

**IMPROVEMENT TRAINING SPECIALISTS
MANUFACTURING competitive products
In engineering**

***AP Martynov, Ph.D.
Donbass State Engineering Academy
GA Ivanov, Ph.D.
Mykolayiv State Agrarian University
OHM. Bystryi Engineer
National University of Life and
Nature Ukraine***

The analysis of the formation of future specialists in product design skills with a reasonable choice of the type of interchangeability. Proposed a set of technical and organizational measures to improve the learning process, valuation methods and technological precision assembly of products.

Specialist, production, product, industry, mechanical engineering.

Formulation of the problem. In a market economy the quality of graduates of technical and agricultural universities is determined mainly by the degree of formation of future specialist skills and the ability to produce competitive products. Therefore, higher education should be integrated into their educational standards, curricula and structure of the main subjects, the total requirements of production and business, and preferably to the specific staffing companies in the region.

Teaching process in majors aimed at encouraging students to use in practice the knowledge and skills that are essential professionally trained graduates.

© AP Martynov, GA Ivanov, A. Bystryi, 2015

Analysis of recent research. In the manufacturing process of any product all types of production machines, eventually solved the problem of providing its compilation of ensuring proper type of geometric interchangeability.

Typical processes drafting engineering products and basic approaches to technological presented in the literature, for example in [1], a taking into account the characteristics of heavy machinery as in [2], which, however, has no recommendations on the methodology of training specialists of this field of study.

In the manufacturing process of any product for all types of production to solve the problem of providing technological assembly

providing relevant type of interchangeability. As a special technical literature widely used term "workability" of the details, which refers to the ability of materials subjected to treatment by cutting or otherwise complex properties that provide for their cutting cutting optimal values of main process parameters (cutting speed, surface quality, cutting force etc.) [3].

The problem of technological assembly is complex and involves, above all, the question of determining the optimal tolerances, limit deviations plantations and in the design of products with substantiated choice type substitutability (complete, incomplete, group, or with pryhonkoyu adjustable).

Process flow design, construction joints and assembly of mechanical engineering shows that an important aspect in activity and higher education is the process of continuous training students in the discipline "Interchangeability, standardization and technical measurements" during the period of study.

In the design of the design and technological documentation related to the selection of the required accuracy and surface roughness of, justification for landings taking into account technological features of processing, and especially with a reasonable valuation deviations of form and position of surfaces is necessary to take into account current applicable standards for the basic norms of interchangeability, because it primarily generates qualitative indicators engineering products and their competitiveness. [4]

During training, the actions taken shape and lay the foundation engineering thinking in the design, manufacture and control product competitiveness.

Therefore, the level of specialist skills in the field of manufacturing products to a large extent depends on the quality of its training on discipline "Interchangeability, standardization and technical measurements".

The complexity of the discipline - in organic connection of the provisions in question and technical decisions on questions relating to the implementation of product service purposes, the technology of its manufacturing and assembly (often here, in the language of philosophy, there is a "law of unity and struggle of opposites") and to control the finished product, ensuring its quality - on many of these students had not studied.

It is therefore important that in education literature found reflection modern presentation and methods of setting precision landings purpose in compounds, including, for example, folding units with standard bearings bearings that are most common in engineering products regardless of the batch.

Methods of valuation accuracy of rolling bearings. Despite the fact that the drafting unit with standard rolling bearings (common specifications - for GOST 520-2003) is the most common in engineering products regardless of the batch process to connect to detail studied enough - comprehensive studies conducted only with respect to radial two-row roller bearings type 3182100 (GOST 7634-75) with a tapered hole when installing radial gap in which bearings adjustable by axial movement relative to the inner ring tapered spindle neck [5, 6].

the purpose of research is to study the common factors that ensure the accuracy of the drafting units of rolling bearings with the achievement of the desired character with the combination of rings and surfaces of the shaft hole.

Results. The problem of skladayemosti is complex and involves primarily the issue of appointment of optimum tolerances, limit deviations and landings in the design.

Landing bearings bearings on the shaft and housing must be selected taking into account the type and size of bearing, conditions of service, value and nature of the loads acting on it, but above all, as you know, the type of load rings: local, circulation or vibrational.

According to the most widespread among practitioners guide [7], and any and all textbooks and manuals landing circulating loaded bearing ring is determined by the intensity of the so-called radial load using the formula:

$$P_R = \frac{R}{(B - 2 \cdot r)} \cdot k_D \cdot k_1 \cdot k_2, \quad (1)$$

where: P_R - intensity radial load, kN / m;

R - constant in the direction of radial load, kN;

k_D - Dynamic coefficient of planting, depending on the load (overload to 150%, moderate shocks and vibrations $k_D = 1$, 300% overload, strong shocks and vibrations $k_D = 1.8$);

k_1 - Coefficient taking into account the degree of easing tension on planting and thin-walled hollow shaft body (hollow shaft for $k_1 = 1-3$; solid – $k_1 = 1$ for the case $k_1 = 1-1,8$);

k_2 - uneven load distribution ratio R between the rows of rollers double-row tapered roller bearings or ball bearings between the doubled if the axial load on the support ($k_2 = 1-2$; the absence of axial load $k_2 = 1$);

B - Bearing width, m;

r - Radius of curvature trim ring, m.

To select a locally loaded rings in these sources are recommended tolerance fields holes and shafts depending on the type of bearings, working conditions and the nature of the load. This technique and size ratios are referring to the publication years 1948-1956 without any

evidence. If the dynamic coefficient (kD) identify complicated, approach can determine the minimum tension between circulating loaded ring and surface details. The sequence of calculations.

Determine the least tension laden circulating ring of the formula:

$$N_{min} = \frac{13 \cdot R \cdot k}{(B - 2 \cdot r) \cdot 10^6}, \quad (2)$$

where: N_{min} - the lowest settlement tension that provides the necessary bond strength Circulating loaded ring bearing shaft, mm;

R - Radial load on the bearings, kN;

k - constructive factor depending on bearing series (K = 3,5 - especially light series; k = 2,8 - light series; k = 2,3– secondary series; k = 2,0 - heavy series).

Select the required standard approach that meets the condition:

$$N_{min.st} \geq N_{min}. \quad (3)$$

Where: $N_{min.st}$ - the smallest tension standard landing.

Instead, as we know, the current in Ukraine GOST 3325-85, which are not only methodological foundations destination landings Bearing rings, and detailed tables for their choice, taking into account primarily the mode of operation (depending on the ratio of the current radial load and dynamic load bearing) species considered higher load bearing type and diameter as well as numerous examples of machines and assembly units. Incidentally, referring to this standard [7], the enclosed table with a simple list fields recommended tolerances and landings rings for various types of bearings depending only on the type of load, but without a reasonable selection of examples landings.

A comparative analysis of the two methods of planting or appointment under consideration shows the following fields tolerance of differences.

The tables for selection landings rings of circulating stress method [7] missing some fields tolerances of shafts, namely p6, r6, r7, GOST 3325-85 recommended for numerous class machines and units working in difficult conditions and field tolerance to the host reject h, provided the standard for precision machines (motors, small Electric, Internal spindles, etc.) and Bearing in Locking sleeve (GOST 8545-75).

For locally-loaded rings usually required landing clearance or transition more likely to gap - for such a landing ring under starting torque, shocks and vibrations occasionally scrolls regarding dual surface, thus ensuring uniform wear track rolling and the possibility of axial movement of compensation such way thermal deformation.

To select crops such rings GOST 3325-85, unlike materials [7], are specific landing, of course, subject to the necessary precision class bearings and mode of operation of the respective machine.

But the lack of choice in the method according to work [7] and other sources mentioned above is that they do not take into account the peculiarities of production units drafting of demountable buildings. The experience of engineering nominal (estimated) joints durability of rolling bearings in the real world can be much reduced by deformation ring bearings, insufficient space to fit their surfaces (less than 70 ... 75%) due to unjustified appointment of technical standards for accuracy compounds z'yednuvanyh parts and surfaces, and deformation of both parts of the case after cutting planes connector and holes (here after preliminary compilation). The latter caused by technological heredity related to strains that occur in the processing of parts [8, 11], especially non-rigid holes (which are the body parts), through internal reallocation of residual stresses in the thickness of the metal [9].

To minimize this phenomenon in the manufacture and drafting of demountable buildings perform a number of measures to ensure the quality of drafting units in question. For example, e-axis offset relative to the plane of the connector hole tolerance limit (Fig. 1, a), and before the installation of large bearings in semi holes adapts its landing surface in areas adjacent to the plane of the connector, performing so-called collapse the dimensions of which are regulated by special normative document depending on the size of the hole (Fig. 1b).

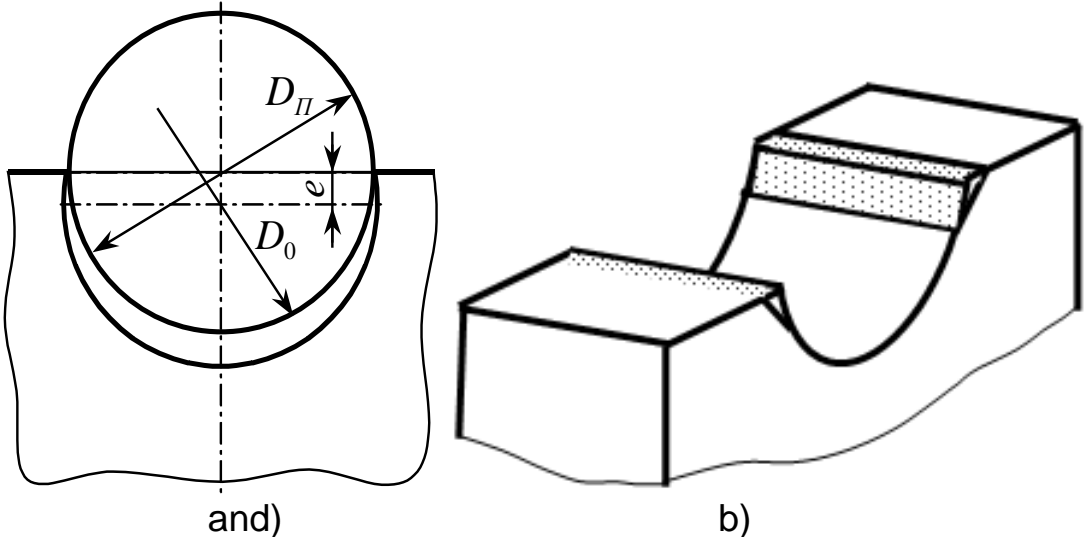


Fig. 1. Layout of the outer ring bearings in napivotvir body (a) and fitting surfaces (b).

It is easy to see from Fig. 1, and that the condition of assembly of the outer ring of the bearing napivotvorom can be expressed by:

$$2\sqrt{\frac{D_0^2}{4} - e^2} \geq D_{II}, \tag{4}$$

where: D_H and D_0 - The actual diameter of the outer ring according bearings and shell holes, respectively.

After simple calculations, we find that in theory assembly provided provided [9] that:

$$e \leq \frac{1}{2} \sqrt{D(ES_0 - \Delta D_m)}. \quad (5)$$

Here D - nominal diameter of connection; ΔD_m and ES_0 - according deviation lower bearing ring outer diameter and hole deviation upper case.

Calculations with regard GOST 25346-82 (taken 6 and 7 Kvalitet for holes) and GOST 3325-85 showed that, for example, for a range of diameters 100 ... 500 mm, the most widespread in large gears, allowable deflection hole axis relative to the plane of the roses' volume hull is 1 ... 4 mm [8] that, given the cost of lining precision attainable borshtanhy borers virtually no limits bearings skladayemosti drafting unit. To ensure the gap in the external connections locally loaded bearing rings in the holes detachable buildings in accordance with GOST 3325-85 is recommended to appoint field tolerance H6, H7, G6, G7 regardless of bearings, size and operating conditions. Location fields tolerances compounds bearing outer ring according to the recommended options shown in Fig. 2.

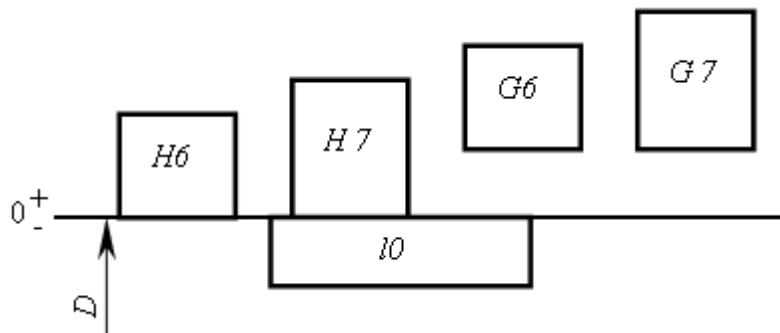


Fig. 2. Location fields tolerances bearing outer ring (I0) and hole (H6, H7, G6, G7) in the body.

Note that the tolerance field JS7, K7 and M7, are listed among the tables [7] and other sources for the above holes are generally unacceptable because, first, with margins of tolerance rings I0, I6 and others. they will transition (not with a clearance!) landing, and secondly, do not account for the phenomena described industrial technological inheritance.

As the production experience, the diameters of the holes detachable appointed buildings tolerance field with the main decline N. This, in our view, due to the traditional principle of common purpose

fields tolerances on all dimensions of internal surfaces in the "body" of the details, that in this case " plus "from the zero line, technologically efficient. Nevertheless, not always build quality, especially large demountable buildings meet the necessary standards. Production observations showed that often Bearing for installation at fitting must remove the layer 2 ... 3 times greater than standard.

Conclusions

1. When designing drafting units of rolling bearings landing circulating loaded rings must be assigned considering the ratio of the load and dynamic load capacity.

2. The diameters of the holes in buildings detachable outer ring with a local stress fields appropriate to appoint tolerance H6, H7, G6, G7, and the drawing up of large units - field tolerances G6, G7, which will create a backlash in connection with the ring, and, hence, the ability to turn the last periodic in service folding unit bearings and reduce uneven wear of tracks and rolling the associated increase durability drafting units of rolling bearings.

List of references

1. Mashinostroenie. Encyclopedia. 5 Technology T.SH assembly in mashinostroeniya / AM Dalsky [et al.]. - M.: Engineering, 2005. - 640 p.
2. Martynov A.P. Standart Machine Elements, Power Transmissions and Pipelines / A.P. Martynov, A.I. Zhabin // Assembly practice in Machine Building. - Moscow: Mir Publishers, 1987. - P. 226-255.
3. Martynov AP Skladayemist compounds in engineering products with regard to standard GPS / AP Martynov // Reliability optimization tools and technology systems: Coll. Science. pr. - Kramatorsk, 2012. - Vol. 30. - P. 279-285.
4. Martynov AP Modern STATUS standartov on Basic norms vzaymozamenyayemosty and Formation ynzhenerykh navykov graduates high schools / AP Martynov, RM Trysch // Modern Education and yntehratsyonnyye processes / Sat. scientific. Labor Internat. scientific method. conference. - Kramatorsk, 2012. - P. 242-249.
5. Blaer IL Elimination Method perekosov behovoy current track roller-bearings / IL Blaer // Vestnik mashinostroeniya. -2005.-№11.- 8 C.-11.
6. Martynova AP Research sobyayemosty krupnykh shpyndelnykh nodes with rolling bearings / AP Martynova, OF Babin, Y.S. Kovalenko // Reliability optimization tools and technology systems: Coll. Science. pr. - Kramatorsk, 2009. - Vol. 24. - P. 142-152.
7. Paley, MA Tolerances and landing: Directory / MA Paley, AB Romanov, VA Braginsky. - S-Pb.: Polytehnika, 2001. - 576 p.
8. Ivanov GA Investigation of high-performance grinding parts of agricultural machines / HO Ivanov, VV Dytyuchenko VV Kushnarev // Bulletin of Agricultural Science Black Sea. - Mykolaiv, 1998. - Vol. 2. - P. 123-129.

9. SP Ginkul Optymalnaya sequence operations mehanycheskoy obrabotku korpusnyh parts / SP Ginkul // Sudostroytel'naya industry. Technology and Organization mashinostroeniya trial production. - 1986. - S. 31-37.
10. Martynova AP Structural and technological factors increase skladannosti drafting units of rolling bearings / AP Martynov, GA Ivanov // Journal of Agricultural Science Black Sea. - Mykolaiv, 2013. - Vol. 2. - P. 186-193.
11. Interchangeability, standardization and technical measurements : textbook / GA Ivanov, V. Shebanin, DV Babenko, SI. Pastushenko ; Ed. GA Ivanov VS Shebanin. - K. : Agricultural Education, 2010. - 577 p.

Features of the formative analysis conducted in the future professionals навиков designing of products with obosnovannym vzaymozamenyaemosty SELECT r. Predlahaetsya a complex of technical measures on orhanyzatsyonnyh usovershenstvovanyyu learning process, methodology and accuracy normyrovanyya tehnolohychnosty Drawing products.

Specialist, Production, Fixing, region, Mashinostroenie.

The analysis of features of formation at future experts of skills of design of products with reasonable choice of type of interchangeability is carried out. The complex of technical and organizational measures for training process improvement, technique of rationing of accuracy and technological effectiveness of drawing up products is offered.

Expert, production, product, area, mechanical engineering.

658,531 UDC: 631.3

MAIN AREAS OF DEVELOPMENT OF TECHNICAL STANDARDS IN Workshop production

ZV Ruzhylo, IL Rogovskiy, Ph.D.

VI Miller, Ph.D.

Shows and reasonable directions of development of the system of technical regulations in repair production agriculture.

Direction, system, provision, repair, production.

Formulation of the problem. Since independence, Ukraine in agriculture have been significant changes in quantitative and qualitative

© Z. Ruzhylo, IL Rogovskiy VI Miller, 2015