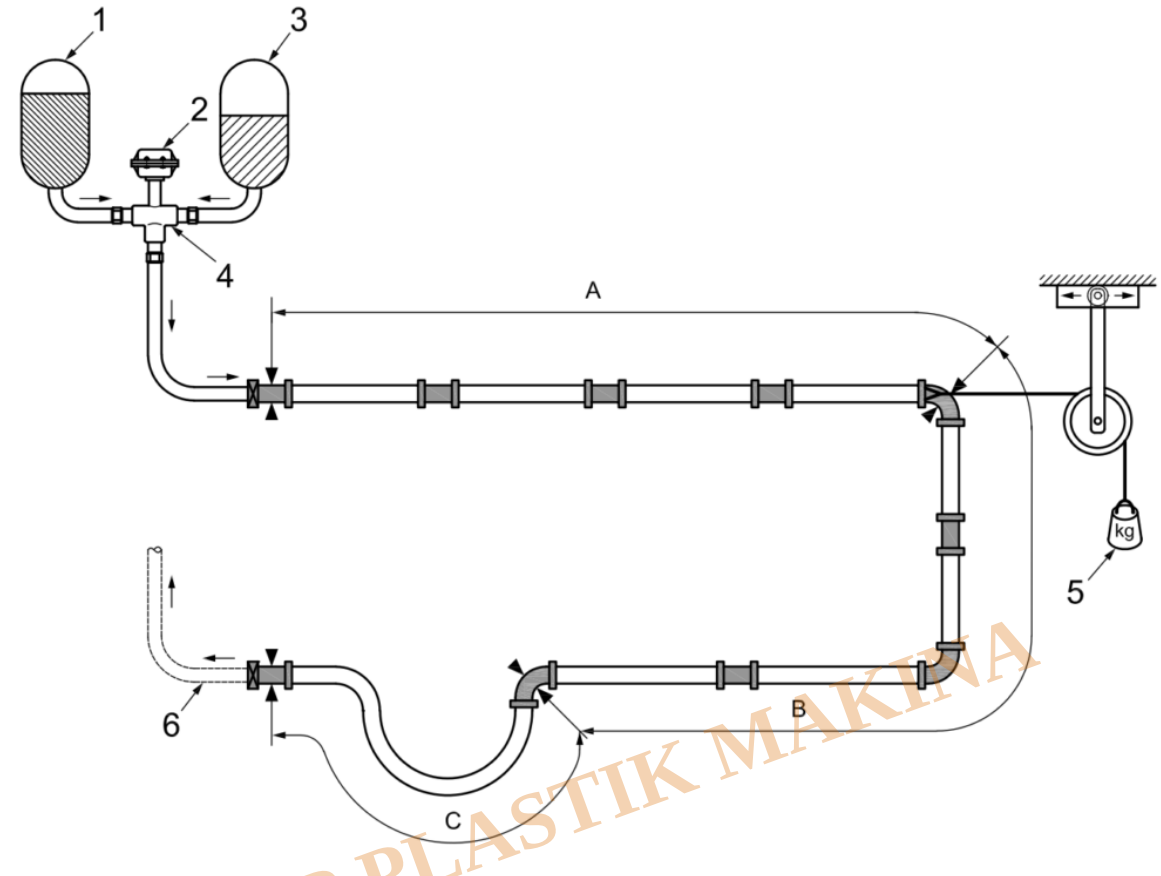
BS ISO 19893 Thermoplastics Pipes and Fittings for Hot and Cold Water — Test Method for the Resistance of Mounted Assemblies to Temperature Cycling / Testing Equipment

Description

2 Principle

A test assembly of pipes and fittings (see Figure 1) is subjected to temperature cycling by the passage of
water under pressure using hot and cold water alternately, for a specified number of cycles.
While being subjected to temperature cycling, parts of the assembly of pipes and fittings are maintained under tensile stress and/or flexural strain using static clamps.
During and after the test, the assembly is monitored for signs of leakage.
NOTE It is assumed that the following test parameters are set by the reference product standard (i.e. the standard making reference to this International Standard):
a) the test temperatures (see 3.1, 3.2 and 6.1);
b) the duration of a complete cycle and each part of the cycle (see 3.1, 3.2 and 6.1);
c) the test pressure (see 3.6 and 6.1);
d) the tensile stress (see 3.8 and 5.3);
e) the bending radius (see Clause 4 and Figures 1 and 2);
f) the total number of cycles, including the first five cycles (see 6.2 and 6.3).



Key

1	hot water reservoir	6	return pipe to reservoir (alternative test assembly)
2	alternation equipment	A	branch A (anchored section)
3	cold water reservoir	B	branch B (section free to expand and contract)
4	balancing valves	C	branch C (bent pipe section)
5	tensioning device		

Figure 1 — Test assembly of temperature cycling test

3 Apparatus

3.1 Cold water source, capable of all of the following:
a) supplying the water volume necessary to maintain the temperature variation throughout the test piece
within the specified maximum difference (see 6.2);
b) supplying this water at the lowest temperature specified in the reference product standard with an accuracy of +- 2°C;
c) supplying this water for the duration of at least each cycle as specified in the reference product standard. If not specified otherwise in the reference product standard, to an accuracy of the duration time
of +1….0 minute(s).

3.2 Hot water source, capable of all of the following:
a) supplying the water volume necessary to achieve the required water velocity (see 6.2);
b) supplying this water at the highest temperature specified in the reference product standard to an

accuracy of +- 2°C;

c) supplying this water for the duration of at least each cycle as specified in the reference product standard. If not specified otherwise in the reference product standard, to an accuracy of the duration time
of +1…0 minute(s).
3.3 Balancing valves, capable of regulating the water velocity as necessary to maintain the temperature variation throughout the test piece within the specified maximum difference (see 6.2).
3.4 Alternation equipment, capable of achieving each change in hot and cold water temperatures at the inlet within 1 min.
3.5 Thermometer(s), capable of checking conformity to the specified test temperatures (see 3.1, 3.2 and
6.2).
3.6 Pressure gauge(s) and a device, for regulating the water pressure in the test assembly at the pressure specified in the reference product standard to an accuracy of +- 0,5 bar1)
(+- 0,05 MPa), except for brief pressure spikes, which can occur if the temperature of water is changed.
3.7 Supporting brackets, as appropriate, comprising anchor brackets (fixed points) capable of restraining
piping components and guide brackets, capable of supporting piping components without inhibiting longitudinal movement (see Clause 5 and Figure 1).
3.8 Tensioning device, capable of applying the required initial tensile stress (see 5.3).
NOTE This is to simulate stress which can be induced in any fixed pipe section as a result of contraction caused by cooling to temperatures below those prevailing during installation.

4 Test assembly

The test assembly shall comprise an assembly of pipes and fittings jointed and clipped in accordance with
Figure 2 and the manufacturer’s recommended practice, except as follows.
If, while following the manufacturer’s recommended practice, the pipe cannot be bent to the configuration shown for branch C in Figure 2, for instance, because of the material, wall thickness and/or outside diameter of the pipe, branch C shall conform to Figure 3.
The test assembly as shown in Figure 2 shall include the following:
a) for branch A: at least three prestressed pipes linked by straight connectors, stressed in accordance with
5.3, where the free length of such combination shall be (3 000 +- 100) mm;
b) for branch B: at least two straight pipes, each free to move and having a minimum free length of (300 +- 10) mm;
c) for branch C: at least one bend (see Figure 2 or 3, as appropriate) supported by ends. The free length of
pipe shall either be in the range of 27dn to 28dn, where dn is the nominal diameter of the pipe or alternatively, shall have a length which enables the minimum pipe bending radius, as stated by the manufacturer, to be formed. Unless specified by the product standard or agreed between parties, the bending radius shall be 6de.

5 Preparation of the test assembly

5.1 If applicable, subject the test assembly to preconditioning in accordance with the recommendations

of
the manufacturer(s) of piping components and/or the jointing components (e.g. adhesive).
5.2 Condition the test assembly at a room temperature of (23 +- 2) °C for at least 1 h.
5.3 Prestress branch A of the test assembly to the tensile stress specified in the reference product standard and fix in position the free ends of the stressed branch.

EXAMPLE Dimension of the pipe: 32 × 3 mm.

Tensile stress according to the reference product standard: $\sigma_t = 2$ MPa $= 2$ N/mm^2. Equation for the circular ring area:

$$A = 0{,}25 \times \pi \times \left[{d_n}^2 - (d_n - 2e)^2 \right]$$

where

A circular ring area, expressed in square millimetres (mm^2);

d_n outside diameter, expressed in millimetres (mm);

e wall thickness, expressed in millimetres (mm).

$$A = 0{,}25 \times \pi \times \left[(32)^2 - (32 - 6)^2 \right] = 273\,\text{mm}^2$$

Equation for the tensile force:

$$F = \sigma_t \times A = 2 \times 273 = 546\ \text{N}$$

This is equal to an applied mass of 56 kg.

Unfasten the fixed straight connector on the downstream side of branch A, charge branch A with the tensile force of 546 N (e.g. with a weight of 56 kg) on a bowden cable. Tighten the fixed straight connector again. From that moment, the prestress in branch A is preset and the weight can be removed.
5.4 Fill the test assembly with cold water so that all air is expelled.

6 Procedure
6.1 Start the sequence of cycles, of cold and then hot water, specified in the reference product standard [see b) of the note to Clause 2] under the conditions of pressure and temperatures applicable to the class of service conditions as specified in the reference product standard. The ambient air temperature, Ta,air, during the whole testing time shall be: 20 °C =< Ta,air < 35 °C.
Unless specified otherwise in the relevant system standard referring to this particular diameter range, the
following settings shall be used for diameters smaller than 63 mm:

— duration of a complete cycle: $30\ ^{+2}_{0}$ minutes;

— duration of the cold cycle: $15\ ^{+1}_{0}$ minutes;

— duration of the hot cycle: $15\ ^{+1}_{0}$ minutes;

— total number of cycles: 5 000.

6.2 Within the first five cycles:
a) adjust the balancing valve(s) so that for the remainder of the test, during each part of the water cycle where a temperature is to be maintained, the temperature drop between the inlet and the outlet of the test assembly is less than 5 °C;
b) perform any tightening or adjustment of joints necessary to eliminate any leakage;
c) adjust the pressure control devices so that for the remainder of the test, the specified test pressure is maintained.
6.3 Throughout and following completion of the number of cycles specified by the reference product standard, inspect all joints for any signs of leakage, e.g. scaling. If leakage occurs, record the type and position of the leakage and when it was observed.
6.4 In the test arrangement for diameters larger than 63 mm (depicted in Figure 4), the cycle times are usually increased in order to maintain a stable and reproducible temperature profile. If problems occur with the temperature control, especially with the alternation time (? 1 min at the inlet) or the constancy of the temperature, alternative durations shall be used. Unless specified otherwise in the relevant system standard referring to this particular diameter range, the following settings shall be used for diameters larger than 63 mm:

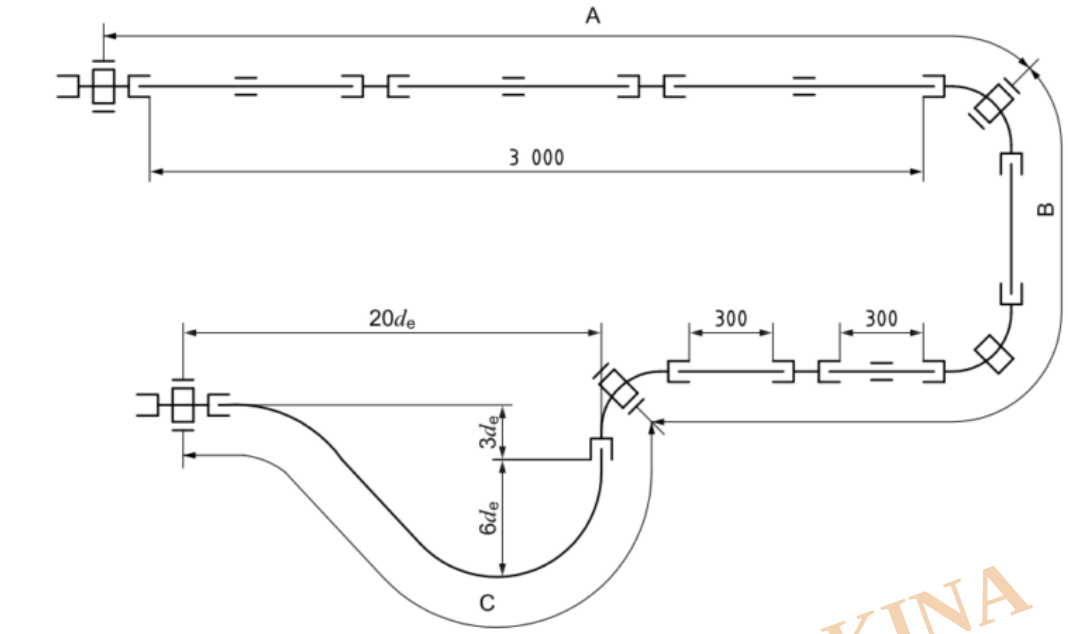
— duration of a complete cycle: $60\ ^{+2}_{0}$ minutes;

— duration of the cold cycle: $30\ ^{+1}_{0}$ minutes;

— duration of the hot cycle: $30\ ^{+1}_{0}$ minutes;

— total number of cycles: 2 500.

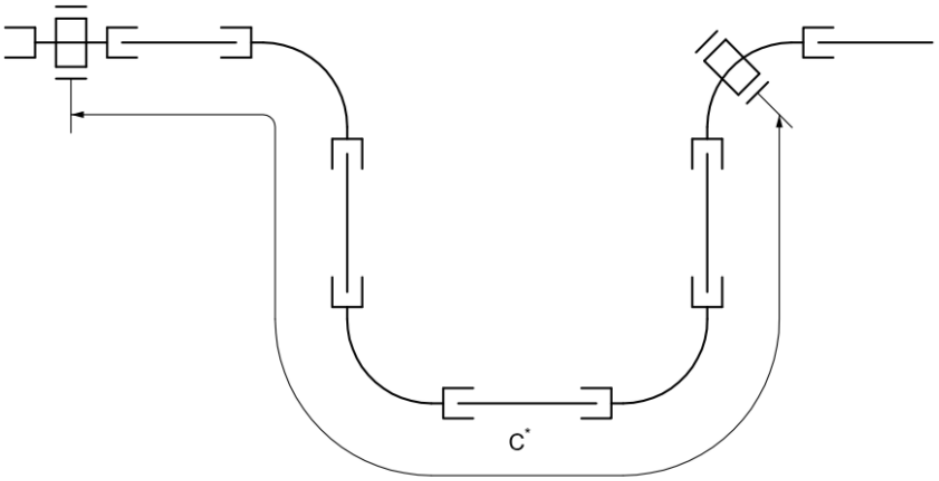
Dimensions in millimetres



Key

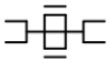
A	branch A (anchored section)
B	branch B (section free to expand and contract)
C	branch C (cold bent pipe section)
	fixed straight connector
	straight connector
	pipe with guide
	free pipe
	supported elbow (moves freely)
	fixed elbow
	elbow

Figure 2 — Test arrangement



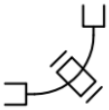
Key

C* branch C (for rigid pipes)


fixed straight connector


straight connector

free pipe


fixed elbow

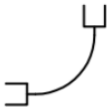
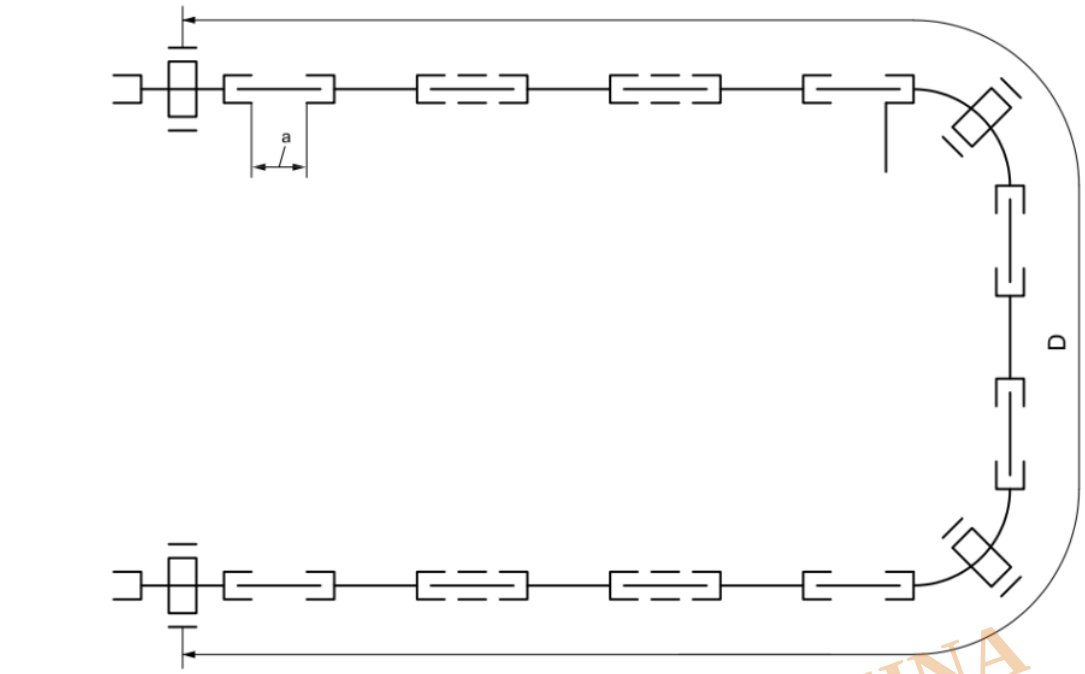

elbow

Figure 3 — Alternative test arrangement of branch C for rigid pipes



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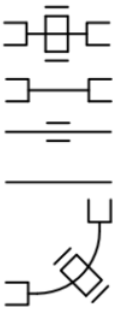

fixed straight connector

straight connector

pipe with guide

free pipe

fixed elbow

[a] Minimum length of each pipe section = 120^{+20}_{0}.

Figure 4 — Alternative test arrangement of branch B for diameters larger than 63 mm (no prestress)

Thermal Cycling Test Unit and Cabin According to BS ISO 19893

The temperature cycling tester is designed to determine the resistance of thermoplastic pipe network and connections consisting of stiff or ?exible parts to alternating thermal shock. This applies to pipe systems intended to be used for conveying hot and cold pressurized water. Thermal Recycling Testers for Plastic Pipes is used to evaluate the function of hot and cold water-pipes PP?PE-X, PVC-C, PB), under a certain pressure for 5000 cycles. A test assembly of pipes and fittings is subjected to temperature cycling by the passage of water under pressure using hot and cold water alternately for a specified number of cycles. While being subjected to temperature cycling parts of the assembly of pipes and fittings are maintained under tensile stress and/or flexural strain by the use of static clamps. ASTM F 1335-98 Standard Specification for Pressure-rated Composite Pipe and Fittings for Elevated Temperature Service. The standard covers pressure-rated composite pipe and fittings for the transport of hot or cold liquids, beverages, or gases that are compatible with the composite pipe and fittings. Composite pipe is produced using a butt welded aluminum pipe as a core, with an extruded inside layer of crosslinked polyethylene (PEX) or polyethylene (PE). An adhesive layer is used to bond the inside layer to the wall of the aluminum pipe. An outer layer of polyethylene (PE) and an adhesive layer are extruded to the outer wall of the aluminum pipe.

- According to EN12293, ISO10508, BS ISO 19893
- Sample cabin 3 station (more is possible as per customer request)
- 3 pressure lines (All in same pressure control)
- Hot and cold water tank SS304
- Chiller for cold tank
- Computer controlled (Computer is up to the customer-will be quoted separately)
- Report in MSWORD
- Pressure up to 14 bar
- Sliding door for sample cabin, Plexi windows
- PLC controlled
- Automatic cycle control according to standard
- Leakage detection of samples and stop automatically

- Motorized valves automatically control the whole process
- Flow switches equipped in the circulation lines
- Automatic water level control system

Chiller for Thermal Cycling Tester

Category

1. Equipment for Standards
2. Standards