DIN EN ISO 13783 â€“ Test Method for Leaktightness and Strength While Subjected to Bending and Internal Pressure â€“ Testing Equipment

Description

3 Principle

A test piece, consisting of PVC-U pipes mounted into a PVC-U double socket coupler, is exposed to a specific cycle of internal hydrostatic pressures for specific test periods and at a specific temperature while the assembly is simultaneously subjected to a lateral bending force.

4 Apparatus

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4.1 A pressure control device, connected to the test piece and capable of applying a variable internal hydrostatic pressure of at least 2,5 times the nominal pressure (PN) of the PVC-U pipe and joint assembly.

4.2 A vacuum pump, capable of applying a negative internal pressure of at least -0,8 bar (-0,08 MPa).

4.3 A loading jig, capable of applying a horizontal bending force to an assembled test piece while it is subjected to an internal hydrostatic pressure. The jig includes vertical supports equally spaced at 5dn on either side of the axis of the horizontal force to restrain the test piece so that the horizontal force will induce bending, and horizontal supports beneath the test piece, to enable horizontal axial alignment of the test piece components. The supports have a low friction surface, to minimize inhibition of axial bending. An example of a test arrangement is shown in figure 2.

The length of the pipe sections and the total length of the test pieces shall conform to the values given in figure 2.

4.4 Gauges, for measuring the internal hydrostatic pressure and the applied bending force, each having an accuracy of Â±1 % at the measured values.

5 Test piece

The test piece shall consist of two PVC-U pipe sections mounted into the PVC-U end-loadbearing double socket coupler to be tested. The assembly shall be carried out in accordance with the instructions of the manufacturer of the double socket coupler.

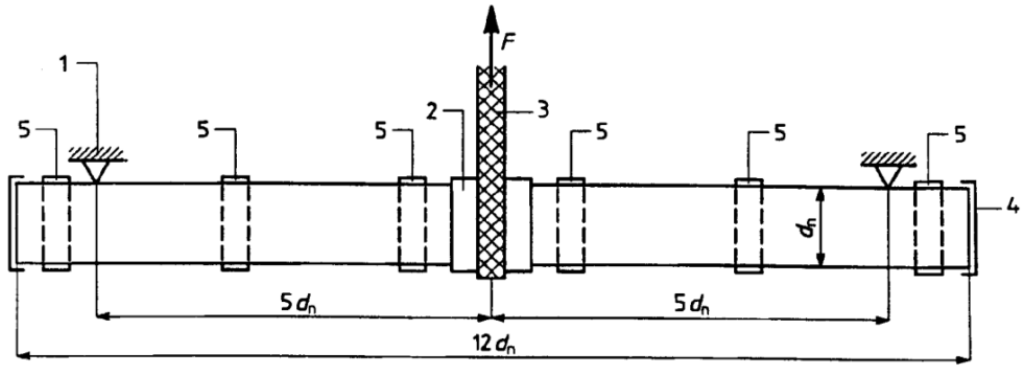
The pipes and the double socket shall be of the same nominal pressure.

NOTE: The mean outside diameter of the pipes should preferably conform to the minimum specified value, and the socket dimensions (mean inside diameter and the diameter of the groove for housing the sealing ring) should preferably conform to the maximum allowable values stated by the manufacturer in order to have dimensions as close as possible to the extreme limits of their relevant tolerances.

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6 Procedure

6.1 Calculate the bending force F using the following equation:



1 Supports to oppose the bending force
2 End-load-bearing double socket
3 Pliable band to apply the force
4 End cap
5 Supports for the weight of the test piece

Figure 2: Example of assembly and specified lengths (planview)

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$$F = 0{,}1 \left(\frac{d_n - e_n}{d_n}\right)^2 \times (\pi \sigma e_n d_{n,m} - F_e)$$

where:

d_n is the nominal outside diameter of the PVC-U pipes, in millimetres;

e_n is the nominal wall thickness of the PVC-U pipes, in millimetres;

σ is the resulting stress, due to the simultaneous effect of bending and internal pressure it shall be 20 MPa (N/mm^2);

$d_{n,m} = d_n - e_n$;

F_e is the force, in newtons, acting axially on the end caps and given by the following equation:

$$F_e = p_i \left(\frac{\pi d_i^2}{4}\right)$$

where:

p_i is the internal water pressure in MPa, which shall be 0,1 times the value of PN;

d_i is the calculated inside diameter of the PVC-U pipe, i.e. $(d_n - 2e_n)$.

NOTE: Some values calculated for *F*, based on PVC-U pipes, are given in table 1.

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Table 1: Calculated values for the bending force, *F*

PN	Bending force *F* on the double socket coupler (in newtons)					
	6,0	6,3	8	10	12,5	16
d_n	S 20,8	S 20 *)	S 16	S 12,5	S 10	S 8
110	1179	1217	1510	1833	2280	2748
125	1555	1594	1975	2385	2930	3489
160	2511	2640	3155	3955	4816	5738
200	3867	4013	5012	6127	7500	8989
250	6078	6376	7763	9540	11592	13956
315	9588	9923	12321	14817	18413	22235
355	12300	12647	15587	18797	23377	28284
400	15468	16050	19830	23654	29797	35765
500	24311	25220	30778	37893	46622	56064
630	38353	39690	48939	59602	73651	

*) S is the pipe series conforming to ISO 4065:1996.

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6.2 Lay the assembled test piece on the supports, ensuring that the pipes and the coupler are in axial alignment (see figure 2).

6.3 Fill the test piece with water at (20 Â± 5) Â°C and release all air. Allow the assembly to condition for 60 min to ensure equalization of temperature.

6.4 Carry out the procedure given in 6.5 at any ambient temperature between 15 C and 25 C while maintaining this ambient temperature within Â±2 C and examining the joints for leakage during the whole test cycle.

6.5 Carry out the following test procedure in accordance with the schematic arrangement shown in figure 3, which is not intended to require strictly linear rates of change in pressure or force, and by maintaining each static pressure and bending force within (+5/0)%.

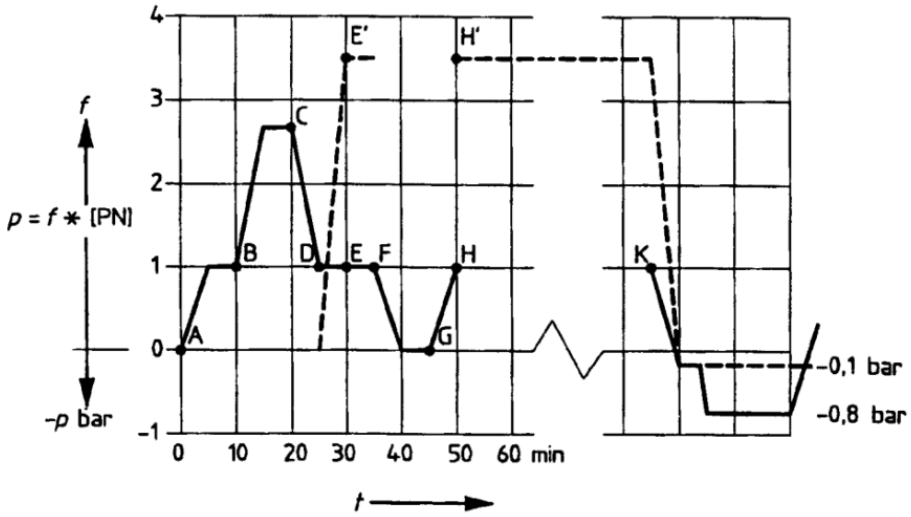
At A: increase the water pressure over a period of 5 min to 1 times [PN], and maintain this pressure for 5 min.

At B: increase the water pressure over a period of 5 min to 2,5 times [PN], and maintain this pressure for 5 min.

At C: reduce the water pressure over a period of 5 min to 1 times [PN].

At D: apply the calculated value of the bending force, F, in the horizontal plane over a period of 5 min whilst maintaining the internal pressure of 1 times [PN].

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NOTE: The solid line represents the time limits for pressure changes (inclusive of constant values) and the dotted line represents the bending force, *F*, (exclusive of values). The lines do not infer that the rates of change of pressure or force are strictly linear.

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Figure 3: Schematic hydrostatic pressure test regime with bending

At E: maintain the water pressure at 1 times [PN] for a further period of 5 min whilst maintaining the bending force F.

At F: reduce the water pressure to atmospheric pressure within 5 min and ensure that the deflection of the pipe is maintained constant for a further period of 5 min.

At G: increase the water pressure within a period of 5 min to 1 times [PN].

At h: adjust the bending force, F, to its original value. (The angle of deflection will normally be a little greater than at E.) Repeat the cycle from E to H a further nine times.

At K: at the end of the 10th cycle, release the bending force and drain the water from the assembled test piece. Apply a negative pressure to the test piece until a constant pressure of (-0,1 Â± 0,02) bar is achieved. Isolate the vacuum pump from the test piece, and observe the pressure for 15 min. Apply a further negative pressure to the test piece until a constant pressure of (-0,8 Â± 0,02) bar is achieved, then isolate the vacuum pump from the test piece, and observe any increase in pressure for a further 15 min.

6.6 On completion of the test disassemble the joints and examine all parts for details of any cracks and deformations and record the results.

Category

1. Equipment for Standards
2. Standards