TR Number	**19-02 (21-07 & 21-08 added to 19-02)**
Primary Reference	192.7, 9, 59, 63, 121, 123, 143, 145, 149, 281, 283, 285, 313, 367, 455, Appendix B
Secondary	From 21-07: GM Appendix G-192-1, G-192-1A
Purpose	Review existing GM and revise as appropriate in light of Amendment 192-124. Review/revise as appropriate in light of Amdt 192-128 (from TR 21-07 & 08)
Origin/Rationale	From TR 21-07 – 192.7, App. B: Documents incorporated by reference have been updated to include a later version of API 1104 Welding (simply added code reference, did not update version), ASTM D 2513(a) 2018, ASTM F2620-19 for PE fusion. Amendments for nomenclature related to PE, ASTM D2513. From TR 21-08 – 192-121: This updated some text and tables for plastic pipe design parameters including wall thickness and SDR.
Assigned to	Plastic

Section 192.11

3 USE OF PLASTIC PIPE

See guide material under §§192.121 ~~and 192.123~~.

Section 192.59

~~*This guide material is under review following Amendment 192-124.*~~

Each operator should establish that new or used pipe complies with the requirements of the applicable ASTM piping specification (listed specifications are IBR ~~referenced~~ in §192.7) for the type of plastic pipe, such as ASTM D2513 for polyethylene (PE), ASTM F2945 for polyamide 11 (PA11), ASTM F2785 for polyamide 12 (PA12), or ASTM D2517 for thermosetting plastics by one of the following methods.

(a) ...

...

Section 192.63

~~*This guide material is under review following Amendment 192-124.*~~

(a) ...

(b) Thermoplastic pipe manufactured prior to August 16, 1978, may not be marked with the appropriate code letters for elevated temperature operation. Operators who have installed such pipe should take proper precautions to ensure the pipe is used only within the actual temperature and stress limits for which it was tested and qualified. See ~~§192.123(b)(2)~~ §192.121(f).

~~(c) Marking requirements for PE pipe manufactured after March 6, 2015 are described in ASTM D2513-09a. All other new installations of thermoplastic materials must meet the ASTM D2513-87 (see §192.7 for IBR) marking requirements (§192.63(a)).~~

[Letter Ballot note: The content of GM 1 IMPACT AND DUCTILITY under §192.123 was previously moved to GM 2 HANDLING under §192.69 by TR 19-03 in Addendum 2 as shown below. No additional changes to §192.69 in this TR.]

Section 192.69

1 STORAGE

...

2 HANDLING

(a) When handling plastic pipe.

(1) Use proper slings or other non-abrasive lifting equipment when loading and unloading pipe.

(2) Avoid rough handling especially at low temperatures which can fracture thermoplastic pipe if subjected to significant impact or shock loads.

(3) Avoid dropping or striking the pipe with handling equipment, tools, or other objects.

(4) Avoid pushing or pulling over sharp projections.

(5) Prevent kinking or buckling. Any kinks or buckles that occur should be cut out as a cylinder.

(b) The impact and ductility properties of plastics should be evaluated when the material is intended for use in facilities subjected to low temperatures. Lower temperatures will affect thermoplastic pipe by increasing stiffness and vulnerability to impact damage.

(c) For coiled pipe, lower temperatures will require more effort to uncoil the pipe, and it can spring back forcibly if the ends are not anchored or restrained. The forceful movement of the loose pipe ends becomes more pronounced in cold weather and personnel should be aware of this for their own safety. Extra precautions should be taken when installing larger-diameter coiled pipe (>3-inch) in cold temperature conditions. The manufacturer of straightening and re-rounding equipment should be consulted for recommendations regarding low-temperature equipment operation.

Section 192.103

2 NON-STEEL PIPE

The minimum wall thickness for materials other than steel pipe are prescribed elsewhere in Part 192. See §§ ~~192.123~~ 192.121 and 192.125.

[Letter Ballot note: This TR initially proposed to move GM section titled 1 IMPACT AND DUCTILITY from §192.123 to §192.121, but the content has already been moved to GM 2 HANDLING under §192.69 by TR 19-03 in Addendum 2 - see §192.69 above. As shown below, this TR now proposes to move the GM 1 heading of IMPACT and DUCTILITY from §192.123 to §192.121 with part of the guide material and a reference to the GM under §192.69.]

Section 192.121

~~*This guide material is under review following Amendment 192-124.*~~

1 IMPACT AND DUCTILITY ***(moved from 192.123)***

(a) The impact and ductility properties of plastics should be evaluated when the material is intended for use in facilities subjected to low temperatures. Low temperatures will affect thermoplastic pipe by increasing stiffness and vulnerability to impact damage.

(b) Significant impact or shock loads on thermoplastic pipe at low temperatures can fracture the pipe.

(c) See 2 of the guide material under §192.69 for guidance when handling plastic pipe at

low temperatures.

2 EFFECTS OF LIQUID HYDROCARBONS *(moved from 192.123)*

2.1 General.

Liquid hydrocarbons such as gasoline, diesel fuel, and condensates, either inside the pipe or in the surrounding soil, are known to have a detrimental effect on PE and PVC plastic piping materials. PA piping is not affected by liquid hydrocarbons. Contact the piping manufacturer for specific recommendations.

2.2 Effect on design pressure.

(a) If thermoplastic materials covered by ASTM D2513 (see §192.7 for IBR) are to be exposed continuously to liquid hydrocarbons, it is recommended that the design pressure be de-rated in accordance with the following formula. See Section 9 below for references on this subject.

$P_{de\text{-}rated} = P \times DF_C$

Where:
$P_{de\text{-}rated}$= De-rated design pressure, gauge, psig (kPa).
P = Design pressure, gauge, psig (kPa).
DF_C = Chemical Design Factor determined in accordance with Table 192.121i

Pipe Material	Chemical Design Factor
PE (polyethylene)	0.50
PVC (polyvinyl chloride)	0.50

TABLE 192.121i

(b) If PE or PVC pipe is to be exposed intermittently to liquid hydrocarbons, the pipe manufacturer should be consulted to determine the appropriate DFc.

3 ~~1~~ ~~NATURAL GAS~~ HYDROSTATIC DESIGN BASIS (HDB)

(a) ~~Hydrostatic Design Basis (HDB)~~ HDB values are awarded by the Hydrostatic Stress Board (HSB) of the Plastics Pipe Institute (PPI) and are listed in PPI TR-4, which can be accessed at: www.plasticpipe.org

(b) ...

(c) Long-term hydrostatic strength (LTHS) for ...

(d) ...

(e) HDB values at 73 °F for thermoplastic materials covered by ASTM D2513 are listed in Table ~~192.121i~~ 192.121ii. The values used in the design formula for thermoplastic materials are actually HDB values that are a categorized value of the long-term hydrostatic strength.

Pipe Material	HDB @ 73 °F, psi
PA 32312 (PA 11)	2500
PA 42316 (PA 12)	3150
PE 2406/PE 2708 [1]	1250
PE 3408/PE 4710 [1]	1600
PVC Type I, Grade 1, Class 12454B (PVC 1120) [2]	4000
PVC Type II, Grade 1, Class 1433D (PVC 2116) [2]	3200

[1] Pipe materal designation codes PE 2406 and PE 3408 are listed in the 1999 edition of ASTM D2513. Pipe material designation codes PE 2708 and PE 4710 are listed in the current edition of ASTM D2513. ~~Until PHMSA OPS references the more recent edition of ASTM D2513, PE pipe is dual marked as PE 2406/PE 2708 or PE 3408/ PE 4710.~~

[2] Editions of ASTM D2513 issued after 2001 no longer permit use of PVC piping for new gas piping installations, but do specify that it may be used for repair and maintenance of existing PVC gas piping. The Regulations may continue to reference an edition of ASTM D2513 earlier than 2001. The operator is advised to check §192.7.

TABLE ~~192.121i~~ 192.121ii

4 PLASTIC PIPE MANUFACTURED BEFORE MAY 18, 1978 *(moved from 192.123)*

The following language was removed from §192.123(b)(2)(i) by Amendment 192-93:

> "However, if the pipe was manufactured before May 18, 1978, and its long-term hydrostatic strength was determined at 73 °F (23 °C), it may be used at temperatures up to 100 °F (38 °C)."

This language permitted the installation and operation of plastic pipe manufactured prior to May 18, 1978, at temperatures up to 100 °F using the 73 °F HDB. This sentence was removed since this vintage plastic pipe is no longer available nor is it still being installed. However, pipe installed under this clause is "grandfathered" and can continue to be operated at temperatures up to 100 °F using the 73 °F HDB.

5 ~~2~~ PETROLEUM GASES

PE ~~and PA~~ materials listed in ASTM D2513 may be used for liquid petroleum gas (LPG) piping applications. ~~The pressure-temperature relationship with petroleum gases should be such that condensation will not occur when using PE piping.~~ NFPA 58 (see §192.7 for IBR for §192.11) prescribes the following:

(a) PA may be used in liquid or vapor LPG systems up to the design pressure of the piping material. PPI recommends a chemical derating factor of 1.0 (no derating) for PA ~~11~~ piping.

(b) The pressure-temperature relationship with petroleum gases should be such that ~~liquification~~ liquefaction of the petroleum gas ~~condensation~~ will not occur when using PE piping. PE, when recommended by the manufacturer, may be used in vapor-only LPG systems up to 30 psig pressure. PPI recommends a 0.5 chemical derating factor for the use of PE piping.

(c) PVC is not permitted.

Some information on the strengths of polyethylenes with propane is given in PPI TR-22, "Polyethylene Piping Distribution Systems for Components of Liquid Petroleum Gases." ~~See guide material under §192.123.~~

6 ~~3~~ MINIMUM REQUIRED WALL THICKNESS

The minimum wall thickness (t_m) for a given design pressure is determined from the formula below. ~~Also, see §192.123(c) and (d) plus 3 of the guide material under §192.123.~~

$$t_m = PD/(P + 0.64\ S)$$

Where:
P = Design pressure, gauge, psi (kPa)
D = Nominal (Specified) outside diameter, in. (mm) as shown in Table ~~192.121ii~~ 192.121iii for commonly used tubing
S = HDB, for thermoplastic pipe, psi (kPa) determined at 73 °F (23 °C), 100 °F (38 °C), 120 °F (49 °C), or 140 °F (60 °C); for reinforced thermosetting pipe, 11,000 psi (75,800 kPa)

COMMONLY USED TUBING [1]	
Nominal Tubing Size (CTS) [2]	**Nominal (Specified) Outside Diameter (D) [2] (inches)**
¼	0.375
⅜	0.500
½	0.625
¾	0.875
1	1.125
1¼	1.375
1¾	1.875

[1] Values obtained from ASTM D2513, Table 2 ~~3~~.

[2] Applies to copper and plastic tubing.

TABLE ~~192.121ii~~ 192.121iii

7 ~~4~~ INTERPOLATION OF ~~HYDROSTATIC DESIGN BASIS (HDB)~~ HDB VALUES

(a) For thermoplastic pipe that is to be installed at a service temperature greater than 73 °F and less than that at which the next HDB has been established, the HDB at the anticipated service temperature can be determined by interpolation. The pipe manufacturer should be consulted for assistance in determining an interpolated HDB.

(b) The interpolation formula as prescribed in §192.121 is published in PPI TR-3 (see §192.7 for IBR) as follows.

$$S_T = S_L - \frac{(S_L - S_H)\left(\frac{1}{T_L} - \frac{1}{T_T}\right)}{\left(\frac{1}{T_L} - \frac{1}{T_H}\right)}$$

Where:
S_T = Interpolated LTHS for the anticipated service temperature, psi
S_L = LTHS established at a temperature below the anticipated service temperature, psi
S_H = LTHS established at a temperature above the anticipated service temperature, psi
T_L = Temperature at which the lower LTHS (S_L) was established, K
T_T = Anticipated service temperature, K
T_H = Temperature at which the higher LTHS (S_H) was established, K

(c) Section 192.121 requires that the interpolation be made between the LTHS values at the lower and higher temperatures. The resulting interpolated LTHS is categorized into an HDB. This interpolated HDB is then used to determine the design pressure under §192.121.

(d) Example:

An operator is installing SDR 11 PE pipe where the anticipated service temperature is 78 ºF. HDB values are established and published in PPI TR-4 at 73 °F (296 K) and 140 °F (333 K). Thus, the operator has the option of establishing an interpolated HDB at the anticipated service temperature, 78 °F (299 K), or using the 140 °F HDB of 800 psi.

(1) In order to calculate the HDB for the anticipated service temperature, the operator must obtain the actual LTHS values established for the material at the nearest temperature above and below the temperature for which the interpolated value is to be determined. These values are typically available from the pipe supplier. If these LTHS values are not available, the lowest LTHS for the HDB category in Table ~~192.121ii~~ 192.121iv may be used as a conservative estimate.

(2) Once the LTHS values are obtained, the interpolation calculation input is as follows.
S_L(73 °F) = 1567 psi
S_H(140 °F) = 845 psi
T_L = 73 °F (295.93 K)
T_T = 78 °F (298.71 K)
T_H = 140 °F (333.15 K)
Hence, the interpolation calculation determines that S_T = 1506.86 psi or 1507 psi.

(3) To determine the HDB at 78 °F, the interpolated LTHS value is categorized using Table 1 from ASTM Standard D2837~~-04~~, a selection of which is shown in Table ~~192.121iii~~ 192.121iv.

Range of Calculated LTHS Values		Hydrostatic Design Basis (HDB)	
Psi	(MPa)	Psi	(MPa)
600 to <760	(4.14 to <5.24)	630	(4.34)
760 to <960	(5.24 to <6.62)	800	(5.52)
960 to <1200	(6.62 to <8.27)	1000	(6.89)
1200 to <1530	(8.27 to <10.55)	1250	(8.62)
1530 to <1920	(10.55 to <13.24)	1600	(11.03)

TABLE ~~192.121iii~~ 192.121iv

(4) Based upon an interpolated LTHS value of 1510 psi, the HDB to be used in the design formula for this example is 1250 psi.

For this SDR 11 PE pipe with an anticipated service temperature of 78 °F, the design pressure is calculated in accordance with §192.121 using the interpolated HDB of 1250 psi as follows.

$$P = \frac{2S}{(SDR-1)}(.32) = \frac{2(1250\,psi)}{(11-1)}(.32) = 80\,psig$$

8 INSTALLATION OF PA-11 OR PA-12 PIPING FOR HIGHER PRESSURE APPLICATIONS (moved from 192.123)

See 9 of the guide material under §192.321.

~~9~~ 5 REFERENCES (new list items below moved from 192.123)

(a) PPI TR-4, "PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe."

(b) PPI TR-9, "Recommended Design Factors and Design Coefficients for Thermoplastic Pressure Pipe."

(c~~b~~) PPI TR-22, "Polyethylene Piping Distribution Systems for Components of Liquid Petroleum Gases."

(d) "An Evaluation of Polyamide 11 for Use in High Pressure/High Temperature Gas Piping Systems," T.J. Pitzi et al., 15th Plastic Fuel Gas Pipe Symposium Proceedings - 1997, p. 107.

(e) "Polyamide 11 Liners Withstand Hydrocarbons, High Temperature," A. Berry, Pipeline & Gas Journal, December 1998, p. 81.

(f) "Mechanical Integrity of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 14th Plastic Fuel Gas Pipe Symposium Proceedings - 1995, p. 141.

(g) "Strength of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 15th Plastic Fuel Gas Pipe Symposium Proceedings - 1997, p. 309.

(h) GRI 96/0194, "Service Effects of Hydrocarbons on Fusion and Mechanical Performance of Polyethylene Gas Distribution Piping."

(i) "Prediction of Organic Chemical Permeation through PVC Pipe," A.R. Berens, Research Technology, November 1985, p. 57.

Section 192.123 *{updated to Addendum 2}*

This guide material is under review following Amendment 192-124.

1 IMPACT AND DUCTILITY Moved to GM 1 under 192.121

(Note: This guide material was moved to §192.69.)

2 PETROLEUM GASES Moved to GM 5 under 192.121, which included this sentence.

The pressure-temperature relationship with petroleum gases should be such that condensation will not occur when using PE piping.

3 HOT TAPS Moved to GM 4 under 192.281

(a) When making a hot-plate saddle fusion on PE pipelines, the probability of a blowout increases with an increase in pressure or a decrease in wall thickness. This should be considered, particularly when performing hot-plate saddle fusion on PE pipelines as follows: 1-inch and 1¼-inch pipe with an SDR greater than 10, and 2-inch, 3-inch, and 4-inch pipe with an SDR greater than 11. Where this is a concern, the pipeline pressure may need to be reduced during such fusions. Alternatively, a heavier-wall thickness could be used than that required by the pressure design formula. See PPI TR-41, "Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping."

(b) Electrofusion tapping tees may be used as an alternate to hot-plate, fusion tapping tees to reduce the probability of blowouts when hot tapping PE pipes. The manufacturer of the electrofusion fitting should be contacted for recommendations.

(c) Mechanical tapping tees may be used as an alternative to heat-fusion tapping tees to avoid the possibility of blowouts when tapping PE pipes.

4 EFFECTS OF LIQUID HYDROCARBONS Moved to GM 2 under 192.121

4.1 General.

Liquid hydrocarbons such as gasoline, diesel fuel, and condensates, either inside the pipe or in the surrounding soil, are known to have a detrimental effect on PE and PVC plastic piping materials. PA 11 piping is not affected by liquid hydrocarbons. Contact the piping manufacturer for specific recommendations.

4.2 Effect on design pressure (see §192.121).

(a) If thermoplastic materials covered by ASTM D2513 (see §192.7 for IBR) are to be exposed continuously to liquid hydrocarbons, it is recommended that the design pressure be de-rated in accordance with the following formula. See 4.3 below for references on this subject.

$$P_{de\text{-}rated} = P_{§192.121} \times DF_C$$

Where:

$P_{de\text{-}rated}$ = De-rated design pressure, gauge, psig (kPa).

$P_{§192.121}$ = Design pressure, gauge, psig (kPa) determined under §192.121.

DF_C = Chemical Design Factor determined in accordance with Table 192.123i.

Pipe Material	Chemical Design Factor
PA (polyamide)	1.00
PE (polyethylene)	0.50
PVC (polyvinyl chloride)	0.50

TABLE 192.123i

(b) If PE or PVC pipe is to be exposed intermittently to liquid hydrocarbons, the pipe manufacturer should be consulted to determine the appropriate DF_C.

4.3 References. **Moved to GM 9 under 192.121**

(a) PA pipe.

(1) "An Evaluation of Polyamide 11 for Use in High Pressure/High Temperature Gas Piping Systems," T.J. Pitzi et al., 15th Plastic Fuel Gas Pipe Symposium Proceedings - 1997, p. 107.

(2) "Polyamide 11 Liners Withstand Hydrocarbons, High Temperature," A. Berry, Pipeline & Gas Journal, December 1998, p. 81.

(b) PE pipe.

(1) PPI TR-9, "Recommended Design Factors and Design Coefficients for Thermoplastic Pressure Pipe."

(2) PPI TR-22, "Polyethylene Piping Distribution Systems for Components of Liquid Petroleum Gases."

(3) "Mechanical Integrity of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 14th Plastic Fuel Gas Pipe Symposium Proceedings - 1995, p. 141.

(4) "Strength of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 15th Plastic Fuel Gas Pipe Symposium Proceedings - 1997, p. 309.

(5) GRI 96/0194, "Service Effects of Hydrocarbons on Fusion and Mechanical Performance of Polyethylene Gas Distribution Piping."

(c) PVC pipe.

"Prediction of Organic Chemical Permeation through PVC Pipe," A.R. Berens, Research Technology, November 1985, p. 57.

5 PLASTIC PIPE MANUFACTURED BEFORE MAY 18, 1978 **Moved to GM 4 under 192.121**

The following language was removed from §192.123(b)(2)(i) by Amendment 192-93:

"However, if the pipe was manufactured before May 18, 1978 and its long-term hydrostatic strength was determined at 73 °F (23 °C), it may be used at temperatures up to 100 °F (38 °C)."

This language permitted the installation and operation of plastic pipe manufactured prior to May 18, 1978, at temperatures up to 100 °F using the 73 °F HDB. This sentence was removed since this vintage plastic pipe is no longer available nor is it still being installed. However, pipe installed under this clause is "grandfathered" and can continue to be operated at temperatures up to 100 °F using the 73 °F HDB.

6 MECHANICAL FITTINGS **Moved to GM 3.5 under 192.281**

ASTM Subcommittee F17.60 publishes the following specifications to qualify mechanical fittings that connect plastic pipe for design temperatures from -20 °F to 140 °F.

(a) ASTM F1924, "Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing."

(b) ASTM F1948, "Standard Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing."

(c) 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.

7 INSTALLATION OF PA-11 PIPING FOR HIGHER PRESSURE APPLICATIONS **Moved to GM 8 under 192.121**

See 9 of the guide material under §192.321.

Section 192.143

~~*This guide material is under review following Amendment 192-124.*~~

1 GENERAL

...

2 CORROSION CONTROL

...

3 PLASTIC PIPELINE COMPONENTS

Specifications (see §192.7 for IBR as listed specifications) related to plastic pipeline components:

(a) ASTM D2513, “Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings”

(b) ASTM D2517, “Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings”

(c) ASTM F1055, “Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing”

(d) ASTM F1924, “Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing”

(e) ASTM F1948, “Standard Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing”

(f) 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”

(g) 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”

(h) ASTM F 2600, “Standard Specification for Electrofusion Type Polyamide-11 Fittings for Outside Diameter Controlled Polyamide-11 Pipe and Tubing”

(i) ASTM F2767, “Specification for Electrofusion Type Polyamide-12 Fittings for Outside Diameter Controlled Polyamide-12 Pipe and Tubing for Gas Distribution”

(j) ASTM F2785, “Standard Specification for Polyamide 12 Gas Pressure Pipe, Tubing, and Fittings”

(k) ASTM F2817, “Standard Specification for Poly (Vinyl Chloride) (PVC) Gas Pressure Pipe and Fittings for Maintenance or Repair”

(l) ASTM F2945, “Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings”

Section 192.145

~~*This guide material is under review following Amendment 192-124.*~~

5 PLASTIC VALVES

~~ASTM D2513 (see listing in §192.7, not IBR for §192.145) requires that plastic valves meet the requirements of~~ For plastic valve specifications, see ASME B16.40 (see §192.7 for IBR as listed specification), "Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems." The manufacturing test requirements outlined in §192.145(b) for plastic valves are part of the testing requirements outlined in ASME B16.40.

Section 192.149

~~*This guide material is under review following Amendment 192-124.*~~

(a) Steel butt-welding fittings. . .

(b) Steel induction bends. . .

(c) Threaded fittings. . .

(d) Socket welding fittings. . .

(e) For plastic fittings and components, see guide material under §192.143.

Section 192.281

1 INTRODUCTION (Plastic-to-plastic and plastic-to-metal)

...

2 GENERAL (Plastic-to-plastic)

...

3 FIELD JOINING (Plastic-to-plastic and plastic-to-metal)

3.1 Solvent cement for repairing PVC piping only. (Plastic-to-plastic)

Note: Editions of ASTM D2513 issued after 2001 no longer permit use of PVC piping for new installations, but do specify that it may be used for repair and maintenance of existing PVC gas piping. The Regulations may continue to reference an edition of ASTM D2513 earlier than 2001. The operator is advised to check §192.7 for IBR.

(a) ...

...

(f) Other recommendations for making joints may be found in ASTM D2855 (for PVC), the Appendix of ASTM D2235 (for ABS), ~~and~~ the Appendix of ASTM D2560 (for CAB, but withdrawn 1986), and ASTM F2817, "Standard Specification for Poly (Vinyl Chloride) (PVC) Gas Pressure Pipe and Fittings for Maintenance or Repair" (see listing in §192.7, not IBR for §192.281).

3.2 Heat fusion for PA-to-PA and PE-to-PE only by externally applied heat. (Plastic-to-plastic)

(a) ...

...

(k) For hot taps on PE, see 4 below, ~~guide material under §192.123.~~

...

3.3 Heat fusion by electrofusion. (Plastic-to-plastic)

(a) ...

(b) ASTM F1055 ~~(see §192.7as listed specification)~~, ASTM F2600, ASTM F2767 (see §192.7 for IBR as listed specifications), and ASTM F1290, "Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings" are references for joining plastic pipe by electrofusion.

(c) ...

3.4 Adhesive for thermosetting pipe only. (Plastic-to-plastic)

...

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

(a) ...

(b) ...

~~(c) The pull-out resistance of compression-type fittings varies with the type and size of the fitting and the wall thickness of the pipe being joined. ASTM D2513 (see §192.7) describes requirements for three categories of mechanical fittings.~~
~~(1) Category 1 - full seal, full restraint. These types of mechanical fittings, when properly installed, are designed to provide a joint that is stronger than the piping being connected.~~
~~(2) Category 2 - full seal, no restraint.~~
~~(3) Category 3 - full seal, partial restraint.~~

(c) Listed specifications (see §192.7 for IBR as listed specifications) related to plastic mechanical fittings: **(From GM 6 under 192.123)**
(1) ASTM F1924, "Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing"
(2) ASTM F1948, "Standard Specification for Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing"
(3) 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"

(d) For each mechanical joint, it is required that the joining procedure be qualified by the tests in §192.283(b).

(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) …

(g) Some plastic pipe mechanical joints, especially those made with older metal mechanical / compression fittings, have been known to leak or pull out due to not being of a full restraint design, or due to installation errors as pointed out in OPS Advisory Bulletin ADB-08-02 (73 FR 11695, March 4, 2008; see Guide Material Appendix G-192-1, Section 2). ~~For this reason, consider using ASTM D2513-defined Category 1 (also known as Cat 1) fittings which, by design, provide for joints in plastic gas piping that are both full restraint and full seal. Such fittings are readily available for plastic gas piping in sizes through NPS 2 and some manufacturers supply Category 1 fittings in larger sizes. If Category 1 fittings are not used, another type of qualified joining procedure is required to be used as discussed in 3.5(d) and (e) above.~~

(h) ...

...

TABLE 192.281i

4 HOT TAPS (From 192.123 GM)

(a) When making a hot-plate saddle fusion on PE pipelines, the probability of a blowout increases with an increase in pressure or a decrease in wall thickness. This should be considered, particularly when performing hot-plate saddle fusion on PE pipelines as follows: 1-inch and 1¼-inch pipe with an SDR greater than 10, and 2-inch, 3-inch,

and 4-inch pipe with an SDR greater than 11. Where this is a concern, the pipeline pressure may need to be reduced during such fusions. Alternatively, a heavier-wall thickness could be used than that required by the pressure design formula. See PPI TR-41, "Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping."

(b) Electrofusion tapping tees may be used as an alternate to hot-plate, fusion tapping tees to reduce the probability of blowouts when hot tapping PE pipes. The manufacturer of the electrofusion fitting should be contacted for recommendations.

(c) Mechanical tapping tees may be used as an alternative to heat-fusion tapping tees to avoid the possibility of blowouts when tapping PE pipes.

Section 192.283

1 WRITTEN PROCEDURES

...

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)

...

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

Test assemblies should successfully meet the following requirements.

(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, ~~or~~ 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, ~~or~~ ASTM D2517, ASTM F2785, or ASTM F2945 (whichever is applicable), for the specific kind and size of plastic pipe used in the assembly.

...

3 UNLIKE PE COMPONENT QUALIFICATION

...

Section 192.313

~~*This guide material is under review following Amendment 192-124.*~~

…

Section 192.321

...

9.3 Hot taps.

Currently, only mechanical or electrofusion hot-tapping tees are recommended for use on PA-11 or PA-12 piping. To avoid a blow-out when making hot taps using fusion fittings, the pressurized pipeline should not be heated above the manufacturer's recommendations. Consult the manufacturer for the appropriate hot-tapping joining method recommendations. See ~~3~~ 4 of the guide material under §~~192.123~~ 192.281.

Section 192.361

...
5.3 Underground clearance and heat sources.

(a) ...

...

(e) Some low-voltage and high-voltage electric lines ... Also, see ~~4~~ 7 of the guide material under §192.121.

Section 192.367

~~*This guide material is under review following Amendment 192-124.*~~

...

Section 192.455

~~*This guide material is under review following Amendment 192-124.*~~

…

Section 192.917

...
12 PLASTIC TRANSMISSION PIPELINES

...
12.3 Manufacturing threats.

This threat refers to defects of the pipe or fittings that are associated with the manufacturing process. Additional guidance for manufacturing considerations related to plastic pipelines can be found in guide material under §§192.121~~, 192.123~~ and 192.613 and OPS Advisory Bulletins (ADBs). See 16.2 below for a list of applicable ADBs.

Appendix B to Part 192

~~*This guide material is under review following Amendment 192-124.*~~

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GMA G-192-1

1 MATERIAL SPECIFICATIONS, CODES, STANDARDS, AND OTHER DOCUMENTS

1.3 Valves		
~~ASME B16.40~~	~~Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems~~	~~§192.145~~
1.11 Plastic Related		
~~ASTM F1924~~	~~Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Piping and Tubing~~	~~§192.123~~
~~ASTM F1948~~	~~Plastic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Piping and Tubing~~	~~§192.123~~
~~ASTM F1973~~	~~Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems~~	~~§192.123~~
GRI-96/0194	Service Effects of Hydrocarbons on Fusion and Mechanical Performance of Polyethylene Gas Distribution Piping	~~§192.123~~ §192.121
~~PPI TR-4~~	~~PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe~~	~~§192.121~~
PI TR-9	Recommended Design Factors and Design Coefficients for Thermoplastic Pressure Pipe	~~§192.123~~ §192.121
PPI TR-22	Polyethylene Piping Distribution Systems for Components of Liquid Petroleum Gases	§192.121 ~~§192.123~~
PPI TR-41	Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping	~~§192.123~~ §192.281 §192.283

3 TECHNICAL PAPERS & PUBLICATIONS

3.3 PLASTIC RELATED	
"An Evaluation of Polyamide 11 for Use in High Pressure/High Temperature Gas Piping Systems," T.J. Pitzi et al., 15th Plastic Fuel Gas Pipe Symposium Proceedings – 1997, p. 107	~~§192.123~~ §192.121
"Mechanical Integrity of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 14th Plastic Fuel Gas Pipe Symposium Proceedings – 1995, p. 141	~~§192.123~~ §192.121
"Polyamide 11 Liners Withstand Hydrocarbons, High Temperature," A. Berry, Pipeline & Gas Journal, December 1998, p. 81	~~§192.123~~ §192.121
"Prediction of Organic Chemical Permeation through PVC Pipe," A.R. Berens, Research Technology, November 1985, p. 57	~~§192.123~~ §192.121
"Strength of Fusion Joints Made from Polyethylene Pipe Exposed to Heavy Hydrocarbons," S.M. Pimputkar, 15th Plastic Fuel Gas Pipe Symposium Proceedings – 1997, p. 309	~~§192.123~~ §192.121

GMA G-192-10

GUIDE MATERIAL APPENDIX G-192-10

(See guide material under §192.511, plus

§§192.143, 192.503, 192.507, 192.509, 192.513, and 192.619)

TEST CONDITIONS FOR SERVICE LINES

1 SUMMARY OF PRESSURE TEST REQUIREMENTS

This table is presented as a compilation for the application of the test requirements of §192.511 and §§192.503, 192.507, 192.513, and 192.619 as applied to service lines. Additional guidance is provided in the notes.

	Other Than Plastic				Plastic
Maximum Operating Pressure	Less than 1 psig	1 psig to 40 psig	Over 40 psig but less than 100 psig	100 psig and over	All Pressures See Note (1)
Test Medium	Water Air Natural Gas Inert Gas	Water Air Natural Gas Inert Gas	Water Air Natural Gas Inert Gas	Water Air Natural Gas Inert Gas	Water Air Natural Gas Inert Gas See Note (2)
Maximum Test Pressure	See Note (3)	See Note (3)	See Note (3)	See Note (3)	3 x design pressure See Notes (4) & (5)
Minimum Test Pressure	See Note (6)	50 psig	90 psig See Note (7)	1.5 x maximum operating pressure; See Notes (7) & (8)	50 psig or 1.5 x maximum operating pressure, whichever is greater; See Note (4)
Minimum Test Duration	See Note (9)	See Note (9)	See Notes (7) & (9)	See Notes (7) & (9)	See Notes (9) & (10)

Notes:

(1) Plastic pipe must be designed in accordance with §192.121~~, and the design pressure for PE and PA pipe must be limited by §192.123 §192.121~~.

(2) See temperature limitations for thermoplastic material in §192.513(d).

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