

CONNECTION HOSES**Technical document 10-01**

Technical document 10-01 **rev. 02**
18/01/2021

CSTB (Centre Scientifique et Technique du Bâtiment), a public establishment supporting innovation in construction, has four key activities—research, expertise, assessment and dissemination of knowledge—organised to meet the challenges of ecological and energy transition in the construction sector. Its fields of expertise include construction materials, buildings and their integration into districts and towns.

With over 900 employees, its subsidiaries and networks of national, European and international partners, the CSTB group works for all the stakeholders in the construction sector to advance building quality and safety.

Any reproduction or representation, in whole or in part, by whatever means, of the pages published in this technical document and executed without the authorisation of CSTB is illegal and constitutes a counterfeit. The only authorised exceptions are 1) reproductions strictly reserved for the use of the typist and not intended for any collective use or 2) analyses and short quotations required due to the scientific or informational nature of the work in which they appear (article L.122-5 of the Intellectual Property Code). This document has been drawn up under the initiative and direction of CSTB, which has brought together the opinions of all interested parties

© CSTB

MODIFICATION HISTORY

Revision No.	Application date	Modifications
00	20/12/2018	Creation of this Technical Document
01	20/06/2019	<ul style="list-style-type: none"> - Addition of references to test standards - Addition of follow-up tests: <ul style="list-style-type: none"> - Cyclic pressure endurance - Corrosion resistance - Addition of test specifications for elastomers
02	18/01/2021	<p>-§ 1.2 : Modification of the test standards – The EN 15079 standard is replaced by the CSTB's test protocol inspired by this same standard.</p> <p>-§ 3.2 : Specification thickness of elastomer panel : 2 mm ± 0,2 mm instead of 2,5 mm.</p> <p>-§ 4.1 : Modification of legend n ° 1 becoming legend n ° 5 concerning "heating cooling".</p> <p>-§ 4.4 : Packaging marking.</p> <p>-§ 7 : Sampling of 20 hoses per DN (formerly 10) + Addition of sending a label.</p>

Table of Contents

1. STANDARDS	5
1.1. Product standards	5
1.2. Test standards (methods)	5
2. Types of hoses	7
3. CERTIFIED CHARACTERISTICS AND TEST METHODS	8
3.1. Certified characteristics	8
3.2. Test methods and specifications	9
4. MARKING	10
4.1 Product marking	10
4.1.1 Finished products.....	10
4.1.2. Inner pipes.....	10
4.2. QB marking model.....	11
4.3. Commercial documents	11
4.4. Packaging	12
5. CHECKS PERFORMED BY THE MANUFACTURER.....	13
5.1 Statement of results - inspection registers.....	14
6. MONITORING ARRANGEMENT BY CSTB	15
6.1. Tests performed during follow-up at CSTB.....	15

Connection hoses with a tube made of an elastomer or synthetic material covered in a metal, plastic or synthetic fibre braid

1. STANDARDS

1.1. Product standards

- NF EN 13618: Flexible hose assemblies in drinking water installations - Functional requirements and test methods.

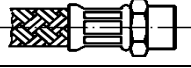
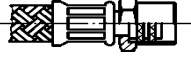

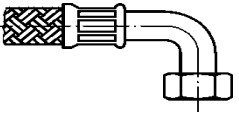

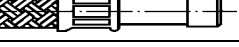
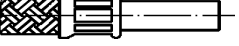

1.2. Test standards (methods)

- NF EN ISO 1167-1: Thermoplastic pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure – Part 1: General method.
- NF EN ISO 1167-2: Thermoplastic pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure – Part 2: Preparation of pipe test pieces.
- NF EN ISO 1167-3: Thermoplastic pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure – Part 3: Preparation of components.
- NF T 46-047: Rubber and rubber products – Determination of composition of vulcanizates and uncured compounds by thermogravimetry.
- NF EN ISO 10147: Pipes and fittings made of crosslinked polyethylene (PE-X) – Estimation of the degree of crosslinking by determination of the gel content.
- NF EN 728: Plastics piping and ducting systems – Polyolefin pipes and fittings – Determination of oxidation induction time.
- NF EN ISO 3126: Plastics piping systems – Plastics components – Determination of dimensions.
- NF EN ISO 9227: Corrosion tests in artificial atmospheres – Salt spray tests.
- NF ISO 48: Rubber, vulcanized or thermoplastic – Determination of hardness.
- NF EN ISO 868: Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness).
- NF ISO 37: Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties.
- NF ISO 1817: Rubber, vulcanized or thermoplastic – Determination of the effect of liquids.
- ISO 9924-1: Rubber and rubber products – Determination of the composition of vulcanizates and uncured compounds by thermogravimetry – Part 1: Butadiene, ethylene-propylene copolymer and terpolymer, isobutene-isoprene, isoprene and styrene-butadiene rubbers.

- ISO 9924-2: Rubber and rubber products – Determination of the composition of vulcanizates and uncured compounds by thermogravimetry – Part 2: Acrylonitrile-butadiene and halobutyl rubbers.
- NF ISO 815-1: Rubber, vulcanized or thermoplastic – Determination of compression set – Part 1: At ambient or elevated temperatures.
- **CSTB test protocol inspired by standard NF EN 15079: Analysis by optical spark emission spectrometry**

2. Types of hoses

Hoses of all types are fitted with metal end fittings defined below:

Type	Designation / Standard	Shape
1	Fixed male fitting compliant with EN ISO 228-1 or ISO 7-1	
2	Rotating male fitting compliant with EN ISO 228-1 or ISO 7-1	
3	Straight female fitting compliant with EN ISO 228-1 or ISO 7-1	
4	Female elbow fitting compliant with EN ISO 228-1	
5	Double-taper compression fitting	
6	Fitting with short, smooth tube with shoulder	
7	Fitting with short, smooth tube without shoulder	
8	Male fitting with metric thread	
9	Special applications	In the positive assessment of suitability for use (Technical Appraisal)

3. CERTIFIED CHARACTERISTICS AND TEST METHODS

3.1. Certified characteristics

The characteristics listed in the table below conform to the specifications indicated in the positive assessment of suitability for use (Technical Appraisal).

The certified characteristics of the Connection hoses application are the following:

Certified characteristics	Domestic distribution	Domestic distribution Heating and cooling circuit	Heating and cooling circuit
Hydrostatic pressure resistance	X	X	X
Water hammer resistance (up to and including DN 15)	X	X	
Characteristics of elastomer or synthetic materials	X	X	X
Determination of composition of vulcanizates	X	X	X
Spectrometric analysis of brass fittings	X	X	X
Cyclic pressure endurance	X	X	X
Corrosion resistance	X	X	X

The specifications and configuration of the follow-up tests are defined in the tables below.

3.2. Test methods and specifications

The conditions for verification of the characteristics certified at CSTB are referred to in the following table.

These verification conditions may be supplemented by specific measures given in the positive assessment of suitability for use (Technical Appraisal, etc.)

Certified characteristics	Test standards	Specifications
Hydrostatic pressure resistance	NF EN 13618-B4 and NF EN 1167 1- water in the air	Family A: 90°C 3xPN – 1 hr after conditioning at 90°C -168 hr -12 bar
		Families B and C: 110°C 3xPN after conditioning at 90°C -168 hr -12 bar
Water hammer resistance	NF EN 13618- B6	Families A and B: 5/50 bar - 90°C - 0.5 hertz 200 cycles up to and including DN 15 after conditioning at 90°C -168 hr -12 bar
Characteristics of elastomer	NF EN 681-1	<ul style="list-style-type: none"> - hardness - tensile strength at failure - elongation at failure - compression set - volume changes in water <p style="color: red; text-align: center;">Thickness specification of the elastomer panel: 2.5 mm</p>
Spectrometric analysis of brass fittings	Test protocol CSTB inspired by standard NF EN 15079 (July 2015)	Compliance of the brass grade defined in the Technical Appraisal
Determination of composition of vulcanizates	NF T 047	Identification by thermogravimetry
Tests on synthetic materials	PEX pipe, NF EN ISO 10147	Gel content – PEX \geq 60%
	Polyolefin pipe NF EN 728	OIT \geq 20 minutes Temperature 210°C
	Silicone or TPSIV pipes NF EN ISO 868	Hardness (see Technical Appraisal)
Cyclic pressure endurance	NF EN 13618 - B5	5/30 bar - 90°C - 0.5 hertz - 25,000 cycles after conditioning at 90°C -168 hr -12 bar
Corrosion resistance	NF EN 13618 - B8	EN 248

4. MARKING

4.1 Product marking

4.1.1 Finished products

The marking placed on the crimping ring for flexible hoses and on the end fittings or tube for semi-rigid hoses, must include at least the following information:

- the manufacturer's identity (name or symbol) and/or the commercial name,
- the nominal diameter,
- the production date (at least the year),
- the QB logo or, failing this, the word "QB" only and in full (2),
- the last two parts of the certificate number (1)
- the nominal temperature (4) For family A, the marking "70°C" is authorised instead of "90°C" if the products are marked "EN 13618",
- the number of the positive assessment of suitability for use (Technical Appraisal, etc.) (4),
- the **compulsory statement "heating"/"cooling" (5)**
 - hoses designed only for heating and cooling applications and for which the ACS is not mandatory.

4.1.2. Inner pipes

Pipes must be marked indelibly and continuously (each hose must have at least 1 marking on the inner pipe).

The marking must include at least the following elements:

- the manufacturer's identity (name or symbol),
- the production date (at least the month and year),
- an item code or reference (3),
- for the sanitary application, the acronym "ACS" (optional).

If the inner elastomer pipe has its own certificate and only in this case, the marking must be supplemented by the QB logo followed by the last two parts of the certificate number.

(1) *If this number cannot be placed on the crimping ring or the end fitting, it must be added to the hose by means of an adhesive label.*

(2) *By way of derogation from the QB mark usage guide*

(3) *Left to manufacturers' discretion but enabling traceability of the raw material, these identification elements and their meaning must be submitted to CSTB.*

(4) *If this number cannot be placed on the crimping ring or the end fitting, it must be added on the hose by means of an adhesive label or on the primary packaging.*


(5) *If this mention cannot appear on the crimping ring or the end fitting, it must be added to the hose via an adhesive label or on the primary packaging.*

4.2. QB marking model

Representation of the QB certification identification logo:




Example 1:

xxxx - DN 10 – 90°C - 14.1/15-000_V1  35 – 000_V1 – 18


Name, DN xx, Temperature, Technical Appraisal number, QB logo, the last two parts of the certificate number, Year

Example 2:

xxxx - DN 10 – 90°C –  - 18


Name , DN xx, Temperature, QB logo, Year, *(the Technical Appraisal number and last two parts of the certificate number are provided on an adhesive label or on the primary packaging).*

Example 3:

xxxx - DN 10 – 90°C - 14.1/15-000_V1  35 – 000_V1 – 18 - **heating**

Name , DN xx, Temperature, Technical Appraisal number, QB logo, The last two parts of the certificate number, Year, **heating application only (mandatory for hoses without an ACS).**

Example 4:

xxxx - DN 10 – 90°C –  -18 - **heating**

Name, DN xx, Temperature, QB logo, Year, *(the Technical Appraisal number and last two parts of the certificate number are provided on an adhesive label or on the primary packaging),* **heating application only (mandatory for hoses without an ACS).**


4.3. Commercial documents

In commercial documents, the references to the positive assessment of suitability for use and the Certificate must only appear beside the certified products and in the format shown in the below example:

- Reference to the Technical Appraisal:

No.14.1/18- 000_V1 ← (Atec version no.)*
(GS No.) / (Year of formulation) - (Atec order number).

- Reference to the certificate:

 **35- 000_V1** ← (Atec version no.)
(Plant No.) - (last 3 figures of the Technical Appraisal).

Any other presentation must be submitted to CSTB for approval.

N.B. Marking rule for ATEC *Vx: marking of the ATEC number in the version *Vx is optional, the original ATEC number is sufficient.

4.4. Packaging

Packaging must include the number of the positive assessment of suitability for use (Technical Appraisal, etc.) and the *QB* logo followed by the last two parts of the certificate number associated with the manufacturer's ID or the product's trade name.

If the hoses are part of a packaging including other products (for example: safety group kit), the *QB* logo may appear alone on the packaging.

5. CHECKS PERFORMED BY THE MANUFACTURER

The checks performed by the manufacturer and the measuring of the various characteristics take place in accordance with the inspection plan as well as the operating procedures defined in the reference standards indicated in paragraph 1 of this technical document.

For components and systems

The nature and frequency of the inspections vary according to the nature of the materials, the components and the production procedures. Refer to the positive assessment of suitability for use (Technical Appraisal, etc.) for more details.

Inspections conducted on the raw materials

Inspections conducted on raw materials can be performed in the manufacturer's laboratory or be the result of a quality assurance system obtained from suppliers.

Inspections conducted in production

In-production inspections are conducted according to the procedures defined by the manufacturer.

Inspections conducted on finished products

Inspections conducted by the holders on finished products and their frequency vary from one product to another. Refer to the positive assessment of suitability for use (Technical Appraisal, etc.) for more details.

Flexible hoses and semi-rigid hoses:

- appearance,
- dimensions and hose length,
- tightness (and/or)
- pressure resistance,
- Tensile strength.

Elastomers for pipes used for making connection hoses:

Tests on elastomer panels:

- Hardness:

EPDM	Butyl
ISO 48	ISO 48
New hardness: see Technical Appraisal	New hardness: see Technical Appraisal
Variation after 7 days at 125°C: Between -5 and +8 IRHD	Variation after 7 days at 125°C: Between -5 and +8 IRHD

- Tensile properties:

EPDM	Butyl
ISO 37	ISO 37
variation after 7 days at 125°C Rr < -20%	variation after 7 days at 125°C Rr < -30%
At between -40% and +10%	At between -40% and +10%

- Compression set:

EPDM	Butyl
ISO 815 after 24h at 125°C ≤ 20%	ISO 815 after 24h at 125°C ≤ 95%

- Volume changes in water:

EPDM	Butyl
ISO 1817 variation after 7 days at 95°C between -1% and +8%	ISO 1817 variation after 7 days at 95°C between -1% and +20%

5.1 Statement of results - inspection registers

The results of inspections for each product together with the date of execution of the inspection must be systematically recorded by a means left up to the manufacturer to decide (registers with numbered leaves, sheets, electronic records, etc.).

This means must allow immediate access and availability (detachable copies, photocopies, print-outs of electronic data, etc.) of the following information relative to the raw materials, finished products and the procedures implemented:

- the identification of the batch,
- origin of the materials and the specified characteristics,
- results of inspections and tests,
- parameters used in the case of procedures,
- any observations to which the inspections gave rise,
- any corrective and preventive action.

6. MONITORING ARRANGEMENT BY CSTB

6.1. Tests performed during follow-up at CSTB

Tests performed half-yearly

Tests for hoses in the 'Domestic hot or cold water distribution' family

Test	Specifications
Hydrostatic pressure resistance	90°C 3xPN 1 hr after conditioning at 90°C - 168 hr - 12 bar
Water hammer resistance	5/50 bar - 90°C - 0.5 hertz - 200 cycles after conditioning at 90°C - 168 hr - 12 bar
Analysis by spark optical emission spectrometry on fittings	Brasses declared by the manufacturer and listed in the positive assessment of suitability for use (Technical Appraisal)
Cyclic pressure endurance	5/30 bar - 90°C - 0.5 hertz - 25,000 cycles after conditioning at 90°C -168 hr -12 bar
Corrosion resistance	EN 248

Tests for hoses in the 'Heating and cooling circuits' family

Test	Specifications
Hydrostatic pressure resistance	110°C 3xPN 1 hr after conditioning at 90°C - 168 hr - 12 bar
Water hammer resistance	5/50 bar - 90°C - 0.5 hertz - 200 cycles after conditioning at 90°C - 168 hr - 12 bar
Analysis by spark optical emission spectrometry on fittings	Brasses declared by the manufacturer and listed in the positive assessment of suitability for use (Technical Appraisal)
Cyclic pressure endurance	5/30 bar - 90°C - 0.5 hertz - 25,000 cycles after conditioning at 90°C -168 hr -12 bar
Corrosion resistance	EN 248

Tests specific to the type of interior pipe

Type	Tests
Elastomers (EPDM, Butyl)	Elastomer characteristics and identification by thermogravimetry
PEX	Gel content
Polyolefins	TIO
Silicones and TPSiV	Hardness

7. SAMPLING FOR TESTS AT CSTB

Samples of 20 hoses per DN (number of diameters sampled according to the size of the manufactured range) :

- up to 4 DN in the range: 1 DN sampled
- 5 DN or more in the range: 2 DN sampled

When 2 DN's are sampled, it is important that at least one of the two DN's is \leq DN 15, so that the water hammer test is carried out every six months.

For a range of hoses having 2 types of braid (stainless steel, plastic and textile): Alternate sampling of the different types of braid for each 6-month period.

The production date of the samples sent must appear on the sampling sheet.

An adhesive label (whose marking requirements are defined in §4) must be stuck on the sampling sheet which one must be enclosed with the package with the samples.