

EUROPEAN ASSESSMENT DOCUMENT

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KIT FOR TRANSPORT OF COLD AND HOT WATER INSIDE BUILDINGS

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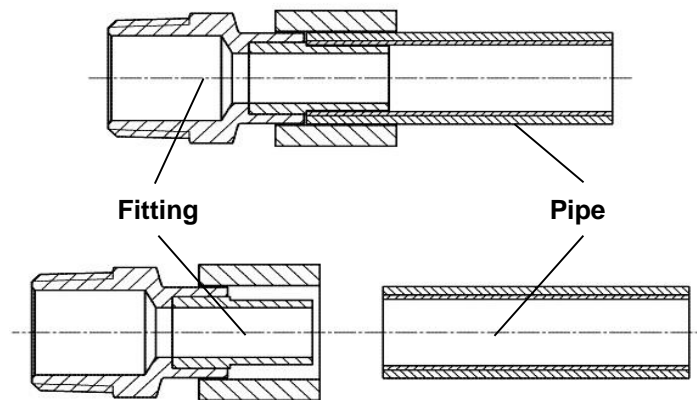
1 SCOPE OF THE EAD

1.1 Description of the construction product

The piping system consists of a

- medium transporting inner pipe made of stainless steel provided with a solid fixed smooth outer covering made of plastics and
- stainless steel/plastic composite press fittings.

Figure 1: Piping System



The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document, shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use of the construction product

1.2.1 Intended use

The kit as covered by this EAD is intended to be used for the transport of cold and hot water inside buildings.

The aspect on the characteristic "effect on the quality of water intended for human consumption" is NOT addressed neither in this document, nor in the related ETA.

Operating temperature is 70 °C with a maximum temperature of 80 °C and a malfunction temperature of 95 °C according to table 2 of EN 806-2:2005. The maximum operating pressure is 10 bar with a safety factor of 1.5 (see Table 1).

Table 1 Temperature profiles during 50 years according to EN 806-2 table 2

Application class	Operating temperature	Maximum temperature	Malfunction temperature	Typical field of application
1	60 °C for 49 years	80 °C for 1 year	95 °C for 100 h	Hot water supply (60 °C)
2	70 °C for 49 years	80 °C for 1 year	95 °C for 100 h	Hot water supply (70 °C)

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account the working life of the piping system for the intended use of 50 years when installed. These provisions are based upon the current state of the art and the available knowledge and experience.

For the kit which fulfills the conditions specified in Table 1, it can be assumed, that these are also suitable for transporting cold water for a period of 50 years at a temperature of 20 °C and an operating pressure of 10 bar.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works¹.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

¹ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the working life than referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2 shows how the performance of the piping system is assessed in relation to the essential characteristics.

Table 2 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	class
Basic Works Requirement 4: Safety and accessibility in use			
2	Pipe	2.2.2	
	Materials	2.2.2.1	
	Stainless Steel	2.2.2.1.1	level
	Plastics	2.2.2.1.2	level
	Pipe characteristics	2.2.2.2	
	Surface condition	2.2.2.2.1	level
	Dimensions	2.2.2.2.2	level
	Internal pressure resistance	2.2.2.2.3	level
	Homogeneity of the weld seam	2.2.2.2.4	level
	Delamination	2.2.2.2.5	level
	Bending behavior at low temperatures	2.2.2.2.6	level
	Behaviour under bending stress	2.2.2.2.7	level
	Thermal durability of the outer layer	2.2.2.2.8	level
3	Fitting	2.2.3	

No	Essential characteristic	Assessment method	Type of expression of product performance
	Materials	2.2.3.1	
	Stainless steel	2.2.3.1.1	level
	Plastics	2.2.3.1.2	level
	Fitting characteristics	2.2.3.2	
	Surface condition	2.2.3.2.1	level
	Dimensions	2.2.3.2.2	level
	Internal pressure resistance	2.2.3.2.3	level
4	Piping system	2.2.4	
	Vacuum resistance	2.2.4.1	level
	Pressure cycling resistance	2.2.4.2	level
	Thermal cycling resistance	2.2.4.3	level
	Internal pressure resistance	2.2.4.4	level
	Pull-out resistance	2.2.4.5	level
	Bending resistance	2.2.4.6	level
	Leak path protection functionality	2.2.4.7	level

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

2.2.1 Reaction to fire

The reaction to fire of the pipe - excluding the stainless steel/plastic composite press fitting parts - shall be tested according to EN ISO 11925-2 and classified according to the standard EN 13501-1.

The plastic composite parts of the press fitting are very thin. Therefore it may be assumed that these parts in connection with the pipe do not contribute to fire growth or to the fully developed fire and they have no influence to smoke hazard. In the context of this end use application of the stainless steel/plastic composite press fittings can be considered to satisfy any reaction to fire requirements.

The stainless steel parts of the press fitting are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the EC Decision 96/603/EC (as amended) without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

Therefore, the performance of the press fitting is A1.

2.2.2 Pipe

2.2.2.1 Materials

2.2.2.1.1 Stainless steel

The conformity of the supplied stainless steel is assessed according to EN 10088-2, clause 7.2.

2.2.2.1.2 Plastics

The conformity of the supplied plastic materials is assessed by means of an inspection certificate 3.1 according to EN 10204. Clean own re-processable material which is the same as the virgin material may be added to that virgin material. External re-processable material shall not be used.

2.2.2.2 Pipe characteristics

2.2.2.2.1 Surface condition

In order to declare the uniformity of the pipe surfaces the inner and outer pipe surface and if present of a weld seam shall be verified by visual inspection of the manufacturer.

A test report on the visual inspection of the inner and outer surface of the pipe and if present a weld seam, shall describe at least the surface roughness, the occurrence of scratches, voids and other surface irregularities.

2.2.2.2.2 Dimensions

The dimensions of the pipe shall be verified by means of technical drawings as provided by the manufacturer.

The dimensions of the pipe shall be measured in accordance to EN ISO 3126. The conformity of the measured dimensions and the technical drawings as provided by the manufacturer shall be assessed.

2.2.2.2.3 Internal pressure resistance

The internal pressure resistance of the pipe shall be verified.

The internal pressure resistance of the pipe is assessed in accordance with EN ISO 1167-1, EN ISO 1167-2 and the conditions given in Table 3.

A test report shall state, whether the time to failure of the pipe exceeds 5 minutes or not.

Table 3: Test conditions for internal pressure resistance

temperature [°C]	pressure [bar]	length []	specimens []
23	40	> 500	3

2.2.2.2.4 Homogeneity of the weld seam

The homogeneity of the weld line is characterized by shape, absence of holes and other irregularities limiting the performance of the system. Because of the statistical occurrence of such irregularities, the homogeneity of the weld seam shall be monitored continuously during the welding process.

The continuous homogeneity of the weld seam is assessed according to EN ISO 15549. The used reference sample according to EN ISO 15549 clause 8.4 shall be clearly described in the test report.

2.2.2.2.5 Delamination

The peel force F_{pull} causing delamination between the stainless steel and plastic parts of the pipe shall be verified.

The delamination shall be assessed by means of a test report according to ISO 17454, clause 9. Deviating from ISO 17454 the number of test pieces may be reduced from 10 to 5 pieces. The assessment shall be performed with pipes of two different conditions (a) and (b):

- (a) without any further conditioning (as manufactured)
- (b) thermal cycling conditioning in accordance with EN 12293 using the test parameters given in EN ISO 21003-5, clause 5.5, table 5

2.2.2.2.6 Bending behaviour at low temperatures

The correlation between bending radius and the occurrence of irregularities like folds, cracks or buckles shall be verified.

The correlation between bending radius and the occurrence of irregularities is assessed by bending tests using a form/template as shown in EN ISO 3503, figure 1. Comparison testing shall be performed with the smallest bending radius and a reference showing the most critical pattern of irregularities on the inner surface of the pipe, both as specified by the manufacturer.

For the purpose of this EAD, the sequence of bending tests is defined as follows:

1. 3 straight test specimens per nominal dimension shall be conditioned for > 2 hours at 0 (zero) °C ± 1 °C
2. Each specimen shall be bent to an angle of > 90° at the specified smallest radius using the form/template shown in EN ISO 3503, figure 1
3. Relax the bent specimen for > 30 seconds
4. The specimens following step 3 shall be bent in the reverse direction for > 20°.

All of the above steps 2 – 4 shall be performed within one minute. Following bending step 4, the bent pipe shall immediately be visually compared with the specified reference.

The test report shall state at least

- whether the bent samples show more critical irregularities compared to the reference or not,
- the smallest bending radius as specified by the manufacturer and
- the reference showing the most critical pattern of irregularities on the inner surface of the pipe as specified by the manufacturer.

2.2.2.2.7 Behaviour under bending stress

The correlation between bending radius and internal pressure resistance shall be verified.

The correlation between bending radius and resistance to internal pressure is assessed by using a form/template as shown in EN ISO 3503, figure 1. The test shall be performed with the smallest bending radius as specified by the manufacturer. The bent pipe shall be exposed to internal pressure resistance according to EN ISO 1167-1.

For the purpose of this EAD, the sequence of bending tests is defined as follows:

1. 3 straight test specimens per nominal dimension shall be conditioned for > 2 hours at 23 °C ± 2 °C
2. Each specimen shall be bent to an angle of > 90° at the specified smallest bending radius using the form/template shown in EN ISO 3503, figure 1
3. Relax the bent specimen for > 30 seconds
4. The specimens following step 3 shall be bent in the reverse direction for > 20°.

All of the above steps 2 – 4 shall be performed within one minute. Following step 4, the bent pipe shall be exposed to internal pressure resistance according to EN ISO 1167-1 and the test conditions given in Table 4.

The test report shall state at least

- whether the bent samples exposed to internal pressure exceed 5 minutes time to failure or not
- the smallest bending radius as specified by the manufacturer.

Table 4: Test conditions for behaviour under bending stress

temperature [°C]	pressure [bar]	specimens []
23	40	3

2.2.2.2.8 Thermal durability of the outer layer

The thermal durability of the pipe outer layer is verified by oven ageing.

The thermal durability of the pipe outer layer is assessed by exposing the complete pipe to a test procedure according to EN ISO 21003-2, Annex C.

EN ISO 21003-2, Annex C, clause C.4 is not relevant within this EAD. The related test report shall only state the occurrence or absence of cracks after completing the testing procedure.

2.2.3 Fitting

2.2.3.1 Materials

2.2.3.1.1 Stainless steel

The conformity of the supplied stainless steel is assessed according to EN 10088-2, clause 7.2, EN10088-3, clause 7.2 or EN 10283, clause 8.

2.2.3.1.2 Plastics

The conformity of the supplied plastic materials is assessed by means of an inspection certificate 3.1 according to EN 10204.

2.2.3.2 Fitting characteristics

2.2.3.2.1 Surface condition

The inner and outer surface of the fitting shall be verified by visual inspection.

A test report on the visual inspection of the inner and outer surface of the fitting describing at least the surface roughness, the occurrence of scratches, voids and other surface irregularities.

2.2.3.2.2 Dimensions

The dimensions of the fitting parts shall be verified by means of technical drawings as provided by the manufacturer.

The dimensions of the fitting parts shall be measured in accordance to EN ISO 3126. The conformity of the measured dimensions and the technical drawings as provided by the manufacturer shall be assessed.

2.2.3.2.3 Internal pressure resistance

The fitting parts made of plastic and intended to for the transport of cold and hot water shall be verified for their internal pressure resistance.

The internal pressure resistance of the plastic fitting parts intended for the transport of cold and hot water shall be assessed in accordance to EN ISO 21003-3, clause 8. A test report shall at least state whether the test conditions given in EN ISO 21003-3, clause 8.3, table 2, are met or not.

2.2.4 Piping system

2.2.4.1 Vacuum resistance

The vacuum resistance of the piping system is verified in accordance to EN 12294.

The vacuum resistance of the piping system is assessed by means of a test report in accordance to EN 12294, clause 7, which shall state at least, whether the test parameters given in EN ISO 21003-5, clause 5.7, table 7, are met or not.

2.2.4.2 Pressure cycling resistance

The pressure cycling resistance of the piping system is verified in accordance to EN 12295.

The pressure cycling resistance of the piping system is assessed by means of a test report in accordance to EN 12295, clause 7, which shall state at least, whether the test parameters given in EN ISO 21003-5, clause 5.6, table 6, are met or not.

2.2.4.3 Thermal cycling resistance

The thermal cycling resistance of the piping system is verified in accordance to EN 12293.

The thermal cycling resistance of the piping system is assessed by means of a test report in accordance to EN 12293, clause 7, which shall state at least whether the test parameters given in EN ISO 21003-5, clause 5.5, table 5, are met or not.

2.2.4.4 Internal pressure resistance

The internal pressure resistance of the piping system shall be verified according to this EAD.

The internal pressure resistance of the piping system according to this EAD is assessed after preparation in accordance to EN ISO 1167-1 and EN ISO 1167-2 and the test conditions given in Table 5.

The test report shall at least state, whether the time to failure of the piping system exceeds 1.000 hours or not.

Table 5: Test conditions for internal pressure resistance

temperature [°C]	pressure [bar]	specimens []
95	25	3

2.2.4.5 Pull-out resistance

The pull-out resistance of the piping system is verified in accordance to EN ISO 3501.

The pull-out resistance of the piping system is assessed by means of a test report in accordance to EN ISO 3501, clause 8, using the test parameters given in EN ISO 21003-5, clause 5.4, table 4.

2.2.4.6 Bending resistance

The bending resistance of the piping system is verified in accordance to EN ISO 3503.

The bending resistance of the piping system is assessed by means of a test report in accordance to EN ISO 3503, clause 8, using the test parameters given in EN ISO 21003-5, clause 5.3, table 3. The test reports shall state at least whether a test pressure of 25 bars is exceeded or not.

2.2.4.7 Leak path protection functionality

If present, it shall be verified whether a piping system with leak path protection functionality and press fittings, not yet pressed, are leaking or not and whether the same setup but with subsequently pressed fittings is leaking or not.

If applicable, the leak path protection functionality of fittings shall be assessed with a test setup consisting of different fitting components (e.g. elbows, tees, couplings). In total 20 fitting components have to be connected with pipe and pressure tested. The assembly may not slip apart due to unpressed fitting components.

First, this assembly is tested under water with pressurized air using the test pressures given in Table 6. Each test pressure is held for > 10 seconds.

The test report shall state at least the average air bubble number per second at each test pressure. Second, the fitting components in the already tested assembly will be pressed. This assembly is then filled with water.

The test report shall also state, whether the pressed, water-filled assembly shows leaking when being pressurized according to the test conditions given in Table 7.

Table 6: Test conditions for leak path protection, unpressed

medium	pressure	criteria
air	110 mbar	one or more rising air bubbles per second
air	1,0 bar	one or more rising air bubbles per second
air	6,0 bar	one or more rising air bubbles per second
water	1,0 bar	one or more falling drops per second

water	6,0 bar	one or more falling drops per second
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Table 7: Test conditions for leak path protection, pressed

temperature [°C]	pressure [bar]	time [h]
23	25	1

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 Systems of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 1999/472/EC. The system is: 4

In addition with regard to reaction to fire the systems are 3 or 4. System 1 as foreseen in the above mentioned Decision 1999/472/EC for certain cases is not relevant because

- the pipes are to be classified according to the standard EN 13501-1 based on tests according to EN ISO 11925-2 (see 2.2.1) which lead at the best to class E, and
- the fittings are covered by the Decision 1996/603/EC, as amended (see 2.2.1).

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the piping system in the procedure of assessment and verification of constancy of performance are laid down in Table 8.

Table 8 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) including testing of samples taken at the factory in accordance with a prescribed test plan					
1	Reaction to fire	2.2.1.1	Compliance with the requirements of the ETA	CS ¹⁾	One evaluation per material
2	Conformity of the supplied materials with the specification agreements between manufacturer and supplier	2.2.2.1.1 2.2.2.1.2 2.2.3.1.1 2.2.3.1.2	yes / no	continuous	Each delivery
3	Conformity of the surface conditions between manufacturer's references and samples and observations	2.2.2.2.1 2.2.3.2.1	yes / no	continuous	documentation once per batch
4	Conformity of the dimensions between manufacturer's specifications and measurements	2.2.2.2.2 2.2.3.2.2	yes / no	1	once per week or batch
5	Conformity of the weld seam homogeneity between manufacturer's reference and measurements	2.2.2.2.4	yes / no	continuous	documentation once per batch

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
6	Performance of the pipe in respect to internal pressure resistance and delamination	2.2.2.2.3 2.2.2.2.5 a	performance value	1	once per week or batch
7	Conformity of the pipe's bending behaviour between manufacturer's reference and measurements	2.2.2.2.6	yes / no	1	once per week or batch
8	Performance of the plastic fitting parts in respect to internal pressure resistance at 20°C	2.2.3.2.3	performance value	1	once per week or batch
9	Checking the marking	Visual examination			once per day

1) CS : Conform EN(-ISO) standard

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment is of relevance.

EN 806-2	Specification for installations inside buildings conveying water for human consumption - Part 2: Design.
EN ISO 1167-1	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids -- Determination of the resistance to internal pressure -- Part 1: General method.
EN ISO 1167-2	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids -- Determination of the resistance to internal pressure -- Part 2: Preparation of pipe test pieces.
EN ISO 3126	Plastics piping systems - Plastics components - Determination of dimensions.
EN ISO 3501	Plastics piping systems - Mechanical joints between fittings and pressure pipes - Test method for resistance to pull-out under constant longitudinal force
EN ISO 3503	Plastics piping systems - Mechanical joints between fittings and pressure pipes - Test method for leaktightness under internal pressure of assemblies subjected to bending
EN 10088-2	Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.
EN 10088-3	Stainless steels - Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.
EN 10204	Metallic products - Types of inspection documents.
EN 10283	Corrosion resistant steel castings
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test.
EN ISO 11925-2	Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test - Technical Corrigendum 1.
EN 12293	Plastics piping systems - Thermoplastics pipes and fittings for hot and cold water - Test method for the resistance of mounted assemblies to temperature cycling.
EN 12294	Plastics piping systems - Systems for hot and cold water - Test method for leaktightness under vacuum.
EN 12295	Plastics piping systems - Thermoplastics pipes and associated fittings for hot and cold water - Test methods for resistance of joints to pressure cycling;
EN 13501-1	Fire classification of construction products and building elements --Part 1: Classification using data from reaction to fire tests;
EN ISO 15549	Non-destructive testing - Eddy current testing - General principles.
ISO 17454	Plastics piping systems - Multilayer pipes - Test method for the adhesion of the different layers using a pulling rig.
EN ISO 21003-2	8+A1Multilayer piping systems for hot and cold water installations inside buildings - Part 2: Pipes.
EN ISO 21003-3	Multilayer piping systems for hot and cold water installations inside buildings - Part 3: Fittings.
EN ISO 21003-5	Multilayer piping systems for hot and cold water installations inside buildings - Part 5: Fitness for purpose of the system.