April 1997

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

Industrial Pipelines Made of Thermoplastics
Planning and Execution
Above-Ground Pipe Systems

DVS
Technical Code
DVS 2210-1

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DVS, Technical Committee, Working Group “Joining of Plastics”

Orders to: DVS Media GmbH, P. O. Box 10 19 65, 40010 Düsseldorf, Germany, Phone: +49(0)211/1591-0, Telefax: +49(0)211/1591-150

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1 Scope

This directive includes fundamentals for the planning, calculation, prefabrication and assembly of industrial pipelines that are made of thermoplastics and are laid above ground. Prerequisites for the application of the directive are not only experience in general pipeline construction but also extensive knowledge about the materials specified in Section 1.2.

The pipelines referred to in the directive can be used in order to transport liquid and gaseous substances. The pipelines may be laid either inside buildings, ducts and shafts or outdoors. Pipelines for heating, sanitary and ventilation installations are not dealt with in this directive.

This directive must be considered for the specified area of application. Particularly in the case of pipelines for the transport of environmentally hazardous or toxic substances, there is no need for any additional agreements between the customer and the company performing the work with regard to the application of the directive.

Separate attention must be paid to any laws, regulations or official requirements that demand, extend or restrict the application of this directive. Remarks about this subject are included in Section 2.

1.1 Areas of Application

Typical areas of application are:

– Waste water installations
– Electroplating installations
– Semi-conductor industry
– Industrial and chemical installations
– Cooling and service water supply
– Food and beverage industries
– Water treatment installations

This directive may also be valid for areas of application that are not specified.

1.2 Materials*

The directive applies to the following materials:

– Polyethylene(HDPE)
– Polypropylene, Types 1 to 3(PP-H), (PP-B) and (PP-R)
– Polyvinyl chloride(CPVC) and (UPVC)
– Polyvinylidene fluoride(PVDF)

The selection of the material is influenced by the application in question and by the operating conditions to be expected. The directive may also be applied to thermoplastics that are not specified here.

* The material designations must be understood as generic terms for a group of thermoplastics in each case. The information corresponds to the current status of the standardisation. Thermoplastics with commercial designations according to DIN, EN and ISO standards must be assigned to the respective material groups according to their characteristics (e.g. HDPE includes the PE 63, PE 80 and PE 100 types and PVC the HI, NI and RI types).

2 General Remarks

Pipelines that are used in installations for the storage or transportation of water-polluting substances must be handled according to the construction and testing principles stipulated by Deutsches Institut für Bautechnik (DIBt).

Pipelines that have an outside diameter > 32 mm and an operating overpressure of more than 0.1 bar and are used to transport combustible, corrosive or poisonous gases, vapours and liquids are governed by the Pressure Vessel Ordinance (DruckbehV). The pipelines also include their equipment parts. All the mountings, measuring and regulating devices and other devices that may exert an influence on the safety of the pipeline must be regarded as equipment parts.

In connection with the provisions stipulated in DruckbehV, it is necessary to comply with the Technical Rules (TRR 120) for pipelines made of thermoplastics.

3 Planning

3.1 Fundamentals

As far as the planning of thermoplastic pipelines is concerned, consideration must be given to the particular material characteristics with regard to their behaviour when subjected to operation-induced and external influences. These include mechanical, thermal and chemical stress types. The mathematical design of the pipeline must correspond to the loads arising in the testing, assembly and operating states. The essential material characteristics are described in Section 3.3.

3.2 Influencing Variables

The expected service life of the pipeline is influenced by the operating loads. It must therefore be ensured that during the planning phase, the influencing variables from all of the operating states are defined carefully and that the approach for the design is based on these influencing variables.

The fundamental loads on thermoplastic pipelines and their effect on the operational safety are described below.

3.2.1 Loads Caused by Internal Overpressure

As a rule, the internal pressure in a pipeline must not exceed the operating overpressure stipulated in the generic standards for pipes. Persistent overpressure caused by internal pressure leads to the accumulative expansion of the pipe until it fractures.

It must be borne is mind that the operating overpressures specified in the pipe standards are not generally applicable to all pipe fittings. Particularly in the case of fittings manufactured from pipe, geometrical influences and fabrication-induced imperfections may result in a necessary reduction in the internal pressure loads permissible according to the pipe standard.

Another restriction of the internal pressure resistance of pipelines in comparison with the data in the pipe standards results from bending and thermal stresses whose effect may be superimposed on the stresses caused by the internal pressure. Therefore, the overall stress condition inside a pipe system must always be determined mathematically and must be used as a measure for assessing the permissible operating overpressure.

It must be taken into consideration that the pipeline is frequently exposed to an intermittent operating overpressure rather than a continuously operating overpressure. The levels and durations of the loads in question must be the subject of a separate examination. Over time, the individual load sections result in the definitive stresses that allow a statement to be made about the expected service life of the pipeline.

Pressure surge loads may also arise, and these must be investigated mathematically and their effect on the operational safety of the pipeline must be assessed. Pressure surges must be reduced or avoided primarily by taking design-related measures.