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# Increase of Lifetime for Fine Blanking Tools

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**Abstract**

To improve the lifetime of blanking tools, the application of high quality steel, heat treatment and coatings has become an interesting issue for many European companies dealing with stamping, punching and blanking operations. Important trends such as longer lifetime, higher accuracy and higher complexity of the products are challenging and require more special materials and techniques.

The technological solutions to improve the existing processes are not obvious because of the enormous amount of possibilities in available materials, heat and surface treatments such as PVD coatings for the envisaged industrial processes and applications. An in-depth research to understand the manufacturing processes with the consequence of an increased performance and lifetime of the tools as well as the opportunity of further optimization was the main goal of this project.

In many blanking processes where heavy duty conditions are applied, the use of hard metals, durable coatings and wear resistant tool steel is already established to extend the lifetime. The tools studied in this project were applied without coatings. The increasing production rate and the use of high strength steel sheet induce wear, crack formation and flaking of blanking tools with consequent low lifetimes. This project studied the tribological synergy of the substrate-heat treatment-surface preparation relationship and their influence on lifetime in heavy load conditions. A preliminary study was performed on the cutting edges of special designed triangular punches made of several high alloyed steels which were heat treated in a conventional way and by deep cryogenic treatment after quenching.

After this research some demonstration tools were tested in industrial conditions to show the feasibility of certain selected combinations.


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*Keywords:* blanking, tool steel, heat treatment, deep cryogenic treatment

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## 1. Introduction

Figure 1 shows the principle of fine blanking and conventional stamping. The major difference between the two methods is the presence of a counterforce and the small clearance between the punch and the die [2].
Both methods were used to study the lifetime of punches.

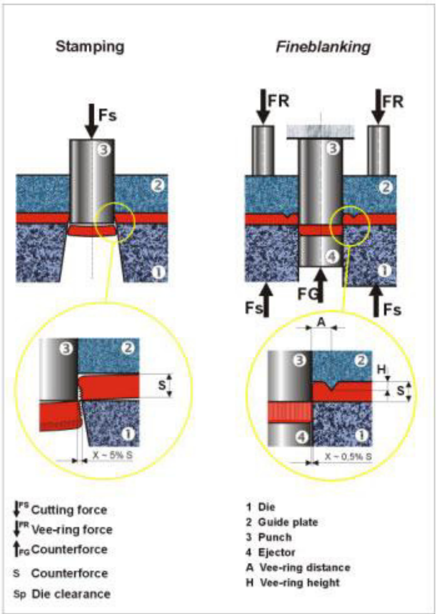


Fig. 1. Principle of fine blanking versus stamping

## 2. Experimental design

### *2.1. Materials and heat treatment*

To investigate the optimal tool steel, a material selection was made based on the composition i.e. the carbon and carbide content, the toughness and the wear behaviour of some commercial available tool steel [1]. Table 1 shows the composition of the tool materials that were selected and used in this project.

Table 1. Chemical composition of the examined tool steel

| Steel type | %C | %Cr | %Mo | %V | %W | %Co | other | sum % alloy |
|---|---|---|---|---|---|---|---|---|
| 1.2379 | 1,55 | 11,3 | 0,8 | 0,8 | 0,0 | 0,0 | | 12,8 |
| K 890 | 0,85 | 4,4 | 2,8 | 2,1 | 2,6 | 4,5 | | 16,3 |
| S390 | 1,64 | 4,8 | 2,0 | 4,8 | 19,4 | 8,0 | | 30,0 |
| Vanadis 4E | 1,40 | 4,7 | 3,5 | 3,7 | 0,0 | 0,0 | | 11,9 |
| Vanadis 23 | 1,28 | 4,2 | 5,0 | 3,1 | 6,4 | 0,0 | | 18,7 |
| Vancron 40 | 1,1 | 4,5 | 3,2 | 8,5 | 3,7 | 0,0 | + N | 19,9 |

The steel 1.2379 often used as a punch and die material was used as a reference [4]. The other steel types are powder metallurgical (PM) steel with high performance regarding wear resistance and toughness. The steel types were heat treated at different austenitizing temperatures and tempered in a conventional way (HT) and after a deep cryogenic treatment (HT+DCT) [3,4,5]. The conditions for this treatment are mentioned in table 2. The DCT cycle was performed at a commercial center with the following parameters: