

GENERAL SPECIFICATION

PIPELINES - RISERS

GS EP PLR 322

**Reinforced Thermoplastic Polyethylene pipes for
Pipelines
Design, Manufacturing, Construction and Integrity
Management**

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1. Scope

This specification defines the Company general requirements for:

- Design
- Pipe manufacturing and inspection
- Field joining and inspection
- Field laying and final inspection

of Reinforced Thermoplastics Polyethylene (RTPE) pipelines.

This specification shall be used in conjunction with a Project Particular Specification (PPS) to be made for purpose detailing the additional tests and requirements or the possible modifications to the present specification, based on the special design conditions of the pipeline project.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
1/ Design	
API RP 15S	Qualification of spoolable reinforced plastic line pipe
EN 1555-1	Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE) - Part 1: General
ISO 9080	Determination of the long term hydrostatic strength of thermoplastics materials in pipe form by extrapolation
2/ Manufacturing	
ISO 4427-2	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply
ISO 4437	Buried polyethylene (PE) pipes for the supply of gaseous fuels - Metric series - Specifications
3/ Testing	
ASTM D1652	Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2196	Standard Test Method for Rheological Properties of Non Newtonian Materials
ASTM D2343	Standard Test Method for Tensile Properties of Glass Fiber Strands, Yarns, and Rovings Used in Reinforced Plastics

Reference	Title
ASTM D2471	Standard Test Method for Gel Time and Peak Exothermic Temperature of Reactivity Thermosetting Resins
ASTM D3849	Standard Test Method for Carbon Black-Morphological Characterization of Carbon Black Using Electron Microscopy
ASTM D570	Standard Test Method for Water Absorption of Plastics
EN 12099	Plastics piping systems. Polyethylene piping materials and components. Determination of volatile content.
ISO 1133-1	Plastics — Determination of the melt mass-flow rate (MFR) and melt volume flow rate (MVR) of thermoplastics — Part 1: Standard method
ISO 1183 (Parts 2; 3)	Plastics - Methods for determining the density of non-cellular plastics
ISO 11357-6	Plastics - Differential scanning calorimetry (DSC) Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT).
ISO 18553	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds.
ISO 13953	Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint
ISO 15512	Plastics - Determination of water content
ISO 6964	Polyolefin pipes and fittings - Determination of carbon black content by calcination and pyrolysis - Test method and basic specification
4/ Construction and installation	
ISO 12176 (Parts 1; 2; 3; 4)	Plastics pipes and fittings - Equipment for fusion jointing polyethylene systems - Parts 1; 2; 3; 4
5/ Non destructive examination	
EN 462-1	Non destructive testing - Industrial radiographic film - Part 1: Image quality indicators (wire type), determination of image quality value
ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel - General principles
ISO 11699-1	Non-destructive testing - Industrial radiographic film — Part 1: Classification of film systems for industrial radiography

Reference	Title
5/ Quality assurance	
ASTM D2992	Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
ASTM D3839	Standard Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe
ASTM D445	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
EN 10204	Metallic products - Types of inspection documents
EN 12201	Plastics piping systems for water supply, and for drainage and sewerage under pressure - Polyethylene (PE)
EN 13067	Qualification testing of welders - Thermoplastics welded assemblies
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organizations

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
Not applicable	

3. General

3.1 Definition

Throughout this specification, the following definitions apply:

Purchaser	Means the Company or the Supplier (as applicable), which have placed the Purchase Order to the Manufacturer.
Inspector	Means the Company's representative(s) of member(s) from an Inspection Agency duly appointed by the Company or the Supplier (as applicable) to act as its representative(s) for the purpose of the contract.
Approval	Means the authorisation in writing given by the Company to the Supplier to proceed with the performance of a specific part of the work without releasing in any way the Supplier from any of its obligations or liabilities under the contract or at law; Approve, Approved and Approval shall be construed accordingly.
May	Used to indicate that a provision is optional.

Shall	Used to indicate that a provision is mandatory.
Should	Used to indicate that a provision is not mandatory but is recommended as good practice.
PPS	Designates the Project Particular Specification.
Batch	Material produced in the same manufacturing run.
Spool	Length of RTPE pipe manufactured with the same batch of raw materials and without any intermediate inline coupler.
Lot	The term LOT applies to pipe fittings in the following. A lot represent the number of fittings of the same dimensions and produced with the same materials.

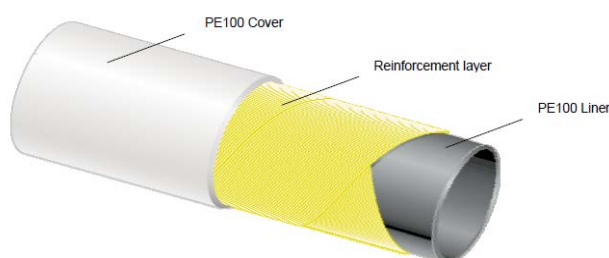
3.2 Quality Assurance / Quality Control

1. The Suppliers shall operate a Quality Assurance system in accordance with [ISO/TS 29001](#), approved by a recognised authority. The Quality Assurance Manual shall be submitted prior to the start of work.
2. Four weeks prior to the commencement of pipe manufacturing, the Supplier shall prepare and submit a Quality Control Plan which describes the inspections to be performed during the supply of pipes. The Quality Control Plan shall set forth "witness", "hold", "review", and "random" points.
3. Just before production starting, mill QA Representative accompanied by Inspector shall check at every production and inspection station, that the relevant working instructions and procedures are available, complete, conform to the procedures agreed by Company or to Company specification requirements. A report shall be issued by Supplier, signed by Inspector and enclosed with the final dossier.

3.3 Project Particular Specification (PPS)

The following information shall be provided in the PPS (see also proposed table in **Appendix 1**):

1. Effluent chemical composition (it is reminded that RTPE products are currently qualified only for water applications)
2. Type of pipe: three layers HDPE reinforced pipe (see sketch below extracted from www.soluforce.net)



3. Grade: only PE100 or PE80 shall be considered for liner and cover
4. Field layout drawings including isometrics

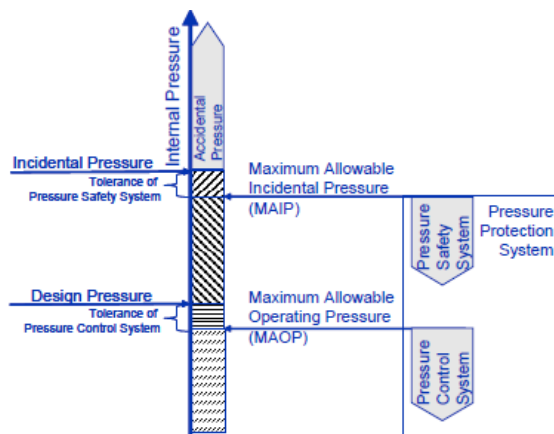
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5. Maximum Allowable Incidental Pressure (definition is given on the following sketch) which will stands for “system design pressure” for design calculations



6. Design temperature: technical feasibility for $T_{\text{design}} > 65^{\circ}\text{C}$ shall be previously checked with Manufacturers
7. Design life: shall not exceed 20 years
8. Pipe geometry (OD)
9. Live (LL) and dead (DL) loads if any
10. Occurrence of cyclic loading and corresponding amplitude (F_{min} , F_{max} and ΔF) and frequency (f)
11. Joining: combination of butt welding (for inner layer welding) and electrofusion welding is required
12. Requirements for fire performance (if any)
13. Requirements for static electricity check (if any)
14. Requirements for low temperature application (if relevant)
15. Requirement for beam deflection test (mainly for unburied pipelines).

4. Inspection by the Company

- All procedures shall have prior approval of TEC/PLR Company department. All qualification tests shall take place under the supervision of the Inspector.
- The Supplier shall notify the Inspector sufficiently in advance to enable him to be present at qualification tests and at all other tests or stages of manufacture subject to acceptance in accordance with this specification.
- The Supplier shall ensure that the Inspector has full and free access to all parts of the Mill during all fabrication and inspection stages.
- The Inspector shall ensure that materials and pipes are fabricated in accordance with all the specified requirements and Company's approved procedures.

5. At pipe mills: offices, workshops, storage yards etc., information on paper and/or in computers (procedures, working instructions, data, records, tracking system, etc.) concerning the order manufacturing and inspection, shall be made fully available and comprehensible to Inspector reading. Where the mill country language is not English, all these information shall be written in double language, i.e. mill country language and English language.
6. It shall be made available in the Inspector office, a free access to the mill computerized system:
 - Tracking system of production and inspection
 - All data and results of mechanical tests, NDE results...
 - Any other information considered pertinent by the Inspector for his monitoring
 - Computer, software environment compatible with the mill software, software interface where necessary for data exploitation with EXCEL shall be made available by the Supplier
 - Company's Inspector shall be provided with facilities/equipments for sending and receiving faxes, communicating by emails and fast Internet access.
7. Inspection by the Inspector shall be carried out during pipe production in order to avoid any special or additional handling. Inspection will be made in such a manner to avoid delay in pipe production insofar as the pipes which are presented to him meet the specified requirements.
8. The Inspector shall finalize (when required) its inspection by the application of a special stamp (to be mutually agreed with the Manufacturer).
9. The Inspector shall notify the Company without delay of any difficulty, irregularity, problem or delay likely to occur during pipe production.
10. The Company reserves the right to check tests carried out by the Supplier. For this purpose, the Company may request the delivery of the corresponding samples or specimens to be analyzed in an independent laboratory chosen by the Company.

5. Design

Design shall be performed following [EN 12201](#) requirements and the following recommendations. The pipe Manufacturer is required to check design calculations and to propose changes when it is required.

5.1 Maximum pressure rating

The maximum pressure rating shall be determined as required in [API RP 15S](#).

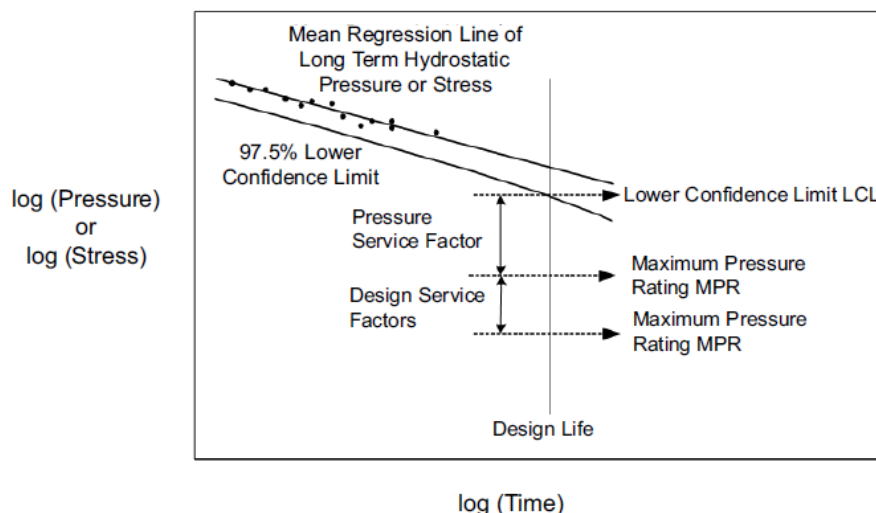
The maximum incidental pressure shall be strictly below:

$$MAIP < \frac{LTHP(LCL) \text{ at } 65^{\circ}C}{psf * dsf}$$

Where,

- LTHP (LCL) is the 97.5% low confidence limit of the long term hydrostatic pressure for the design life determined from tests at $T \geq T_{\text{design}}$ (see sketch below). **Regression curve of**

the proposed product shall be established from tests duration up to minimum 10,000 hours.



Please note that no extrapolation of regression curve to higher temperature is allowed and the following requirements shall apply:

- Regression curve at 20°C can be used for design temperature $\leq 20^\circ\text{C}$
- For $20^\circ\text{C} < T_{\text{design}} \leq 65^\circ\text{C}$, the regression curve at 65°C shall be used unless a regression curve at $T_{\text{rc}} \geq T_{\text{design}}$ is available (in this case the regression curve at T_{rc} can be used)
- Design at higher temperature is allowed only if a full regression curve is available at $T_{\text{rc}} \geq T_{\text{design}}$ (in this case the regression curve at T_{rc} can be used).
- “psf” is the pressure design factor given by the manufacturer.
- “dsf” is the service design factor given in the following table.

Application	Water injection	Oil	Gas
Design coefficient	0.5	Not applicable for instance*	Not applicable for instance*

* can be discussed on a case by case basis.

An additional service design factor might have to be taken into account in case of cyclic loading for example. In this case, the additional service design factor shall be given in the PPS.

6. Pipe manufacturing

6.1 Approval of Supplier's procedures

The Supplier shall submit the following documentation for review and approval at least one month prior to commencement of fabrication.