SYNTHETIC PIPE SYSTEMS FOR PRESSURISED HOT AND COLD WATER

CONTENTS

1. CHAPTER 1 - PURPOSE OF THE GUIDE AND AREA OF APPLICATION

1.1. Purpose

The purpose of this guide is to set out the information required for applications for Technical Appraisals or Technical Application Documents (DTA) for ''Piping Systems'' comprising pipes made of synthetic materials and metal or synthetic fittings, for single-layer or multi-layer pipes.

Hereafter, the term ''Technical Appraisal'' may be replaced by ''DTA''.

"Piping System" means the combination of pipe(s) and fittings and any tool(s) used to assemble them, with all these components clearly identified, as well as the specific rules for the design and construction of water networks.

There are 3 main types of Piping System:

- Type 1:
  For pipes Technical Appraisal written for a type of pipe combined with fittings covered by a Technical Appraisal.
  For fittings: Technical Appraisal written for a type of fitting combined with pipes covered by a Technical Appraisal.
- Type 2:
  For pipes: Technical Appraisal for a piping system consisting of a type of pipe combined only with one or more types of specific fittings defined in the same Appraisal (the combination with other fittings or pipes, whether covered by a Technical Appraisal or otherwise, is not included).
  For fittings: Technical Appraisal for a piping system consisting of a type of fitting combined only with one or more types of specific pipes(s) defined in the same Appraisal (the combination with other pipes or fittings, whether covered by a Technical Appraisal or otherwise, is not included).
- Type C: Technical Appraisal for a type of pipe combined with specific fittings defined in the same Appraisal and with other fittings covered by Technical Appraisals.
  Specifications for the main products are defined in the following standards:
  - PP piping systems: NF EN ISO 15874,
  - PEX piping systems: NF EN ISO 15875,
  - PB piping systems: NF EN ISO 15876,
  - PVC-C piping systems: NF EN ISO 15877,
  - Multilayer piping systems: NF EN ISO 21003,
  - PE- RT piping systems: NF EN ISO 22391.

The criteria examined during appraisal notably include the description and identification of the products, the performances presented and a description of the evidence used to check these performances.

1.2. Area of application

This Guide covers the applications defined in the table below, taken from ISO 10508 standard.

Application classes 2, 4 and 5 comply with ISO 10508. According to this standard, regardless of the application class selected, the system must also be able to transport cold water at 20°C for 50 years and a working pressure of 10 bars.

It also covers the "chilled water" application class, for air-conditioning and cooling systems with a minimum temperature of 5°C.

Classes	Service mode	Maximum operating level	Accidental operation	Typical application
Class 2	70 °C 49 years	80 °C 1 year	95 °C 100 hours	Domestic hot and cold water supply
Class 4	20 °C - 2.5 years and 40 °C - 20 years	70 °C 2.5 years	100 °C 100 hours	Low-temperature radiators, underfloor heating

	and 60 °C - 25 years			
Class 5	20 °C - 14 years and 60 °C - 25 years and 80 °C - 10 years	90 °C 1 year	100 °C 100 hours	High-temperature radiators

2. CHAPTER 2 - SYSTEM DESCRIPTION

2.1. General

2.1.1. Identity - Area of use (see internal regulations)

- Applicant name and address;
- Manufacturer name and address: head office and plant(s);
- Commercial name for product and associated products;
- Definition of area of use: classes and corresponding working pressures (pD).

2.1.2. History - References

Details of any production history (list of work sites) and/or production volume (in France or Europe) must be provided.

2.2. Definition of constituent materials (see Internal Regulations)

All the constituents of the products must be disclosed, in confidence or otherwise, to the Rapporteur of the Specialised Group.

The origin, nature and percentage by mass and/or dimensions of the layers and their tolerances must be detailed.

2.3. Product definition

It includes:

- the range of products manufactured (diameters, thicknesses, tolerances) (see Appendix B);
- the different possible pipe colours;
- the delivery condition of the pipes (straight bars and/or coils, bare pipes and/or pre-coated pipes);
- the list of associated pipes or fittings and any accessories;
- All the settings and tools needed to install the assemblies must be provided and detailed (e.g. radial crimping or welding assemblies);
- a list of the main physical, physicochemical and mechanical characteristics;
- the inspections (methods, frequency, specifications) carried out during incoming inspection, during production and in the factory laboratory;
- product marking;
- description of the manufacturing process from receipt of raw materials to the finished product;
- packaging and storage conditions for transport.

2.4. Limits on use

Any limits on use in the areas under consideration must be indicated.

2.5. Health compliance

Proof of compliance with health regulations must be provided.

2.6. Installation description

A full description of the rules for installing the system must be provided for each class of application considered.

Precautions for use must be clearly indicated.

2.7. Commercial use of the product

The applicant must specify how the product will be used commercially.

3. CHAPTER 3 - TECHNICAL FILE

This sub-file must include all the reports, interpretations or deductions through which the applicant intends to provide proof of the advertised properties, for those that are demonstrable, and documentary evidence for those that are subject to assessment.

The test methods and specifications used to assess the file are given in Appendix A and Appendix B respectively.

3.1. General characteristics

Depending on the type of product/material and the applications claimed, the following properties may be required:

- Nature of the materials used in the range of pipes, fittings and accessories and their commercial names;
- Density;
- Melt flow index (for non-crosslinked polyolefins);
- Vicat softening temperature (for non-crystalline products);
- Degree of Crosslinking (for PEX);
- Hot shrinkage (pipes) ;
- Impact resistance (for PPR pipes DN ≤ 25mm);
- Charpy impact resistance (for PPR pipes DN ≥ 32mm);
- Heat resistance (fittings);
- Pressure resistance;
- Regression curves for materials in pipe form (pipes and fittings);
- Oxidation resistance;
- Opacity;
- Expansion coefficient;
- Thermal conductivity;
- Delamination resistance (multilayer pipe);
- Crush resistance (ducts);
- Duct sealing;
- Any other specific characteristics of the submitted product (e.g. expansion coefficient, thermal conductivity) must be proved.

3.2. Assessment of service life - durability

3.2.1. Service life factors to consider

Possible application classes are defined in paragraph 1.2.

The operating pressures (pD) to be considered are listed in Chapter 1 of Appendix B.

For these applications, pressure variations, apart from water hammer, are considered to have a negligible influence on ageing.

Other factors to consider relate to the ambient environment.

These are radiation and, in particular, UV radiation, the presence of air and the oxygen it contains (oxidation phenomena).

The manufacturer must also indicate any precautions to be taken when using these products in contact with coating materials and paints.

3.2.2. Testing these factors

3.2.2.1. Long-term hydrostatic resistance of pipes by extrapolation

The regression curves requested in the reference standards must be drawn up by a laboratory accredited to standard NF EN ISO 17025 by a member body of the EA (European Accreditation).

3.2.2.2. Oxidation data

Oxidation data must be provided by the applicant, showing the effectiveness and non-migration of the antioxidant system. This may involve testing after accelerated ageing in air and water at high temperature. These data will be verified by an accredited laboratory, notably by differential thermal analysis tests after ageing.

3.3. Suitability for use

Suitability for use is assessed with reference to the regulations in force and current installation practice in France, including the minimum range required for an installation and the corresponding experimental system checks.

In the case of press fittings, the entire range of tools on offer must be represented.

In the case of types A and C, a representative sample of the different types of connection or different types of pipe will be tested.

3.3.1. Composition of the range

3.3.1.1. Breadth of range

The proposed range must enable all or part of the networks to be installed in the following sections:

Application class	Description	Section of work	Minimum range
Class 2	Domestic hot and cold water supply	Individual installation	3 DN among 12 to 32
		Collective installation	1 DN mini > 32
Class 4	Low-temperature radiators, underfloor heating	Individual radiators	3 DN among 12 to 32
		Collective radiators	1 DN mini > 32
		Wall-mounted radiators	1 DN minimum
Class 5	High-temperature radiators	Individual installation	3 DN among 12 to 32
		Collective installation	1 DN mini > 32

For all the diameters listed above, the range must include fittings for connection to the network (threaded or tapped to the gas pitch).

In the case of straight bar pipes, the range offered must also include elbows, tees, sleeves, reducers and plugs for each diameter.

3.3.2. Experimental circuits

The experimental circuits (see chapter 6 of appendix B) will be made up of pipes and fittings of different diameters representative of the range offered by the applicant.

In the case of press fittings, the entire range of tools on offer must be represented.

3.3.3. Fittings and assemblies

In addition to the tests on experimental circuits used to check suitability for use, tests of resistance to pressure cycles must also be carried out. (PVC-C).

Appendix A - Test methods

1 Standardised test methods

The table below shows the main standardised test methods used. They are derived in particular from European standards 15874 to 15877, 21003 and 22391 on PP, PEX, PB, PVC-C, Multilayer and PE-RT.

Reference text	Type of test
NF EN ISO 10147	Crosslinked polyethylene (PEX) pipes - Estimation of the degree of crosslinking by determination of the gel content
NF EN 712	Resistance to pull-out under constant longitudinal force
NF EN 713	Leaktightness under internal pressure of assemblies subjected to bending
NF EN 727	Determination of vicat softening temperature
NF EN ISO 3127	Determination of resistance to external blows - Round-the-clock method
ISO 9854	Determination of Charpy impact properties
NF EN ISO 580	Injection-moulded thermoplastics fittings - Methods for visually assessing the effects of heating
NF EN ISO 1167	Determination of resistance to internal pressure
NF EN ISO 1133	Determination of the melt mass-flow rate
NF EN ISO 2505	Thermoplastics pipes - Longitudinal reversion
NF EN ISO 3126	Plastics piping systems – Plastic components - Measurement of dimensions
NF EN ISO 7686	Plastics pipes and fittings - Determination of opacity
NF EN ISO 9080	Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation
NF EN ISO 19893	Resistance of mounted assemblies to temperature cycling
NF EN ISO 13056	Leaktightness under vacuum
NF EN ISO 19892	Resistance of joints to pressure cycling
ISO 17454	Multilayer pipes - Adhesion of the different layers by using a pulling rig
NFT 54-094	Resistance to pressure cycles

2 Additional test methods

2.1 Determination of opacity

This test is carried out under the conditions defined by standard NF EN ISO 7686, with the use of an integrating sphere.

2.2 Determination of oxidation induction time (OIT)

This test is carried out under the conditions set out in standard NF EN 728 of April 1997.

2.3 Analysis of the chemical composition of metal fittings and components

This check is carried out in accordance with CETIM internal procedures T-9818 and T-9932.

Appendix B - Specifications

Specifications are defined in the reference standards for the products covered by the guide (chapter 1), and are supplemented by the following characteristics, inherent in the uses and practices common in France, as specified in particular by the application procedures described in the national forewords to the European standards.

1. Operating pressures by application class

Application classes	Operating pressures
Class 2	6 bars
	10 bars
Class 4 (underfloor heating only)	4 bars
	6 bars
Class 4 (Low-temperature radiators)	6 bars
	10 bars
Class 5	6 bars
Chilled water	10 bars

2. Dimensional pipe characteristics - Choice of series in accordance with ISO 4065 and product standards

Materials	**Pipe dimensions**
PB	Class A Serie S = 3.2 Class A Serie S = 5 *
PP-B	Class A Series S = 5 Class C (underfloor heating only)
PE-RT	
PP-R	Class A Series S = 2.5*
	Class A Series S = 5 (Chilled water)
PVC-C	Class A Series S = 4
	Class A Series S = 6.3

* By general decision: for any Technical Appraisal application for PP-R or PB, part of the range (small dimensions with small thickness for which a heat fusion weld may cause the weld to collapse), series 3.2 is only authorised by derogation and only when the assembly is carried out by heat fusion. The use of any type of mechanical fitting is prohibited.

By interpretation of the DTU 65.14, underfloor installations: heating and reversible heating, the requirements defined in this guide may be applicable to PEX, PB, PE-RT and PP pipes whose dimensions are not standardised.

In the case of externally coated pipes, the additional tolerance on the total thickness of the finished product is +0.1 mm.

3. **Determination of oxidation induction time (OIT)**

Under the test conditions of standard NF EN 728 using the isothermal method (for a product mass of 15 ± 2 mg and an oxygen flow rate of 50ml/min), the Oxidation Induction Time (OIT) must comply with the following minimum values:

- on PEX pipes: OIT = 30 min at 200°C ;
- on PB pipes: OIT = 20 min at 210°C ;
- on PP-R pipes: OIT = 20 min at 200°C ;
- on PE- RT pipes: OIT = 40 min at 200°C.

4. **Pipe oxidation resistance**

Pipes must meet one of the following specifications:

- the Oxidation Induction Time (OIT) on the sample after it has been conditioned for 500 hours in boiling water, then 100 hours in an oven at 160°C must comply with the specifications in Chapter 3 for new samples.

5. **Resistance of PVC-C fittings to alternating pressures**

Under the test conditions of standard T54-094, fittings must comply with the following specifications:

- DN < 110 mm: minimum resistance of 5000 cycles of 20/60 bars at 1 Hz;
- DN> 110 mm: minimum resistance of 2500 cycles of 20/60 bars at 0.4 Hz.

6. **Experimental heating system**

In the case of a system applying for class 5, a circuit made up of pipes and fittings representative of the range of products offered must be subjected to continuous water circulation at 110°C, under a test pressure of 4 bar, for a minimum of 1000 hours without fault.

7. **Opacity - Transmittance**

Pipes must have a transmittance of less than 14% when tested under the test conditions defined in paragraph 2.2 of Appendix A.