

In addition to welding and other joining processes, adhesive bonding processes are being utilised to an ever greater extent for the manufacture of industrial products. Adhesive bonding has the advantage that it can be used to join different materials without any heat input or distortion and with uniform transfer of forces.

The effective application of the adhesive is a major technical challenge. The use of adhesive application equipment has a decisive influence on the quality of the bonded products. It must be ensured that the adhesive is applied properly in a reliable process, namely it must be ensured that no application errors arise such as mixing errors and excessive or insufficient adhesive metering.

As such, there must be suitable monitoring and quality assurance measures in place for all steps in the adhesive application process. The individual process steps and the necessary technical and personnel-related requirements for the adhesive application must be described clearly and any irregularities must be avoided. Monitoring must be carried out in order to ensure that the prescribed quality is attained.

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1 Area of application

This technical code has been prepared in such a way that:

- it is independent of the type of adhesive, sealant or filling compounds (viscous substances)
- it applies to both one component and multicomponent adhesives
- it does not relate to bulk materials
- it is not intended for adhesive tapes
- it does not relate to printing (screen, tampon [pad] and thermal transfer printing) or to roller or roll application
- it is independent of the nature of the adhesive application and the substrate, but always relates to the mechanical processing of the adhesive
- it indicates possible parameters which may serve as quality criteria
- possible sources of errors in the adhesive application process are indicated
- it indicates possible quality assurance measures and improvement measures in order to preserve and ensure the quality of the adhesive application
- it provides guidance for determining the ability of an adhesive application installation and user to apply adhesives or sealants in accordance with the specified requirements
- it provides guidance for describing the requirements on adhesive application.

2 Standards, guidelines, technical codes, directives and other documents

This technical code includes stipulations from other publications in the form of dated references. These references are quoted at relevant places in the text. Details of these publications are given below.

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 "Adhesive Bonding Technology"

DIN EN ISO 527	Plastics – Determination of tensile properties
DIN EN ISO 7390	Building construction – Jointing products – Determination of resistance to flow of sealants
DIN EN ISO 9000	Quality management systems – Fundamentals and vocabulary
DIN EN ISO 9001	Quality management systems – Requirements
DIN EN ISO 9004	Managing for the sustained success of an organization – A quality management approach
DIN EN ISO 10365	Adhesives – Designation of main failure patterns
DIN EN ISO 14678	Adhesives – Determination of resistance to flow (sagging)
DIN EN 542	Adhesives – Determination of density
DIN EN 827	Adhesives – Determination of conventional solids content and constant mass solids content
DIN EN 1067	Adhesives – Examination and preparation of samples for testing
DIN EN 1242	Adhesives – Determination of isocyanate content
DIN EN 1464	Adhesives – Determination of peel resistance of adhesive bonds – Floating roller method
DIN EN 1465	Adhesives – Determination of tensile lap-shear strength of bonded assemblies
DIN EN 1612-1	Plastics and rubber machines – Reaction moulding machines – Part 1: Safety requirements for metering and mixing units
DIN EN 12092	Adhesives – Determination of viscosity
DIN EN 12701	Structural adhesives – Storage – Determination of words and phrases relating to the product life of structural adhesives and related materials
DIN EN 14022	Structural adhesives – Determination of the pot life (working life) of multicomponent adhesives
DIN 54457	Structural adhesives – Testing of adhesively bonded joints – Grub peel test
DIN 55319-2	Statistical methods – Part 2: Process capability statistics for characteristics following a multivariate normal distribution
DIN 55319-3	Statistical methods – Part 3: Process capability statistics for measurement results following a multivariate normal distribution
DIN 65448	Aerospace; structural adhesives; wedge test
Guideline DVS®-EWF 3301	DVS®-EWF European Adhesive Specialist (EAS)
Guideline DVS®-EWF 3305	DVS®-EWF European Adhesive Bonder (EAB)
Guideline DVS®-EWF 3309	DVS®-EWF European Adhesive Engineer (EAE)
Technical code DVS 3310	Quality requirements in adhesive bonding technology
Technical code DVS 3311	Adhesive Bonding Supervision – Tasks and Responsibilities
GefStoffV	Hazardous Substances Act; Provisions for protection against hazardous substances
VawS	Regulations on installations for the handling of substances hazardous to water
Directive 97/23/EC	Directive on pressure vessels

3 Definitions and terms

The following definitions apply for this technical code:

Metering quantity / discharge rate:

The quantity of adhesive applied per unit time arising from the requirements on the process (e.g. cycle time and bead geometry), for example in g/s or cm³/s.

Processing time:

Describes the maximum possible processing time up to the end of the joining operation. In general this is the skinning time or the open time in the case of one-component adhesives or the pot life in the case of two-component or multicomponent adhesive systems (DIN EN 14022 or according to information from the manufacturer).

Tack-free time:

The time which is needed in order to obtain a surface which is dry to the touch (in s).

Mixing ratio:

Describes the ratio of the components to be mixed with each other (on a gravimetric/volumetric basis) as specified by the manufacturer. This is directly related to the tolerance specifications and the metering accuracy.

4 Personnel involved in the adhesive application

Possible personnel-related and technical requirements for quality assurance during the adhesive application are specified and described below.

4.1 General

The user must have a sufficient number of trained personnel for carrying out and monitoring the adhesive application and for servicing and cleaning the installations (see the DVS®-EWF 3301 and DVS®-EWF 3305 guidelines as well as the DVS 3310 technical code).

4.2 Personnel carrying out the adhesive application

The required qualifications for personnel carrying out the adhesive application, namely installation operators and operators of robots, are specified in the relevant part of the DVS®-EWF 3305 guideline. Suitable qualifications are, for example, the training courses according to the DVS®-EWF 3301 and DVS®-EWF 3305 guidelines. Where required, all qualification documents must be kept up-to-date.

Furthermore, the installation operators and the servicing and cleaning personnel must be trained and instructed by the companies which supply the adhesive application installations. The personnel must be trained during the commissioning of the installations and must be supported during the running-in phase. If the application installation or the application process is modified or extended, the installation operators must be re-instructed.

4.3 Personnel supervising the adhesive application

The user must have suitable supervisory personnel to give the necessary work instructions and to ensure that the work is carried out carefully and is monitored. Suitable qualifications for this are, for example, the qualifications in accordance with the DVS®-EWF 3301 guideline: "European Adhesive Specialist". All people who are responsible for the quality tasks must have adequate authority to instigate any necessary measures. The duties, interrelationships and limits of the areas of responsibility of such people must be adequately specified.