

# Steel butt-welding pipe fittings

## Elbows and bends with reduced pressure factor

**DIN**  
**2605**  
Part 1

Formstücke zum Einschweißen;  
Rohrbogen; verminderter Ausnutzungsgrad

Supersedes DIN 2605,  
September 1962 edition, and  
DIN 2606, July 1965 edition.

*In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.*

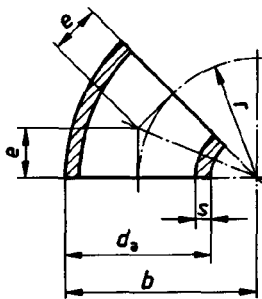
Dimensions in mm

### 1 Field of application

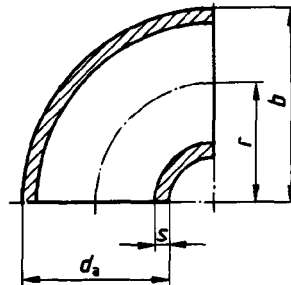
This standard specifies seamless and welded steel elbows and bends that are intended to be butt welded to pipes. Although the wall thicknesses specified correspond to those of the pipes, these fittings do not permit operation at the same internal pressure as the pipe welded on, i.e. they have a reduced pressure factor (cf. table 1 and clause 5).

### 2 Types and designation

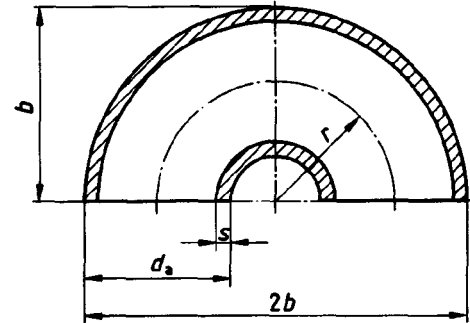
45° elbow



90° elbow



180° bend



$r$  is to be calculated as follows: type 2:  $r \approx 1,0 \cdot d_a$

type 3:  $r \approx 1,5 \cdot d_a$

type 5:  $r \approx 2,5 \cdot d_a$

type 10:  $r \approx 5,0 \cdot d_a$

type 20:  $r \approx 10,0 \cdot d_a$

Designation of a type 3 (3) seamless (S) 90° (90) elbow in accordance with this standard (1), where  $d_a$  is equal to 88,9 mm and  $s$  is equal to 2,3 mm, made from material belonging to material group G as in DIN 2609 (G):

Elbow DIN 2605-1-90-3-88,9 × 2,3 S-G

Continued on page 2 to 6

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### 3 Dimensions

Table 1. Dimensions and pressure factor

Nominal size DN	Pipe outside diameter, $d_a$ 1)	Type	Wall thickness, $s$ , for series					Maximum pressure factor, as a percentage, for series					$r$	$b$	$e$									
			1	2 <sup>2)</sup>	3	4	5	1	2	3	4	5												
15	21,3	2	1,6	-	2,0	3,2	4,0	53	-	54	57	59	17,5	28	7									
		3						74		75	76	28,0				38	12							
		5						85		85	85							42,5	53	18				
20	26,9	2	1,6	-	2,3	3,2	4,0	59	-	60	61		62	25,0	39						10			
		3						67		68	69	29,0	43			12								
		5						86		86	86						57,5	71	24					
25	33,7	2	2,0	-	2,6	3,2	4,0	52	-	53	54			55	25,0					42	10			
		3						70		70	71	38,0	56	16										
		5						86		86	86					72,5	90	30						
32	42,4	2	2,0	-	2,6	3,6	4,0	52	-	52	54				54				32,0	53	13			
		3						70		70	71	48,0	69	20										
		5						86		86	87				92,5	114	38							
40	48,3	2	2,0	-	2,6	4,0	5,0	51	-	52	53							54	38,0	62	16			
		3						72		72	73	57,0	82	24										
		5						87		87	87				107,5	132	45							
50	60,3	2	2,0	-	2,9	4,5	5,6	56	-	56	57							58	51	81	21			
		3						74		74	75	76	106	32										
		5						87		87	87				135	165	56							
		10						92		93	93							254				284	105	
		20						96		96	96													508
65	76,1	2	2,3	-	2,9	5,0	7,1	55	-	55	56								57	63	102			
		3						74		74	75	95	133	39										
		5						87		87	87				175	213	73							
		10						92		92	93							318	356			132		
		20						96		96	96												635	673
80	88,9	2	2,3	-	3,2	5,6	8,0	57	-	57	58									59	76			
		3						75		75	76	114	159	47										
		5						87		87	88				205	250	85							
		10						93		93	93							381	425	158				
		20						96		96	96											762	806	316
100	114,3	2	2,6	-	3,6	6,3	8,8	60	-	60	61										61			
		3						76		76	77	152	210	63										
		5						88		88	88				270	327	112							
		10						93		93	93							508	565	210				
		20						96		96	96										1016	1073	421	
125	139,7	2	2,6	-	4,0	6,3	10,0	61	-	61	61													62
		3						77		77	77	190	260	79										
		5						88		88	88				330	400	137							
		10						93		93	93							635	705	263				
		20						97		97	97										1270	1340	526	
150	168,3	2	2,6	4,0	4,5	7,1	11,0	60	-	61	61													62
		3						77		77	77	229	313	95										
		5						87		87	87				390	474	162							
		10						93		93	93							762	846	316				
		20						97		97	97										1524	1608	631	

1) The pipe outside diameters given have been taken from series 1 in ISO 4200.

2) The wall thicknesses specified for series 2, for nominal sizes up to DN 1000, are in accordance with the normal wall thickness series given in DIN 2458.

A dash in a box indicates a size that has not been standardized.

Table 1 (continued).

Nominal size DN	Pipe outside diameter, $d_a$ 1)	Type	Wall thickness, $s$ , for series					Maximum pressure factor, as a percentage, for series					$r$	$b$	$e$			
			1	2 <sup>2)</sup>	3	4	5	1	2	3	4	5						
200	219,1	2	2,9	4,5	6,3	8,0	12,5	62	62	62	63	63	203	313	84			
		3						77	78	78	78	78				305	414	126
		5						87	87	87	88	88				510	620	211
		10						93	93	93	93	93				1016	1126	421
		20						97	97	97	97	97				2032	2142	842
250	273	2	2,9	5,0	6,3	8,8	-	62	62	63	63	254	391	105				
		3						78	78	78	78				381	518	158	
		5						88	88	88	88				650	787	269	
		10						93	93	93	93				1270	1407	526	
		20						97	97	97	97				2540	2677	1052	
300	323,9	2	2,9	5,6	7,1	10,0	-	63	63	63	63	305	467	126				
		3						78	78	78	78				457	619	189	
		5						88	88	88	88				775	937	321	
		10						93	93	93	93				1524	1686	631	
		20						97	97	97	97				3048	3210	1263	
350	355,6	2	3,2	5,6	8,0	11,0	-	66	66	66	66	356	533	148				
		3						79	79	79	80				533	711	221	
		5						88	88	88	88				850	1028	352	
		10						94	94	94	94				1778	1956	737	
		20						97	97	97	97				3556	3734	1473	
400	406,4	2	3,2	6,3	8,8	12,5	-	66	66	66	66	406	610	168				
		3						79	79	80	80				610	813	253	
		5						88	88	88	88				970	1173	402	
		10						94	94	94	94				2032	2235	842	
		20						97	97	97	97				4064	4267	1683	
450	457	2	4,0	6,3	10	-	-	66	66	66		457	686	189				
		3						79	79	80					686	914	284	
		5						88	88	88					1122	1350	465	
		10						94	94	94					2286	2515	947	
		20						97	97	97					4572	4801	1894	
500	508	2	4,0	6,3	11	-	-	66	66	66		508	762	210				
		3						79	79	80					762	1016	316	
		5						88	88	88					1245	1500	516	
		10						94	94	94					2540	2794	1052	
		20						97	97	97					5080	5334	2104	
600	610	2	5,0	6,3	12,5	-	-	66	66	66		610	914	253				
		3						79	79	80					914	1219	379	
		5						88	88	88					1525	1830	632	
		10						94	94	94					3050	3355	1263	
		20						97	97	97					6100	6405	2527	
700	711	2	5,0	7,1	12,5	-	-	62	61	60		711	1066	295				
		3						75	73	72					1067	1422	442	
		5						83	81	81					1778	2133	737	
		10						88	86	85					3555	3911	1473	
		20						91	89	88					7110	7466	2945	
800	813	2	5,6	8,0	12,5	-	-	61	60	60		813	1220	337				
		3						74	73	72					1219	1626	505	
		5						82	81	81					2033	2439	842	
		10						87	86	85					4065	4472	1684	
		20						90	89	88					8130	8537	3368	

For 1) and 2), see page 2.

A dash in a box indicates a size that has not been standardized.

Table 1 (concluded).

Nominal size DN	Pipe outside diameter, $d_a$ 1)	Type	Wall thickness, $s$ , for series					Maximum pressure factor, as a percentage, for series					$r$	$b$	$e$
			1	2 <sup>2)</sup>	3	4	5	1	2	3	4	5			
900	914	2	6,3	10	12,5	-	-	61	60	60	-	-	914	1371	379
		3						74	72	72			1372	1829	568
		5						82	80	81			2285	2742	947
		10						87	85	85			4570	5027	1893
		20						90	88	88			9140	9597	3786
1000	1016	2	6,3	10	12,5	-	-	61	60	60	-	-	1016	1524	421
		3						74	72	72			1524	2032	631
		5						82	80	81			2540	3048	1052
		10						87	85	85			5080	5588	2104
		20						90	88	88			10160	10668	4208
1200	1220	2	6,3	12,5	-	-	-	61	60		-	-	1220	1830	505
		3						74	72				1830	2440	758
		5						82	81				3050	3660	1263
		10						87	85				6100	6710	2527
		20						90	88				12200	12810	5053
1400	1420	2	6,3	12,5	-	-	-	61	60		-	-	1420	2130	588
		3						74	72				2130	2840	882
		5						82	81				3550	4260	1471
		10						87	85				7100	7810	2941
		20						90	88				14200	14910	5882
1600	1620	2	6,3	12,5	-	-	-	61	60		-	-	1620	2430	671
		3						74	72				2430	3240	1007
		5						82	81				4050	4860	1678
		10						87	85				8100	8910	3355
		20						90	88				16200	17010	6710

For 1) and 2), see page 2.  
A dash in a box indicates a size that has not been standardized.

Table 2 below specifies outside diameters for DIN 2448 or DIN 2458 pipes which are still in use, but which deviate from those given in table 1. Elbows and bends for such pipes may still be ordered, provided they comply with all other relevant requirements specified here.

Fittings in accordance with table 2 should not be used for new designs.

Table 2. **Elbow and bend dimensions**  
(not suitable for new designs)

Pipe outside diameter, $d_a$	Type	Wall thickness, $s$	$r$	$b$
25	3	2,0	27,5	40
	5		52,5	65
30	3	2,6	33,5	48
	5		62,5	77
31,8	3	2,6	35	51
	5		67,5	83
38	3	2,6	45	64
	5		82,5	101
44,5	3	2,6	51	73
	5		97,5	120
51	3	2,6	63,5	88
	5		115	140
57	3	2,9	72	100
	5		127,5	156
63,5	3	2,9	82,5	114
	5		142,5	174
70	2	2,9	65	100
	3		92	127
	5		160	195
82,5	2	3,2	77,5	119
	3		107,5	149
	5		190	231
101,6	2	3,6	95	146
	3		133,5	184
	5		237,5	288
108	2	3,6	100	154
	3		142,5	196
	5		252,5	306
127	2	4,0	117,5	181
	3		175	238
	5		300	364
133	2	4,0	125	192
	3		181	247
	5		312,5	379
152,4	2	4,5	142,5	219
	3		215	291
	5		357,5	434
159	2	4,5	150	230
	3		216	294
	5		375	454
177,8	2	5,0	170	259
	3		250	340
	5		430	519
193,7	2	5,6	180	277
	3		270	367
	5		455	552
244,5	2	6,3	235	375
	3		340	462
	5		580	702

#### 4 Tolerances

The lower limit deviation for all sizes and wall thicknesses shall be  $-12,5\%$ .

See DIN 2609 for upper limit deviations.

Table 3. **Limit deviations for dimensions  $b$  and  $2b$** <sup>3), 4)</sup>

Nominal size DN	Limit deviations for dimension		
	$b$ 45° elbow	$b$ 90° elbow	$2b$ 180° bend
15 to 65	$\pm 6,0$	$\pm 2,5$	$\pm 8,0$
80 to 100	$\pm 7,0$	$\pm 3,0$	$\pm 9,0$
125 to 200	$\pm 8,5$	$\pm 3,5$	$\pm 10,0$
250	$\pm 9,5$	$\pm 4,0$	$\pm 14,0$
300 to 450	$\pm 12,0$	$\pm 5,0$	$\pm 14,0$
500 to 600	$\pm 14,5$	$\pm 6,0$	$\pm 16,0$
700			To be agreed.
800 or more	$\pm 19,0$	$\pm 8,0$	To be agreed.

3) The limit deviations specified for  $b$  relate to types 2, 3 and 5, these for types 10 and 20 being subject to agreement.  
4) Dimension  $b$  to be measured at the fitting end edges.

#### 5 Pressure factor and design assumptions

The pressure factor is defined as the ratio of permissible working pressure of the elbow or bend to that of the connecting pipe (the former being lower than the latter), and is expressed as a percentage. The wall thicknesses of fittings have been designed so that the fittings can accommodate the same pressure as the connecting pipe, in accordance with *Technische Regel für Dampfkessel* (Code of practice for steam boilers) TRD 301, the following assumptions also having been made:

- lower limit deviations for pipe wall thickness as follows:  
for  $d_a$  up to 610 mm:  $-12,5\%$ ;  
for  $d_a$  greater than 610 mm and  $s$  up to 10 mm:  $-0,35$  mm;  
 $s$  exceeding 10 mm:  $-0,5$  mm;
- lower limit deviations for fitting wall thickness, as given in table 3;
- identical material;
- identical welding factor for longitudinal welds;
- identical outside diameters;
- no allowance for corrosion.

#### 6 Other wall thicknesses

Elbows and bends with wall thicknesses other than those specified in table 1 may also be ordered in accordance with this standard.

#### 7 Welding end preparation

Where required, the inside of welding ends may be bevelled to an angle of  $15^\circ$  to  $18^\circ$ , or the outside to an angle of  $27^\circ$  to  $30^\circ$ , relative to the fitting axis.

#### 8 Technical delivery conditions

See DIN 2609 for technical delivery conditions for elbows and bends as covered here.

**Standards and other documents referred to**

DIN 2448 Seamless steel pipes and tubes; dimensions and mass per unit length

DIN 2458 Welded steel pipes and tubes; dimensions and mass

DIN 2609 Steel butt-welding pipe fittings; technical delivery conditions

ISO 4200 Plain end steel tubes, welded and seamless; general tables of dimensions and masses per unit length

TRD 301\*) *Zylinderschalen unter innerem Überdruck* (Cylindrical shells subject to internal pressure)

**Other relevant standard**

DIN 2605 Part 2 Steel butt-welding pipe fittings: elbows and bends for use at full service pressure