INVESTIGATION OF PRODUCTIVITY AND ACCURACY OF PROCESSING IN THE MANUFACTURE OF SHAPING EQUIPMENT

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ABSTRACT

As a result of the research, the technological process of machining was improved for a body part of high complexity "Housing" in conditions of mass production using technological equipment with numerical control.

Based on the plans for the surface treatment of the part, a starting technological process was developed and illustrations of the processing route were made. Suitable equipment and technological equipment have been selected.

Keywords: *vacuum ring, pvb, cellulose, eva, tpu, silicone rubber, nitrate.*

АННОТАЦИЯ

В результате проведенных исследований усовершенствован технологический процесс механической обработки кузовной детали повышенной сложности «Корпус» в условиях серийного производства с использованием технологического оборудования с числовым программным управлением.

На основании планов обработки поверхности детали был разработан стартовый технологический процесс и сделаны иллюстрации маршрута обработки. Подобрано подходящее оборудование и технологическое оборудование.

Ключевые слова: *вакуумное кольцо, ПВХ, целлюлоза, ева, тпу, силиконовый каучук, нитрат.*

INTRODUCTION

This work was performed at the Department of "Technology of machine - building" of federal state budgetary educational institution of higher professional education "your country of Lipetsk - Gov. Technical University" in cooperation with the company of JSC "Energy" Yelets.

The main products of the enterprise JSC "ENERGY" - a chemical power source, in addition the company produces cash boxes are designed for large retail chains, as well as performing various orders metalloob - rabotke, including for the production of tooling from the surface - styami complex shape.

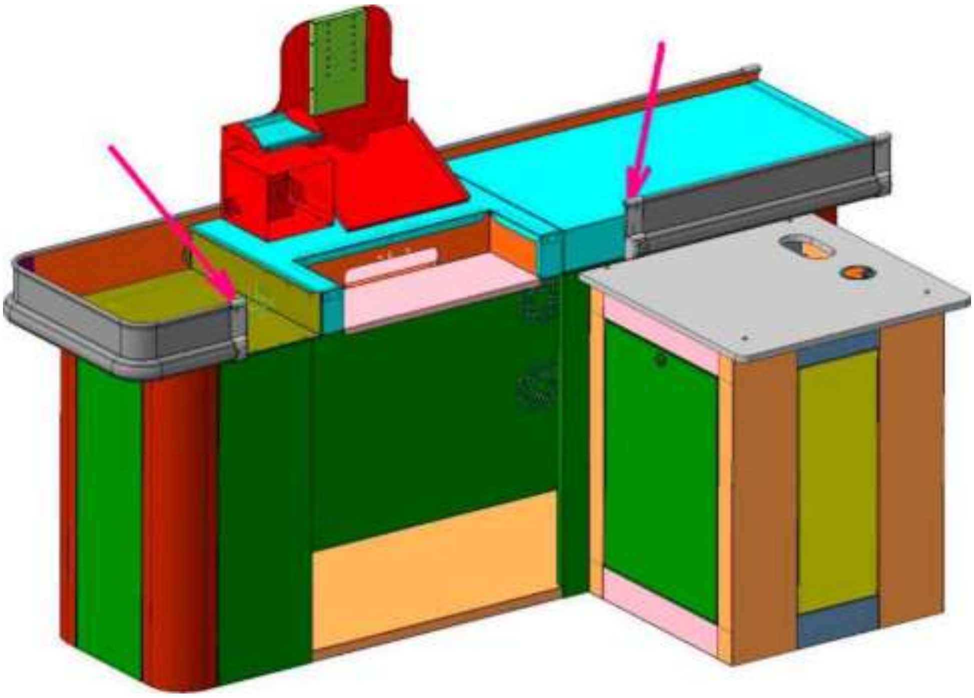

Figure 4.1. Cash box for TS "MAGNET"

Figure 4.2. Detail "END 1" .

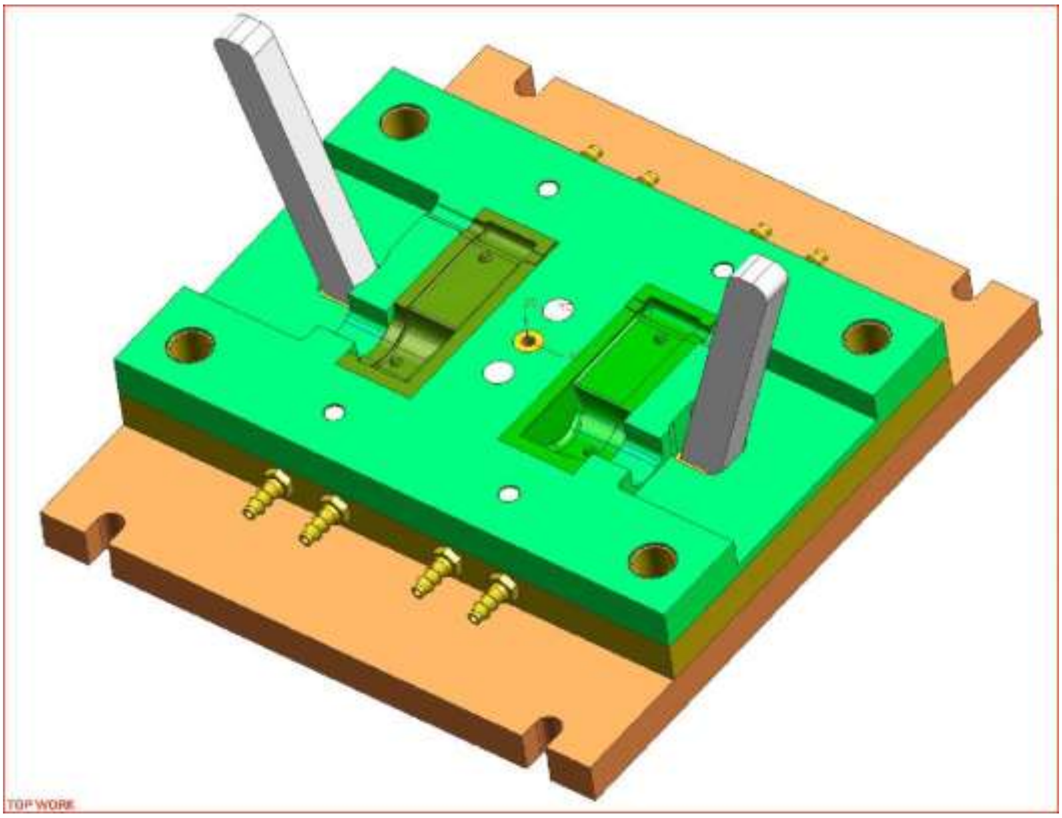

Figure 4.3. Stationary part of the mold .

For the release of checkouts retail chain "Magnit" (Figure 4.1), would - la designed mold for details of the "LIMIT" (Figure 4.2, Figure 4.3), with the development of technological process of shaping de - hoists complex shape (MATRIX Fig. 4.4).

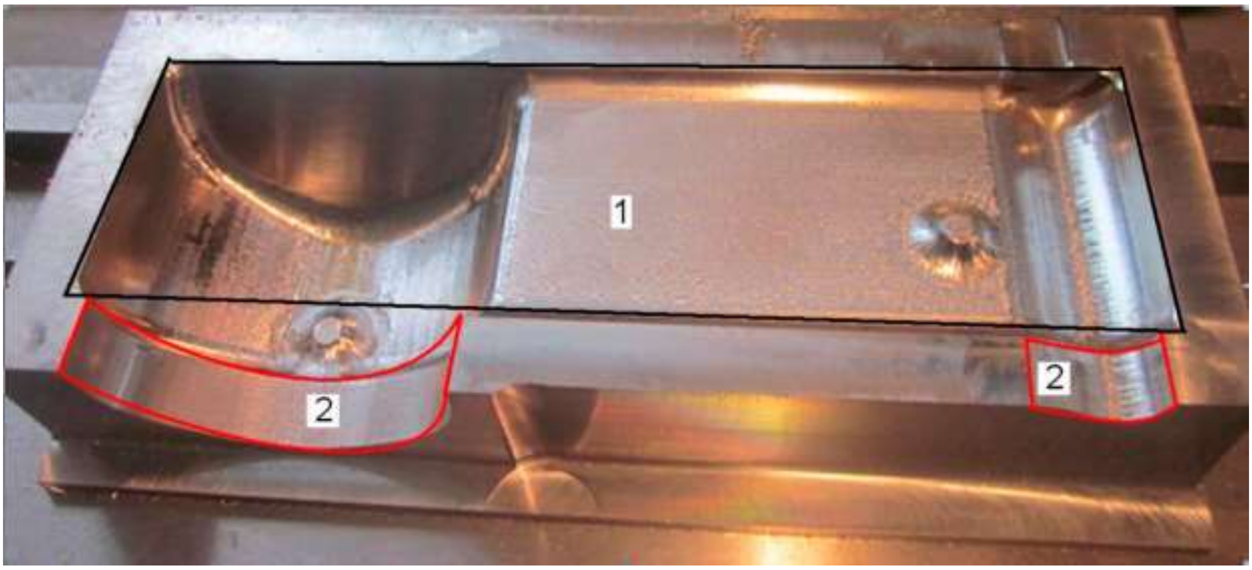

Figure 4.4. Matrix for the manufacture of parts "KONTSEVIK"

Matrix blank - tool stainless steel 40X13 GOST 5632-72; the part has concave surfaces of complex shape of 7-9 grades (Fig.4.5).

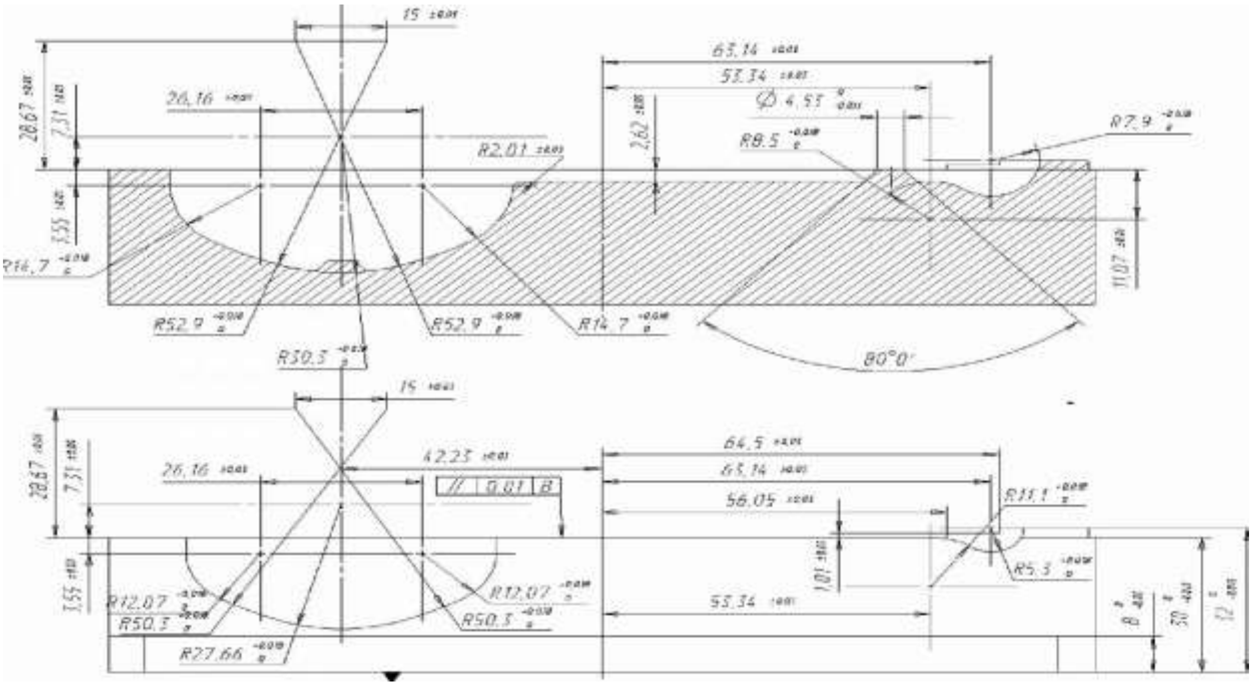

Fig.4.5. Sketch of the matrix for the part "END 1"

Surfaces "2" (see Fig.4.4.) Mates with the matrix punch and the movable sign (Fig.4.6), so that the accuracy of performance data - surfaces meet high requirements - 7 Qualitet.

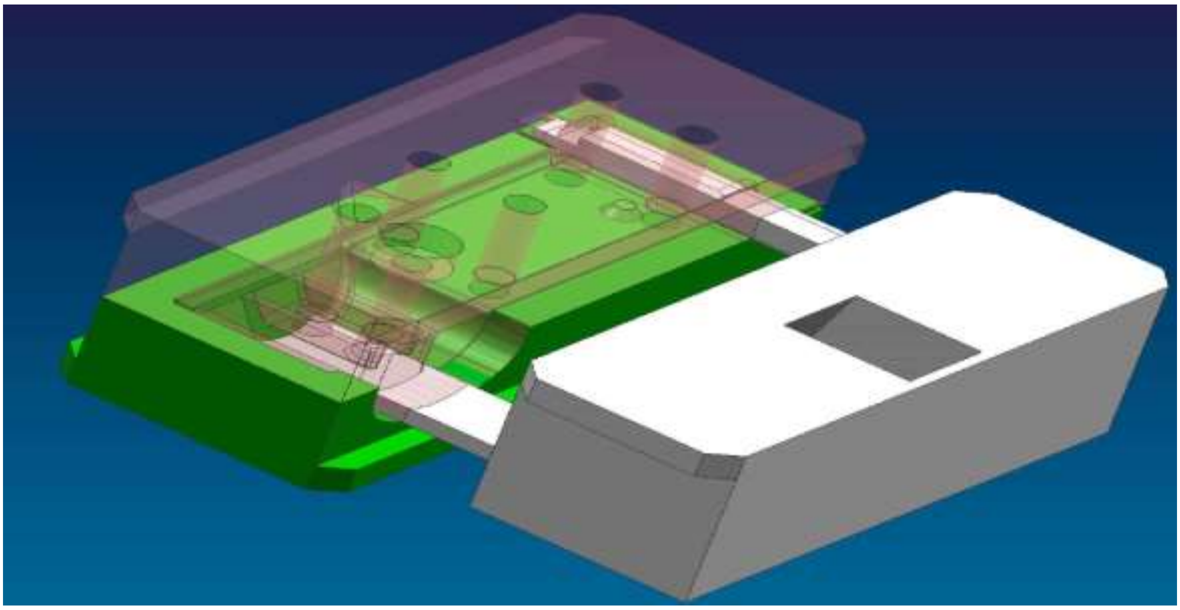

Figure 4.6. Contacting parts

If the mating surfaces with a gap to perform more than 0.04 mm, then manufacturing a plastic product formed burrs that untill - admissible for aesthetic requirements, in addition, gravies material may cause damage to equipment. If these surfaces are manufactured with an oversize, it will be necessary to make the fit surfaces, which are made - etsya fitter lekalschikom qualifications, the time under - race may exceed the time of machining. In this regard, fur - nical processing mating surfaces must perform with the maximum approximation to the drawing request.

Comparison of Concave Surface Processing Methods

In the first chapter, it was shown that the treatment of forming the DETA - MDL carried out in two stages:

- preliminary roughing, before heat treatment;
- final finishing, after heat treatment. Pretreatment of the concave mating surface R 12, 07 xR 50, 3 xR 27, 66 xR 50, 3 xR 12, 07, was carried out with a cylindrical mill of HANITA 010mm.

Preliminary allowance T_{st}. = 0.25 mm, allowance for the previously untreated zone T_{bottom}. = 0.72 mm. Hardness HRC 40.45.

The final processing was carried out with a HANITA cutter 010mm. with spherical end R5mm. normal to the treated surface (Figure 4.7).

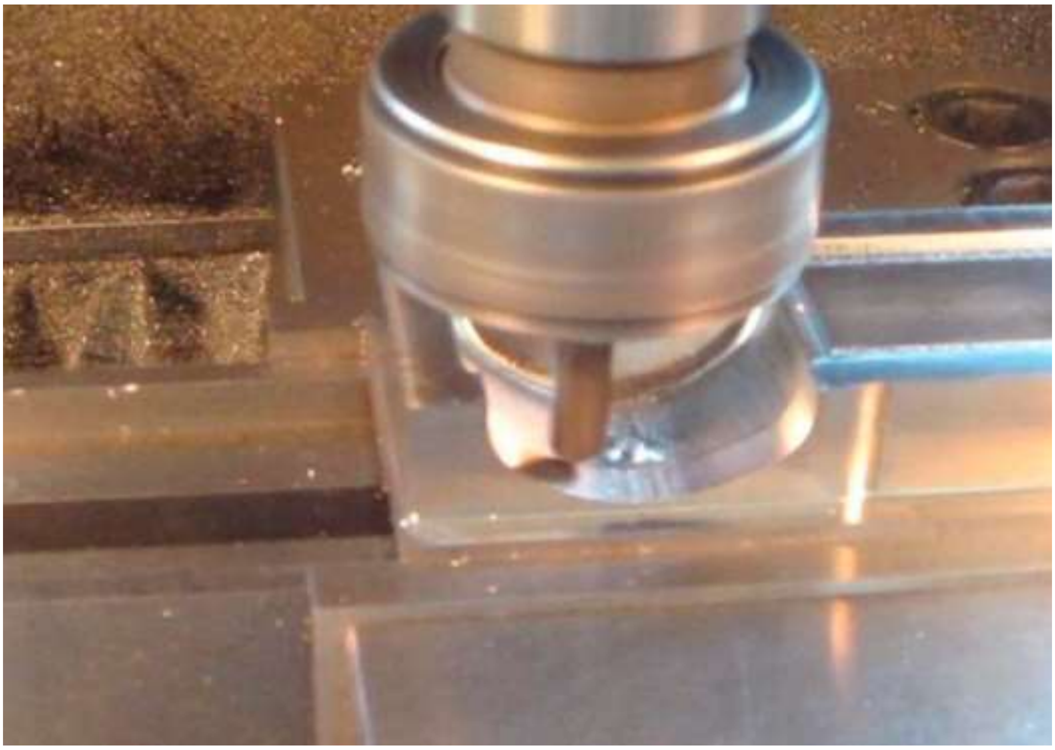

Figure 4.7. Matrix finishing

Since there are two identical dies in the mold, two processing methods were tried. In the first case, the mating surface was machined without tool path correction , at a constant flow rate S = 10 mm / min, spindle speed N = 4700 min $^{-1}$, distance between passes L = 0.1 mm, processing time was 576 min;

```
N10 G40 G17 G94 G90 G71
;20 ( INSTRYMENT MILL_D10R5 )
N30 G54 G64
N40 S4700 M3
N50 G0 X-62.384 Y-30. Z20.
N60 Z-5.012
N70 G1 Z-7.012  F10.
N80 X-62.375 Z-10.893

N61950 Z-5.012
N61960 G0 Z20.
N61970 Z200
N61980 X0 Y0
N61990 M5
N62000 M2
;62010 ( VREMIA OBRABOTKI "576.08" MIN )
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The accuracy control of the machined concave mating surfaces was carried out on the DEA IOTA 1204 coordinate measuring machine (Fig. 4.8), according to the measurement scheme shown in Fig. 4.9.

Figure 4.8. Coordinate Measuring Machine

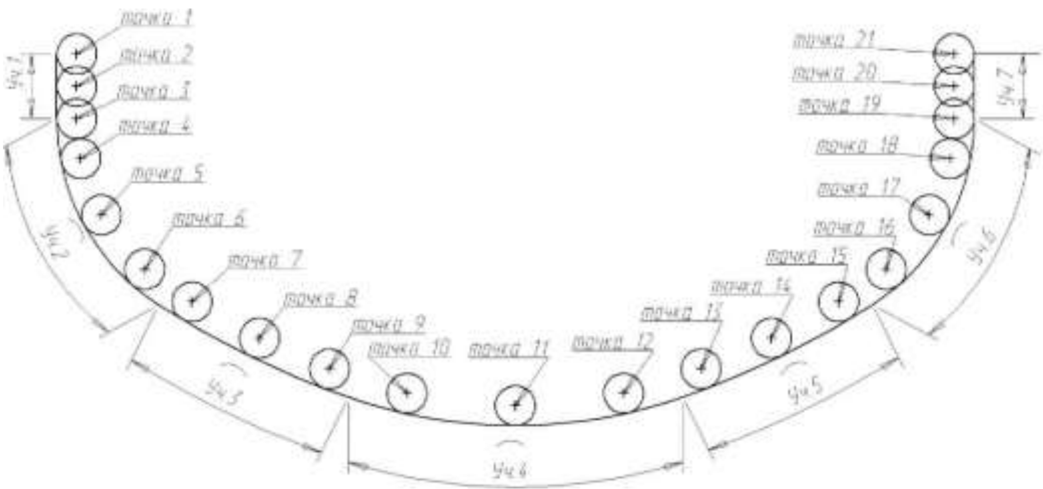

Figure 4.9. Surface measurement scheme on CMM

Snap - 0 (zero) - xY - geometric center of the part, z top plane (32_{-0013}). The measurement results are presented in Table 4.1.

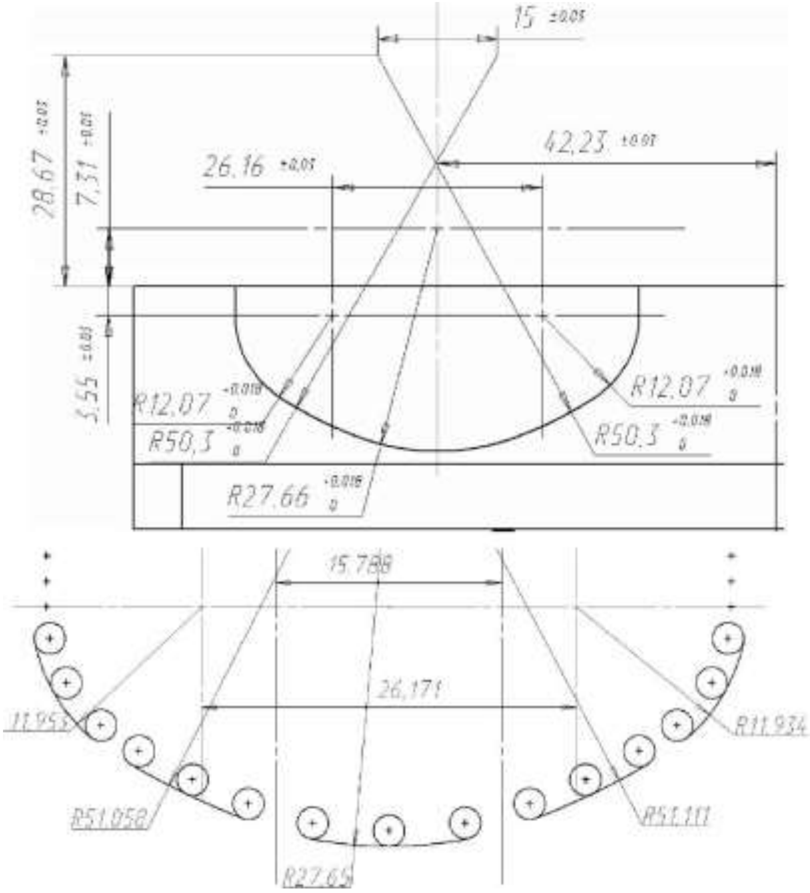

Figure 4.10. Comparison graphs of target and actual dimensions according to option number 1

Table 4.1.

ESTATE - current	Point number	Coordinates			Parameter according to the drawing, mm		Actual parameter, mm
		X	Y	Z	max	min	
2	four	18.5272	-25	-7.745	12,088	12.07	11.953 Size not consistent
	five	19.6725	-25	-10.834			
	6	22.1038	-25	-13.8053			
3	7	24.7566	-25	-15.5894	50,318	50.3	51,058 Size not consistent
	eight	28.5	-25	-17.5856			
	nine	32.4061	-25	-19.26			
four	10	36.904	-25	-20.5993	27,678	27.66	27.65 you size - to keep
	eleven	42.2344	-25	-21.1421			
	12	47.5648	-25	-20.5993			
five	13	52.0626	-25	-19.26	50,318	50.3	51,111 The size

	fourteen	55.9688	-25	-17.5856			is not consistent
	fifteen	59.7122	-25	-15.589			
6	sixteen	62,365	-25	-13.8053	12,088	12.07	11.934 Size not consistent
	17	64.7953	-25	-10.834			
	eighteen	65.9416	-25	-7.7464			

Comparison of set and actual sizes shows that the impurity nenie processing method according to the nominal surface 3D model without regu - lation cutting conditions can not achieve the requirements defined in the design documents, and the supply range of the most loaded section (previously untreated area) n ety increases time obrabot ki ...

Parameters of the mating surface according to the first option

In the second case, in the processing of the second matrix (specular mapping - voltage of the first), the tool parameters have been set with the erred - NOSTA induced bending tool - D = 9.87 mm, the radius of the sphere R = 4.935 mm.

The control program was developed with settlement and an executive unit enables changing of the NC tool path, to determine the raw zone We establish - -hand cutting conditions close to the optimum, at any site obrabaty - Vai surface without using additional adaptive systems.

The use of frame-by-frame control of cutting modes reduces the processing time to 48 minutes, that is, more than 10 times;

```
N10 G 40 G 17 G 94 G 90 G 71
N20 T 00 M 6 ; 3 0 (INSTRYMENT MILL_D10R5)
N40 G54 G64
N50 R101 = 0.124 R102 = 5. R103 = .5
N60 S4700 M3
N70 G0 X-62.384 Y-30. Z20.
N80 Z-5.012
N90 R5 = 2. R6 = 90. R7 = 2. R8 = 0.0
N100 R9 = R3 + R7R10 = R4 + R8 R11 = ATAN2 (R10, R9) R12 = 90-R6-R11 R13 = (SIN (R12)) R14 = ABS (R1 / (2 * R13))
N110 R15 = R102 / (R14 + R102) R16 = ASIN (R15) R17 = TAN (R16) R18 = ((R102 * R17) / 2) + R103 R19 = (R14-R18) / (R14) R20 = ABS ( 90- SIN (R19))
N120 IF R6> = R20 GOTOF MA1 IF R6 <R20 GOTOF MA2
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N433320 G0 Z20. N433330 Z200 N433 340 X0 Y0 N433350 M5 N433360 M2 ; 4 3337 0 (VREMIA OBRABOTKI "48.15" MIN)

Parameters of the mating surface according to the second option . The measurement results for the second option are presented in Table 4.2.

Table 4.2.

ESTATE - current	Point number	Coordinates			Parameter according to the drawing, mm		Actual parameter, mm
		X	Y	Z	max	min	
2	four	-66,075	-25	-7.745	12,088	12.07	12,087 The size sustained
	five	-64.9438	-25	-10.834			
	6	-62.5634	-25	-13.8053			
3	7	-59.9667	-25	-15.5894	50,318	50.3	50.309 The size sustained
	eight	-56.2753	-25	-17.5856			
	nine	-52.4273	-25	-19.26			
four	10	-48.1763	-25	-20.5993	27,678	27.66	27,678 The size sustained
	eleven	-42.2344	-25	-21.272			
	12	-36.2925	-25	-20.5993			
five	13	-32.0415	-25	-19.26	50,318	50.3	50.269 The size not kept
	fourteen	-28.1935	-25	-17.5856			
	fifteen	-24.502	-25	-15.589			
6	sixteen	-21.9053	-25	-13.8053	12,088	12.07	12,081 The size sustained
	17	-19.525	-25	-10.834			
	eighteen	-18.3948	-25	-7.7464			
7	nineteen	-18.1744	-25	-5.5575			
	twenty	-18.1744	-25	-3.7847			
	21	-18.1744	-25	-2.012			

Measurements on the CMM determined the center points of the measuring ball (02.2 mm). Figure 4.11 shows the actual parameters processed - hydrochloric surfaces which are built along the tangents to the circles 02.2 mm.

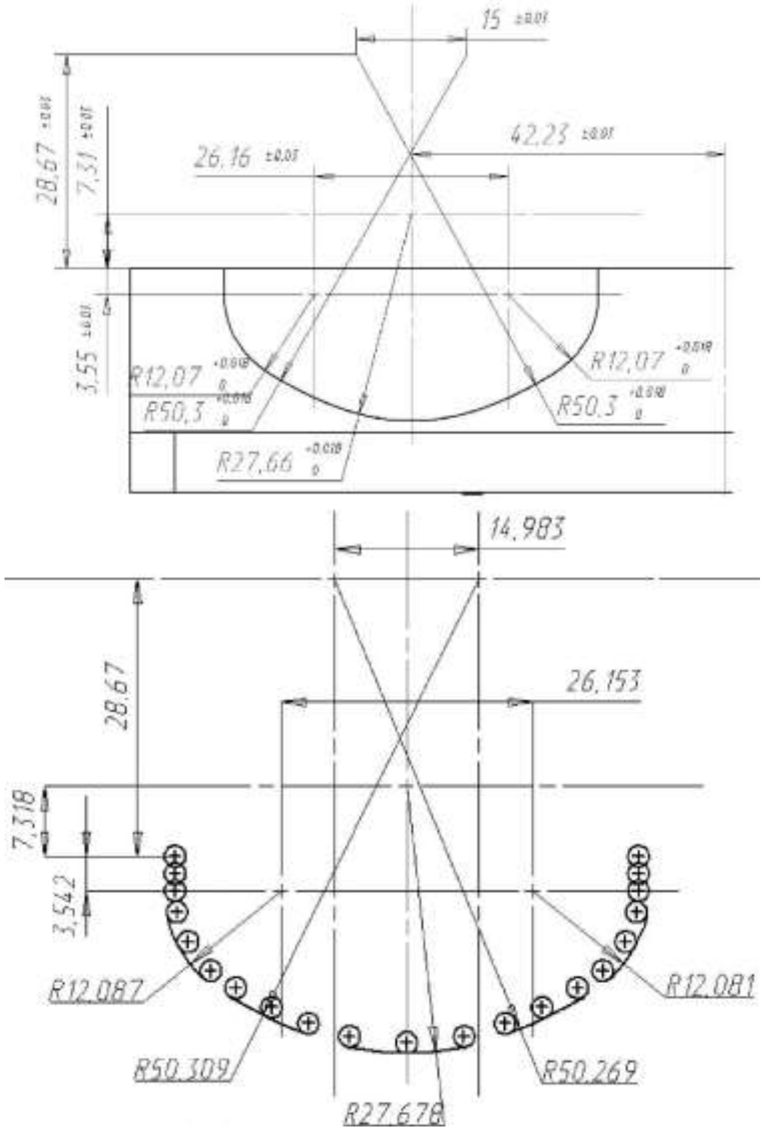

Figure 4.11. Comparison graphs of the specified and actual sizes for option No. 2 .

Application of the results of theoretical and experimental studies - vany in terms of production, in the manufacture of hard surfaces with geometrical requirements showed that the processing time decreased significantly, the design requirements have been met the Documentation - tation.

CONCLUSIONS

The practical implementation of the results of theoretical and experi - Basic Research on the example of the details of "The Matrix", showed the following - present.

1) Application of a bulk milling tool path distortion, taking into account the geometrical errors occurring, can reduce the number of passes of finishing and

improve the accuracy of machining, which is confirmed by the measurements - niyami; at the same time, labor-intensive plumbing for finishing complex surfaces is minimized.

2) Frame-supply control and the frequency of rotation of the spindle, l tailored - including changing the geometry of the cutting area, without using additional - - negative adaptive devices, not only stabilize the geometric - ical error handling, leading it to a constant value, but also significantly increase the productivity of machining .

3) Method of determination of previously untreated surfaces and implements - tion it in terms of production on CNC milling machines excluding - an emergency situation relating to damage expensive inst - ments.

The results of theoretical and experimental studies were introduced into the tool production of JSC "ENERGIA" in Yelets for the development of control programs for CNC milling machines.

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