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SOVERSHENSTVOVANIE TECHNOLOGY IZGOTOVLENIYA CORPORATION PLUNJERNOGO PUMP

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Annotation

The technological process and the manufacture of a plunger pump housing have been developed and described in this article. The choice of the type and methods of obtaining the workpiece is shown in the article, along with the methods for achieving the required accuracy of the pressure automaton, technological bases, optimal allowances that ensure the minimum material consumption are selected. Operations were normalized, a fixture that ensures the accuracy of manufacturing the part was selected. The calculation of the technological cost of the body of the automatic pressure was carried out.

Keywords: material consumption, technological process, basing, machine shop

Introduction

This work is devoted to the development of a technological process for the manufacture of housing parts for the NP-25 plunger pump with an organizational and economic basis.

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The plunger pump station is a unit consisting of a variable displacement hydraulic rotary piston pump and an MP-25 DC drive motor and is designed to supply working fluid under pressure to the backup hydraulic system for controlling the hatches of the product.

Figure 1- Appearance of the pump NP25

Plunger (piston) hydraulic pump of adjustable capacity with end distribution of working fluid NP-25 (Fig. 2) is designed to supply hydraulic system with working fluid.

Specifications:

Working fluid: AMG-10 oil GOST 6794-53
Operating fluid temperature range: from -40 to +800C
Working pressure: 250 kgf/cm2
Productivity: 17 l/min
Pump weight: 4.7 kg

When the piston moves to the right (suction stroke), the volume of the working chamber increases, a vacuum is created. The pumped liquid under the action of atmospheric pressure opens the suction valve and fills the working chamber. At this time, the discharge valve is closed. Thus, during the suction stroke, the working chamber is connected to the suction pipe and isolated from the discharge pipe.

When the piston reverses, a pressure is created in the working chamber that exceeds the pressure in the discharge pipe, the discharge valve opens and the liquid, corresponding in volume to the useful volume of the working chamber, is displaced.

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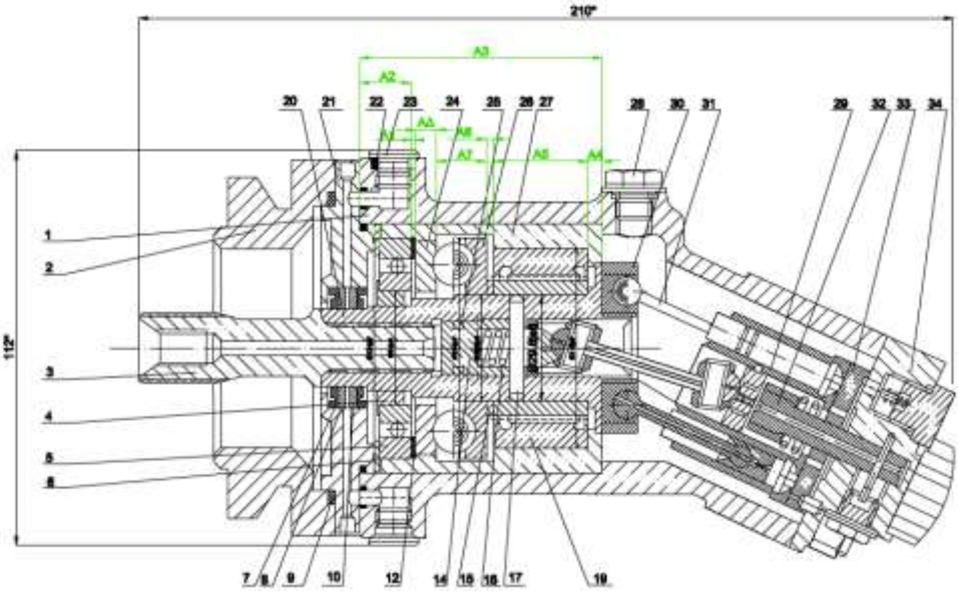

Figure 2 - General view of the plunger pump NP-25

The housing is part of the piston pump. The piston pump housing is the main part in the assembly. The housing ensures the stability of the relative position of the specified part in accordance with the technical requirements, both in statics and in dynamics, excluding unacceptable deformations of the part. Annual production program is 1070 pcs.

Based on the official purpose, as well as in accordance with the mechanical and thermodynamic properties of the mating parts and assemblies, it can be concluded that the required material should provide high efficiency in obtaining a workpiece of complex shape, good machinability, performance of working conditions under variable loads and temperatures, with as much as possible a more approximate coefficient of thermal expansion with the rest of the details, the lightness of the product.

For castings of complex configuration, AL9(AK7ch) alloy with the addition of 0.3-0.5% manganese is used, which has good casting, technological and mechanical properties.

For castings of complex configuration, AL9(AK7ch) alloy with the addition of 0.3-0.5% magnets which has good casting, technological and mechanical properties is used,

Alloy AK7ch is used: for the manufacture of ingots and various shaped castings by various casting methods (in sand molds, according to investment models, in a chill mold, under pressure).

The base part of the product has a technological base that ensures its sufficient stability during the assembly process. The unification of fasteners and other parts helps to reduce the range of assembly tools and more efficient use of mechanization of assembly work. The design of the product allows the general assembly of pre-assembled components.

An analysis was carried out, according to a quantitative assessment, of the manufacturability of the design:

coefficient of standardization of structural elements:

$$Кst = \frac{Est}{E},$$

Est - the number of standard structural elements;

E is the total number of structural elements

$$Кst = \frac{30}{56} = 0,53$$

When developing a technological process for assembling a product, it is necessary to strive to achieve in an economical way the compliance of the assembled product with its official purpose. To do this, the manufacturing process must meet product specifications with minimal assembly costs and high production process productivity. The previously made decision on the type of organization of the production process of assembling the product must be supplemented by the choice of the form of organization.

We choose a non-line stationary assembly. Non-linear stationary assembly is characterized by the fact that the assembled object from the beginning to the end of the assembly remains at one workplace.

All necessary parts and assembly units are delivered to the workplace. Assembly work is distributed among the workers and teams by the foreman and foreman of the site.

Release stroke:

$$T = F_d / N = (4896 \square 60) / 150 = 587{,}52 \text{ мин.}$$

Table 1

Annual production program, pcs.	Release cycle, min	Overall dimensions, mm	Organizational form assembly
1070	1958	234x103x110	Non-line stationary

The choice of the type and form of assembly organization at this stage of the development of the technological process should be considered preliminary. Clarification of the choice will follow after the equipment and technological equipment for the assembly shop are selected and the rationing of assembly work is carried out (Fig. 3).

The final stage in the development of the assembly process is the rationing of assembly work, the determination of the labor intensity of the assembly and the necessary jobs or positions that the assembled objects must pass, as well as the formation of transition operations. Rationing and assessment of the labor intensity of assembly work is carried out according to the formulas and according to the time standards for metalwork and assembly work.

When standardizing in serial production, for each assembly operation, the preparatory and final time is determined according to the relevant standards, which is 6 ... 15 minutes - for assembly. When determining the time spent on the operation (labor intensity of the operation), the preparatory-final time refers to one product and is added to the piece time. The summation of the complexity of individual operations makes it possible to find the complexity of assembling the entire product, to determine the number of necessary jobs or positions required for assembling the same products, according to the formulas given in the work.

All norms of time for the implementation of individual transitions are given in the technological map of the assembly of the product.

A scheme and an assembly map were drawn up, calculations were made to standardize assembly operations, it is necessary to determine the number of workers or teams of workers needed to assemble kits, subassemblies, assemblies and the overall assembly of the product. The calculation of the number of assemblers at the assembly site is made according to the formula:

$$P_{pr} = \frac{T_\Sigma}{\Phi_p \cdot k_m}$$

where T_Σ – the total machine intensity of manufacturing products are;

$\Phi_{д.о.} = F_н \cdot k$ – effective annual fund of working time, hour;

$F_н = 253 \square 8 = 2024$ – nominal annual fund of time when working in one shift, hour; $k = 0{,}98$ – coefficient of use of the nominal fund of time.

K_m – coefficient of multi-machine maintenance (let's consider km as 1, since the assembly is mechanized).

$$P_{pr} = \frac{100 \cdot 23{,}8}{1984 \cdot 1 \cdot 60} = 0{,}02$$

The calculated number of collectors is rounded up to the nearest higher integer and we accept the number of collectors Ppr=1.

After calculating the required number of workplaces and assembly workers, it was determined that 1 worker is needed for assembly.

Therefore, there is no need to build an assembly sequence diagram.

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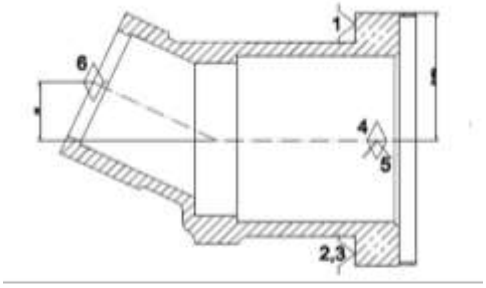
To ensure a uniform allowance, two options are considered:

Option 1: basing in a self-centering vise

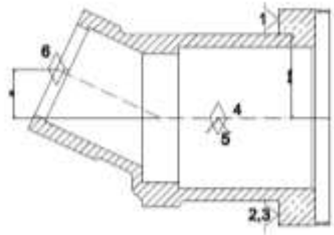


$$К_{\Delta} = К_1$$

$$\omega_{к\Delta} = \omega_{A1} = \omega_{к1}$$

$$\omega_{A\Delta} = \omega_{A1} + \omega_{A2} = 0{,}2 + 0{,}4 = 06$$

Option 2: basing in a vise with a fixed jaw



$$M_{\Delta} = M_{тс}$$

$$\omega_{A1} = \omega_{M\Delta} = \omega_{тс} = 0{,}3 \text{ мм}$$

$$\omega_{A\Delta} = \omega_{A1} + \omega_{A2} = 0{,}3 + 0{,}4 = 07 \text{ мм}$$

An analysis of two options for basing the body showed that the allowance in the hole Ø70 is more uniform when machining according to the first option.

Conclusions

In the course of the work, the purpose of which was the task of developing a project for a site for a mechanical workshop for the manufacture of a NP-25 plunger pump body with a feasibility study, ensuring the quality of workmanship, the following indicators were determined: productivity, low cost and serial production. An analysis of the official purpose of the body assembly of the plunger pump NP-25 was made, the principle of its operation was disassembled.

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