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1 Scope of application

The DVS 2210-1 technical code includes fundamentals for the design, calculation, prefabrication and assembly of industrial piping made of thermoplastics and laid above ground.

Supplement 3 describes the fundamental design principles and requirements for flanged joints in above-ground piping made of thermoplastics. It should serve to supplement the generic standards (e. g. DIN 16962-4/12, DIN 16963-4/11 and DIN 8063-4 as well as DIN EN ISO 15493 ff. and DIN EN ISO 10931) with regard to the proper application in the construction of plastic piping. This supplement will replace Section 5.3.3.3 of DVS 2210-1.

The fundamentals for the dimensioning of flanged joints are dealt with in DVS 2210-1, Supplement 4 (under preparation). The recommendations included in Supplement 4 encompass not only flanged joints whose dimensions have not yet been standardised but also flanged joints whose loading limits should be established by calculation.

1.1 Remarks about application

The application of Supplement 3 is not restricted to certain areas of use of thermoplastic piping.

The fundamental principles are applicable to all flanged joints that are joined in a non-positive-locking form using bolts and a seal.

Supplement 3 deals exclusively with flanged joints that must bear forces from internal pressure loads and/or forces or moments from the thermal expansion of the pipe system. These also in-

clude tank flanges if they are joined with piping in a non-positive-locking form.

Any flange nozzles (not connected by piping) on plastic tanks with an internal overpressure of $p \leq 0,5$ bar must be structurally designed according to the DVS 2205-4 technical code, Supplement 1.

Special flanges, e. g. in an oval or rectangular shape, are not included in the scope of the DVS 2210-1 technical code or its supplements.

The scope of application can only be extended to flanged joints in buried piping if loads from outside (e. g. due to the installation location) are considered separately.

1.2 Materials

The area of application of Supplement 3 is valid without restrictions for pipe systems made of:

Polyethylene: PE (PE 80 and PE 100)
 Polypropylene: PP-H, PP-B and PP-R (Types 1, 2 and 3)
 Polyvinyl chloride: PVC-C and PVC-U
 Polyvinylidene fluoride: PVDF

Comprehensive parameters and experience relating to their behaviour when subjected to long-term loads are available for the thermoplastics named above. Therefore, it may be assumed that the fundamental principles are the same for these materials.

The diversity of thermoplastics, with their different material properties, does not permit the generalisation of all the fundamental principles summarised in Supplement 3.

The behaviour of other thermoplastics, such as ABS, PB or LCP/PE, is similar to that of the above plastics but their applicable parameters are currently incomplete.

When choosing the seal material, attention must be paid not only to good ductility but also to the chemical and thermal suitability.

When choosing the material for the loose flanges, the loads to be expected on the flanged joint are an essential factor. It must be guaranteed that the bolting to be applied during assembly is maintained permanently, i.e. the flanges subjected to permanent loads must have insignificant creep.

If the parameters for determining the material properties and behaviour of flanged joints subjected to loads are available for any particular application, the fundamental principles specified in Supplement 3 can be used accordingly. This applies, for example, to flanged joints in pipe systems made of thermoset plastics.

Unless otherwise mentioned, Supplement 3 only deals with those flanged joints whose parts have standardised shapes and dimensions (see section 2).

Flanged joints outside the above scope may be subject to other standards, technical codes and guidelines that are not included in the scope of DVS 2210-1. In this case, no or only limited reference may be made to Supplement 3 in order to solve specific problems. In any case, the user is responsible for the proper use of the fundamental principles described in Supplement 3.

This publication has been drawn up by a group of experienced specialists working in an honorary capacity and its consideration as an important source of information is recommended. The user should always check to what extent the contents are applicable to his particular case and whether the version on hand is still valid. No liability can be accepted by the Deutscher Verband für Schweißen und verwandte Verfahren e.V., and those participating in the drawing up of the document.

DVS, Technical Committee Working Group "Joining of Plastics"

2 Components of the flanged joint

Below, the essential components of a flanged joint are listed and described. The flanged joint predominantly used in the construction of plastic pipe systems using loose flanges is depicted in Fig. 1.

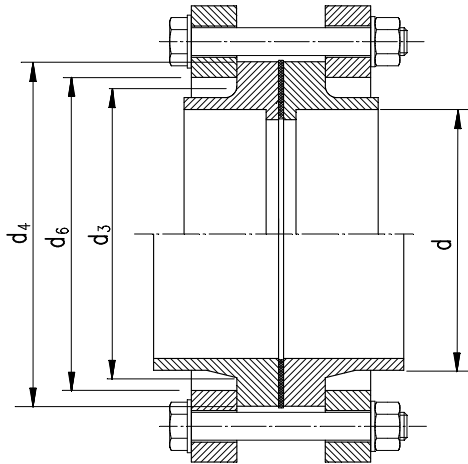


Figure 1. Standard flanged joint with loose flanges.

2.1 Welding necks

Necks with welding ends, generally called welding necks, can be joined with the pipe using both the heated tool butt welding process (HS) and the electrofusion welding process (HM) – this applies mainly to PE but also to PP. Necks with short (HS) and long (HS and HM) welding ends are available for this purpose.

Standardised dimensions for welding necks are specified in DIN 16962-4, DIN 16963-4 and DIN EN ISO 10931. The standardisation of the welding necks does not cover all pipe series. Therefore, dimensional requirements outside standardised specifications must be made for applications with higher internal pressures (see also Section 2.6).

In this respect, it must be ensured that the diameter of the neck shoulder, d_3 , remains within the dimensional limits specified in DIN EN 1092-1 (Fig. 2).

The connecting dimension, d_4 , of the standardised welding necks, classified according to nominal pressure, should comply with DIN 2501-1 with the designation according to Table 1.

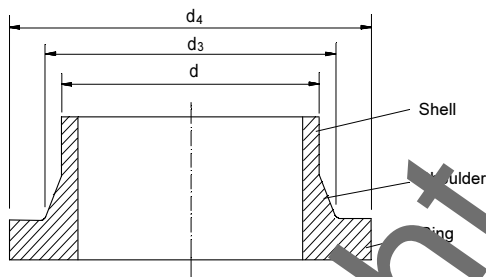


Figure 2. Welding neck.

Table 1. Designation of the connecting dimensions.

DN	d_3 (DIN EN 1092-1)	d_4 (DIN 2501-1)
Up to DN 150	After PN 10	After PN 40
As from DN 200		After PN 10

Remark: The connecting dimensions according to Table 1 depend on the nominal pressure and do not provide any information about the load-bearing capacity of the welding neck or of the flanged joint.

Depending on the strength of the material, the welding neck with associated dimensions related to the nominal pressure can, if necessary, be subjected to an internal overpressure $p >$ nominal pressure. In applications above the nominal pressure, calculational proof must be provided or a manufacturer's certificate obtained.

2.2 Neck bushes

Neck bushes (Fig. 3) are joined to the pipe using an overlap joint. Depending on the properties of the material concerned, the joint can be formed by means of heated tool sleeve welding or adhesive bonding.

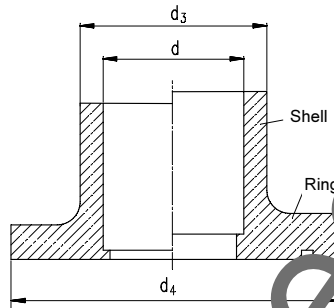


Figure 3. Neck bush.

Standardised dimensions for neck bushes are given in DIN 8063-4, DIN 16962-4, DIN 16963-4, DIN 16964-4, DIN 16832-1 and DIN EN ISO 10931. With regard to the designation of the connecting dimensions of neck bushes and their internal pressure capacity, attention must be paid to the information in Section 2.1.

2.3 Loose flanges

Loose flanges are supported on the ring of the welding neck or the neck bush and must exhibit a sufficient bending stiffness when the bolt forces are applied. In addition, attention must be paid to their corrosion resistance, depending on the application.

It is possible to manufacture loose flanges from solid plastic if the material strength permits economically viable dimensioning (e. g. loose flanges made of glass-fibre-reinforced plastic or PVC). The combination of a plastic flange with an insert made of steel or carbon has proven to be suitable due to its low deformation.

The standardisation of loose flanges for welding necks and neck bushes made of plastic is based on the dimensions in DIN EN 1092-1, "Steel flanges, PN 10".

2.4 Blind flanges

Blind flanges are used to shut off a section of pipe and permit the subsequent continuation of an existing line. Blind flanges analogous to Shape A (without a sealing strip) in DIN EN 1092-1 are predominantly used in the construction of plastic pipe systems. In this case, the load-dependent thickness of the flange is determined mainly by the strength of the material used. As in the case of loose flanges, various materials and material combinations are used.