




Design Compression Molding Machine with Hydraulic System

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Abstract. Seal is a part of the machine that is used by one of the Light Fire Extinguishers (LFE) so that the contents of this tube are kept awake until it is used to extinguish the fire. In the process of making this seal, a machine is used mold to make the seal part. One is as male (upper mold) and the second as female (lower mold). The one of the methods offered is a compression system using hydraulics and a heating system using a temperature control system, the process of which can be controlled using the electronic devises. In this study, a compression molding machine was produced with temperature settings from 100 °C to 900 °C, from the results of experiments carried out on this machine, it can produce seal products that meet market standards, namely having h.gh adhesion and resistance to high pressure vessel especially for the light fire extinguisher (LFE).

Keywords: Seal · Fire · Extinguisher · Temperature

1 Introduction

Many manufacturing machines are encountered with various types and different functions in this present industrial field. The manufacturing machine is the device that functions to facilitate the manufacture of components from an object, such as metal casting machines, material carving machines, and machines that change the dimensions of a material [1]. These machines evolve very quickly in the current era of infrastructure development from manual to automatic so that humans only spend less energy and the work feels lighter. From the many tools developed by humans, various systems emerged to facilitate the operation of these tools. Hydraulics and pneumatics are one of the systems that are widely applied to manufacturing machines nowadays.

Hydraulic is a form of variation or relocation of power by using a piloting medium in the form of a liquid fluid to obtain a power greater than the initial power issued. There are many advantages in hydraulic applications to manufacturing machines [2, 3]. As it is known that in principle there is an emphasis with a combination of pressure, holding time, and process temperature. Many research that has been done as well as what has been done by previous studies [3–5].

Hydraulic systems are widely used for a variety of apparatuses. The system established from Pascal's law has become one of the important sciences for its use in the industrial field. Starting from home industries such as car washes to big companies such as molding machines. Apparatuses arranged in a hydraulic cylinder include tubes, pistons, axles, glands, covers, and seals [3, 6, 7]. Each component has its own function and role and the type of seal in each component is also different, the hydraulic cylinder component material does not have to be rust resistant because hydraulic oil is not only used for driving but also assists to lubricate hydraulic cylinder parts. The bigger the pressure in the hydraulic tube, the concentrated the hydraulic wall of tube, since the seal does not leak. The type of shape and substantial must be in accordance with the state of the hydraulic cylinder, for joining techniques in the hydraulic cylinder apparatuses must also be deliberated, such as during welding, the material of the welding wire must be appropriate. with the welded of material [8].

The research conducted by Wang et al., was setting the final optimal process parameters is recognized as one of the most imperative phases in injection molding to improve the quality of the molded product. In this study, the Taguchi method was applied to find the optimal micro-injection mold with minimum shrinkage conditions for micro-gears in micro-molding experiments. Variance Analysis (ANOVA) was approved out to determine the most significant factors that subsidized to the shrinkage quality of micro gears. The dominant factors that affect shrinkage are packing time with a impact of 32.47% and injection speed with a influence of 22.34% [4].

The hydraulic system will be applied to the rubber seal molding device, where many rubber seal manufacturers produce using a manual jack in this experiment. By applying of a hydraulic system to the rubber seal molding device, it will make the work easier and require less effort to operate. In recent years, there has been a growing demand for small and even micro scale spare parts in a lot of industrial words. Since, this trend towards reduction makes microsystem technology even more important. This light fire extinguisher (LFE) seal is considered as one of the product of molding process, it has the proficiency of mass production with moderately economical production expense. Furthermore, the FES can be intended for the manufacture of parts with micro-shapes or parts with capacities in the milligram.

2 Methodology

The purpose of the design stage is to get a good tool or system as expected by considering the characteristics of the components used. For this reason, the first stage is the data sheet book or other manual, then the next stage is materials chosen, in order to obtain the required component data. In addition, with the design that is carried out systematically and interrelated, equipment with good specifications will be obtained according to the function of the tool. The flow chart of research as shown in the Fig. 1.

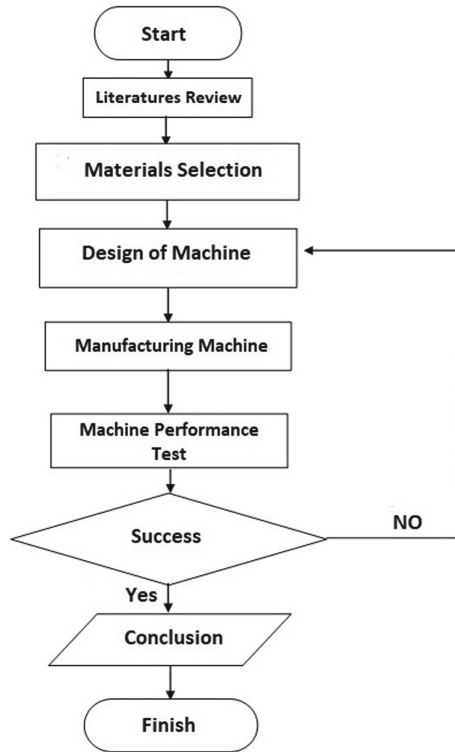


Fig. 1. The research flow chart

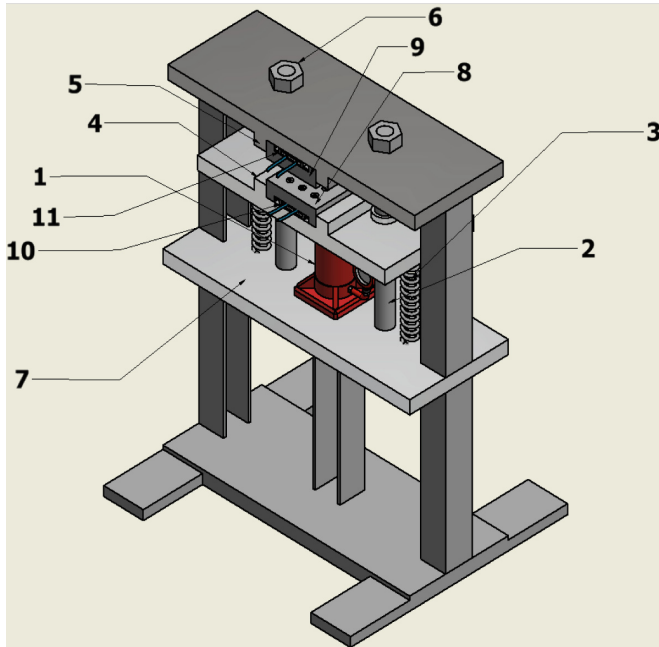
The design of the machine should be calculation the moment that is occurs on the machine construction. A basic calculation for plat calculation is needed that uses the following formula:

$$t = \sqrt{\frac{mb \max}{(b - d)x ti}} \quad (1)$$

Where: t is the plat of thickness (mm); $mb \max$ is bending moment maximum; b is the plat length; ti is the material strength (N/mm^2); V is safety factor.

The design of the top plate, bottom plate, table plate, and seat plate using the formula above, namely by taking into account the moments that occur.

The design construction of machine can be seen in Fig. 2.



Note: 1. Bottle jack with 2 Ton pressure gauge; 2. Shaft; 3. Spring; 4. Bottom mold holder; 5. Top mold holder; 6. Locking Bolts Shaft; 7. Tables; 8. Bottom mold; 9. Top mold; 10. Bottom mold heater; 11. Top mold heater

Fig. 2. The machine design construction

3 Result and Discussion

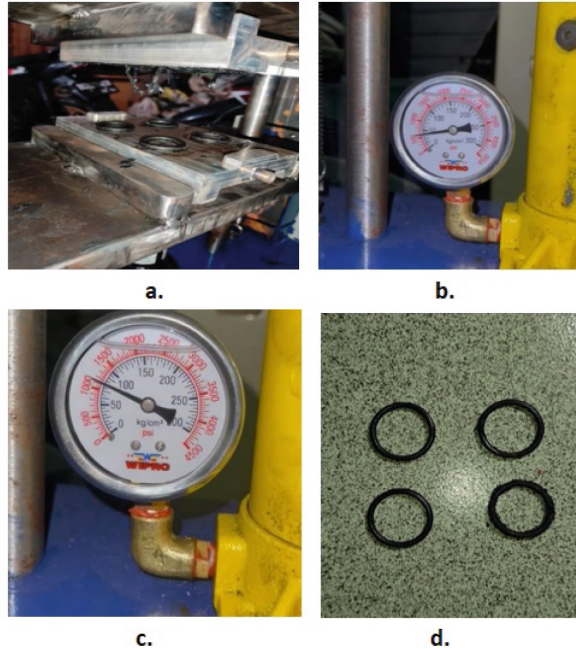
The success of the machine manufacture is needed the performance testing.

The tests carried out include:

1. The movement is included the movement of the jack in the pressing process when printing the seal.
2. Pressure performance testing is determined how long the jack can be maintained during the production process, in order to produce fire seals that meet specifications and standards.
3. Then finally, the products are test after they produced using the compression molding machine.

The mold is produced 4 pieces of seals during the production process. The parameters are set. The mold temperature is set 240 °C, it is hold in 20 min. The compression is set 30 kg/cm², then increase 75 kg/cm² in 5 min. After this stage open the mold.

The result of the manufacturing process can be seen in Fig. 3d, it can be seen the product 3 in good condition and 1in poor condition.



- a. Mold
- b. The first stage compression
- c. The holding compression stage
- d. Products

Fig. 3. The Production Processing

4 Result and Discussion

After running the performance test that can be concluded this compression molding machine can be used in production, however the manufacturing process using this machine needed long time it about 45 min from setting machine and holding time for compression mold. This machine can be developed because the product resulted still have failure product.

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