QUALITY ASSURANCE IN DESIGN OF PIECES DEEP-DRAWING

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Abstract: *The quality of the pressed parts is provided with the quality design and quality of their manufacturing. It is characterized by physical continuity function of the piece, the dimensional accuracy, precision shape, relative position accuracy and mill-finished of workpiece surfaces as well as the physico-chemical and mechanical properties of workpiece material, corresponding development necessary to satisfy a given function.*
Key-words: *projectedquality, production quality, reliability and durability of the die*

1. INTRODUCTION

The specialists consider quality of products as any of the following considerations: to satisfy a need, degree of consumer satisfaction, conformity to specifications, cost is minimized for a given use, the capacity to perform the function for which it was created product, satisfying the entirely beneficiaries.

2. CONCEPTS TO DEFINE PRODUCT QUALITY

Due to the increasing and diversification of requests of products and following the development of industrial production can discuss about: *the potential quality*, that the resulting after the design as before assimilation into manufacturing; *the quality partial*, representing the ratio between obtained and the required quality; *the quality assured*, namely the one obtained from the activity of quality control (prevention, measurement and corrective action); *the total quality*, including the utility level, aesthetics and ergonomics products.

In practice the following terms are used to define quality: *the quality projected* (or *design quality*), which represent the extent to which the product design fulfils the requirements of the beneficiary; *the quality manufacturing* of the product indicates the degree of conformity with the technical documentation and it is determined by the process, the equipment production, labour activity, tracking and control activity, etc.; *the quality delivered*, which represent the effective level quality of products delivered by the supplier.

Defining the quality is based on use value, which represents all the characteristics of a product that gives utility. There are products that have the same value of use, but satisfy different needs for which they were created. It results notion of *product quality*, which is the extent to which it meets the needs for which it was created, under the technical and economic conditions efficiency and respecting the norms of environmental protection and social. It is evident that the concept of product quality and technical level of achievement include it.

Product quality „is realized" in the production process and it is tested in consumption process of their. For this reason, there is a distinction between the *quality of production*, including quality of design processes, the work of organizing production and *product quality*, which is the ultimate expression of quality production processes as perceived by the consumer. The quality production ensures high quality means of production realized, which reintroduced in manufacturing determines its improvement and creates the superior materials condition to increase the quality of new products. In these circumstances the quality is not the sum of the static characteristics but presents a dynamic character, evolving as a spiral. The quality characteristics are: *technical*, related to the physical, chemical propertys, etc. (generated by the structure of the material), to the constructive and functional product design; *psycho-sensory* which aimed at aesthetic, ergonomic aspects, etc..; *to availability* imposed by the existence of durable and extremely complex products to be reliable and maintainable. The reliability is the ability of a product to confer safe operation in certain circumstances, for a well defined period. Maintainability is the ability of a product to be back in operation in a given time [1].

3. THE INFLUENCE OF ACTIVE ELEMENTS ON PRODUCT QUALITY

To ensure the technological aspect of the machined parts, the process engineer and the designer must consider [2]: the designing a die with a more simple form; the correct choice of its material, for avoid the occurrence of internal tensions, the cracks after hardening; the optimal establishment of tolerances; the ensuring wear resistance, fatigue performance and high construction precision of the active elements through the correct technological methods of processing and heat treatment; the appropriate choice of material (from the point of view of mechanical, chemical, metallurgical features) and determining the shape, dimensions and dimensional accuracy of the work piece; the technological process to ensure the final dimensional accuracy, shape, position, the influenced layer depth, the surface roughness.

Using FEM was found that for large values of the die radius smaller values are required punch force and the conditions of formation of wrinkles are reduced. Predicting the maximum drawing coefficient for each operation leads to lower production costs [3].

Increasing the quality of surface active elements improves the material deformation. Thus, the use of a knurled punch is recorded a strain greater than one true and the section dangerous moving to the die radius and flange. The probability fracture in this area is low, because the movement of the flange material into the cavity is produced by the end of the process [4].

Factors that influence the durability and reliability of the dies in various stages are shown in fig. 1 [2].

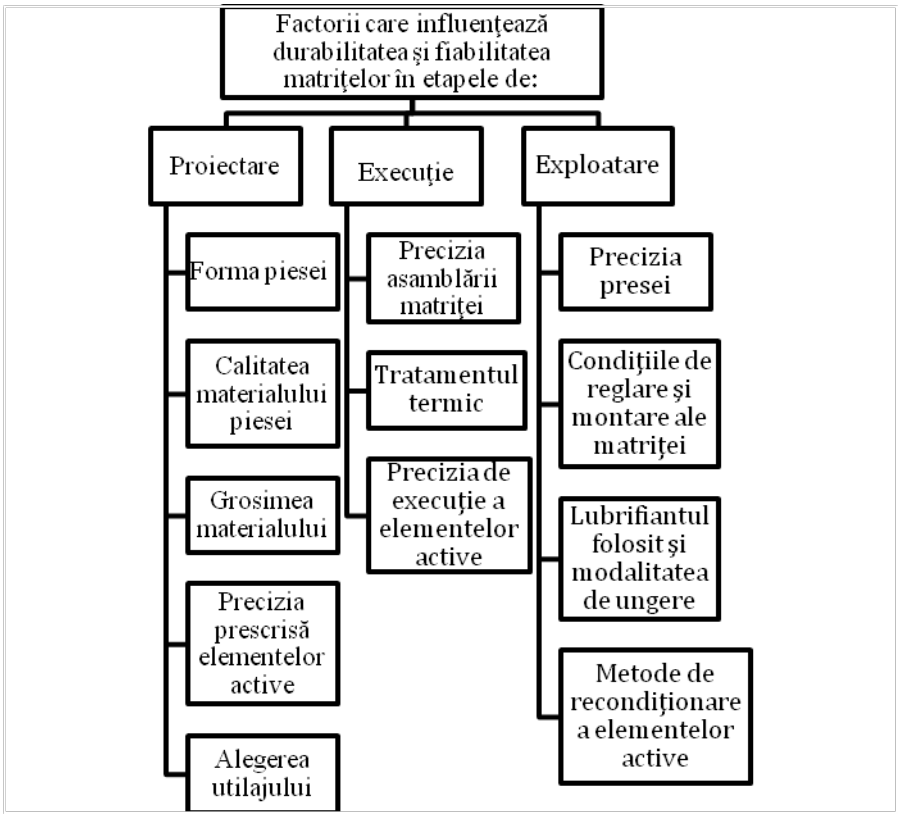

Fig. 1. Factors influencing the durability and reliability of dies

The durability of the die is influenced by the value of clearance between the active elements and the precision press machine, which in turn influences the wear of the die. The precision of the machine is influenced by the size of the static and dynamic rigidity. The rigidity is important because the elastic deformations of movable active elements determines the height change of workspace with direct implications for precision processing of the pieces. For this is required respect to a condition relating to the working distance of the die, Rm:

$$R_{min} + 10 \leq R_m \leq R_{max} - 5 \quad [mm], \qquad (1)$$

Wherein: R_{min} - minimal working distance, $R_{min} = R_{max} - C$, R_{max} - maximum working distance, C - the length of the adjusting tiller.

As a result durability of the die is influenced by the accuracy of assembly and adjustment of the press and of the die. During operation of the die are distinguished the following durabilitys: the durability itself, given the number of parts obtained between two reworking the active plate;the durability of active elements, given by the maximum number of working stroke to replace their; the maximum duration running of the die given by the maximum number of working stroke to complete wear of the plate, when it can not be reconditioned.The operating time to total wear of the active elements of a deep drawing die is dependent on increase clearance between punch and plate above the permissible limits or changing the die radius. The duration of the active plate by complete wear is expressed by the equation:

$$D_m = [(D_1 - D_0) / (2g) + 1] \cdot D_s \cdot k, \qquad (2)$$

where: D_1 - the maximal inside size of the active plate; D_0 - the initial size of the die; g - the thickness of material removed from each reconditioning of the die profile; D_s - durability of the die between two reworking of the profile; k - coefficient which takes into account the decrease of the die durability after each reconditioning of the profile.

The importance of wearing of the active elements has been shown for deep-drawing by thinningwilled of the wall thickness of the body fireextinguisherwhichis obtained through four operations [5]. It was observed that for the blanksironis necessary to change the last die afterhundreds or thousands of pieces, and if Al blanks after millions of parts.

4. THE INFLUENCE OF PIECES CONFIGURATION ON PRODUCT QUALITY

Can be obtained by successive deep drawing of band different pieces of electronics, medical, consumer products, characterized by good strength, are relatively light and geometries not accessible to other processing methods. The complexity of the dies and of the transfer mechanisms are reflected in the cost of parts [6].These costs increase even more in the case of small and complex pieces, in which a large number of operations required. Drilling operations, to ensure the flange flatness, deformation of the bottom, embossing are considered design and processing particularities. They also increase the cost of parts, because them carried out requires auxiliary equipment (tools actuated by air cylinder).Moreover, their use should synchronized with pressing process. Sometimes they can cost more than deep drawing operations. Working of the curvatures (considered details) within or outside is made with very small or very thin tools which can wear out or break quickly, something that affects costs. The dimensional control of details is very difficult and time required to carrying out its is very high, which is reflected in the cost. The latter is directly linked to the position which has curvature in relation to the rest of the piece (eg. punching a hole in a square box) or the orientation of a detail in relation to other. As a result, the processing of these curves requires much attention from the design stage concerning organizing the process of deformation and

assembly tools, to ensure proper alignment of the dies that compose the technological line.

The costs are dictated by: the number of operations (most important factor), the configuration and dimensions of the piece, the deep drawing ratio, the number and relative positions of the details.

5. THE INFLUENCE OF WORKPIECE MATERIAL ON PRODUCT QUALITY

A very important element is the material to be present mechanical and metallurgical properties required to obtain a quality parts. It is characterized by thick, hardening, elastic recovery. When using individual blanks, the thickness of material strongly influences the price of processing and affects the cost tools because to increase of the thickness it is necessary designing and implementation of controlling devices of individually blank through active plate. For the less ductile material is recommended to increase the number of operations in order to avoid occurrence of breaks. The elastic recovery is characteristic of Al alloys and of stainless steels work-harden. The efforts made to obtain its within admissible limits determines a significant increase the price of the piece.

The eventual deviations from surface quality of the active elements occurred during processing will impede the material flow leading to scrap registration with the appropriate influencing of prices. The hard materials such as stainless steels, which quickly wears the active elements, require expensive tools made of materials which are difficult process with a high time-consuming [6].

6. CONCLUSIONS

The deep drawing parts manufacturing quality is the result of interactions between the technological system components and processing technology by cold plastic deformation.

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