



Materials System Specification

01-SAMSS-034

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RTR (Fiberglass) Pressure Pipe and Fittings

Document Responsibility: Non-metallic Standards Committee

Saudi Aramco DeskTop Standards

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Revised paragraphs are indicated in the right margin

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1 Scope

- 1.1 This specification defines the requirements for glass-fiber-reinforced thermosetting resin pipe (RTRP) couplings, fittings, flanges and spools using polyester, vinyl ester or epoxy resin with restrained or unrestrained joints. For simplicity the fiberglass pipe that includes RTRP is being referred as RTR pipe in the text of this Specification.
- 1.2 The minimum pressure/temperature rating of the pipe and fittings shall be 10 bar (150 psig) at 65°C, except as noted in paragraph 1.3 of this Specification. Higher pressure rating of the pipe and fittings shall be at increments of 3.5 bar (50 psig), up to and including 20 bar (300 psig). Pipe and fittings with pressure rating greater than 20 bar (300 psig) shall be at increments of 7 bar (100 psig), up to and including 70 bar (1000 psig). The minimum associated temperature rating shall be at 65°C or higher, as stated in the Purchase Order.
- 1.3 For dedicated fire water piping systems the minimum pressure/temperature rating shall be 12 bar (175 psig) at 93°C and shall be certified as per paragraph [10.3.2](#) of this Specification.
- 1.4 This standard does not apply to RTRP pipe intended for use in process water, injection water and hydrocarbon services applications. For such application refer to [01-SAMSS-042](#).

2 Conflicts and Deviations

- 2.1 Any conflicts between this specification and other applicable Saudi Aramco Materials System Specifications (SAMSSs), Engineering Standards (SAESs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this specification in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this specification shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#) *Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement*

Saudi Aramco Engineering Standard

[SAES-A-004](#) *General Requirements for Pressure Testing*

Saudi Aramco Inspection Requirements Form

[175-012000](#) *Inspection Requirements for Pipe & Fittings: Fiberglass; RTRP (Glass-Fiber-Reinforced Thermosetting Resin) & RPMP (Glass-Fiber-Reinforced Plastic-Mortar)* ||

Saudi Aramco Non-material Requirements Form

[NMR-7930](#) *Nonmaterial Requirements* ||

3.2 Industry Codes and Standards

References noted below are a part of this specification, to the extent indicated, and shall be the latest edition at the time of Purchase Order placement, unless otherwise noted in the Purchase Order documents.

American Society of Mechanical Engineers

[ASME B1.20.1](#) *Pipe Threads, General Purpose*

[ASME B16.5](#) *Pipe Flanges and Flanged Fittings*

[ASME B31.3](#) *Chemical Plant and Petroleum Refinery Piping*

[ASME B46.1](#) *Surface Texture*

American Petroleum Institute

[API SPEC 15LR](#) *Low Pressure Fiberglass Line Pipe*

American Society for Testing and Materials

[ASTM C33](#) *Specification for Concrete Aggregates*

[ASTM D2412](#) *External Loading Properties of Plastic Pipe by Parallel-Plate Loading*

[ASTM D2563](#) *Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts*

<u>ASTM D2925</u>	<i>Beam Deflection of Reinforced Thermosetting Plastic Pipe under Full Bore Flow</i>
<u>ASTM D2992</u>	<i>Hydrostatic Design Basis for Reinforced Thermosetting Resin Pipe and Fittings</i>
<u>ASTM D2996</u>	<i>Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe</i>
<u>ASTM D3567</u>	<i>Dimensions of Reinforced Thermosetting Resin Pipe and Fittings</i>
<u>ASTM D3754</u>	<i>Fiberglass Sewer and Industrial Pressure Pipe</i>
<u>ASTM D4024</u>	<i>Reinforced Thermosetting Resin Flanges</i>
<u>ASTM D4161</u>	<i>Bell and Spigot Reinforced Thermosetting Resin Pipe Joint Using Flexible Elastomeric Seals</i>

American Water Works Association

<u>AWWA C207</u>	<i>Steel Pipes Flanges for Waterworks Service</i>
<u>AWWA C950-01</u>	<i>Fiberglass Pressure Pipe</i>

International Organization for Standardization

<u>ISO 75</u>	<i>Plastics - Determination of Temperature of Deflection under Load</i>
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Manufacturers Standardization Society

<u>MSS SP-44</u>	<i>Steel Pipeline Flanges</i>
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NSF International

<u>NSF 14</u>	<i>Plastic Piping System Components and Related Materials</i>
<u>NSF 61</u>	<i>Drinking Water System Components-Health Effects</i>

4 Definitions

Buyer or Purchaser: The Company (Saudi Aramco, AOC, or ASC) that places the order for the material.

Buyer's Representative: The person acting on behalf of the Buyer, who may be from the Consulting Services Department (CSD), Inspection Department (ID), Purchasing Department, or user organization.

Independent Agency: The Saudi Aramco-approved independent agency. A third party, not listed as Saudi Aramco-approved Independent Agency and reporting tests to

Saudi Aramco that has been witnessed by Consulting Services Department or Inspection Department of Saudi Aramco, is also qualified as an Independent Agency.

Manufacturer: RTR (fiberglass) piping manufacturing facility, that has made at the proposed plant at least one RTR (fiberglass) piping system with the same materials, manufacturing process, product design, design pressure and temperature, and joint type as the system on order. The system shall have performed satisfactorily in service for at least 1 year.

Saudi Aramco's Engineer: The Chairman of Non-Metallic Standards Committee in Consulting Services Department, Dhahran. ||

Vendor: The other party that supplies the material who may or may not be the manufacturer of the product.

5 Cell Classification

All pipes, joints, fittings, couplings, flanges and spools, supplied under this specification, shall be identified by cell classification methods stated in Table 1. These classification methods are in accordance with [AWWA C950-01](#), [API SPEC 15LR](#), and [ASTM D3754](#).

Equivalent cell classifications by other ASTM standards, such as [ASTM D2996](#), are also acceptable.

Table 1 – Cell Classification ⁽¹⁾

Service	Pipe Size	Pressure Rating	Classification Method
Water	25 mm - 3600 mm	10 bar (150psig) - 18 bar (250 psig)	AWWA C950-01
Water	25 mm - 400 mm	20 bar (300 psig) - 70 bar (1000 psig)	API SPEC 15LR
Sanitary & Oily Water Sewer	200 mm - 3600 mm	Up to 18 bar (250 psig)	ASTM D3754 ⁽²⁾
Other fluids	25 mm - 400 mm	Up to 70 bar (1000 psig)	API SPEC 15LR

Notes: (1) Equivalent cell classifications by other ASTM standards, such as [ASTM D2996](#), are also acceptable.

(2) For pipes to be installed in buried applications.

6 Materials and Fabrication

6.1 All pipes, joints, fittings, couplings, and spools, supplied under this specification, shall meet the performance requirements of [Section 8](#).

6.2 Pipe and couplings shall be filament-wound using polyester, vinyl ester or epoxy

resin and fiberglass reinforcement.

6.3 Resin System

Resin shall be suitable for the services specified, and shall be noted by the vendor in his proposal. The resin system used for the interior liner, the structural wall, fittings, and adhesives shall be polyester, vinyl ester or epoxy, with suitable curing agents so that it meets the performance requirements and temperature limits in this Specification.

6.4 Glass Reinforcement

The structural wall reinforcement shall be of commercial-grade glass fiber, suitable for the services specified in the Purchase Order, treated with a compatible binder and coupling agent.

6.5 Additives

Resin additives such as pigments, dyes or coloring agents may be used provided they do not detrimentally affect the performance of the pipe. The pipe must contain a UV inhibitor.

6.6 Reinforcing Fiberglass Ribs

Pipe sizes 2600 mm and higher can be manufactured with reinforcing fiberglass external ribs to achieve the required stiffness.

6.7 Joint Types

The pipe shall have one or a combination of the following joining systems that shall provide for fluid tightness for the intended service condition.

a) Unrestrained Joints

1. Gasketed bell-and-spigot
2. Gasketed bell and bell coupling for use with spigot end pipe

b) Restrained Joints

1. Bell-and-spigot, adhesive bonded
 2. Butt-and-wrap, with reinforced overlays
 3. Mechanical joints: flanged, and restrained gasketed joints
 4. Non-commercially available special joints or any proprietary joints shall have a prior approval from the Chairman of Non-Metallic Standards Committee.
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6.8 Adhesives

Adhesive for bonded joints shall be of a material suitable for the services and design conditions specified. It shall be mutually compatible with the resin used to manufacture the pipe. Adhesives shall be provided in a self-contained kit with all necessary materials and instructions. Shelf life of adhesive kits, at 38°C, shall not be less than 9 months from the date of shipment. Adhesive kits shall indicate the required storage conditions and date of expiration of shelf life. Adhesives shall be suitable for use at 48°C working environment.

6.9 Flexible Elastomeric Seals and Joint Tightness

The chemical composition of the flexible elastomeric seals shall be compatible with the type of service and environment to which it will be subjected.

6.10 Fittings

Flanges, bends, reducers, tees, wyes and other fittings may be compression-molded, manufactured from mitered section of pipe, or manufactured by the filament wound process, using thermosetting polyester, vinyl ester or epoxy resin and fiberglass reinforcement such that the resistance to chemical attack, the pressure rating, and the temperature rating, are equal to or better than that of the pipe.

6.11 Except for compression-molded fittings, all pipe, fitting, and flange surfaces that are exposed to the fluid shall have a smooth, uniform, resin-rich liner with a minimum thickness of 0.51 mm. The interior liner shall be reinforced with either non-woven polyester fibers or glass veil surfacing mat. Polyester or glass veil liner reinforcement is not required on 100 mm and smaller fittings at the mitered joints, provided all gaps at the joints are completely filled with resin to act as an effective corrosion barrier and to prevent the presence of any exposed glass fibers.

6.12 All machined or cut surfaces shall be post-coated with catalyzed resin, except for bonding surfaces for field points and mechanical RTR (fiberglass) threads. Post-coating shall be performed within four hours of machining or other surface preparation.

6.13 Adhesive-bonded joints shall be bell-and-spigot type and shall not require a field-applied overwrap to develop the required strength.

6.14 Flanges, if provided, shall be flat-faced, or flat-faced with a confined O-ring gasket groove.

6.15 All pipe, fittings and flanges for a particular installation shall be manufactured or supplied by the same Vendor to avoid incompatibility due to intermixing of products from different manufacturers.

- 6.16 Threads shall be per [ASME B1.20.1](#) and shall conform to the requirements of [ASME B31.3](#), paragraph A 314.2.2.

7 Dimensions and Tolerances

- 7.1 Dimensions and surface finishes shall be measured in accordance with [ASTM D3567](#) and [ASME B46.1](#). The average wall thickness of the pipe shall not be less than the nominal wall thickness published in the manufacturer literature, current at the time of purchase. The minimum wall thickness at any point shall not be less than 87.5% of the nominal wall thickness, when measured in accordance with [ASTM D3567](#).
- 7.2 Flange bolt hole sizes and the number of bolt holes and bolt hole circles for up to 600 mm nominal pipe size shall comply with [ASME B16.5](#). For larger than 600 mm nominal pipe size, flange bolt holes sizes and the number of bolt holes and bolt hole circles shall comply with [AWWA C207](#), or [MSS SP-44](#).
- 7.3 Unless otherwise defined in the Purchase Order, specified face-to-face, centerline-to-face, and centerline-to-centerline dimensions of special fabrications (spools) shall have a tolerance of + 6 mm. The lateral offset of flanges from the pipe centerline and rotation of flanges shall be limited to 3 mm. The flange face alignment shall be within 1.5 mm of the required position when measured across the flange face. These tolerances may be doubled at the most for piping 450 mm nominal size and larger.

8 Performance Requirements

- 8.1 General
- 8.1.1 The Manufacturer shall perform design type tests, as required in paragraph [8.2](#), on materials made at each manufacturing facility where materials for Buyer would be produced.
- 8.1.2 Design type tests shall be witnessed and certified by an independent agency.
- 8.1.3 Testing and test reports shall pertain to items representative of those supplied under the Purchase Order. Design type testing shall be repeated after any change in materials, manufacturing methods, or product design.
- 8.1.4 The Manufacturer shall provide supporting background information of [Section 4](#), for review by Buyer's Representative before purchase order award.

8.2 Design Type Tests

8.2.1 Hydrostatic Design Stress and Pressure Ratings

8.2.1.1 The long-term hydrostatic strength of pipe shall be determined in accordance with Procedure A or B of [ASTM D2992](#). The Manufacturer shall select the procedure and one representative size for these tests. Adhesive joints shall be included, using both the factory and field adhesives and their respective joining and curing procedures, if different.

8.2.1.2 Pressure rating calculations shall be performed in accordance with [AWWA C950-01](#) using a design factor (or service factor) not less than of 1.8.

8.2.1.3 The calculated pressure ratings shall equal or exceed the pressure rating of the piping specified in [Section 1](#) of this specification and in the Purchase Order.

8.2.2 Temperature

The maximum allowable working temperature of a pipe is to be in accordance with the Manufacturer's recommendations, but in every instance, is to be at least 20°C (36°F) lower than the minimum heat distortion temperature (HDT) of the pipe material, determined according to [ISO 75](#) method A or equivalent. The minimum HDT is not to be less than 80°C (176°F) unless calculations and testing are shown to validate a product with an HDT below this value. At elevated temperatures, degradation of material properties is to be considered. In general, RTR materials have stable mechanical properties up to 65°C (150°F). Above this temperature, RTR materials may show some degradation. At the HDT, the material properties may be 50% or less than the ambient temperature properties.

Where low temperature services are considered, special attention is to be given with respect to material properties. Some testing has shown RTR to have stable mechanical properties to as low as -40°C (-40°F).

8.2.3 Chemical Resistance Determination

The chemical resistance determination for all industrial services except potable, sea and well water, sanitary sewage and oily water sewer, shall be carried out as per [ASTM D3754](#), Section 6.3.2. A certification from an affiliate manufacturing plant or resin suppliers can be accepted

if the same materials and process are used. If the test data is not available, the Manufacturer may submit documented service data to Saudi Aramco's Engineer for approval.

8.2.4 Long-Term Ring Bending Strength

Long-term ring bending strength shall be determined in accordance with [AWWA C950-01](#), with stress relaxation or creep failure tests instrumented to detect an abrupt, significant reduction in mechanical properties. Pipe for conveying sanitary sewage, storm water, and oily water may be tested, as an alternate, in accordance with [ASTM D3754](#), Section 6.3. The test data shall be statistically extrapolated to establish strength at 50 years.

8.2.5 Flange Pressure Rating

8.2.5.1 Flanges shall be pressure-rated and marked in accordance with [ASTM D4024](#). The manufacturer shall test, on a one-time basis, three samples of minimum, median and maximum flange sizes of the manufacturing range at the plant for each pressure rating.

8.2.5.2 For flanges larger than 1000 mm in diameter for each size a design calculation, as per Saudi Aramco-approved design method, may be submitted as a substitute to the Short Term Rupture Strength test, described in [ASTM D4024](#), Section 11.5. The Vendor shall obtain the approval of the design method from Saudi Aramco's Engineer.

8.2.6 Joint Integrity Test

8.2.6.1 Joints shall be of the adhesive-bonded, reinforced overlays, gasketed bell-and-spigot, or mechanical type joints, as defined in [AWWA C950-01](#).

8.2.6.2 For qualifying manufacturer's jointing procedures and methods, the joints shall be tested as follows:

- a) Gasketed joints shall be tested in accordance with [ASTM D4161](#), and shall meet the performance requirements of Sections 6 and 7 of [ASTM D4161](#), except that the test pressure shall be 2 times the rated pressure instead of the test pressure stated in [ASTM D4161](#) Section 7.2, and 3 times the rated pressure instead of the test pressure stated in

[ASTM D4161](#) Section 7.3. Restrained rigid joints, such as adhesive-bonded and butt-and-wrap lamination joints shall be exempt from the angular deflection requirement. One test as per Sections 6 and 7 of [ASTM D4161](#) shall be performed for each gasket profile.

- b) Adhesive-bonded and butt-and-wrap lamination joints shall meet or exceed the hoop tensile and axial tensile strength requirements of the pipe as tested in accordance with [AWWA C950-01](#). One test for each jointing method shall be performed to establish design stress values.

8.2.7 Beam Strength Test

- 8.2.7.1 Pipes for above ground application shall be tested in accordance with [ASTM D2925](#), with the exception that the ends of the test specimens may be capped with the end caps unrestrained and simply supported at their centers of gravity.
- 8.2.7.2 Temperature of the fluid, used for the test, shall be maintained at the maximum temperature rating of the pipe, +2°C.
- 8.2.7.3 The apparent elastic modulus of the pipe, calculated using the total maximum measured deflection, shall not be less than 6900 MPa (1,000,000 psi).

9 Quality Control (QC) Test Requirements

9.1 General

- 9.1.1 The items manufactured to this specification are subject to verification by Buyer's Representative in accordance with Form [175-012000](#), Inspection Requirements, attached to the Purchase Order.
- 9.1.2 In-Kingdom manufacturers may supply one piece of short pipe per QC test interval, as specified in paragraph [10.2.3](#) of this specification, whose length is reduced by cutting of the QC test specimens. The length of such short pipe shall not reduce the standard manufacturing length by more than 650 mm.

9.2 Pipe Stiffness

- 9.2.1 The pipe stiffness shall be determined in accordance with
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[ASTM D2412](#). The sampling method shall be in accordance with [AWWA C950-01](#).

- 9.2.2 The pipe shall exhibit, without structural damage, the minimum stiffness at 5% deflection specified in Table 2.

Table 2 – Minimum Pipe Stiffness Requirement

Nominal Pipe Size	Minimum Pipe Stiffness (FY) at 5% Deflection	
	kPa	(psi)
25 to 300	380	(55)
350	345	(50)
400	345	(50)
500	310	(45)
600	275	(40)
700	240	(35)
800	205	(30)
900 to 1200	170	(25)
Larger than 1200	170	(25)

- 9.2.3 At 10% deflection, there shall be no visual indication of cracking, crazing, interlaminar separation or structural damage. The Manufacturer shall indicate which small pipe sizes cannot reach 10% deflection at higher pressure ratings, and shall report the maximum deflection for such cases.

9.3 Axial Tensile Strength

The pipe shall be sampled and tested for axial tensile strength in accordance with [AWWA C950-01](#). The test results shall meet or exceed the minimum axial tensile strength requirements listed in Table 11 of [AWWA C950-01](#) for belowground installations. For aboveground; the test result shall not be less than one-half of hoop tensile strength requirement as stated in paragraph [9.4](#) of this specification.

9.4 Hoop Tensile Strength

The pipe shall be sampled and tested for hoop tensile strength in accordance with [AWWA C950-01](#). The test results shall meet or exceed the minimum hoop tensile strength requirements listed in Table 10 of [AWWA C950-01](#), or as calculated by the following equation, whichever is greater:

$$F = 4 * P * r \quad (1)$$

where:

- F = required minimum hoop-tensile strength, in pounds force per inch of width (kN/m).
- P = specified pressure rating, in pounds per square inch (kPa).
- r = nominal pipe radius, in inches {(outer diameter-single wall thickness)/2} (m)

9.5 Visual Inspection

Components shall be visually inspected for compliance with the defect limits in Table 3 of this specification.

Table 3 – Allowable Defects, RTR (Fiberglass) Pipe and Fittings Visual Acceptance Limits ⁽¹⁾

Name	Interior Surface	Exterior Surface	O-Ring Sealing Surface
1. Air Bubble ⁽²⁾ (Void)	Not to penetrate any surface - limits apply to all surfaces, maximum dimension 1-2 mm diameter, 0.5 mm thickness, 4 per one m ² area	Same requirements as for Interior Surface	Same requirements as for Interior Surface
2. Foreign Inclusion	Not to penetrate any surface - limits apply to all surfaces, maximum depth 1 mm, 1 per one m ² area	Same requirements as for Interior Surface	Same requirements as for Interior Surface
3. Pit ⁽²⁾ (Pinhole)	Max. depth 0.25 mm, maximum width 1.0 mm, 35 per one m ² area	Not to penetrate reinforced wall	Maximum dimension 0.25 mm
4. Porosity (Pinhole)	See Pit	See Pit	See Pit
5. Scratch	Max. depth 0.40 mm not to exceed liner thickness	Not to penetrate reinforced wall	Maximum depth 0.25 mm
6. Wormhole (Surface void)	See Note 2	See Note 2	See Note 2
7. Wrinkle	Max. depth 2 mm	Not applicable	None allowed
8. Other	See Note 3		

- Notes:**
1. All defect definitions per [ASTM D2563](#).
 2. If the void can be broken with the tip of a ballpoint pen, treat as a Pit. If the void cannot be broken with the tip of a ballpoint pen, treat as an Air Bubble.
 3. Blisters, Burned Areas, Cracks, Crazing (surface cracks), Dry Spots, Edge Delamination, Internal Delamination, Fractures and Shorts not permitted with or without repair.

9.6 Hydrostatic Leak Test

9.6.1 All pipe, fittings and spools shall be hydrostatically leak tested at the factory in accordance with [AWWA C950-01](#), to a test pressure equal to twice the pressure rating. This test pressure shall be maintained for at least 30 seconds and not exceeding 1 minute.

9.6.1.1 The hydrotest fixture for restrained-gasketed joint pipe and fittings shall use end plugs and gaskets that apply the full end load due to pressure to the component during test. For adhesive-bonded pipe and fittings, full end load does not have to be applied.

9.6.1.2 If air is used as the pressurizing medium, the component shall be completely submerged in clear water during the pressurization and inspection period.

9.6.1.3 All pipe, fittings, spools and joints shall be visually examined for leakage. Any item showing evidence of weeping or leakage shall be rejected.

9.6.2 The standard adhesive-bonded flanges, standard adapters, saddles, nonstandard fittings with plain ends configurations, and prefabricated spools with plain ends that cannot be hydrotested at the manufacturing facility due to size limitations and configurations shall be handled as follows:

- a) The Vendor shall require the Saudi Aramco Inspector's approval for field testing of such items.
- b) The Vendor shall mark these items to be field hydrotested.
- c) These items shall be hydrotested in accordance with [SAES-A-004](#) after assembling at the job site.
- d) The assembled items and the testing shall be at Vendor's risk.
- e) Buyer's Representative shall witness the test. The rejected parts shall be removed from the system or repaired by the Vendor in accordance with a Saudi Aramco-approved repair procedure. The replaced or repaired part shall be retested.

9.7 Rejection

If the results of any QC test do not conform to the requirements of this specification, that test shall be repeated on two additional samples from the same lot of pipe. Each of the two samples shall conform to the requirements specified. If either of the two additional samples fail, the lot shall be rejected.

10 Drawings, Test Reports and Certificates Requirements

10.1 Drawings

Product drawings that show product dimensions and tolerances, including couplings, fittings and joints, shall be submitted one time for prior approval by Saudi Aramco's Engineer.

10.2 Test Reports

10.2.1 The Manufacturer's test reports, as summarized in Table 4, shall be made available to the Buyer's Representative to ensure that the same materials and manufacturing methods used in the fabrication of test specimens were used to make the components on order, and to assure compliance with the requirements of [Section 8](#) of this specification.

10.2.2 The required testing for compliance with this specification is summarized in Table 4 below:

Table 4 – Summary of Required Drawings and Testing (1)

	Required by Spec. Section	Component Testing, Size, Configuration, and Timing
1. Certified Drawings		
a. Pipe, Couplings, Fittings, Joints	10.1	All P.O. items
2. Design Type Test		
a. Hydrostatic Design Stress	8.2.1	Single
b. Chemical Resistance	8.2.3	Single
c. Long-Term Ring Bending Strength	8.2.4	Single
d. Flange Pressure Rating	8.2.5	Min, med, max for each pressure rating
e. Joint Strength Test	8.2.6	Single
f. Beam Strength Test	8.2.7	See Note (1)
3. Quality Control Test		
a. Pipe Stiffness	9.2	AWWA C950-01 , Sec. 5.1.2.2
b. Axial Tensile Strength	9.3	AWWA C950-01 , Sec. 5.1.2.4
c. Hoop Tensile Strength	9.4	AWWA C950-01 , Sec. 5.1.2.3
d. Visual Inspect	9.5	All Sizes
e. Hydrostatic Leak Test	9.6	All Sizes
f. Dimensions	7	AWWA C950-01 , Sec. 5.1.2.6
4. Certifications		
a. Potable Water	10.3.1	As required by NSF or approved equal
b. Dedicated Fire Water	10.3.2	As required by FM or approved equal

Note: (1) The test sample shall be min., med., max. diameter at 150 psi pressure rated at highest temperature rating.

- 10.2.3 QC tests as described in [Section 9](#) of this specification shall be performed at the intervals described in the indicated industry standards.
- 10.2.4 Documents of QC tests performed during fabrication shall be traceable to the manufactured items. The documents on the items shall be submitted to the Buyer's Representative for quality conformance verifications.
- 10.2.5 The Manufacturer shall maintain a record of all QC tests for a period of not less than two years, as per [AWWA C950-01](#) and, if requested, shall submit the data to the Purchaser.

10.3 Certifications

10.3.1 Potable Water Certification

Pipe, fittings, O-rings, gaskets, lubricants and adhesives specified for potable water systems shall be tested and certified as suitable for potable water use, in accordance with [NSF 14](#) and or [NSF 61](#); or other equivalent standards approved by Saudi Aramco's Engineer. A test certificate shall be submitted. The seal or mark of the certifying organization shall be indicated on the pipe.

10.3.2 Fire Water Certification

Piping systems, including pipe, fittings, jointing systems and adhesives, specified for dedicated fire water systems, shall be tested and certified by Factory Mutual (FM) or an equivalent agency approved by Saudi Aramco's Engineer. A test certificate shall be submitted. The seal or mark of the certifying organization shall be indicated on the pipe.

Exception:

Piping system that is not FM or an equivalent agency certified, if used for dedicated firewater system, shall have pressure rating not less than 14 bars (200 psig) or at least 50 psig higher than the operating pressure of the fire water system, whichever is higher; and shall not be of less than 93°C temperature rating.

11 Nonmaterial Requirements

- 11.1 The Vendor shall provide the parts' data and documentation as specified in Form [NMR-7930](#), Nonmaterial Requirements, if the form is attached to the Quotation Request and the Purchase Order.

- 11.2 If requested by the Purchaser, the Vendor shall provide a quotation to provide complete or partial installation supervision services to the Buyer, such as to provide personnel to monitor installation of RTRP (fiberglass piping) piping system, and to check joints, supports and anchors, and ensure that they are properly installed.

12 Identification Tagging

- 12.1 All components shall be permanently marked for proper identification. All required marking shall remain legible under normal handling and installation practices. The marking shall include the following:

- Manufacturer's name or trade name, manufacturing location or country of origin and identification code
- Pressure/temperature rating
- Nominal diameter
- Cell classification in accordance with manufacturing industry standards (from [Section 5](#) of this specification)
- Inspection and hydrotesting mark
- Date and shift of manufacture
- **SMG number** (if applicable)
- Purchase Order number
- Flange designation code
- The seal or mark of the certifying organization (such as NSF for Potable Water Certification or FM for Fire Water Certification) shall be indicated on the pipe as applicable.

- 12.2 Stenciled paint markings or labels shall be covered by a catalyzed resin topcoat. Adhesive-bonded paper or plastic labels without a catalyzed resin topcoat shall not be used.

- 12.3 Small fittings and flanges that cannot be marked shall be tagged.

13 Packing and End Protectors

13.1 Packing

- 13.1.1 Unless otherwise specified in the Purchase Order, pipe, fittings, O-rings, gaskets, locking rings, and adhesives shall be packed in a

manner to withstand rough handling. The size and type of packing shall permit long-term storage.

13.1.2 The packages shall be provided with skids to facilitate handling by forklift truck unless otherwise instructed by the purchaser.

13.2 End Protectors

13.2.1 End protectors shall be provided and securely attached to open ends of all pipes.

13.2.2 End protectors shall be designed to protect the pipe ends from impact damage, contamination, and weathering of machined bonding surfaces due to ultraviolet exposure. They shall have an open center permitting inspection of the pipe bore.

13.2.3 Flange faces on fabricated piping shall have protective covers not smaller than the flange outside diameter.

13.2.4 All threaded connections shall be protected with protective caps.

14 Purchase Order Information

The following information shall be as stated in the Purchase Order:

- Required pipe size and length,
- Pressure/Temperature Rating if higher than the minimum required (paragraphs [1.2](#) and [1.3](#) of this specification)
- Provide chemical analysis of the fluid if the pipe is used for other than sanitary sewers, oily water sewers, and water services,
- Specific service and installation consideration, including buried and/or above ground installation,
- Cell classification in accordance with [Section 5](#) of this specification,
- Certification requirement, if any (paragraph [10.3](#) of this specification),
- Pipe-end configuration (spigot, bell, flanges, etc.),
- Type of joints as listed in [Section 6](#) of this specification,
- Required number and size of couplings and fittings, if any,
- Flange Pressure Rating (Paragraph [8.2.5](#) of this specification),

- Adhesive kits required, if any (specify type and construction of pipe & fittings for which it is suitable),
- Special tools required, if any,
- Special packing, marking, and shipping, if any ([Sections 12](#) and [13](#) of this specification).

Revision Summary

15 September 2012	Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with editorial changes.
19 March 2013	Editorial revision of 01-SAMSS-034 to change the primary contact and document responsibility from Materials and Corrosion Control to Non-metallic Standards Committee.