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

Welding of thermoplastics in series fabrication
Rotational friction welding – Installations, procedures and characteristics

DVS
Technical Code DVS 2218-1

Contents:

1 Scope of application

This technical code applies to the joining of mouldings and semi-finished products made of thermoplastics by means of rotational friction welding.

2 Procedural description

The heat required for the plastification of the parts to be joined is generated by friction. In this respect, one joining part is set in a rotating movement by a catch and the second joining part is fixed. During the welding, an axial pressure and/or a radial pressure must be effective on the joining parts so that they are completely plastified by interfacial friction and shear heating. The prerequisite for rotational welding is the presence of a rotationally symmetrical joining face. This may be circular, annular or conical or may have another suitable shape. The quality of the welded joint depends on material-specific, design-induced, procedure-induced and machine-related influences. The utilisation of the rotational friction welding procedure requires a special, suitable formation of the joining faces. As a rule, the rotational movement is produced by servo-motor drive systems, however in any case by drive systems with regulated rotational speeds.

3 Structure and effective method of rotational friction welding machines

Rotational friction welding machines transfer a rotational movement which is produced by a drive system and consists of constant or variable rotational movements to one of the two joining parts to be welded. At the same time, the required joining pressure is generated by a defined force. This only applies to rotational butt welding. In the case of rotational sleeve welding, the welding force is generated by corresponding fit-ups and/or pinching-expanding jigs.

3.1 Requirements on rotational friction welding machines

The terms of reference determine the choice of the machine type as well as the scope of the control/regulation. If necessary, the following requirements must be satisfied by the machine control and regulation system (see also Sections 3.3 and 7):

- rotational speed (adjustable and regulable)
- friction time
- welding force (during the welding process, variable and regulable)
- holding force (during the welding process, variable and regulable)
- force build-up before the beginning of the joining process (adjustable and regulable)
- welding path or insert depth (adjustable and controlled)
- insert speed (adjustable and controlled)
- welding and cooling times (adjustable and controlled)
- joining path limitation (adjustable)

Furthermore, it should be possible to document the process data with statistical evaluation for quality assurance purposes.

3.2 Machine structure

In the case of standard machines, the drive motor is preferably located on the top side of the rotation unit or in a flat position in horizontal alignment. The workpiece support must centre the stationary welding part and keep it in the correct position with a sufficient holding force. The catch must accommodate the rotating welding part with non-positive and positive locking. The holder tools ensure the fixing of the joining parts as well as the transfer of the joining forces and of the rotational movement. Attention must be paid to the maximum permissible tool weight for the movement (see Fig. 2).

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

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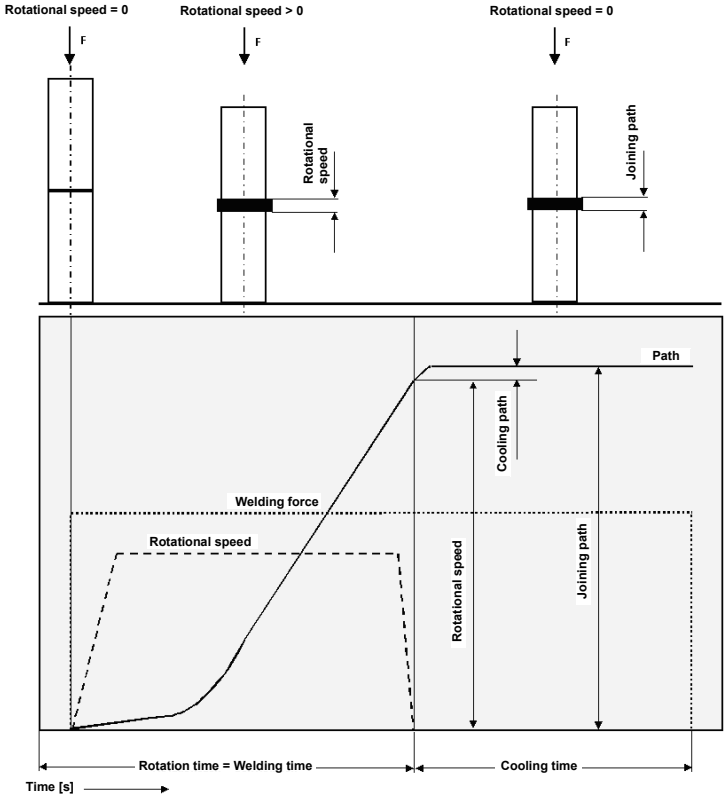

Figure 1.
Principle of rotational welding on a butt joint. The procedural diagram in the case of the inertia flywheel does not show a welding force but instead merely a regulated insert speed to the end position.

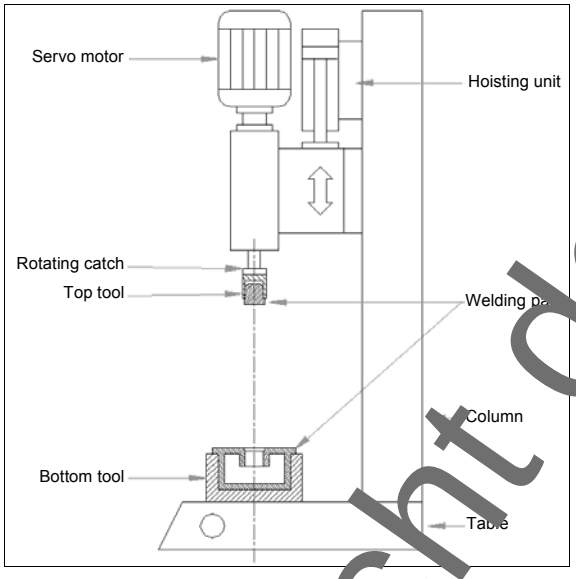

Figure 2.
Schematic representation of a **vertical** rotational friction welding installation.