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DESIGN OF A MEASURING INSTRUMENT FOR A COMPONENT USED TO SYNCHRONIZE THE SPEED BETWEEN TRANSMISSIONS

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Abstract: In today's modern times, it is necessary to simplify and speed up the work. Great advantage and help in this area, are auxiliary workshops, which we call briefly the preparations. These are used today in virtually every manufacturing process. This work deals with the design of the equipment, control auxiliary equipment. The work is deals with the issue of auxiliary workshops. In particular, a control device to be designed for components for synchronizing the speeds between gears in automobiles. The introduction is describe the need for such equipment in enterprises are of a technical and economic importance. In the core of the work is described and illustrated the device design itself, with a brief functional description and control procedure. Part of the work is to verify the facility's capability using the statistical method. Benefits and appraisal of work for a given area of application of the proposed equipment are presented at the end of this paper.
Keywords: device, equipment, control, design

INTRODUCTION

In today's modern era of fully modern and progressive technology is a very strong emphasis placed on the continuous acceleration of production and control processes in the field. In carrying out these processes is labor productivity significantly affected, and so on business creation. Productivity of work is possible improve then, that for example in company are improve manufacturing and control processes. [3] In the production process (especially mechanical), it acts on the manufactured component, respectively. to the produced component size, the entire chain of influences, and in fact it is not possible to produce a component with a perfectly precise dimension and the dimension produced must be checked. The question of control in engineering companies (especially automotive) is very important, but also financially demanding. [1,2] This fact, forces companies to get the equipment they can do use effective its function. One such device is an auxiliary workshop device. Their technical significance consists mainly of easier assurance of accuracy, reduction of non-production, reduction of physical effort but also reducing the requirements for qualified service. [1] The issue of auxiliary device will also be dealt with in this article. Specifically, the design of the device for a component witch to use on synchronizing speed between the gears in the car transmission. [2]

THE PART FOR THE DEVICE IS TO BE MADE

The requirements for the device design depend on the measured parameters on the component. It is a component that is mounted in a car transmission and its main task is to synchronize the speed between the gears. The design of the device will be designed to measure or control important parameters according to the manufacturing process. Due to the fact that the part has a conical shape, it is important to keep the cone 9 ° 40 '± 0 ° 5'. This cone angle on the component is controlled by another device before checking the other parameters. This means that the proposed device will control the parts that have passed the angle check. The device will control the depth or distance from the front of the ring 4,8 ± 0,07 mm. At this depth should be on the component kept average Ø58,09 mm on the conical part as shown in Figure 1. The entire check should be performed at 100 N ± 10 N load according to the request. The device will record deviations from 4.8 ± 0.07 mm. This measurement has so far been carried out on three-axis measuring device. This has had disadvantages such as: long measuring sections, inability to measure the ring under load, the need for qualified service personnel to work with a three-axis measuring device.

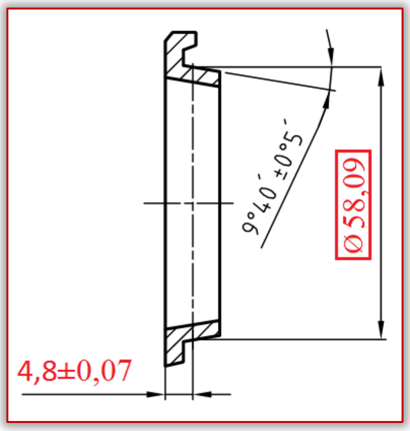

Figure 1: Measured component parameters for control

PRINCIPLE, SCHEMA AND DEVICE DESIGN

The device is designed to ensure fast, simple, and accurate component control. Controlled components will be placed on the motherboard and this motherboard must ensure exact horizontal position. As required, the ring must be under load 100N±10N, and under this load measured. The load to act on the component guarantees the weight of the designed top.

The upper part of the device is coupled with the produced "counterpart" of the synchronous ring (measuring cone) through the guide. The measuring cone is precisely manufactured so that at a certain point from its lower edge - specifically 1.1 mm - it has a value of the diameter of the inner conical part ø58,09 mm. A digital deviation is mounted on the top of the device and the measuring tip is in contact with this part and records the dimensional deviations. For the proper operation of the device, it is necessary to produce an adjusting member. The adjusting member is made very precisely to the size of the ideal synchronous ring. Before the rings are checked, it is necessary to adjust the device using the adjusting member. The adjusting member is located on the base and the measure cone is pressed on it with power 100N. Since both pieces are made as counterparts with a value of average at a given location ø58,09 mm, these locations will overlap as shown in Figure 2. The diverter is reset by the operator and the device is set in this way. After setting up the device, check the synchronic rings. We will place the synchronic ring on the main board and push the cone through the line on a ring. Consequently, the digital deviation detects deviations from the required dimensions.

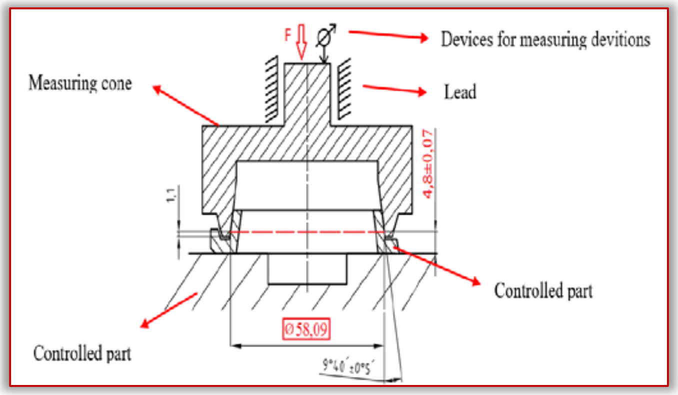

Figure 2: Schematic view of the proposed device

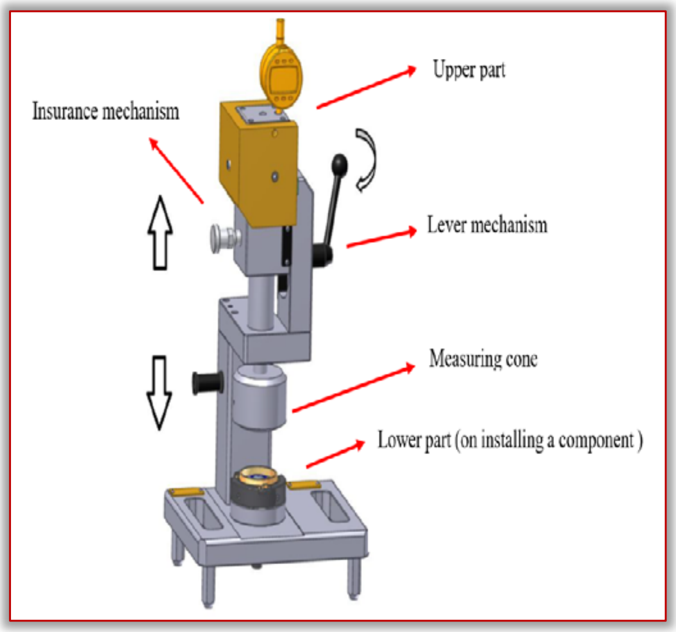

Figure 3: Device model

Figure 3 shows a model of a control device consisting of two main parts, the top and the bottom. The top part is equipped with a lever mechanism which, ensures its vertical movement. This part also includes components that ensure that a force of 100 N is applied to the measured synchronous ring, and also includes a meter with a mechanism that detects deviations from the nominal size on the controlled parts. This section also includes a functional part of the device, a measuring cone, which is in direct contact with the control ring and checks with a comparative measurement that the parameter is in the tolerance field. The main function of the lower part of the device is location a controlled ring or adjusting member. Figure 3 shows the starting state of the device. The lever of the mechanism is in the upper location, which means that the movable part with the measuring cone is in the upper position.

The mechanism is designed so that the lever cannot be released automatically, thanks to the safety mechanism. Before starting the synchronous ring check itself, you need to set the device using the adjusting element that is part of the design.

So as possible to move the lever, the locking mechanism must be unlock. By moving the lever in the arrow direction in Figure 3, the measuring cone is pushed into the adjusting member until it stops. In the lower position overlaps the ø58,09 mm value on the measuring cone with the same value of the diameter of the adjusting member at a height of 4,8 ± 0,07 mm (according to the scheme in Figure 2).

The operator then sets the digital deviation. After setting, the measuring cone is pulled out of the adjusting member by means of the lever, so that insurance mechanism gets into starting place. Then the operator selects the adjusting member from the meter. At this stage, the device is ready for checking synchronous rings. The controlled ring is placed on the main washer. Again, the safety mechanism has to be unlocked and the measuring cone into the controlled ring is inserted by the lever. The operator then sees the deviation from the nominal size on the display.

VERIFY DEVICE PROPERTIES

Is possible use multiple authentication methods to check device accuracy. Device capability will confirm the functionality of the device and the data that will be measured will be trustworthy. The device was checked using statistical method where the functionality of the device is expressed using the Cgm and Cgmk indices. The facility's capability check is composed of repeated measurements at the place, where the gauge is uses.

The device performs 30 repetitive measurements and the resulting values are written into table, which is later the basis for the chart. Values that have been detected are put into relations for the mean value of the mean Xa, and the standard deviation Sw, and of them then calculate the Cgm and Cgmk eligibility indices.

Table 1: Values n, measured by the device in micrometers (μm)

-34	-33	-33	-34	-32	-32	-30	-32	-33	-33
-31	-31	-33	-32	-33	-31	-35	-31	-31	-32
-33	-33	-33	-32	-32	-33	-33	-33	-33	-33

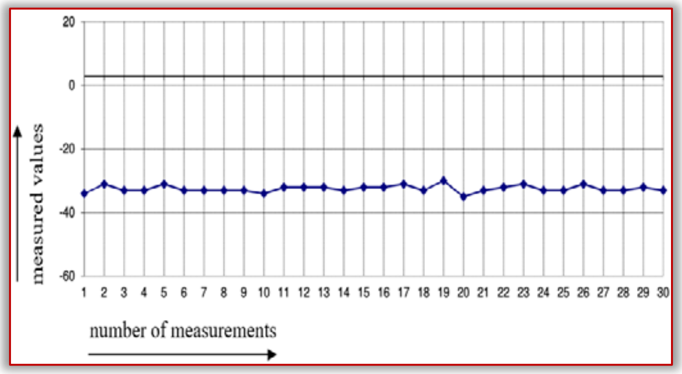

Figure 4: Dependence of the measured values on the number of measurements

Average value of the mean:

$$X_a = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{1}{30}\sum_{i=1}^{30} -34; -31\ldots = -32{,}467\ \mu m$$

Standard deviation:

$$S_w = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(X_i - X_a)^2} =$$

$$\sqrt{\frac{1}{30-1}\sum_{i=1}^{30}(-34 - (-32{,}467))^2} = 1{,}074 \mu m$$

Process capability index:

$$C_{gm} = \frac{0{,}2T}{6.S_w} = \frac{0{,}2\,.140}{6\,.1{,}074} = 4{,}344$$

Top process capability index:

$$C_{gmKU} = \frac{(X_r + 0{,}1T) - X_a}{3.S_w} =$$

$$\frac{(-32+0{,}1\,.140)-(-32{,}467)}{3\,.1{,}074} = 4{,}488$$

lower process capability index:

$$C_{gmKL} = \frac{X_a-(X_r-0{,}1T)}{3.S_w} =$$

$$\frac{-32{,}467-(-32-0{,}1\,.140)}{3\,.1{,}074} = 4{,}199$$

The criterion for assessing the accuracy of the device is Cgm ≥1,34 and CgmKU, CgmKL ≥ 1,33. In the index CgmKU and CgmKL is the correct value that is less. It follows from that, that the device is correct.

CONCLUSION

The component for which the device was designed and constructed was at the factory first controlled by a three-axis measuring device. The main disadvantage of checking on a triangle measuring device and therefore the reason for solving this problem was: long control times, the need for an operator who can control the device software, training the operator, and the inability to control the component under load 100N.

The design itself was based on that the device was able to measure the relevant parameters on the synchrony ring under load, but in order to ensure simple operation of the equipment as well as fast and safe operation. The device is designed so that its movable part, ending with the measuring cone, which is pressed into the synchronous ring by a simple lever movement, proved load the ring and on display image the dimensional deviation from of nominal value.

Checking the rings is possible after setting the product with the adjusting member, which serves to preserve and reproduce the dimensional quantity. The main benefit of the designed product is to significantly reduce the time it takes to component check, simple operation and the possibility of checking the rings under the appropriate load.

In the measurements it was found that the measured values produced by new design device (synchronous ring measured under load) and three-axis measuring device, were different only minimal, in order of thousands of millimeters.

Note:
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