312; ASTM F3226
Steel and stainless steel tubing and fittings	ASTM A254; ASTM A269; ASTM A539; ASTM F3226

**Table 1302.3  
Fuel Oil Piping and Fitting**

## Fuel Gas Piping Systems

IFGC Chapter 4 Gas Piping Installations, Section 402.7 states, in exceptions 1-3, that “the maximum operating pressure for piping systems located inside buildings shall not exceed 5 psig, except where one or more of the following conditions are met:

1. The piping joints are welded or brazed.
2. The piping is joined by fittings listed to ANSI LC-4/CSA 6.32 and installed in accordance with the manufacturer’s instructions.
3. The piping joints are flanged and pipe-to-flange connections are made by welding or brazing.”

It is important to note that exception item 2, to the 5 psig limitation called out in Section 402.7, are fittings which are listed to ANSI LC-4/CSA 6.32. Press-connect fittings listed to this standard, are a valid installation solution to exceed 5 psig in locations inside buildings. The listing to this same standard is equally important when it comes to subsequent sections of the IFGC that refer to methods of joining piping and tubing in gas piping applications.

In IFGC 403.9.1 Metallic pipe joints and fittings, Pipe joints, it also states “Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded or assembled with press-connect fittings listed in accordance with ANSI LC-4/CSA 6.32. Pipe lighter than Schedule 40 shall be connected using press-connect fittings, flanges, brazing or welding.” IFGC 403.9.2 and 403.9.3 state that metallic press-connect fittings are suitable for gas piping joint installations for copper tubing (Section 403.9.2) and stainless steel tubing (Section 403.9.3) when the press-connect fittings are listed in accordance with ANSI LC-4/CSA 6.32. Additionally, Section 404.5 indicates that fittings listed to ANSI LC-4/CSA 6.32 standard may also be installed in concealed locations.