PEX Sample Specification* – United States/Canada

PART 1 – GENERAL

1.0 PRODUCT DESCRIPTION

A. PEX piping shall be manufactured from crosslinked polyethylene materials in accordance with ASTM F876 with a standard dimension ratio of SDR 9

B. PEX hot and cold water distribution systems shall conform to ASTM F877

C. PEX materials shall be listed in PPI TR-4 with a minimum Hydrostatic Design Basis (HDB) of 1250psi at 73ºF and 800psi at 180ºF

D. PEX fittings shall be manufactured from dezincification resistant brass, polysulfone (PSU) or polyphenylsulfone (PPSU) materials

E. PEX fitting rings shall be manufactured from copper, stainless steel or PEX in accordance with the applicable fitting standard(s)

1.1 APPLICATIONS

A. PEX Plumbing Systems are intended for use in:
   1. Potable water distribution systems
   2. Closed-loop in-floor radiant heat systems

B. This specification only represents potable water distribution systems

1.2 PIPE CATEGORIES AND STANDARDS

A. PEX piping shall be produced using one of the following manufacturing methods:
   1. Type A: Peroxide induced chemical crosslinking
   2. Type B: Silane induced chemical crosslinking
   3. Type C: Electron beam induced crosslinking

B. PEX piping cell classification in accordance with ASTM F876
   1. In systems with hot-water recirculation, piping shall meet or exceed a cell classification of 5306
   2. In systems without hot-water recirculation, piping shall meet or exceed a cell classification of 3306
   3. Under no circumstance shall piping be used with the following cell classification properties:
      i. A first digit of 0 or 1, indicating no rating for chlorine resistance or limited hot water chlorine resistance
      ii. A second digit of 0, indicating no rating for UV resistance

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1.3 FITTING AND JOINING METHOD CATEGORIES AND STANDARDS

A. PEX Fittings shall conform to one of the standards listed below:
   1. Expansion Fittings
      i. ASTM F1960: Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyetheylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing
      ii. ASTM F2080: Cold Expansion Fittings with Metal Compression Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR 9 Polyethylene of Raised Temperature (PE-RT) Tubing
   2. Crimp Fittings
      i. ASTM F1807: Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR 9 Crosslinked Polyethylene (PEX) Pipe and SDR 9 Polyethylene of Raised Temperature (PE-RT) Tubing
      ii. ASTM F2159: Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR 9 Crosslinked Polyethylene (PEX) Pipe and SDR 9 Polyethylene of Raised Temperature (PE-RT) Tubing
      iii. ASTM F2434: Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR 9 Crosslinked Polyethylene (PEX) Pipe and SDR 9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing
   3. Clamp Fittings
      i. ASTM F2098: Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings
   4. Press Fittings
      i. ASTM F3347: Metal Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR 9 Cross-linked Polyethylene (PEX) Tubing
      ii. ASTM F3348: Plastic Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR 9 Cross-linked Polyethylene (PEX) Tubing
   5. Other Fitting Standards
      i. ASTM F2735: Plastic Insert Fittings for SDR 9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing
      ii. ASTM F2854: Push-Fit Crosslinked Polyethylene (PEX) Mechanical Fittings from Crosslinked Polyethylene (PEX) Tubing

B. All PEX tools shall be properly calibrated per manufacturer recommendations

1.4 CHEMICAL COMPATIBILITY & PERMEATION

A. The general contractor(s) shall use ancillary building products (including, but not limited to fire stops, thread sealants, leak detectors, coated hangers, insulation etc.) that are chemically compatible with PEX piping.

B. The general contractor(s) shall use ancillary building products (including, but not limited to fire stops, thread sealants, leak detectors, coated hangers, insulation etc.) that are chemically compatible with PSU and PPSU materials.

C. The general contractor(s) shall use ancillary building products (including, but not limited to fire stops, thread sealants, leak detectors, coated hangers, insulation etc.) that will not cause permeation through PEX piping.
    1. If permeation risk of ancillary building products cannot be eliminated, PEX piping shall be sleeved in a compatible, non-permeable material.

D. In the absence of standard test method or listing for compatible and/or non-permeable ancillary building products with PEX piping, PSU and PPSU materials, independent verification shall be sought from both the manufacturer of the pipe and/or fitting and the manufacturer of the ancillary building product

E. Documented compatibility advisories (note guidance may vary from manufacturer to manufacturer)
    1. Do not allow the following to come into contact with PEX piping
        i. Adhesive tape
        ii. Organic chemicals
        iii. Strong acids
        iv. Strong bases
        v. Petroleum distillates
        vi. Petroleum based paints, greases or sealants
        vii. Solvents
        viii. Solvent based paints, greases or sealants
        ix. Termiticides
        x. Pesticides
        xi. Other detrimental materials which may cause permeation, corrosion, degradation or structural failure of the piping
    2. Do not allow the following to come into contact with PSU or PPSU fittings
        i. Closed-cell insulation
        ii. Urethane foam insulation/sealant
        iii. Solder flux
        iv. Pipe dope
        v. PVC cements and primers
        vi. Strong acids
        vii. Strong bases
        viii. Oil based paints
        ix. Solvents
        x. Termiticides or pesticides

1.5 USE IN PLENUMS

A. PEX piping shall be listed and labeled per ASTM E84, in accordance with code requirements

B. PEX piping shall only be installed in plenums in strict adherence with the ASTM E84 listings held by the individual manufacturer
    1. Common limitations of these listings include:
        i. ½" and ¾" piping with minimum of 18" spacing between adjacent pipe runs
        ii. Encased with approved plenum rated pipe insulation

iii. Supported continuously with non-combustible pipe supports and any gaps encased in approved plenum rated pipe insulation

2. Verify individual listing limitations

1.6 UV Exposure

A. Minimum UV resistance of PEX piping shall be determined using ASTM F2657 and shall be indicated using the second digit of the cell classification number
   1. A value of 0 shall indicate no rating
   2. A value of 1 shall indicate 1 month of resistance
   3. A value of 2 shall indicate 3 months of resistance
   4. A value of 3 shall indicate 6 months of resistance

B. Maximum UV exposure for PSU and PPSU varies by manufacturer and typically ranges from 15 days to 30 days where specific guidance is offered

C. Plumbing contractor shall be responsible for ensuring UV exposure to PEX piping and fittings prior to installation does not exceed the time permitted by the manufacturer and/or rating

D. PEX piping shall be protected from UV exposure through all phases of construction
   1. PEX piping stored on the jobsite shall be covered with a UV-blocking material
      i. UV-resistant material shall not be considered UV-blocking
   2. PEX piping installed in areas which may be temporarily exposed to direct sunlight during construction shall be covered with a UV-blocking material until the risk of exposure is removed (e.g. completion of building envelope).

E. PEX Piping shall not be installed in areas subject to UV exposure without sleeving in a UV-blocking material specific guidance varies by manufacturer but may include:
   1. Within 5 ft. of direct view from fluorescent lighting (including CFL bulbs)
   2. Direct or indirect (reflected) UV exposure

1.7 COMPATIBLE WATER CONDITIONS

A. PEX Piping may be subject to chlorine induced oxidative degradation when exposed to incompatible water conditions.

B. It shall be the responsibility of the installing contractor to ensure the operating water conditions are compatible with the PEX plumbing system.

C. Water conditions shall not exceed the operating parameters defined in ASTM F2023 and further explained in PPI TN-53 (https://plasticpipe.org/pdf/tn-53-pex-chlorine-ratings.pdf).
   1. Water within a PEX plumbing system shall not have an Oxidative Reduction Potential (ORP) above 825mV at any point in the system
   2. Water pressure within a PEX plumbing system shall not exceed 80psig
   3. Water temperature within a PEX plumbing shall not exceed 140ºF

D. Some manufacturers recommend limiting prolonged exposure to chlorine levels in excess of 2 parts per million, ensure adherence with manufacturer recommendations for maximum chlorine levels.

E. Velocity in hot water recirculating systems shall not exceed 2 ft./sec. per UPC Appendix I section 10.6.4 and some manufacturer recommendations.

1.8 FREEZE PROTECTION

A. Plumbing piping shall always be installed under the assumption that freezing conditions will exist at some point during the life of the building.

B. Pipe and fittings shall be installed only within the conditioned space of the building
   1. All piping installed in attics, crawlspaces, cantilevers, exterior walls or other areas exposed to the elements shall be installed on the internal side of the building insulation.

C. All air gaps which may allow freezing air to enter and flow against the pipes, such as exterior wall penetrations or gaps between building insulation components shall be sealed per manufacturer instructions.

1.9 POTABLE WATER CERTIFICATION

A. PEX pipe and fittings shall carry an NSF 61 listing for “commercial hot” applications
   1. Some PEX brands are not certified to NSF 61 for “commercial hot” applications, always verify the NSF listings of the PEX product being installed.

PART 2 – PRODUCTS

2.0 MATERIALS

A. Pipes and fittings shall be produced by the same manufacturer

B. Piping shall be assembled only with fitting styles (see section 1.3) for which the pipe is approved

2.1 MANUFACTURERS

A. There are numerous manufacturers of PEX pipes and fittings. The representative list of brands, cell classification and country of origin below is provided for illustrative purposes only:

1. Apollo PEX (3006/5006/5106/5306)
    i. USA
2. Bluefin PEX
    i. China
3. Bow SuperPEX (5306/5006)
    i. Canada
4. CP Supplies CANFLEX (5306)
    i. Canada
5. Eastman PEX (3006)
    i. USA
6. Efield PEX (5006)
    i. China
7. Everhot (5006)
    i. China
8. HydroSmart (5006)
    i. Canada
9. Merflex PEX (3006)
    i. USA
10. Mr. PEX (5106)
    i. Undisclosed
11. Myson Comfort Fit (3006)
    i. USA
12. Palconn PEX (5006)
    i. China
13. PEXFLOW (5006)
    i. China/Spain
14. PEX GUY (5006)
    i. China
15. PlumbFLOW (5306)
    i. USA
16. Plumbsource (5006)
    i. China
17. PowerPEX (3006/3306/5306)
    i. USA
18. Purelink Plus (5106)
    i. Canada
19. Pure PEX (5106)
    i. USA
20. Rehau RAUPEX (3006/3306/5306)
    i. USA/Germany
21. Rifeng (5006)
    i. China
22. Riifo (5006)
    i. China
23. Roth (3006)
    i. USA
24. SafePEX (1006)
    i. USA
25. SafePEX Pro (1306)
    i. USA
26. Sharkbite PEX (3306/5006)
    i. USA
27. Sil-O-PEX (5306)
    i. USA
28. Surelink (5106)
    i. Canada
29. Tubomart PEX (5006)
    i. China
30. Uponor AquaPEX (5106/5306)
    i. USA
31. VesiFlow (5006)
    i. USA
32. Viega PureFlow PEX (5006/5306)
    i. USA
33. Waterline PEX (3006)
    i. China/USA
34. Watts WaterPEX (3006)
    i. China/USA
35. Zurn PEX (5306)
    i. USA

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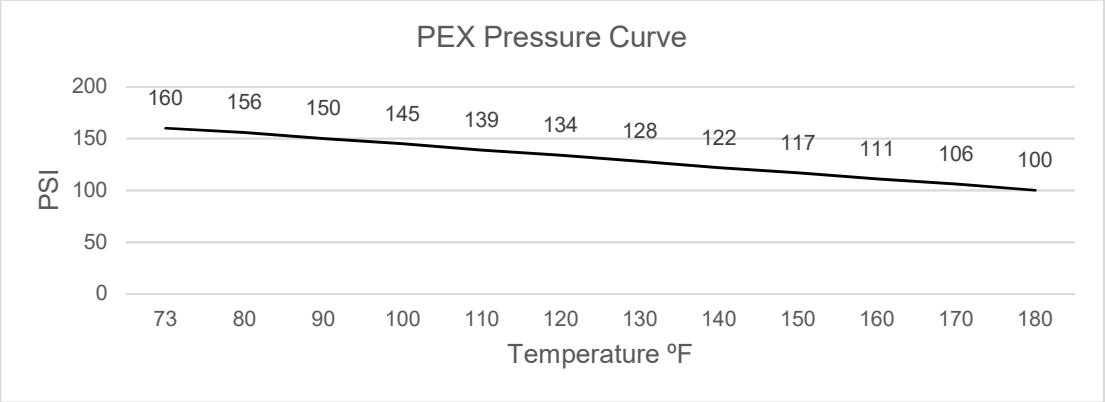
PART 3 – EXECUTION

3.1 SYSTEM OPERATING PARAMETERS

A. The operating pressure with a PEX plumbing system shall not exceed 160psi at 73ºF, 100psi at 180ºF, or any other point above pressure curve below:



B. The operating temperature within a pressurized PEX plumbing shall not exceed 180ºF
   1. Individual manufacturers may allow short term performance at higher temperatures

C. When used with chlorinated water, the operating pressure of the system shall not exceed 80psi and the temperature of the system shall not exceed 140ºF

D. Design velocity shall not exceed manufacturer recommendations, which vary by manufacturer, below is an illustrative range typical of many manufacturers, always verify the limitations of the specific manufacturer used:
   1. Domestic hot water
      i. 8 ft./sec.
   2. Domestic cold water
      i. 8 -12 ft./sec.
   3. Hot water recirculating systems
      i. 2 ft./sec
      ii. This limit is also noted in the 2015 UPC Appendix I section 10.6.4(b)

E. Minimum bend radius
   1. The minimum bend radius of PEX varies by manufacturer and ranges from 5-8 times the outside diameter of the pipe.
      i. Some manufacturers severely limit the minimum bend radius (e.g. 15-24 times the outside diameter) when bending against the natural coil of the pipe.
      ii. Some manufacturers report minimum bend radius may vary with temperature and the speed at which the bend is made.
   2. Pipe bend supports shall be used for all 90º bends to prevent kinking
   3. Kinked pipe shall be removed and discarded
   4. Pipe shall not be bent within the minimum permissible distance of a connection
      i. Minimums vary by manufacturer

F. Under slab installation
    1. To minimize the risk of chemical permeation, PEX piping installed under slab shall be sleeved in a non-permeable material
    2. All slab penetrations shall be sleeved to prevent tubing damage
    3. Local codes may restrict the placement of mechanically formed PEX joints under a slab, verify local code requirements
    4. Some manufacturers require fittings buried under slab be fully wrapped
    5. Under slab piping shall be evenly supported with clean earth, sand, gravel or other approved materials.

G. Installation embedded in concrete
    1. All penetrations shall be sleeved to prevent tubing damage
    2. Tubing shall be securely fastened to the reinforcing mesh or rebar to prevent it from moving during the concrete pour
        i. Fasteners shall not abrade or cut the tubing
    3. Some manufacturers prohibit placing fittings in concrete, others require fittings be fully wrapped; verify individual manufacturer requirements

3.2 THERMAL EXPANSION AND CONTRACTION

A. PEX piping will expand about 2.75 inches per 50 feet of straight length of pipe per 50ºF increase in temperature.
    1. Effects of expansion and contraction in PEX systems will be more pronounced where fixed points exist

B. Do not pull PEX piping tight during installation, allow slack in the line to account for thermal expansion and contraction

C. Methods of accommodating linear thermal expansion and contraction
    1. Offsets, slack and changes of direction
        a. Ideal for shorter runs of pipe and smaller diameters
    2. Expansion loops
        a. Ideal for longer runs of pipe and larger diameters
        b. Do not install loops so that the loop is touching both joists or studs in a floor or wall
    3. Consult individual manufacturer guidelines for specific methods of addressing expansion and contraction by brand

D. When using slack or loops to accommodate thermal expansion, ensure the bend in the pipe will not exceed the minimum bend radius

E. Ensure the piping layout adequate isolates joints, fittings and connections from high-thrust or bending forces.

3.3 ANCILLARY SYSTEMS

A. Hangers and Supports
    1. Hangers and supports shall be chemically compatible PEX piping and fittings.
    2. Hangers and supports shall not restrict the free lateral movement caused by thermal expansion and contraction
    3. Metal hangers and supports shall be free of sharp edges which may abrade the pipe
    4. Concentrated loads such as metal valves, expansion tanks, and other appurtenances shall be directly supported, or the pipe supported immediately adjacent to the load
    5. Vertical runs shall be supported at every floor level, a mid-story guide may be used
    6. When penetrating metal studs, chemically compatible plastic grommets or similar devices shall be used to isolate the pipe from abrasion
    7. Support spacing shall comply with local code requirements and shall not exceed 32”
        i. Exception: under the UPC & UMC pipe >1” may be supported at 48”

B. Adapters
    1. Adapters shall be brass except for CPVC x PEX adapters which shall consist of a CPVC socket or spigot end with a brass PEX barb
    2. Compression stops must be used with an insert stiffener to ensure the pipe wall does not collapse under compression

C. Valves
    1. Valves shall be joined using a method specified in section 1.3
    2. Metal valves shall be directly supported or the pipe supported immediately adjacent to the valve

D. Water Heater Connections
    1. Direct connections to gas water heaters shall be piped in copper per local code requirements
    2. Some PEX brands may be directly connected to electric water heaters in some code jurisdictions, verify local codes and manufacturer recommendations

E. Insulation
    1. All insulation materials shall be chemically compatible with PEX piping
    2. All insulation materials shall be chemically compatible with PSU and/or PPSU fittings
    3. Individual manufacturers have varying recommendations regarding closed-cell foam insulation, verify the individual manufacturer recommendation

F. Proximity to heat sources
    1. Do not install PEX piping with 12” of any recessed light fixtures unless the fixture is I.C. rated
    2. Do not install PEX piping within 6” of any gas appliance vent piping
    3. Do not solder, braze, weld or fusion-weld within 18” of PEX piping in the same water line

3.4 QUALITY CONTROL

A. The installing contractor shall be trained in the specific installation procedures for the brand of PEX being used on the job, training shall be provided by either the pipe/fitting manufacturer or their designated representative

B. Pressure tests shall be completed in compliance with applicable local codes and shall be conducted hydrostatically, air testing shall not be permitted.
    1. For under slab or embedded installations, the assembly shall be pressure tested prior to pouring the concrete

C. The installing contractor shall inspect assembled joints to ensure PEX fittings have been fully inserted to the stop, per individual manufacturer recommendations.

PART 4 – REFERENCES

A. Select Manufacturer Installation Guides
   1. https://www.viega.us/content/dam/viega/aem_online_assets/download_assets/us/impf_573225_1218_pureflow_commercial_water_system_en.pdf
   2. https://uponorglobal.azureedge.net/-/media/uponor-global/resources/manuals/us/pdam.pdf
   3. https://www.zurn.com/media-library/web_documents/pdfs/brochures/zmktg370-04-pdf.aspx
   4. https://www.zurn.com/media-library/web_documents/pdfs/catalogs/zmktg370-60-pdf.aspx
   5. http://media.wattswater.com/IS-WATERPEX.pdf
   6. https://www.pscia.com/ASSETS/DOCUMENTS/ITEMS/EN/nib_pexcatalog.pdf
   7. https://www.heatlink.com/sites/default/files/Brochure/L3235-Potable-Water-Press-System-Installation-Guide.pdf

B. Always verify the most current manufacturer installation guides for the manufacturer(s) being used.