

# Installation and Handling of Spoolable Reinforced Line Pipe

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# Installation and Handling of Spoolable Reinforced Line Pipe

## 1 Scope

This document establishes recommended practices for onshore installation and handling of spoolable reinforced plastic line pipe (API Specification 15S products) to prevent damage to pipe and field-fittings (couplings, connectors, and end-fittings) in the field environment and to assure assembly integrity prior to use. This document covers handling, layout planning, and installation by direct bury (trench and backfill), surface lay, directional drilling, plowing, and pull-through methods. Post-installation inspection and field testing are also covered.

This recommended practice outlines and identifies the important items that should be considered by each manufacturer and installer in their detailed procedures. This document is not intended to serve as a procedure or checklist for the installation and handling of spoolable reinforced line pipe products, nor is it inclusive of all items that may be required for the installation and handling of these products.

Each spoolable reinforced line pipe product is manufactured with unique technology, and every manufacturer shall have detailed procedures, guidelines, and recommended practices for the proper and safe installation and handling of their products. The manufacturer should define all the necessary equipment, tools, and ancillary items required for the safe installation, handling, rigging, transport, joining, and any other associated activities required for proper installation of their products.

## 2 Normative References

The following referenced document is indispensable for the application of this document. The latest edition of the referenced document applies (including any addenda/errata).

API Specification 15S, *Specification for Spoolable Reinforced Plastic Line Pipe*

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

ISO 9001,<sup>1</sup> *Quality management systems — Requirements*

## 3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **adjacent pipe**

Pipe attached to spoolable composite pipe using a connector. The adjacent pipe may be metallic, spoolable composite, or another material.

### 3.2

#### **connector**

A device used to provide a leak-tight structural connection between the end-fitting and adjacent piping (e.g., bolted flanges, clamped hubs, weld necks, and proprietary connectors).

### 3.3

#### **coupling**

A specific type of fitting developed for joining one section of spoolable composite pipe to another (e.g., in-line connector).

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<sup>1</sup> International Organization for Standardization, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, [www.iso.org](http://www.iso.org).

### **3.4**

#### **cover**

The protective outer sheath of the pipe.

### **3.5**

#### **end-fitting**

A mechanical device that forms the transition from the spoolable pipe to the connector.

### **3.6**

#### **end user**

The entity responsible for pipeline operation.

### **3.7**

#### **field-fitting**

An end-fitting with a connector or coupling designed for permanent installation.

### **3.8**

#### **handling MBR**

The minimum allowable bend radius the unpressurized pipe is subjected to during any handling.

### **3.9**

#### **joining**

The process by which a field-fitting is attached to the spoolable composite pipe to create a fluid-tight joint.

### **3.10**

#### **lowest allowable installation temperature**

The lowest allowable pipe temperature for deployment (e.g., unspooling and installation of fittings).

### **3.11**

#### **manufacturer**

An entity that fabricates products according to API Specification 15S.

### **3.12**

#### **operating MBR**

The minimum allowable bend radius for pipe when installed and pressurized to NPR.

### **3.13**

#### **pre-ripping**

The process of loosening the ground with earth-moving equipment prior to installation by plowing.

### **3.14**

#### **purchaser**

A person, organization, or other entity that is a recipient of a pipeline product provided by a seller under a purchase order or contract of sale.

### **3.15**

#### **purchaser's agent**

An installation contractor, inspector, or manufacturer hired by the purchaser to perform specific tasks (e.g., storing, unspooling, joining, handling, inspecting).

### **3.16**

#### **installer**

An individual who performs any specific portion of the installation process, including but not limited to inspection, testing, digging, unspooling pipe, and joining field-fittings.



### 3.17

#### **respooling MBR**

The minimum allowable bend radius when respooling the pipe in the factory or the field.

### 3.18

#### **road crossing**

A design feature in pipeline construction that accounts for the placement of a spoolable reinforced plastic line pipe across a road such that vehicular traffic can pass over the pipe without damage to the pipe or vehicle.

### 3.19

#### **spoolable pipe**

Pipe that is flexible enough to be provided as a coil or on a structural reel for transportation.

NOTE For the purposes of this document, the terms "coils," "reels," and "spools" may be used interchangeably.

### 3.20

#### **spoolable composite pipe**

The family of composite reinforced pipes in which the structural layer is flexible enough to enable spooling and unspooling.

## **4 Acronyms and Abbreviations**

For the purposes of this document, the following acronyms and abbreviations apply.

CRA	corrosion-resistant alloy
MBR	minimum bend radius
NPR	nominal pressure rating
UV	ultraviolet

## **5 Handling**

### **5.1 Packaging**

The following provisions apply for packaging of pipe and field-fittings:

- a) Packaged pipe shall have protective material applied to pipe ends to prevent contamination and damage at pipe terminations.
- b) At a minimum, both free ends of the pipe shall be tightly secured to the reel, coil, or attached supports.
- c) Field-fittings shall be packaged such that they are protected from damage and corrosion during transport.

### **5.2 Reel and Coil Transportation and Handling**

The following requirements apply to reel and coil transportation and handling:

- a) The manufacturer shall provide all pertinent information to the transportation company, including but not limited to:
  - 1) dimensions;
  - 2) weight;
  - 3) guidance for securing reels or coils that mitigates damage to the product during transport.

- b) The manufacturer shall provide the purchaser with guidelines for safe pre-installation handling of reels and coils, including requirements for special handling and lifting equipment as appropriate.
- c) Reels and coils shall be transported and handled per the manufacturer-specified guidelines.
- d) Consideration of hazards during transportation and pre-installation handling shall include, at a minimum, product weights, height, rollover, chocking, and securing.
- e) Reels and coils shall be moved by forklift, crane, or an appropriate vehicle in accordance with manufacturer recommendations.

**WARNING** — Reels and coils shall not be moved by rolling on ground. Serious injury or death could result.

**CAUTION** — Reels and coils shall not be moved by rolling on ground. Property damage or damage to pipe on reel could result.

### 5.3 Receiving Visual Inspection

The following requirements apply to reel and coil receiving visual inspection:

- a) The manufacturer shall provide the purchaser with visual inspection guidelines, acceptance criteria, and mitigation requirements (e.g., rejection, cutout, re-rounding) for pipe and field-fittings. At a minimum, the visual inspection guidelines shall include criteria and mitigation requirements for the items listed in Table 1.
- b) The purchaser or purchaser’s agent shall conduct visual inspection of delivered pipe and field-fittings per manufacturer-specified guidelines at time of delivery and as transported.

NOTE Conditions may limit receiving inspection to accessible portions of the packaged pipe.

- c) Prior to or during installation, visual inspection of all pipe and field-fittings shall be undertaken by the installer.
- d) Visual inspection records shall be documented by the purchaser or purchaser’s agent and retained by the end user per Section 10.
- e) Any damage shall be mitigated after consulting with the manufacturer and/or according to manufacturer guidelines before installation. Mitigation records shall be documented per the requirements in 5.3.d).

**Table 1—Visual Inspection Guideline Template to be Provided by Manufacturer for Receiving Visual Inspection**

Component	Inspection Item	Acceptance Criteria <sup>a</sup>	Mitigation <sup>a</sup>
Pipe	Kinks		
	Dents		
	Gouges or cuts		
	Bulge or blister		
	Missing protective end caps or covers		
	Outer cover discoloration		

**Table 1—Visual Inspection Guideline Template to be Provided by Manufacturer for Receiving Visual Inspection (Continued)**

Component	Inspection Item	Acceptance Criteria <sup>a</sup>	Mitigation <sup>a</sup>
Field-fittings	Corrosion		
	Mechanical damage		
Ancillary items (e.g., risers, venting components, tracer wire)	Corrosion		
	Mechanical damage		
	Missing components		
<sup>a</sup> Acceptance criteria and mitigation requirement columns are to be populated by the manufacturer.			

## 5.4 Storage

The following requirements apply to storage:

- a) The manufacturer shall provide guidelines for reel, coil, pipe, and field-fitting storage as applicable, including:
  - 1) handling MBR in accordance with API Specification 15S;
  - 2) respooling MBR and allowable number of bending cycles in accordance with API Specification 15S;
  - 3) limitations for weathering-related outdoor unprotected storage time frames if they exist;
  - 4) preferred storage position of the goods and the consequence when stored in an undesirable position;
  - 5) information for pipe supplied in coil form if applicable, including the maximum allowable number of coils that may be stacked.
- b) Reels, coils, and partially used reels and coils shall be stored per manufacturer-specified guidelines.
- c) Reels and coils shall be stored on stable surfaces and secured to prevent rolling or overturning.
- d) Reels and coils shall not be stored on unstable or soft terrain such that reel sinking or coil leaning leads to loading on pipe. For storage areas susceptible to environmental conditions that could affect soil stability, the purchaser shall provide a means of preventing sinkage (e.g., railroad ties laid perpendicular to the reel cradles). In the case of sinkage, the affected pipe section shall be mitigated according to manufacturer guidelines;
- e) Empty reels shall be properly secured to prevent unwanted movement.

## 6 Pipeline Layout Planning

### 6.1 Layout Design

The manufacturer shall provide the purchaser with the product properties and information specified in API Specification 15S.

**NOTE** It is important for route planning that the end user has the information necessary to conduct an analysis of system loads, if desired, based on operating temperatures, pressures, and cycling practices.

The purchaser shall comply with manufacturer guidelines in pipeline layout designs and any additional requirements from applicable regulations. Where conflicts exist, the purchaser should contact the manufacturer for assistance.

Pipeline layout design shall be documented (e.g., with drawings showing pipe location and features such as crossings, risers, or bends) and retained by the end user per Section 10.

### 6.1.1 Design Considerations

The following design considerations apply to pipeline layout planning:

- a) During pipeline layout planning, the system designer appointed by the end user should consider the following factors (which may lead to stresses or pipeline movement):
  - 1) thermal expansion and contraction (from anticipated temperature swings, including solar energy absorption of the pipe body);
  - 2) pipe pressurization;
  - 3) transient pressure effects (e.g., water hammer);
  - 4) environmental hazards (e.g., flooding, fire, animals);
  - 5) soil loading (e.g., vehicle loading, ground movement);
  - 6) point loading (e.g., rocks or other pipes above or below the pipe);
  - 7) connections between spoolable and rigid pipe and surface equipment;
  - 8) pipeline anchor points, pipe supports, or thrust blocks.
- b) The end user shall consider risks associated with pipeline system design, with particular emphasis on failure mechanisms of surface lay pipe relative to a buried design. These failure mechanisms may include but are not limited to third-party damage, impingement with another object during pipeline shifting, fire, UV damage, or freezing.
- c) The end user shall consider risks associated with co-trenching with other pipelines or underground infrastructure (i.e., adequate separation distances to avoid loading or thermal interference and provide clearances for future maintenance).

### 6.1.2 Bends

Bends in the pipeline system shall be designed with a radius greater than or equal to the operating MBR of the product, including consideration of the potential for pipeline movement or additional stresses.

Field-fittings shall not be installed in the bend zone. The pipe manufacturer shall provide the minimum distance between the beginning of the straight section of the bend and the field-fitting.

### 6.1.3 Crossings

The following requirements apply to crossings:

- a) The manufacturer shall provide material considerations and guidance for road and rail crossings, and the pipeline system designer shall follow manufacturer guidance.
- b) The need for a casing pipe for road and rail crossings should be determined by the pipeline system designer in consultation with the pipe manufacturer and in accordance with local regulations. The casing size and material shall be sufficient to prevent pipe damage. Where pipe is cased, proper support shall be provided to the pipe at the casing ends to avoid shear loading due to pipe and soil settlement.
- c) Soil compaction should be used in crossing design.

- d) Where possible, avoid the use of field-fittings within a crossing.
- e) The pipe manufacturer should provide recommendations on the type and separation of centralizers adequate for the pipe design.
- f) The casing ends should be sealed using adequate casing end seals.

#### 6.1.4 Risers

The following requirements apply to risers and riser supports:

- a) The manufacturer shall provide material considerations and guidance for risers, and the pipeline system designer shall follow manufacturer guidance.
- b) Use of movement restrictors (e.g., thrust blocks or equivalent methods) should be considered.
- c) Riser location and configuration shall be selected after considering potential axial and combined load threats to the riser. These may include soil settlement, shifting due to pressure/temperature in the line, or other external loads.

#### 6.1.5 Pipe Locators

Systems to locate the buried pipes should be installed. Tracer wire, above pipe markers, and warning tapes are commonly used. The warning tape should be installed above the buried line to locate pipe for future excavation.

## 7 Installation and Joining

### 7.1 General

The following provisions apply for the installation and joining of spoolable reinforced line pipe:

- a) The manufacturer shall develop and provide installation and joining guidelines, procedures, checklists, and precautions as appropriate, and these shall be made available for review by the purchaser.
- b) Manufacturer procedures and guidelines shall provide details on how to identify the product, including pipe and field-fittings, using factory applied markings.
- c) The manufacturer shall provide an inspection checklist for each of the installation methods described in 7.3. The checklist can be developed in a single or combined table of each of the stages of pipe installation.
- d) The manufacturer shall have a documented installer qualification program that shall be made available for review, as required. Joining shall only be performed by trained and qualified installers.
- e) All installation activities shall be conducted under a quality management system including competency requirements that conforms to an internationally recognized standard such as API Q1 or ISO 9001.
- f) All installers who perform joining shall have available for inspection qualification documentation with the following information:
  - 1) pipe manufacturer;
  - 2) product name, if applicable;
  - 3) installer name;
  - 4) date of training;

- 5) qualification limitations (e.g., supervision requirements, diameter, joint type, or application);
- 6) expiration date.
- g) Installation shall be performed according to the pipe manufacturer's documented installation guidelines. Any deviations from the manufacturer installation guidelines shall be recorded by the installer and retained by the end user per Section 10.
- h) Only field-fittings qualified by the pipe manufacturer shall be used for installation.
- i) Installer qualification documentation shall demonstrate qualification within the manufacturer's specified range. Installer installation activities shall be maintained within the qualification documentation range.
- j) Installation locations and configurations shall be as outlined in the pipeline layout plan. Any deviations from the layout plan shall be recorded by the installer and retained by the end user per Section 10.

## 7.2 Unspooling

The following provisions apply to unspooling:

- a) Manufacturer guidelines shall provide requirements and essential information for unspooling, including:
  - 1) recommendations for unspooling method (vertical vs. horizontal, stationary vs. moving);
  - 2) required unspooling equipment for supporting, controlling, lifting, and braking the reels and coils;
  - 3) maximum allowable axial tensile load;
  - 4) pulling and anchoring method (e.g. truck, tractor, backhoe, or other vehicle), including considerations for preventing overturning;
  - 5) description of when, if ever, use of re-rounding techniques should be employed and procedures detailing acceptable re-rounding equipment and pressures;
  - 6) temperature limitations for unspooling and guidance for warming the pipe to the lowest allowable installation temperature if required.
- b) Loads during unspooling shall not exceed manufacturer-specified maximum allowable axial tensile load during installation.
- c) A tension-limiting device or tension-monitoring device shall be used during installation. Alternatively, the manufacturer or installer shall demonstrate by calculation that the maximum axial tensile load will not be exceeded, subject to agreement by the purchaser.

**CAUTION** — Unpredictable pipe movement can occur when a tension-limiting device fails. Appropriate equipment or devices shall be used to prevent injury or equipment damage.

- d) Actual or calculated axial tensile load shall be recorded and retained per Section 10.
- e) The installation area shall be protected from unauthorized entry and personnel shall be out of the line of fire of unspooling pipe.
- f) Pipe ends shall be restrained before cutting to prevent the release of stored energy.
- g) Handling MBR shall not be violated during unspooling operation, and final pipe layout shall comply with manufacturer-specified operating MBR.

- h) If the unspooling reel is beyond the distance of direct command, a reliable communication method shall be used to coordinate pipe pulling and unspooling.

### 7.3 Installation Methods

#### 7.3.1 Trench and Backfill

The following provisions shall apply to products used in trench and backfill installations:

- a) The manufacturer shall provide and the installer shall follow installation recommendations, including:
- 1) minimum burial depth (depth of cover);
  - 2) trench bedding, if required;
  - 3) compaction recommendations, where applicable;
  - 4) limitations on surface loads above pipe after burial;
  - 5) recommendations to avoid backfill materials near the pipe that might cause pipe damage, such as jagged, sharp rocks;
  - 6) guidance on co-trenching with other pipelines or underground infrastructure.
- b) Excavations shall meet applicable safety requirements from the operator or regulatory agency.

#### 7.3.2 Boring and Directional Drilling

The following provisions shall apply to products used in boring and directional drilling applications:

- a) The manufacturer shall provide installation guidelines, including:
- 1) minimum recommended bore diameter;
  - 2) proper casing size, if applicable;
  - 3) maximum allowable axial tensile load;
  - 4) preparing crossings for pipe pull-through;
  - 5) pipe relaxation;
  - 6) visual inspection of the pipe after pulling;
  - 7) guidance for the effect of elevation and direction changes.
- b) Loads during unspooling shall not exceed the manufacturer-specified maximum allowable axial tensile load during installation.
- c) A tension-limiting device or tension-monitoring device shall be used during installation. Alternatively, the manufacturer or installer shall demonstrate by calculation that the maximum axial tensile load will not be exceeded, subject to agreement by the purchaser.
- d) The actual or calculated axial tensile load shall be recorded and retained per Section 10.

- e) A sufficient amount of pipe shall be pulled past the bore exit hole to allow for pipe relaxation per manufacturer guidance and to allow for 360° visual inspection of the pipe cover, as agreed between the manufacturer and purchaser.

### 7.3.3 Plowing

The following provisions shall apply to products used in plowing applications:

- a) The manufacturer shall provide installation guidelines including provisions for field-fittings.
- b) The installer should consider pre-ripping the pipeline route, especially where rough ground is anticipated.
- c) The installer shall ensure the chute is properly designed for pipe diameter and field-fittings.
- d) The installer shall ensure that plowing equipment that comes into contact with pipe and field-fittings does not cause mechanical damage.

NOTE The tension-limiting requirements in 7.2 do not apply to plowed-in installations.

### 7.3.4 Pull-through Installation

The following provisions shall apply to products used in pull-through applications:

- a) The manufacturer shall provide installation guidelines, including:
  - 1) maximum allowable axial tensile load;
  - 2) visual inspection of the pipe and cover after pull-through and acceptance criteria;
  - 3) evaluation of host pipe condition and internal diameter (e.g., camera, test section, pigging);
  - 4) guidance on pre-installation verifications or inspections for bends and compliance with MBR requirements;
  - 5) disposition of pipe if it kinks during installation;
  - 6) guidance for the type and application of lubricants to reduce pull-through tension, if applicable;
  - 7) pipe relaxation time period, if applicable;
  - 8) guidance for use of field-fittings that reside in host pipe, including pipe and installed field-fitting clearance with host pipe.
- b) Pull-length calculations and determination of bell hole locations shall be conducted per manufacturer guidelines.
- c) The interior surface of host pipe shall be free of upsets that could damage the pipe (e.g., welding slag, excessive weld root penetration, dents, gouges, excessive corrosion products, weld beads for plastic pipe casing).
- d) Pulling ropes and cables shall be inspected by the installer for compliance per the equipment manufacturer or supplier guidance.
- e) Handling MBR shall not be violated during pulling operation.
- f) The final pull-through layout shall not violate operating MBR.



- g) If wire rope is used as the pull line, a swivel should be installed to prevent the wire rope from applying torque to the pipe as it is pulled during installation.
- h) An axial tensile load indicator system that provides a real-time readout of axial pulling during installation should be used. Tension-limiting devices may also be used. Alternatively, the manufacturer or installer shall demonstrate by calculation that the maximum axial tensile load will not be exceeded, subject to agreement by the purchaser. The actual or calculated axial tensile load shall be recorded and retained by the end user per Section 10.
- i) A sufficient amount of pipe shall be pulled past the bore exit hole to allow for pipe relaxation per manufacturer guidance and to allow for 360° visual inspection of the pipe cover, as agreed between the manufacturer and purchaser.
- j) Pipe shall be evaluated per visual inspection guidelines and inspection criteria provided by the manufacturer.
- k) Pipe shall be suitably restrained at both ends of the host pipe to prevent pressure- or temperature-induced expansion loads or deformation beyond allowable limits during operation.
- l) The manufacturer shall provide guidance for how to retrieve, repair, or replace the pipe in case of damage during installation.

### 7.3.5 Surface Lay Installations

The following provisions shall apply to products used in surface lay applications:

- a) The manufacturer shall provide installation guidelines, including:
  - 1) pipe restraint requirements;
  - 2) guidance for the support of field-fittings, if applicable;
  - 3) types and acceptable spans between pipe rack supports, including recommendations for support to pipe interface materials, if applicable.
- b) The installer shall verify ground condition to prevent damage to pipe. Pipe shall be laid clear of any surface obstructions (trees, shrubs, rocks) that could wear against the pipe.
- c) Where surface lay pipe crosses a road, devices shall be installed as specified during the pipeline layout planning phase to allow vehicles to cross the pipeline without damage or impact to the pipe or vehicle. Road crossings shall be large enough to hold the pipe and field-fittings and shall freely accept the pipe or field-fitting diameter without creating point loads or creating abrasion damage during operation. At a minimum, the road crossing design shall consider the following:
  - 1) structural strength: the road crossing shall be engineered and constructed with sufficient strength to handle the expected external loads and clearance for crossing traffic;
  - 2) placement: road crossings near intersections and curves shall provide sufficient distance to allow roadway traffic to safely use the road crossing;
  - 3) markings: load warning signs should be posted on roads as needed and pipeline crossings should be clearly marked with flags or other indicators.

### 7.4 Joining

The following requirements apply to joining:

- a) The manufacturer shall specify and the installer shall document key process parameters for joining.

- b) The manufacturer shall provide maintenance guidance for tools required for proper installation.
- c) The installer shall properly inspect the condition of joining equipment and address maintenance requirements of joining equipment prior to initiating the joining process.
- d) Only field-fittings and tools (e.g., for crimping and swaging) from the pipe manufacturer shall be used for joining.
- e) Only joining equipment (e.g., for crimping and swaging) specified by the pipe manufacturer shall be used.
- f) For field-fittings that require welding to adjacent metallic pipe, pipe should be welded to the field-fitting before joining the field-fitting to the spoolable pipe. If welding after joining is necessary, the manufacturer shall specify and the installer shall comply with all measures to prevent damage to the spoolable pipe (e.g., length requirements, temperature controls, pipe angles).
- g) The installer shall conduct the following activities to prepare the pipe and field-fittings for joining:
  - 1) Verify the compatibility of the pipe and field-fitting in accordance with manufacturer specifications and purchase order.
  - 2) Verify the field-fittings are free of defects or damage that would compromise pipeline integrity, in accordance with manufacturer acceptance criteria.
  - 3) Inspect the pipe for anomalies or damage in accordance with manufacturer acceptance criteria.
  - 4) Prepare pipe end(s) to receive the field-fitting in accordance with manufacturer installation guidelines.
- h) Joining shall be performed according to the pipe manufacturer's procedures and documented per a manufacturer-provided checklist.

## **8 Post-installation Visual Inspection**

### **8.1 After Unspooling**

Following unspooling, but before pipe burial, the installer and purchaser or purchaser's agent shall perform visual inspection per the manufacturer-specified checklist to:

- a) identify any area that has violated operating MBR (e.g., with radius templates);
- b) identify exterior damage to pipe (e.g., kinks, dents, ovalization, gouges, etc.);
- c) identify any additional factors listed on the manufacturer checklist.

Non-conformances observed during visual inspection shall be corrected or repaired per manufacturer guidelines. Visual inspection records shall be documented by the purchaser or purchaser's agent and retained by the end user per Section 10.

### **8.2 After Field-fitting Installation**

Following field-fitting installation (before or after burial), the purchaser or purchaser's agent shall perform an inspection per the manufacturer checklist to:

- a) identify damage to field-fittings;
- b) confirm that annulus venting components (vent valves, tubing), as applicable, are properly installed per manufacturer recommendations and that venting components are free of obstructions;

- c) ensure compliance with a manufacturer-specified length of straight pipe run from each end connection;
- d) check for alignment between adjacent pipe, field-fitting, and pipe;
- e) verify that the connection between field-fittings and adjacent pipe meets the manufacturer's or end user's assembly requirements;
- f) identify any thermal damage to pipe caused by hot work during field-fitting installation.

Non-conformances observed during inspection shall be corrected or repaired per manufacturer guidelines. Inspection records shall be documented by the purchaser or purchaser's agent and retained by the end user per Section 10.

## 9 Testing

### 9.1 Hydrostatic Pressure Testing

The following requirements apply to hydrostatic pressure testing of installed pipe:

- a) Hydrostatic pressure testing of field installed pipe shall be undertaken by the purchaser or purchaser's agent to verify the integrity of pipe and field-fittings.
- b) Hydrostatic pressure testing shall be conducted with certified equipment and knowledgeable personnel.
- c) Suitable safety precautions shall be taken, considering the stored energy and fluid temperature involved in pressure testing.
- d) The manufacturer shall be consulted for suitability and guidance for pneumatic pressure testing, including applicable safety precautions.
- e) The manufacturer shall provide guidelines for pressure testing, including:
  - 1) minimum and maximum test pressures, and pressurization/depressurization rates;
  - 2) requirements for conditioning pipe prior to the hydrostatic pressure test;
  - 3) minimum hydrostatic pressure test hold duration;
  - 4) specific guidance for testing complex systems (e.g., movement restrictors at connections to steel pipe);
  - 5) guidance for adequate restraint during testing;
  - 6) guidance for dealing with the effect of elevation changes on the applied test pressure;
  - 7) guidance for interpretation of pressure decreases from pipe relaxation;
  - 8) requirements for pigging used in hydrostatic testing activities such as dewatering, if applicable.
- f) Regulations, if applicable, shall define test pressures and durations. The hydrostatic pressure test plan shall be reviewed with the manufacturer if the testing parameters are in excess of manufacturer specifications.
- g) Connections between spoolable and adjacent pipe shall be included in the hydrostatic pressure test. If it is not possible to include adjacent rigid pipe, exclusion shall be documented and justified.
- h) The test pressure shall be limited by the lowest-rated component in the system being tested.

- i) Hydrostatic pressure testing should be conducted after backfilling as backfilling can cause damage to pipe. The manufacturer may request that field-fittings are left exposed until after the hydrostatic pressure test has been completed. If the hydrostatic pressure test is performed before backfilling, a leak test of the annulus, if applicable, should be performed after backfilling to verify integrity of the cover.
- j) For field-fittings using thermosetting resins, hydrostatic pressure testing shall be performed only after minimum cure time.
- k) Repair after hydrostatic pressure test failure shall be performed by the installer in accordance with the manufacturer's recommendations and followed by additional hydrostatic pressure test to verify repair.
- l) All hydrostatic test records, including records of failed hydrostatic pressure tests and related information including but not limited to test parameters, failure description, installation conditions, and photographs, shall be documented by the party conducting the hydrostatic pressure testing operation and retained by the end user per Section 10.

## 9.2 Leak and Flow Testing of Annulus

If applicable, the manufacturer shall provide guidance for testing cover integrity and adequate annular flow.

If applicable, the purchaser or purchaser's agent shall verify cover integrity after field-fitting installation.

If applicable, repair after leak and flow test failure shall be performed in accordance with the manufacturer's recommendations and followed by additional tests to verify repair.

If applicable, leak and flow testing of annulus records shall be recorded by the party conducting testing and retained by the end user per Section 10.

## 9.3 Corrosion Prevention

The manufacturer shall provide guidance for mitigating corrosion of field-fittings (e.g., by installation of cathodic protection, use of CRA field-fittings, field applied protective coatings, or viscoelastic tape).

If applicable, the purchaser or purchaser's agent shall verify performance of the cathodic protection system.

If applicable, the manufacturer shall provide guidelines for proper placement of welded anode lead wires to the field-fitting.

## 10 Records

Records of pipeline layout and installation activities shall be retained by the end user. The records shall include:

- a) receiving visual inspection records per 5.3.d);
- b) pipeline layout plan per Section 6;
- c) tension measurements or calculations per Sections 7.2 c), 7.3.2 c), or 7.3.4 h), if applicable;
- d) any non-conformances to the pipeline layout plan or manufacturer's requirements that occur during installation activities per Section 7, including disposition of non-conformances;
- e) after-unspooling inspection records per 8.1;
- f) field-fitting installation records per 8.2;
- g) hydrostatic pressure testing records per 9.1;

h) leak and flow testing of annulus records per 9.2, if applicable.

The records shall be retained by the end user for a minimum of five years or as required by customer, legal, or other applicable requirements, whichever is longer. The end user should consider retaining records for the full life of the pipeline if relevant to the integrity management of the pipeline.

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