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1 Preface / scope of application

The technical code applies to the joining of mouldings and semi-finished products made of thermoplastics in series fabrication.

The portrayed course of the project is described in clearly delimited steps from the product idea to the readiness for series fabrication. This guide is intended to serve as an overview for all the participants in the project from the component design, the fabrication planning, the machine manufacture and the production. Any conflicting interests arising in this case should be solved on the basis of common and transparent interfaces.

In this respect, the objectives are to:


- **Completely** portray the development up to the readiness for series fabrication
- Portray the steps necessary for this purpose in their logical **sequence**
- Outline each individual step with regard to the **prerequisites** and the **results**
- Stipulate the **responsibilities** for the implementation of individual steps in the course of the project
- Allow the participants an insight into preceding and subsequent steps in order to fulfil their own areas of responsibility **comprehensively**
- Achieve the reasonable solution to the terms of reference by clearly defining the requirements and by checking them at every step up to the readiness for series fabrication
- Develop components **appropriate for the process** as well as processes **appropriate for the component**

In general, it is a question of organising the project sequence accurately with high-quality results and of planning it effectively in this way. Any subsequent improvements to components, tools or machines should be plannable or avoidable as far as possible.

2 Procedure for the application of the flow chart

For joints between thermoplastics, the flow chart, see Fig. 1, shows a structured procedure for the development up to the readiness for series fabrication. The starting point is the definition of the requirements on the component function and on the fabrication. In this respect, the consideration is restricted to those requirements which relate to the joint.

The project sequence is divided into individual steps or milestones.

Every step builds upon the results of the preceding step and forms the basis for the subsequent step. After every step, the result is checked in relation to the previously defined requirements. The evaluation criteria for the success of a step are portrayed with a  and are explained in the text.

The next step in the sequence is only begun if the preceding steps were successful or any established deviations are not relevant to series fabrication.

While the right side of the chart always refers to the original requirements, the left side in the advanced project relates to the compliance with the quality criteria abstracted from them.

Only in the ideal case is the project sequence run through without any iteration. As a rule, it will be necessary to repeat steps in this respect, either just one step must be repeated in a smaller or, as a more far-reaching measure, the prerequisites or the requirements must be amended for the unsuccessful step. The extent of the repetitions is not portrayed explicitly.

A continuous validation operation checks the estimates obtained from the design FMEA as to whether the design and the stipulated quality criteria are suitable for ensuring the component function. It is not portrayed explicitly on the chart.

3 Description of the steps in the project sequence**1. Profile of the requirements on the components**

The **component function** should be described in the sense of the question:

- "What purpose does the component serve?"

Knowing the component function makes it possible to:

- Understand the requirements resulting from it
- Develop alternative solutions or compromises between the different requirements (component, fabrication and process)

The **component requirements** are described in the sense of the question:

- "What is the component intended to achieve?"

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

The basis is the component function.

In this respect, the profile of the requirements must be reduced to those requirements which are connected with the joining process and with the components involved in it. The requirements should always be described completely and unambiguously (cf. also the portrayal of the quality criteria).

Typical component requirements are, e.g.:

- Detachable or undetachable joint
- Mechanical requirements: tension, pressure, vibration, overpressure, torsion, ...
- Optical requirements: gloss, impressions, partial melting or discoloration phenomena, ...
- Dimensional accuracy
- Leak tightness
- No particles
- Functional requirements: easy running, permeability, jamming, backlash, ...
- ...

The component requirements are recorded in system specifications. In this form, they are the far-reaching basis for all the other steps.



System specifications for the component

2. Profile of the requirements on the fabrication

The basis is the component requirement.

The fabrication requirements are described in the sense of the questions:

- "How many components must be produced?"
- "Where is the component produced?"
- "What boundary conditions must be complied with?"

Typical fabrication requirements result from stipulations of the:

- Production quantity
- Flexibility with regard to different quantities
- Fabrication time (hours per day, week or year)
- Production speed
- Permissible scrap rates
- Availability requirements
- Manual work and the number of workers
- Degree of automation
- Fabrication location
- Fabrication competence of the operating personnel
- Flexibility with regard to different component variants or other product series
- Material flow (stock, accessibility, loading and unloading, scrap separation, ...)
- Investment costs
- ...

The fabrication requirements are recorded in system specifications. In this form, they are the far-reaching basis for all the other steps.



System specifications for the fabrication

3. Responsibilities

The responsibilities must be stipulated in the sense of the question:

- "Who is responsible for what step?"

The manufacturers, the suppliers and the customers must name and document the contacts and the people responsible for the overall project and the individual steps.



Responsibility matrix

4. Component concept

The function, component and fabrication requirements serve to elaborate a component concept consistent with them. It describes the component in the sense of the questions:

- "How should the requirements be satisfied?"
- "With what should the requirements be satisfied?"

If necessary, it is compared with the already finalised fabrication requirements.

Described contents	Decision-taking aids
- Functional principle and relevant functional groups	
- Material selection Type, fillers and additives	DIN EN ISO 1043-1: Plastics – Code letters and abbreviations – Part 1: Base polymers and their particular properties Draft DIN EN ISO 1043-2: Plastics – Code letters and abbreviations – Part 2: Fillers and reinforcing materials DIN EN ISO 11469: Plastics – Type-specific identification marking of plastic mouldings
- Manufacturing processes of the individual joining members and fabrication tolerances associated with them	

The component concept is documented and is supplemented by concept drawings.



Component concept

5. Fabrication concept

The component concept and the fabrication requirements serve to elaborate a fabrication concept consistent with them.

As far as possible, the fabrication concept anticipates the process planning, with a:

- Layout sketch (portrayal) of the machines, their relative sizes and their arrangement
- List of the work steps: compilation of the work steps defining the shape and the function
- Portrayal of the already known quality controls in the work plan



Fabrication concept

6. Select the joining process

The selection of the joining process is based on a component concept coinciding with the previously known requirements.

A joining process which sets new process-induced requirements on the component is selected in this step. These requirements must be reconcilable with the previous concept. Otherwise, a different joining process must be chosen or an alternative concept must be elaborated.