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**Unplasticized poly (vinyl chloride)
(PVC-U) pipe fittings for water
supply**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan PVC Pipe and Fittings Association (JPPFA)/The Japan Plastics Industry Federation (JPIF)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS K 6743**:2004 is replaced with this Standard.

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Unplasticized poly (vinyl chloride) (PVC-U) pipe fittings for water supply

Introduction

This Japanese Industrial Standard has been prepared based on the first editions of **ISO 4422-1** and **ISO 4422-3** published in 1996 with some modifications of the technical contents, i.e. addition of requirements concerning product dimensions and performance and their test methods that are widely used in the Japanese market.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with explanations is given in Annex JC.

1 Scope

This Standard specifies the unplasticized poly (vinyl chloride) (PVC-U) pipe fittings and impact-resistant unplasticized poly (vinyl chloride) (PVC-U) pipe fittings (hereafter referred to as “fittings”) used mainly for adhesion-jointing of the unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply specified in **JIS K 6742**.

NOTE : The International Standards corresponding to this Standard and the symbol which denotes the degree of correspondence are as follows.

ISO 4422-1:1996 *Pipes and fittings made of unplasticized poly (vinyl chloride) (PVC-U) for water supply—Specifications—Part 1: General*

ISO 4422-3:1996 *Pipes and fittings made of unplasticized poly (vinyl chloride) (PVC-U) for water supply—Specifications—Part 3: Fittings and joints* (Overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For the normative reference with the year indication (Christian Era), only the edition of the indicated year, and for those without, the most recent edition (including amendments) shall be applied.

JIS B 0203 *Taper pipe threads*

JIS B 0205-2 *ISO general purpose metric screw threads—Part 2: General plan*

JIS B 7502 *Micrometer callipers*

JIS B 7507 *Vernier, dial and digital callipers*

JIS K 6353 *Rubber goods for water works*

JIS K 6742 *Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply*

- JIS K 6815-1:2002 *Thermoplastics pipes—Determination of tensile properties—Part 1: General test method*
- JIS K 6815-2:2002 *Thermoplastics 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)*
- JIS K 6900 *Plastics—Vocabulary*
- JIS S 3200-1 *Equipment for water supply service—Test methods of hydrostatic pressure*
- JIS S 3200-7 *Equipment for water supply service—Test methods of effect to water quality*
- JIS Z 8401 *Guide to the rounding of numbers*
- ISO 264 *Unplasticized polyvinyl chloride (PVC) fittings with plain sockets for pipes under pressure—Laying lengths—Metric series*
- ISO 580:2005 *Plastics piping and ducting systems—Injection-moulded thermoplastics fittings—Methods for visually assessing the effects of heating*
- ISO 727-1 *Fittings made from unplasticized poly (vinyl chloride) (PVC-U), chlorinated poly (vinyl chloride) (PVC-C) or acrylonitrile / butadiene / styrene (ABS) with plain sockets for pipes under pressure—Part 1: Metric series*
- ISO 2507-1:1995 *Thermoplastics pipes and fittings—Vicat softening temperature—Part 1 : General test method*
- ISO 2507-2:1995 *Thermoplastics pipes and fittings—Vicat softening temperature—Part 2: Test conditions for unplasticized poly (vinyl chloride) (PVC-U) or chlorinated poly (vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly (vinyl chloride) (PVC-HI) pipes*
- ISO 9853:1991 *Injection-moulded unplasticized poly (vinyl chloride) (PVC-U) fittings for pressure pipe systems—Crushing test*
- ISO 12092:2000 *Fittings, valves and other piping system components made of unplasticized poly (vinyl chloride) (PVC-U), chlorinated poly (vinyl chloride) (PVC-C), acrylonitrile-butadiene-styrene (ABS) and acrylonitrile-styrene-acrylester (ASA) for pipes under pressure—Resistance to internal pressure—Test method*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions of **JIS K 6900** and the following apply.

3.1 type A fittings

fittings which are manufactured by injection moulding

3.2 type B fittings

fittings which are obtained by processing the original pipes specified in **JIS K 6742**

3.3 type inspection

inspection to judge whether the quality of fittings conform to every performance indicated by design

3.4 delivery inspection

inspection to judge whether the fittings conform to the performance recognized to be necessary at the time of delivery

4 Classification and symbols

The classification and symbols of fittings shall be in accordance with table 1.

Table 1 Classification and symbols

Classification	Symbols
Unplasticized poly (vinyl chloride) (PVC-U) pipe fittings	TS, IWPS ^{a)}
Impact-resistant unplasticized poly (vinyl chloride) (PVC-U) pipe fittings	HITS
Note ^{a)} IWPS is a type of fitting based on ISO 4422-3 .	

5 Performance

The performance of fittings shall conform to the requirements of performance items shown in table 2. For type B fittings, except for pressure resistance, the specified performance shall apply to the original pipes specified in **7.2**.

Table 2 Performance

Performance item	Performance	Symbols of applicable pipes	Applicable subclause
Tensile strength at yield MPa	45 min. for the tensile strength at yield at 23 °C.	TS	9.1.1
	40 min. for the tensile strength at yield at 23 °C.	HITS	
Pressure resistance	No fracture shall be found.	TS, HITS, IWPS	9.1.2
Flattening resistance ^{a)}	No fissures or cracks shall be found.	TS, HITS	9.1.3
Impact resistance	“No abnormalities” ^{b)} shall be found.	HITS	9.1.4
Vicat softening temperature °C	76 min.	TS, HITS	9.1.5
	74 min.	IWPS	

Table 2 (concluded)

Performance item		Performance	Symbols of applicable pipes	Applicable subclause
Leachability	Lead and its compounds mg/L	0.008 max. in the amount of lead.	TS, HITS, IWPS: parts that are made of polyvinyl chloride	9.1.6
	Zinc and its compounds mg/L	0.5 max. in the amount of zinc.		
	Organic matter (TOC) mg/L	1 max.		
	Taste	No abnormalities shall be found.		
	Odour	No abnormalities shall be found.		
	Chromaticity degrees	1 max.		
	Turbidity degrees	0.5 max.		
	Loss of residual chlorine mg/L	0.7 max.		
	Leachability as defined in JB.4.2	In accordance with table 3.	Parts of TS, HITS, IWPS that are in contact with water but not vinyl chloride polymer	
Compressibility		No fissures or cracks shall be found.	IWPS	9.1.7
Hot internal pressure creep property		No fractures shall be found.	IWPS	9.1.8
Thermal relaxation property		“No defects” ^{c)} shall be found.	IWPS	9.1.9
Notes ^{a)} Applicable only to type B fittings. ^{b)} “No abnormalities” is a state judged based on JA.4 . ^{c)} A “defect” is defined as a crack, delamination or blister, of which the depth exceeds 50 % of the thickness of the fitting at its position, produced within the range of 0.3 of radius $\times$ (nominal diameter d_n) with the gate as the centre, a crack or delamination, of which the depth exceeds 10 % of the thickness, produced outside the said range and a blister having a length exceeding five times the fitting thickness. In the case of weld opening, any opening of which the depth exceeds 50 % of the thickness is a defect.				

Table 3 Criteria for leachability of the part other than vinyl chloride polymer at the water-contacting part

Performance item	Performance
Cadmium and its compounds	For the amount of cadmium, 0.01 mg/L max.
Mercury and its compounds	For the amount of mercury, 0.0005 mg/L max.
Selenium and its compounds	For the amount of selenium, 0.01 mg/L max.
Lead and its compounds	For the amount of lead, 0.01 mg/L max.
Arsenic and its compounds	For the amount of arsenic, 0.01 mg/L max.
Hexavalent chromium and its compounds	For the amount of hexavalent chromium, 0.05 mg/L max.
Cyanogen and its compounds	For the amount of cyanogen, 0.01 mg/L max.
Nitrogen of nitric acid state and nitrogen of nitrous acid state and its compounds	10 mg/L max.
Fluorine and its compounds	For the amount of fluorine, 0.8 mg/L max.
Boron and its compounds	For the amount of boron, 1.0 mg/L max.
Carbon tetrachloride	0.002 mg/L max.
1,4-dioxane	0.05 mg/L max.
1,2-dichloroethane	0.004 mg/L max.
1,1-dichloroethylene	0.02 mg/L max.
cis-1,2-dichloroethylene	0.04 mg/L max.
Dichloromethane	0.02 mg/L max.
Tetrachloroethylene	0.01 mg/L max.
Trichloroethylene	0.03 mg/L max.
1,1,2-trichloroethane	0.006 mg/L max.
Benzene	0.01 mg/L max.
Formaldehyde	0.08 mg/L max.
Zinc and its compounds	For the amount of zinc, 1.0 mg/L max.
Aluminium and its compounds	For the amount of aluminium, 0.2 mg/L max.
Iron and its compounds	For the amount of iron, 0.3 mg/L max.
Copper and its compounds	For the amount of copper, 1.0 mg/L max.
Sodium and its compounds	For the amount of sodium, 200 mg/L max.
Manganese and its compounds	For the amount of manganese, 0.05 mg/L max.
Chloride ion	200 mg/L max.
Evaporation residue	500 mg/L max.
Anionic surface active agent	0.2 mg/L max.
Nonionic surface active agent	0.02 mg/L max.
Phenols	Converted to the amount of phenol, 0.005 mg/L max.
Organic matter (TOC)	5 mg/L max.
Taste	Abnormal condition shall not exist.
Odour	Abnormal condition shall not exist.

Table 3 (concluded)

Performance item	Performance
Chromaticity	5 degrees max.
Turbidity	2 degrees max.
Epichlorohydrin	0.01 mg/L max.
Amines	As triethylenetetramine, 0.01 mg/L max.
2,4-toluene diamine	0.002 mg/L max.
2,6-toluene diamine	0.001 mg/L max.
Vinyl acetate	0.01 mg/L max.
Styrene	0.002 mg/L max.
1,2-butadiene	0.001 mg/L max.
1,3-butadiene	0.001 mg/L max.

6 Appearance and shape

6.1 Appearance

The fittings shall be smooth on the inside and outside surfaces, and free from flaws and fissures that may be detrimental to use.

6.2 Shape

The shape of fittings shall be in accordance with tables 8 to 27 for TS and HITS and **ISO 264** for IWPS. The joint part shall have practically right-circular cross-section and the end surface thereof shall be square to the axis of fittings.

The ribs for reinforcement may be attached to the appropriate place on the outside surface.

7 Dimensions and tolerances thereof

7.1 Dimensions and tolerances thereof for fittings

The dimensions and tolerances thereof for fittings shall be in accordance with tables 6 to 27 for TS and HITS, and **ISO 264** and **ISO 727-1** for IWPS.

If the tolerance specified is a value in percentage, the test result shall be rounded up to a whole number.

7.2 Dimensions and their tolerances of the original pipes to be processed to type B fittings

The dimensions and their tolerances of the original pipes to be processed to type B fittings shown in table 7, table 10 and tables 22 to 27 shall be as shown in table 4. When, however, the thickness of processed fittings is not less than the minimum thickness of the pipes of the corresponding nominal diameter specified in **JIS K 6742**, the pipes specified in **JIS K 6742** may be regarded as the original pipes.

Table 4 Dimensions and their tolerances of original pipe

Unit: mm

Nominal diameter	Outside diameter		Thickness	
	Basic dimension	Tolerance on maximum or minimum outside diameter ^{a)}	Basic dimension	Tolerance
13	18.0	± 0.2	2.8	± 0.2
16	22.0		3.3	± 0.3
20	26.0		3.3	
25	32.0		3.9	
30	38.0	± 0.3	3.9	± 0.3
40	48.0		4.4	
50	60.0	± 0.4	5.0	± 0.4
75	89.0	± 0.5	6.6	
100	114.0	± 0.6	8.1	± 0.5
150	165.0	± 1.0	11.2	± 0.7
Note ^{a)} The tolerance on the maximum or minimum outside diameter means the difference between the basic dimension and the maximum value or the minimum value of the outside diameters measured on a randomly picked section (maximum or minimum outside diameter).				

8 Materials

The materials of fittings shall be as follows.

- a) The materials of unplasticized poly (vinyl chloride) (PVC-U) pipe fittings shall be the vinyl chloride polymer to which stabilizer, pigment and others are added.

Plasticizer or the material containing plasticizers shall not be used.

- b) The materials of impact-resistant unplasticized poly (vinyl chloride) (PVC-U) pipe fittings shall be the vinyl chloride polymer to which stabilizer, pigment, modifier that has not significantly adverse impact on the weather resistance and others are added.

Plasticizer or the material containing plasticizers shall not be used.

- c) The materials of the part other than vinyl chloride polymer shall have the strength and durability sufficient to stand usual use and installation.

9 Test methods

9.1 Performance test

9.1.1 Tensile test

The tensile test of fittings shall be carried out according to **JIS K 6815-1**:2002 and **JIS K 6815-2**:2002. However, clauses **5** and **6** of **JIS K 6815-1**:2002 may be replaced with the following.

- a) **Test piece** The adequate test piece shall be made from the sample fittings in the case of type A fittings, and from sample original pipes in the case of type B fittings, as agreed between the parties concerned with delivery.
- b) **Conditioning** The test piece shall be conditioned at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for at least 60 min.

9.1.2 Pressure resistance test

The pressure resistance test of fittings shall be conducted in accordance with **JIS S 3200-1**, except that the test hydraulic pressure shall be 4.0 MPa.

9.1.3 Flattening test

The flattening test of original pipes to be processed into type B fittings shall be as follows:

Cut out a ring-shaped test piece of 50 mm length. After conditioning the test piece at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for at least 60 min, place it between two flat plates, and compress it at the speed of $10\text{ mm/min} \pm 2\text{ mm/min}$ in the direction at right angles to its axis until the outside diameter of the test piece becomes half the original size. Examine visually the outer surface of the pipe. The test temperature shall be $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The flat plates for compressing the test piece shall have such dimensions that they will be sufficiently larger than the deformed test piece when the test piece has compressed to half.

9.1.4 Impact resistance test

The impact resistance test of type A fittings shall be conducted in accordance with Annex JA. That for type B fittings, conducted using the original pipes to be processed into type B fittings, shall be in accordance with Annex JA of **JIS K 6742**.

9.1.5 Vicat softening temperature test

The Vicat softening temperature test shall be conducted in accordance with **ISO 2507-1**:1995 and **ISO 2507-2**:1995.

9.1.6 Leaching test

The leaching test of fittings shall be conducted in accordance with Annex JB.

9.1.7 Compressibility test

The compressibility test of fittings shall be conducted in accordance with **ISO 9853**:1991.

9.1.8 Hot internal pressure creep test

The hot internal pressure creep test shall be conducted in accordance with **ISO 12092:2000**. The test conditions shall be as given in table 5.

Table 5 The test conditions of hot internal pressure creep test

Sample	Test temperature °C	Test pressure MPa	Test duration h
Type A fittings	20	0.42	1
		0.32	1 000
Type B fittings, of nominal diameter 90 or under		0.42	1
Type B fittings, of nominal diameter over 90		0.336	

9.1.9 Thermal relaxation test

The thermal relaxation test shall be conducted in accordance with **ISO 580:2005**.

9.2 Appearance and shape

The appearance and shape of fittings shall be visually examined.

9.3 Dimensions

The dimensions of original pipes to be processed into fittings and type B fittings shall be measured by means of micrometer callipers as specified in **JIS B 7502** or vernier, dial and digital callipers as specified in **JIS B 7507** or any measuring instrument at least equivalent to these in precision.

9.4 Expression of test results

The test results of **9.1.1** and **9.1.5** and those of “lead and its compounds”, “zinc and its compounds”, “amount of total organic carbons (TOC)” and “loss of residual chloride” in **9.1.6** shall be calculated to one place lower than the performance requirement value as specified in table 2 and rounded off to the specified value according to **JIS Z 8401**. The test results of **9.1.6** shall be in accordance with clause **9** of **JIS S 3200-7**.

10 Inspection

The inspection of fittings shall consist of a type inspection and a delivery inspection, and the inspection items of each shall be as follows. The results of each item shall satisfy the relevant requirement of this Standard.

The sampling method for inspection shall be as agreed between the parties concerned with delivery.

- a) **Type inspection** The type inspection shall be conducted on the following items. The symbols in parenthesis indicate the type of fitting to which the item is applicable.

- 1) Tensile strength at yield (TS, HITS)
- 2) Pressure resistance (TS, HITS, IWPS)
- 3) Flattening resistance (applicable to type B fittings) (TS, HITS)
- 4) Impact resistance (HITS)
- 5) Vicat softening temperature (TS, HITS, IWPS)
- 6) Leachability (TS, HITS, IWPS)
- 7) Compressibility (IWPS)
- 8) Hot internal pressure creep property (IWPS)
- 9) Thermal relaxation (IWPS)
- 10) Appearance and shape (TS, HITS, IWPS)
- 11) Dimensions (TS, HITS, IWPS)
- 12) Marking (TS, HITS, IWPS)

b) **Delivery inspection** The delivery inspection shall be conducted on the following items. Upon agreement between the parties concerned with delivery, it may only consist of the items selected from the following. The symbols in parenthesis indicate the type of fitting to which the item is applicable.

- 1) Tensile strength at yield (TS, HITS)
- 2) Pressure resistance (TS, HITS, IWPS)
- 3) Flattening resistance (applicable to type B fittings) (TS, HITS)
- 4) Impact resistance (HITS)
- 5) Leachability (TS, HITS, IWPS)

The leachability inspection shall be carried out in definite intervals.

- 6) Compressibility (IWPS)
- 7) Thermal relaxation (IWPS)
- 8) Appearance and shape (TS, HITS, IWPS)
- 9) Dimensions (TS, HITS, IWPS)
- 10) Marking (TS, HITS, IWPS)

11 Marking

11.1 Colour of fittings

The colour of fittings shall be grey for unplasticized poly (vinyl chloride) (PVC-U) fittings, and dark grayish blue for impact-resistant unplasticized poly (vinyl chloride) (PVC-U) fittings.

11.2 Marking on fittings

The marking on fittings shall be as follows.

- a) The following information shall be indelibly marked on the outside surface of the fitting.
 - 1) The symbol “JIS”
 - 2) Nominal diameter
 - 3) Manufacturer's name or its abbreviation
- b) The following information shall be indelibly marked on the outside surface of the fitting or on the package.
 - 1) Number of this Japanese Industrial Standard
 - 2) Classification or its symbol
 - 3) Year and month of manufacture or its symbol
 - 4) The angle of bend, for bends
 - 5) The symbol “VC”, for VC sockets

11.3 Handling precautions

The precautions on handling should be described in instruction manual or technical data, etc. and an instruction inviting to read these be borne on the products, packages, or invoices.

Examples of precautions are shown in the following.

- a) The fittings shall not be subjected to severe impact caused by such as being dropped from a high place or being thrown.
- b) The fittings shall not be directly screw threaded.
- c) Materials which may adversely affect the quality of fittings such as acetone, thinner, creosote, insecticide, termite exterminator, etc. shall not be sprayed, coated or brought into contact with the fittings.

Even when the materials as above mentioned are not in direct contact with the fitting, if, for example, the fitting is only shallowly buried underground, care needs to be taken that the spilt material does not penetrate through to reach the fitting and corrode it.

- d) The adhesives shall be thinly applied on the cleaned joint surfaces of both the pipe and the fitting, and after the two are immediately jointed, the specified insertion force shall be applied for the specified duration. After jointing, the extra adhesives which have stuck out shall be removed. When installing, the vapour of medium in adhesives filled in the pipe shall be expelled by measures such as ventilation.

The adhesives to be used shall be suitable for the type of fitting.

- e) When storing fittings outside, make sure to keep them from direct rays of sun by means such as a canvas, with care not to trap heat inside.
- f) When using the fitting for faucet for connection to a faucet, decorated steel pipe, threaded steel pipe and the like, the installation method and standard tightening torque specified in the instruction manual or technical data or the like shall be observed. Excess tightening can cause water leakage or breakage of the fitting for faucet.
- g) Measures such as installing flexible fittings at appropriate positions shall be taken as required in order to resist the expansion or contraction due to uneven sinking, temperature change and other phenomena.