

[Publication Note: §192.283 needs to be updated to reflect Amdt. 192-124, 128 and 156]

Guide Material §192.281

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3.5 Mechanical joints for all plastic piping. (Plastic-to-plastic and plastic-to-metal)

(a) ...

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(e) ~~Section 192.283(b)(4) requires that joints on pipe sizes less than NPS 4 must be able to withstand greater tensile forces than required to yield the plastic pipe (i.e., the pipe will yield before the mechanical joint). Joints for pipe sizes NPS 4 and greater must be able to sustain the tensile stresses as required by §192.283(b)(5). One of the methods for meeting these requirements is the use of Category 1 fittings.~~

(f) In addition to using qualified joining procedures for mechanical joints as discussed in 3.5(d) and (e) above, the operator should consider minimizing the longitudinal pull-out forces ...

(g) ...

(h) ...

...

TABLE 192.281i

4 HOT TAPS

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GUIDE MATERIAL §192.283

1 WRITTEN PROCEDURES

- (a) An operator may elect to develop joining procedures or may adopt the joining procedures developed by groups such as the Plastics Pipe Institute, ASTM, gas association, or manufacturers. The operator is responsible for ensuring that the joining procedure used is qualified in accordance with the requirements of §192.283. ASTM F2620 (see §192.7 for IBR for §192.281) is a qualified heat fusion joining procedure per §192.281 and does not require qualification testing per §192.283.
- (b) Qualified joining procedures should include images demonstrating the appearance of satisfactory joints. Written procedures for fitting installation are often packaged with each fitting.
- (c) Qualified procedures should be in the operator's installation manuals and may be printed on wallet or shirt pocket cards, or made available by other means.

2 PROCEDURE QUALIFICATION (Plastic-to-plastic and plastic-to-metal)

2.1 Procedure and qualification for joints and permanent repairs. (Plastic-to-plastic and plastic-to-metal)

- (a) Solvent cement, heat fusion, and adhesive. (Plastic-to-plastic)
 - (1) Procedure. A separate procedure should be established for each ~~plastic compound and for each~~ method of joining. The procedure specification should include the following as applicable.
 - (i) Plastic compound(s).
 - (ii) Joint design.
 - (iii) Size and thickness range.
 - (iv) Method of joining.

- (v) Pipe and fitting preparation (e.g., scraping, peeling, facing, abrading).
- (vi) Cleaning requirements.
- (vii) Curing or set-up time.
- (viii) Ambient temperature limits.
- (ix) Temperature of the heating tool.
- (x) Heating time.
- (xi) Pressure.
- (xii) Cooling time.
- (xiii) Tools and equipment.
- (xiv) Joining or repair technique. See 3 of the guide material under §192.281.
- (2) Qualification. The procedure specification should be considered qualified if test assemblies of joints or repairs made in accordance with the procedure specification meet the requirements of 2.2 below. The test assemblies should be cured, set, or hardened in accordance with the manufacturer's recommendations.
- (b) Mechanical. (Plastic-to-plastic and plastic-to-metal)
 - (1) Procedure. A separate procedure should be established for each kind and type of mechanical fitting to be used for making a joint or repair. It should include at least the following.
 - (i) Kind and type of plastic material(s).
 - (ii) Other piping elements to be joined to the plastic.
 - (iii) Joint design.
 - (iv) Size and thickness range.
 - (v) Type of mechanical fitting.
 - (vi) Tools and equipment.
 - (vii) Joining and repair procedure.
 - (2) Qualification. To qualify the procedure specification, test assemblies of joints or repairs should be made in accordance with the procedure specifications and tested in accordance with 2.2 below. The test assemblies may be restrained to the same extent that they would be in service. These assemblies should be sectioned or dismantled to inspect for damage to the plastic pipe. The procedure should be rejected if there is evidence of damage that would reduce the service life of an installed joint or repair.
 - (3) Other considerations. See 3.5 of the guide material under §192.281.

2.2 Test requirements. (Plastic-to-plastic and plastic-to-metal)

- (a) PE pipe and PE heat fusion fitting joining qualification testing required under §192.283 is summarized in Table 192.283i. PE electrofusion fitting qualification testing required under §192.283 is outlined in Table 192.283ii.

Section 192.283 Required Tests for Pipe and Heat Fusion Fittings made to ASTM D2513-18a

Connection Type	Test	Test Method	Test Conditions	Requirements
Non-Lateral and Lateral ¹ One of Either A or B	A Sustained Pressure	D1598	73°F (23°C) at hoop stress of 1320psi for MDPE 1600psi for HDPE	Failure Time ≥ 1000 hours
			or	or
			176°F (80°C) at hoop stress of 580psi	Failure time ≥ 1000 hours

			OR	
			176°F (80°C) ² at hoop stress of 670 psi	OR Failure time ≥ 170 hours
	B <u>Hydrostatic Burst</u>	<u>D1599</u>	<u>73°F</u>	<u>Ductile failure</u>
<u>AND</u>				
<u>Non-Lateral</u>	<u>Tensile</u>	<u>D638</u>	<u>73°F</u>	<u>Elongation at break ≥ 25% or failure initiated outside of the fusion area</u>
<u>Lateral</u>	<u>Impact</u>	<u>F905</u>	<u>73°F</u>	<u>Joint shall not fail when impacted with a force sufficient to break the body or other portion of the specimen</u>

(1) Test methods for lateral connections are not IBR in the code. Indicated test methods are typically used.

(2) The 80° C tests provide more stringent requirements included in ASTM D2513-24e1 and newer versions of the document, but not included in ASTM D2513-18a.

TABLE 192.283i

Section 192.283 **B** Required Tests for Electrofusion Fittings made to ASTM F1055-98(2006)

	<u>Test</u>	<u>Test Method</u>	<u>Test Conditions</u>	<u>Requirements</u>
One of Either A or B	<u>A. Hydrostatic Burst Pressure</u> (F1055 9.1)	<u>D1599</u>	<u>73°F (23°C)</u>	<u>Joint non-failure at minimum pipe hoop stress 2,520 psi</u>
	<u>B. Sustained Pressure</u> (F1055 9.2)	<u>D1598</u>	<u>176°F (80°C) at hoop stress of 580 or 670 psi</u>	<u>Failure time ≥ 1000 or 170 hours</u>
			<u>OR</u>	
			<u>176°F (80°C) at hoop stress of 670 psi</u>	<u>Failure time ≥ 170 hours</u>
<u>AND</u>				

<u>One of Either A or B</u>	<u>A. Tensile Strength</u> (Couplings) (F1055 9.3)	<u>D638</u>	<u>73°F</u>	<u>Elongation at break ≥ 25% or failure initiated outside of the fusion area</u>
	<u>B. Joint Integrity Test</u> (Couplings & Saddles) (F1055 9.4)	<u>F1055</u>	<u>73°F</u>	<u>Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test.</u>

The 80° C tests provide more stringent requirements included in ASTM D2513-24e1 and newer versions of the document, but not included in ASTM D2513-18a

TABLE 192.283ii

- (b) For qualification of heat-fused joints between PA11 or PA12 gas pressure pipe and fittings, the tests in Table 192.283i are the same except the test conditions and test requirements for hydrostatic burst and sustained pressure follow ASTM F2785 for PA12 pipe and ASTM F2945 for PA-11 pipe (see §192.7 for IBR as listed specifications).
- (c) For qualification of joints between reinforced epoxy resin gas pressure pipe and fitting made to ASTM D2517 (see §192.7 for IBR), the tests in Table 192.283i are the same except the test conditions and test requirements for hydrostatic burst and sustained pressure follow ASTM D2517.
- (d) Mechanical joints made with thermoplastic pipe (PE, PA-11, or PA-12) must have qualified procedures per the following specifications, which are incorporated by reference under §192.7.
- ASTM F1924, "Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing."
 - ASTM F1948, "Standard Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing."
 - ASTM F1973, "Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems."
 - ASTM F2145, "Standard Specification for Polyamide 11 (PA 11) and Polyamide 12 (PA12) Mechanical Fittings for Use on Outside Diameter Controlled Polyamide 11 and Polyamide 12 Pipe and Tubing."

Test assemblies should successfully meet the following requirements. {2nd LB note: Green font shown below was approved by Public Review for 2025 Edition in TR 19-02.}

- (a) ~~Leak test. An assembly should not leak when subjected to a stand-up pressure test with air or gas.~~
- (b) ~~Short-term burst test. An assembly should meet the minimum burst requirements of ASTM D2513, ASTM D2517, ASTM F2785, or ASTM F2945 (whichever is applicable) (see listing in §192.7, not IBR for §192.283), for the specific kind and size of plastic pipe used in the assembly.~~
- (c) ~~Sustained-pressure test. An assembly should not fail when subjected to a sustained pressure test, such as the 1000-hr test described in ASTM D2513, ASTM D2517, ASTM F2785, or ASTM F2945 (whichever is applicable), for the specific kind and size of plastic pipe used in the assembly.~~
- (d) ~~Tensile test. An assembly should elongate no less than 25% or failure should initiate outside the joint area when subjected to ASTM D638 testing.~~
- (e) ~~Inspection. An assembly should be subjected to suitable nondestructive or destructive inspection to determine if the bonded area is substantially equivalent to the intended bond area.~~

3 QUALIFICATION OF HEAT FUSION BETWEEN PE COMPONENTS MADE FROM UNLIKE COMPOUNDS-PE COMPONENT QUALIFICATION

PE components made of different compounds ~~and different grades of materials~~ may be heat-fused, provided that properly qualified procedures for joining the specific compounds are used. Any combination

of PE 2306, PE 2406/PE 2708, PE 3306, PE 3406, and PE 3408/PE 4710 may be joined by heat fusion using qualified procedures for specific materials. PPI TR-33 (Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe) was the basis for ASTM F2620 and it showed that compounds with melt index cell classification "3" and "4" per ASTM D3350 are heat fusible. ~~Operators attempting to qualify such procedures may be able to obtain qualified procedures from pipe manufacturers. (See guide material under §192.281 for PE heat fusion.)~~ Additionally, the following references may be of assistance.

- (a) ~~PPI TN-13, "General Guidelines for Butt, Saddle and Socket Fusion of Unlike Polyethylene Pipes and Fittings."~~
- (b) ~~PPI TR-33, "Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe."~~
- (c) ~~PPI TR-41, "Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping."~~

{2nd LB note: See Beatty letter ballot comment in LB4-2025 (copied below at end of TR) that notes "GM under 192.281 (i.e., Section 3.5), references 192.283(b)(4) and (5) which may be outdated. Consider checking to see if this language should be edited under this TR." These references in GM 3.5(e) are outdated since §192.283(b)(4) and (5) no longer exist in the current regulation after Amdt. 192-124. TR 19-02 addressed several items from Amdt. 192-124 and is approved to the 2025 Edition, but TR 19-02 did not fix these outdated references. See revision added under §192.281 below to delete the outdated references in GM 3.5(e) – the deletion shown below in green font in existing GM 3.5(e) is from TR 19-02. Updates for cross-references to GM 3.5 under 192.321 are also added below.}

Guide Material

§192.321

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2 DIRECT BURIAL OF PLASTIC PIPE

2.1 Contraction.

The piping should be installed with sufficient slack to provide for possible contraction. Under high temperature conditions, cooling may be necessary before the last connection is made. See 3.5(~~fe~~) of the guide material under §192.281.

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3 PLASTIC PIPE INSERTED INTO A CASING OR INTO AN ABANDONED PIPELINE

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3.2 Special considerations.

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- (d) Cased plastic pipe can contract due to cold gas or low ambient temperature. See 3.5(~~fe~~) of the guide material under §192.281.

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GMA G-192-1

1 MATERIAL SPECIFICATIONS, CODES, STANDARDS, AND OTHER DOCUMENTS

1.11 Plastic Related		
...	...	...
PPI TN-13	General Guidelines for Butt, Saddle and Socket Fusion of Unlike Polyethylene Pipes and Fittings	§192.281 §192.283
...	...	...

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PPI TR-33	Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe	§192.281 §192.283
PPI TR-41	Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping	§192.281 §192.283