DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.

Calculation of thermoplastic tanks and appartuses
Welded flanges, welded collars – constructive details

Directive DVS 2205-4
Supplement
(November 1996)

D V S

Contents:

1 Scope

This directive describes the design of pressure-loaded welded flanges and welded collars in accordance to the design conditions for tanks and apparatuses out of thermoplastics as mentioned in section 2

Polyethylene high density	(PE-HD)
Polypropylene	(PP-H, PP-B, PP-R)
Polyvinylchloride	(PVC-NI, PVC-RI)
Polyvinylidenefluoride	(PVDF)

in the general application range:

Diameter 500 up to 4000 mm for welded flanges and
Diameter 500 up to 1200 mm for welded collars

The welded flanges referred to in the following comprise welded-on collars (figures 1 and 2) and welded neck flanges (figure 3) with flat gaskets.

The welded collars comprise welded-on collars (figures 4 and 5) and welded neck collars (figure 6) with flat gaskets and O-rings.

2 Design conditions

The design of welded flanges and welded collars is based on the directives DVS 2205-1 and -4.

The heights of the flange plate h_F are calculated with continuous gasket out of elastomers (shore-A hardness 60°), because this gasket material is mainly used for tanks and apparatuses out of thermoplastics. If other gasket materials are specified, h_F has to be calculated c.

Additionally, the height h_F has been calculated under the following conditions:

1. Pressure p = 0,5 bar as fictitious pressure, in order to get a usable height of the welded flange resp. of the welded collar.
2. Creep strength $K_{(A1, A3)}$ of the material for the loading time of 25 years at a working temperature of 30°C according to directive DVS 2205-1. The standard DIN 8075 is valid for polyethylene. DIN 8078 is valid for polypropylene Type 1 and 2, DIN 8061 are considered for polyvinylchloride (PVC-U and PVC-RI Type 1 and 2).
3. Safety factor S = 2,0

If the working conditions differ from the above mentioned, h_F has to be calculated accordingly.

Connecting bolts have to be used basically with plain washers according to DIN 9021. Both, the connecting bolts and the plain washers should be made of stainless steel (e.g. A2, A4 according to DIN 267-11) in order to prevent corrosion.

3 Tables of dimensions

3.1 Welded flanges – table 1

3.2 Welded collars – table 2

3.3 Screw tightening moments

The required screw tightening moments are as follows:

M 10: 15 Nm
M 12: 25 Nm
M 16: 50 Nm

The installation of the connection bolts should be performed by means of a torque wrench. The screws have to be torqued evenly. Exceeding the mentioned tightening moments has to be avoided.

The above mentioned screw tightening moments are valid for flange connections out of thermoplastics at the application of flat gaskets out of elastomers with a shore-A hardness of approximately 60°. If profiled gaskets are used, the mentioned screw starting torques may be reduced by 20 %.

DVS, Technical Committee, Working Group "Joining of Plastics"

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Table 1. Welded flanges for apparatuses out of thermoplastics – dimensions.

welded-on flanges

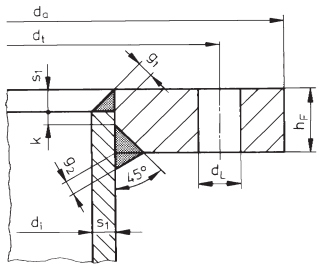


Figure 1

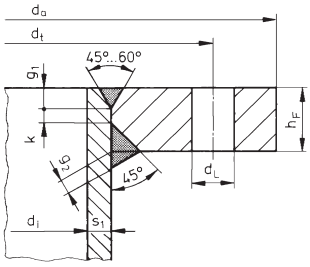


Figure 2

welding neck flange

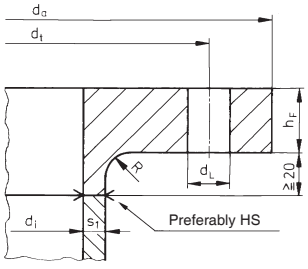


Figure 3

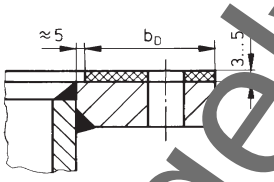
$g_1 = 0.7 \cdot s_1$ from tank calculation
$g_2 \geq 0.4 \cdot s_1$
up to d_i = 1000 mm: d_a and d_t according to DIN 2501 PN 6
as from d_i = 1200 mm: d_a and d_t according DIN 2501 PN 2.5
Abbreviations and symbols see DVS 2205-4

$k \approx 0.2 \cdot h_F$

R = 10 ... 15 mm

d_i	d_a	d_t	holes		h_F			
			Number	d_L	PE	PP	PVC	PVDF
500	645	600	20	12	25	20	20	15
600	755	705	24	12	25	25	20	15
700	860	810	28	12	25	25	20	15
800	975	920	32	12	30	30	25	20
900	1075	1020	36	12	30	30	25	20
1000	1175	1120	40	12	35	30	25	20
1200	1375	1320	44	14	35	35	30	20
1400	1575	1520	52	14	35	35	30	20
1500	1690	1630	56	14	40	40	30	25
1600	1790	1730	60	14	40	40	35	25
1800	1990	1930	64	14	45	40	35	25
2000	2190	2130	72	14	45	45	35	30
2200	2405	2340	80	14	50	50	40	30
2400	2605	2540	84	14	50	50	40	30
2500	2705	2640	88	14	55	50	40	30
2600	2805	2740	88	18	55	50	40	35
2800	3030	2960	96	18	60	60	50	35
3000	3230	3160	104	18	65	60	50	40
3200	3430	3360	112	18	65	60	50	40
3600	3840	3770	120	18	70	70	55	45
3800	4045	3970	124	18	70	70	60	45
4000	4245	4170	132	18	75	70	60	45

Flat gasket



Design conditions:
Working pres[illegible]ar
Working te[illegible]perat[illegible]e: 30°C
Working ti[illegible]e: [illegible]25 years
Safety facto[illegible]2,0