DESIGNING AND DEVELOPING A G CODE PROGRAMMING LANGUAGE FOR THE NEW VERSION OF CASE R303– 4.0 ALTERNATIVE FII, CONSTITUENT OF THE GARLAND PRODUCT B2G BY MEANS OF THE NUMERICALLY CONTROLLED MACHINE NEF400

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Abstract: This paper proposes the design and implementation of a programming language for the new version of Case R303-4.0 alternative FII, constituent of the garland product B2G by means of the numerically controlled machine NEF400. Beforehand we are going to make a comparison with the traditional version of this type of case to emphasize the benefits, reliability and the impact the new type of case will have on the final price of the product. The development of the G code programming language is made by means of the NEF400 CNC turning machine. Since these reference points are used in conveyor belts from quarries, in underground mining, agriculture, in the zootechnical field, in extracting useful minerals, safety and life duration in exploitation are very important.

Designing and developing a G code programming language by means of a NEF400 for the new version of Case R303– 4.0 alternative FII, constituent of the product „Garland B2g 1400, 1600, 1800, 2000, 2250”

B2g garlands are made of 2 inferior rolls φ 108/194xL with bearing 6308 and 4 Cases R303– 4.0 version FII. (1400, 1600, 1800, 2000, 2250 – the dimensions of the rubber conveyor belt; L – the length of the inferior roll).

Diagram 1. Types of B2g garlands:
1 – inferior roll φ 108/194xL; 2 – clip; 3 – hook.
The inferior roll φ108/194xL with bearing 6308 (diagram 2) is made of 2 cases R303 assembled in a casing and an axel.

**Diagram 2. Inferior φ 108/194xL with bearing 6308.**

Case R303– 4.0 version FII – execution design (diagram 3a).
Diagram 3. Case R303 – execution design:

a – the new version R303- 4.0 version FII; b – traditional version.

The new shape of the casing R303- 3.0 version FII.

Fig. 4. Casing R303- 3.0 version FII.

The new type of casing allows the full pressing at the ends of cases R303 4.0 version FII and in this way a bead on the exterior of the casing is not needed anymore, thus obtaining a revolutionary design and a high reliability.
Diagram 5. Casing (pipe \(\phi 108x4\)) and semiproduct for the case R303 4.0 version FII (pipe \(\phi 104/12\)).

Case R303– 4.0 version FII – finite product (diagram 6a)

Diagram 6. Case R303 – finite product:
\(a\) – the new R303– 4.0 version FII; \(b\) – traditional version.
Case R303 – 4.0 version FII – sealing system (diagram 7a)

![Diagram of sealing system](image)

a)  

Fig. 7. Sealing system: a – the new R303 – 4.0 version FII; b – traditional version.

Case R303 4.0 version FII – G code program

<table>
<thead>
<tr>
<th>First grip (exterior processing)</th>
<th>Second grip (interior processing)</th>
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</thead>
<tbody>
<tr>
<td>T5d1</td>
<td>T5 d1</td>
</tr>
<tr>
<td>TC (1)</td>
<td>TC (1)</td>
</tr>
<tr>
<td>S800 m4f0.22</td>
<td>S800 m4f0.22</td>
</tr>
<tr>
<td>G0 x105z0.5</td>
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<tr>
<td>G1 x75</td>
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<tr>
<td>G0 x100z1</td>
<td>G1 x100z1</td>
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<tr>
<td>G1 x103z-1</td>
<td>G1 x103z-7</td>
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<tr>
<td>G1 z-38</td>
<td>G1 z-12</td>
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<tr>
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<tr>
<td>m30</td>
<td>T3d1</td>
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<td>S800 m4f0.22</td>
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<td>G0 x95z1</td>
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<td></td>
<td>G1 x90z-2</td>
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<tr>
<td></td>
<td>G1 z-43</td>
</tr>
</tbody>
</table>
Notations:
- function \( S \) – indicates the rotary speed of the piece
- function \( T \) – indicates the tool
- \( T_5 \) – outer knife PLWNL080408 with pad WNMG;
- \( T_3 \) – inner knife STPLNL080408 with pad WNMG;
- \( T_7 \) – finishing knife with pad DCMT110804.
- function \( f \) – indicates the cutting feed of the tool
- function \( d_1 \) – tool warehouse
- \( X,Z \) – coordinate axes of NEF400 machine
- \( m3/m4 \) - trigonometric/clockwise rotation of the piece
- \( m30 \) – final command of the program.

Case R303 4.0 version FII is obtained from 2 grips, with an effective processing time of 35 seconds for the first grip, respectively 1 minute and 15 seconds for the second grip, resulting a total time of 1 minute and 50 seconds much lower than that needed to obtain the case in its traditional version: 3 minutes and 45 seconds.

**CONCLUSIONS**

The key to success on any CNC machine is to understand the basics of machining technology, combined with the correct programming in machine language and the proper use of the machine, paying greater attention to the periodic planned reviews and the rational exploitation of the machine.

The productivity of such CNC machines is very high and is emphasized by:
- Automation of the process of clamping the piece, which is hydraulic
- Automatic removal of the cuttings by means of conveyor (cuttings removal device) which significantly reduces the auxiliary time afferent to the operation.
- Higher speeds and cutting feeds, high precision, no longer requiring grinding operations, resulting in lower basic durations.
- High productivity - the new case R303 4.0 version FII, producing 350 pieces /shift with an operator per shift .
- High quality pieces made to the same size without any waste, resulting in a very low production cost.
- Safety in operation since the machine processing occurs in a protected area which has a door with tempered glass, the operator not having access into the machine’s workspace .
- The disadvantage of these machines is that they can be used with high productivity and low costs, only for mass or series production.
Comparing the new type of case R303 4.0 version FII with the traditional one the following advantages can be noticed:

- Very low running time 110 seconds versus 225 seconds.
- Reduced wear of the abrasive pads used, plus a spare knife.
- High reliability due to the differences between the piece’s dimensions (pipe ø 104x12 with L = 50 mm versus ø 108x14 with L = 65 mm).
- Low cost price due to the scarcity of the resulting waste, due to the price difference of the semifinished product, and the innovative sealing system of the new case, with axle lock by means of a Seger ring on the spindle not on the bore like the classic case.
- Lower weight 0.83 kg versus 1.27 kg.
- Revolutionary design the new case being completely embedded in the casing, thus increasing its durability under the same operating conditions as the weld does not appear on the outside of the pipe anymore but on the outline of the case.
- Fewer preparatory operations before the final ringing and painting operations.

BIBLIOGRAPHY