

KS

KOREAN INDUSTRIAL STANDARD

Plastics piping systems for hot and cold water
installations
— Chlorinated polyvinyl chloride (PVC-C) pipes

KS M 3414 : 2003

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Foreword

This standard is written on the basis of **ISO/FDIS 15877-2** *Plastics piping systems for hot and cold water installation - Chlorinated polyvinylchloride (PVC-C) - Part 2 : Pipes* with a little change of standard structure and technical modifications. The technical differences and the contents which are not originated from international standard are underlined.

1. Scope

1.1 This standard specifies the characteristics of pipes made from chlorinated poly(vinyl chloride) (PVC-C) for piping systems intended to be used for hot and cold water installations within buildings for the conveyance of water, whether or not intended for human consumption (domestic systems), and for heating systems, under design pressures and temperatures appropriate to the class of application (see **Table 1** of **KS M ISO 15877-1**).

This standard covers a range of service conditions (application classes), design pressures and pipe series.

NOTE It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

It also specifies the test parameters for the test methods referred to in this standard.

In conjunction with the other Parts of **KS M ISO 15877** it is applicable to PVC-C pipes, their joints and to joints with components of PVC-C, other plastics and non-plastics materials intended to be used for hot and cold water installations.

1.2 Annex C(Normative) will be effective with the body of this standard until Dec 31, 2006, and then it will be deleted.

2. Normative references

This Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

KS L 2303 *Glass apparatus for chemical analysis*

KS L 2317 *Volumetric glassware*

KS M 0001 *General rules for chemical analysis*
KS M 0012
KS M 0016
KS M 0028
KS M 3415 : 2003, *Plastic piping system for hot and cold water installations - Chlorinated poly(vinyl chloride) (PVC-C) - Fitting*
KS M 7602 *Filter paper (for chemical analysis)*
KS M 8001 *General rules for test methods of reagents*
KS M 8005 *Standard substances for volumetric analysis*
KS M ISO 1167 : 2003, *Thermoplastics pipes for the conveyance of fluids - Resistance to internal pressure - Test method*
KS M ISO 2505-1 : 2003, *Thermoplastics pipes - Longitudinal reversion - Part 1 : Determination method*
KS M ISO 2505-2 : 2003, *Thermoplastics pipes - Longitudinal reversion - Part 1 : Determination parameters*
KS M ISO 3126 : 2003, *Plastics piping systems - Plastics piping component - Measurement and determination of dimensions*
KS M ISO 6259-2 : 2003, *Thermoplastic pipes - Determination of tensile properties Part 2 : Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)*
KS M ISO 7686 : 2003, *Plastics pipes and fittings - Opacity - Test method*
KS M ISO TR 9080 : 2003, *Plastics piping and ducting system - Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*
KS M ISO 11922-1 : 2003, *Thermoplastics pipes for the conveyance of fluids - Dimensions and tolerances - Part 1 : Metric series*
KS M ISO 15877-3 : 2002, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 3: Fittings (ISO/FDIS 15877-3:2002)*
ISO/FDIS 15877-5 *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 5: Fitness for purpose of the system (ISO/FDIS 15877-5:2002)*

3. Terms and definitions, symbols and abbreviated terms

For the purposes of this standard the terms and definitions, symbols and abbreviated terms given in **KS M ISO 15877-1** apply together with the following symbols:

l : length of pipe

σ_y : tensile strength at yield point

4. Material

4.1 General

The PVC-C material from which the pipes are made shall conform to this standard and to the relevant requirements of **KS M ISO 15877-1**.

4.2 Pipe material

The material from which the pipes are made shall be chlorinated poly(vinyl chloride) (PVC-C) resin to which are added those additives that are needed to facilitate the manufacture of pipes conforming to this standard.

4.3 Evaluation of σ_{LCL} -values

The pipe material shall be evaluated in accordance with **KS M ISO TR 9080** or equivalent, where an internal pressure test is made in accordance with **KS M ISO 1167** to find the σ_{LCL} -values. The σ_{LCL} -values thus determined shall be at least as high as the corresponding values of the reference curves given in Figure 1 over the complete range of times.

NOTE 1 One equivalent way of evaluation is to calculate the σ_{LCL} -values for each temperature (e.g. for 20°C, 60°C and 95°C) individually.

NOTE 2 The reference curves in **Figure 1** in the temperature range of 10 to 95 are derived from the following equation (1):

$$\log t = -109.95 - \frac{231897.4}{T} \log \sigma + \frac{4370287}{T} + 50.74202 \log \sigma$$

where, t : time (h)

T : temperature (K)

σ : Hoop stress (MPa)

4.4 Influence on water intended for human consumption

The material shall conform to **KS M ISO 15875-1**.

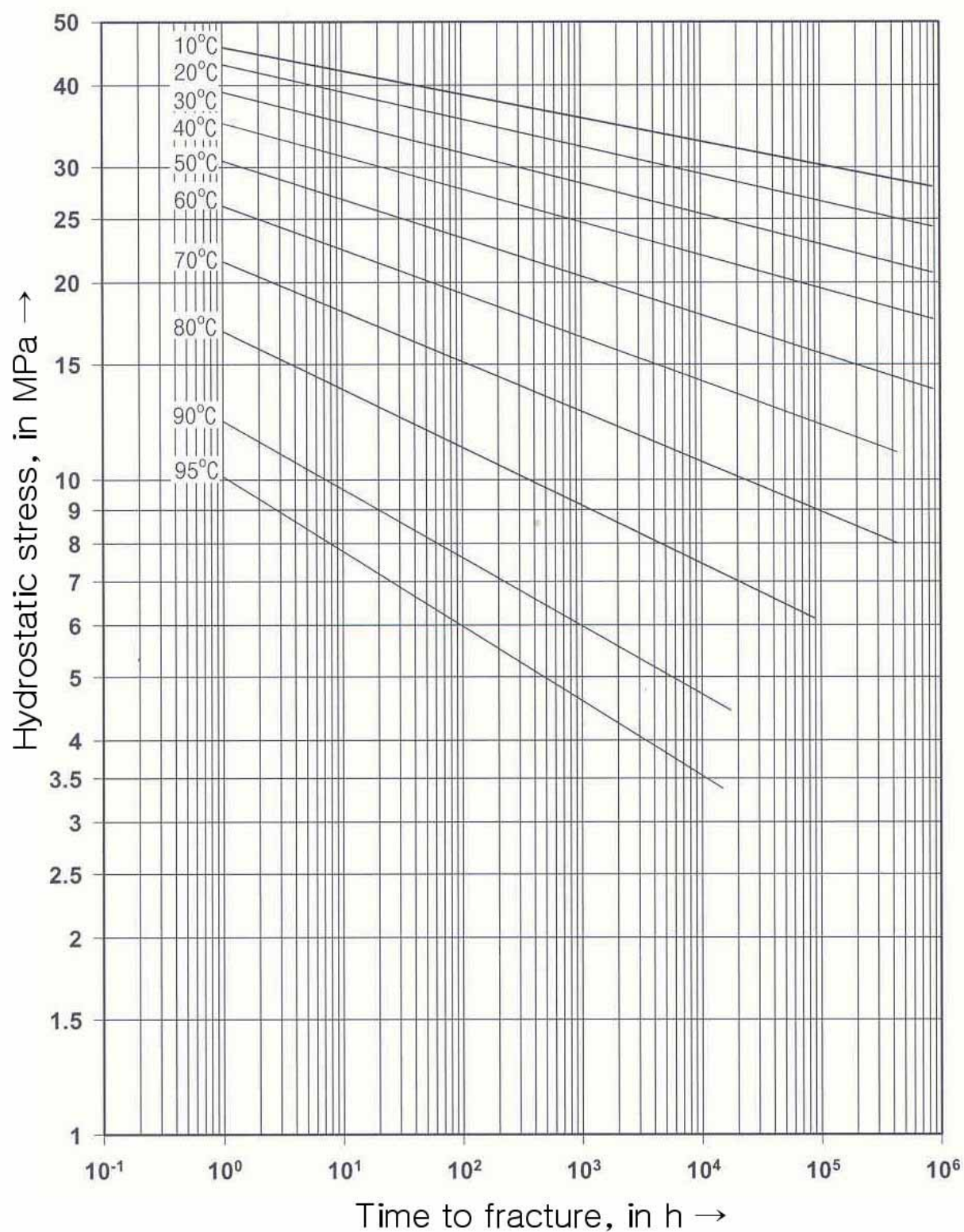


Figure 1 — Reference curves for the expected hydrostatic strength of PVC-C pipe material

4.4 Influence on water intended for human consumption

The material shall conform to **KS M ISO 15877-1**.

5. General characteristics

5.1 Appearance

When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity to this standard. The material shall not contain visible impurities.

The ends of the pipe shall be cleanly cut and square to the axis of the pipe.

5.2 Chamfering

If a chamfer is required, the angle of chamfering shall be between 15° and 45° to the axis of the pipe. When pipes without chamfer are used, the pipe ends shall be deburred.

5.3 Opacity

PVC-C pipes that are declared to be opaque shall not transmit more than 0,2% of visible light, when tested in accordance with **KS M ISO 7686**

6. Geometrical characteristics

6.1 General

6.1.1 Dimensions shall be measured in accordance with **KS M ISO 3126**.

Note **Figure 2** covers schematic sketches only, to indicate the relevant dimensions. It does not necessarily represent the manufactured components.

6.1.2 The maximum calculated pipe value, $S_{calc, max}$, for the applicable class of service conditions and design pressure, P_D , shall conform to **Table 1**.

Table 1 $S_{calc, max}$ -Values

Design pressure p_D MPa	Application class Class2
	$S_{calc, max}$ -Values ¹⁾
0.4	10,0
0.6	6,9
0.8	5,2
1.0	4,2

1) The values are rounded to the first place of decimals.

NOTE The derivation of $S_{calc, max}$ is provided in **Annex A**. The method described takes account of the properties of PVC-C under the service conditions for the classes given in **Table 1** of **KS M ISO 15877-1**

6.2 Dimensions of pipes

6.2.1 Outside diameters

The mean outside diameter, d_{em} , of a pipe shall conform to **Table 2**.

6.2.2 Wall thicknesses and their tolerances

For any particular class of service conditions, design pressure and nominal size, the minimum wall thickness, e_{min} shall be chosen in such a way that the corresponding pipe series S is not greater than the values of $S_{calc, max}$ as given in **Table 1**.

The wall thickness, e , shall conform to **Table 2** in relation to the pipe series S .

The tolerance on the wall thickness, e shall conform to **Table 3**.

Table 2 Diameters and wall thicknesses

Dimensions in millimeters

Nominal size DN/OD	Nominal outside diameter d_n	mean outside diameter		Pipe series		
		$d_{em,min}$	$d_{em,max}$	S 6.3	S 5	S 4
				Minimum wall thickness e_{min}		
12	12	12.0	12.2	1.4	1.4	1.4
14	14	14.0	14.2	1.4	1.4	1.6
16	16	16.0	16.2	1.4	1.5	1.8
20	20	20.0	20.2	1.5	1.9	2.3
25	25	25.0	25.2	1.9	2.3	2.8
32	32	32.0	32.2	2.4	2.9	3.6
40	40	40.0	40.2	3.0	3.7	4.5
50	50	50.0	50.2	3.7	4.6	5.6
63	63	63.0	63.3	4.7	5.8	7.1
75	75	75.0	75.3	5.6	6.8	8.4
90	90	90.0	90.3	6.7	8.2	10.1
110	110	110.0	110.4	8.1	10.0	12.3
125	125	125.0	125.4	9.2	11.4	14.0
140	140	140.0	140.5	10.3	12.7	15.7
160	160	160.0	160.5	11.8	14.6	17.9

Table 3 Tolerances on wall thicknesses

Dimensions in millimeters

Minimum wall thickness		Tolerance ¹⁾
θ_{min}		
>	≤	χ
1.0	2.0	0.4
2.0	3.0	0.5
3.0	4.0	0.6
4.0	5.0	0.7
5.0	6.0	0.8
6.0	7.0	0.9
7.0	8.0	1.0
8.0	9.0	1.1
9.0	10.0	1.2
10.0	11.0	1.3
11.0	12.0	1.4
12.0	13.0	1.5
13.0	14.0	1.6
14.0	15.0	1.7
15.0	16.0	1.8
16.0	17.0	1.9
17.0	18.0	2.0

1) The tolerance is expressed in the form $^{+x}_0$ mm, where x is the value of the tolerance given. The level of the tolerances conforms to Grade W of **KS M ISO 11922-1**

6.2.3 Length of pipes

The effective length, l , of a pipe shall not be less than specified by the manufacturer when measured as shown in **Figure 2**.

6.2.4 Pipes with sockets

When pipes with sockets are used, the dimensions of sockets shall conform to **KS M ISO 3415**.

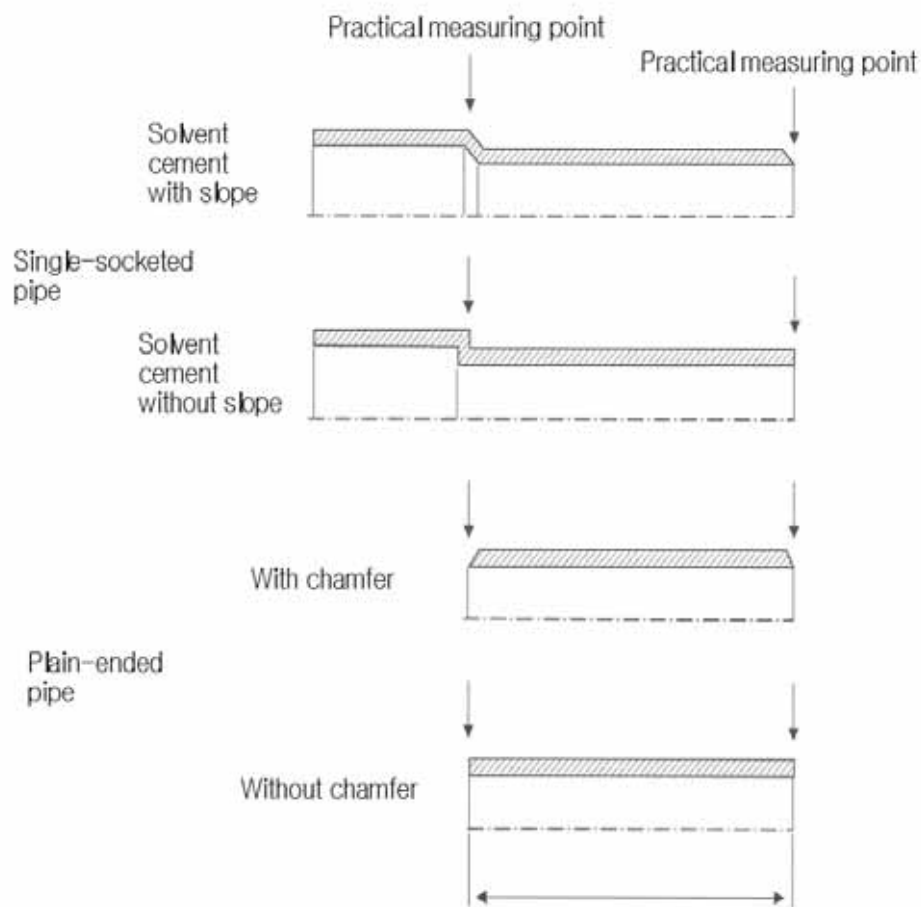


Figure 2 Effective length of pipes

7. Mechanical characteristics

7.1 Resistance to internal pressure

When tested in accordance with the test method specified in **Table 4**, using the indicated parameters, the pipe shall withstand the hydrostatic (hoop) stress without bursting or leakage.

Table 4 Test parameters for testing resistance to internal pressure

Characteristic	Requirements	Test parameters for the individual tests				Test method
Resistance to internal pressure	No failure during the test period	Hydrostatic (hoop) stress MPa	Test temperature ℃	Test period h	Number of test pieces	KS M ISO 1167
		43,0 1)	20	1	3	
		5,6	95	165	3	
		4,6	95	1000	3	
		3,6	95	8760	3	
		Test parameters for all tests				
		Sampling procedure Type of end caps Orientation of test piece Type of test 3) 4)		2) Types a) or b) Vertical Water-in-air or water-in-water		

- 1) The test stress is above the minimum expected strength curve as the real short-term stress at 20°C is higher than the strength curve.
- 2) The sampling procedure is not specified. For guidance see **ISO/TS 15887-7**.
- 3) Testing at 95°C shall be done in water-in-air.
- 4) In case of dispute, testing at 20°C shall be done in water-in-water.

NOTE Testing at 95°C, 8760h and 3,6 MPa verifies the thermal stability (see clause 8).

7.2 Impact resistance

When tested in accordance with the test method specified in **Table 5**, using the indicated parameter, the pipe shall have a true impact rate TIR conforming to **Table 5**.

Table 5 Test parameters for testing impact resistance

Characteristic	Requirements	Test parameters		Test method
Impact resistance (round-the-clock method)	TIR ≤ 10%	Type of striker Mass of striker Fall height of striker Conditioning medium Test/conditioning temperature Sampling procedure	d25 Shall conform to Table 6 Shall conform to Table 6 Water or air 1) (0 ± 1) °C 2)	ISO 3127

1) In case of dispute, air shall be used.

2) The sampling procedure is not specified. For guidance see **ISO/TS 15877-7**.

Table 6 Masses and fall heights of striker for testing impact resistance

Nominal size DN/OD	Nominal outside diameter (mm) <i>dn</i>	Mass of striker (kg) +0,01 0	Fall height of striker (m)
12	12	0,5	0,3
14	14	0,5	0,3
16	16	0,5	0,4
20	20	0,5	0,4
25	25	0,5	0,5
32	32	0,5	0,6
40	40	0,5	0,8
50	50	0,5	1,0
63	63	0,8	1,0
75	75	0,8	1,0
90	90	0,8	1,2
110	110	1,0	1,6
125	125	1,25	2,0
140	140	1,6	1,8
160	160	1,6	2,0