UNI-BELL PVC PIPE ASSOCIATION

UNI-B-15-10

RECOMMENDED STANDARD SPECIFICATION
FOR POLYVINYL CHLORIDE (PVC)
FABRICATED PRESSURE FITTINGS

November 2010

UNI-BELL PVC PIPE ASSOCIATION
2711 LBJ Freeway, Suite 1000
Dallas, Texas 75234
972-243-3907
www.uni-bell.org
Recommended Standard Specification for Polyvinyl Chloride (PVC) Fabricated Pressure Fittings

Section 1, Scope

This recommended product specification pertains to fabricated PVC pressure fittings made from AWWA C900 or AWWA C905 pipe. The fittings shall be compatible with ductile-iron equivalent size PVC pipe.

Section 2, Referenced Standards

AWWA C900, “Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch (100mm through 300mm), For Water Transmission and Distribution”
AWWA C905, “Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14-Inch through 48-Inch (350mm through 1,200mm), For Water Transmission and Distribution”

Section 3, Definitions

The following definitions shall apply in this recommended standard specification:

1. **Constructor:** The party that provides the work and materials for placement or installation.

2. **Dimension Ratio (DR):** The ratio of a pipe’s specified average outside diameter to its specified minimum wall thickness.

3. **Fabricated Fittings:** Fabricated fittings comprise single segments or multiple segments of PVC pipe joined under factory-controlled conditions to form an essentially homogeneous structure. Reinforcement may be applied and permanently bonded to the outside surfaces of the fitting.
The different types of fittings are as follows:

a. **Tees** have an outstanding leg that is 90° from the running leg.
b. **Crosses** have two outstanding legs that are opposite each other.
c. **Bends** may be the standard angles (11.25°, 22.5°, 45° and 90°) or any custom-built angle.
d. **Couplings** are used to join two similar-diameter pipes.
e. **Reducers** are used to abruptly join two different pipe diameters.
f. **Adapters** are used to join two different pipe diameters when the difference in nominal pipe diameter is one-inch or less. Note: At least one end of the adapter must be compatible with ductile-iron equivalent size PVC pipe.
g. **Tapers** are used to reduce hydraulic losses when joining two different pipe diameters.

4. **Hydrostatic Design Basis:** The categorized long-term strength in the circumferential or hoop direction as established from long-term pressure tests in accordance with ASTM D2837.

5. **Inspector:** The authorized representative of the purchaser who is entrusted with the inspection of products and production records. The inspector may also observe the production operations and quality-control tests to ensure that products comply with the requirements of this recommended standard specification and the purchaser.

6. **Manufacturer:** The party that manufactures, fabricates, or produces materials or products.

7. **Purchaser:** The person, company, or organization that purchases any materials or work to be performed.

Section 4, Materials

4.1 **Fabricated fittings.** PVC fabricated fittings shall be made from pipe that was made from PVC resin that has been compounded to provide physical and chemical properties that equal or exceed cell class 12454 as defined in ASTM D1784. Fittings shall be fabricated from pipe materials that qualify for a minimum hydrostatic design basis (HDB) of 4,000 psi in accordance with PPI TR-3. Fittings shall be made only from PVC pipe that meets or exceeds AWWA C900 or AWWA C905.

4.2 **Elastomeric Gaskets:** One gasket shall be furnished with each bell of every fitting. Elastomeric gaskets shall meet the requirements of ASTM F477 for high-head (50 feet of head or higher) applications.

4.3 **Fabricated fitting overwrap reinforcement:** Optional reinforcement, either PVC or non-PVC, may be applied by the manufacturer to meet the requirements of this recommended standard specification.

4.1.3.1 Resin. Resin used shall be a commercial grade of unsaturated polyester resin or epoxy resin.

4.1.3.2 Glass. Glass reinforcing materials shall be commercial “E” type glass in the form of mat, continuous roving or roving fabric, or a combination of these, having a coupling agent that bonds the glass reinforcement and the resin.

4.4 **Gaskets and Lubricant:** Only gaskets and lubricants that are compatible with PVC shall be used. The gaskets and lubricants shall be compatible with one another when used together.
5.1 Workmanship: The component pipe segments and the bonds between them shall be free from voids, cracks, inclusions, and other defects which prevent the fitting from meeting the performance requirements of this recommended standard specification. The joining surfaces of spigots and bells shall be free from imperfections that could cause leaks. When component segments are joined using solvent cement, the procedure shall conform with the standard practice for making pressure joints outlined in ASTM D2855.

5.2 Dimensions:

5.2.1 Fitting barrel. Edge-joined segments of fabricated fittings shall have the same dimension ratio.

5.2.2 Standard configurations. Standard configurations shall include customary angles for branch connections or bends. Non-standard angles of branch connections or bends may be specified. Leg lengths shall be the minimum practical for the method of fabrication, unless otherwise specified.

5.2.3 Reinforcement of solvent cement joints. Fitting segments, which are joined by solvent cementing, shall be designed on the basis of maximum lap shear strength of the solvent cement joint of 900 psi. Overwrapped reinforcement shall not be considered in the design of the solvent cement joint.

5.3 Segment joint quality:

5.3.1 Butt-fusion or thermal weld. A suitable probe, energized with 25,000 V, shall be swept along the joint line approximately 0.1 inch away from the PVC surface of the joined segments on the side opposite to the grounding medium. The grounding medium shall be a metallic conductor held against the seam surface opposite the probe. For thermally welded seams other than butt-fusion, the test shall be conducted only after the first 20 percent of the weld thickness is applied. Any discontinuity in the segment joint is indicated by the jump of an arc (sparking) from the probe tip and shall be cause for rejection of the fitting until such time that the weld is repaired.

5.3.2 Solvent-cemented bond quality. Specimens for lap shear testing shall be prepared in accordance with the requirements of ASTM D2564, except as modified herein. The test specimens shall be obtained from a sample solvent-cemented joint produced by the solvent-cementing procedures used to fabricate fittings. After at least a 72-hour solvent cement curing time at 73.4°F ± 3.6°F, three specimens shall be tested per segment joint. Each specimen shall be a section of the segment joint measuring approximately 1 inch by 2 inch and shall not include any overwrapping reinforcement. A portion of each test specimen shall be machined off as needed to obtain a specimen similar to that shown in Figure 1.
After placing the specimen in testing device similar to that shown in Figure 1, apply the force at a shear speed of 0.05 inch/minute. The minimum average lap shear strength of three specimens shall be 900 psi.

Note: Where mechanical joint restraint devices are used to control thrust movements of fabricated fittings, consult with the fittings manufacturer to determine the tensile thrust limitations for the specific sizes, configurations, and pressure classes specified.

5.4 Quality Control pressure test. The fabricated fitting shall not fail, balloon, burst, or weep when subjected to an internal pressure equal to two times the pressure class of the pipe from which the fabricated fitting was made. The minimum test period is two hours.

5.5 Qualification pressure test. The fabricated fitting shall not fail, balloon, burst, or weep, as defined in ASTM D1598, at a sustained pressure of 1.5 times the pressure class of the pipe from which the fabricated fitting was made. One specimen shall be subject to this pressure for a minimum of 1,000 hours as specified in ASTM D2241. Either free-end or restrained-end closures that are free of leaks at maximum pressure shall be used.

5.6 Joint qualification test. Bell-end fabricated fittings designed for making PVC pipe joints using elastomeric gaskets to effect the pressure seal shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D3139. (These are qualifying test requirements to determine proper design and performance of the specimen joints.)
Section 6, Verification

6.1 Quality Control and Qualification Test Requirements. The manufacturer shall take adequate measures in the production of fabricated fittings to assure compliance with the requirements of this recommended standard specification. The fabricated fittings shall be tested at 73.4°F ± 3.6°F, unless otherwise specified, and in accordance with the requirements of Section 5 at intervals specified in this section.

6.2 Fabricated fitting segment fusion. Each fitting manufactured using the butt-fusion or thermal welding method of segment joining shall be tested in accordance with Section 5.3.1.

6.3 Fitting segment solvent-cement bond quality. Where solvent cement is used to join fitting segments, the quality of the bond shall be tested in accordance with Section 5.3.2 at start-up and once every 200 fittings produced using this procedure. Testing shall also be required upon changing PVC cement product brand, or surface preparation used in the process prior to any fittings being made using the alternative product(s). Failure to meet the requirements of Section 5.3.2 shall result in the rejection or testing of all fittings manufactured since the last successful test.

6.4 Fabricated fitting pressure test.

6.4.1 Qualification pressure test. For a specific production process and whenever the production process is changed, a representative fabricated fitting specimen shall be subjected to a sustained pressure test in accordance with Section 5.5. A representative specimen shall be the most critically stressed fitting configuration.

For each category, the largest fitting manufactured is the most critical. For each category, the most critically stressed configuration is:

- Bends: Largest Bend Angle Produced
- Tees: Size-On-Size
- Crosses: Size-On-Size
- Reducers, Adapters, and Tapers: Largest Overall Diameter Change

6.4.2 Quality Control pressure test. Test a representative fabricated fitting specimen once every 200 fittings produced or six months, whichever is greater. Sampling shall include the most critically stressed fitting configuration as defined in 6.4.1 produced during this period. Retest is required when the fabrication process changes. Test to be conducted in accordance with Section 5.4. (Note: 100% sampling is not mandatory).

6.5 Quality-Control Records. The manufacturer shall maintain, for a period of not less than two years, a record of quality-control tests and shall, if requested, submit the pertinent record to the purchaser.
6.6 Plant inspection.

6.6.1 Plant access. The purchaser’s inspector shall have access at reasonable times to those parts of a manufacturer’s plant that are necessary to assure that products comply with this recommended standard specification.

6.6.2 Responsibility for compliance. Plant inspection by the purchaser or the omission of such inspections shall not relieve the manufacturer of the responsibility to furnish materials complying with the applicable requirements of this recommended standard specification.

Section 7, Delivery

7.1 Marking. Fittings shall bear identification markings that will remain legible after normal handling, storage, and installation. The markings shall be applied in a manner that will not reduce the strength of the fabricated fitting. Marking on fabricated fittings shall include the following:

7.1.1 Nominal size, outside diameter regimen, and deflection angle (if applicable). For example, 18-inch, CIOD, 45°.

7.1.2. The fitting material: PVC.

7.1.3. The pressure class. For example, PC 165.


7.1.5. Manufacturer’s name or trademark.

7.2 Affidavit of Compliance. The manufacturer shall, if so required by the purchaser, furnish an affidavit that the delivered materials comply with the requirements of this recommended standard specification and of the purchaser.
Prepared by the
UNI-BELL PVC PIPE ASSOCIATION *

MEMBERS:

CERTAINTEED CORPORATION
DIAMOND PLASTICS CORPORATION
IPEX, INC.
JM EAGLE
NATIONAL PIPE PLASTICS, INC.
NORTH AMERICAN PIPE CORPORATION
PIPYLE LIFE JETSTREAM INC.
ROYAL PIPE SYSTEMS
SANDERSON PIPE

The statements contained in this recommended specification are those of the Uni-Bell PVC Pipe Association and are not warranties, nor are they intended to be warranties. Inquiries for information about specific products, their attributes and recommended uses and the manufacturer’s warranty should be directed to member companies.

* First edition published as UNI-B-15-10