НАВЧАЛЬНО-МЕТОДИЧНА ЛІТЕРАТУРА

Ministry of Education and Science of Ukraine
Ternopil National Technical University named after. I. Puluj
Department of Mechanical Engineering Technology

Methodical manual on the implementation of the course project on discipline "Technological preparation of production"

for students of all forms of study
Direction of preparation 131 " Applied mechanics"

Ternopil

2021

Ministry of Education and Science of Ukraine
Ternopil National Technical University
the named after Ivan Puluj

Mechanical Engineering
department

Methodical instructions

Methodical manual on the implementation of the course project on discipline
"Technological preparation of production"
for students of all forms of study
Direction of preparation 131 " Applied mechanics"

Ternopil – 2021

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Composed taking into account the curriculum for bachelor Direction of preparation 131 " Applied mechanics".

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Contents of the course project

Task

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2 DOCUMENTATION OF TECHNOLOGICAL PREPARATION OF PRODUCTION

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2.2 Development of rates of materials (billets, metal, components) for the site (or its fragment). *

2.3 List of necessary technological devices.

2.4 List of necessary technological equipment.

2.5 List of cutting and measuring tools.

2.6 Tasks for the design of special equipment, device or tools.

2.7 Drawing up a plan for the workshop work.

2.8 Drawing up a schedule for documentary preparation of the node production.

2.9 Drawing up a grid schedule for planning the production of the node

REFERENCES

Volume of explanatory note to the course project - 35-45 sheets of A4 paper.

Graphic part of the course project

1. Drawings of the node working on manufacturability (A1 or A2).
2. Drawings of a device for machining or control (A1).
3. Drawings of a die (mold) for manufacturing workpieces of parts used for the manufacture of parts of a given node, or adjustment (A1).
4. 4. Network schedule of production preparation planning (A1 or A2).
5. *) A fragment of a node is accepted for execution of the project if the node contains more than 20 original parts.
6. The volume of the graphic part for the course project is 3-4 sheets of A1 format.

Working out the design of the node on manufacturability

Practical recommendations for the choice of technologically rational solutions for typical designs of elements of assembly units during their design

The number of parts in the assembly unit must be minimal. On Fig. 1 is an example of simplifying the design of the worm shaft supports. The number of parts in the assembly is greatly reduced by replacing the thrust bearings in the worm supports by the roller bearings.

Assembly of components of the product must be carried out independently and in parallel. In Fig. 2 shows an example of the breakdown of a conical transmission node into independent components. The design of the assembly consists of two cups, in which, with the possibility of rotation mounted conical wheels, the assembly of cups, including adjusting the bearings with gaskets 2, can be performed in parallel and independently. The general assembly consists only with mounting the cups in place and adjusting the gaskets 1 of the correct gap in engagement.

Assembly should be convenient. The convenience of assembly is to use simple production techniques that do not require special tools and appliances. The locations of assembly and installation of parts and assemblies must be open and accessible not only for the process itself but also for regulation and control.

During designing, it is necessary to take into account the elementary techniques that ensure the simplicity of assembly work: connected parts must be provided with chamfers (Fig. 3). It is usually sufficient to perform the chamfer on the bushing (Fig. 3a) or on the shaft (Fig. 3b).

Chamfer on a thread (fig. 3, c) is required both for assembly and for improvement of working conditions of the cutting tool.

Installation of parts on different landing bases should not be simultaneous (Fig. 4, a), but sequential (Fig. 4, b). The size A must be sufficient to provide a diameter d.

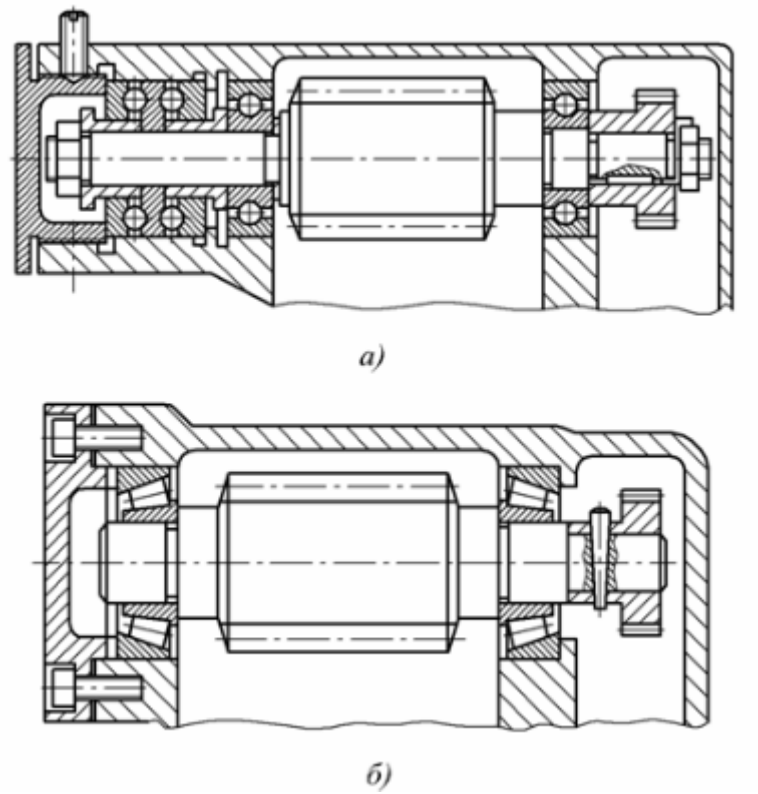


Figure 1 - Worm shaft support structure:

a - complicated; b – simplified

Moving of the parts over fixed landings should be as minimal as possible. Such displacement reduces the assembly effort and prevents disruption of landing on the moving part. Of the two options shown in Fig. 5, option b may be considered preferable, its advantage being the presence of identical diameters on both machined parts of the shaft. In addition, the paired parts in this case can be unified.

In the design of products must be provided assembly bases that provide the necessary mutual placement of components during assembly. It is necessary to install and fix them on certain points, lines, bases that are on each of the connected parts and. The assembly base is the set of surfaces, lines, or points relative to which the placement of a surface, line, or point is determined, based on the conditions for the proper functioning of the product.

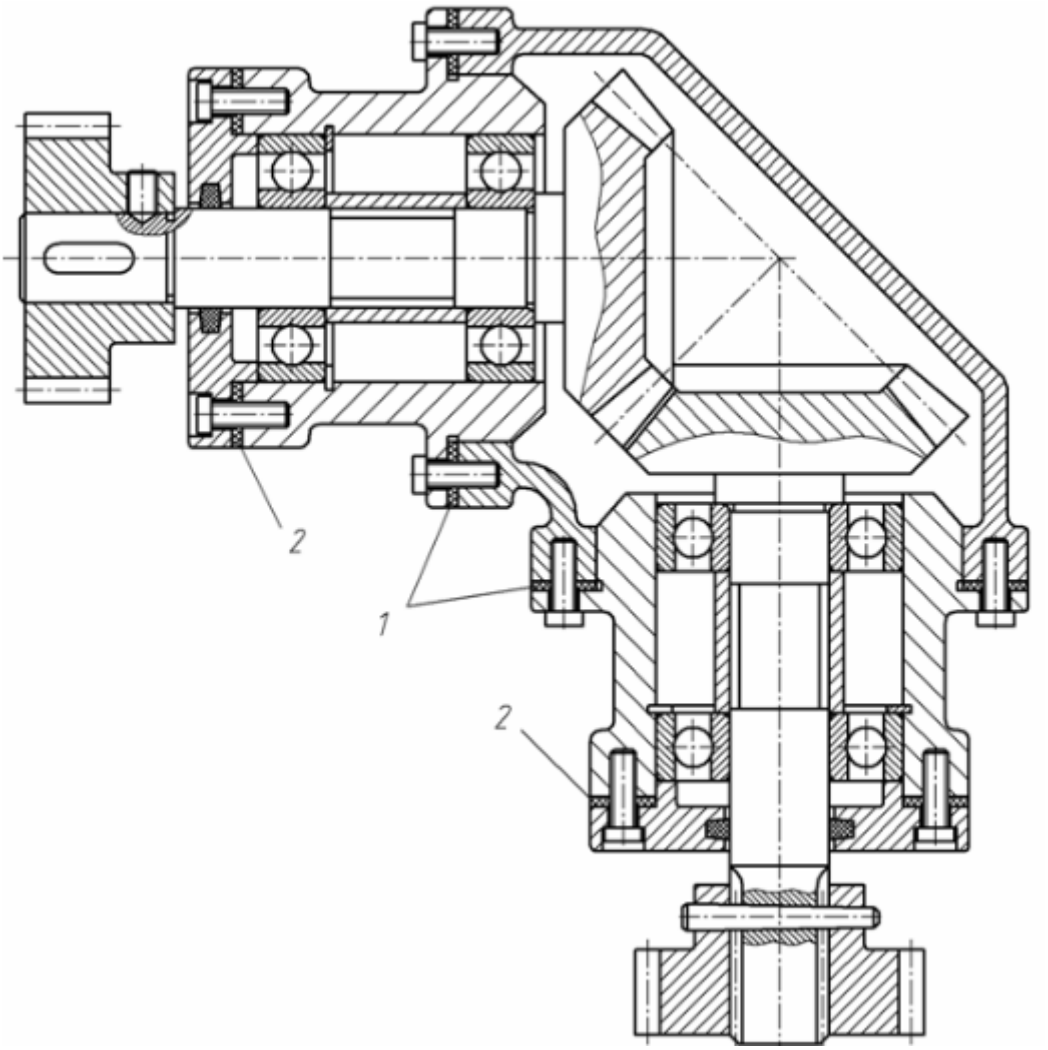


Figure 2 - Disassembly of conical transmission node: 1 and 2 are the adjusting spacers according to the engagement gap and the bearings

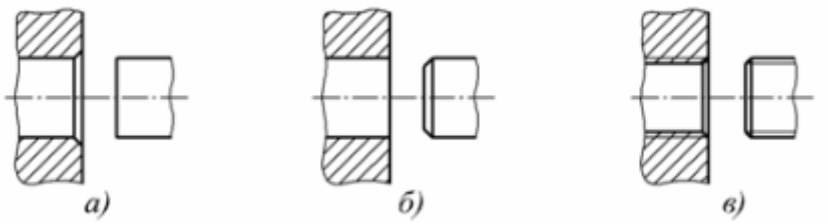


Figure 3 - Execution options for the western facets on the connected parts

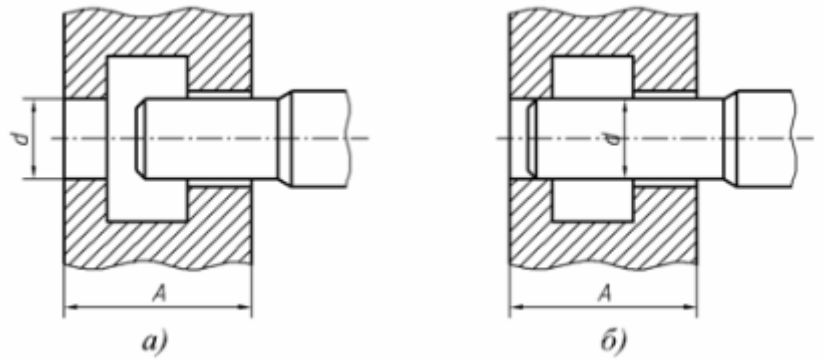


Figure 4 - Schemes of installation of parts on landing bases

Figure 5 - Examples of mounting bearings on the shaft

In Fig. 6,a shows a base for mounting the gear wheel. The absence of the assembly base (Fig. 6b) leads to the installation of the gear wheel by the marking, which requires drilling of the hole during assembly.

In mass and large-scale production, it is advisable to create assembly bases in the form of auxiliary locking elements (keyholes, etc.) due to some increase in machining, which provide the required arrangement of the assembly without fitting (Fig. 7a).

Installation of the assembly by means of pins (Fig. 7b) does not ensure the interchangeability of the connected parts and requires laborious metalwork, including manual marking, installation in a predetermined position, fixing, drilling of openings, etc.

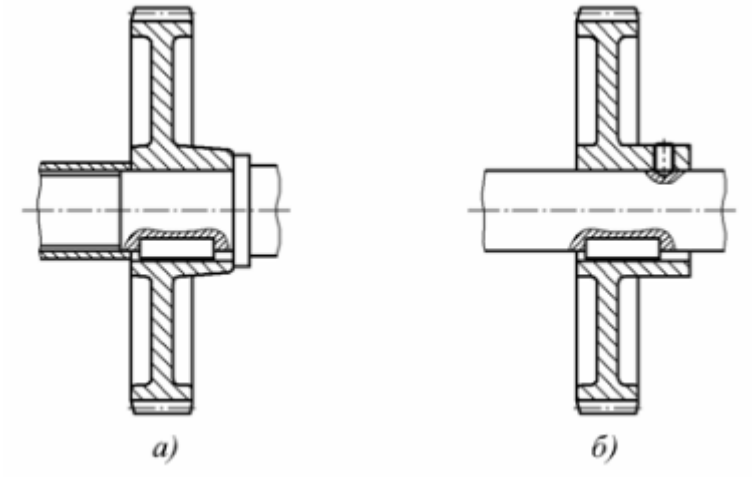


Figure 6 - Base of the gear wheel on the shaft

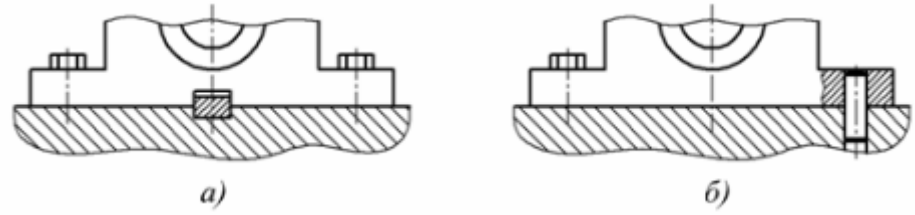


Figure 7 - Use of auxiliary assembly bases

The design of the product should provide the most rational methods of installation and mutual fixing of parts during assembly.

With a corbel on one part and a corresponding groove on the other. This method requires a precise treatment of the projection and groove, preferably by planing, ie a relatively unproductive method. The presence of a corbel on one of the parts complicates the processing of the base of the connected parts and the design of the devices used. Due to the impossibility of machining multiple tools with one tool and one of the parts, an exacting operation may be required to accurately fit these parts to each other during assembly.

The advantage of this method is the compactness of the assembly, which enables it to be used for fixing small parts.

With pins. The grooves in both parts must be very accurately machined with a cutter or broach. The base of the keyway is pre-sanded. The joint surfaces of the interconnected parts are milled or sanded by one passage, ensuring their exact fit. The presence of a pin does not complicate the design. Sometimes the keyway is fastened with a screw or a cylindrical pin. The keyway is used when the product will be subjected to heavy loads during operation. A common disadvantage of these mounting methods is the ability to lock the parts only in the transverse direction.

Cylindrical pins. The method is simple and reliable, but when assembling the holes under the pins of both parts must be turned together, which prevents the rotation of one part relative to the other.

Tapered pins. The method is less economical because conical sweeps are more expensive than cylindrical ones. In addition, the manufacture of tapered pins is more difficult. The advantage of this method is the landing with tensioning pins and the complete absence of gaps.

Landing bolts and bushes (Fig. 8). The bolts are used for both accurate fixing and fastening of parts, which is an advantage of this method. This method can be recommended in the absence of space for the installation of cylindrical pins and in the case where the connection operates at high loads. In this case, the processing of landing holes for passage is mandatory.

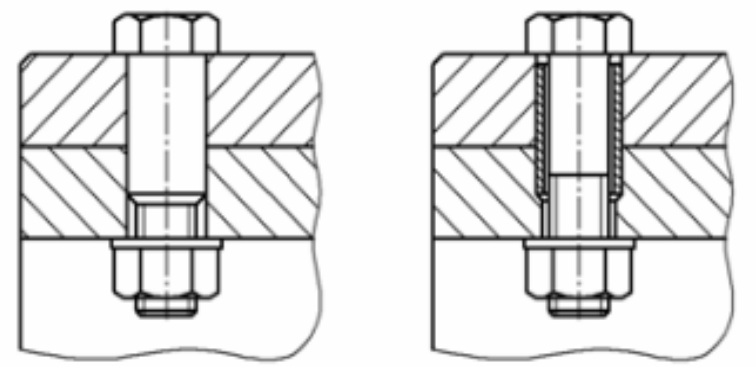


Figure 8 - Options for fixing parts with bolts and bushings

Fixing of axial displacement with nuts. This method requires the cutting of a thread on the shaft and in the nuts, and can only be recommended when it is necessary to adjust the position of the workpiece on the shaft or press it firmly against the projection of the shaft or install it with a certain clearance.

Using an adjusting ring with a screw. The method is quite economical in relation to the manufacture of the fixing part (mounting ring). It is advisable to drill the shaft before assembly. This method is recommended for low axial loads in the direction of the mounting ring.

Adjusting ring with conical pin (Fig. 9a). With this method, you must simultaneously open the hole for the pin in the ring and in the shaft. The method is quite economical with the free rotation of the workpiece on the shaft with defined axial clearance and the forces acting on the ring. If necessary, the pin is fixed from the fall of the spring ring.

Spring ring (Fig. 9b). The method is quite rational when installing a part on the shaft with a gap and in the presence of small axial loads in the direction of the ring, which is made of circular spring wire, or a special profile with ears for easy installation and disassembly.

The mounting screw that goes into the shaft groove. The method is quite simple. It is recommended, if necessary, to ensure the free rotation of the workpiece on the shaft in the absence of axial loads.

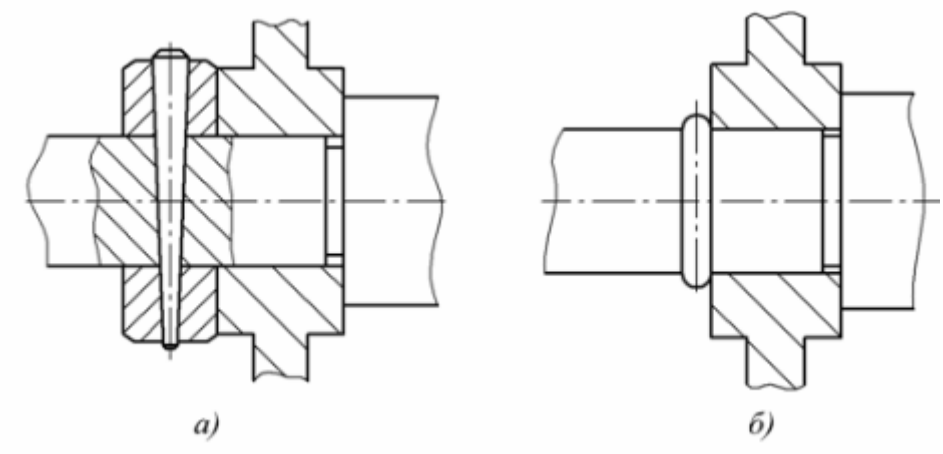


Figure 9 - Methods of fixing parts in the middle of the shaft

End washers. The washer should not be shaped (Fig. 10, a), but flat (Fig. 10, b). The fastening of the washer by turning the cylindrical pins is used with the free rotation of the workpiece on the shaft.

The design with two screws for which it is less rational to drill and cut the cut in the holes, it is advisable to use only for large shafts.

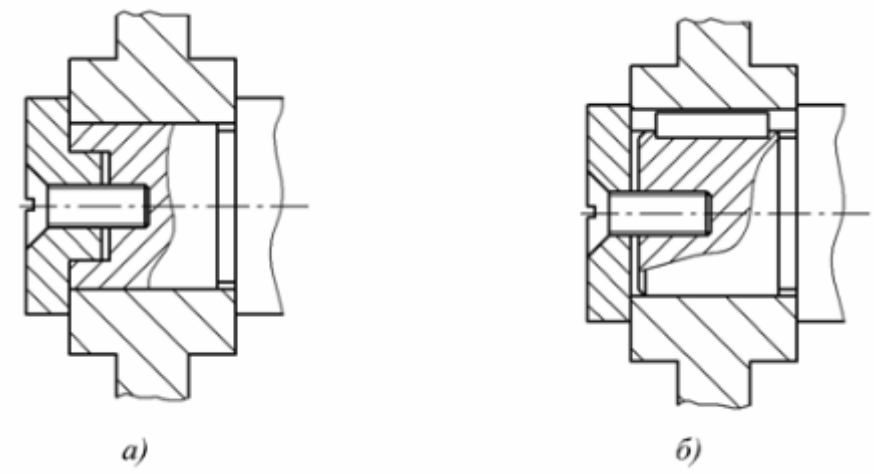


Figure 10 - Methods of fixing parts at the ends of the shafts

With a special screw (Fig. 11). The method is irrational, since the manufacture of a screw requires a large amount of machining, in addition, when assembling it is necessary to drill a hole under the locking screw.

Washer and recessed pin (Fig. 12). A very simple and cheap way. Recommended for all non-compliant connections. Drill holes must be drilled before assembly.

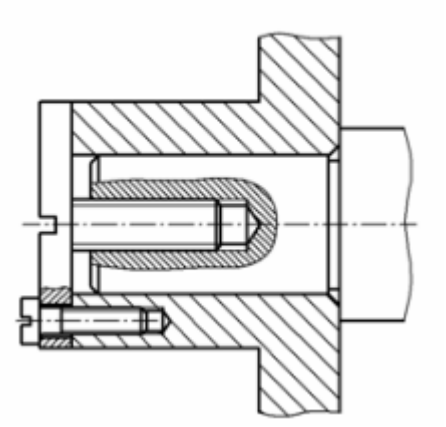


Figure 11 - Irrational method of fixing a part at the end of a shaft

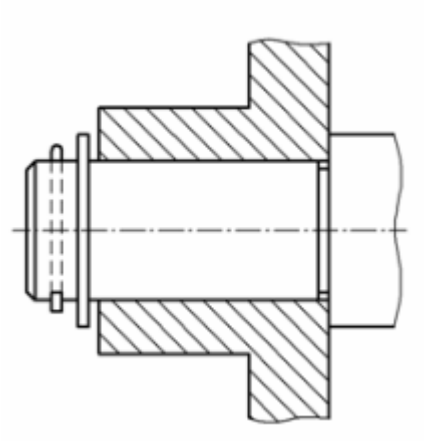


Figure 12 - Fixing the workpiece to the shaft with a washer and pin

Fixing against rotation by means of mounting screws (Fig. 13). The method can be recommended in the absence of significant torques and axial forces and only if the possibility of drilling the shaft during assembly.

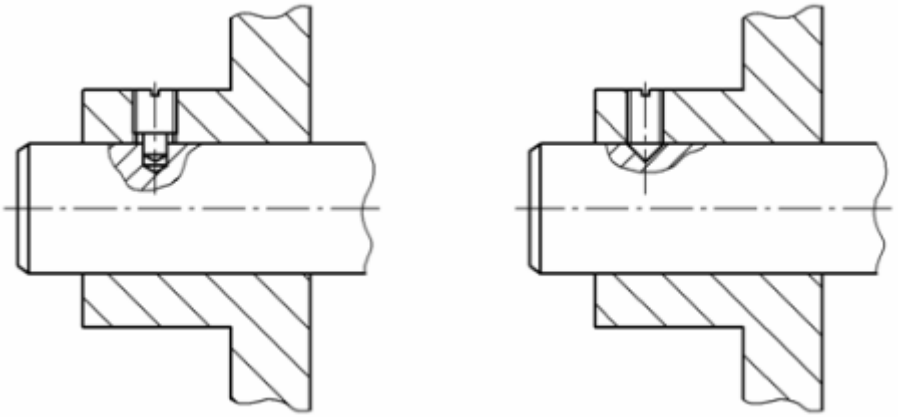


Figure 13 - Fixing parts with screws

Tapered pin (Fig. 14). Despite the need to simultaneously open the hole for the pin in the workpiece and shaft, this method is rational because it is quite simple,

prevents the rotation and axial displacement of the workpiece. It is recommended, if possible, to simultaneously drill parts for mounting the flywheels and unloaded gears without the use of keyholes.

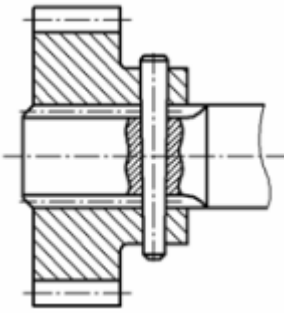


Figure 14 - Fixing parts with a conical pin

Planting the details on the square (Fig. 15, a). Due to the low productivity and relatively inaccurate machining of the square on the shaft, this method is only used in extreme cases; for example, if frequent removal of a part is required if the square is at the end of the shaft and at relatively large tolerances for manufacturing accuracy. In order to reduce the amount of metal that is removed during pulling, it is desirable to perform the section of the hole as shown in fig. 15, a.

Landing of a part by means of a scaffold on a shaft (fig. 15b, c). Both options are irrational, since manual fitting is required for accurate landing. The method shown in Fig. 15, in, slightly better, because when machining the hole by pulling the tool is loaded evenly. Installation by these methods, it is advisable to replace the installation on the slots.

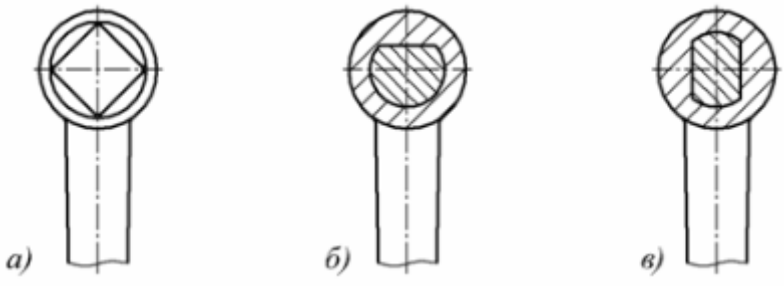


Figure 15 - Fixing of parts by means of a shaft face

In addition, there are the following methods of fixing parts during landing on the shaft: planting parts on the cone, prismatic (Fig. 16, a) and segmental (Fig. 16, b) keyholes, spline and circular key.

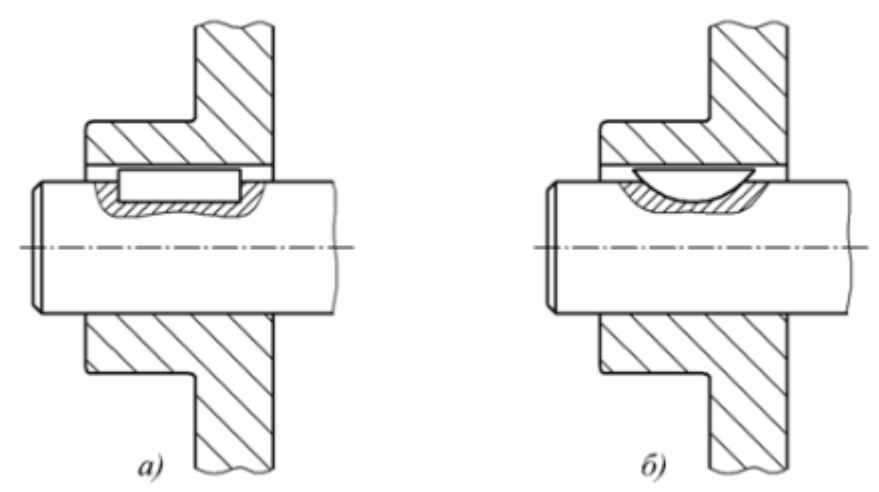


Figure 16 - Fixing parts with keyholes

Installation on radial ball bearings. With rigid installation of both bearings (Fig. 17, a). The method is shown as an example of incorrect installation, in which it is difficult to ensure the normal operation of the bearings.

With the outer rings of both bearings (Fig. 17b) The method is used to eliminate the axial clearance of the shaft, which is achieved by partial pulling of the bearings; the temperature expansions of the parts are negligible. This method requires fine adjustment of the location of the outer rings, it is used very rarely.

With rigid installation in the axial direction of one bearing with the free second (Fig. 17, c). This method of mounting the shafts on the radial ball bearings is the most correct and rational. It requires no regulation and ensures the normal operation of the site in all conditions.

Mounting on tapered roller bearings. As a rule, one of the bearing rings (internal or external) is mounted with tension and the other is movable. Adjustment is carried out by moving the ring, which is set in motion.

In the case of shaft rotation. When the shaft rotates, the outer ring of the bearing is movably mounted, due to which the adjustment is made.

In case of body rotation. The outer rings of the bearings are fixed and the adjustment is made by moving one of the inner rings. In this case, the form of boring of the housing is hampered by the need to focus the outer bearing rings in the housing.

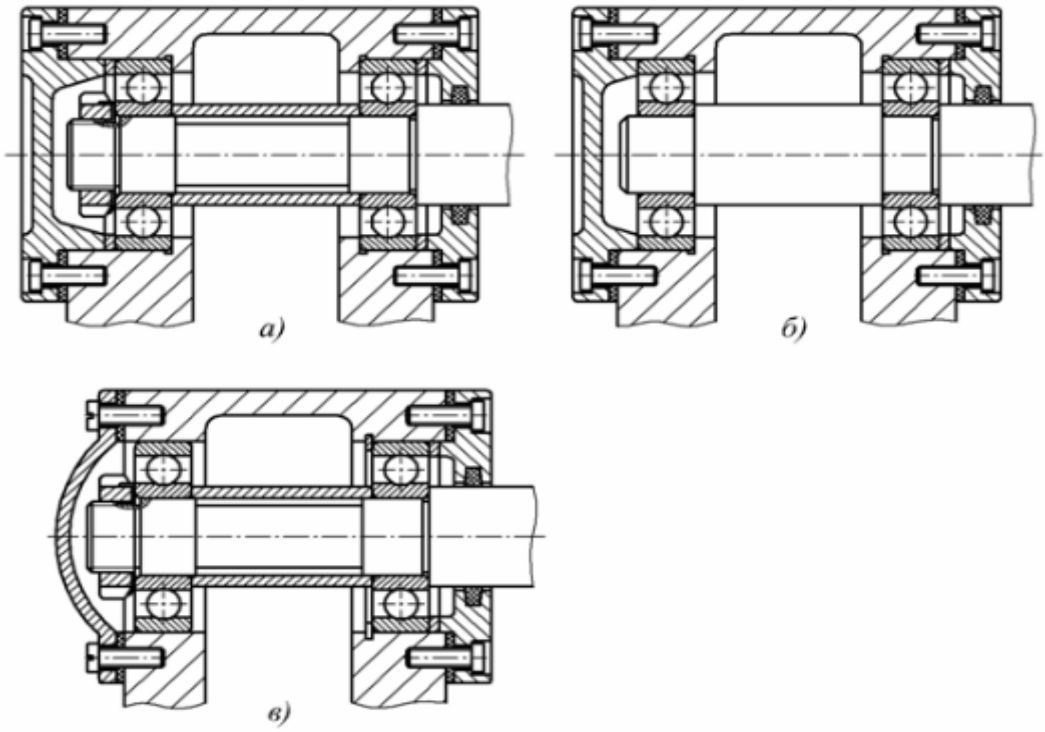


Figure 17 - Shaft Installation on Radial Bearings

Installation on thrust ball bearings. The main mistake in the design of the supports on the thrust ball bearings is the centering of both rings: the rotating shaft and the fixed - in the housing (Fig. 18, a). Such centering is superfluous, since one of the rings must be freely fixed by a groove on the balls, which, in turn, are mounted in the groove of the second ring. In this respect, the structures of the supports shown in Fig. 2 are correct. 18, b and c.

With insufficient length of the tail part of the shaft, the separator with balls may hang during the assembly process. Therefore, when designing it is necessary to provide sufficient length of the tail part of the shaft on which the bearing is installed.

Methods of fixing nuts and screws. Unauthorized unscrewing and loosening of threaded connections is not allowed. Therefore, when fixing, the following requirements are required:

- free access to the threaded connections that require a systematic inspection;

- assemblies and units to be removed for inspection must have a system of attachment with minimum complexity;

- the total number of sizes of screws and nuts used in the product must be minimal;

- the sizes of the heads of screws and nuts on a turn-key basis should be as uniform as possible;

- fasteners should be standard.

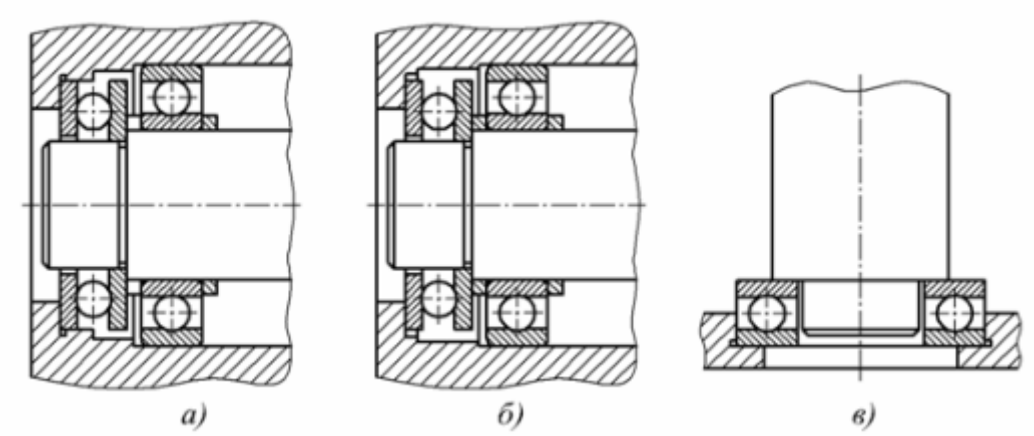


Figure 18 - Shaft Installations on Support Bearings

Locking can be carried out by a lock nut, a wire splint, a wire, spring washers (GOST 10461-81), a washer with a foot (GOST 13463-77).

Mechanization of assembly processes on the basis of modern means of technological equipment (robotics complexes, etc.) largely depends on ensuring the manufacturability of the designs of assembly units.

The complexity of structural and technological solutions of assembly units make it difficult, and sometimes make it impossible to mechanize such work movements as the orientation of the assembly structural elements, their fixation (fastening).

The transition to mechanization of assembly processes is associated with the complex solution of the following problems:

- working out design solutions in terms of the possibility and simplicity of mechanization of the assembly process (for example, providing parts with symmetrical simple forms, the use of special bases and guides);

- the choice of optimal assembly methods that provide the desired accuracy, technological regulation, rebounds and fits;

- classification of the assembly units of the product by design and technological parameters, reflecting the possibility of their mechanized assembly;

- development of typical technological processes of mechanized and automated assembly for the relevant product classification groups;

- wide differentiation of assembly operations and techniques, reduction of possible variants of placement of basic parts for simplification of designs of assembly mechanisms;

- development of standard designs of assembly mechanisms for orientation, installation and fastening of details.

The technological process of assembly

Assembly - this is the final stage of the production process, which largely depends on the quality of products and their production within the timeframe. Nowadays, the complexity of assembly work in mechanical engineering is 25… 30% of the total complexity of manufacturing products.

Initial data for designing technological assembly processes are as follows: drawings of assembly and general types of assembly units; technical requirements for acceptance and testing of products; assembly dimension chains; production program of production of products; the specification of the assembly units and the connecting parts that come in for assembly; mode of operation.

Development of the technological process of assembly assembly is carried out with the following requirements:

- partitioning the node into nodes with possible differentiation of them in the drawing;

- the desire for a significant concentration of assembly operations;

- maximum mechanization of assembly works;

- the possibility of using standard assembly devices;

- Combining assembly and control operations, etc.

The technological process of assembling the mechanism of switching ranges is presented below.

Дубл.			
Взам.			
Підп.			

Зм.	Лист	№ докум.	Підпис	Дата

TNTU	3518020-43270		46000 50141.0001
The mechanism of switching between bands			

«APPROVED»
Head of the department
Pylypets M.I.._____
«__»_____ 200_ p.

Set of documents

on the technological process of assembly

_____

Developed by _____
Approved by _____

ТП	

ГОСТ 3.1118-82 Форма 1

Дубл.			
Взам.			
Оригінал			

				TNTU	3518020-43270		46000 50141.0001
Developed							
Approved							
Agreed							
Confirmed				The mechanism of switching between bands		12	1
N. control							

М 01										
М 02	Код	ЕВ	МД	ЕН	Н. витр.	КВМ	Billet code .	Profile and dimensions	КД	МЗ

А	Shop	Dep.	РМ	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УТ	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
Р	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.витр.
А03	18			001	0400 Transportation	812 2	2	1	1	90	1,0					
Б04	Electric forklift ЕП-201															
О05	1. Transportation of parts and assembly units to the workplace															
Т06					Pallet 7											
07																
08																
А09	18			005	Drawing up the locking mechanism 3518020-41059-01 Т.											
Б10	Workbench						707	3	1	1	1	90		1.0		T_o=21.7
К11	1 Hydraulic cylinder for locking ranges 3518020-42180												90	1	1	
К12	16			Lock case cover 3518929-40016А									90	1	1	
К13	23	Lock cover gasket 3518020-40079											90	1	1	
К14	26	Locking corpus 3518020-41059-01.											90	1	1	
К15	29	Washer of a seal of the stock 3518020-44006														
К16																

MT	Mechanical treatment

Дубл.																	
Взам.																	
Оригінал																	
																	2

											3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.вит р.
К01	31				Lock washer 3518020-44035								90	1	1	
К02	36				Locking rod 3518020-41019-01.								90	1	1	
К03	37				Stock seal nut 3518020-46023								90	1	1	
К04	39				Toggle switch lever 3518020-46126								90	1	1	
К05	41				The control rod 3518020-46167-0.1								90	1	1	
К06	48				Stock bolt 3518020-46366								90	1	1	
К07	51				Limiter bushing 3518020-48002А.								90	1	1	
К08	53				Lock housing gasket 3518020-4008								90	1	2	
К09	55				Spring return hydraulic cylinder lock 3518020-46551								90	1	1	
К10	58				Bolt М8-6g 20.56.019 ГОСТ 7798-70								90	1	2	
К11	59				Bolt М8-6g 20.56.019 ГОСТ 7798-70								90	1	2	
К12	66				Washer 8Т.65Г.019 ГОСТ6402-70								90	1	4	
К13	69				Ring 022-028-36-2-2 ГОСТ9833-73								90	1	1	
М14					Wire 1,0-004 ГОСТ 3282-74								15	1	0,150	
М15					Solidol ««С» ГОСТ4366-76								42	1	0,150	
М16					Paint thickener ИЦЛ 123-78								42	1	0,050	
М17					The industrial oil И-20А ГОСТ20799-75								42	1	0,020	
МТ	Mechanical treatment															

ГОСТ 3.1118-82 Форма 1б

Дубл.			
Взам.			
Оригінал			

		3

3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification									
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S / Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ / Н.витр.
01															
О02	1.				Prepare a set of parts for assembly.										
О03	2.				Install the lock housing 3518020-41059-01 on the workbench.										
О04	3.				Lubricate seal space under the rod by control solid oil.										
Т05					Brush КР20 ГОСТ10597-80. Technological capacity.										
О06	4.				Install the ring 22-028-36-2-2 into the housing opening.										
О07	5.				Install the control rod 3518020-46167-01 into the housing opening										
Т08					Hammer 7850-0103 ХР ГОСТ2310-77.										
О09	6.				Put on the rod control lever shift forks 3518020-46162 according to the drawing.										
О10	7.				Slide the control rod into the housing opening, install the shift plug lever.										
Т11					Hammer 7850-0103 ХР ГОСТ2310-77.										
О12	8.				Screw in the stock bolt 3518020-46366to the hole of the fork lever, lock the lever.										
Т13					Clef 7811-0023 НС1Х9 ГОСТ2835-80.										
О14	9.				Tighten the stem bolt to a torque 32-62 Н.										
Т15					Orifice. 7812-4034 Torque wrench.										
О16	10.				Secure the stock bolt with a wire 1,0-0-4 according to the drawing										
Т17					Pliers 7814-0082 Х9 ГОСТ5547-86.										

MT Mechanical treatment

Дубл.																	
Взам.																	
Оригінал																	
																	4

											3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.выр.
01	11.				Install the sealing washer 3518020-44006 into the housing opening.											
О02	12.				Install the ring СП-30-21-5 into the groove of the sealing nut 3518020-46023											
Т03					Technological capacity.											
О04	13.				Attach the sealing nut to the control rod and screw it into the housing opening.											
Т05					Clef 7811-0023 НС1Х9 ГОСТ2835-80.											
О06	14.				Lubricate the place under the seal of locking cover on the housing with a paint thickener											
Т07					Brush КР20 ГОСТ10597-80. Technological capacity.											
О08	15.				Install the cover gasket on the housing 3518020-40079,lock cover 3518020-44071,align the holes.											
О09	16.				Secure gasket with cap by bolts M8x20 and washers 3pcs.											
Т10					Clef 7811-0023 НС1Х9 ГОСТ2835-80.											
О11	17.				Lubricate rod lock 3518020-46019-01 by solid oil											
Т12					Brush КР20 ГОСТ10597-80. Technological capacity.											
О13	18.				Install the locking rod into the housing opening.											
О14	19.				Install the gasket 3518020-4008, hydraulic cylinder 3518020-42180 on the housing, align the openings.											
О15	20.				Fasten the hydraulic cylinder with bolts M8x25 and washers 2pcs.											
Т16					Clef 7811-0023 НС1Х9 ГОСТ2835-80.											
О17	21.				Install the roller washer 3518020-44035,the sleeve restricting 3518020-48002А in the opening of the case.											
МТ	Mechanical treatment															

Дубл.			
Взам.			
Оригінал			

5

3518020-43270	The mechanism of switching between bands

A	Sh op	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.вит р.
О01	22.				Install a spring 3518020-46551 that returns the lock cylinder to the hole.											
О02	23.				Install the gasket 3518020-400016A on the housing, align the holes.											
О03	24.				Secure the cover with bolts M8x25 and washers 8T.65Г 2pcs.											
Т04					Clef 7811-0023 НС1Х9 ГОСТ2835-80.											
О05	25.				Transfer housing assembly for next operation.											
06																
07																
А08	18			010	Assembly of the switching mechanism 518020-41058-01 T											
Б09					Workbench		707	3	1	1	1	90		1,0		T_o=31,7
К10	3				Upper switch pusher 3518020-43170.								90	1	1	
К11	4				Lower switch fork 3518929-43200-01.								90	1	1	
К12	5				Upper switch fork 3518020-43210-01.								90	1	1	
К13	6				Lower stock of ranges switch 3518020-43700-01.								90	1	1	
К14	11				Stock bolt 60671Б.								90	1	2	
К15	17				Cover gasket of housing switch mechanism 3518020-40017.								90	1	2	
К16	25				The switching mechanism body 3518929-41058-01.								90	1	1	
К17	27				Cork 3518020-41081.								90	1	1	

МТ Mechanical treatment

Дубл.			
Взам.			
Оригінал			

3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.витр.
К01	28				Switch case housing 3518020-44004-01.								90	1	2	
К02	35				Bracket connecting panels 3518020-44126.								90	1	1	
К03	38				Finger lock 3518929-46024.								90	1	1	
К04	58				Bolt M8-6g 20.56.019 ГОСТ 7798-70.								90	1	12	
К05	59				Bolt M8-6g 25.56.019 ГОСТ 7798-70.								90	1	2	
К06	77				Ball Б11-40 ГОСТ7322-81.								90	1	3	
М07					Wire 1,0-004 ГОСТ3282-74.								90	1	0,030	
М08					Solidol «С» ГОСТ4366-76.								90	1	0,010	
М09					Paint thickener ИЦЛ 123-78								90	1	0,060	
О10	1.				Prepare a set of parts for assembly.											
О11	2.				Install the range switch housing 3518020-41059 on the workbench.											
О12	3.				Install the lower range switch stem 3518020-46168-01 to the hole and secure.											
Т13					Hammer 7850-0103 ХР ГОСТ2310-77.											
О14	4.				Attach the lower shift plug 3518020-43200-01 to the stock according to the drawing.											
О15	5.				Insert the lower stem with the plug into the hole.											
Т16					Hammer 7850-0103 ХР ГОСТ2310-77.											
О17	6.				Insert the lower stem according to the drawing.											

МТ	Mechanical treatment

Дубл.																	
Взам.																	
Оригінал																	
																	7

										3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.З	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.выр.
О01	7.				Screw the stem bolt 60671Б into the hole of the fork and secure the fork to the stem.											
Т02					Clef 7811-0023 НС1Х9 ГОСТ2839-80.											
О03	8.				Tighten the stem bolt to a torque 34,5-42,5 Н.											
Т04					Nozzle. 7812-4034 Torque wrench.											
О05	9.				Secure the stock bolt according to the drawing by wire 1,0-0-4.											
Т06					Pliers 7814-0092 Х9 ГОСТ5547-86.											
О07	10.				Insert ball Б11-40 into hole of housing.											
О08	11.				Insert the locking finger 3518020-46024 into the housing opening.											
Т09					The mandrel. Hammer 7850-0103 ХР ГОСТ2310-77.											
О10	12.				Insert ball Б11-40 into hole of housing.											
Т11					The mandrel. Hammer 7850-0103 ХР ГОСТ2310-77.											
О12	13.				Repeat transitions 3-9 for top stem 3518020-43170 and top fork 3518020-43210-01.											
Т13					See transitions 3-9.											
О14	14.				Insert ball Б11-40 into hole of housing.											
О15	15.				Grease the pusher of the switch 3518020-42820 with solidol.											
Т16					Brush КР20 ГОСТ10597-80. Technological capacity.											
О17	16.				Install the switch pusher into the housing opening.											
МТ	Mechanical treatment															

Дубл.																	
Взам.																	
Оригінал																	
																	8

											3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.вит р.
Т01					The mandrel. Hammer 7850-0103 ХР ГОСТ2310-77.											
О02	17.				Screw the process bolt M16x1,5x30 instead of the switch ВАК-01 into the housing opening.											
Т03					Wrench 7811-0026 НС1Х9 ГОСТ2838-80.											
О04	18.				Install a protective cap 3518020-40056 on the body and secure with 2 bolts M8x35 and nuts 8Т.65Г.											
05																
Т06					Wrench 7811-0021 НС1Х9 ГОСТ2838-80.											
О07	19.				Install the protective sleeve on the cap 54-00343.											
О08	20.				Lubricate the housing under the cover of the housing cover switch mechanism by paint sealant.											
Т09					Brush КР20 ГОСТ10597-80. Technological capacity.											
О10	21.				Install the cover gasket 3518020-40017 and housing cover 3518020-44004-01 on the housing, align the openings.											
О11	22.				Secure the cover with gasket bolts M8x20 and nuts 8Т.65Г 7pcs.											
Т12					Wrench 7811-0021 НС1Х9 ГОСТ2838-80											
О13	23.				Repeat transitions 21 and 22 again for the other side of the housing.											
Т14					See transitions 21 and 22.											
О15	24.				Install the connector panel bracket 3518020-44126 on the cover, align the openings.											
О16	25.				Secure cover with bracket bolts M8x20 and washers 8Т.65Г 7pcs.											
Т17					Wrench 7811-0021 НС1Х9 ГОСТ2838-80											
МТ	Mechanical treatment															

Дубл.																			
Взам.																			
Оригінал																			
																		9	

											3518020-43270	The mechanism of switching between bands	

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.вит р.
О01	26.				Lubricate the threaded part of the tube 3518020-41081 with a paint sealant.											
Т02					Brush КР20 ГОСТ10597-80. Technological capacity.											
О03	27.				Screw the plug into the housing opening.											
Т04					Wrench 7811-0023 НС1Х9 ГОСТ2839-80											
О05	28.				Transfer the housing assembly to the next operation.											
06																
07																
А08	18			015	Assembly											
Б09					Workbench		707	3	1	1	1	90		1,0		То=17,6
К10	12				The cylindrical pin 3518020-61327.								90	1	2	
К11	21				Gasket 3518929-40077.								90	1	1	
К12					Assembled mechanism of switching ranges 3518020-41058-01 Т.								90	1	1	
К13					Assembled locking mechanism 3518020-41059-01 Т.								90	1	1	
К14	44				Clamp spring 3518020-46202.								90	1	2	
К15	45				Lock of the stem of the ranges 3518929-46203.								90	1	2	
К16	59				Bolt М8-6gх25.56.019 ГОСТ7788-70.								90	1	4	
К17	62				Bolt М8-6gх35.56.019 ГОСТ7788-70.								90	1	2	
МТ	Mechanical treatment															

Дубл.																			
Взам.																			
Оригінал																			
																		10	

											3518020-43270							The mechanism of switching between bands	

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification											
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.	
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.выр.	
К01	66				Washer 8Т.65Г.019 ГОСТ6402-70.								90	1	6		
М02					Paint thickener ИЦЛ 123-78								42	1	0,100		
О03	1.				Prepare a set of parts for assembly.												
О04	2.				Install the range switch housing 3518020-41058-01Т to the stand.												
О05	3.				Insert 2 pins 61327 into housing opening.												
Т06					Hammer 7850-0103 ХР ГОСТ2310-77.												
О07	4.				Install the 2 stem retainers 3518020-46203 into the housing openings.												
Т08					Hammer 7850-0103 ХР ГОСТ2310-77.												
О09	5.				Install the 2 stem retainers 3518020-46202 into the housing openings.												
О10	6.				Lubricate the housing under the sealant gasket ИЦЛ 123-78.												
Т11					Brush КР20 ГОСТ10597. Technological capacity.												
О12	7.				Install the gasket 3518020-40077 on the housing align the holes.												
О13	8.				Set the locking mechanism 3518020-41059-01Т to the switching mechanism.												
О14	9.				Insert the switch lever into the retainers and then into the openings of the locking mechanism housing.												
О15	10.				Align the openings under the lock housing mounts to the switch mechanism housing.												
О16	11.				Secure the locking housing with 6 bolts М8х25 and nuts 8Т.65Г.												
Т17					Wrench 7811-0021 НС1Х9 ГОСТ2839-80												
МТ	Mechanical treatment																

Дубл.																	
Взам.																	
Оригінал																	
																	11

												3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.выр.
О01	12.				Check the stock switch by test.											
Т02																
О03	13.				When switching on one stem, the others must be in neutral.											
Т04																
О05	14.				Transfer the storage unit to the control operation.											
06																
07																
А08	18			20	Reception control		960	4	3	1	1	90		1,0		T_o=4,3
Б09					Workbench											
О10	1.				Check the exterior view for the completeness of the assembly unit.											
О11	2.				Check the exterior inspection when performing the 005 lubrication of the seat under the solid seal.											
О12	3.				Inspect the outside for plugs and gaskets.											
О13	4.				Check when performing the operation 005 tightening the rod bolt with torque 32-62Nm.											
Т14					Nozzle. 7812-4034 Torque wrench.											
О15	5.				Check when performing the operation 010 tightening the rod bolt with torque 34,5-42,5Nm.											
Т16					Nozzle. 7812-4034 Torque wrench.											
О17	6.				Check when performing the operation 015 smooth switching of the rods.											

МТ	Mechanical treatment

Дубл.																	
Взам.																	
Оригінал																	
																	12

										3518020-43270	The mechanism of switching between bands

А	Shop	Dep.	PM	Oper.	Code, name of operation	Document identification										
Б	Code, equipment name					СМ	Проф.	Р	УП	КР	КОВД	ОН	ОП	Кшт.	Тп.S	Тшт.
К/М	The name of the part, assembly unit or material					Designation code						ППП	ОВ	ОН	КВ	Н.вит р.
01																
02																
А03	18			25	0400 Transportation											
Б04					The bridge crane		909	2	2	1	1	90		1,0		
О05	1.				Transport the node to the warehouse.											
Т06		Pallet														
07																
08																
09																
10																
11																
12																
13																
14																
15																
16																
17																
МТ	Mechanical treatment															

Maps of detail-specific rates of materials consumption

Preparation of detail-specific rates of material costs.

For each machine (product) by special forms maps of detail-specific rates of consumption of ordinary, high-quality and non-ferrous metal rolling are drawn up.

The cost of metal rolling per machine (product) is compiled into a complete set of parts, taking into account the set of spare parts and tools that are added to the machine according to the design documentation and specifications.

Before filling the cards, the details are grouped according to the brand and thickness of the workpiece material in the order of increasing the designation of the parts with an indication of their quantity in the product, the dimensions of the workpieces and cutting features.

Filling in the detail-specific cost norms map begins with filling in the source material. Before each mark size of material indicates:

- in columns A, B and C the name, brand of material and initial dimensions of the material in accordance with the design or technological documentation;

- in the column D - accepted form of order;

- in column E - the name of the unit of measure;

- in columns F and G - standards or specifications for material and assortment;

- column I - is filled by a computing center.

Within each group of profile of metal rolling details are placed in order of increasing the size of the cross section of the profile.

Within one profile, the details are placed in order of increasing the numerical designation of the material marks.

Parts made of the same profile of the same brand of material are placed in alphabetical order of their designations, or in order of increasing numerical designations.

The exception is the parts made of sheet metal. The main part and the parts made from its waste are placed side by side.

For all product details within the same steel grade and profile size, the total values are calculated:

- by net weight of details (box 5);

- by weight of workpieces (box 10);

- by mass of forgings (box 12);

- the rate of consumption of metal (box 14);

According to graphs 5, 10 and 14, the aggregate values for the profile groups (large-grade steel, medium-grade, etc.) are compiled and entered in the general norms.

In columns 1 to 18 enter the following data:

column 1 - designation and name of the part;

column 2 is the part code;

column 3 - the total amount of these parts in the product;

column 4 is the mass of the part;

column 5 - the value of column 3 is multiplied by the value of column 4;

column 6 - dimensions of the workpiece;

column 7 - size of waste for cutting plus clamp in the manufacture of the workpiece;

column 8 - the number of parts made from one workpiece;

column 9 is the mass of the workpiece in kilograms per unit, taking into account all allowances;

column 10 is the result of multiplying the data of column 3 by the data of column 9;

column 11 is the mass of the forging or stamping;

column 12 is the result of multiplying the data of column 3 by the data of column 11

column 13 is the rate of material consumption in kilograms per part;

column 14 - the rate of material consumption in kilograms for the product (the product of data in columns 3 and 13).

When manufacturing parts partly or wholly from business waste, the cost rate in column 14 is eliminated completely or reduced by a percentage corresponding to the number of parts manufactured from waste;

column 15 is the mass of the workpiece for the manufacture of which waste is used, taking into account the percentage of waste provision;

column 16 - designation of the part for the manufacture of which the waste is used;

column 17 is the total mass of unused waste, which is equal to the difference between the valuesof columns 14, 5 and 15 (gr.14 - gr.5 - gr.15);

column 18 is the number of the workshop of the first procurement operation.

Production association	Code	**Map of specific standards the expense of rolled metal and pipes**	Product name and brand	Product code	Form ПС	
TNTU			КС6-10.020		Sheet	3
					Sheets	1

Detail					The workpiece					Weight of stampings (forgings), kg		Cost rate, kg		Waste used		Waste used-total, kg	Manufacturer's shop
Product name and brand	Code	Number of parts per item pcs.	Mass in area, volume		Size in mm	Cut + clip in mm	Number of parts, with workpiece	Mass, taking into account the allowances in the area, volume		single stamping (forgings)	on product	on detail	on product	mass kg	on which details		
			on detail	on product				on detail	on product								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

	Name of source material		Brand of steel		The original dimensions		Order form		Unit		ГОСТ		Code the original material					
									name	Code	on ТУ	on the assortment						
	A		B		C		D		E	F	G	H	I					
					Casting													
		Casting		*СЧ20*														
									kg		*1412-85*							
КС6-10.101 Pulley		*1*	*6.8*	*6.8*			*1*	*4.53*	*4.53*				*11.4*	*11.4*				
		Casting		*35Л*					*kg*		*977-75*							
КС6-10.301 Console		*1*	*3.9*	*3.9*			*1*	*4.1*	*4.1*				*4.3*	*4.3*				
КС6-10.302 Console		*1*	*2.6*	*2.6*			*1*	*3.9*	*3.9*				*4.1*	*4.1*				
		Total		*6.5*					*8.0*					*8.4*				
				Grade structural steel														
		Ring		*40*	*B-36*				*kg*		*1050-88*	*2590-88*						
КС6Б-10.601 drive shaft		*1*	*0.58*	*0.58*	*172*		*1*	*1.374*	*1.374*				*1.43*	*1.43*				

Chief Engineer of a Production Association	Date	Head БМН	Date	Compiled	Date

A		B	C	D	E	F	G	H	I			Аркуш	3
												Аркушів	3
ГОСТ7796-70	BoltM8x35.56.019	4								0.12			
	BoltM10x30.56.019	2								0.068			
									Total	0.188			
			Nuts										
ГОСТ5915-70	NutM10.5.019	2								0.032			
			Washers										
ГОСТ6402-70	Washer 8.65Г	16								0.012			
	Washer 10.65Г	4								0.008			
									Total	0.020			
				Purchased products									
ГОСТ8753-80	Pump НШ-10Е-3-Л	1				pcs.							
	Pump НШ-32У-2	1				pcs.							
ГОСТ8882-75	Bearing												
	180208с17	1				pcs.							
	180508кгс17	1				pcs.							
ГОСТ9833-73	Ring												
	019-023-25-2-2	2				pcs.							
	032-038-36-2-2	2				pcs.							

Chief Engineer of a Production Association	Date		Head БМН	Date	Compiled	Date

Preparation of tasks for designing special technological equipment

Special technological equipment

A set of devices for installing and securing workpieces and tools, performing assembly operations, transporting workpieces, semi-finished products, parts or product, the tool, and the controls are designed according to the tasks given by the technological services to the respective design units. The following departments include design offices: equipment; tool; Lithuania; hot and cold stamping. The tool for designing task forms is shown in fig. 2 and 3.

The following data are indicated in the design task:

- task number;
- date of issue;
- designation of equipment;
- name of the equipment or tool;
- designation and name of the part;
- designation of the machine on which the equipment will be installed;
- sketch details;
- workpiece parameters: dimensions, material;
- for stamps - cutting scheme and technological effort.

If the company has previously developed such equipment, the documentation of which can be used in the design, then indicate its number and the degree of possible use (completely, partially, with changes).

In addition, on the task sheet there are columns with names and signatures:

- the technologist who issued the task;
- the head of the bureau;
- chief specialist (chief technologist, chief welder, chief metallurgist);
- author of the development;
- a mark on performance.

Sketches of the tasks depict simplified and indicate only those parameters of the detail that are directly related to this technological operation.

TASK

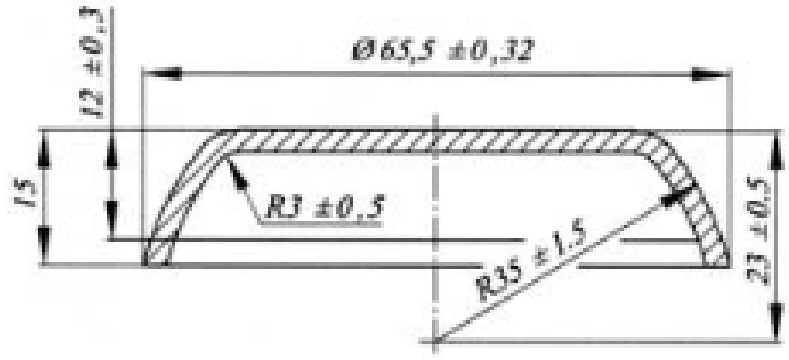
"___"_____200__p. № _____

tooling designation

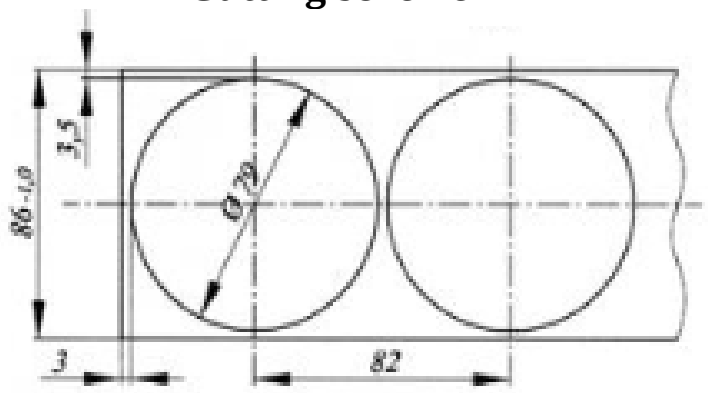
to design a die for cutting and pulling_____
_____
_____
_____

part __БМД 05.421-01, cover_____ fot machine mod. _____КТ330_____
(mark., name)

S K E T C H



Cutting scheme



1.Material – Sheet $\frac{20ГОСТ1994-74}{1-111-Г-ГОСТ16523-70}$

2. Technological effort - 34 thousand.

When designing use:

1. Previously developed snap _____
marking
_____
_____
name
degree of use _____
_____
2. Performance mark_____
_____
3. Author's surname
_____

Technologist	Signature	Head of Bureau	Signature	Chief Technologist	Signature

TASK

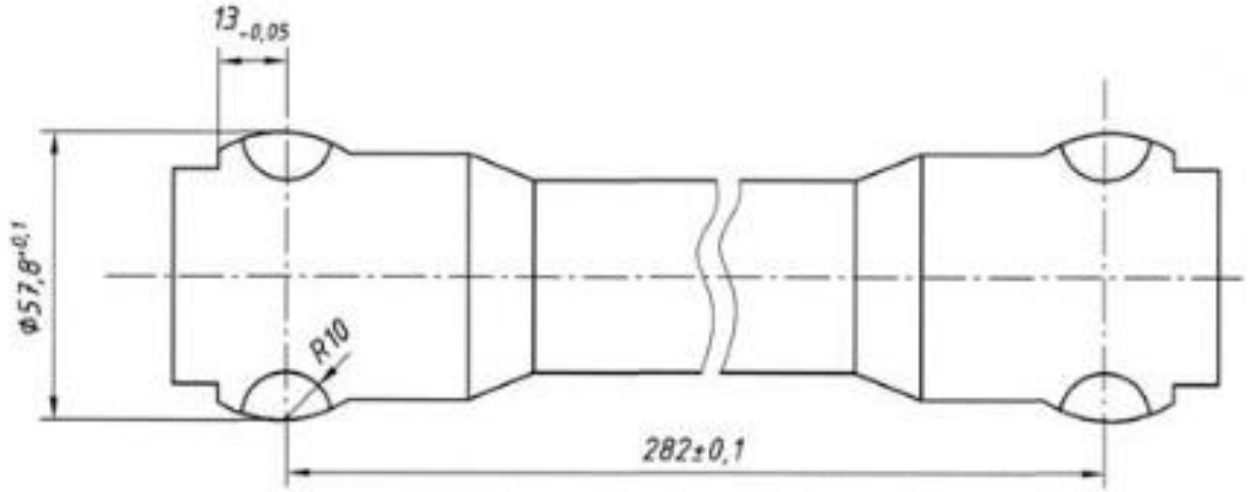
"___"_____200__p. № _____

tooling designation

to design conductor for drilling 12 holes_____
_____
_____
_____

part __KC6B-07.601. Shaft_____ fot machine mod. _____2H135_____
(mark., name)

S K E T C H



When designing use:

4. Previously developed snap _____
marking
_____
_____
name
degree of use _____
_____
5. Performance mark_____
_____
6. Author's surname
_____

Technologist	Signature	Head of Bureau	Signature	Chief Technologist	Signature

Filling out the routing information

The design statement includes all assembly units and parts included in the specific product.

It is divided into sections in the following order:

- original assembly units;
- borrowed units;
- original details;
- borrowed details;
- standard products;
- repair products;
- other products;
- materials.

The original assembly unit (part) is a unit assembly (part) designed specifically for a given product or other non-batch production product.

A borrowed assembly unit (workpiece) is a non-standard workpiece, or assembly unit of another product, used in the design of the product.

Within the section assembly units and parts are placed in ascending order of the first character (letter, number) then the second, third, etc.

The routing information is in the forms 8 and 8A according to ГОСТ 1105-7 or forms КТО 1 and 1А according to ГОСТ 23.4.55-73.

The columns are filled in according to their purpose:

column 1 - designation of the set of technological documents in accordance with ГОСТ 3.1201-74;

column 2 - code or company name where the document was developed;

column 3 - product designation;

column 4 - designation of the technological document in accordance with ГОСТ 3.1201-74;

columns 5 - designation of products (machines), which include a part;

column 6 - designation of the part or assembly unit on which the route is drawn up;

column 7 - the name of the part or assembly unit on which the route is drawn up;

column 8 is the designation of the assembly unit that includes the part;

column 9 is the number of parts in the assembly unit;

columns 10 - the number of parts that are included in the corresponding products (machines);

column 11 is an inter-workshop route, which is recorded in the sequence of passage through shops and warehouses of parts and assemblies in the process of their manufacture;

column 12 is the in-shop route.

The first is to record the main route and then the additional by type of performance.

Changes to the information of technological routes are made on the basis of "message", which is approved by the chief engineer of the enterprise.

The basis for issuing a message on changes of information of technological routes is:

- the order on introduction in production of changes in a design;
- plan of organizational and technical measures, proposal;
- instructions of the director, chief engineer, chief specialists of the enterprise.

New assembly units and parts are included in the technology routes, as a rule, following the above procedure.

Inv. № orig.	Signature and date	Взам. інв. №	Inv. № rep.	Signature and date

(1)

TNTU (2)

The routing statement

КП ТПВ 05-125.07.00 (4)

Letter

Assembly unit, detail				Product designation			Inter-workshop route	Internally-shop route (note)
Marking	Name	Included in the assembly unit		ЖИЦД 711.358 002		(5)		
		Marking	Number	Number for product				
(6)	(7)	(8)	(9)	(10)	(10)	(10)	(11)	(12)
ОГЕ 07.101	Cover		1	1	1		942-003-018/21-004/21	
ОГЕ 07.101	Cover		1	1	1		042-004/01-018/21-004/34-018/01-004/21	
ГОСТ 7798-70	Bolt							
	M6x6gx20.88.019	ОГЕ 07.120	4	26	48		046-004/21	

											Розроб.				Sheet
											Перев.				1
															Sheets
	Зм.	Sheet	№ docum.	Signфe.	Date	Зм.	Sheet	№ docum.	Signфe.	Date	H.contr.				3

Filling in the schedule of documentary preparation of production

The schedule of documentary preparation of production is intended for detailed planning on service (shop) of volumes and terms of development of documents, production of equipment and equipment, working out of technological processes and control of terms of execution. The schedule is the production planning planning service. It contains the following information:

- full or abbreviated name of the institution that developed the document;
- name and designation of the product for which the schedule is being developed;
- the full or abbreviated name of the technological service for which the schedule is drawn up, for example, "Chief Technology Officer" and planning period;
- the name and signature of the relevant official approving the document, as well as the date of approval;
- name of types of processing, according to the standard of the enterprise;
- names of types of equipment and equipment, according to the enterprise standard;
- designation of the document on the basis of which the preparation of production is conducted;
- designation of the assembly unit (parts) for which the production preparation is carried out;
- designation of the workshop for which production is being prepared;
- the term of development of material standards and drawings of billets;
- term of production of blanks;
- the category of complexity of development of the regulation of technological process of workpiece processing;
- the deadline for the elaboration of the regulation of the technological process of machining parts;
- the deadline for the development of time standards for the technological process;
- the total number of sizes of equipment and equipment to be designed;
- the number of the most difficult for the conditions of the enterprise units of equipment and equipment from among those being designed;
- the term of completion of equipment design and equipment;

- term of completion of production, testing and adjustment of equipment;

- the termination of the technological process on the constituent batch of parts;

There is a form of production preparation document for the production of special technological equipment for an individual unit or machine. It contains the following information:

- the name and signature of the relevant official approving the document, as well as the date of approval;

- designation of the part (assembly unit);

- number of the workshop being prepared;

- equipment design task numbers;

- details of the equipment developer;

- designation of equipment;

- terms of design, manufacture and implementation of equipment.

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«APPROVED»
Chief Engineer

_____

S C H E D U L E K “___”_____200__p.

підготовки виробництва

Luminaire housings ЖИЦД 711.358.003

№	Marked., name parts, assembly unit	Worksh op, consu mer	Equipment name	№ technica l tasks for the project	Equipmen t developer	Equipment designation	Terms		Plan fact.		Note
							designin g	issuing drawings	product ion	implementati on of technical processes	
1	2	004/34	4	5	6	7	8	9	10	11	10
1	*КС6Б-*		*Accessories for milling planes in*								
	52.101		*isize 125mm.*								
	Corp										
				01		*TNTU*	*6.10*	*20.10*	*3.11*	*10.11*	
2		004/34	*A device for drilling two holes*								
			14H14								
				03		*TNTU*	*5.10*	*10.10*	*20.10*	*25.10*	
3		004/34	*A device for turning two holes*								
			D14.5 H9								
				02		*TNTU*	*16.10*	*30.10*	*13.11*	*20.11*	
4		004/34	*A device for drilling six holes d7*								
				04		*TNTU*	10.10	15.10	25.10	30.11	
5		004/34	*Drilling device with six spindels*								
				05		*TNTU*	15.09	29.09	13.10	17.10	