MANUFACTURE OF AUTOMOTIVE PLASTIC PARTS UNDER PRESSURE
AND THE FACTORS AFFECTING IT

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ABSTRACT

The article describes the advantages of the injection method under pressure, the casting process and its stages, shows
the changes in the load (compression force) depending on the temperature and heating time of the mold during
the manufacture of parts.

Pressure casting is the most common method of obtaining automotive parts, which is a technological process of manufacturing a product in which liquid plastic is poured into a metal mold under pressure, evenly distributed on it, and hardened. The process of injection molding requires complex equipment and serious technical preparation. With the help of this technology it is possible to obtain any plastic products without...
additional processing. The method of casting parts under pressure has a high productivity, which has the following advantages.

1. **High accuracy of the finished product.** The injection (delivery) of liquid plastic under pressure allows it to be evenly distributed across its shape, filling even the smallest holes.

2. **Possibility to get parts of any complexity,** with very thin walls, including. A metal mold is made for the production of the products, the design takes into account all the small details of the future product. The result is a simple and very complex product, with many holes and folds.

3. **The need for mechanical processing of the product is minimal.** Most of the time, the finished product does not require any processing. The cost of producing even complex products is very small.

4. **Unlimited finished products.** The metal mold created before production has a very long service life, with which you can prepare any amount of product.

5. **Cheap price - on the condition of producing a large batch.** The more items are made, the cheaper the price of one copy. Because the main budget is spent on the preparatory phase, which is carried out only once.

❖ The process of manufacturing plastic products by the injection molding method involves several steps. They can be divided into two groups:

- **Preparatory work;**
- **Direct injection.**

1. **Creating a 3D model of the product.** The 3D model can be created in the form of drawings, descriptions or photographs. Three-dimensional modeling is performed by an experienced specialist in a special program.

2. **Prototype preparation.** Once a 3D model has been created and approved, a prototype can be created, i.e. a sample of a future product. This is often done using a 3D printing tool. A prototype is needed to evaluate and test a future product. If any uncertainty is detected, the first step is returned and the 3D model is completed.

3. **Template design.** This process is based on a 3D model of the future product. It is important to consider all the smallest details and subtleties of detail in the design.

4. **Mold making.** The finished 3D model is divided into several parts. Each piece is prepared separately, after which they are assembled into a mold;

5. **Testing.** Then, the first copy of the product is prepared using a ready-made mold, which is carefully studied and tested. If inaccuracies or deficiencies are found, the mold is cleaned.

Preparations can take weeks to months. However, this is an important step that should not be rushed. The quality of future products depends on it.

At present, there is an opportunity to create a 3D model of the product, prepare a prototype and design the mold in the innovative research laboratory "Reengineering and Design" at the Department of "Automotive" in Andijan Machine-Building Institute.

Direct injection.

1. **Pour the plastic into the mold under pressure.** The liquefied plastic is poured into the mold under high pressure.

2. **Distribute the plastic evenly on the mold.** Due to the pressure, the plastic is evenly distributed throughout the shape, filling even small holes.

3. **Cooling of the mold and hardening of the plastic part.** The cooling time depends on several parameters: the type of plastic, the temperature of the mold, and so on. For small things, usually a few seconds is enough.

4. **Finished product.** Once the mold has cooled, it is opened to give the finished product [1].

A casting (thermoplastic gun) store will be required for the direct casting process. The injection chamber under pressure is shown in Figure 1. The pressurized injection machine consists of a stock (1), a piston (2), a cylinder (3), a nozzle (4) and a press mold (5). 600-650 gr of plastic composition is poured into the loading hopper of the casting machine (1). The plastic composition is transferred to the material cylinder (3) of the casting machine and heated in it for 30-40 minutes at a temperature of 240-270 °C. The part (4) heated to a temperature of 240 °C is initially mounted on a shaping plate (5) heated to 80-100°C.

When the piston (7) of the casting machine moves from right to left, the squeezed tip of the molten plastic composite (6) is removed from the cylinder and it fills the gap between the forming surface and the surface of the eroded part. Therefore, the temperature of the liquid composition should be 20°C higher than its melting temperature, the specific pressure of the casting should be 30-35 MPa, and the time under pressure should be 20 hours. Then the pressure is reduced and the press mold is separated. The restored part is removed from it, the seams are cleaned, the excess pieces of material are removed, the part is thermally treated in oil at a temperature of 120-130 °C for 1.5-2 hours. The part is then cooled to 110 °C along with the oil and cooled to room temperature in the open. When plastics are cast under pressure, their dimensions should be checked after 24 hours [2, p.103.; 3, p. 44-46].
In the manufacture of automotive parts under pressure from plastic materials, the retention time of the compressive strength and the heating temperature of the mold are of great importance. We consider this on the example of high and low pressure polyethylene and polypropylene, local plastic raw materials produced in Uzbekistan at the Shurtan, Mubarek and Ustyurt gas complexes.

Figure 2 shows the dependence of the holding time of the load on the injection molding of polyethylene and polypropylene. Analysis of the graph shows that the compressive strength also increases as the holding time increases. But after its amount exceeds 15-20 seconds, the value of the download decreases.

The highest load value was observed in polypropylene, while the lowest value was observed in low pressure polyethylene. It depends on the physical and mechanical properties of plastics and their structural structure. The conclusion is that the injection of high-pressure polyethylene into the mold under pressure among plastics is smoother and faster than others, for which there is no need for large compressive strength.

Figure 3 shows a graph of the specific load of plastic materials in pressure casting depending on the heating temperature of the mold. As can be seen from the figure, the specific load increases with increasing mold heating temperature. However, the value of the specific load decreases after the mold temperature exceeds 60-70 degrees. This is due to various changes in the physical and mechanical properties of plastic materials with respect to temperature. That is, as the mold temperature increases, the plastic material is poured well into the mold in liquid form, resulting in the mold cavity being well filled and the casting quality being good. No more load is required to cast such liquefied plastics into the mold, resulting in a decrease in the specific load [4, p.70-71].

The decrease in the temperature of the mold, on the other hand, causes the plastic to thicken as it is poured into it, resulting in the mold cavity not filling well and the casting quality not being good.
CONCLUSION

The following conclusions can be drawn on the basis of scientific research, analysis and study of research results.

1. When pouring plastics into the mold, the highest value of the load is observed in polypropylene, and the lowest value is observed in low-pressure polyethylene. This depends on their physical and mechanical properties and their structural structure. Among the plastics seen, the injection of high-pressure polyethylene into the mold under pressure is smoother and faster than others.

2. As the heating temperature of the mold increases, the specific load increases, and it decreases after 60-70 degrees due to various changes in the physical and mechanical properties of plastic materials with respect to temperature. At the same time, as the temperature of the mold increases, the plastic material is well poured into the mold in liquid form, no large load is required, resulting in a decrease in the specific load.

3. Among the plastics seen in the experiment, the best result in this regard was recorded in high-pressure polyethylene.

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