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**Plastics piping systems for industrial  
applications — Poly(vinylidene fluoride)  
(PVDF) —**

**Part 3:**  
Fittings

*Systèmes de canalisation en matières plastiques pour les applications  
industrielles — Poly(fluorure de vinylidène) (PVDF) —*

*Partie 3: Raccords*



## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10931-3 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 3, *Plastics pipes and fittings for industrial applications*.

ISO 10931 consists of the following parts, under the general title *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF)*:

- *Part 1: General*
- *Part 2: Pipes*
- *Part 3: Fittings*
- *Part 4: Valves and auxiliary equipment*
- *Part 5: Fitness for system purpose*
- *Part 6: Recommendations for installation*

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## Introduction

ISO 10931, which is divided into six parts (see Foreword) specifies the properties of pipes and piping system components made of poly(vinylidene fluoride) (PVDF) for industrial applications. It includes recommendations for installation (see ISO 10931-6) and is intended to be used by authorities, design engineers, testing and certification institutes and manufacturers. This part of ISO 10931 covers characteristics of fittings.

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# Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) —

## Part 3: Fittings

### 1 Scope

This part of ISO 10931 specifies the characteristics of fittings made from poly(vinylidene fluoride) (PVDF) for industrial applications which include the conveyance of water and chemicals in liquid and gaseous form.

It also specifies the parameters for the test methods referred to in this part of ISO 10931.

It is applicable to PVDF fittings intended for the conveyance of fluids under pressure at temperatures up to 150 °C. However, for applications above 120 °C, which depend on the crystalline melting point of the PVDF material, the advice of the suppliers of the fittings should be sought.

This part of ISO 10931 is applicable to fittings for the following types of joints:

- butt fusion;
- socket fusion;
- mechanical.

It is applicable to fittings manufactured by moulding and/or by machining, or by jointing segments of pipes.

NOTE — For information about the resistance of PVDF materials to chemicals, see ISO/TR 10358.

### 2 Normative references

The following standards contain provisions which, through reference to this text, constitute provisions of this part of ISO 10931. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10931 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 1167:—<sup>1)</sup>, *Thermoplastics pipes for the transport of fluids — Resistance to internal pressure — Test method.*

ISO 3663:1976, *Polyethylene (PE) pressure pipes and fittings, metric series — Dimensions of flanges.*

ISO/TR 9080:1992, *Thermoplastics pipes for the transport of fluids — Methods of extrapolation of hydrostatic stress rupture data to determine the long-term hydrostatic strength of thermoplastics pipe materials.*

1) To be published. (Revision of ISO 1167:1973)

ISO 9631:1991, *Rubber seals — Joint rings for hot water supply pipelines up to 110 °C — Specification for the material.*

ISO 10931-1:—<sup>2)</sup>, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Part 1: General.*

ISO 10931-2:—<sup>2)</sup>, *Plastics piping systems for industrial applications — Poly(vinylidene fluoride) (PVDF) — Part 2: Pipes.*

ISO 11922-1:—<sup>2)</sup>, *Thermoplastics pipes for the transport of fluids — Dimensions and tolerances — Part 1: Metric series.*

### 3 Definitions

For the purposes of this part of ISO 10931, the definitions given in ISO 11922-1 and ISO 10931-1 and the following definitions apply.

**3.1 fitting:** Item which connects two or more pipes and/or fittings together and may perform some other function.

**3.2 butt fusion fitting:** Fitting having one or more ends of the same dimensions as those of the connecting pipe, with which the joint is made by heating and melting the end faces of the fitting and the pipe with a heated tool, followed by pressing both faces together, under controlled conditions.

**3.3 socket fusion fitting:** Fitting which incorporates one or more sockets of such dimensions that a satisfactory joint can be made by applying heat to the outer wall of the pipe end and to the inner part of the fitting socket, followed by immediate insertion of the pipe end into the socket.

### 3.4 Mechanical fittings

**3.4.1 compression fitting:** Fitting with which a joint is made by compression of a ring or sleeve on the outside wall of the pipe, with or without additional sealing elements and with or without an internal pipe support.

**3.4.2 flanged fitting:** Fitting having at least one end consisting of a flanged joint.

Connection is made by means of a mating flange, fused on the end of the pipe. The flanges are mechanically held together under pressure and sealed by means of an elastomeric gasket.

## 4 Material

**4.1** The material from which the fittings are made shall be a PVDF homopolymer of category 1, conforming to ISO 10931-1.

**4.2** Clean reworked PVDF material produced during the manufacture and works testing of products conforming to this part of ISO 10931 may be used in limited amounts, provided it is derived from the same compounds as that being used for the relevant production, and the final products conform to the applicable requirements of this part of ISO 10931.

## 5 Appearance

When viewed without magnification, the internal and external surfaces of the PVDF fitting shall appear smooth, clean and free from scoring, cavities and other surface defects likely to affect its performance.

## 6 Geometric characteristics

### 6.1 Diameter

The nominal inside diameter of a PVDF fitting shall correspond to and be designated by the nominal outside diameter ( $d_n$ ) of the connecting pipes which conform to ISO 10931-2.

### 6.2 Angles

The nominal angle for a PVDF elbow shall be either 45° or 90°, and the nominal angle for PVDF tees and crosses shall be 90°.

### 6.3 Dimensions of different types of fittings

#### 6.3.1 Butt fusion fittings

The dimensions and tolerances for PN10 and PN16 butt fusion fittings of PVDF shall be in accordance with tables 1 and 2 respectively and with figure 1.

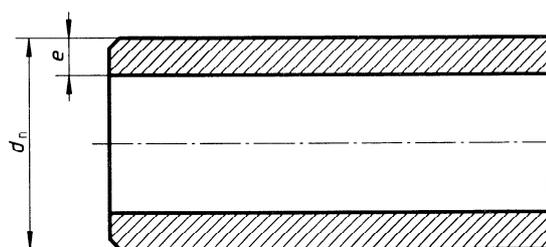


Figure 1 — Butt fusion fitting

<sup>2)</sup> To be published.

**Table 1 — Dimensions and tolerances for PVDF butt fusion fittings PN10**

Dimensions in millimetres

Nominal outside diameter	Tolerance on outside diameter relative to $d_n$	Maximum out-of-roundness	Nominal wall thickness	Tolerance on wall thickness relative to $e_n$
$d_n$			$e_n$	
63	+0,4 0	0,8	2	+0,5 0
75	+0,4 0	0,9	2,3	+0,5 0
90	+0,4 0	1,1	2,8	+0,5 0
110	+0,5 0	1,3	3,4	+0,6 0
125	+0,6 0	1,5	3,9	+0,6 0
140	+0,8 0	1,7	4,3	+0,7 0
160	+1 0	1,9	4,9	+0,8 0
180	+1,1 0	2,2	5,5	+0,8 0
200	+1,2 0	2,4	6,2	+0,9 0
225	+1,4 0	2,7	6,9	+0,9 0
250	+1,6 0	3	7,7	+1 0
280	+1,8 0	3,4	8,6	+1,1 0
315	+2 0	3,8	9,7	+1,2 0

**Table 2 — Dimensions and tolerances for PVDF butt fusion fittings PN16**

Dimensions in millimetres

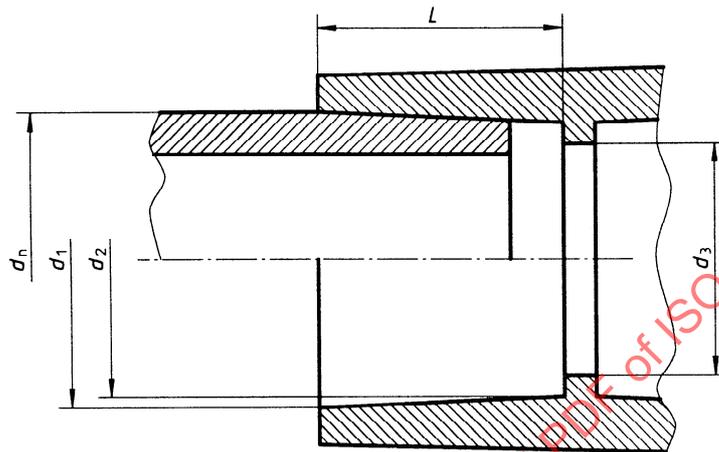
Nominal outside diameter	Tolerance on outside diameter relative to $d_n$	Maximum out-of-roundness	Nominal wall thickness	Tolerance on wall thickness relative to $e_n$
$d_n$			$e_n$	
16	+0,3 0	0,3	1,9	+0,4 0
20	+0,3 0	0,3	1,9	+0,4 0
25	+0,3 0	0,4	1,9	+0,4 0
32	+0,3 0	0,5	2,4	+0,5 0
40	+0,3 0	0,5	2,4	+0,5 0
50	+0,3 0	0,6	3	+0,6 0
63	+0,4 0	0,8	3	+0,6 0
75	+0,4 0	0,9	3,6	+0,6 0
90	+0,4 0	1,1	4,3	+0,7 0
110	+0,5 0	1,3	5,3	+0,8 0
125	+0,6 0	1,5	6	+0,9 0
140	+0,8 0	1,7	6,7	+0,9 0
160	+1 0	1,9	7,7	+1 0
180	+1,1 0	2,2	8,6	+1,1 0
200	+1,2 0	2,4	9,6	+1,2 0
225	+1,4 0	2,7	10,8	+1,3 0
250	+1,6 0	3	11,9	+1,4 0

**6.3.2 Socket fusion fittings**

The dimensions and tolerances of PVDF socket fusion fittings shall be in accordance with figure 2 and table 3.

Two series of PVDF fittings exist for pipe diameters from 75 mm to 110 mm, designated type A and type B, as follows.

- Type A: socket fusion fitting for connecting to a pipe without machining;
- Type B: socket fusion fitting for connecting to a pipe with machining.



- $d_n$  is the nominal outside diameter of pipe, which is equivalent to the nominal inside diameter of socket;
- $d_1$  is the mouth diameter of socket;
- $d_2$  is the root diameter of the socket;
- $d_3$  is the minimum bore, i.e. the minimum diameter of the flow channel through the body of the fitting;
- $L$  is the actual length of the socket from mouth to fitting root.

**Figure 2 — PVDF socket fusion fitting and pipe dimensions**

**Table 3 — Dimensions and tolerances for socket fusion fittings** (see figure 2)

Dimensions in millimetres

Nominal inside diameter of socket ( $d_n$ )	Inside socket length $L$	Inside diameters of socket								Out-of-roundness max.	Bore $d_3$ min.
		Mouth, $d_1$				Root, $d_2$					
		min.		max.		min.		max.			
A	B	A	B	A	B	A	B				
16	13	15,2		15,5		15,1		15,4		0,4	11,2
20	14,5	19,2		19,5		19		19		0,4	15,2
25	16	24,2		24,5		23,9		24,3		0,4	19,4
32	18	31,1		31,5		30,9		31,3		0,5	25
40	20,5	39,1		39,5		38,8		39,2		0,5	31,4
50	23,5	49,0		49,5		48,7		49,2		0,6	39,4
63	27,5	61,9		62,5		61,6		62,1		0,6	49,5
75	≥ 30	74,3	73,8	74,9	74,3	73,1	73,5	73,7	74,0	0,7	59
90	≥ 33	89,3	88,6	89,9	89,2	87,9	88,3	88,5	88,9	1	71
110	≥ 37	109,4	108,5	110,0	109,1	107,7	108,1	108,3	108,7	1	87

### 6.3.3 Mechanical fittings

#### 6.3.3.1 Compression fittings

PVDF compression fittings shall have dimensions which suit a PVDF pipe conforming to ISO 10931-2.

#### 6.3.3.2 Flanged fittings

The mating dimensions of PVDF flanged fittings shall conform to ISO 3663.

### 6.4 Threads

Where a pipe thread is used for jointing, it shall conform to ISO 7-1.

### 6.5 Transition fittings or adaptors

The jointing dimensions of the transition fittings or adaptors, whatever the material, relating to the PVDF plastics piping shall conform to the geometric characteristics of the piping system.

## 7 Mechanical characteristics

### 7.1 Material

The PVDF material from which the fittings are made shall have a MRS  $\geq$  25 MPa, as determined in accordance with ISO/TR 9080.

NOTE — Typical PVDF material properties are given in ISO 10931-1:1996, table A.1.

### 7.2 Component test for resistance to internal pressure

When tested in accordance with ISO 1167 under the test conditions given in table 4, the fittings shall not fail within the test time given.

This test is a component test for the fitting body. When testing butt fusion fittings and socket fusion fittings, they may be connected to the pipe with which they are intended to be used.

**Table 4 — Test conditions for PVDF fittings resistance to internal pressure**

Test method	Temperature $T$ °C	Time $t$ h	Test stress $\sigma_{TF}$ MPa
A	95	200	11,5
B	120	200	8,5

The test results obtained according to method A for the resistance to internal pressure are intended primarily to indicate possible defects caused by the fittings manufacturing process and not the long-term performance of the PVDF material.

In the case of higher working temperatures, method B may be used. This test is not mandatory for evaluation of fittings, and shall be verified separately.

## 7.3 Calculation of test pressure

For a given test temperature and test time, the test pressure,  $p_{TF}$  of the fitting shall be calculated using the following equation:

$$p_{TF} = \frac{\sigma_{TF}}{\sigma_{s,F}} \times p_S$$

where

$\sigma_{TF}$  is the test stress for the fitting material (see table 4);

$\sigma_{s,F}$  is the design stress of the fitting, which for PVDF fittings is 16 MPa;

$p_S$  is the service pressure.

## 8 Elastomeric seals

Elastomeric seals shall conform to the technical requirements of ISO 9631. The elastomeric seals shall have no detrimental effect on the properties of the fittings and pipes and shall not cause the assembly to fail to conform to the functional requirements given in ISO 10931-2.

## 9 Marking

9.1 Marking details shall be either

- printed or formed directly on the fitting in such a way that the marking does not initiate cracks or other types of failure, or
- on a label,

in such a way that the marking legibility is maintained during storage, weathering, processing and normal methods of installation and use.

9.2 If printing is used, the colour of the printed information shall differ from the basic colour of the product.