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Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the resistance to cyclic internal pressure

Tubes en plastiques thermodurcissables renforcés de verre (PRV) — Détermination de la résistance à la pression cyclique interne

Reference number
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Foreword

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ISO 15306 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 6, *Reinforced plastics pipes and fittings for all applications*.

Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the resistance to cyclic internal pressure

1 Scope

This International Standard specifies a method for determining the resistance of glass-reinforced thermosetting plastics (GRP) pipes to cyclic internal pressure.

NOTE Whilst this standard refers to pipes, the procedure described can also be applied to fittings.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
cyclic pressure
pressure, expressed in bars[1)], which fluctuates about a specified value at a given frequency and with the same amplitude above and below the specified value

2.2
mean pressure
specified pressure level, expressed in bars, about which the pressure fluctuates

2.3
pressure amplitude
difference between the specified value, expressed in bars, of the cyclic pressure and the upper or lower pressure limit

2.4
cycle frequency
number of cycles per unit time, expressed in cycles per minute

2.5
cycle length
time taken for the pressure to change from the lower limit to the upper limit and then return to the lower limit

2.6
leakage
continuous loss of test fluid through the pipe wall to an extent detectable visually

2.7
bursting
rupture of the pipe wall with immediate loss of test liquid

1) 1 bar = 10^5 N/m^2 = 0,1 M

3 Principle

A test piece is subjected to a specified cyclic pressure (see 2.1) having a fixed frequency and amplitude (see 2.4 and 2.3) for a specified number of cycles.

NOTE It is assumed that the following test parameters are set by the standard making reference to this standard:

a) the type of end-sealing device to be used (see 4.3);

b) the free length of the test pieces (see 5.2 and Figure 1);

c) the number of test pieces (see 5.1);

d) the conditioning requirements, if any (see 5.3);

e) the test temperature and its tolerance (see Clause 6);

f) the mean pressure (see 7.2);

g) the pressure amplitude (see 7.2);

h) the cycle frequency (see 7.5);

i) the test liquid inside the test piece and the external environment (see 7.3);

j) the number of cycles (see 7.5).

4 Apparatus

4.1 Source of internal pressure, with a suitable control mechanism, capable of both of the following:

a) applying the required pressure gradually;

b) maintaining the cycle for the duration of the test within an accuracy of $\pm$ 4 % of the specified minimum and maximum pressures.

4.2 Pressure-recording device, capable of measuring and recording the upper and lower pressure limits and the number of cycles (see 4.1 and 7.2) under the applicable cyclic conditions.

4.3 End-sealing devices for the test pieces (see Figure 1), of the type specified [see item a) of the Note to Clause 3], such that end thrust is induced by the internal pressure or not, as applicable.

5 Test pieces

5.1 Number

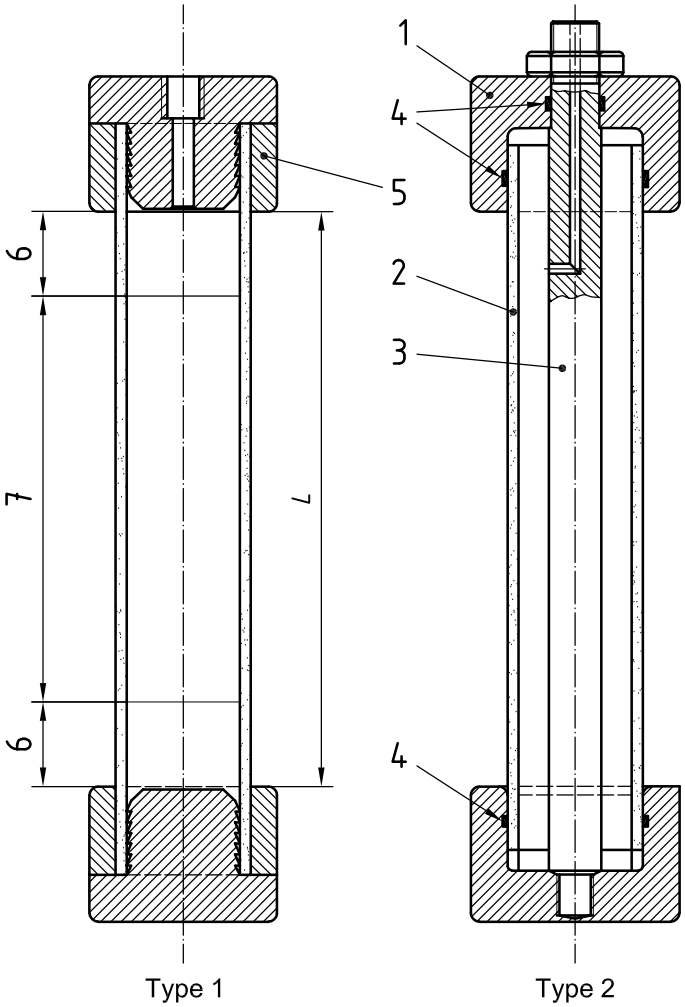
The number of test pieces shall be as specified in the referring standard.

5.2 Length

The length of the test pieces shall be as specified in the referring standard.

5.3 Conditioning

Unless otherwise specified in the referring standard, conditioning is not required.



a) Type 1 end caps (for testing with end thrust) **b) Type 2 end caps (for testing without end thrust)**

Key

1 end cap
2 test piece
3 tie bar carrying end thrust
4 elastomeric seal
5 end-sealing device
6 see Clause 8 for this dimension
7 valid failure zone
L length of test piece

Type 1: Testing with end thrust (external seals)

Type 2: Testing without end thrust (internal seals)

Figure 1 — Typical arrangement for pressure testing of pipes

6 Test temperature

The test temperature and the tolerance on the test temperature shall be as specified in the referring standard.

7 Procedure

7.1 Determine the following dimensions of each test piece:

a) the external or internal diameter;

b) the wall thickness;

c) the length.

7.2 Unless otherwise specified in the referring standard, set the pressure settings as follows:

— the mean pressure shall be equal to PN, the nominal pressure of the pipe, expressed in bars[1)];

— the pressure amplitude shall be ± 0,25 times PN expressed in bars[1)].

EXAMPLE For a PN 10 pipe, the pressure amplitude will be ± 2,5 bar and hence the lower pressure limit is 7,5 bar and the upper limit 12,5 bar.

7.3 Fit the end-sealing devices (4.3) and fill the test piece with the test liquid specified in the referring standard, ensuring that all air is expelled.

The external environment shall be air unless otherwise specified by the referring standard.

7.4 Connect the arrangement to the source of internal pressure.

Prior to commencing the test, ensure that both the external environment and the test liquid are at the test temperature (see Clause 6).

7.5 Bring the internal pressure to the lower limit of the cycle.

Increase the internal pressure until the upper limit is reached. Then reduce the pressure to the lower limit. Repeat this process using the applicable cycle frequency given in Table 1, unless otherwise specified in the referring standard, until either the test piece fails (see Clause 8) or the minimum required number of cycles specified in the referring standard is reached.

7.6 Record the number of cycles to failure (see Clause 8) for test pieces which fail before reaching the minimum required number of cycles.

Table 1 — Cycle frequency

Nominal size of test piece DN	Cycle frequency
⩽ 150	(16 ± 4) cycles/min
> 150 but ⩽ 350	(8 ± 2) cycles/min
> 350 but ⩽ 600	(4 ± 1) cycles/min

8 Expression of results

Pass/fail criteria for the series of test pieces tested shall be as given in the referring standard.

A failure may be disregarded if it can be shown to have occurred outside of the valid failure zone ("a" in Figure 1), i.e. within a distance from an end-sealing device ("b" in Figure 1) calculated from Equation (1) of:

$$3{,}3 \times (\mathrm{DN} \times e)^{0{,}5} \tag{1}$$

where

DN is the numerical value of the nominal size of the pipe, expressed in millimetres;

e is the wall thickness of the pipe, expressed in millimetres.

9 Test report

The test report shall include the following information:

a) a reference to this standard and to the referring standard;

b) full identification of the pipe tested;

c) the number of test pieces tested;

d) the dimensions of each test piece;

e) equipment details, e.g. accuracy, details of calibration;

f) the mean test pressure and the pressure amplitude for each test piece;

g) the number of cycles for each test piece (see 7.6);

h) the type of failure for each test piece which suffers failure;

i) whether the test was conducted with or without end thrust;

j) the test temperature;

k) the orientation of the test pieces during testing (e.g. horizontal, vertical);

l) any factors which may have affected the result, such as any incidents or any operating details not specified in this International Standard;

m) the dates and times of commencement and completion of testing of each test piece.

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